

Exhibit 24

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

SECURITIES AND EXCHANGE)
COMMISSION,)
)
Plaintiff,)
) Case No.
v.) 20-Civ-10832 (AT) (SN)
)
RIPPLE LABS, INC., BRADLEY)
GARLINGHOUSE, and CHRISTIAN)
LARSEN,)
)
Defendants.)
_____)

CONFIDENTIAL - SUBJECT TO PROTECTIVE ORDER

VIDEOTAPED DEPOSITION OF
FRANK ALLEN FERRELL, III, Ph.D.
Wednesday, February 23, 2022

Reported by:
BRIDGET LOMBARDOZZI
CSR, RMR, CRR, CLR
Job No. 2202232BLO

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

SECURITIES AND EXCHANGE)	
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v.)	20-Civ-10832 (AT) (SN)
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RIPPLE LABS, INC., BRADLEY)	
GARLINGHOUSE, and CHRISTIAN)	
LARSEN,)	
)	
Defendants.)	

Videotaped deposition of FRANK ALLEN FERRELL,
III, taken on behalf of Plaintiff, held at the offices of
Debevoise & Plimpton, 919 Third Avenue, New York, New
York, commencing at 9:27 a.m. and ending at 6:49 p.m., on
Wednesday, February 23, 2021, before Bridget Lombardozzi,
CCR, RMR, CRR, CLR, and Notary Public of the States of
New York and New Jersey, pursuant to notice.

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4 STELLA UVAYDOVA, SEC (Remote)

5 THOMAS DEVINE, Videographer
6 Shereck Video Service

INDEX

WITNESS

EXAMINATION

FRANK ALLEN FERRELL, III, Ph.D.

BY MR. SYLVESTER

11

EXHIBITS

SEC - AF
NUMBER

DESCRIPTION

PAGE

Exhibit AF-1 Expert Report of

18

Allen Ferrell, Ph.D.

October 4, 2021

NO BATES, 133 pages

Exhibit AF-2 Rebuttal Expert Report of

23

Allen Ferrell, Ph.D.

November 12, 2021

NO BATES, 52 pages

Exhibit AF-6 Expert Rebuttal Report of

106

 Ph.D.

November 12, 2021

NO BATES, 31 pages

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25

EXHIBITS		
SEC - AF NUMBER	DESCRIPTION	PAGE
Exhibit AF-21	Stata Program Linear	239
	Regression Runs for Exhibit 3	
	NO BATES, 1 page	

1 DEPOSITION SUPPORT INDEX

3 DIRECTION TO WITNESS NOT TO ANSWER

4 Page Line

5 58 9

6 60 9

10 STIPULATIONS

11 Page Line

12 11 15

15 PORTION MARKED HIGHLY CONFIDENTIAL

16 Page Line

17 - -none- -

20 REQUEST FOR DOCUMENTS

21 Page Line

22 - -none- -

1 - - -

2 9:27 a.m.

3 February 23, 2022

4 - - -

5 THE VIDEOGRAPHER: Good

6 morning. We're going on the record at

7 9:27 a.m. on February 23rd, 2022.

8 This is the videotaped deposition of

9 Allen Ferrell in the matter of

10 Securities and Ex -- Securities and

11 Exchange Commission v. Ripple Labs,

12 Inc., Bradley Garlinghouse and

13 Christian Larsen, Case Number

14 20-cv-10832 (AT) (SN).

15 This deposition is being held

16 at the offices of Debevoise &

17 Plimpton, 919 Third Avenue, New York,

18 New York.

19 My name is Thomas Devine,

20 certified legal video specialist with

21 Gradillas Court Reporters located at

22 400 N. Brand Boulevard, Suite 950,

23 Glendale, California.

24 Appearances will be noted on

25 the stenographic record.

1 Will the court reporter
2 please swear in the witness and we may
3 proceed.

4 F R A N K A L L E N
5 F E R R E L L, III, Ph.D., having been
6 duly sworn, was examined and testified
7 as follows:

8 THE REPORTER: Thank you.

9 You may proceed.

10 MR. SYLVESTER: Good morning

11 --

12 MR. KELLOGG: Before we
13 begin, Mark --

14 MR. SYLVESTER: Sorry.

15 MR. KELLOGG: -- I'd like to
16 put one thing on the record. Per
17 prior practice, any objection by one
18 defendant is considered an objection
19 by all defendants.

20 MR. SYLVESTER: Sounds good.

21 DIRECT-EXAMINATION

22 BY MR. SYLVESTER:

23 Q. Good morning, Professor.

24 A. Good morning.

25 Q. Could you please state your name for the

1 record?

2 A. My full name is Frank Allen Ferrell,
3 III.

4 Q. I'm Mark Sylvester. I'm an attorney
5 with the SEC. I'm here with my colleagues from
6 the SEC, Artur Minkin and Jon Daniels. A few of
7 my colleagues are joining by Zoom as well.

8 You've had your deposition taken before,
9 correct?

10 A. Yes.

11 Q. Okay. Is there anything that would
12 prevent you from testifying fully and truthfully
13 here today?

14 A. No.

15 Q. Were you retained to provide expert
16 services in this case?

17 A. Yes.

18 Q. Who retained you?

19 A. I -- I was -- I worked with Kellogg
20 Huber -- Kellogg and Debevoise. I believe the
21 engagement letter's with them. I did the
22 engagement letter through Compass Lexecon, so I
23 would -- I would have to -- I would refer back to
24 that engagement letter.

25 Q. Are you also retained by the individual

1 defendants in this case?

2 A. Again, I don't remember the engagement
3 letters with the law firms or with the underlying
4 clients. I would have to look at the engagement
5 letter. My understanding is I'm on the engagement
6 letter with Compass Lexecon pursuant to which I
7 performed my work.

8 Q. Do you know whether Paul Weiss or Cleary
9 are parties to that letter as well?

10 A. I don't remember.

11 Q. Okay. Are you familiar with the term
12 "XRP"?

13 A. Yes.

14 Q. Are you familiar with the term "digital
15 asset"?

16 A. Yes.

17 Q. Are you familiar with the term
18 "investment contract"?

19 A. Yes.

20 Q. Does "investment contract" have a
21 generally accepted meaning in the field of
22 economics?

23 MR. KELLOGG: Objection.

24 Calls for a legal conclusion.

25 MR. SYLVESTER: Actually,

1 Counselor, I'm asking him to narrow
2 his answer to the field of economics.

3 BY MR. SYLVESTER:

4 Q. So my question is, does "investment
5 contract" have a generally accepted meaning in the
6 field of economics?

7 A. My understanding of the phrase
8 "investment contract" is it's a legal term.

9 Q. Okay.

10 A. It has a legal component to it.

11 Q. Again, focusing on the field of
12 economics, is there any authoritative economics
13 text that defines investment contract to your
14 knowledge?

15 A. Same answer as before. That is the
16 invest -- the phrase "investment contract" has a
17 legal component to it. And just to be clear, I'm
18 not providing an opinion on whether anything's an
19 investment contract or not.

20 Q. Whether or not the term has a legal
21 component to it, are you aware of any
22 authoritative economics text that defines
23 investment contract?

24 A. None occurs to me sitting here. That
25 is, the phrase "investment contract" -- and,

1 again, as used in this litigation and the
2 complaint -- has a legal component to it.

3 Q. Okay. Does it also have an economics
4 component?

5 A. Well, I don't want -- there is --
6 obviously "investment contract" is a reference to
7 contracts, but it has a legal component to it and
8 so I'm not opining on whether anything is an
9 investment contract or not.

10 Q. Okay.

11 MR. KELLOGG: I'm sorry to
12 interrupt, but the people on Zoom said
13 they can't see the witness.

14 MR. SYLVESTER: Let's go off
15 the record if this takes more than a
16 second.

17 MR. KELLOGG: A little more.

18 THE VIDEOGRAPHER: What
19 should I do? Go off the record?

20 MR. SYLVESTER: No, if you
21 just need to tilt the camera, that's
22 fine. I just didn't know if it was
23 going to be a longer correction.

24 MR. KELLOGG: That's good.

25 Thank you.

1 BY MR. SYLVESTER:

2 Q. In preparation of your expert opinions
3 in this case, did you review any economics
4 literature that discussed the economic
5 characteristics of an investment contract?

6 A. No.

7 Q. Are you aware of any economics
8 literature that sets forth how to assess whether
9 the economic substance of an asset or a
10 transaction constitutes an investment contract?

11 A. No. That's -- that would constitute in
12 part a legal opinion.

13 Q. Okay. When you say "that would
14 constitute in part a legal opinion," can you
15 explain what you mean?

16 A. As I said before, the phrase "investment
17 contract" is obviously a phrase that's used in --
18 in the case law and in legal texts. And so my
19 understanding of the phrase "investment contract"
20 is that it has a legal -- it's a legal construct
21 or a legal meaning to it. And I'm not opining on
22 that question given it would involve a legal
23 opinion.

24 Q. Okay. So fair to say that the economics
25 literature doesn't address the question of -- of

1 how to figure out what the economic substance of
2 an investment contract is?

3 MR. KELLOGG: Objection.

4 A. Phrased in that way, I agree with that
5 statement. That is, "investment contract," as I
6 understand that phrase, is a phrase that's used in
7 case law and in legal argumentation. So that
8 would involve a legal opinion and I'm not
9 providing that.

10 Q. Does the term "commonality" have a
11 generally accepted meaning in the field of
12 economics?

13 A. I'm sure the phrase "commonality" is
14 used in economics, but I -- I -- I'm not aware
15 of -- offhand, I don't have a citation for the
16 usage of the word "commonality."

17 Q. When you used the word "commonality" in
18 your expert report, are you referring to an
19 economics term or to one of the elements of the
20 Howey test?

21 A. You would have to -- you would have to
22 refer me to my expert report to answer that
23 question fully. But if we're talking about
24 commonality as part of providing an opinion on
25 investment contract status, I'm not providing that

1 opinion.

2 Q. Let's -- let me hand you what's been
3 marked AF-1. Let me try to hand that to you.

4 (Whereupon, exhibit is received and
5 marked SEC Ferrell Exhibit AF-1 for
6 identification.)

7 BY MR. SYLVESTER:

8 Q. There you go.

9 A. Thank you.

10 MR. SYLVESTER: Michael, I'll
11 just ask you to pass these out if
12 that's all right.

13 MR. KELLOGG: Thank you.

14 THE WITNESS: Oh, she --
15 the -- the court reporter wants a
16 copy, too.

17 THE REPORTER: Thank you.

18 BY MR. SYLVESTER:

19 Q. If I could just direct you, Professor,
20 to the -- well, let me start with authentication.

21 Do you recognize AF-1?

22 A. I do.

23 Q. Okay. And is this the expert report
24 that you prepared in this case, or one of them?

25 A. Yes.

1 Q. Okay. Let me turn you to romanette III
2 of the table of contents of AF-1.

3 A. Romanette III?

4 Q. Yes. Near the bottom -- bottom of the
5 page, there's a Section F, "Economic Assertions
6 for Commonality are Fundamentally Flawed."

7 Do you see that?

8 A. I don't see where you're looking at.
9 Can you -- what -- can you repeat where you're --
10 what part you're looking at?

11 Q. Sure.

12 Are you on Romanette III?

13 A. Yes.

14 Q. Okay. Do you see the bolded "XRP is a
15 Virtual Currency" at the very bottom of the page?

16 A. Yes, I do.

17 Q. Immediately above that there's a
18 subsection title, Section F, "Economic Assertions
19 for Commonality are Fundamentally Flawed."

20 A. Yes.

21 Q. Okay. So my question is, when you used
22 "commonality" in that title, were you referencing
23 an economic concept or were you referencing an
24 element of the Howey test?

25 MR. KELLOGG: Objection.

1 A. I'm referencing my discussion on pages
2 67, 68, 69 and 70. So that's what I'm referencing
3 there. And just give me one second here.

4 Yeah. And in that discussion that's
5 being referenced in that bullet or in that table
6 of contents, I, in part, reference back to my
7 analysis in Section II where I get into the
8 economic substance of the -- of the contracts.

9 So I would just reference the actual
10 content of that discussion on pages 67 through
11 page 70.

12 Q. What is the definition of commonality as
13 used in the -- as used in Subsection F of your
14 opening report?

15 MR. KELLOGG: Objection.

16 A. It's really the discussion I have in
17 that section of the report in terms of what I'm
18 talking about. So, for example, in paragraph 141,
19 I mention there's no pooling of the funds.
20 Paragraph 142, I talk about the contracts. I also
21 talk about my factor model.

22 So it's really a reference to these
23 economic points that I'm making in that section.

24 Q. Returning to my question about the
25 economics literature, as used in your Subsection

1 F, is "commonality" a generally accepted term in
2 economics literature?

3 MR. KELLOGG: Objection.

4 A. So what I'm referencing here in the
5 beginning of paragraph 140 is -- and I cite to the
6 complaint -- is the economic theory by the SEC as
7 articulated in the complaint. So the first
8 sentence in this Section F is I am citing to the
9 complaint and then I'm discussing thereafter, as I
10 explained at the end of paragraph 140, the
11 economic analysis.

12 So, again, Subsection F is the economic
13 theory articulated in the complaint and then the
14 economic analysis that I reference and discuss in
15 paragraphs 141 through paragraph 145.

16 Q. Okay. I think you've answered, as far
17 as I understand it, how you're using commonality
18 for purposes of AF-1, is that right?

19 MR. KELLOGG: Objection.

20 A. I -- I -- I just discuss what I'm
21 actually doing in paragraph F -- I'm sorry, in
22 Section F. So Section F is called "Economic
23 Assertions for Commonality are Fundamentally
24 Flawed." And it is correct that in paragraph 140,
25 I cite to the complaint for the articulation of

1 the economic theory by the SEC in the complaint.

2 So I am working off of that.

3 As you see at the end of paragraph 140,
4 I then say "As I explain below, the SEC's claims"
5 -- that is the claims about the economic theory --
6 "are flawed as a matter of economic substance."

7 So that -- that's what this section is
8 doing. That's what I'm referring to when I say
9 "Economic Assertions for Commonality are
10 Fundamentally Flawed."

11 Q. And did you cite any economics
12 literature in your report for the definition of
13 commonality?

14 MR. KELLOGG: Objection.

15 A. I -- all the citations I use are in the
16 report. We can talk about the citations. But for
17 purposes of this section, I am focused in the
18 beginning, in paragraph 140, for the economic
19 theory as articulated by the SEC in its complaint.

20 Q. Sitting here today, can you think of any
21 economics literature that defines the term
22 "commonality"?

23 MR. KELLOGG: Objection.

24 A. I don't -- I don't have a view on that.
25 When I'm discussing in this section the economic

1 assertions for commonality, I'm talking about the
2 economic assertions in the complaint.

3 Q. Is --

4 A. I'm sorry. Just to -- just to elaborate
5 one second. I didn't mean to interrupt.

6 Q. Please.

7 A. So just to be a little more specific,
8 the first three footnotes in Subsection F that
9 we've been discussing -- Footnotes 243, Footnotes
10 244, Footnotes -- Footnote 245 -- are all
11 citations to the complaint. Again, apropos of my
12 earlier answer that I'm dealing here with the
13 economic assertions for commonality as articulated
14 in the SEC complaint.

15 Q. And as used in the SEC complaint,
16 commonality is one of the elements of Howey,
17 right?

18 MR. KELLOGG: Objection.

19 A. That calls for a legal conclusion. I --
20 I have read the complaint and it is certainly the
21 case that the complaint does talk about
22 commonality.

23 (Whereupon, exhibit is received and
24 marked SEC Ferrell Exhibit AF-2 for
25 identification.)

1 BY MR. SYLVESTER:

2 Q. Let me hand you what's been marked AF-2.
3 There we go.

4 A. Thank you.

5 Q. Professor, is AF-2 the expert rebuttal
6 report you submitted in this case?

7 A. Yes.

8 Q. Okay. Are all of the expert opinions
9 that you intend to offer in this case included
10 within either AF-1 or AF-2?

11 A. I don't know what counsel's going to ask
12 me to opine on. I will say in addition to the
13 rebuttal report and the opening report, I have
14 reviewed the rebuttal reports by Dr. [REDACTED] and
15 by Dr. [REDACTED] and Mr. [REDACTED]. And I certainly have
16 views on that. So I would include in my answer,
17 in terms of my work, my review and assessment as
18 it relates to me of those opposing expert reports.

19 Q. Do you intend to submit a supplemental
20 expert report in this case?

21 A. Sitting here today, I have not been
22 asked to do that.

23 Q. Other than the rebuttal reports of
24 Dr. [REDACTED] Dr. [REDACTED] and Mr. [REDACTED] have you read
25 any other expert reports in this case?

1 A. I did review -- I did read, albeit
2 not -- albeit it's not a focal point, I did read
3 the initial report of Dr. [REDACTED] Obviously I
4 did because I -- I discuss that in my rebuttal. I
5 also read the initial report of Dr. [REDACTED]

6 Q. Okay. And you did not provide a
7 rebuttal opinion to Dr. [REDACTED] opening report,
8 correct?

9 A. That is correct.

10 Q. Why not?

11 MR. KELLOGG: Objection.

12 A. It wasn't my assignment. It was not
13 work that I was asked to do.

14 Q. Did you review Dr. [REDACTED] work papers
15 related to the analysis he performed in connection
16 with his opening report?

17 A. I don't have a recollection of that.
18 I -- I focused -- again, just to be clear on the
19 record, I did read Dr. [REDACTED] opening report, but
20 I focused on his rebuttal.

21 Q. And sitting here today, you can't
22 remember one way or the other whether you reviewed
23 Dr. [REDACTED] work papers that he prepared in
24 connection with his opening report?

25 A. I believe the answer to that is no.

1 Q. Okay. Did you perform any analysis of
2 Dr. [REDACTED] analysis that he set forth in his
3 opening report?

4 A. No. It's not -- it was not a focal
5 point. I focused on -- in terms of Dr. [REDACTED] and
6 what he says, I focused on his rebuttal.

7 Q. Did you review Dr. [REDACTED] work papers
8 that he prepared in connection with his rebuttal
9 report?

10 A. Yes.

11 Q. Okay. Did you perform any analysis of
12 Dr. [REDACTED] analysis that he performed in
13 connection with his rebuttal report?

14 A. Yes.

15 Q. What analysis did you perform?

16 A. So one of the things I did with respect
17 to the rebuttal report of Dr. [REDACTED] is -- two
18 things. One is, he critiques me for using one
19 return for THC -- I forget the exact date -- the
20 THC crypto. So this is one out of approximately
21 6,700 returns, roughly speaking, that I used in
22 the PCA analysis. He critiques the usage of that
23 one return.

24 And so I simply reran the model not
25 using that particular return and not using THC to

1 see if my conclusions are robust to that and I
2 found that they were. It doesn't affect anything.

3 The second thing I did with respect to
4 Dr. [REDACTED] in addition to obviously carefully
5 reviewing what he says, is I calculated the
6 alphas -- not the change in alpha, but the
7 alphas -- in his Figure 17, that last page of his
8 report, and whether or not they were statistically
9 significant at the 5 percent level.

10 So I believe those are the two
11 additional things that I did in addition to just
12 carefully reading what he had to say with respect
13 to Dr. [REDACTED]

14 Q. And -- and just for the record, you
15 don't intend to submit any supplemental report
16 reflecting any analysis that you conducted
17 regarding Dr. [REDACTED] analysis in his rebuttal
18 report, correct?

19 A. I have not been asked by counsel to
20 submit a supplemental report --

21 Q. Okay.

22 A. -- sitting here today.

23 Q. Other than the deposition transcripts
24 that are listed in your AF-1, have you reviewed
25 any other deposition testimony in this case?

1 A. No. All the deposition testimony is
2 listed in the materials I listed in the report.

3 Q. Okay. Other than the rebuttal of
4 Dr. [REDACTED] opening report that is set forth in
5 your AF-2, are there any other expert opinions
6 that you're rebutting in this case?

7 A. Yes. Doc -- just to be clear, I did
8 review Dr. [REDACTED] -- Mr. [REDACTED] critique of my
9 opening report. And so I obviously reviewed that
10 discussion by Mr. [REDACTED] as well.

11 Q. Okay. With respect to your critiques of
12 Mr. [REDACTED] sitting here today, you don't intend to
13 crystallize those into a supplemental report that
14 you'll be submitting, correct?

15 A. Same answer as before. I've not --
16 sitting here today, I have not been asked by
17 counsel to prepare a supplemental report.

18 Q. Okay. Have you performed any additional
19 analysis pertaining to any of the opinions that
20 you offered in Exhibit 1 since October 4th of 2021
21 other than anything that might have been
22 encompassed by your previous answers here today?

23 MR. KELLOGG: Objection.

24 A. Exhibit 1, is that my opening report?

25 Q. It is.

1 A. Okay. So could you repeat the question?

2 Q. Sure.

3 Other than any analysis we've already
4 discussed today, have you performed any additional
5 analysis regarding the opinions that you've set
6 forth in AF-1?

7 MR. KELLOGG: Objection.

8 A. So I did -- so we talked about Dr. [REDACTED]
9 We talked -- and my analyses there of his
10 rebuttal. I did -- as I did with Dr. [REDACTED] in his
11 rebuttal -- take a careful look at Dr. [REDACTED]
12 critique of my work, as well as Dr. [REDACTED]

13 So I would encompass in my answer my
14 review and assessment not just of Dr. [REDACTED]
15 rebuttal, but those additional rebuttal reports
16 which obviously speak to and concern the issues
17 that I discuss in AF-1.

18 Q. Did you do any additional analysis
19 outside of what you just described in your last
20 answer?

21 A. Yes.

22 Q. What?

23 A. So just -- just to be clear. So earlier
24 we discussed my work in discussing Dr. [REDACTED]
25 rebuttal.

1 With respect to Dr. -- or Mr. [REDACTED] the
2 one addition -- besides obviously reading and
3 carefully considering what he had to say, the
4 additional work I did with respect to that
5 rebuttal report, or his critique of my opening
6 report, is I did look at non-MoneyGram remittance
7 data for 2020 in connection with reviewing
8 Dr. [REDACTED] -- Mr. [REDACTED] critique of my work.

9 With respect to Dr. [REDACTED] and his
10 critique, I did a couple additional analyses. One
11 is, my understanding is that he critiques me for
12 including -- as a distribution to a non-Ripple
13 party, he critiques my inclusion in that type of
14 distribution the distribution of XRP to custody
15 accounts.

16 I don't agree with that critique, but,
17 nevertheless, I also analyzed whether any of my
18 results, the results I report in my opening
19 report, were changed if you just look at
20 distributions that are programmatic, market maker,
21 or -- or sales on to exchanges to see if it's
22 robust to confining the distribution analysis to
23 those distributions. And I found that it doesn't
24 make any difference to my conclusions. So that's
25 one thing that I did with Dr. [REDACTED]

1 I should say, also, with Dr. [REDACTED]
2 before the filing of my report, the report in
3 AF-1, I had run the -- the -- I had run the
4 distributions both in U.S. dollars and in XRP
5 units. Obviously I went with U.S. dollars in my
6 denomination, but I'd already known prior to the
7 filing of my report, the report in AF-1, that that
8 doesn't make a difference. It's obviously one of
9 his critiques.

10 Another comment along these lines is
11 before the filing of my report as -- you know, the
12 report in AF-1, I had also run the factor model on
13 weekly returns, on 30-day fixed -- you know,
14 30-day fixed period returns, and on the calendar
15 monthly returns.

16 Now, as I explain in my report, I felt,
17 and still feel, that 28 days is the best level of
18 frequency for the factor model, but prior to the
19 filing of the report, I knew that it was robust.
20 It was -- the results of the factor model, the
21 results of whether the alpha is statistically
22 significant, were robust to weekly, 30-day, or
23 calendar. So I know that's something that
24 Dr. [REDACTED] mentions in his rebuttal and so I
25 mention it -- mention that fact here.

1 One other thing I wanted to say. So
2 Dr. [REDACTED] distribution analysis; his critique
3 of the frequency of the data. Let me just think
4 here, make sure I give a complete answer.

5 Oh, one other thing I should mention as
6 long as we're having this conversation about all
7 of the work I've done, including prior to the
8 filing, is prior to the filing of the report in
9 AF-1, I had also ran the factor model just on the
10 CoinMarket return data. And that -- that
11 didn't -- I -- I used CryptoCompare for the
12 reasons I describe in the report, and I think
13 that's the right choice, but I had run the model
14 on just the CoinMarket price return data and that
15 didn't change anything.

16 Let me just think. Anything else in
17 Dr. [REDACTED]?

18 So I know that Dr. [REDACTED] critiques the
19 use of this -- the square root price impact model.
20 And, you know, I -- I do have comments on that.
21 Obviously that's something I didn't discuss beyond
22 the footnote with the academic citations that I
23 have for that, but I certainly have reactions to
24 his critique of the use of that -- that square
25 root price impact model.

1 Just give me one more second to think
2 here if there's anything else. I think that's a
3 pretty complete list. Let me just think if
4 there's anything else. Give me a moment if you
5 could.

6 Q. Sure.

7 A. It might be helpful to see Dr. [REDACTED]
8 rebuttal. I'm just trying to think if there's
9 anything else in Dr. [REDACTED].

10 Oh, I remember now. I was searching for
11 it and now I remembered.

12 The other thing that I did after -- this
13 is after the filing of his rebuttal report, just
14 to be clear. The last thing that I did in terms
15 of that work is I recalculated the 1.6 percent
16 price impact number -- let me be a little clearer.
17 The potential price impact number of 1.6 percent,
18 I recalculated that using just top-tier exchanges
19 as identified by CryptoCompare and using just that
20 volume. And it changes the number using that
21 formula from 1.6 to 2 percent.

22 I believe that's a complete answer to
23 your -- your question.

24 Q. Returning to the portion of your answer
25 where you described running your factor model on

1 weekly returns and 30-day fixed returns, did you
2 perform that analysis prior to submitting AF-1?

3 A. Yes.

4 Q. Is that analysis described anywhere in
5 AF-1?

6 A. No. I -- and the reason being -- maybe
7 I'm going beyond your question -- is I felt,
8 and -- and feel -- my opinion is that 28 days is
9 the -- is the best definition, the best return
10 series to use.

11 So I would rely on the 28-day period
12 that I use for the reasons given in my report.
13 I'm just noting that the criticism by, I believe,
14 Dr. [REDACTED] of I should have used different
15 frequency data -- again, a criticism I don't agree
16 with -- but it doesn't make a difference.

17 Q. And did you include within the backup
18 materials that you provided for production to the
19 SEC any of your analysis regarding your -- running
20 your factor model on weekly returns and 30-day
21 fixed returns in connection with your opening
22 report?

23 MR. KELLOGG: Objection.

24 A. I don't know offhand. What I relied
25 upon in AF-1 is -- is the -- and what I report is

1 the 28-day returns. I don't -- but going directly
2 to your question, I don't know offhand.

3 Q. Okay. You also mentioned, if I
4 understood your testimony correctly, that you also
5 ran your factor model using just CoinMarketCap
6 data prior to submitting AF-1, is that right?

7 A. That's correct. So when I say
8 "CoinMarketCap data," I mean the prices in
9 CoinMarket, yes.

10 Q. Okay. When you say "CoinMarket" and I'm
11 saying "CoinMarketCap," are we talking about the
12 same thing or no?

13 A. I believe we are.

14 Q. Okay. And does AF-1 mention anywhere
15 that you ran your factor model using only
16 CoinMarketCap data?

17 MR. KELLOGG: Objection.

18 A. I do not believe it does because the
19 return series that I used was the best return
20 series, in my opinion, which was the combination
21 of CoinMarketCap and CryptoCompare. That's
22 consistent with the academic literature in my
23 view.

24 Q. And sitting here today, do you know
25 whether the backup materials that you prepared in

1 connection with your opening report, AF-1,
2 contains your analysis in which you ran your
3 factor model on CoinMarketCap data only?

4 MR. KELLOGG: Objection.

5 A. Same answer as before. I don't know
6 offhand. Obviously what I relied upon in my AF-1
7 report is -- is the return series that's described
8 in that report.

9 Q. Focusing just on your preparation of
10 AF-1, is there any other category of analysis that
11 you performed in connection with forming your
12 opinions that are set forth in AF-1 that is not
13 described in AF-1?

14 MR. KELLOGG: Objection.

15 A. I believe I've -- I've -- I've
16 mentioned -- I think our earlier discussion
17 encapsulates that -- that other work.

18 Q. Okay. When were you retained to provide
19 expert services in this case?

20 A. I don't have an exact date. I know
21 that -- I believe that I started work early last
22 year. I believe February of last year is when I
23 started doing work. I don't know the exact date
24 of the engagement letter, but that's my best
25 recollection.

1 Q. Were you retained to provide expert
2 services related to this case prior to your
3 retention as an expert witness in this case?

4 MR. KELLOGG: Objection.

5 A. Could you repeat the question?

6 Q. Sure.

7 Were you retained to provide expert
8 services in this case prior to your retention as
9 an expert witness in this case?

10 A. My -- my understanding from the
11 beginning was I was going to be an expert. I have
12 no memory of it changing in any way. So my
13 understanding was from -- from the beginning is I
14 would be hired as an expert.

15 Q. When you say the word "expert" in that
16 answer, do you mean a testifying expert?

17 A. Yes.

18 Q. Okay.

19 A. That was my understanding.

20 Q. Prior to your retention as an expert
21 witness in this case, did you know anything about
22 Ripple?

23 A. I had read about it in general market
24 commentary.

25 Q. What did you know about Ripple prior to

1 your retention?

2 A. Well, at a high level, it's a crypto
3 asset. It involves blockchain. It was one of the
4 larger cryptocurrencies earlier in time. I do
5 remember reading about the filing of the SEC
6 lawsuit that's at issue here. So at that level of
7 generality.

8 Q. Prior to your retention as an expert in
9 this case, had you ever met Mr. Garlinghouse?

10 A. No.

11 Q. Prior to your retention, had you ever
12 met Mr. Larsen?

13 A. No.

14 Q. Prior to your retention, had you ever
15 met anyone who worked at Ripple to your knowledge?

16 A. No.

17 Q. Prior to your retention, had you ever
18 met any of the lawyers representing defendants in
19 this case?

20 MR. KELLOGG: Objection.

21 You can answer yes or no.

22 A. I have a bad memory for this sort of
23 thing. It's entirely -- entirely possible, but I
24 don't have a recollection.

25 Q. Did -- go ahead. Sorry.

1 A. I do want to be clear that I'm really
2 terrible at mem -- at remembering this sort of
3 thing. I don't want to offend anybody. I don't
4 have a recollection.

5 Q. Prior to your retention in this case,
6 had you ever been retained as an expert witness by
7 Kellogg?

8 A. I don't believe so. I don't have a
9 memory of that. I am involved in cases where
10 there's a number of firms. It's possible that
11 Kellogg was, you know, involved because that often
12 happens. But I don't -- answering your question,
13 I don't have a memory sitting here right now of
14 being retained by Kellogg in other matters. It's
15 possible, but I don't have a recollection sitting
16 here.

17 Q. Prior to your retention, had you ever
18 been retained as an expert witness by Debevoise &
19 Plimpton?

20 A. Yes.

21 Q. How many times?

22 A. Again, I'm going to be very cautious
23 here. I -- I don't have a clear recollection.
24 I -- I believe it's several times prior to this
25 engagement that I've been retained by Debevoise.

1 I want to say two, but it could easily be more
2 than that. But I want to say something like one
3 or two times is my best recollection sitting here.
4 Again, with the very important caveat that, you
5 know, I've -- I work with a lot of law firms and,
6 you know, I don't have a list in my mind of the
7 number of times I've worked with this or that
8 firm.

9 But the answer to your question is, yes,
10 I have been retained by Debevoise before.

11 Q. When was your most recent retention as
12 an expert witness by Debevoise?

13 A. Putting aside this matter, I do remember
14 doing a 10b-5 matter with Debevoise. I believe
15 this is a few years ago. That's my best
16 recollection. It's possible that I've done a case
17 since then. I would have to double-check. I know
18 I've worked with Debevoise in the past.

19 MR. KELLOGG: I'd like to
20 direct the witness not to discuss the
21 nature of any prior representation.

22 THE WITNESS: Okay.

23 BY MR. SYLVESTER:

24 Q. Okay. Prior to your retention in this
25 case, had you read the SEC's complaint against

1 Ripple?

2 A. I read it around the time of my
3 engagement. I might have read it contemporaneous
4 with -- with the engagement. I don't know the
5 exact timing of that.

6 Q. Prior to your engagement, I believe you
7 testified that you had read about the SEC's case
8 against Ripple, is that right?

9 A. Yeah, as we -- sorry, I didn't mean to
10 interrupt.

11 Q. Go ahead.

12 A. Yeah. So I -- I -- I have a
13 recollection of it being reported upon in the
14 press. I don't have a -- I don't -- don't have a
15 recollection of -- of -- I don't have a
16 recollection of reading it -- I believe that's in
17 December of 2020. I think that I read it after
18 that point. So my memory is the complaint was
19 filed in December of 2020 and I read it -- I don't
20 think I read it in December, you know.

21 I guess I want to leave this open. I --
22 I read it somewhere in the December-February time
23 frame, if I -- if my memory of the -- of the
24 timing is correct.

25 Q. And just so the record is clear, are we

1 talking about the complaint or about press
2 articles about the lawsuit?

3 A. Well, we -- we have two different
4 questions now lingering. One question is, when
5 did I read the complaint? And with respect to
6 that question, it's somewhere in the
7 December-February time frame. I don't have a
8 specific recollection of exactly when I read the
9 complaint.

10 The second question that's out there is,
11 when did I read about the SEC filing a complaint?
12 My memory, my best recollection, is I do recall
13 reading in the press that the SEC had filed a
14 lawsuit, is my best recollection.

15 Q. And with respect to reading in the press
16 about the SEC's lawsuit against Ripple, when did
17 that occur?

18 A. Same time period. Somewhere in the
19 December-February time period. If I'm remembering
20 correctly when this all transpired, which I
21 believe was December of 2020. That's -- that's my
22 best recollection.

23 Q. It -- it's fair to say, Professor, that
24 you were familiar with the Howey case prior to
25 your engagement in this case?

1 MR. KELLOGG: Objection.

2 A. That's a fair statement.

3 Q. Okay. Again in the period prior to your
4 retention, what was your opinion, if you had one,
5 about whether the SEC's allegations, if proved,
6 would demonstrate a violation of its securities
7 laws?

8 MR. KELLOGG: Objection;
9 calls for a legal conclusion.

10 A. Yeah, that calls for a legal conclusion.
11 I'm not providing an opinion on that.

12 Q. Perfectly understood. But I think we've
13 established that you understood the Howey test
14 prior to your retention and that you at least may
15 have read the complaint or a press article about
16 the complaint prior to your retention.

17 So I'm asking if you formed any opinion
18 based on what you'd read --

19 MR. KELLOGG: Objection;
20 calls for a legal conclusion.

21 MR. SYLVESTER: I haven't
22 finished my question, Counselor.

23 BY MR. SYLVESTER:

24 Q. I'm focusing just on the period prior to
25 your retention.

1 Based on anything that you read about
2 the case or the complaint, did you form an opinion
3 about whether or not the SEC's allegations, if
4 proved, constitute a violation of securities laws?

5 MR. KELLOGG: Objection.

6 A. Well, I would not form a legal
7 conclusion without having read the actual
8 complaint. So the answer to that question is
9 certainly no. And, you know, in terms of reading
10 the complaint, obviously I have views about the
11 economic theory and assertions in the complaint,
12 but I have not formed a legal opinion as to how
13 the judge should rule here. So I'm not -- not
14 providing that opinion.

15 Q. Again, I'm just focusing on the period
16 prior to your retention in this case.

17 Did you have any views about the
18 economic theories or assertions in the complaint
19 prior to your retention as an expert?

20 MR. KELLOGG: Objection.

21 A. So, again, my memory reading the
22 complaint is -- is in that time frame. So I don't
23 remember whether it is at the same time as the
24 engagement or it was a month, you know, a week
25 earlier, but it's in that time frame that I read

1 the complaint.

2 As I said before, I did read general
3 descriptions in the press of the SEC's theory, but
4 I -- you know, quite frankly, I would not form a
5 legal conclusion, even if I was asked to do so,
6 based on secondhand reporting on legal matters.

7 Q. When you read the complaint, did you
8 form an opinion about whether the facts alleged,
9 if proved, would demonstrate a violation of the
10 securities laws?

11 MR. KELLOGG: Objection;
12 calls for a legal conclusion.

13 A. I don't have a view on that.

14 Q. I'm not sure what that answer means.

15 Does that mean no or you don't recall or
16 something else?

17 A. I don't have a -- okay. I -- I am
18 not -- I'm not providing and I don't have a legal
19 analysis of all the legal issues that relate to
20 this dispute; that is, whether, in fact, this
21 constitutes a security as defined by the
22 securities laws. That's -- obviously very capable
23 counsel and -- and the judge and -- and the legal
24 system will decide that. I'm not providing an
25 opinion and I haven't formed a legal opinion on

1 that.

2 Q. What was it that you read in the press
3 about the SEC's case against Ripple prior to your
4 retention?

5 A. I don't -- I don't have a specific
6 recollection. I -- I -- I read a lot of press and
7 I don't -- I don't -- I do have a generalized
8 recollection of reading about it, but I'm not
9 going to be able to give you more particulars.

10 Q. Do you own XRP?

11 A. No.

12 Q. Have you ever owned XRP?

13 A. No.

14 Q. Sitting here today, do you have any
15 plans to acquire XRP?

16 A. No.

17 Q. Are you charging a fee for your expert
18 services in this case?

19 A. Yes.

20 Q. How much is your fee?

21 A. So my expert fee is 1,250 at the time
22 that I was retained. So that part of my
23 compensation is my hourly rate. Just to have a
24 complete answer for the record, another component
25 of my compensation is I get a percentage of junior

1 people at Compass Lexecon that work pursuant to my
2 instructions and supervision.

3 So an example of that would be somebody
4 put -- puts together binders and sends that to me.
5 So junior people at Compass Lexecon working in
6 this matter under my instructions and supervision,
7 I do get compensation based on that as well as my
8 hourly rate.

9 Q. Is the compensation that you just
10 referenced a percentage of your billables?

11 A. Yes, but with the important
12 qualification that it's not the billables at
13 large. It's junior staff at Compass Lexecon for
14 which this would apply.

15 Q. What's that percentage?

16 A. So I do have a confidential contract
17 with Compass Lexecon. I -- it's -- I just want to
18 make sure I'm not violating any confidentiality.

19 MR. FIGEL: Give us just a
20 second.

21 (Pause)

22 MR. KELLOGG: So if your
23 agreement with Compass is that it's
24 confidential, then you should not
25 reveal it.

1 THE WITNESS: Okay.

2 BY MR. SYLVESTER:

3 Q. Okay. So just for purposes of the
4 record, you're declining to answer my question
5 based on a preexisting confidentiality agreement
6 with a private party?

7 A. So my understanding, sitting here today,
8 is that my agreement with Compass Lexecon is
9 confidential. That's my understanding sitting
10 here today. And so the answer to your question
11 would be yes. But I do, to reiterate, get a
12 percentage of the junior staff working pursuant to
13 my instruction and supervision in this matter.

14 MR. KELLOGG: To make it
15 clear, we do not represent Compass
16 Lexecon so we're not forming a legal
17 opinion about the nature of the
18 contract.

19 MR. SYLVESTER: Understood.

20 THE WITNESS: And I --
21 maybe -- so I want to make clear
22 that's my understanding of the nature
23 of the agreement sitting here today,
24 that it's confidential. I -- I can
25 certainly confirm or disconfirm that

1 my understanding is correct or
2 incorrect.

3 BY MR. SYLVESTER:

4 Q. How much have you billed for your
5 services in this matter so far?

6 A. So I haven't added up the number of
7 hours, but it is substantial. So it's several
8 hundred hours over this period since I've been
9 engaged, so -- but I had not added up the hours.

10 Q. Is the seven -- strike that.
11 Is the several hundred hours just your
12 time or you plus any staff assisting you?

13 A. So my answer to your earlier question is
14 just my time.

15 Q. Okay.

16 A. So it would be multiple of, you know,
17 several -- I know "several" has a lack of -- you
18 know, it's -- it's not a specific number, but it
19 is a significant amount of time, my personal
20 time.

21 Q. And do you have a sense of how many
22 hours any staff working with you in connection
23 with this matter have billed?

24 A. I do not, no.

25 Q. Okay. Would Compass Lexecon have those

1 records?

2 A. I would assume so.

3 Q. Okay. And would Compass Lexecon have
4 precise records of how many hours you've billed in
5 this matter?

6 A. I'm not privy to their recordkeeping
7 system. I would assume so but that -- that's just
8 an assumption.

9 Q. Have you received any compensation for
10 your work in this case in XRP?

11 A. No.

12 Q. Do you have any plans to receive XRP as
13 compensation for your expert services in this
14 case?

15 A. No.

16 Q. Did others assist you with providing
17 your expert services in this case?

18 A. Yes.

19 Q. Who?

20 A. So I interacted with -- I'm just going
21 to spell her name -- A-N-D-R-I-A, Andria,
22 van der Merwe. And she is the senior person at
23 Compass Lexecon with whom I interfaced.

24 Q. What's her title?

25 A. Executive vice president or senior --

1 I -- I forget her exact title, but she's a -- a
2 senior person at Compass Lexecon with whom I've
3 worked in the past with.

4 Q. Is there anyone --

5 THE VIDEOGRAPHER: Excuse me,
6 Counsel. Your -- your mic is sort of
7 rubbing against your shirt. Sorry for
8 the interruption.

9 MR. SYLVESTER: No problem.

10 BY MR. SYLVESTER:

11 Q. Is there anyone else who assisted you
12 with providing your expert services in this case?

13 MR. KELLOGG: Objection on
14 work product grounds.

15 Do not discuss any
16 conversations with attorneys.

17 THE WITNESS: Okay.

18 A. So my understanding is that she --
19 this is the person at Compass Lexecon -- did have
20 assistance from Compass Lexecon staff in terms of
21 work product or analysis. But my interactions
22 were through her, or with her, in terms of -- of
23 my instructions and supervision and so forth.

24 Q. Who are the assistants that
25 Ms. van der Merwe interacted with in connection

1 with the preparation of your expert report?

2 A. So I don't have a list off the top of my
3 head. So I know there was junior staff that were
4 doing different tasks, but I interfaced with her.

5 Q. Did you ever directly communicate with
6 any of the junior staff that were doing different
7 tasks in connection with preparation of your
8 expert opinion?

9 A. So my memory sitting here today is just
10 -- my best recollection in terms of Compass
11 Lexecon staff is one other person as -- as best I
12 can remember. Ron -- I'm going to mispronounce
13 his last name -- Lewon -- Lewinski, Lewonski.
14 Ronald Lewonski. Some -- something along those
15 lines.

16 So in addition with -- to interfacing
17 with her, that's the one other person that I can
18 recall sitting here today.

19 Q. What is Mr. Lewonski's role at Compass
20 Lexecon?

21 A. So he's a -- was a statistician.

22 Q. He's no longer with the company?

23 A. My memory is that he moved to another
24 company to do something -- some statistical stuff
25 with another company. I -- was it Amazon or -- I

1 forget which company.

2 Q. What assistance did Mr. Lewonski provide
3 with your expert opinions?

4 A. So, again, I interfaced with that --
5 that one person at Lexecon. He did join in a
6 conversation about the factor model. So it was
7 that one conversation where I do remember he -- he
8 talked.

9 Q. Did he have any assistance in designing
10 your factor model?

11 A. Well, the factor model was my -- my
12 instructions and I'm the one that provided
13 instructions on exactly what I wanted done and
14 how -- how it was to be done.

15 Q. How did Ms. van der Merwe assist in your
16 expert services in this case?

17 MR. KELLOGG: Objection.

18 A. So she helped -- you know, a couple
19 different buckets. She helped put together
20 binders of materials for me; kept the flow of
21 materials organized. She -- through her,
22 interfacing with her, there was a lot of data
23 work, merging of data and so forth. And I used
24 Compass Lexecon pursuant to my instructions for
25 that.

1 So, yeah, it was really -- I worked
2 closely with her in preparing the analyses and the
3 end result of my reports reflected in AF-1 and
4 AF-2.

5 Q. What was the role of the junior
6 assistants at Compass Lexecon with whom you did
7 not directly communicate in preparation of your
8 expert opinions in this case?

9 MR. KELLOGG: Objection.

10 A. So -- so I don't have a breakdown of who
11 did what. I interfaced with this person. I know
12 that she had assistants. But, again, it was
13 pursuant to my instructions and -- and supervision
14 about the ultimate work product.

15 Q. Was Ms. van der Merwe responsible for
16 the merging of price data between CoinMarketCap
17 and CryptoCompare?

18 MR. KELLOGG: Objection.

19 A. So you used the word "responsible." At
20 the end of the day, I'm responsible. She did
21 assist in the merging of the data pursuant to my
22 instructions and supervision.

23 Q. Do you know how much -- strike that.

24 Are Ms. van der Merwe and Mr. Lowanski
25 also charging, through Compass Lexecon, defendants

1 for their services?

2 A. I have no personal knowledge of that. I
3 assume so, but I have no personal knowledge.

4 Q. Do you know what their billing rates
5 are?

6 A. No.

7 Q. Did anyone at Compass Lexecon provide
8 any comments to drafts of AF-1?

9 MR. KELLOGG: Objection.

10 A. The comments or the -- the interactions
11 were -- I certainly discussed with Compass Lexecon
12 what I wanted done. I certainly had their
13 assistance. In terms of the draft itself, my
14 memory of the draft was really reflecting the work
15 product. So I think the discussions, the
16 thinking, the analysis, occurred before the final
17 production of the report. So I certainly had
18 those conversations.

19 Q. Who wrote the first draft of AF-1?

20 A. I did.

21 Q. Okay.

22 A. But I -- I did have the assistance of
23 Compass Lexecon. So, for example, some -- the
24 exhibits were produced pursuant to my instructions
25 and supervision by Compass Lexecon primarily

1 because we would still be waiting -- waiting for
2 the report if I were to do these exhibits in a --
3 in a clean and, you know, properly formatted way.

4 So I did have the assistance of Compass
5 Lexecon, but the first draft was mine.

6 Q. Okay. Who are all the individuals at
7 Compass Lexecon who contributed in any way to the
8 drafting of your report?

9 MR. KELLOGG: Objection;
10 mischaracterizes the testimony.

11 A. So -- so my interactions with Compass
12 Lexecon in terms of the draft is -- is what I
13 described earlier. I did the first draft. I did
14 have the assistance of Compass Lexecon; they
15 helped put together the exhibits pursuant to my
16 instructions and supervision. And obviously, you
17 know, that was, you know, something that, as I
18 worked on the draft, I continued to have the
19 assistance of Compass Lexecon.

20 Q. Who were the people that provided the
21 assistance in -- as described in your last
22 answer?

23 MR. KELLOGG: Objection;
24 asked and answered.

25 A. It's the same answer as before. I

1 interfaced, with that one exception that I can
2 recall, with -- with -- with that one person at
3 Compass Lexecon.

4 Q. With Ms. van der Merwe?

5 A. Yes.

6 Q. Did any attorneys provide comments to
7 drafts of Exhibit 1?

8 MR. KELLOGG: Objection.

9 Direct the witness not to
10 answer. You can answer yes or no, but
11 that's it.

12 A. What's the pending question?

13 Q. Did any attorneys provide comments on
14 drafts of Exhibit 1?

15 A. I don't recall ever receiving comments
16 from counsel on the draft. I certainly talked
17 about -- well --

18 MR. KELLOGG: Objection.

19 Don't -- don't go into detail.

20 A. So I -- I don't recall ever receiving
21 comments on the draft from -- from counsel, is my
22 best recollection.

23 Q. Okay.

24 A. So, in other words, you know, for -- for
25 example, I did a draft and then there's a markup

1 of the draft by counsel. I don't recall ever
2 that -- I never recall that happening.

3 Q. Just a yes or no: Did you ever receive
4 comments orally from counsel on the draft?

5 MR. KELLOGG: You can answer
6 yes or no.

7 A. It depends on what you mean by
8 "comments." So I did describe to counsel --

9 MR. KELLOGG: I'm going to
10 direct the witness not to answer that
11 question.

12 MR. SYLVESTER: Not to answer
13 whether or not he received comments
14 orally from counsel?

15 MR. KELLOGG: Yes.

16 MR. SYLVESTER: I believe --
17 do you want to strike it from the
18 record? Because he already answered.

19 MR. KELLOGG: Yes.

20 MR. SYLVESTER: Okay. So
21 just so the record is clear, you would
22 permit Professor Ferrell to answer the
23 question whether or not he received
24 written comments to his draft, but
25 you object and instruct him not to

1 answer as to whether or not

2 he received oral --

3 MR. KELLOGG: I object to --

4 MR. SYLVESTER: Please let me
5 finish just for the record.

6 You would object -- object
7 and instruct him not to answer as to
8 whether or not he received oral
9 comments from counsel on his draft
10 expert report.

11 THE WITNESS: Would this be a
12 good time to take a five-minute break?
13 We've been --

14 MR. SYLVESTER: That's fine
15 by me. Let's go off the record.

16 MR. FIGEL: Why don't we
17 finish this --

18 THE VIDEOGRAPHER: Okay.
19 Thank you. The time is approx --
20 approximately 10:24. We're going off
21 the record.

22 (Whereupon, a recess is
23 taken.)

24 THE VIDEOGRAPHER: The time
25 is approximately 10:44. We're back on

1 the record. This is the beginning of
2 Media 2.

3 MR. SYLVESTER: Okay. When
4 we went off the record, we were having
5 a colloquy about Ripple's counsel's
6 instruction not to answer.

7 Have you come to a position
8 on whether or not he is --

9 MR. KELLOGG: Correct. I
10 will direct the witness not to answer
11 any questions about conversations or
12 other interactions with counsel about
13 the drafting process of the report.

14 MR. SYLVESTER: And just for
15 clarity, that includes whether or not
16 such conversations occurred?

17 MR. KELLOGG: Correct.

18 MR. SYLVESTER: Okay.

19 BY MR. SYLVESTER:

20 Q. And are you, Professor, going to follow
21 counsel's instruction not to answer any questions
22 regarding any conversations you had with counsel
23 about the drafting process of your report
24 including whether or not such conversations
25 occurred?

1 A. I'm going to follow the instruction of
2 counsel.

3 Q. Okay.

4 MR. SYLVESTER: Before we get
5 back to questioning -- questioning, I
6 also want to put a reservation of
7 rights on the record.

8 To the extent that Professor
9 Ferrell testifies here today about any
10 analysis that he has performed that
11 the SEC has not received or any
12 opinions he has formed that are not
13 set forth in his expert reports, AF-1
14 or AF-2, we reserve all rights to
15 preclude any such analysis or any such
16 testimony at a later date.

17 BY MR. SYLVESTER:

18 Q. Moving on, have you served as an expert
19 witness prior to this case?

20 A. Yes.

21 Q. Approximately how many times have you
22 been retained as an expert witness?

23 A. I don't have an answer for that. I
24 don't have a number.

25 Q. General terms is fine.

1 A. I've been retained over the years in a
2 number of securities and capital market cases, but
3 I don't have a number.

4 Q. Is it north of 50, would you estimate?

5 A. If the question is north of 50 in my
6 lifetime, yes.

7 Q. Okay. Is it north of 100, would you
8 estimate?

9 A. In my lifetime, yes, it would be north
10 of 100. I do want to note that I have been on
11 occasion retained as an expert and the case
12 settled and I effectively do very little or --
13 if -- if anything.

14 So north of 100 with that understanding
15 of what an engagement might entail.

16 Q. Okay. Is it north of 200?

17 A. I don't believe so, but I -- I don't --
18 I don't have a specific recollection sitting here.
19 If you're talking about my entire life, I don't --
20 I don't know sitting here.

21 Q. Okay. In the entirety of your expert
22 engagements, have you ever been retained by the
23 plaintiff's counsel?

24 A. Yes.

25 Q. Okay. Sitting here today, just an

1 approximate number, what percentage of the time
2 have you been retained by plaintiff's counsel over
3 the history of your engagements?

4 A. I don't have a specific recollection. A
5 majority is on the defense side. I have on
6 occasion been retained by plaintiffs.

7 Q. Okay. Prior to this case, have you been
8 retained in a case where a governmental entity was
9 a party?

10 A. Yes.

11 Q. How many times has that occurred?

12 A. So I want to be clear. Is the question
13 that I'd been retained by the government or the
14 government's been involved?

15 Q. My first question was, is the
16 government -- let me just ask it again.

17 Have you been retained in a case where a
18 governmental entity was a party regardless of who
19 retained you?

20 A. Yes.

21 Q. Okay. Have you ever been retained by
22 the government in any such case?

23 A. Yes.

24 Q. Okay. How many times have you been
25 retained by the government as an expert witness?

1 A. So, you know, just sitting here, the one
2 memory that comes to mind is I was retained by the
3 U.S. Attorney -- U.S. Attorney in the Southern
4 District in a criminal securities case is -- you
5 know, just sitting here today, is the -- is the
6 one case that comes to mind. That was a couple
7 years ago.

8 Q. Okay. And now backing up to the
9 entirety of cases in which the government was a
10 party and you were an expert witness,
11 approximately how many of those exist?

12 A. I don't know. It's -- it has happened
13 on occasion, but it's -- it's -- it's relatively
14 infrequent. Relatively infre -- it does happen,
15 but relatively infrequently.

16 Q. Would you say that number is as high as
17 ten?

18 A. It's possible. I don't -- I don't have
19 a specific number.

20 Q. Okay. Would you say it's as high as 50?

21 A. No.

22 Q. Okay. Have you ever served as an expert
23 witness in a case in which the SEC was a party?

24 A. Yes.

25 Q. How many such cases?

1 A. I don't have a specific number. It's a
2 small number of cases, is my best recollection,
3 but I don't have a specific number.

4 Q. Has the SEC ever retained you as an
5 expert witness?

6 A. No.

7 Q. So in each of the cases that you've been
8 retained as an expert witness in which the SEC was
9 a party, you've been a witness for the defense?

10 A. Yes. The handful of times I can recall
11 that happening, yes.

12 Q. Has your expert opinion ever been
13 excluded by a court?

14 A. No.

15 Q. Let me reask a better question related
16 to that.

17 Has there ever -- has your expert
18 opinion ever been excluded in whole or in part by
19 a court?

20 A. No.

21 Q. Okay. Have you ever held any
22 professional licenses?

23 A. I was a member of the bar for, like, a
24 year in the '90s. So that's -- no other
25 professional licenses.

1 Q. Okay. Was your bar license ever revoked
2 or suspended?

3 A. I -- I stopped being a member of the bar
4 because I wasn't practicing law, so...

5 Q. Have you ever --

6 A. I let it lapse.

7 Q. I'm sorry. You said it lapsed?

8 A. I believe so.

9 Q. Okay. Have you ever been the subject of
10 any disciplinary action related to your
11 professional activities?

12 A. No.

13 Q. Are you familiar with the term "event
14 study"?

15 A. Yes.

16 Q. Okay. Have you conducted event studies
17 in the past as part of your expert witness work?

18 A. Yes.

19 Q. Approximately how many times?

20 A. How many -- is the question how many
21 times have I done an event study?

22 Q. As a part of your expert witness work in
23 the past.

24 A. A large number of times.

25 Q. North of 50?

1 A. Possibly.

2 Q. North of 100?

3 A. I don't have a specific recollection. I
4 don't know.

5 Q. Have you ever submitted a rebuttal
6 expert opinion critiquing an event study conducted
7 by another expert witness?

8 A. Yes.

9 Q. How many times have you done that?

10 A. A fair number of times. I don't have a
11 specific number, but I -- I have definitely done
12 that.

13 Q. Okay. Would you estimate that as north
14 of 50?

15 A. I don't have a specific number. I'm not
16 sure if it's north of 50. I don't know.

17 Q. How about north of 20?

18 A. My best -- I don't have a specific
19 number. The answer is probably yes.

20 Q. Okay. Have you conducted event studies
21 in contexts other than engagements as an expert
22 witness?

23 A. Yes.

24 Q. Okay. What context?

25 A. Academic writing and I also teach event

1 studies.

2 Q. Are the academic publications in which
3 you've addressed the topic of event studies listed
4 among your publications in AF-1?

5 A. All my current publications are -- are
6 listed there. Let me just take a quick look. I
7 am -- yes. So my most recent paper is listed in
8 the rebuttal. So I believe this is a complete
9 list of my academic writings.

10 Q. Okay. Before performing an event study,
11 do you always check whether the market for the
12 considered security is efficient?

13 A. My best recollection is in the context
14 where I've done an event study, it's been assumed
15 that the market's efficient is my best
16 recollection.

17 Q. When you say "it's been assumed," is
18 that you doing the assuming or someone else?

19 A. It's an assumption -- you know, if we're
20 talking about my expert work, it's an assumption
21 of the litigation under -- under Basic versus
22 Levinson or under the -- let me -- let me restate.

23 That typically when I do an event study
24 in my -- is in a situation where it's been assumed
25 for purposes of litigation that the market is

1 efficient.

2 Q. Now moving to your -- strike that.

3 For event -- event studies that you've
4 conducted in academic contexts, for those event
5 studies, do you always check whether the market
6 for the considered security is efficient?

7 A. I believe the event studies that I do in
8 my -- in my work is for large publicly traded
9 companies. So I don't -- I didn't run the legal
10 test for efficiency there, but we're talking
11 about, my best recollection is, large publicly
12 traded companies such as listed in the New York
13 Stock Exchange where I don't think there would be
14 a dispute as to efficiency is -- is my sense.

15 Q. And there are other tests for market
16 efficiency setting aside legal tests, correct?

17 MR. KELLOGG: Objection.

18 A. There's certainly academic literature on
19 efficiency going back to Gene Fama's work in the
20 1960s for sure.

21 Q. And focusing only on economic tests for
22 market efficiency, before performing an event
23 study in an academic context, do you check whether
24 the market is considered efficient in economic
25 terms?

1 A. The same answer as before. So my best
2 recollection of kind of the event study factor
3 type analysis I've done academic work for involves
4 publicly traded securities; New York Stock
5 Exchange listed securities, for example.

6 So, you know, I received it on that
7 basis.

8 Q. Have you ever performed an event study
9 where the market in your view was not efficient?

10 A. I don't recall offhand doing that. I'm
11 not saying it's impossible. I don't have a
12 recollection sitting here today of doing that.

13 Q. When you perform an event study, do you
14 always check for statistically significant
15 abnormal returns on days without any relevant news
16 during the period you're examining?

17 MR. KELLOGG: Objection.

18 A. You know, when I run an event study such
19 as, you know, as an expert, the question's always
20 what is the point of the event study and that
21 informs what I look for and what's relevant. So
22 it really depends on the purpose that I'm using
23 the event study for or the purpose that, for
24 example, an opposing expert's using the event
25 study and that informs the questions that I think

1 are relevant.

2 Q. If you're conducting an event study in
3 which you're testing the impact of a news event on
4 the price of a security, in that -- in an event
5 study that addresses that question, do you always
6 check for statistically significant abnormal
7 returns on days without any relevant news?

8 MR. KELLOGG: Objection.

9 A. Again, it depends on the event study
10 that I'm assessing or conducting. I'd just want
11 to know more context about the purposes of the
12 event study and the facts and circumstances.

13 Q. Can you recall conducting an event study
14 in which you took steps to determine whether or
15 not there were statistically significant abnormal
16 returns on days other than days on which the
17 relevant news was released?

18 MR. KELLOGG: Objection.

19 A. That's at a high level of generality.
20 It's certainly possible, but it would depend on
21 what the relevant economic questions were given
22 the facts and circumstances of the case and given,
23 if we're talking about expert work, what the
24 opposing expert's doing and the purpose for which
25 they're offering the event study. So it would

1 really depend on the context and the facts and
2 circumstances.

3 Q. That makes sense, but I'm asking about
4 your recollection of your prior work.

5 Can you recall taking the steps to
6 determine whether or not there were statistically
7 significant abnormal returns on no news days when
8 conducting an event study?

9 MR. KELLOGG: Objection.

10 A. It's possible. I don't have a specific
11 recollection.

12 Q. Okay. Let's assume that you conduct an
13 event study -- now we're in hypothetical land.

14 Let's assume that you conduct an event
15 study and you observe a statistically significant
16 abnormal price return following a news event.
17 Let's also say that you observe a number of days
18 without news that also have statistically
19 significant abnormal price returns.

20 How would your analysis or conclusions
21 about the price reaction to news events change, if
22 it would?

23 MR. KELLOGG: Objection.

24 A. I don't have a view. I would have to
25 think about it.

1 Q. Did you conduct an event study as part
2 of your work in this case?

3 A. No.

4 Q. Have you ever conducted an event study
5 that pertained to digital asset prices?

6 A. No.

7 Q. Okay. Are you offering any opinion in
8 this case regarding the suitability of event study
9 methodology and assessing whether there exists a
10 link between Ripple news and the price of XRP?

11 MR. KELLOGG: Objection.

12 A. I am certainly providing an opinion that
13 the factor model is the appropriate statistical
14 model given the facts and circumstances of this
15 case. So I do have a -- a view as to whether,
16 given the economic theory in the complaint,
17 that -- I do have a view as to whether the event
18 study methodology or the factor model methodology
19 is more appropriate. So that level of generality
20 I do have an opinion.

21 Q. Are you providing the opinion that the
22 factor model that you employed is the only
23 appropriate statistical model to employ to
24 determine whether there is a link between Ripple
25 news and the price of XRP?

1 MR. KELLOGG: Objection.

2 A. I'm providing the opinion that the
3 factor model is -- is the correct statistical
4 model, correct statistical technique, to assess
5 the economic theory as articulated in the
6 complaint.

7 Q. And what I'm just focusing in on is, is
8 it the only correct statistical technique in your
9 view?

10 MR. KELLOGG: Objection.

11 A. Well, you know, there's a panoply of
12 academically peer-reviewed statistical techniques.
13 The question here is, which one of those
14 statistical techniques is appropriate given the
15 facts and circumstances of this case? And my
16 opinion is that the factor model is the correct
17 way, not the event study approach.

18 Q. Is there any part of your expert opinion
19 that states expressly that the event study
20 approach is the incorrect way to study whether
21 there exists a link between Ripple news and the
22 price of XRP?

23 MR. KELLOGG: Objection.

24 A. Sure. So I try to, you know, explain
25 this in detail in my opening report. That is, the

1 SEC's economic theory articulated in the complaint
2 is -- there's a whole series of events:
3 Statements, distributions, et cetera. There's a
4 whole series of events -- activities; conduct, if
5 you will -- that occurred over this seven-year
6 period, 2013 to 2020, that in aggregate is
7 associated with the price of XRP going up.

8 So, for example, paragraph 79 to 82 of
9 the complaint. Paragraph 9 of the complaint
10 refers to all the conduct referenced in the
11 complaint as the basis for the legal conclusion.

12 And so given the facts and circumstances
13 of this case, I felt it was appropriate that one
14 analyze the cumulative effect of the conduct
15 identified in the complaint and whether it is, in
16 fact, associated with excess returns. That is to
17 say, returns that are specific to XRP and are not
18 otherwise explainable by general movements in
19 the -- in the cryptocurrency markets.

20 I would also say, to give a complete
21 answer, that for the event -- that another virtue
22 of this approach -- that is, the factor model
23 approach -- is one can analyze the entire time
24 period. I also analyzed, obviously, 2015 to 2020,
25 as well, separately. That has the virtue of

1 capturing the entirety of the price return series
2 versus a situation where even if you observe a
3 short-term correlation between a news event and an
4 XRP change in price, even assuming that were true,
5 there's still the further question of whether that
6 gets reversed later.

7 Again, this -- this sort of speaks to
8 market efficiency and the need to know and the
9 impact that the efficiency of the market has on
10 how one -- whether you can meaningfully interpret
11 the results of an event study given that, you
12 know, you're not -- you may not be able to
13 identify the appropriate event window.

14 So, again, for those reasons, the
15 reasons articulated in my report, I believe the
16 factor model is the appropriate statistical test
17 in the facts and circumstances of this case.

18 Q. When was the last time you read the
19 SEC's complaint in this matter?

20 A. Last night.

21 Q. How many times have you read the
22 complaint?

23 A. Many times.

24 Q. More than ten?

25 A. Probably.

1 Q. More than 20?

2 A. Probably not.

3 Q. Okay. And just for the record, you read
4 the complaint approximately more than ten times in
5 connection with preparing your expert report in
6 this case?

7 A. Yes.

8 Q. Okay. As part of -- part of forming
9 your opinion in this case, you conducted a
10 principal components analysis, is that right?

11 A. Yes.

12 Q. Okay. As I understand it, the purpose
13 of conducting the principal components analysis
14 was to describe the main drivers of general
15 cryptocurrency markets, is that right?

16 MR. KELLOGG: Objection.

17 A. It's a way of capturing the information
18 in the non-XRP cryptocurrency markets that I then
19 use in the factor model.

20 Q. When you say "capturing the
21 information," what information do you mean?

22 A. Well, there's the 91 tokens that I use
23 for the 2015 to 2020 period. There's the 9 crypto
24 assets that I use for the full period. And so
25 there's a covariance matrix associated with that.

1 And the PCA analysis is a way to extract
2 information embedded in the covariance matrix of
3 the cryptocurrency assets that I'm using, extract
4 into the principal components that I then use in
5 the regression analysis or in the factor model
6 analysis.

7 Q. As part of your previous engagements as
8 an expert witness, have you ever conducted a
9 principal components analysis?

10 A. I don't recall either way.

11 Q. Setting aside whether or not you
12 conducted a PCA -- strike that.

13 If I say "PCA" throughout the day, I
14 mean principal components analysis. Okay?

15 A. Understood.

16 Q. Okay. Setting aside whether or not you
17 conducted a PCA in your prior engagements, have
18 you ever been called upon to opine as to whether
19 a specific factor or event influenced price
20 returns?

21 MR. KELLOGG: Objection.

22 A. I -- I mean, going back to our earlier
23 questions, I have done event study analyses in the
24 past.

25 Q. And so that I understand your answer,

1 I -- strike that.

2 In your prior expert engagements when
3 you have been called upon to opine as to whether a
4 specific factor or event influenced price returns,
5 the expert analysis that you conducted was an
6 event study, is that right?

7 MR. KELLOGG: Objection.

8 A. That's not quite right. So I have used
9 event studies in -- in the context of thinking
10 about prices. I've also used factor model as well
11 in other contexts. So it depends on the facts and
12 circumstances of the case, including the
13 efficiency of the market.

14 Q. Prior to this engagement, how many times
15 have you used a factor model to opine on the
16 question of whether a specific factor or event
17 influenced price returns?

18 MR. KELLOGG: Objection.

19 A. I don't have a specific recollection. I
20 have used it in the past, but I don't have a
21 number.

22 Q. Under ten?

23 A. Yes.

24 Q. Under five?

25 A. Probably. I'm not sure.

1 Q. Can you recall sitting here today any of
2 the matters in which you've used a factor model to
3 opine as to whether a specific factor or event
4 influenced price returns?

5 A. So I do remember -- I'm not going to
6 remember cases. I do remember there's been
7 matters where the claim is that there's been
8 leakage of information into the marketplace that
9 affected the returns over a period of time. And I
10 do remember using a factor model in that context.

11 So, again, a claim concerning events
12 spanned over a period of time where the claim is
13 that it's impacting the price return series.

14 Q. Do you recall the security at issue in
15 the case you just described?

16 A. I believe it was a publicly traded
17 security, is my memory. A publicly traded stock.

18 Q. Prior to this case, have you ever
19 offered an expert opinion that an asset was or was
20 not a currency?

21 A. No.

22 Q. Prior to this case, have you ever
23 offered an expert opinion that an asset was or was
24 not a virtual currency?

25 A. No.

1 Q. Prior to this case, have you ever
2 offered an expert opinion that an asset did or did
3 not function as a store of value?

4 A. No.

5 Q. Prior to this case, have you ever
6 offered an expert opinion that an asset did or did
7 not function as a unit of account?

8 A. No.

9 Q. Prior to this -- prior to this case,
10 have you ever offered an expert opinion that an
11 asset did or did not function as a medium of
12 exchange?

13 A. I don't believe so.

14 Q. Okay. Have you ever --

15 A. So these are -- just to be clear on the
16 record, this is my best recollection sitting here
17 today.

18 Q. Have you authored any academic articles
19 that addressed the topic of whether an asset is or
20 is not a currency?

21 A. No.

22 Q. Have you authored any academic articles
23 that address the topic of whether an asset is or
24 is not a virtual currency?

25 A. No.

1 Q. Have you authored any academic articles
2 that address the topic of whether or not an asset
3 functions as a medium of exchange?

4 A. I don't believe so.

5 Q. Have you authored any academic articles
6 that address the topic of whether an asset
7 functions as a store of value?

8 A. I don't believe so.

9 Q. Have you authored any academic articles
10 that address the topic of whether an asset
11 functions as a unit of account?

12 A. I don't believe so.

13 Q. Have you written any publications
14 pertaining to digital assets?

15 A. I don't believe so.

16 Q. Have you taught any classes that cover
17 the topic of digital assets?

18 A. Yes.

19 Q. What classes?

20 A. I cover it in corporate finance and I
21 cover it in my securities regulation class. Oh,
22 and it also comes up in my law and finance class
23 on start-ups.

24 Q. What topics do you cover related to
25 digital assets in your securities regulation

1 courses?

2 A. So I -- so the securities regulation
3 class is a -- is a class at the law school
4 although I incorporate economics and finance into
5 that. And so the securities regulation class, I
6 do cover different issues relating to the
7 application of securities laws and -- and digital
8 assets have come up in that context, such as ICOs
9 or, you know, tokens, where, for example, there's
10 some right associated to -- with profits or
11 earnings of the entity that's issuing them to --
12 to raise capital.

13 So that would be the securities
14 regulation class. It comes up in that context.
15 Kind of the panoply of instruments that you
16 observe in the marketplace.

17 In corporate finance, I talk about it as
18 sort of a new -- new-ish, I should say, financial
19 asset. So just sort of the characteristics of
20 this -- of this space of crypto assets.

21 And then the law of finance seminar, we
22 do talk about start-ups including start-ups in
23 the -- in the block up -- in the blockchain space.

24 So it comes up in different ways in --
25 in -- in these different courses.

1 Q. Have you ever taught -- strike that.

2 Have you -- strike that.

3 When you teach your securities
4 regulation class, do you teach case law?

5 A. Yes.

6 Q. Have you, as part of your securities
7 regulation class, ever taught any cases in which
8 the SEC has brought any claims against a digital
9 asset issuer?

10 A. I don't believe so. Now, the case book
11 that I use I do think mentions -- might -- I'd
12 have to look back. It's possible the case book
13 mentions those cases in passing, but I don't have
14 a recollection of specifically assigning those
15 cases.

16 Q. Have you ever taught a class in which
17 you address the topic of the SEC's case against
18 Ripple?

19 A. No. No. I have mentioned in the
20 context of securities regulation crypto assets. I
21 don't remember ever assigning a case or a
22 complaint to the class. So I do mention the issue
23 in class, but, again, I don't have a recollection
24 of ever assigning an SEC complaint or -- or a
25 case. So it's really at that level of generality.

1 Q. Setting aside the SEC's case against
2 Ripple, have you ever taught any class in which
3 you discussed Ripple or XRP?

4 A. I don't think I've ever gotten into the
5 allegations in this case, no. I do mention -- I
6 have mentioned securities regulations. It's
7 mentioned in the case book as well, I believe.
8 You know, the -- the policy issues around crypto
9 assets and how they interact with the securities
10 laws. So at that level of generality, yes.

11 Q. Prior to this case, had you been
12 retained as an expert in any case involving
13 digital assets?

14 A. I don't believe so.

15 Q. Prior to this case, had you ever
16 conducted any analysis of price movement of
17 digital assets?

18 A. I don't believe so.

19 Q. Are you offering any opinion in this
20 case on the informational efficiency of the XRP
21 market?

22 A. No.

23 Q. Okay.

24 A. I'm not providing an opinion on that
25 except to say -- except referencing my earlier

1 comments about the event study approach versus the
2 factor model.

3 Q. Turning to Appendix B of your opening
4 report, AF-1.

5 A. Appendix B?

6 Q. That's right.

7 A. Yes.

8 Q. Labeled "Materials Considered."

9 Do you see that?

10 A. I do.

11 Q. Did you personally review each of the
12 materials listed in Appendix B?

13 A. I did.

14 Q. You know what a Wells submission is, is
15 that right?

16 A. Yes, I do.

17 Q. Okay. Did you review any of defendants'
18 Wells submissions in this case?

19 A. I don't believe I reviewed the Wells
20 submission is my best recollection. That's my
21 best recollection sitting here.

22 Q. Okay. Let's turn to paragraph 90 of
23 AF-1 on page 39.

24 A. Page 39?

25 Q. Yes.

1 A. Paragraph 90?

2 Q. That's right.

3 A. Okay.

4 Q. The second sentence, you refer to "the
5 economic reality that Ripple's efforts do not
6 impact XRP prices."

7 A. I don't -- I don't see that. Page 39?

8 Q. 39, paragraph 90.

9 A. Yes.

10 Q. Sentence 2. I'm quoting the latter
11 portion of sentence 2. Your reference is to "the
12 economic reality that Ripple's efforts do not
13 impact XRP prices."

14 A. I do. Okay. I didn't realize you were
15 reading a portion of the sentence. Okay.

16 MR. KELLOGG: Sorry. Mark,
17 where are we?

18 MR. SYLVESTER: The second
19 sentence of paragraph 90, latter
20 portion.

21 BY MR. SYLVESTER:

22 Q. Okay. Is your view, Professor, that the
23 economic reality described in this sentence --
24 sorry. Strike that.

25 Is your view that the economic reality

1 that Ripple's efforts do not impact XRP prices
2 based on your analysis that you describe in
3 Section III of your report?

4 MR. KELLOGG: Objection.

5 A. Well, it does reflect the -- the
6 analysis in Section III, but I -- you know, I
7 would also, you know, reference all the work in
8 the report, including my review of the contracts.
9 You know, the contracts are also referenced in the
10 complaint as well.

11 But I am including as a basis here the
12 factor model, that's true.

13 Q. Okay. And can we shorthand the -- the
14 analysis performed in Section III.C of your report
15 as your factor model? Is that fair?

16 A. Well, I -- I have a factor model in
17 III.D as well.

18 Q. Okay.

19 A. So I -- I wouldn't confine the factor
20 model just to III.C if what you're interested in
21 is the factor model.

22 Q. Maybe it's easier if I just distinguish
23 throughout the day your two analyses by referring
24 to the analysis that you performed with respect to
25 Sections III.D and III.C of your report. Would

1 that work?

2 A. If you want to refer to the analysis in
3 III.C, I have no problem with that.

4 Q. Okay. All right. And in III.C you
5 describe the statistical analysis you performed?

6 A. One of the statistical analyses, yes.

7 Q. Right.

8 Did you design the analysis that's
9 described in Section III.C to answer the question
10 of whether Ripple's efforts impact XRP prices?

11 MR. KELLOGG: Objection.

12 A. Well, a full answer to that is it's
13 designed to assess the economic theory articulated
14 in the SEC complaint; i.e., there's a whole series
15 of events, including distributions, but not
16 limited to distributions, that had the effect or
17 associated with XRP price increases over that time
18 period, the time period being 2013 to 2020.

19 So the factor model is the appropriate
20 statistical test to assess that economic theory.

21 Q. In your last answer you referenced a
22 whole series of events including, but not limited
23 to, distributions.

24 What other events are part of that
25 series of events?

1 A. I would just reference the complaint.
2 So the complaint identifies various statements,
3 tweets, I believe, distributions, that in the
4 SEC's view over this time period are -- is
5 associated with XRP prices increasing. And,
6 again, I would reference the complaint for the
7 full list of the various events, distributions,
8 news -- statements that the SEC believes in
9 aggregate is associated and helps explain XRP
10 price increases over this time period, the 2013 to
11 20 -- 2020 period.

12 And, again, my view is the factor model
13 is the appropriate way to test whether that's
14 accurate or not.

15 Q. In your view the factor model is the
16 appropriate way to test whether all of the items
17 that you just listed had an impact on XRP's price,
18 is that right?

19 MR. KELLOGG: Objection.

20 A. It's the appropriate way to assess
21 whether over this time period the events -- events
22 defined as the conduct identified by the
23 complaint -- had or are associated with excess
24 returns of XRP; i.e., returns of XRP that are not
25 explained by general movements in the non-XRP

1 cryptocurrency markets.

2 Q. Let's look back to paragraph 90. At the
3 very bottom of page 39 --

4 A. Yes.

5 Q. -- you reference your "empirical
6 analysis of long-run XRP price return."

7 Do you see that?

8 A. I do see that portion of the sentence at
9 the bottom of page 39.

10 Q. Okay. And is that phrase that I just
11 read a reference to the analysis that you
12 performed that's described in Section III.C?

13 MR. KELLOGG: Objection.

14 A. I am referencing the analysis in III.C,
15 but I -- I would note that I also have a factor
16 model that is relevant to my opinion here in
17 III.D.

18 Q. Okay. The top bullet, still on
19 paragraph 90, but on page 40 now, says "Variation
20 in long-run XRP price return can be explained by
21 exogenous cryptocurrency market factors that are
22 outside Ripple's control."

23 Do you see that?

24 A. I do.

25 Q. Okay. What does the term "long-run"

1 mean in this sentence?

2 A. It -- it's a reference to the estimation
3 periods that I -- I looked at.

4 THE REPORTER: What period?

5 A. It's a reference to the estimation
6 periods that I used and there's two: The 2013 to
7 2020 period, and then my Estimation Period 2,
8 which is 2015 to 2020.

9 Q. Did you perform any analysis to evaluate
10 the question of whether Ripple's efforts impact
11 XRP prices in the short run?

12 MR. KELLOGG: Objection.

13 A. The answer to that is yes in the sense
14 that if there were news events -- I'm going to --
15 I'm going to use the phrase "events" to reference
16 the complaint's identification of what the SEC
17 feels or believes is impacting, is relevant to
18 the -- to the XRP pricing.

19 So, again, I just want to be clear.
20 When we're talking about events, I'm assuming that
21 we're talking about the events deemed relevant by
22 the complaint, but you can tell me if I'm
23 misunderstanding.

24 Q. I think it's fair to make sure we're
25 talking about the same thing.

1 So the complaint makes a number of
2 allegations about Ripple's actions. Fair to say?

3 A. Yes.

4 Q. Okay. So when you use the word
5 "events," are you talking about the various types
6 of Ripple's actions that are alleged in the
7 complaint?

8 A. Yes.

9 Q. Okay.

10 A. The distributions, the statements, the
11 various events so identified by the complaint.
12 And I -- and I do analyze, you know, the short
13 term in the sense that if these events had an
14 immediate -- for example, had an impact on XRP
15 pricing that was permanent, didn't get reversed
16 because the market is inefficient, then that would
17 be picked up in the -- in the factor model.

18 So events that have permanent price
19 effects that don't get reversed, for example,
20 would -- would show up in the XRP return and it
21 would show up in whether the excess returns, the
22 returns specific to XRP, are statistically
23 significant or not.

24 Q. Other than the one set forth in
25 Dr. [REDACTED] opening report, are you aware of any

1 event study that evaluates the question of whether
2 news of Ripple's actions had any correlation with
3 XRP price returns?

4 MR. KELLOGG: Objection.

5 A. Not sitting here. Nothing that I -- I
6 recall.

7 Q. Okay. Focusing just on your analysis
8 set forth in III.C, did counsel ask you to make
9 any assumptions in connection with the analysis
10 you performed as described in III.C?

11 MR. KELLOGG: Objection.

12 You can answer yes or no.

13 A. No.

14 Q. Okay. Are you expressing any opinion in
15 this case about whether or not Ripple's efforts
16 affect daily or intraday XRP prices?

17 A. I am in the sense that I described
18 earlier, which -- which is to say, if Ripple news,
19 the various things that the SEC identifies in the
20 complaint, if those events had an immediate --
21 let's say a same-day price effect, just
22 hypothetically, and that price effect was
23 permanent, it didn't get reversed because the
24 market's inefficient. So it doesn't get reversed
25 11 days later. It's a permanent price effect,

1 whether it be intraday or at the end of -- end of
2 the closing day, whatever your time interval is.
3 Those permanent pricing effects would show up in
4 the returns that I analyzed and would show up if
5 it's -- if it's XRP specific in the excess returns
6 that I'm analyzing in the factor model.

7 So in that way I am analyzing that
8 question, again in the context of the time series,
9 over my estimation period.

10 Q. Setting aside that analysis that you
11 just described, did you perform any other analysis
12 pertaining to the question of whether or not
13 Ripple's efforts affect daily or intraday XRP
14 prices?

15 MR. KELLOGG: Objection.

16 A. That would be my answer to the question.

17 Q. Okay.

18 A. Which is, the short term can matter to
19 the long term if the short term is permanent and,
20 therefore, would show up in the re -- the price
21 series.

22 If the -- if one -- you know, just to
23 take the opposite hypothetical, if, for example,
24 there's a correlation between a news event and a
25 change in XRP price, as a hypothetical, and that

1 gets reversed, hypothetically, nine days later,
2 then that would not -- and -- and all that's
3 occurring within my 28-day window, that would not
4 show up in the return by definition. It might
5 show up in the weekly, but not in the -- the
6 28-day period.

7 So, again, I am -- I would be picking up
8 in my factor analysis events that -- that affect
9 the -- the return versus, you know, some news
10 event that might be reversed by the market.

11 Q. Sitting here today, do you know whether
12 the hypothetical that you just described occurred?
13 Meaning there was a news event, there was a Ripple
14 news event, there was a change in XRP price, there
15 was a reversion, and it wasn't picked up in your
16 factoring analysis?

17 MR. KELLOGG: Objection.

18 A. No. So the prob -- one problem in my
19 view and one reason why the factor model is a
20 better approach is I have not seen any -- I'm not
21 aware of, I should say, Dr. [REDACTED] addressing how
22 his event study can -- can -- can adjust for that.

23 So, again, it goes back to my reason for
24 why the factor model is better. We're talking
25 about XRP in 2013 and -- and going forward. We're

1 talking about the long-term price series given the
2 allegations in the complaint. And so I just view
3 that as this is the better way to go.

4 Q. Is it possible in your view that there
5 was a Ripple news event and a resulting change in
6 XRP price, the XRP price then reverted within your
7 28-day window, and that did not show up in your
8 factor model?

9 MR. KELLOGG: Objection.

10 A. So in your hypo, if the price increased
11 and decreased within the 28-day period, I think it
12 follows that it would not be in the -- the 28-day
13 period. It may -- it might be in the week period,
14 depending on the timing of those events, but a
15 complete price reversal within that time interval
16 by definition would not be -- wouldn't be, A, a
17 permanent price effect; and, B, wouldn't be in the
18 time series; and, C, wouldn't explain why XRP
19 price is going up over time.

20 Q. Okay. You've mentioned in your
21 testimony a few times, I think, the phrase
22 "because the market is inefficient." And I just
23 want to clarify for the record. Are you offering
24 any opinion in this case about the efficiency of
25 the XRP market?

1 MR. KELLOGG: Objection.

2 A. I am not.

3 Q. Okay.

4 A. I -- I -- I'm saying that if the market
5 is in -- inefficient, the market for XRP, for
6 example, in 2013 or some time period, then in that
7 scenario the event study is going to have this
8 problem of what the appropriate event window is.
9 That is to say, how do you control for or adjust,
10 when thinking about price impacts, for reversals
11 or whatever it is that renders the market
12 inefficient?

13 So I was really talking in terms of that
14 scenario.

15 Q. And you haven't done any analysis to
16 determine one way or the other whether the XRP
17 market is or is not inefficient?

18 MR. KELLOGG: Objection.

19 A. Correct.

20 Q. Okay. Are you expressing the opinion in
21 this case that XRP would have performed as it
22 historically did irrespective of Ripple's actions?

23 MR. KELLOGG: Objection.

24 A. That's not -- that's not quite the way I
25 would frame it. The way I would frame it is

1 there's no excess returns. There's no XRP
2 specific price returns -- there's no price returns
3 specific to XRP that -- above and beyond the
4 general cryptocurrency market movements.

5 Q. And does that mean in your view -- in
6 your view that XRP would have performed as it did
7 irrespective of Ripple's actions?

8 A. It -- well, the -- that test and that
9 finding is -- does directly speak to the SEC's
10 claim in its complaint that Ripple's efforts
11 caused the price to increase or is associated with
12 a price increase, you know, over this time period.

13 So it -- it's really addressing the
14 economic theory articulated in the complaint; that
15 is to say, there's Ripple-specific efforts that
16 help explain or are associated with an XRP price
17 rise. And it's really that proposition that I'm
18 testing.

19 Q. Who collected the data that you used for
20 your factor analysis?

21 A. Compass Lexecon.

22 Q. Do you know who personally conducted the
23 data pull?

24 A. We're -- we're going to just go back to
25 our earlier conversation. I interfaced with

1 Ms. van der Merwe at Compass Lexecon. I gave
2 instructions on the type of analysis I wanted to
3 do, including the data pull and where to pull the
4 data. And so I would just reference our earlier
5 discussion in that regard.

6 Q. Did you personally do anything to check
7 the quality of the data that you used in
8 performing your factor analysis?

9 A. You said "personally." Sure. I went
10 over the data with Compass Lexecon. I talked
11 about where I wanted the data to be pulled. So,
12 yes, a lot of work went into that including myself
13 personally.

14 Q. What data quality checks, if any, did
15 you perform?

16 A. Well, so, I reviewed the academic
17 literature about where the academic peer-reviewed
18 finance literature pools return data. The
19 academic literature is quite clear that
20 CoinMarketCap and CryptoCompare are widely used in
21 the peer-reviewed academic research. And so I
22 guess I began my data collection by grounding
23 myself in the accepted approach in the academic
24 literature. So I guess that's the main starting
25 point.

1 As I said earlier today, I also ran
2 before the filing of the report all the time
3 series on CoinMarketCap just as a robustness
4 check. I think the data sources that I use in the
5 report are the correct ones. But it was really, I
6 guess answering your questions, following the
7 academic literature on this.

8 Q. Returning to the data sources that you
9 used underlying your opinions in the report, in
10 addition to referencing the academic literature,
11 are there any other data quality checks that you
12 performed?

13 A. Well, sure. I mean, I went over the
14 data collection process, how they're pulling the
15 data, I looked at the data. So, yes, this was a
16 process that unfolded over time. So it wasn't
17 simply, you know -- you know, just reading
18 academic finance papers but, rather, making sure
19 that that was properly implemented in how the data
20 here was put together.

21 Q. Why did you -- excuse me.

22 Why did you opt to use price data from
23 two sources?

24 A. Well, if you look at the academic
25 peer-reviewed literature, CryptoCompare is widely

1 used in the peer-reviewed academic research --
2 academic peer-reviewed literature as a source
3 of -- of price return data.

4 Now, you do run into the following
5 issue, which is CryptoCompare does not go back to
6 2013. So another source that is also used in the
7 academic literature is CoinMarket. So
8 CoinMarket -- CryptoCompare doesn't go back to the
9 beginning and, therefore, I relied, consistent
10 with the academic literature, on -- on CoinMarket
11 for that time period.

12 Q. Does CoinMarket cover the entire period
13 from 2013 to 2020?

14 A. I believe so. And that's why I was able
15 to run it, as I discussed earlier, just on
16 CoinMarket. But I felt the better way to go is to
17 use CryptoCompare because that is used as a data
18 source in peer-reviewed academic research.

19 Q. For clarity, for the opinions underlying
20 your report, you used both data sources, is that
21 right?

22 A. Yes.

23 Q. Okay. Is there any academic literature
24 you can think of sitting here today that uses two
25 sets of data sources for pricing?

1 A. I haven't looked at that specifically.
2 I mean, not sitting here today. I can say that
3 the academic peer-reviewed literature uses both
4 and uses CryptoCompare for later time periods.
5 That's simply not possible to use for the earlier
6 period because it doesn't exist in CryptoCompare.

7 So, you know, sitting here today, both
8 are used in the academic research literature. As
9 I said earlier, even if you just run it on
10 CoinMarket, it doesn't make a difference.

11 Q. What's the advantage of using two sets
12 of data versus just using CoinMarket data?

13 A. Well, at the end of the day, it doesn't
14 matter. The results are the same. The excess
15 returns are not statistically significant at the 5
16 percent level.

17 That being said, if you review the
18 academic peer-reviewed literature, you do observe
19 papers using CryptoCompare for their analysis.

20 Q. Right. My question, though, goes to
21 your -- the methodology that you selected for your
22 report.

23 Was there an advantage in your mind to
24 using two data sources versus just using the
25 CoinMarket data?

1 A. Again, it doesn't make a difference,
2 but, yes, there is an advantage in the sense that
3 when you read the peer-reviewed academic research
4 literature, and the literature is analyzing a
5 later time period, a period for which there is
6 CryptoCompare data, you do observe the
7 peer-reviewed academic literature using that data
8 source. Not that it means CoinMarket is bad data,
9 but, rather, you do observe papers using
10 CryptoCompare.

11 So the Liu paper in the Journal of
12 Finance, or coming out in the Journal of Finance,
13 uses CryptoCompare, I believe if I'm citing the
14 paper correctly, but let -- let me restate that.

15 There are peer-reviewed academic papers
16 that are using CryptoCompare. Obviously you can't
17 use that in the earlier period here because it
18 doesn't exist in the data set.

19 Q. Did you do anything to verify
20 compatibility of price data from the two data sets
21 that you used?

22 A. Yes. So I did CoinMarketCap and I ran
23 it on that, as I said, as well as reviewing the
24 data. And as we discussed earlier today, I know
25 that Dr. [REDACTED] has -- I'm going to put aside the

1 fact that he identifies three date -- three
2 returns that I don't use, where he claims I didn't
3 do due diligence on data that I didn't use. I'm
4 going to put that aside.

5 He does identify one return out of the
6 6,700 I used that looks, I think, abnormally
7 large. And so I did rerun it dropping that and it
8 doesn't -- doesn't affect anything.

9 Q. Let me limit my question to any steps
10 that you took prior to submitting your expert
11 report in AF-1.

12 A. Okay.

13 Q. Prior to submitting AF-1, did you do
14 anything to verify the compatibility of the price
15 data in the two data sets?

16 A. I would go back to my earlier answer.
17 I -- I ran everything on CoinMarket; didn't make a
18 difference. I visually inspected the data. I
19 instructed Lexecon where to pull the data from
20 based on the academic research. You know, went
21 over the data with them -- or with her in
22 conversation and on looking at the data.

23 So, again, it was a process that I
24 undertook in constructing the factor model and the
25 data inputs to it.

1 Q. You've referenced a few times Dr. [REDACTED]
2 reference to the token THC in your data set,
3 correct?

4 A. Yes.

5 Q. Prior to reading Dr. [REDACTED] rebuttal
6 report, were you aware of those unusual price
7 spikes of THC within your data set?

8 A. So you just used the word "spikes,"
9 plural, in your statement. My understanding --
10 but we could look at his report -- is that he
11 identified one out of the -- I'm approximating
12 now -- one out of the 6,700 crypto returns that I
13 used as, in his judgment, being too large. So it
14 wasn't plural, it was one, if we're talking about
15 the same thing. And, again, it's -- it affects
16 nothing.

17 Q. Be that as it may, were you aware of the
18 price of the one -- strike that.

19 Let's look at Dr. [REDACTED] rebuttal
20 report. Can we look at --

21 A. I don't have his report.

22 Q. I will get it for you.

23 A. I'm sorry. I didn't mean to jump ahead.

24 Q. Let's look at -- at AF-6, please.

25 (Whereupon, exhibit is

1 received and marked SEC Ferrell
2 Exhibit AF-6 for identification.)

3 MR. SYLVESTER: Thank you
4 very much. Okay. Here we go.

5 THE WITNESS: I want to give
6 one to her.

7 BY MR. SYLVESTER:

8 Q. I'm handing you what's been marked AF-6.

9 This is the expert rebuttal report of Dr. [REDACTED]

10 Professor Ferrell, this is the [REDACTED]
11 rebuttal report we've been discussing?

12 A. Yes.

13 Q. Okay. Let's turn to page 19 of that
14 report, Figure 10.

15 A. Figure 10?

16 Q. Yes, please.

17 A. Okay. Oh, we were -- I'm sorry. You
18 ask your question and I'll make -- go ahead.

19 Q. So my question was, were you aware of
20 the prices of the THC token that Dr. [REDACTED]
21 identifies as outliers prior to submitting your
22 expert report, AF-1?

23 MR. KELLOGG: Objection.

24 A. Okay. So I'm going to read from
25 paragraph 38 of his report where he's referencing

1 Figure 10.

2 "As shown in Figure 10, most prices for
3 THC are fractions of a cent, but there are three
4 dates (August 21, 22 and 23, 2017) when THC prices
5 are reported to reach values of over 10 million
6 U.S. dollars per token in the CryptoCompare data."
7 Okay. And then he has Figure 10.

8 Okay. So my comment on this is this is
9 a little silly because I don't use August 21st,
10 22nd or 23rd. It's not used in my factor model.
11 I use, as I say, the 28-day period which I believe
12 runs from -- I'm not going to get the exact dates,
13 but it runs from early August to early September.

14 So he's pointing to data that is not
15 used in my analysis. So, you know, this is --
16 this is really completely irrelevant.

17 Q. Commentary aside, were you aware of
18 these -- what Dr. [REDACTED] characterizes as "outlier
19 prices" on the three dates listed in Figure 10
20 prior to submitting your expert report in AF-1?

21 A. I --

22 MR. KELLOGG: Objection.

23 A. I don't recall seeing that. Again,
24 completely irrelevant. It's not used in my data
25 analysis. I do appreciate being accused of not

1 doing due diligence when the data being identified
2 is not actually used by myself.

3 Q. Were there any outlier price data with
4 respect to the THC returns that did get
5 incorporated into your analysis?

6 A. I believe -- and we can look at the
7 report. Let me just -- give me one second here.

8 Yeah. So he -- in addition to these
9 three that we've been talking about in Figure 10,
10 he identifies -- and this is what I was
11 referencing earlier -- a THC return date in
12 paragraph 41.

13 Q. Okay. So in your view there was one
14 inaccurate price data point for THC that was
15 incorporated into your analysis. Is that fair?

16 A. I agree that 8,916 percent is a very
17 large return. So this is one return out of
18 approximately 6,700 returns that I used that was
19 in the original data, not the -- not in the -- you
20 know. So this -- this wouldn't be affected by my
21 CoinMarketCap running of the model. But there is
22 one return out of the 6,700 that is this return.
23 And as I said earlier, it makes no difference to
24 the outcome, as one would expect.

25 Q. So the record is clear, THC is one of

1 the tokens that's used in your principal
2 components analysis as reflected in AF-1, correct?

3 A. That's right. It's one of the 9 --
4 well, let's -- just to be clear, it's one of the
5 91 tokens that are used in Estimation Period 2,
6 the 2015 to 2020 period. I don't believe THC is
7 in the 9 tokens that's used for the full time
8 period.

9 So his discussion here is about -- I
10 believe, is focused on the Estimation Period 2
11 where this is one -- this token or this crypto is
12 one of the 91.

13 Q. In your report in AF-1, you report the
14 results of your analysis using a 28-day return
15 period, is that right?

16 A. Yes.

17 Q. Why did you opt to use a 28-day return
18 period in your expert report?

19 A. Well, I have a footnote explaining why I
20 think this is the best specification, and that is
21 I'm running it essentially on a Tuesday to a
22 Tuesday. So you avoid national holidays on
23 Mondays. You avoid mixing different days of the
24 week if you were, for example, to run it on a
25 calendar basis. You're running it from a Tuesday

1 to a Tuesday and you're avoiding weekend effects.

2 So, you know, for those reasons that I
3 reference in the footnote, I felt a 28-day was the
4 best specification. And, again, I explain all of
5 this in the report.

6 Q. Is there any advantage in your mind to
7 starting your analysis and ending your analysis on
8 a Tuesday versus a Wednesday, a Thursday or a
9 Friday?

10 A. So Tuesday is the first day -- I forget
11 exactly when the data starts, but it's after that
12 weekend and Monday. Obviously, you know, I tried
13 to run the model as early as I could with these
14 considerations in mind for that same time period.

15 But, you know, all the permutations that
16 Dr. [REDACTED] presents in his report, whether it be
17 running it on a Wednesday or a Thursday or what
18 have you, does not change the result. The result
19 being there's no statistically significant alpha
20 at the 5 percent level.

21 Q. Prior to submitting your report in AF-1,
22 had you run your factor model starting and ending
23 on a Wednesday?

24 A. I don't recall the answer to that. I --
25 what I did do, which is related to your question,

1 is, as I said earlier, I did run it on weekly and
2 on -- on 30-day and on calendar month. So I don't
3 know whether the calendar month would -- how that
4 would end in terms of days of the week, but I did
5 run those alternative specifications. Didn't
6 change the results. But, again, for the reasons I
7 describe in my report, I felt 28 days was the best
8 specification.

9 Q. And, again, you ran those weekly, 30-day
10 and calendar month factor models prior to
11 submitting your expert report in AF-1?

12 A. I did.

13 Q. Okay. Are there any academic articles
14 that explain any benefits to using CryptoCompare
15 data versus CoinMarket data?

16 A. So you have to direct me to that, you
17 know, if you have a particular paper in mind. But
18 it is the case that folks -- you know,
19 peer-reviewed literature does use CryptoCompare
20 data for later time periods, although, you know,
21 as I said before, it doesn't actually affect --
22 that choice of the data set doesn't actually
23 affect the results.

24 Q. Turning back to a previous question,
25 prior to submitting your report in AF-1, it's true

1 that you did not use a -- a Wednesday start and
2 end date to run your factor model, correct?

3 MR. KELLOGG: Objection.

4 A. I -- as I said before, I would just
5 reference my earlier answer. I forget the start
6 dates for the -- you know, whether -- you know,
7 for example, I forget whether the calendar mixes a
8 Wednesday with -- I just don't remember. I did
9 run it on weekly, 30, and calendar. Again, it
10 doesn't make a difference, as does the
11 permutations, the specifications in Dr. [REDACTED].
12 None of it changes the result that the alpha is
13 statistically insignificant at the 5 percent
14 level.

15 Q. But sitting here today, you don't
16 recall having run your analysis using a Wednesday
17 or a Thursday start date prior to AF-1, is that
18 right?

19 MR. KELLOGG: Objection;
20 asked and answered.

21 A. Same answer as before.

22 Q. I believe you testified earlier that THC
23 was part of your principal components for your
24 Estimation Period 2, is that right?

25 A. I believe that's correct.

1 Q. Was it part of PC 2?

2 A. Well, the principal component analysis
3 is extracting information from the entire
4 covariance matrix. So I do believe it appears --
5 you know, it is being weighted or reflected in PCA
6 2. So I think that is -- at that level of
7 generality, I think that's a fair statement.

8 Q. Okay. Do you recall what were the other
9 tokens in Principal Component Number 2?

10 A. Oh, I don't. I mean, I have -- you
11 know, all the 91 is extracting all of the
12 information from the covariance matrix. I'm happy
13 to look at -- if what you're referring to is page
14 22, I'm happy to take a look at that.

15 Q. Are you referring to page 22 of AF-1?

16 A. Oh, I thought you were -- I thought we
17 were discussing Figure 13 of [REDACTED] where he's
18 talking about PCA 2.

19 Q. We can look at Figure 13 of [REDACTED] I was
20 just asking if you -- if you know one way or the
21 other what other tokens in Principal Component 2
22 there were in addition to THC.

23 A. Well, the P -- just to be clear, the PCA
24 is extracting all the information from the
25 covariance matrix for all 91. Now, the -- what

1 that translates into in terms of how different
2 coins get weighted, you know -- yeah, that's a
3 separate question. But, you know, the PCA
4 analysis is extracting, in constructing the PCA
5 components, all the information for the entire
6 covariance matrix of the 91 tokens.

7 Q. Can we --

8 A. Or the 91 -- I keep saying "tokens."
9 Ninety-one tokens. I'm using that interchangeably
10 with crypto assets.

11 Q. Can we look at Exhibit 3 of your AF-1?

12 A. AF-1?

13 Q. Yes, please. Exhibit 3.

14 Exhibit 3 is labeled "Regression of XRP
15 price return on principal components of other
16 cryptocurrencies."

17 Do you see that?

18 A. I do.

19 Q. Okay. Can you explain to me what the
20 difference is between Principal Component 1 and
21 Principal Component 2 on your Exhibit 3?

22 A. I just explained it. I would reference
23 the PCA analysis, which is extracting -- it's a
24 projection of the covariance matrix into a lower
25 dimension of data. So it's extracting, in the

1 Principal Component 1, the most information from
2 the covariance matrix to construct PCA 1, which is
3 going to be a weighting across tokens based on
4 where the information resides in the covariance
5 matrix to construct PCA 1 and -- and then so forth
6 and so on.

7 Q. What was the weight of THC in Principal
8 Component 2?

9 A. I don't have that memorized. So it is
10 extracting information from the entire covariance
11 matrix. So the 91 by 91 covariance matrix -- you
12 know, I have not memorized, you know, the implied
13 weighting of the PCA 2 across the 91 tokens.

14 Q. Is the use of a 28-day, Tuesday to
15 Tuesday, return a generally accepted methodology
16 in -- in economics literature studying price
17 returns?

18 A. I think it is consistent or a reflect of
19 the academic literature for the reasons I state in
20 my footnote.

21 So, for example, it's established that
22 there's weekend effects with crypto assets. There
23 are -- and so given these concerns about
24 day-of-the-week effects for crypto, in the
25 literature I think it's consistent to do the

1 28-day as the best specification.

2 Q. Sitting here today, can you think of any
3 academic literature that uses a 28-day return
4 period?

5 MR. KELLOGG: Objection.

6 A. So I believe there's a paper by Chain,
7 C-H-A-I- -- C-H-A-I-N, that uses a 28-day window.
8 That's one that might be most on point with your
9 question. But, again, I would reference the
10 academic literature on day-of-the-week effects for
11 crypto as the reason why I thought Tuesday to
12 Tuesday was the best specification. As I said
13 before, the other specifications have the same
14 result.

15 Q. Did you cite that Chain paper in your
16 expert report?

17 A. I don't believe I did.

18 Q. Did you review the Chain paper prior to
19 preparing your expert report?

20 A. Yes. Yes, I -- I reviewed a lot of
21 papers. I feel -- felt like it was sufficient, I
22 still feel like it's sufficient, that there are
23 day-of-the-week effects for crypto. And the best
24 specification would incorporate that fact into
25 defining the appropriate window or the appropriate

1 time period; i.e., the 28 days.

2 Q. What other papers besides the Chain
3 paper did you review in preparation of your expert
4 report but not cite in your expert report?

5 A. Well, I've read over the years many
6 crypto papers. I'm not going to have a -- a list
7 off the top of my head.

8 Q. And I just -- I -- I don't want to
9 interrupt you, but I just want to limit my
10 question to in preparation of your expert report.
11 Just that time period.

12 MR. KELLOGG: Objection.

13 A. Again, I'm bringing to bear my knowledge
14 as -- as -- as an academic economist, the
15 literature. I do cite papers for specific reasons
16 in my report, but I am invoking my experience as
17 an academic economist in how I thought and
18 prepared my analyses.

19 Q. In your view, does your PCA identify the
20 most important economic factors in the crypto
21 market?

22 MR. KELLOGG: Objection.

23 A. I don't think that's -- I -- I think
24 that's too broad and too -- I guess I don't agree
25 with that framing. Really, what information that

1 -- what information are you interested in is a
2 function of what the analysis is that you're
3 doing.

4 For my analysis, the PCA is extracting
5 in an efficient way the information in the
6 covariance matrix of the 91 or the 9 tokens given
7 what I'm interested in, which is exploring the
8 price movements of XRP in relation to the other
9 cryptocurrency markets. So, again, for my
10 purposes I think it does capture the right
11 information.

12 I guess I'm hesitant to speak to any --
13 you know, other potential research questions I
14 would have to -- I would have to think about.

15 Q. In your view, is the information that's
16 captured from the covariance matrix of the 91
17 tokens econo -- information about important
18 economic factors in the crypto market?

19 MR. KELLOGG: Objection.

20 A. It is extracting information about
21 the -- the times -- the pricing time series in the
22 non-XRP cryptocurrency markets in a very
23 established way. I think the PCA analysis has
24 been around, I think, over a hundred years. So it
25 is a well-grounded, academically peer-reviewed

1 technique widely used to capture information that
2 might be relevant to a research question or an
3 analysis.

4 Q. Is there other information about the
5 cryptocurrency market other than price and time
6 series and non-XRP cryptocurrency markets that the
7 PCA provides?

8 MR. KELLOGG: Objection.

9 A. I'm not sure what the question's asking.

10 Q. I'm asking whether or not the PCA
11 provides any other information about relevant
12 factors in the cryptocurrency market other than
13 just the time and price series of the data -- of
14 the underlying data.

15 A. Well, it --

16 MR. KELLOGG: Objection.

17 A. I mean, I guess we have to talk a little
18 bit about what a PCA does. It's projecting higher
19 dimensional data using, you know, the -- the
20 covariance matrix into a lower dimension. So it
21 is extracting in an efficient manner information
22 in -- in the -- in the other non-XRP crypto market
23 return price series.

24 Q. When you say "information" in that
25 answer, what is that information that's being

1 extracted?

2 A. The covariance matrix.

3 Q. And --

4 A. So --

5 Q. Sorry. Go ahead.

6 A. Yeah. So it's a well-established
7 technique to extract information reflected in the
8 time series of the 91 or the other 9 tokens.

9 Q. What information does it extract?

10 A. It extracts -- we have lots of time
11 series for 91 or 9. It's extracting the time
12 series along the dimensions that have the most
13 information about what the -- what the
14 cryptocurrency markets are doing. So typically
15 the PCA is going to work off the eigenvalue of the
16 matrix to project from a higher dimension to a
17 lower dimension the informational content of the
18 data.

19 So, again, completely standard. It's
20 used in asset pricing models. It's used for other
21 purposes all the time. It's nothing surprising or
22 novel in any way about using a PCA to extract
23 information from -- from -- you know, from a data
24 set.

25 Q. Did you use --

1 MR. KELLOGG: Mark, is now a
2 good time for a break?

3 MR. SYLVESTER: Sure. Fine
4 by me.

5 THE VIDEOGRAPHER: Okay.
6 Thank you. The time is approximately
7 11:58. We're going off the record.

8 (Whereupon, a recess is
9 taken.)

10 THE VIDEOGRAPHER: And the
11 time is approximately 12:15 p.m.
12 We're back on the record. This is the
13 beginning of Media 3.

14 BY MR. SYLVESTER:

15 Q. Professor, did you use the Fama-French
16 factors in your analysis?

17 A. No.

18 Q. It's true that at no point you conducted
19 your factor model using daily price data, is that
20 right?

21 A. Correct.

22 Q. Okay. This is a hypothetical question.
23 Let's assume the only change to your analysis is
24 that you analyzed the price return data at a daily
25 interval versus your 28-day interval. Let's

1 assume that other digital assets explain a very
2 small --

3 THE REPORTER: You're going
4 to have to slow down, Mark.

5 Q. Let's assume that other digital assets
6 explain a very small portion of XRP price return
7 variation. Say less than 50 percent.

8 Would that change your opinion in this
9 case?

10 MR. KELLOGG: Objection.

11 A. If I understand the question correctly,
12 the question is would I reject the model purely as
13 a function of adjusted R-squared? Again, I guess
14 I would want to see the model and what's going on
15 with the model. Obviously different models can
16 have different adjusted R-squares in terms of the
17 explanatory power of the model.

18 So I guess in your hypothetical, I would
19 want to do the work to understand the model and --
20 and see and make -- and make an assessment from
21 there. Given my purposes and what I was testing,
22 you know, I -- I had the specification, I think,
23 that best captures it.

24 Q. Is your opinion in this case based in
25 part on the adjusted R-squares that your model

1 produced?

2 A. Not per se. So the adjusted R-squared
3 for -- for Estimation Period 1, the 90 percent
4 plus, I mean, that is a feature of the model that
5 I use. So in that sense it is part of my analysis
6 because it is the associated adjusted R-squared.

7 So, yes, going back to my earlier
8 answer, I would say the adjusted R-squared for the
9 model or the models that I'm running is a feature
10 of the model. It's an output of the model. So
11 obviously in that sense it's part of my analysis.
12 It's a function of the model.

13 But I would also say that, you know, you
14 can obviously not ascertain the statistical
15 significance of the alpha, which is what I'm
16 primarily focused on, by -- you know, by just
17 referencing what the adjusted R-squared is. So
18 I'm more interested in the model's assessment of
19 the statistical significance of the alpha. But
20 that being said, the adjusted R-squared is
21 obviously part of -- it's reflecting what the
22 model is doing in practice.

23 Q. When you say you're primarily focused on
24 the statistical significance of the alpha, can you
25 explain the relationship between that and your

1 expert opinion that -- I'm quoting from paragraph
2 100 -- "variation in long-run price return of XRP
3 can be explained by exogenous, non-XRP,
4 cryptocurrency price returns or, put differently,
5 by factors outside Ripple's control"?

6 A. Can you remind me what page that is?

7 Q. Sure, 47.

8 A. Can you remind me of what you were just
9 reading?

10 Q. Sure, it's paragraph 100. It starts "In
11 summary..." It's just one sentence.

12 A. Okay. And what was -- I see the
13 language. Which -- now, what was the question?

14 Q. The question was you -- your -- a few
15 answers back, I believe that you said that you're
16 primarily focused on the statistical significance
17 of the alpha, is that right?

18 A. Yes.

19 Q. Okay.

20 A. In the context, to be clear, of having a
21 model that appropriately accounts for non-XRP
22 crypto price movements and so forth.

23 Q. Right. And what I'm trying to do is
24 ask -- strike that.

25 What's the relationship between the

1 statistical significance of the alpha and your
2 conclusions that you reached in paragraph 100, if
3 there is one?

4 MR. KELLOGG: Objection.

5 A. Right. So obviously I do further
6 analysis after paragraph 100, so I don't want to
7 create the misimpression that my analysis of the
8 price returns ends at paragraph 100. And so I
9 would incorporate the further analysis that I do.

10 But I am saying that if the SEC's
11 economic theory as articulated in the complaint is
12 true, one would expect to observe excess returns
13 of XRP and that's the alpha. That is to say,
14 there's returns that are specific to XRP, specific
15 to XRP, that are positive, because the SEC is
16 alleging that on the whole these news and
17 activities of Ripple were helping to drive the
18 price up. So that theory would indicate that the
19 XRP specific price return is positive and
20 statistically significant; i.e., it's -- the
21 return is above and beyond what you would just
22 expect based on general cryptocurrency market
23 movements.

24 Q. Okay. Returning to my hypothetical
25 about running your factor model with daily

1 interval data, if your factor mod -- if you had
2 done that and under the assumption that other
3 digital assets, non-XRP assets, explain a very
4 small portion of XRP price return variation, would
5 that affect your opinion at all?

6 MR. KELLOGG: Objection.

7 A. So your question is some hypothetical
8 analysis that I didn't do, would that affect my
9 opinion? I would have to see what the analysis
10 is. Some hypothetical model using daily prices
11 for a asset pricing model. I mean, I -- one other
12 thing I would say is I do describe in my report
13 the frequency of data that is used for these
14 factor models.

15 So, anyway, your hypothetical's about a
16 hypothetical analysis. I would need to take a
17 look and think about it.

18 Q. Would it be possible to run your factor
19 model as described in your report using daily
20 pricing data?

21 MR. KELLOGG: Objection.

22 A. Yes, you could do that, I assume.
23 Again, I would be worried about the consistency of
24 such approach with the academic literature that I
25 cite about the frequency of the data used in these

1 factor models. The monthly or the weekly is
2 basically what you see. So I cite to those asset
3 pricing model papers about the frequency of the
4 data.

5 But, again, for some hypothetical
6 analysis that I haven't done, what do I think
7 about it? I guess I would want to see it.

8 Q. Are there academic papers that you cite
9 in your report that do -- sorry, strike that.

10 Are there academic papers that you cite
11 in your report regarding cryptocurrency returns
12 that do use daily pricing data?

13 A. Yes. I mean, I think, you know, I cite
14 to one of Dr. [REDACTED] papers where he uses
15 higher frequency data, I think for different
16 purposes than what I'm concerned with. You know,
17 I'm concerned with the long-run time series for
18 the returns. I believe in that particular paper
19 he was more motivated by looking at trading types.

20 So, yes, some of the academic papers use
21 a different frequency of data, you know, given the
22 research question that they were interested in.

23 Q. Why did you elect not to run your model
24 on daily price data for purposes of your opinion?

25 A. Because --

1 MR. KELLOGG: Objection.

2 A. -- the academic papers I cite -- and
3 this is when I've done my own academic work with
4 factor models -- is -- is -- is monthly return
5 data is what you see. I know that, you know, some
6 of the papers I cite also use weekly, but I'm
7 looking over a seven-year period.

8 So my view is that the monthly -- I'm
9 rounding here from the 28 days -- is consistent
10 with the asset pricing model literature.

11 Q. When you've used factor models in your
12 own academic work, have you also used a 28-day
13 interval?

14 A. No, because I've never -- I've never run
15 a factor model in my academic work on -- on
16 crypto, which has these unique features; you know,
17 this -- this feature in the data that you have
18 these day -- these strong day-of-the-week effects.

19 Q. Let's turn to paragraph 20 -- sorry,
20 strike that.

21 Let's turn to paragraph 92 of your
22 opening report, page 41.

23 A. Okay.

24 Q. The first sentence of paragraph 92 is
25 "There is no consensus in the literature on the

1 nature or the number of factors that should be
2 used."

3 Do you see that?

4 A. I do.

5 Q. Is it fair to say, then, that it was
6 your own judgment as to which factors would be
7 appropriate to determine the factors that you used
8 in your analysis?

9 MR. KELLOGG: Objection.

10 A. No, I don't agree with that -- that --
11 that characterization. I use an absolutely
12 standard technique, a technique that's been used
13 in asset pricing model literature to construct the
14 factors. So it wasn't a subjective decision. I'm
15 using well-established techniques --
16 well-established techniques used in the asset
17 pricing model literature to construct the factors.

18 Q. What academic articles did you rely on
19 in support of your selection of factors for your
20 factor model?

21 A. Well, I -- I have a number of academic
22 citations in my -- in my report, including
23 academic citations where the PCA analysis is used.

24 As I said before, I'm also drawing on my
25 general experience as an academic economist and my

1 general knowledge of the asset pricing model
2 literature, as well as the academic cites that I
3 provide.

4 Q. How is it --

5 THE WITNESS: Am I speaking
6 too quickly?

7 THE REPORTER: Yes.

8 THE WITNESS: I'll -- I'll
9 slow down.

10 THE REPORTER: Thank you.

11 BY MR. SYLVESTER:

12 Q. How is it that you were able to draw
13 from the literature for assistance with selecting
14 factors given that there's no consensus as to the
15 nature or number of factors in the literature?

16 MR. KELLOGG: Objection.

17 A. I think you're mischaracterizing that
18 sentence because what -- the sentences that follow
19 in that paragraph, paragraph 92, you know, are
20 referencing sort of off-the-shelf factors. So for
21 CAPM you have a market index. Often people use
22 the S&P 500. For Fama-French you can go to Ken
23 French's website, you can pull the Fama-French
24 factors. So these are established indices in that
25 space.

1 So what the sentence is really saying is
2 there's -- there's no such established indices in
3 the sense that you have it for CAPM and for
4 Fama-French in the equity space. That's not to
5 say that there isn't a relevant academic
6 literature. That relevant academic literature is
7 both the use of the PCA as a -- as a well-known
8 statistical technique, the use of PCA in the
9 context of asset pricing models, and the use of
10 factor models more generally in this space.

11 Q. Okay. So even though, according to your
12 report, there's no consensus in the literature on
13 the nature and number of factors that should be
14 used, you would say, nevertheless, the methodology
15 that you applied here is informed by that academic
16 literature?

17 MR. KELLOGG: Objection.

18 A. Don't agree with that. I -- I'm drawing
19 from the academic literature. It's grounded in
20 the academic literature. It reflects the academic
21 literature: The academic literature on the PCA,
22 the -- the academic literature where PCAs are used
23 in asset pricing models, the academic literature
24 on factor models.

25 Q. Why did you use a PCA for determining

1 factors that affect digital asset returns instead
2 of constructing a market index?

3 MR. KELLOGG: Objection.

4 A. Well, again, I mean, you could -- I
5 mean, I guess I'd just go back to my report, which
6 is there's no established market index for crypto
7 over this time period; that is to say, 2013 to
8 2020. There is a well-established technique in
9 the academic literature for constructing factors
10 and that is -- that is the PCA. And that's
11 consistent and reflective and grounded in the
12 academic literature.

13 Q. If you had wanted to construct a market
14 index for digital assets, could you have done so?

15 MR. KELLOGG: Objection.

16 A. So I'm not aware -- I guess I would just
17 stick with what I say in my report, that my -- my
18 view of the literature is there's no consensus as
19 there is in the CAPM or Fama-French of an
20 off-the-shelf factor to use. There is a consensus
21 that the PCA is -- is an appropriate technique to
22 construct factors and -- and that's what I do.

23 Q. Setting aside consensus, which I
24 understand, just from a layperson's perspective,
25 if you had wanted to construct a market index as

1 an economist for these other digital assets, is
2 that something you would have been capable of
3 doing?

4 MR. KELLOGG: Objection.

5 A. I don't even know what a market index
6 would mean in that context. So we're talking
7 about 2013, where we have the very beginning of
8 crypto assets. We have a lot of coins added
9 later. Again, I don't know what the point of that
10 exercise would be if there's -- you know, if that
11 exercise that you're contemplating is not grounded
12 in the academic literature.

13 Q. Are you aware of any academic literature
14 in which the authors construct a market index for
15 cryptocurrencies?

16 A. So there are papers that I talk about
17 that do construct factors for later time periods
18 in various ways including using PCA. I'm not
19 aware of a consensus in the literature for a
20 market index over this time period in the way that
21 you do for CAPM and Fama-French.

22 Q. Setting aside whether there's a
23 consensus, are you aware of any academic papers in
24 which the authors construct a market index for
25 cryptocurrencies?

1 MR. KELLOGG: Objection.

2 A. You would have to direct me to the
3 paper. I'm sure that folks have looked at the
4 market generally for crypto. I'm not aware of an
5 established market index for this time period in
6 the way that you do for CAPM and Fama-French. So
7 that's my view of the literature.

8 Q. Okay. So just for clarity of the
9 record, sitting here today, you can't think of any
10 academic articles in which the authors construct a
11 market index for cryptocurrencies?

12 MR. KELLOGG: Objection.

13 A. I'm not saying that. So I'm sure that
14 there's papers that look at market effects of
15 crypto. You know, I have some citations here in
16 my -- I'm trying to find it now.

17 So, yeah, that's not a fair
18 characterization. There's certainly papers that
19 look at the general market for crypto assets. If
20 you want to call that a market index or not, I
21 don't know. But, again, I would just revert to my
22 earlier characterization of the literature.

23 Q. What is the -- strike that.

24 Is the PCA a commonly accepted
25 methodology for identifying factors for an asset

1 pricing model?

2 A. Yes.

3 Q. Did you cite any sources in your report
4 that use a PCA to identify factors for an asset
5 pricing model?

6 A. So I know this is not a memory test. I
7 believe I do cite such papers. I believe the Hu
8 paper, is my best memory, does a PCA in the asset
9 pricing model. But I do believe I do cite studies
10 and -- let me just see here.

11 And I will also say, drawing on my
12 general experience as an academic economist, that
13 PCAs are used in the asset pricing model
14 literature. There's nothing unusual or novel or
15 surprising about that.

16 Q. Is it true that when conducting a PCA, a
17 researcher typically tries to understand what the
18 components mean?

19 MR. KELLOGG: Objection.

20 A. Well, I discuss this in my report. I
21 mean, the components -- the meaning of the
22 component is -- is informed by what the PCA
23 analysis is doing. So I guess I would reference
24 our earlier discussion about what the PCA
25 component is reflecting.

1 Q. Does your report provide any economic
2 interpretation between any particular principal
3 component and the cryptocurrency market?

4 A. Well, the -- the PCA is extracting the
5 information from the general non-XRP
6 cryptocurrency markets and -- and their price
7 movements and price properties.

8 Let me just pause here and see if
9 there's anything I want to add to that.

10 Yeah, and I would also reference
11 paragraph 93 where I talked about this in a little
12 more detail.

13 Oh, and then paragraph 94 I mention the
14 Hu paper that uses PCA. I mention the Liu paper.

15 So, again, I think I would go back to my
16 report and answer some of these questions.

17 Q. Is it fair to say that in your analysis
18 you observed the relationship between Principal
19 Component 1 and XRP?

20 A. No. I -- in my analysis I believe for
21 the -- if we can just turn to my Exhibit 3, I have
22 four principal components using the BIC criteria
23 for Estimation Period 1 and I have 11 for the
24 second period.

25 Q. Okay. Can you tell me what the BIC

1 criteria is?

2 A. Well, I have the formula in the
3 footnote. I don't have the formula memorized.
4 But it's the Bayesian information criteria. So
5 it's a well-established criteria for how many
6 variables, independent variables, that you add to
7 the model. And then it tells you whether you
8 should -- you know, in my situation, whether you
9 should have three or four or five or -- or so
10 forth.

11 So it's a criteria that penalizes you
12 for adding a variable, but also you get the
13 benefit of more explanatory power, generally
14 speaking. So the formula for the BIC -- and I'm
15 just going to take a moment to find it in my
16 report because I do have a footnote on it. Give
17 me a second here. It's Footnote 171.

18 Q. I see.

19 So Footnote 171 sets forth the Bayesian
20 information criterion equation, is that right?

21 A. Yes.

22 Q. Okay. And the -- that's referred to in
23 Footnote 4 of your Exhibit 3 as the BIC criteria?

24 A. Let me just confirm that -- the
25 footnote. Just give me one second. Yes, that is

1 correct.

2 Q. Why did you use the BIC criteria in
3 selecting your number of principal components as
4 reflected on Exhibit 3?

5 A. Well, the BIC is an objective criteria
6 for how many components you're going to have. So
7 do you include one? Do you include three? Do you
8 include seven? I don't want to have a subjective
9 judgment as to the number of BIC princ -- the
10 number of principal components. The BIC is a
11 well-established criteria for answering that
12 question that's been used in the academic
13 literature.

14 So, for example, at the end of
15 paragraph -- I'm sorry, at the end of Footnote
16 171, you know, I cite to a Journal of Financial
17 Economics paper that uses BIC for their P -- PCA.

18 Q. Is it -- is it in your view important to
19 use objective criteria for determining how many
20 components you need to have?

21 MR. KELLOGG: Objection.

22 A. Well, my view is -- I would -- I would
23 have my view be more granular than that; is that
24 the BIC is a well-established criteria for
25 deciding the number of components to use.

1 Q. And for your purposes in forming your
2 expert opinion, was it important to you to use a
3 methodology that employed objective criteria in
4 determining your -- the number of components to
5 use?

6 MR. KELLOGG: Objection.

7 A. Again, the way I would frame it is this
8 is a well-established criteria in the literature
9 that I'm using. So I wanted to ground my
10 selection criteria in the academic literature,
11 which is what this does. So that -- I would
12 describe the motivation in those terms.

13 Q. Okay. Can we turn to Exhibit 5 of your
14 AF-1?

15 A. Exhibit 5?

16 Q. Yes.

17 A. Give me one second here.

18 Q. Exhibit 5 is labeled "Regression of XRP
19 Returns on Returns of Largest Market-Cap Coins."

20 Do you see that?

21 A. Yes.

22 Q. I don't see in the footnotes any
23 reference to the BIC criteria.

24 Did you employ the BIC criteria in
25 making your selections for the components of

1 Exhibit 5?

2 A. No, the --

3 MR. KELLOGG: Objection.

4 A. The selection criteria here is largest
5 market cap coins. And, again, as I explain in my
6 report, the purpose of Exhibit 5 is just as a
7 robustness check on the PCA and -- and, also,
8 unlike a PCA principal components analysis, you
9 know, which is this implied weighting across
10 crypto assets, you know, Exhibit 5 enables the
11 reader to actually see individual crypto assets.

12 So, again, it's by way of another, you
13 know -- by way of, you know, moving from the PCA
14 just so that you have individual crypto assets on
15 the right-hand side. But the selection criteria
16 was the largest as, again, as a robustness check
17 on my -- you know, as a -- one additional analysis
18 to my principal analysis that uses the PCA.

19 Q. Did -- did you attempt to use the BIC
20 criteria to engage in your selection process with
21 respect to Exhibit 5?

22 MR. KELLOGG: Objection.

23 A. I've already answered the question.

24 Q. That's a no then?

25 A. I told you the selection criteria for

1 Exhibit 5.

2 Q. And that did not include the BIC
3 criteria, is that right?

4 A. That's correct. I chose -- the
5 selection criteria is the largest market cap
6 coins. The coins that were the largest in this
7 time period. So that was the selection criteria
8 for Exhibit 5 and -- and the results -- and the
9 results have been reported there.

10 Q. Turning back to your Exhibit 3.

11 A. Yes.

12 Q. As I understand your analysis, you did
13 observe some relationship between the principal
14 components in your model and XRP, is that right?

15 A. For some of the principal components.

16 Q. Okay. For the principal components for
17 which you observed the relationship between those
18 principal components and XRP, what's the -- what's
19 the economic intuition behind that relationship in
20 your view?

21 MR. KELLOGG: Objection.

22 A. What I would say is there's a
23 statistical association between the information
24 impounded in that -- that principal component and
25 XRP price returns.

1 Q. Do you provide any economic
2 interpretation of that statistical association?

3 MR. KELLOGG: Objection.

4 A. Sure. That's what I talk about in my
5 report.

6 Q. Can you point to me in your report where
7 you provide an economic interpretation for the
8 statistical association between certain of your
9 PCs and XRP price returns?

10 MR. KELLOGG: Objection.

11 A. Well, I would just refer to my
12 discussion in part 3 where I talk about movements
13 in the noncryptocurrency markets, so the non-XRP
14 cryptocurrency markets, and the relationship to
15 XRP price return data and the meaning of the
16 excess returns.

17 So, again, that is reflected in this
18 full discussion in Part III.

19 Q. You say Part III.

20 Do you have a specific section that
21 you're looking at when you refer me to Part III?

22 A. Well, I would refer you to III.C and
23 III.D, where I talk about the factor model and
24 what it's doing and what the meaning is. So I
25 would just reference my report for that

1 discussion.

2 Q. Let me try to put the question in
3 plainer English that I might understand better.

4 In your report do you express any
5 opinion or explanation as to why there's a
6 statistically significant correlation between some
7 of your PCs and XRP price returns?

8 MR. KELLOGG: Objection.

9 A. So, again, the -- what I'm focused on --
10 I mean, obviously, I'm building this model -- is,
11 is there excess returns for XRP? Is there
12 positive excess returns for XRP above and beyond
13 what -- the general price movements in the non-XRP
14 cryptocurrency markets? That information in those
15 markets is embedded into the PCA -- or into the
16 principal components that are used on the
17 right-hand side of the equation.

18 Q. If I'm understanding your answer
19 correctly, it wasn't part of your project to
20 examine the question of why there was any
21 relationship between certain of your principal
22 components and XRP price returns, is that right?

23 MR. KELLOGG: Objection.

24 A. I don't agree with that. I mean, I'm --
25 I'm -- I'm addressing the empirical question of

1 what is the relationship between XRP and the more
2 general cryptocurrency markets? That's the
3 empirical question that I'm addressing. I
4 didn't know the answer to that before doing the
5 analysis, it's an empirical question, but that
6 is -- that is the question that in part is being
7 addressed here.

8 Q. And it's fair to say as a result of your
9 analysis, you -- you did observe a relationship
10 between XRP price returns and the returns of other
11 digital assets?

12 MR. KELLOGG: Objection.

13 A. Well, again, I would reference Exhibit
14 3 -- Exhibit 4 -- I'm sorry, Exhibit 3 is just
15 the -- Exhibit 4 is just the list. But, yeah, I
16 would go back -- if we're talking about the factor
17 model, I would go back to, you know, the exhibits
18 that report the outcome of that -- of that
19 analysis.

20 Q. And did you make any attempt in your
21 report to explain why you observed the
22 relationship that you observed between XRP price
23 returns and the returns of other digital assets?

24 MR. KELLOGG: Objection;

25 asked and answered.

1 A. Yeah, I would just frame my inquiry the
2 way I did before, which is it's an empirical
3 question about the relationship between XRP and
4 the broader market of crypto assets and I'm
5 observing that empirical relationship in the way
6 that you would do in any asset pricing model. So
7 it's a very standard type of analysis that you
8 would do when you're thinking about that sort of
9 empirical question.

10 Q. In economics literature, if a -- if an
11 author observes a price correlation, is it typical
12 that the author provide some possible economic
13 explanation for that correlation?

14 MR. KELLOGG: Objection.

15 A. You're speaking at a very high level. I
16 would want to look at the paper, what the research
17 question is, in order to answer that.

18 Q. It is a high-level question and it's
19 broad, but I'm asking you as someone who knows the
20 economics literature. In the economics
21 literature -- instead of typical, let's say
22 common.

23 In the economics literature, is it
24 common if an author observes a price correlation
25 that the author provide some possible explanation

1 for that correlation?

2 MR. KELLOGG: Objection.

3 A. Again, it really depends on what the
4 research question is. You know, in an asset
5 pricing model, typically what you're interested in
6 is the empirics: What are the relationships?

7 But, again, what questions are going to
8 be answered in an academic paper obviously is a
9 function of what is the research question at
10 issue.

11 Q. Let's look at Exhibit 7 to your report,
12 AF-1. So exhibit 7 is labeled "Regression of XRP
13 Returns on Principal Components of Other
14 Cryptocurrencies and Returns of Other Assets."

15 Do you see that?

16 A. I do.

17 Q. Okay. There's a column on Exhibit 7
18 that says "Cryptocurrency and S&P 500."

19 Do you see that?

20 A. Yes.

21 Q. The third entry down in that column is
22 negative 0.001 asterisk.

23 Do you see that?

24 A. I do.

25 Q. Okay. What does negative 0.001 asterisk

1 tell us in this chart?

2 A. It tells us that there's a statistically
3 significant relationship between Principal
4 Component 1 and XRP price returns.

5 Q. Okay. Going down that same column,
6 cryptocurrency and S&P 500, if you go down to the
7 row that says "S&P 500 Return," I see an entry of
8 0.398.

9 Do you see that?

10 A. I do.

11 Q. Okay. What does the 0.398 tell us?

12 A. Well, this -- this is telling us that
13 there's not a statistically significant
14 relationship in this specification between the S&P
15 500 and the returns of XRP.

16 Q. Can you interpret Exhibit 7 to say that
17 if the S&P 500 changes by 1 percent, then the XRP
18 return would change by .398 percent?

19 MR. KELLOGG: Objection.

20 A. I would not say that because that point
21 estimate is not statistically significant.

22 Q. When you say "that point estimate,"
23 which number are you referring to?

24 A. I'm referring to 0.398.

25 Q. Do you agree with the general maxim that

1 correlation does not equal causation?

2 MR. KELLOGG: Objection.

3 A. Yes.

4 Q. Do you interpret the results of your
5 analysis, as set forth in Section III.C of your
6 report, to establish correlation between XRP price
7 returns and the price returns of certain other
8 digital assets?

9 MR. KELLOGG: Objection.

10 A. The way I would frame it is XRP moves in
11 relation to the general cryptocurrency market as
12 reflected in -- in my statistical analysis.

13 Q. Is there a distinction between the
14 answer that you just provided and correlation
15 conceptually?

16 MR. KELLOGG: Objection.

17 A. You know, maybe this is a nitpick, but
18 the betas typically are, you know -- correlate,
19 you know -- you know, it's a correlation divided
20 by some form of volatility in the market. But I
21 agree with the proposition that what I'm showing
22 consistent with the asset pricing model literature
23 is the XRP returns do move in relation to the
24 general cryptocurrency markets. There is a
25 statistically significant association.

1 Q. Okay. Do you interpret the results of
2 your analysis set forth in III.C to establish any
3 causal relationship between XRP price returns and
4 the price returns of certain other digital assets?

5 A. What I would say is what I say in my
6 report, which is the price returns -- that there's
7 no XRP specific price returns above and beyond the
8 statistically significant associations with
9 generalized cryptocurrency market price movements.

10 Q. Let's go back to paragraph 100 of your
11 report, which is on page 47.

12 A. Yes.

13 Q. What does the word -- I'll just read it
14 for the record so we're clear.

15 "In summary, my empirical analyses show
16 that the variation in long-run price return of XRP
17 can be explained by exogenous, non-XRP,
18 cryptocurrency price returns or, put differently,
19 by factors outside Ripple's control."

20 Do you see that?

21 A. I do.

22 Q. Okay. What does the word "exogenous"
23 mean in that sentence?

24 A. It means I'm looking at crypto assets
25 other than XRP.

1 Q. Okay. What steps did you take, if any,
2 to verify that non-XRP cryptocurrency returns
3 were, in fact, exogenous of XRP returns?

4 A. Well, I --

5 MR. KELLOGG: Objection.

6 A. Again, I just told you the definition
7 that I'm using here, which is I'm looking at
8 non-XRP price returns in the data. I'm looking at
9 the general movements, whether it be the 9 or the
10 91, the general movements as captured by the
11 principal component analysis in those markets.
12 The markets excluding XRP.

13 Q. Did you perform any analysis to check
14 whether the non-XRP cryptocurrency returns that
15 you examined were affected by changes in XRP price
16 returns?

17 MR. KELLOGG: Objection.

18 A. The analysis I did is reflected in the
19 report, which is, are there statistical
20 associations over this time period, the seven
21 years or the five years, between generalized
22 non-XRP crypto market price return behavior and
23 XRP? That's -- that's the analysis that I did.

24 Q. Is it possible that there is a
25 statistically significant association between XRP

1 returns and the other digital asset returns that
2 you looked at because XRP affects the prices of
3 those other digital assets?

4 MR. KELLOGG: Objection.

5 A. I have not seen any theory or --
6 economic theory articulated to that effect in this
7 litigation, so I'm not aware of such a claim.
8 But, again, all I can do is reiterate, you know,
9 in response to your question, what I did, which is
10 statistical associations between generalized
11 movements in the cryptocurrency markets, you know,
12 across these 91 tokens or across the 9 tokens and
13 movements in XRP.

14 Q. Did you undertake any analysis to rule
15 out the possibility that XRP price -- price
16 movements affect the price movements of the other
17 digital assets that you looked at?

18 MR. KELLOGG: Objection;
19 asked and answered.

20 A. Yeah. So I'll just repeat what I did in
21 my analysis, which is, what are the statistical
22 associations between generalized non-XRP crypto
23 markets and movements in the XRP price; and,
24 furthermore, are there XRP price returns above and
25 beyond what -- what the statistical associations

1 would indicate in terms of the movement of XRP
2 price?

3 Q. So is it fair to say, sitting here
4 today, that you don't have an opinion about
5 whether XRP moved the prices of other digital
6 assets or other digital assets moved the price of
7 XRP?

8 MR. KELLOGG: Objection.

9 A. So, again, I'll just reiterate the
10 analysis I did do, which is the statistical
11 associations between generalized market movements
12 and XRP in just the same way that academics have
13 done it in all sorts of contexts, including public
14 equities.

15 Q. Are you offering an opinion in this case
16 that the price movements in other digital assets
17 caused the price movements in XRP?

18 A. I wouldn't frame it that way. I would
19 say there's a statistically significant
20 association between these generalized price
21 movements and price movements in XRP consistent
22 with the asset pricing model literature.

23 Q. Are you offering an opinion in this case
24 that the price movements in XRP caused the price
25 movements in other digital assets?

1 A. I never say that in my report. Again, I
2 can reiterate what I did, which is, you know, I
3 did an asset pricing model, which is an exercise
4 that's commonly done in the academic literature,
5 looking at the statistical associations between
6 this particular asset, XRP, and more generalized
7 market movements as represented by the 91 tokens
8 or crypto assets and the 9 -- or the 9 for the --
9 for the longer time period.

10 Q. Was it part of your assignment in this
11 case to determine whether, or if, XRP price
12 movements moved the prices of other digital
13 assets?

14 MR. KELLOGG: Objection.

15 A. So, again, the work that I did and the
16 analysis I did is contained in my reports. And,
17 again, I'm happy to reiterate what I did in the
18 factor model, which is to test whether there's an
19 XRP specific price movement above and beyond what
20 you would otherwise expect given the statistical
21 associations in terms of generalized non-XRP
22 crypto market price movements.

23 Q. So I think that means you were not asked
24 to determine whether or not there was a causal
25 relationship between the movements in XRP prices

1 on the one hand and the movements in digital asset
2 prices on the other hand?

3 MR. KELLOGG: Objection;

4 asked and answered.

5 A. So that's not -- those words are not in
6 my assignment. My assignment and what I did is
7 what I just described. So, again, I would be
8 happy to state what I did, but, you know, just
9 sort of the way I would summarize it is I used,
10 consistent or reflective of the asset pricing
11 model literature, an asset pricing model here to
12 explore as whether, as a statistical matter,
13 there's XRP price returns above and beyond what
14 these statistical associations would tend to
15 indicate would happen or would, you know -- or the
16 statistical associations reflecting this --
17 reflecting the results of the factor model.

18 Q. Let's look at paragraph 102 of your
19 report, which is on page 48.

20 A. Page 48?

21 Q. Yes.

22 The first sentence of 102 states "The
23 factor models and the corresponding results I
24 present in Exhibits 3 through 7 allow me to
25 examine whether, on average, there are additional

1 XRP price returns after controlling for other
2 non-XRP cryptocurrency market factors."

3 Do you see that?

4 A. I do.

5 Q. Okay. When you refer to "controlling
6 for other non-XRP cryptocurrency market factors,"
7 do you mean the use of your PCA?

8 A. Well, I believe some of those exhibits
9 is just running it on the individual crypto assets
10 that we discussed earlier, but I'm definitely
11 referring to including here the factor models:
12 That is to say, Estimation Period 1, Estimation
13 Period 2., the factor models supplemented by these
14 additional indices such as the S&P 500, as well
15 as -- you know, obviously I also had the
16 distributions analysis, too, although I don't --
17 let me just -- give me one moment here. Let me
18 just refresh my recollection.

19 So Exhibit 3 is the PCA; exhibit 6 is
20 for the full time period; and Exhibit 7 is -- is
21 for the five-year period. Let me just -- give me
22 a second here.

23 Yeah. So the -- the distribution
24 analysis is not in Exhibits 3 through 7. That
25 comes later.

1 Q. Okay. Did you check to see if your
2 principal components explain the price returns of
3 other digital assets other than XRP?

4 A. No. That was not -- that was not
5 relevant to the asset pricing model inquiry. I'm
6 constructing an asset pricing model for XRP.

7 Q. Why did you not include other factors
8 besides other digital assets in your construction
9 of your PCA?

10 A. Well, I explored that possibility, so I
11 have these exhibits. I'll turn to Exhibit 7. I
12 do explore other factors, sort of standard indices
13 that we were talking about earlier: The S&P 500,
14 the MSC -- MCSI World Index, the Emerging Market
15 Index, the Commodity Index, the gold return, the
16 U.S. dollar, the Japanese yen.

17 So I -- I do explore some standard
18 indices as well, and consistent with the academic
19 literature, these are not statistically
20 significant.

21 Q. Did you include, for instance, the S&P
22 500 in the construction of your principal
23 components?

24 A. Well, I view Exhibit 7 as part of the
25 work that I did here.

1 Q. Understood, but I'm asking a specific
2 question about how you constructed your principal
3 components.

4 Did you include the S&P 500 return
5 within your construction of the principal
6 components?

7 A. Oh, I misunderstood your question.

8 No, the principal components, whether
9 it's one, two, three or four, whatever the
10 principal component is, is -- is capturing the
11 information from other crypto assets.

12 Q. And -- and why was it that you opted not
13 to include, for example, the S&P 500 in your
14 principal components construction?

15 A. Well, because I -- what I wanted to
16 do -- there's a couple of different questions.
17 One question in my asset pricing model is, do --
18 the -- the first logical question is, do other
19 crypto assets, like bitcoin, like Ether and so
20 forth -- whether other crypto assets have an
21 association, a statistical association, with XRP
22 returns. And for that, given the lack of a
23 market -- an academic consensus on market indices
24 over this time period, I used the PCA.

25 So the first logical question is to --

1 to address that relationship. For the S&P 500,
2 there's an index that we all know that's used
3 commonly in the literature. And I just entered
4 that into the equation on the right-hand side once
5 I had captured the information in the non-XRP
6 cryptocurrencies.

7 Q. If in constructing your principal
8 components you're attempting to find the best
9 factors to explain XRP price returns, why not
10 include the S&P 500 returns?

11 MR. KELLOGG: Objection.

12 A. Okay. So that's a little bit of a
13 misstatement of my approach. My approach was,
14 obviously, in exploring XRP returns, one needs to
15 incorporate what's happening in the general
16 cryptocurrency markets. Just as a -- that's
17 obvious. And so the PCA analysis is the way,
18 consistent with the asset pricing model
19 literature, that I do that.

20 With the S&P 500, there's an index that
21 we -- we don't have to do a PCA. There's an index
22 that's readily available, widely used. And, so,
23 once I captured the non-XRP cryptocurrency
24 markets, I then entered the S&P 500.

25 So the PCA is about constructing

1 components for the non-XRP cryptocurrency markets.

2 That's the point of the exercise.

3 Q. So in your view in constructing your
4 principal components, there were not any other
5 factors that would be of relevance other than the
6 prices of certain other digital assets?

7 MR. KELLOGG: Objection.

8 A. So certainly it could be the case the
9 S&P 500 matters. That's why I test it. Again,
10 consistent with the academic literature, it's not
11 statistically significant. But, again, I needed
12 to be able to test the relationship between XRP
13 and these crypto -- more general non-XRP crypto
14 markets. And so consistent with the academic
15 literature, I used PCA for that question.

16 Q. Did you perform any sensitivity checks
17 for your PCA results using different sets of
18 digital assets?

19 A. I used -- well, I used two different
20 sets of digital assets: The 9 for the full period
21 and the 91 for the second period.

22 The -- so I used all the tokens that I
23 could subject to the selection criteria that I --
24 I have in my report; you know, i.e., for -- or,
25 for example, I have price return data for those

1 tokens. And then I allowed the PCA to tell me
2 what's important and what's not.

3 Q. And -- sorry.

4 A. So, again, the way I view my exercise is
5 I looked at the tokens that -- for which I had the
6 available data for the seven-year period and then
7 allowed the PCA to tell me what's important in
8 that -- in that universe.

9 Q. Other than what you just described, did
10 you perform any additional sensitivity checks for
11 your PCA results using different sets of digital
12 assets?

13 A. I used all the digital assets that I
14 could for the first estimation period and for the
15 second.

16 Now, I do want to add for the second I
17 did have a minimum market cap criteria. I think
18 it's reflected in the report. But I allowed the
19 PCA to tell me what was important in the universe
20 of tokens that I had available to me.

21 Q. Let me turn your attention to Footnote
22 162 on page 42.

23 A. Give me one second. 162?

24 Q. Yes.

25 A. Yes.

1 Q. This is the market cap criteria that you
2 just referenced?

3 A. Correct.

4 Q. Okay. Is it possible that at some point
5 during your period the market cap for an included
6 digital asset could have dipped lower than
7 \$100,000?

8 MR. KELLOGG: Objection.

9 A. It's possible.

10 Q. Okay.

11 A. I don't know if that happened, but it's
12 possible. I don't know offhand -- let me take
13 another -- I don't know offhand that that
14 happened. The criteria here, in Footnote 162, is
15 at least 100,000 in either August or December.

16 Q. Do you know -- strike that.

17 In Footnote 4 to your Exhibit 4 --

18 A. Wait. Wait one second.

19 Q. Sure.

20 A. Exhibit 4?

21 Q. Yes.

22 A. Exhibit 4. Okay.

23 Q. You state "XRP market cap on August
24 11th, 2015 was \$274 million."

25 Do you see that?

1 A. I do.

2 Q. Okay. And do you know offhand what
3 XRP's market cap was by December 2020?

4 A. I don't know offhand.

5 Q. I think it is in --

6 A. I think it's in the complaint, but I
7 don't remember offhand.

8 Q. Let's go to page C-3 of your Appendix C.

9 A. Where should I go?

10 Q. Paragraph 6.

11 A. Of Appendix?

12 Q. Let me make sure I have the label right.

13 Yeah, Appendix C, page C-3, paragraph 6
14 of that appendix.

15 A. Let me just take a look.

16 MR. KELLOGG: Mark, can you
17 clarify where we are?

18 MR. SYLVESTER: Sure.

19 Q. Professor, do you see where we are?

20 A. I'm at paragraph 6 at C-3.

21 Q. Okay. I just want to make sure the
22 copies are right.

23 MR. SYLVESTER: Yeah, we're
24 at page -- page C-3 of Appendix C.

25 MR. KELLOGG: Okay. Got it.

1 MR. SYLVESTER: Okay.

2 BY MR. SYLVESTER:

3 Q. So paragraph 6, the -- the last sentence
4 on page C-3 says "For comparison, on those two
5 days, XRP market capitalization far exceeded that
6 cutoff and was \$260 million and \$23 billion,
7 respectively."

8 Do you see that?

9 A. I do.

10 Q. And I read that \$23 billion figure to
11 correspond to December 21st, 2020.

12 Do you read that the same way?

13 A. Yes.

14 Q. Okay. Was it important to your analysis
15 of the relationship between XRP price returns and
16 other digital asset price returns to understand
17 the market caps of XRP and those other digital
18 assets?

19 MR. KELLOGG: Objection.

20 A. Well, I certainly report the market cap.
21 I certainly report regressions on the highest
22 market cap coins in Exhibit 5. So I certainly do
23 work on that.

24 For purposes of the PCA, the PCA will
25 extract the information in the most efficient way

1 from the entire universe of -- of the tokens
2 regardless of their -- you know, regardless of
3 whether it's 100 million or 300 million or what
4 have you.

5 Q. In your view, is it -- is it at all
6 likely that a digital asset with a market cap of
7 \$100,000 would have an impact on the price of XRP
8 when it has a market cap in the hundreds of
9 millions of dollars?

10 MR. KELLOGG: Objection.

11 A. I don't think that's a -- I don't
12 think that -- I think you're miss -- I think your
13 question misunderstands the point of an asset
14 pricing model, which is we have movements, price
15 movements, in the general market. Maybe they're
16 small cap; maybe they're large cap. And the
17 question is, is there a statistically significant
18 association with those movements? And in this
19 instance, XRP.

20 So I don't think there's anything in the
21 asset pricing model methodology that would exclude
22 the possibility that smaller cap coins have some
23 informational content. Obviously, I employed
24 100,000 as sort of the minimum, but I don't -- I
25 would not for the purposes of the PCA rank them in

1 terms of whether they have 200 million or 400
2 million or something else.

3 Now, obviously, in Exhibit 5, I do
4 run -- I do run the regression on the largest
5 market cap coins, but that's -- that's not the
6 factor model.

7 Q. Is there any academic literature that
8 you can think of with respect to cryptocurrency
9 asset prices that uses a minimum \$100,000 market
10 cap for inclusion in the model?

11 MR. KELLOGG: Objection.

12 A. So I cite in the footnote -- not
13 100,000, it's a -- it's a different time period
14 for different coins -- that a threshold is being
15 used in their analysis.

16 Q. What footnote are you looking at,
17 Professor?

18 A. So Footnote 8.

19 Q. On C-3?

20 A. On C-3. So I say "My decision to
21 restrict the sample based on market cap is also
22 supported by the academic literature. See, for
23 example, Liu, 2021, who restricts the coins in
24 their sample to those with a market cap over a
25 million." Journal of Finance.

1 Q. Why was it that you decided to use
2 \$100,000 instead of a million dollars for your
3 model?

4 A. Right. I wanted to be -- I wanted to
5 make sure that I allowed the PCA to -- to
6 potentially incorporate information on a wide
7 range of coins. It's not that -- and those
8 coins -- you know, the crypto assets' price
9 movements might have a statistical relationship
10 even if they're 200,000 or 500,000 with -- with
11 XRP price returns.

12 So I used the lower threshold and,
13 hence -- hence, used a larger universe of coins
14 than would otherwise be the case, particularly in
15 -- anyway, particularly in these earlier periods.

16 Q. And what was the advantage in your view
17 of using that lower threshold?

18 MR. KELLOGG: Objection.

19 A. Well, I wanted to allow the PCA to tell
20 me for universal coins for which I had pricing
21 data, you know, to extract that information
22 from -- from the covariance matrix. And then it's
23 an empirical question whether the information so
24 extracted has a statistically significant
25 association.

1 So if the coins, if the crypto assets
2 that are being analyzed by the PCA, are
3 uninformative about XRP price returns, they're
4 uninformative because I used \$100,000 threshold,
5 for instance, then the statistical analysis would
6 tell us that, you know.

7 So as I report from my Estimation Period
8 1 -- and I'll go back to Exhibit 3 -- in fact, you
9 know, I have a 91 percent -- a 92 percent adjusted
10 R-squared and I'm finding statistically
11 significant association.

12 So the information from the token so
13 defined does have informational content in the
14 asset pricing model about movements of XRP.

15 Q. When you say it has -- strike that.

16 You just said the information in --
17 strike that.

18 I think you just said that the
19 information in the token model -- sorry. Let me
20 start again. Withdrawn.

21 What information about XRP price returns
22 is provided by your model as reflected on Exhibit
23 3?

24 A. I would just go back to our conversation
25 this morning, our conversation about what a PCA

1 does. So the P -- the principal component
2 analysis is using this universe of tokens, however
3 that's being defined. By "tokens" I mean crypto
4 assets. Extracting the information from that and
5 seeing -- testing the empirical question about
6 what is the statistical association? And, more
7 specifically, are there excess returns to XRP that
8 are not otherwise explained or accounted for by
9 these statistical associations?

10 Q. Why was it that you decided to construct
11 two separate estimation periods?

12 A. I know that Ether is an important -- it
13 was a judgment about Ether that started to be
14 traded at this point. Let me just go to my report
15 here. Give me one second.

16 Yeah. So Exhibit 4 has the largest
17 coins as of August 11th, 2015. Ether is there.
18 It's the third largest, you know, after bitcoin
19 and Litecoin.

20 So, again, Ether is an important crypto,
21 not -- I'm not saying for purposes of this
22 litigation, but Ether is well known. That's when
23 it began to trade. Also, starting in 2015, it
24 enables one to use a lot more coins or a lot more
25 crypto assets than 2013.

1 So the virtue of -- of 2015 is I also
2 have more tokens. And so it's just a robustness
3 check on this 2015 to 2020 period, in particular,
4 utilizing through the PCA more tokens than were
5 available as of 2013. So we move from 9 tokens, 9
6 crypto assets, to 91, I believe, as of August
7 2015.

8 MR. KELLOGG: Mark, is this a
9 good time for a lunch break?

10 MR. SYLVESTER: I think it
11 is, yes. Let's go off the record.

12 THE VIDEOGRAPHER: Okay.
13 Thank you. The time is approximately
14 1:16. We're going off the record.

15 (Whereupon, a luncheon recess
16 is taken.)
17
18
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1 A F T E R N O O N S E S S I O N

2 THE VIDEOGRAPHER: And the
3 time is approximately 1 -- excuse me,
4 2:04 p.m. We're back on the record.

5 MR. KELLOGG: Mark, before
6 you start, can I put one thing on the
7 record?

8 MR. SYLVESTER: Sure.

9 MR. KELLOGG: Re our
10 discussion earlier about Allen's
11 compensation agreement with Compass
12 Lexecon.

13 MR. SYLVESTER: Mm-hmm.

14 MR. KELLOGG: We've reached
15 out to Compass Lexecon and they would
16 not agree to allow Allen to testify on
17 that. But we're happy to continue
18 working with you to get whatever
19 information about that you -- you
20 need.

21 MR. SYLVESTER: Okay. Thank
22 you.

23 BY MR. SYLVESTER:

24 Q. Professor, let's turn back to Exhibit 5
25 of your opening report. This is your "Regression

1 of XRP Returns on Returns" --

2 A. Yeah. I just -- I just want to find the
3 part in my report where I discuss the exhibit. So
4 just --

5 Q. Sure. Take your time.

6 A. -- give me a moment here.

7 Q. And just for the record, I'll read the
8 title again. Exhibit 5 is the "Regression of XRP
9 Returns on Returns of Largest Market-Cap Coins."

10 A. Just -- I need a second here.

11 Okay. I'm there.

12 Q. Okay. Great.

13 So turning to Exhibit 5, do you have any
14 explanation as to why some of the coins on Exhibit
15 5 have a statistically significant positive
16 coefficient and others have a statistically
17 significant negative coefficient? I'm looking at
18 Estimation Period 2.

19 A. So you want me to look at Estimation
20 Period 2.

21 Q. Mm-hmm.

22 A. Well, just -- just to be clear, the
23 coefficient on the bitcoin, the negative 0.661,
24 for instance, is conditional on all the other
25 returns in the right-hand side. So it's not the

1 coefficient on bitcoin as an independent variable
2 by itself, but conditional on the other returns
3 being included, it's a negative 0.661. So I just
4 wanted to be clear about what the coefficient
5 represents, and it represents that coefficient in
6 conjunction with the other coefficients in the
7 specification.

8 I'm sorry, could you repeat your
9 question?

10 Q. Sure.

11 Again, focusing just on Estimation
12 Period 2, do you have any explanation for why
13 there's a statistically significant positive
14 coefficient for some coins and a statistically
15 significant negative coefficient for other
16 coins?

17 A. Not beyond what I just said, which is
18 it's conditional or a function of the full
19 specification. And this is just empirically
20 what the model indicates or the regression
21 indicates.

22 So beyond that I don't have any really
23 further commentary on it.

24 Q. Okay. Turning to your Exhibit 3 of
25 AF-1, why is it in your view that Estimation

1 Period 1 and Estimation Period 2 produce such
2 different results as to adjusted R-squared?

3 A. I don't have a specific reason. I
4 don't -- I could speculate as to why the adjusted
5 R-squares are different, the -- the .94 and the
6 .92, but that's the output of the model. The
7 model -- Estimation Period 1 in the model using
8 just 9 tokens, whereas Estimation Period 2 is
9 using 91. That's the -- that's what the
10 statistics tell us.

11 Q. Okay. As part of your analysis and
12 steps that you took to prepare your expert
13 opinion, did you take any steps to examine the
14 question of why there was such a divergence
15 between the adjusted R-squared in Periods 1 and
16 Period 2?

17 MR. KELLOGG: Objection.

18 A. I think we discussed earlier today the
19 additional work that I did in response to the
20 rebuttal report. So all the analyses that I have
21 done is -- is in -- is covered in these reports
22 and in our morning conversation.

23 Q. Turn with me to paragraph 98 of your
24 report.

25 A. Wait one second while I get there.

1 Q. Yeah. And it's going to be the end of
2 paragraph 98 on page 46. I'm looking at the
3 sentence that says "The adjusted R-squared in
4 Estimation Period 1, which includes a period when
5 the cryptocurrency markets were arguably less
6 mature, exceeds 50 percent." And then "The
7 adjusted R-squared in Estimation Period 2 exceeds
8 90 percent."

9 Do you see that?

10 A. I do.

11 Q. Is there say relationship between your
12 adjusted R-squared finding for Period 1 and your
13 statement that the cryptocurrency markets were
14 arguably less mature during Period 1?

15 MR. KELLOGG: Objection.

16 A. I think I would just leave it as it is
17 in the report, which is just the simple
18 observation that in this additional -- you know,
19 the -- the extended period of Estimation Period 1,
20 which begins in 2013, that the crypto markets were
21 arguably less mature, and then I have the
22 citations for that in Footnote 175.

23 So I think -- I -- I'm comfortable with
24 the way that that is framed in this paragraph.

25 Q. How would the market's lack of maturity

1 during Period 1 impact XRP price during that
2 period, if it would?

3 A. I don't have a view on that. My view is
4 informed by what the statistics show, whether it
5 be for the full period or for the Estimation
6 Period 2.

7 Q. Does the lower adjusted R-squared for
8 Estimation Period 1 mean that pre-2015 XRP prices
9 were driven by other factors unrelated to
10 cryptocurrency market factors?

11 MR. KELLOGG: Objection.

12 A. So I -- again, I just wouldn't compare
13 Estimation Period 1 to Estimation Period 2 just on
14 terms of adjusted R-squared, which I think is an
15 embedded assumption in your question. You would
16 want to look at what the full model is doing in
17 the two periods, including in the PCAs that are
18 being used.

19 So I would not just simply compare the
20 adjusted R-squares and -- squared and make some
21 sweeping conclusion about that earlier period.

22 Q. Setting aside the comparison point, what
23 does the adjusted R-squared figure for Period 1
24 mean? What does that reflect in --

25 A. Well, I have a footnote where I cite to

1 this, so I'm just going to take a moment and flip
2 through my report to find -- to find that.

3 Q. 174 talks about R-squared. I'm not sure
4 if that's what you're looking for. Footnote 174 I
5 mean.

6 A. Yes. So that's what I was looking for
7 and it's, again, Footnote 174.

8 Q. Can you explain to me in layman's terms
9 what an adjusted R-squared figure means and what
10 it tells you?

11 A. Well, I mean, it's one metric, not the
12 only metric, but one metric for the goodness of
13 fit in terms of explaining the variation of the
14 dependent variable. Here, the dependent variable
15 being the returns of XRP.

16 Again, adjusted R-squared, whether it's
17 high or low or -- or somewhere in between, is a
18 separate question as to whether there's
19 statistically identifiable excess returns for XRP.

20 Q. Okay. So what does -- focusing just on
21 Period 1 and the actual value of adjusted
22 R-squared, 0.541, what does that tell you about
23 the model's power to explain for Period 1?

24 MR. KELLOGG: Objection.

25 A. The power to explain. I mean, it -- the

1 adjusted R-squared is the percentage of the
2 variation in the dependent variable for that
3 period. That's what's reflected in the adjusted
4 R-squared. That's a separate question, as I
5 indicated earlier, as to whether there's a
6 statistical association between excess returns for
7 XRP and relative to the non-XRP cryptocurrency
8 markets.

9 Q. What's the dependent variable for Period
10 1?

11 A. If we go to Exhibit 3, period -- Exhibit
12 3 says in the title "Regression of XRP Price
13 Return on Principal Components of Other
14 Cryptocurrencies."

15 Q. I think your answer means the dependent
16 variable is XRP price return, is that right?

17 A. Yes.

18 Q. Okay. So the adjusted R-squared figure
19 for Period 1 tells us that for Period 1 only, your
20 model explains approximately 54 percent of the
21 variation in XRP price returns?

22 A. Yes.

23 MR. KELLOGG: Objection.

24 A. Yeah. So that -- that is -- the 54
25 percent is the adjusted R-squared and it is the

1 percentage of the variation in the dependent
2 variable for that model for that period.

3 Q. Okay. Given that, as I understand it,
4 the adjusted R-squared figure for Period 1 tells
5 us that your model explains 54 percent of the
6 variation in XRP price return, did you take any
7 steps to check to see if any other factors
8 contributed to XRP price return changes during
9 Period 1?

10 MR. KELLOGG: Objection.

11 A. Well, I -- I did do the work that we
12 discussed earlier. I mean, I did the regressions
13 in Exhibit 5, which is just the crypto -- the
14 cryptos themselves. I do the work in Exhibit 7,
15 where I explore -- well, this is for the later
16 period. I explore different returns -- actually,
17 I wanted to reference Exhibit 6, where I do
18 additional work for other potential explanatory
19 factors: The S&P 500, the emerging market,
20 commodities, gold, U.S. dollars, yen, euro.

21 So I do do a -- further explore -- you
22 know, further work to think about factors that
23 might be affecting XRP. And, again, these
24 results, the results reflected in Exhibit 6, are
25 consistent with the econom -- academic literature.

1 Q. And as I'm reading the results in
2 Exhibit 6, the model doesn't predict any more than
3 the approximately 54 percent of XRP return
4 variations than the model reflected in Exhibit 3,
5 is that right?

6 A. Yes. The adjusted R-squares at the
7 bottom of Exhibit 6 range from 53 to 54 percent.
8 I'm rounding here. But, you know, what's
9 important really in this exhibit is whether or not
10 the S&P 500 return, the emerging market, the
11 commodities, and so forth, whether they enter into
12 the equation with statistically significant or
13 not.

14 So my conclusion that the S&P 500
15 return, for example, you know, doesn't have the
16 statistical relationship with XRP price return is
17 not a function of the adjusted R-squared; rather,
18 it's a function of the fact that the point
19 estimate, which is negative 0.629, is not
20 statistically significant.

21 Q. Given that for Period 1, your model
22 explains approximately 54 percent of the variation
23 of XRP's price return, did you take any steps to
24 determine whether or not Ripple's actions
25 explained any of the remaining unexplained

1 variation in XRP price return?

2 MR. KELLOGG: Objection.

3 A. Yes, I did.

4 Q. And what were those steps?

5 A. The alpha. The constant term. So I
6 want to be very clear about this. The -- the
7 constant -- I'm also referring to that as alpha.
8 They're -- they're used interchangeably. So in
9 Exhibit 6 it says "constant." That's the same
10 thing as alpha.

11 Alpha represents whether or not relative
12 to -- now here I'm looking at the first column,
13 the "cryptocurrency factors" column -- whether
14 relative to the cryptocurrency markets there is an
15 XRP specific price return above and beyond what
16 the statistical associations would lead you to
17 expect. So that alpha is not statistically
18 significant in all these permutations or
19 specifications.

20 And, again, the theory in the complaint
21 is that Ripple took various efforts,
22 distributions, and statements and so forth -- I'm
23 not going to reproduce the complaint here -- that
24 over this time period, this seven-year period,
25 resulted or was associated with XRP price

1 increasing.

2 And that's a testable proposition and
3 that would be reflected in the alpha. The alpha
4 represents excess XRP returns. Excess relative to
5 the cryptocurrency market. And, again, there's no
6 statistical association.

7 Q. Are you aware that in 2017 XRP prices
8 increased dramatically?

9 MR. KELLOGG: Objection.

10 A. That -- that might well be right. I
11 don't have a specific recollection.

12 Q. Okay. Did you consider constructing
13 estimation periods before and after 2017 when XRP
14 prices were very different?

15 MR. KELLOGG: Objection.

16 A. Well, you know, turning to Dr. [REDACTED] as
17 we discussed this morning, he has a great point, I
18 believe -- just give me one second here. I'm
19 going to need a second.

20 Well, my understanding of Dr. [REDACTED] in
21 his Figure 17 is that he uses as a break point not
22 2017 as your -- as your question poses, but,
23 rather, he uses the bit -- the BitLicense, which I
24 believe, given his Footnote 47 on page 27 of his
25 rebuttal report, occurred in 2016.

1 And as I mentioned earlier today, all
2 his alphas -- not the change in alpha, but all his
3 alphas -- using that as a break point, all the
4 post-BitLicense alphas -- which, again, is the
5 middle of 2016 -- are statistically insignificant.

6 So that would be the most direct
7 response to your question.

8 Q. Let me ask this question: Did you
9 consider constructing any additional estimation
10 periods beyond the two that you constructed?

11 A. No. I felt that was adequate given the
12 theory in the complaint which is alleging and
13 identifying events over this seven-year period.

14 As I -- as we discussed this morning, I also
15 looked at Dr. [REDACTED] specifications which includes
16 alphas for the -- not post-2017, but for the
17 post-2016 period.

18 Q. Did you conduct your analysis for Period
19 1 and then conduct your analysis for Period 2 or
20 did you conduct them at the same time or in the
21 reverse order?

22 A. I don't have a memory of that. I -- I
23 do have a memory very early on of wanting to do
24 the full time period. That was obvious from the
25 beginning. And I also have a memory of wanting to

1 include Ether as one of the tokens given its
2 prominence.

3 So my memory is that was my thoughts
4 right from the beginning. I don't remember the
5 exact order.

6 Q. Why was it that you wanted to include
7 Ether as a token given its prominence?

8 A. Well, the trading only occurred in 2015,
9 and so I just thought that was another natural
10 break point. Also, as I discuss in my opening
11 report, this is a developing market. It's
12 developing over time. There's more tokens
13 available in 2015. And so I thought that time
14 period would be a useful robustness check on the
15 full seven-year period. So I thought that was
16 helpful to include for those reasons.

17 Q. Do you know whether your model for
18 Period 2 would produce a similar adjusted
19 R-squared if you excluded or added a few more
20 monthly observations?

21 MR. KELLOGG: Objection.

22 A. I'm not -- I'm not sure what you're
23 referring to by -- what -- I don't -- I guess I
24 don't understand the question. What -- what
25 observations are you talking about?

1 Q. Let me ask a broader question.

2 Did you check to see how sensitive the
3 adjusted R-squared result was for Period 2 to all
4 of the data inputs that you used?

5 A. How sensitive the -- I mean, the
6 adjusted R-squared is a measure of the model and
7 the fitness of the model for that time period.
8 So, you know -- and that's the standard statistic
9 to report in tables like this. So -- so I felt
10 that that was consistent with standard academic
11 practice.

12 If you're referencing -- and I don't
13 know if you are -- Dr. [REDACTED] discussion in his
14 Figure 3, I'm happy to talk about that. But in
15 terms of my reporting adjusted R-squares, I felt
16 this was -- I -- it is the standard academic
17 practice to do it this way.

18 Q. Let's look at paragraph 96 of your
19 opening report.

20 A. Yes.

21 Q. On page 44 there's a continuation of
22 paragraph 96.

23 A. I'm sorry, can you say that again?

24 Q. Sure. Let me rephrase.

25 If you turn to page 44 --

1 A. Forty-four.

2 Q. -- paragraph 96 concludes on page 44,
3 but my question is about the regression equation.

4 Do you see that?

5 A. All right. Let me just read the full
6 paragraph. Okay?

7 Okay. I've reviewed that.

8 Q. Okay. Is the re -- strike that.

9 Is the regression equation in paragraph
10 96 the equation that you used to perform your
11 analysis that's described in Section III.C of your
12 report?

13 A. Well, it is used in Section III. I do
14 other regressions in Section III as well. So it's
15 in Section III, but there's other regressions in
16 Section III as well.

17 Q. Fair enough.

18 Is -- does the equation in paragraph 96
19 correspond to the regressions that -- the results
20 of which are in Exhibit 3?

21 A. Yes.

22 Q. Okay. Looking back at paragraph 96 and
23 looking at the equation in particular, on the
24 right side of the equation there's a lower case
25 "a."

1 Do you see that?

2 A. Yes.

3 Q. That "a" is the alpha, correct?

4 A. Yes.

5 Q. Okay. Okay. And reading from the very
6 end of paragraph 96, the alpha is the "remaining
7 average return, after accounting for the exposure
8 to the non-XRP cryptocurrency market factors," is
9 that right?

10 A. Well, the alpha plus the error term.
11 But the -- you know, so just looking at that
12 equation in paragraph 96, but the error term has a
13 mean zero. But -- but, yes. So that -- the alpha
14 is on the right-hand side of that equation on page
15 44.

16 Q. Okay. After the alpha term in the
17 equation on -- in paragraph 96, there's an epsilon
18 "t."

19 Do you see that?

20 A. Yes.

21 Q. What is the epsilon "t" on the right
22 side of the equation?

23 A. That is the error term.

24 THE REPORTER: I'm sorry,

25 that is the?

1 THE WITNESS: The error term.

2 Q. Okay. And does that epsilon "t"
3 represent the residual return?

4 A. No. I mean, the residual ter -- I mean,
5 if the -- if you include in the full model the
6 estimated coefficient with alpha, then the epsilon
7 would be -- well, you just -- I guess -- let me
8 restart.

9 The epsilon would be defined by just
10 moving the alpha to the left-hand side in that
11 equation.

12 Q. Okay. Let me reask my question in part
13 because I don't understand statistics as well as
14 you.

15 Is it correct to say that the epsilon
16 "t" is the residual return in the equation?

17 A. I don't want to use that -- I don't want
18 to -- in terms of the definition of residual, if
19 you include in your calculation of the residual
20 the alpha, the alpha estimate, then definitionally
21 you'll be right. Sometimes people use -- I just
22 want to be clear.

23 Sometimes people use the phrase
24 "residual return" to not include the alpha. So I
25 think there's a -- semantically people use, in my

1 experience, the phrase "residual return" in
2 different ways. So I just want to be clear on
3 that.

4 But the alpha is the excess return on
5 average in the return series. The error term is
6 the error term that you would have in any, you
7 know, kind of a regression.

8 Q. And when you say "error term," we're
9 talking about epsilon "t," is that right?

10 A. Yes.

11 Q. Okay. Do you address the error term
12 anywhere in your report?

13 A. Well, the error term is just a standard
14 part of any regression. So all the results that I
15 have include, you know, a regression with an error
16 term by definition. You could think about the
17 error term as this bouncing up and down, this
18 volatility of -- that the regression generates
19 when it's generating the coefficients in the
20 model.

21 Q. What does the error term tell us about
22 the model, if anything?

23 A. What does it tell us? I mean, it's just
24 part of the -- you know, if we're talking about
25 OLS regression, ordinary least squares regression,

1 it's part of the model that there's going to be an
2 error term in any given period just by func --
3 just by function of the fact that you're trying to
4 fit the data into a line or a slope.

5 Q. Okay. I'm looking for an English
6 translation, if there is one, of -- you know
7 how -- we already discussed the adjusted
8 R-squared. It tells you the percentage in
9 variation of XRP returns that's -- that are
10 explained by the model, right?

11 A. I do remember that.

12 Q. Okay. Is there some -- is there some
13 plain English way to explain to me what an -- what
14 this error term tells us about the model?

15 MR. KELLOGG: Objection;
16 asked and answered.

17 A. I mean, I don't know what you mean by
18 "tells us about the model." It's part -- like in
19 an ordinary least squares regression, OLS
20 regression, you're going to have an error term
21 associate -- you know, as part of the model. An
22 error term left over, so to speak, after the
23 coefficients. Whether you -- you know, you
24 conclude the alpha in that or not.

25 Q. Is there any relationship between the

1 error term and actual XRP returns?

2 A. I mean, the XRP returns are being
3 regressed on the model that has an error term in
4 it. So the actual XRP price returns are on the
5 left-hand side of the equation. The error term in
6 the regression's on the right-hand side.

7 Q. Is there any -- other than paragraph 96,
8 is there any paragraph in your report that
9 addresses the error term in your equation?

10 A. I'm not sure what you mean by
11 "addresses." Everything that I report, whether
12 it's Exhibit 3, any regression that I use and --
13 and the regression anybody's using, as far as I
14 know, in this case, has an error term in it. So,
15 yes, it is addressed in all my regressions because
16 that's part of the model.

17 Q. Okay. Let's go to paragraph 102,
18 please.

19 A. I'm sorry, what was that?

20 Q. Paragraph 102 on page 48.

21 So the last sentence in paragraph 102
22 says "As I explain above, a zero regression
23 constant is consistent with the average monthly
24 Ripple price returns (less the risk-free rate)
25 being explained by the non-XRP cryptocurrency

1 factors and no remaining average 'excess' XRP
2 price returns that are unexplained by the model."

3 Do you see that?

4 A. I do.

5 Q. Okay. Is the model in that sentence
6 the -- strike that.

7 What are you referring to when you say
8 "the model" in that sentence?

9 A. The regression that we were talking --
10 well, I'm sorry. You know, I would -- the models
11 are -- are what's being referred to in the first
12 sentence of that paragraph. So the first sentence
13 of the paragraph 102 states "The factor models and
14 the corresponding results I present in Exhibits 3
15 through 7" -- I won't read the full sentence. So
16 that -- that is what is being referenced at the
17 end of that paragraph.

18 Q. Okay. And I take it from reading
19 paragraph 102 that your conclusion that there are
20 no remaining average excess XRP price returns that
21 are unexplained by the model is based in part on
22 the zero regression constant that's referenced in
23 the last sentence of paragraph 102? Is that
24 right?

25 MR. KELLOGG: Objection.

1 A. Zero -- no. That's -- the model -- the
2 regression is what we were talking about earlier
3 in the factor model. The regression that we were
4 talking -- let me just get the actual paragraph.

5 The regression that we were talking
6 about -- well, one of the regressions being
7 referenced here is the regression in paragraph 96,
8 which does have an error term on the right-hand
9 side, which any OLS -- any regression is going to
10 have. You know, it's going to have this error
11 term in it.

12 You know, my reference to a zero
13 regression constant is just simply a reference to
14 the fact that the constant, or alpha, if you will,
15 is statistically indistinguishable from zero. I'm
16 not saying that the point estimate in the model is
17 zero. It's, rather, the point estimate for alpha
18 or the constant, it's statistically
19 indistinguishable from zero.

20 Q. Okay. And the -- just to go back to
21 your Exhibit 3, the point estimate in your models
22 for the alpha for Estimation Period 1 is 0.058 and
23 for Estimation Period 2, negative 0.022, is that
24 right?

25 A. Yes.

1 Q. Okay. So when -- when you use the
2 phrase "zero regression constant" in the final
3 sentence of paragraph 102 --

4 A. Let me just get back to that spot.

5 Q. Sure.

6 A. Okay.

7 Q. When you use the phrase "zero regression
8 constant" in the final sentence of paragraph 102,
9 you are referring, I believe, to your conclusion
10 that the alpha is statistically indistinguishable
11 from zero, is that right?

12 A. Correct. And I would point you to the
13 immediately prior sentence to that statement. "In
14 other words, one cannot reject the null hypothesis
15 that the constant - the observed average monthly
16 XRP price return after subtracting the risk-free
17 rate - is zero (controlling for non-XRP
18 cryptocurrency market factors)."

19 Q. Okay. And -- and you reached the
20 conclusion, as expressed at the very end of
21 paragraph 102, that there are "no remaining
22 average 'excess' XRP price returns that are
23 unexplained by the model," correct?

24 A. Yes. That is to say, there's no excess
25 returns statistically distinguishable from zero.

1 That is to say, we don't -- one does not observe
2 an extra return that's XRP specific on average for
3 this time period. That is to say, what shows up
4 as statistically significant in the model are the
5 principal components that reflect what's going on
6 in the non-XRP cryptocurrency markets.

7 Q. Does your conclusion that no remaining
8 average excess XRP price returns remain that are
9 unexplained by the model depend on anything else
10 other than your conclusion that the alpha in your
11 model is statistically indistinguishable from
12 zero?

13 MR. KELLOGG: Objection.

14 A. I am working off of the alpha being
15 statistically indistinguishable from zero. But,
16 obviously, to reach that conclusion requires a
17 model; requires, you know, all the work that I
18 did. So I would -- would reference all the work,
19 including Exhibits 3 through 7 that are referenced
20 in the beginning of this paragraph, in -- in
21 thinking about that conclusion.

22 Q. Is there another result other than --
23 strike that.

24 Is there another result obtained from
25 running your model other than the conclusion that

1 the alpha is statistically indistinguishable from
2 zero that informs your conclusion that there's no
3 remaining average excess XRP price returns
4 unexplained by the model?

5 MR. KELLOGG: Objection.

6 A. Well, I have a number of exhibits, not
7 just Exhibit 3, that are -- that generate the same
8 conclusion. That is, there's no statistically --
9 there's no alpha, there's no constant, that's
10 statistically indistinguishable from zero in those
11 other models. And as we discussed earlier today,
12 Dr. [REDACTED] alternative specifications also
13 generate the same result.

14 Q. Just for the record, we've talked about
15 the constant in Exhibit 3. I don't see a constant
16 in Exhibit 4.

17 A. Well, Exhibit -- Exhibit 4 --

18 MR. KELLOGG: Objection. Is
19 that a question?

20 MR. SYLVESTER: I wasn't
21 done, but --

22 THE WITNESS: Oh, I'm sorry.

23 BY MR. SYLVESTER:

24 Q. I'll tell you what. I just -- what I'd
25 like to see -- we were just discussing the concept

1 that you've concluded that the alpha is
2 statistically insignificant -- lost it.

3 Can you say it for me again? The alpha
4 is statistically indistinguishable from zero.

5 A. (Indicating.)

6 Q. Okay. Great. Which exhibits does that
7 concept show up in appended to your Exhibit 1?

8 A. Appended to what? Exhibit?

9 Q. Exhibit 1, yeah.

10 A. Oh. Well, I mean, you can see that in
11 Exhibit 3. Exhibit 4 is not a regression. It's
12 just a listing of the 20 largest cryptocurrencies.
13 So this is descriptive of that. It's not a
14 regression.

15 Exhibit 5, this is my regression on the
16 largest MarketCap coins. You see that the alpha
17 or the constant is statistically indistinguishable
18 from zero.

19 You go to my Exhibit 6 and all the
20 different specifications, that's when I'm adding
21 gold and fiat currencies and what have you, all
22 the constant are, likewise, statistically
23 indistinguishable from zero.

24 We go to Exhibit 7. Now we're in that
25 second estimation period. And, again, all these

1 different specifications have the same result;
2 that is to say, the constant -- the alpha is
3 statistically indistinguishable from zero.

4 Exhibit 10.

5 Okay. Now we're into Exhibit 11A, which
6 is on page 92. Once again, in this -- I won't
7 walk through it now, but the three specifications
8 I have here, the -- the alpha is statistically
9 indistinguishable from zero.

10 You go to Exhibit 11B, which is on page
11 93, that's the second estimation period. Same
12 results: Statistically indistinguishable from
13 zero.

14 Exhibit 12A, same result.

15 Exhibit 12B, this is the "Regression of
16 XRP Returns on Ripple XRP distributions -
17 Accounting for Volatility, Estimation Period 2."
18 Statistically indistinguishable from zero.

19 Exhibit 3 is just -- we're getting into
20 different -- different issues here.

21 Exhibits 17, 18, 19, 20 are -- and 21
22 and 22 are the MoneyGram ODL issues.

23 So I tried to be comprehensive in my
24 answer, but, you know, those are the exhibits that
25 come to mind in terms of answering your question.

1 Q. Okay. Let's look back at Exhibit 3.

2 Do you agree, looking at Exhibit 3, that
3 for Period 1 the average monthly return of XRP was
4 5.8 percent higher than the average monthly return
5 predicted by the principal components in the
6 regression during this period?

7 A. I don't agree with that in a statistical
8 sense. It's -- there is a point estimate that's
9 positive, but it's statistically indistinguishable
10 from zero. So as a statistician, as an economet
11 -- as a financial economist, and this is -- this
12 would be reflected in standard academic practice,
13 you would view this constant as statistically
14 indistinguishable from zero.

15 Q. You started your answer with "I don't
16 agree with that in a statistical sense."

17 Is there any sense in which the answer
18 is different?

19 MR. KELLOGG: Objection.

20 A. Well, I agree that there's a point
21 estimate here, which is positive, it's negative in
22 the second period, but you just don't take point
23 estimates. The point of doing statistical
24 analysis is whether this is statistically in the
25 data or not. And as we've been discussing, this

1 point estimate, as is true for the point estimate
2 in Estimation Period 2, the negative 0.022, is
3 statistically indistinguishable from zero.

4 Q. Given the regression for Period 1, isn't
5 5.8 percent the most likely value of alpha?

6 MR. KELLOGG: Objection.

7 A. I don't think that follows from the
8 regression at all. So the regression -- the point
9 of doing statistical analysis is whether we can
10 identify on a reliable basis the -- you know,
11 whether a point estimate is statistically
12 distinguishable. Here, we're testing it against
13 the null being zero.

14 So, again, you know, using -- the point
15 of the statistical analysis is to identify whether
16 an estimate is statistically reliable or
17 statistically present in the data.

18 Q. Do you base your conclusion that the
19 constant is not statistically distinguishable on
20 the "t" statistics?

21 A. Well, I ran it on the Huber-White, so
22 there is -- you know, obviously I'm working off of
23 the standard errors to calculate the statistical
24 significance at the 5 percent level.

25 Q. Do you know how standard errors are

1 calculated?

2 A. Yes, but I'm not going to be able to
3 recall off the top of my head.

4 Q. Okay. Would you agree that, all else
5 equal, if the residuals in the regression were
6 smaller, the estimated standard errors would also
7 be --

8 THE REPORTER: Repeat.

9 Q. Would you agree that, all else equal, if
10 the residuals in the regression were smaller, the
11 estimated standard errors would also be smaller?

12 MR. KELLOGG: Objection.

13 A. I don't know what you mean by
14 "residuals" in your question.

15 Q. If -- let me reask that question using
16 the phrase "error term."

17 Would you agree, all else equal, if the
18 error term in the regression were smaller, the
19 estimated standard errors would also be smaller?

20 MR. KELLOGG: Objection.

21 A. Are you -- you're talking about the
22 error term and not the constant in your question?

23 Q. That's right.

24 A. Can you repeat the question?

25 MR. SYLVESTER: Bridget,

1 would you mind reading that one back?

2 (Whereupon, the record was
3 read back.)

4 MR. KELLOGG: Objection.

5 A. Yeah, I -- I -- I don't want to answer
6 that off the top of my head. I would want to
7 think about that and go back to the formula.

8 So what I can say is based on the
9 standard errors that I actually calculate, this
10 is -- this is what one finds statistically.

11 Q. Would you agree that, all else equal, if
12 the error terms in the regression were all zero,
13 the estimated standard errors would also be zero?

14 MR. KELLOGG: Objection.

15 A. I want to be careful. I want to think
16 about that. I don't want to answer the
17 application of the standard error formula off the
18 top of my head.

19 What I can say is based on the standard
20 errors that I actually calculate for this model,
21 it's not statistically significant.

22 Q. What's the "it" in that sentence?

23 A. The constant. The alpha. So just to be
24 clear, I calculate the standard errors, the
25 statistical significance, for these various

1 models, these various specifications that I'm
2 running. And based on those standard errors, the
3 alpha, the constant, is not statistically
4 significant. Not statistically distinguishable
5 from the -- from zero, which is the null
6 hypothesis.

7 Q. Are you familiar with the concept
8 economically significant?

9 A. I've heard that phrase.

10 Q. Okay. What is the difference between
11 something that's economically significant and
12 statistically significant?

13 MR. KELLOGG: Objection.

14 A. So the context where I've seen this is
15 somebody finds a statistically significant
16 result -- so they have a point estimate, they find
17 a statistically significant result, and then the
18 question becomes, how big a deal is this?

19 So we find an effect of X on Y or a
20 statistical association of X on Y. And then
21 the -- and then -- so the person reports the
22 results of their statistical analysis. There is a
23 statistical relationship.

24 And then the question that one might
25 ask, and sometimes is asked, is, okay, there's an

1 association here, but is this economically
2 meaningful? Is this something that we should care
3 about or how much should we care about it? So it
4 really goes to the question of magnitude once we
5 are assured that there is a statistical
6 relationship in the data.

7 Q. Is it possible for a result to be
8 statistically insignificant but economically
9 significant?

10 MR. KELLOGG: Objection.

11 A. That is not -- not -- I would need to
12 see the context of where that claim is being made.

13 Q. What context would you need to answer
14 that question?

15 A. I'm really not sure what you're talk --
16 what your question is asking, I guess is what I'm
17 saying.

18 Q. I'm just talking about the, sort of,
19 conceptual level in economics literature. If
20 there's a difference between economically
21 significant and statistically significant, is
22 there a possible situation where a result is
23 statistically insignificant but economically
24 significant?

25 MR. KELLOGG: Objection.

1 A. I mean, that's a very broad statement
2 about all of economics. Again, I would just
3 repeat my earlier answer. The context that occurs
4 to me sitting here about economic significance is
5 really your -- you do data analysis. You find
6 that there's a statistical association, so it's in
7 the data in that sense. And then you can ask, is
8 this economically meaningful or how economically
9 meaningful?

10 So, again, that's the context that comes
11 to mind, you know, in this -- with regard to this
12 issue.

13 Q. Let's look back at your Exhibit 3. If
14 you replaced the insignificant .058 constant with
15 zero, would your model still predict XRP returns
16 equally well?

17 MR. KELLOGG: Objection.

18 A. So if I ran a different model, what
19 would be the outcome? I would have to run the
20 model. So if -- so as I understand, your question
21 is you -- your question is if I put an a priori
22 restriction on a model, that the intercept term,
23 the constant term, has to be zero, would it do a
24 better or worse job? I don't -- I'd have to think
25 about it. I don't have a view.

1 Q. Whether it would be better or worse,
2 would it be different than what we're looking at
3 in Exhibit 3?

4 MR. KELLOGG: Objection.

5 A. Well, if I understand your question
6 correctly, it would be different in a trivial
7 sense in that, again, if I understand your
8 question correctly, your -- in your hypothetical,
9 you, as an a priori matter, are setting the
10 intercept term, the constant term, to zero.

11 So that is -- that is different than
12 what I'm doing, which is I'm interested in whether
13 there's alpha to begin with.

14 Q. Okay. Let -- let's consider a
15 hypothetical. So during a given month, a company
16 announces a new product and, following that
17 announcement, its share price increases by 50
18 percent that day. Later that month the same
19 company announces it will recall an existing
20 product and, following the announcement, its share
21 price drops by 50 percent that day.

22 In that circumstance, the average
23 monthly return and the alpha are zero, correct?

24 MR. KELLOGG: Objection.

25 A. That's not actually right. So I'm going

1 to nitpick here. In your hypo -- let's call the
2 price 100. It goes up 50 percent. That's 150.
3 If it falls 50 percent, that's 75. So the price
4 doesn't remain the same.

5 Q. Let's use absolute price terms. Let's
6 say -- let's adjust the hypothetical to say that
7 the price goes from 100 to 120 and then falls from
8 120 to 100.

9 In that circumstance, where it's 100 at
10 the start and 100 at the end, would the average
11 monthly return in alpha be zero?

12 MR. KELLOGG: Objection.

13 A. Not necessarily. So in your hypo it's
14 100 and 100. I agree with you that in that hypo
15 that's a zero return. I think we can all -- you
16 know, I think we can agree on that. Whether
17 that's a -- that's related to a negative or a
18 positive alpha or -- or -- or an alpha that's
19 statistically indistinguishable from zero is an
20 entirely separate question.

21 So what if the al -- the -- the
22 instrument that we're talking about that goes from
23 100 and stays at 100 at the end of the day is
24 underperforming the market and it has a beta of 1?
25 So in that situation staying constant would

1 actually result in a negative alpha.

2 So, again, in response to your question,
3 whether something has a positive or negative alpha
4 is a function not just of the price returns of
5 that instrument, but how is it doing relative to
6 the factors that you have found to be
7 statistically associated with -- with price return
8 behavior?

9 Q. Let's look back at your paragraph 102
10 again.

11 MR. KELLOGG: Sorry, which
12 paragraph?

13 MR. SYLVESTER: 102 on page
14 48.

15 A. Just give me a second here.

16 Q. Sure.

17 A. Okay. I'm there.

18 Q. Okay. Great.

19 Looking again at the last sentence, that
20 we've now read through a few times together, is
21 the standard way to measure excess price return
22 with a constant or -- or is it with the error term
23 that's left unexplained by the model?

24 MR. KELLOGG: Objection.

25 A. Well, I mean, the error term is going to

1 be, you know -- it's going to be bouncing around,
2 up and down, depending on what the returns are
3 doing that month and what the other factors are
4 doing.

5 The alpha, the constant, is going to
6 give you that average excess return per month. So
7 it's absolutely standard in the academic
8 literature to look at the alpha. I think Mike
9 Jensen at HBS, Harvard Business School, had a very
10 famous paper in the 1960s on alpha and there's a
11 long literature on the meaning of alpha since
12 then. I've done some work myself on -- on alpha as
13 a measure of excess returns.

14 So I would say that the academic
15 literature very much supports my focus on alpha in
16 these regressions as a measure of excess returns.

17 Q. What are the academic papers that you
18 cite in your report that use alpha to measure
19 excess returns?

20 A. That I would have to go through and take
21 a look at the papers that are cited. But there's
22 many papers that look at alpha as excess returns.
23 I would mention Gomphers, Ishii, Metrick had a
24 paper in the Quarterly Journal of Economics in
25 2003. The whole point of their paper is alpha, is

1 their excess returns associated with good
2 corporate governance?

3 I've done a paper in Review of Financial
4 Studies where we look at alpha as well. So
5 there's -- that's just an example on the
6 literature on alpha.

7 Again, alpha as a measure of whether or
8 not you're observing not just bouncing up and
9 down, but is there positive or negative excess
10 returns above and beyond what you would expect
11 based on your factor model that you're deploying?

12 Q. The two papers that you just cited, did
13 you review them in connection with preparing your
14 expert report in this case?

15 A. I mean, not particularly. I mean,
16 this -- these are papers that I've known for --
17 well, the Gomphers, Ishii, Metrick, I knew it as a
18 working paper back in -- these are papers -- and
19 one of which I wrote. So these are papers that
20 I've known for, you know, a decade or two decades.

21 Q. Looking back at your --

22 A. But I do want to just --

23 Q. Go ahead.

24 A. -- put a little closure on this.

25 It's absolutely standard in the academic

1 literature to view the alpha, to view the
2 constant, as a measure of excess returns, returns
3 above and beyond -- it could be negative or
4 positive -- relative to the factor model that you
5 happen to be deploying.

6 Q. And other than your article and the
7 Gomphers article, can you think of any other
8 academic literature sitting here today that
9 supports that view?

10 A. Oh, I mean, there's many papers that do
11 that. I mean, I just mentioned Mike Jensen's
12 paper in the 1960s that started this whole thing
13 off. I would have to think more to come up with
14 citations off -- off the top of my head, but, you
15 know, those -- those two papers would all be good
16 starting points.

17 And it's inherent in the model, which
18 is -- right? You have, in the regression model --
19 going back to paragraph 96, if we go look at the
20 regression model itself, you just think about what
21 the alpha represents. It represents, you know,
22 this sort of constant effect, if any, above and
23 beyond the -- you know, what's in your factor
24 model.

25 Q. Let's look again to your Exhibit 3 at

1 the point estimate of your constant for Period 1.

2 A. Yes.

3 Q. Okay. Can we conclude, looking at your
4 Exhibit 3, with 95 percent confidence that the
5 true constant is in the range of approximately two
6 standard deviations of .058 in either direction
7 for Period 1?

8 A. I don't want to agree to a specific
9 confidence interval. I will say the confidence
10 interval includes the zero. That is to say
11 statistically indistinguishable from zero with --
12 you know, using the 5 percent level of confidence.

13 Q. Isn't two standard deviations the
14 generally accepted method for determining the
15 confidence interval?

16 A. Given --

17 MR. KELLOGG: Objection.

18 A. Depending on your confidence level, yes.

19 Q. What's the confidence level expressed in
20 your work in this case?

21 A. Five percent.

22 Q. Okay. So is it fair to say, then, that
23 the 95 percent confidence interval with respect to
24 the true constant range for .058 would be two
25 standard deviations in either direction?

1 MR. KELLOGG: Objection.

2 A. Sitting here today, I believe that's
3 accurate. I would want to double-check, but I
4 believe that's accurate.

5 Q. What is it that you would want to
6 double-check?

7 A. Well, I would want to make sure, you
8 know, sitting here, that I'm not misrepresenting
9 the exact confidence interval. You know, based on
10 the standard error, you know, this is
11 statistically indistinguishable from zero; i.e.,
12 the confidence level includes zero.

13 Q. Right. I guess if I look at -- I'm
14 trying to figure out -- strike all that.

15 Footnote 2 of your Exhibit 3 says
16 "asterisk indicates statistical significance at
17 the 5 percent level."

18 Do you see that?

19 A. I do.

20 Q. Does that mean that for your results
21 displayed in Exhibit 3, you used a 95 percent
22 confidence level?

23 A. Yes.

24 Q. Okay. So why is it that you can't say
25 with certainty that the 95 percent confidence

1 interval for the true constant value for your
2 Estimation Period 1 is within two standard
3 deviations on either side of .058?

4 MR. KELLOGG: Objection.

5 A. So I believe that's accurate. All I'm
6 saying is that I would want to double-check that
7 it's two standard deviations. That's consistent
8 with my memory sitting here, but, you know, I just
9 want to be, you know -- yeah. So I guess I'll
10 leave my answer at that.

11 Q. What would you check?

12 A. Well, I would just want to make sure --
13 you know, I would want to calculate the
14 standard -- the confidence interval, so...

15 Q. How would you calculate the confidence
16 interval?

17 A. Well, the confidence interval is a
18 function of the standard error. The standard
19 error is going to tell you how many standard
20 deviations you have for the confidence interval.
21 If you're asking me to perform the calculation
22 sitting here, I'm not prepared to do that.

23 Q. Why is it that you're not prepared to do
24 that?

25 MR. KELLOGG: Objection.

1 A. Because my report has the standard
2 error. It reports the constant. It reports
3 whether it's statistically indistinguishable. I
4 have all the information in this exhibit that's
5 necessary for the conclusions I draw.

6 I agree with you that the point estimate
7 will have an associated confidence interval
8 associated with it.

9 Q. And sitting here today, do you know how
10 to calculate the associated confidence interval
11 for the constant for Period 1?

12 MR. KELLOGG: Objection.

13 A. So I believe it's two standard
14 deviations. I believe that's accurate. But,
15 again, I'm not going to do new work sitting here
16 in the middle of a deposition.

17 Q. Assuming that it is two standard
18 deviations, what's the calculation that you would
19 perform to determine what the range of values for
20 the true constant are for Period 1?

21 MR. KELLOGG: Objection.

22 A. So I'm not going to do new calculations
23 sitting here. So I agree it's two standard
24 deviations, is my best memory. I agree that
25 there's a confidence interval, but I'm not going

1 to do a calculation sitting in the middle of -- a
2 new calculation sitting in the middle of a
3 deposition.

4 Q. Okay. Setting aside doing the math of a
5 new calculation, just conceptually, can you tell
6 me how you would go about, with words, figuring
7 out what the confidence interval is for the range
8 of true constant values for Estimation Period 1?

9 MR. KELLOGG: Objection.

10 A. I -- I -- I'm going to leave the work
11 that I've done as reflected in the exhibit.

12 Q. Is that because you don't know how to do
13 it?

14 MR. KELLOGG: Objection.

15 A. I don't want to, you know, off the top
16 of my head say something that's inaccurate. So
17 I'm not going to do new work in the middle of the
18 deposition. I'm going to rely on the work that I
19 carefully did over many months. And so -- and
20 that is what forms the basis for my opinion.

21 Now, I agree with you that my best
22 memory is it's two standard deviations associated
23 with a 95 percent confidence level, or interval,
24 but, again, I'm not going to do new math sitting
25 here.

1 Q. Understanding that you refuse to, could
2 you?

3 MR. KELLOGG: Objection.

4 A. I'm just going to repeat my earlier
5 answer.

6 Q. Do you know -- assuming the standard
7 deviation is -- assuming that you would use two
8 standard deviations, do you know how to perform
9 the calculation that would give you the range of
10 values for the true constant for Period 1?

11 MR. KELLOGG: Objection.

12 A. I -- I would want to think about it.

13 Q. Okay. You would agree with me that
14 there -- there is a range of values for the true
15 constant for Period 1, is that right?

16 A. Of course.

17 Q. Okay.

18 A. And that confidence interval, as we
19 discussed, includes zero. That's what it means to
20 say that something's statistically
21 indistinguishable from zero.

22 Q. Could the true value of the constant for
23 Period 1 be as high as 14 percent?

24 MR. KELLOGG: Objection.

25 A. I don't know offhand. There will be a

1 confidence interval on both sides of the point
2 estimate. So I agree with that. So there would
3 be in the confidence interval a number above
4 0.058. I don't have the exact number.

5 Q. Okay.

6 A. But I agree with you directionally that
7 in the confidence interval, there would be a range
8 around the point estimate.

9 Q. Let's assume -- I'll ask you to assume
10 for the sake of my question that 14 percent is
11 within the range of the true constant for Period
12 1.

13 A. Sure.

14 Q. Do you have any more reason to exclude
15 14 percent than you do to exclude zero as the true
16 constant?

17 MR. KELLOGG: Objection.

18 A. So whenever you do statistical testing,
19 you always need -- you always go into the
20 hypothesis. You don't come up with a hypothesis
21 after the fact. So the null hypothesis, which is
22 the necessary first step before doing any
23 statistical analysis, is, is it statistically
24 indistinguishable from zero or is the true
25 value -- or conversely, is it statistically

1 distinguishable from zero?

2 So that's the null hypothesis that I'm
3 testing for the reasons that we discussed earlier
4 today. And it -- you know, it turns out to be
5 statistically indistinguishable from zero.

6 Again, there's obviously always going to
7 be a confidence interval associated with any point
8 estimate.

9 Q. Okay. Assuming, again, that 14 percent
10 is within the range of values for the true
11 constant for Period 1, is there any statistical
12 reason to think that it's more likely that zero is
13 the true constant than 14 percent is the true
14 constant?

15 MR. KELLOGG: Objection.

16 MR. SYLVESTER: Please let me
17 finish.

18 A. I don't -- I don't agree with that
19 approach at all. In statistical testing, you have
20 to go into the null hypothesis. You don't create
21 your altern -- you know, a different hypothesis
22 after the fact. So the hypothesis being tested
23 here, the reason for the statistical analysis
24 going in, is whether or not the alpha is
25 statistically distinguishable from zero. That's

1 the question that's being answered. You don't
2 genie up or create a new hypothesis -- i.e., it's
3 14 percent -- after the fact. I don't think
4 that's a valid approach. It kind of invalidates
5 the statistical methodology which is you're
6 testing a hypothesis.

7 So I -- I guess I strongly disagree with
8 what I understand your question to be proposing.

9 Q. I don't think I'm suggesting that you
10 take this approach. I'm just asking your opinion
11 as an economist and somebody who understands
12 statistics, that if we assume that 14 percent is
13 within the true constant range for Estimation
14 Period 1, can you tell me if it's statistically
15 likelier that the true constant is zero than 14
16 percent?

17 MR. KELLOGG: Objection;

18 asked and answered.

19 A. I just don't agree with that approach.
20 That is, the statistics are designed to answer a
21 hypothesis that you have going in. It does have a
22 confidence interval associated with it, but what
23 I'm testing here, the null hypothesis, sets up the
24 regression analysis that we're doing. That is to
25 say, can we, at a certain confidence interval,

1 reject the hypothesis that the true alpha is zero?

2 So, again, in statistical testing, you
3 have to have a hypothesis going in. You don't say
4 after the fact, well, now I think it's -- you
5 know, that's -- that's what I'm testing. I'm not
6 going to change the hypothesis, you know, after
7 the fact.

8 Q. I totally understand you don't agree
9 with my approach.

10 Are you capable of answering my
11 question?

12 MR. KELLOGG: Objection.

13 A. I've answered it the best way I can.

14 Q. So am I to understand that you're not
15 capable of telling me whether or not it's likelier
16 that the true constant is zero than 14 percent
17 given the parameters of my hypothetical?

18 MR. KELLOGG: Objection;
19 asked and answered.

20 A. I agree with you that there's a
21 confidence interval, but the -- but the
22 statistical model is in service of testing the
23 hypothesis.

24 Q. Okay. Let's look at Dr. [REDACTED] rebuttal
25 again, Exhibit 6.

1 THE WITNESS: So we've been
2 going about an hour. Does it make
3 sense to take a quick break?

4 MR. SYLVESTER: That's fine
5 by me if it's okay --

6 THE WITNESS: Thanks.

7 MR. KELLOGG: Sure.

8 THE VIDEOGRAPHER: Okay.
9 Thank you. The time is approximately
10 3:09 p.m. We're going off the record.
11 It's the end of Media 4.

12 (Whereupon, a recess is
13 taken.)

14 THE VIDEOGRAPHER: And the
15 time is approximately 3:26. We're
16 back on the record. This is the
17 beginning of Media 5.

18 BY MR. SYLVESTER:

19 Q. Professor, are you offering the opinion
20 that because alpha is statistically insignificant,
21 there is no room for any other factors to explain
22 the price returns of XRP?

23 A. Well, no, I'm not saying that. So if we
24 go to my Exhibit 7, for example, you know, I do
25 add other market factors, potential market

1 factors, after I had my PCA components, to explore
2 whether those additional market factors, such as
3 the S&P 500, have, you know, a statistical
4 association.

5 So -- so, you know, I -- I do leave open
6 the possibility, you know, as reflected in this
7 work, that there's other factors that could have a
8 statistical association which I then explore, you
9 know, in the context of looking at these different
10 factors.

11 Q. Are there any additional market factors
12 that explain XRP returns?

13 A. Well, I can only report on the work that
14 I've done. And so I would reference the factors
15 that I do look at in my report, which obviously is
16 the non-XRP crypto market factors, the S&P 500,
17 the World Index Return, the Emerging Market, the
18 Bloomberg Commodity, gold, dollar, yen, euro.

19 Q. And as to any other additional market
20 factors beyond the ones that you just mentioned,
21 you didn't examine them, so you can't say one way
22 or another whether they affected XRP price
23 returns, is that fair?

24 MR. KELLOGG: Objection.

25 A. The work that I did, the factors I

1 looked at are in my report. What I can say is
2 conditional -- conditional in the pricing effect
3 or association of those factors, there is no
4 excess return so it's statistically
5 distinguishable from zero.

6 Q. Okay. But it's -- it's possible -- if I
7 understand your testimony, it's possible to have
8 an alpha that's statistically indistinguishably --
9 indistinguishable from zero and then also have
10 other market factors explain price returns of XRP,
11 is that correct?

12 MR. KELLOGG: Objection.

13 A. Well, I mean, I show that in my work,
14 which is there's no excess returns and there's a
15 statistical association between some of these
16 market factors and XRP price return behavior.

17 Q. Are any of the additional market factors
18 that you identify in Exhibit 7 statistically
19 significant?

20 A. No. So once we move beyond the -- the
21 non-XRP cryptocurrency factors, again, consistent
22 with the academic literature, these additional
23 factors, such as commodities, has no
24 statistically significant association.

25 Q. I think you testified that in your work

1 you show there's no excess returns. I thought
2 what you demonstrated was that there was no
3 average excess returns, is that right?

4 MR. KELLOGG: Objection.

5 A. I think you're drawing a distinction
6 that I wasn't making in your -- in your comment.
7 So I would just go back to the report. The alpha
8 is the excess returns over this time period.

9 Q. Can you show me where you're reading
10 from, please?

11 A. Okay. I haven't found the spot, so give
12 me one second.

13 Okay. So I would just point to my third
14 bullet point on page 40, as the way I characterize
15 it in the report, where I say "On average, XRP
16 price returns are not statistically different than
17 zero, controlling for cryptocurrency market
18 factors, over which Ripple has no control."

19 Q. And is that conclusion the same or
20 different from the conclusion that you articulate
21 in paragraph 102, where you say "In each of the
22 Exhibits, 3 to 7, in all columns, none of the
23 constants - which are estimates of the average
24 monthly XRP price" --

25 A. I'm sorry, I don't -- I don't know where

1 you're reading from.

2 Q. Paragraph 102.

3 A. Okay.

4 Q. About mid paragraph it starts "In
5 each..."

6 A. Yeah.

7 Q. Okay. "In each of the Exhibits, 3 to 7,
8 in all columns, none of the constants - which are
9 estimates of the average monthly XRP return after
10 subtracting the risk free rate and controlling
11 from non-XRP cryptocurrency factors - is
12 statistically significant at the 5 percent level."

13 So I guess my question is, is there a
14 distinction between excess returns and average
15 monthly excess returns?

16 A. I'm not drawing that distinction in my
17 report.

18 Q. Why not?

19 A. Because I'm referring to the same thing.
20 I'm referring to the constant in my exhibit. So
21 the discussions that we've been having is
22 referring to exactly the same regression. So
23 obviously they're referring to the same thing,
24 which is the alpha, the constant term in these
25 exhibits, such as Exhibit 3.

1 Q. Okay. So let's turn back to the bullet
2 you pointed me to. I think that was page 40, is
3 that right?

4 A. I have to find it again. Yes.

5 Q. So when you say in the third bullet on
6 page 40 that you read to me that begins with "On
7 average," that's a different way of saying what
8 you're saying in paragraph 102, is that right?

9 A. I don't know what -- what you mean by
10 "different way." I -- I am using different words.
11 It's not exactly the exact phrase that I use on
12 page 40. It's explain -- it's referring to the
13 same alpha estimates in my exhibits. It's
14 referring to the same thing, which is it's monthly
15 returns -- ergo, the excess return, if any, is
16 going to be a monthly return -- that's going to be
17 reflected in that alpha term in the exhibits.

18 Q. And would an excess return include the
19 error term in addition to alpha?

20 A. The excess return that I'm referring to
21 here is the alpha -- is the -- is the alpha in the
22 equation that we looked at earlier. So let me
23 just go back.

24 So the alpha that's being estimated is
25 the alpha in the regression term on page 43,

1 paragraph 96.

2 Q. Okay. Okay. Let's look at Dr. [REDACTED]
3 rebuttal report again.

4 A. Okay.

5 Q. AF-6. Let's turn to page 14, please.
6 Page 14 has a Figure 6 labeled "XRP 28-Day Net
7 Return Unexplained by Dr. Ferrell's Model
8 (Estimation Period 1)."

9 Do you see that?

10 A. Yeah, I see the Figure 6 heading.

11 Q. Okay. And then on the next page,
12 there's a Figure 7 and that heading is "XRP 28-Day
13 Net Return Unexplained by Dr. Ferrell's Model
14 (Estimation Period 2)."

15 Do you see that?

16 A. I do.

17 Q. Okay. Do Dr. [REDACTED] Figures 6 and 7
18 show the error term unexplained by your model?

19 A. So the way I'm reading this and the way
20 I understand it is that he's using the predicted
21 XRP return. So I'm interpreting him as using the
22 point estimate for the alpha, is my interpretation
23 of that second sentence in paragraph 32. And that
24 he's subtracting the predicted XRP return, which I
25 understand him to be using -- I believe he's using

1 the point estimate and subtracting the actual
2 return. And then he's plotting the delta over
3 time.

4 Q. Okay. So in your view, do Dr. [REDACTED]
5 figures have any relationship to the error term in
6 your equation expressed in paragraph 96 of your
7 report?

8 MR. KELLOGG: Objection.

9 A. So -- so if he's using, in his predicted
10 XRP return that's referenced in paragraph 32, the
11 point estimate on the alpha, then, yes. Under
12 that equation in -- on page -- you know, on page
13 44, if I understand what he's do -- what I
14 understand him saying is he's subtracting -- he's
15 moving that alpha over to the left-hand side
16 and -- and, therefore, what remains is the error
17 term.

18 If he's not using the point estimate for
19 the alpha, then it would obviously be the
20 conjunction of the two or the combination of the
21 two.

22 Q. Did you take any steps to determine
23 whether or not it was possible that unexplained
24 XRP returns -- actual unexplained XRP returns
25 reflected on Figures 6 and 7 were the result of

1 Ripple's actions?

2 MR. KELLOGG: Objection.

3 A. Well, I did, in the sense that the model
4 and the various specifications of the model are
5 asking a question: Is there a monthly excess
6 return over this time period? Not just bouncing
7 up and down, but is there an average excess return
8 associated with XRP over the -- over the
9 seven-year period or five-year period?

10 So I do think the work that I did in the
11 opening report does address that question.
12 Whether or not the error term is bouncing up and
13 down, you know, that's part of -- any regression
14 model is going to have a error term. The
15 regression model is identifying this excess return
16 if it exists.

17 Q. Is the -- strike that.

18 Is the phenomenon of the error term
19 "bouncing up and down," to use your words,
20 reflected in Figures 6 and 7 of Dr. [REDACTED]
21 rebuttal report?

22 MR. KELLOGG: Objection.

23 A. Well, again, I would go back to my
24 earlier answer and I just don't remember offhand.
25 But if in his predicted XRP return in paragraph 32

1 incorporates the point estimate of the alpha, then
2 under equation -- the equation on page 44 of my
3 report, that would be the error term under that
4 assumption.

5 Q. Okay. The last sentence of paragraph 33
6 of Dr. [REDACTED] rebuttal report on page 15 --

7 A. Thirty-three?

8 Q. Thirty-three.

9 -- says "He" -- that's a reference to
10 you, Professor -- "did not perform any testing to
11 see whether Ripple news or actions coincided with
12 any of these unexplained returns," referring to
13 the returns reflected in Figures 6 and 7.

14 So my question with you is, do you agree
15 or disagree with that statement?

16 A. I disagree with that statement because
17 the hypothesis that I was testing is the SEC's
18 theory, economic theory, that Ripple took various
19 efforts over the seven-year period -- and also the
20 five-year period -- over the seven-year period
21 that is associated with XRP price going up. So
22 that is the economic theory that I'm testing,
23 that's the hypothesis that I'm testing, and so I
24 did test for that.

25 The "Ripple news or actions" that he's

1 referring to in paragraph 33, you know, I assume
2 that's a reference to the SEC's theory in this
3 case that there's actions and news that Ripple
4 undertook that's affecting the XRP price. So I
5 most definitely did test that in my factor model.

6 Q. What in your view explains the
7 phenomenon of "bouncing up and down" -- again, to
8 use your words -- that we see in Figures 6 and 7
9 of Dr. [REDACTED] rebuttal?

10 MR. KELLOGG: Objection.

11 A. So in any model, there's going to be a
12 error term. There's going to -- you're never
13 going to get a perfect fit in a model. That's not
14 the nature of statistical testing. But the model
15 can test whether, on average, there's this excess
16 return, whether it be negative or positive,
17 associated with XRP.

18 So that's what the model is identifying,
19 whether there's excess returns associated with XRP
20 over time. The model does have explanatory power,
21 the adjusted R-squared, if you want to use that
22 metric, but it's never going to be 100 percent.

23 Q. Professor, a few answers ago you said "I
24 was testing" -- "what I was testing was the SEC's
25 theory, economic theory, that Ripple took various

1 efforts over the seven-year period -- and also the
2 five-year period -- that is associated with XRP
3 price going up."

4 Can you point me to the place in your
5 report where you identify the SEC expressing that
6 economic theory?

7 A. Well, it's the whole basis for why I'm
8 analyzing excess returns, which is the SEC's
9 theory. So I'm happy to flip through my report,
10 but I talk about the complaint in a number of
11 points.

12 Okay. So I'm just going to walk through
13 my initial report to give a full responsive answer
14 to this.

15 So in paragraph 7, which is under the
16 title back -- "Brief Background on Litigation," I
17 state in the second sentence "The alleged spec" --
18 well, I should read the full paragraph. "The
19 SEC's affirmative theory in its complaint for why
20 XRP should be deemed" --

21 THE REPORTER: One second.

22 Go ahead.

23 A. -- "should be deemed an investment
24 contract extensively relies upon its
25 characterization of XRP as a 'speculative

1 investment.'"

2 This is -- the next part is the one I
3 wanted to focus on. "The alleged speculation is
4 supposedly driven by the hope that Ripple's
5 efforts would somehow find a 'use' for XRP at some
6 point in the future, and that XRP's price would
7 rise as a result of those efforts."

8 I have various citations and quotes in
9 the complaint here. Let me just keep on going
10 through my report.

11 Paragraph 13 in my report, I state "In
12 Section III, I will address the SEC's assertion
13 that 'profit' from 'speculating' on XRP's price
14 increasing would primarily follow as a matter of
15 'economic reality' from Ripple's efforts to manage
16 and develop its business and promoting XRP."

17 So, again, referencing this theory of
18 the SEC that there's actions, events, that is
19 resulting in -- that's associated with Ripple and
20 its -- and its price.

21 Let me just keep going forward. I'm
22 going to skip over the contract section.

23 Paragraph 83 on page 36: "The SEC's
24 claim that the economic reality establishes that
25 XRP is an investment contract because market

1 actors speculated on XRP's price and, moreover,
2 that Ripple's efforts impacted XRP's price is
3 equally mistaken." Skipping a sentence. "Rather,
4 as I will show in Sections III.C and D" -- that's
5 the sections that include the factor model -- "the
6 economic reality is that" -- "is that XRP's
7 long-run price returns are, in fact, associated
8 with factors outside Ripple's control, namely,
9 price returns of non-XRP cryptocurrencies, and
10 that the XRP returns are unrelated to factors
11 under Ripple's control, including the various
12 distributions of XRP mentioned in the SEC's
13 complaint."

14 Paragraph 84. I'm not going to read the
15 whole thing, but it talks about speculative demand
16 according to the SEC causing XRP prices to rise.
17 I quote from the complaint extensively in Footnote
18 141.

19 Paragraph 90. I think this -- this is
20 the beginning of my factor analysis, the very
21 first sentence. "The SEC alleges that Ripple
22 distributed XRP to create profits for themselves
23 and the purchasers in the form of increased
24 prices" -- I italicize that -- "for XRP." I'm
25 citing to the complaint here.

1 Paragraph 107 on page 50: "The SEC also
2 points to various efforts by Ripple that
3 purchasers of XRP allegedly relied upon for an
4 expectation of profit (in the form of increasing
5 XRP's price)."

6 Second sentence of paragraph 108: "The
7 SEC then points to the increase in the market
8 price of XRP as evidence that Ripple's planned
9 distributions of XRP succeeded." I quote -- I
10 cite to the complaint.

11 I think at this point in -- in Section
12 E, I'm talking about the -- some -- a different
13 set of issues, aren't related issues, but let me
14 just take a quick look.

15 Paragraph 140, page 67: "The SEC argues
16 that the fortunes of XRP purchasers depend on
17 Ripple successfully executing their XRP strategy."
18 Citation to the complaint. "According to the SEC,
19 the success or failure of Ripple's XRP strategy
20 was contingent on Ripple propelling trading of XRP
21 that drives demand for XRP, which will dictate
22 investors' profits (recognized in increased prices
23 at which they could sell XRP) or losses."

24 So just flipping through my report,
25 those are the sections I was able to readily

1 identify.

2 Q. Okay. Let's turn back to Dr. [REDACTED]
3 rebuttal report, Figures 6 and 7.

4 Can you exclude the possibility that the
5 bouncing up and down in XRP returns as observed in
6 Figures 6 and 7 occurred because of Ripple's
7 actions?

8 MR. KELLOGG: Objection.

9 A. I can exclude or I can -- I -- I test
10 whether Ripple's actions as identified by the SEC
11 over this time period generated excess returns for
12 XRP. So that's what I tested. So I can --
13 that -- that's a question I addressed.

14 Q. As to any actual XRP price returns
15 unexplained by your model, can you exclude the
16 possibility that those actual returns were because
17 of Ripple's actions?

18 MR. KELLOGG: Objection.

19 A. Again, if the claim is that Ripple's
20 actions caused Ripple's -- caused XRP price to
21 increase over this time period by virtue of the
22 actions and the expectations that those actions
23 caused in the marketplace, I do -- I do address
24 that issue.

25 Q. Let's assume that all of the unexplained

1 XRP returns reflected in Figures 6 and 7 of
2 Dr. [REDACTED] rebuttal report were, in fact, the
3 result of Ripple's actions.

4 Would that affect your expert opinion at
5 all?

6 MR. KELLOGG: Objection.

7 A. That's such a -- a fanciful hypothetical
8 I'm having trouble with it. You know, if that was
9 somehow shown, I -- I would need to think about
10 it, but it strikes me as a -- I'm having a hard
11 time answering the question given the
12 hypothetical.

13 I mean, I would go back to my earlier
14 observation that any regression model is going to
15 have an error term in it; that it's never the case
16 that data fits perfectly along a -- a slope if
17 we're talking about an OLS regression, for
18 example.

19 Q. If Ripple had affected the long-term
20 price of XRP, is it your view that you would have
21 expected to find a statistically significant
22 alpha?

23 MR. KELLOGG: Objection.

24 A. I think that that view would lead to the
25 hypothesis that there would be a statist -- that

1 there would be a alpha. And the test for that is
2 the statistical test that I undertook. That is
3 the reliable methodology in the academic
4 peer-reviewed literature for testing a hypothesis
5 that there is alpha.

6 Q. Okay. Professor, I want to show you
7 what's been marked AF-21.

8 (Whereupon, exhibit is received and
9 marked SEC Ferrell Exhibit AF-21 for
10 identification.)

11 A. Should I put this aside?

12 Q. For now, yeah. I'll just pass them all
13 to you so you can distribute.

14 So, Professor, I'm going to represent to
15 you that AF-21 are two tables of data obtained
16 from running the Stata programs that create the
17 results of your Exhibit 3 and that you provided as
18 part of your work papers for your ex -- for your
19 expert report.

20 A. Okay.

21 MR. KELLOGG: I object to the
22 use of this exhibit.

23 MR. SYLVESTER: Why?

24 MR. KELLOGG: Because it's
25 something that you've created separate

1 and apart from any of the expert
2 reports.

3 MR. SYLVESTER: That's not
4 true. I just represented to Professor
5 Ferrell that this exhibit was created
6 by running the programs that he
7 produced as part of -- or that counsel
8 produced as part of his backup to his
9 expert report. This is part of --
10 this is the output of the analysis he
11 produced to us.

12 MR. KELLOGG: But there's no
13 way for him to check that in looking
14 at this sheet of paper.

15 MR. SYLVESTER: Well, there
16 is one way for him to check it. Let's
17 see if he's seen the data before.

18 May I ask him a question?

19 BY MR. SYLVESTER:

20 Q. Professor, I understand you haven't
21 physically seen AF-21 before today. Be that as it
22 may, have you seen the data that's displayed in
23 AF-21 before today?

24 A. Well, I'm looking at the first linear
25 regression and it is the -- you know, I'm just

1 lining it up with the Estimation Period 1. And,
2 you know, it is the results in that Estimation
3 Period 1, the coefficients and the constant return
4 in that linear regression.

5 I can -- and let me just check the
6 second linear regression here.

7 Same answer.

8 Q. Okay. So it's fair to say that you
9 recognize the data displayed in AF-21, the top
10 panel, as the regression output for Period 1 and
11 the bottom panel as the regression output for
12 Period 2?

13 MR. KELLOGG: Objection.

14 A. That -- that appears to be correct.

15 Q. Okay.

16 A. Without reproducing it on the spot for
17 myself.

18 Q. Understood. We don't have the computer
19 program here with us today.

20 Do you understand -- okay.

21 So turning to Panel 1 first, the top
22 panel, do you see on the right-hand side where it
23 says "Root MSE"?

24 A. Yes.

25 Q. Okay. Do you understand that to be Root

1 Mean Square Error?

2 A. Yes.

3 MR. KELLOGG: Objection.

4 Q. Okay. Are you familiar with the concept
5 of Root Mean Square Error?

6 A. Yes.

7 Q. Okay. You can see for Period 1 that the
8 Root Mean Square Error --

9 A. So are we -- are we still looking at the
10 first linear regression?

11 Q. Yes.

12 A. Okay.

13 Q. And I understand the first linear
14 regression to correspond with your Period 1
15 regression, is that right?

16 A. Yes.

17 Q. Okay. So looking at the first linear
18 regression that corresponds with Period 1, the
19 Root Mean Square Error is .53246.

20 Do you see that?

21 A. I do.

22 Q. Okay. That Root Mean Square Error
23 figure means that the typical monthly unexplained
24 XRP price return in the regression for Period 1 is
25 approximately 53.2 percent, is that right?

1 MR. KELLOGG: Objection.

2 A. I think that's correct.

3 Q. Okay.

4 A. And that -- this is going to, you know,
5 be a function of running the regression and
6 fitting these values on the -- the PCAs and the
7 constant term.

8 Q. Okay. Turning now to the bottom panel,
9 which I understand to be the linear regression
10 employed for Period 2, do you see that the Root
11 Mean Square Error value is .34178?

12 A. I do.

13 Q. Okay. And that means -- that Root Mean
14 Square Error figure means that the typical monthly
15 unexplained XRP price return in the regression for
16 Period 2 is approximately 34.2 percent, is that
17 right?

18 MR. KELLOGG: Objection.

19 A. I believe that's correct.

20 Q. Okay.

21 A. Or that would be one -- yes, I believe
22 that's correct.

23 Q. Okay. Let's turn -- actually, before we
24 turn to anything else, let me just ask you a
25 question.

1 Do you agree that Ripple's distributions
2 could have an impact on XRP price only if those
3 distributions actually entered the market through
4 trading?

5 MR. KELLOGG: Objection.

6 A. Not necessarily. So it depends on, you
7 know, the market views about when distributions
8 are -- I mean, it depends -- I would want to know
9 more about market expectations.

10 So certainly one mechanism for
11 distribution to have an effect is -- is the sale
12 of those distributions into the marketplace, but
13 also the effect -- the fact that there is
14 distributions occurring, even if they end up, say,
15 for instance, in a custody account, could
16 potentially affect market pricing as well. As I
17 explain in my report, you know, increasing supply,
18 all else being equal, could lead to an
19 equilibrium, a lower price.

20 Q. So if I understand your answer, another
21 mechanism for a distribution to have an impact on
22 prices in addition to trading is if there is
23 market awareness of that distribution, is that
24 right?

25 MR. KELLOGG: Objection.

1 A. Right. So the market views supplies
2 increasing over time, that could affect market
3 pricing, too. So, you know, you would want to
4 think about expectations. You would want to think
5 about supply in the marketplace. So all these
6 things obviously are going to be part of the
7 overall picture in thinking about distributions
8 and the increase of supply that the sales or the
9 distributions can represent.

10 Q. In your analysis of Ripple's
11 distributions that's set forth in -- in Section
12 III.D of your report, did you check to see if the
13 distributions that you considered were actually
14 used for trades?

15 MR. KELLOGG: Objection.

16 A. I'd have to see what you're referring to
17 in my report. So should I go to III.D?

18 Q. Sure. I don't -- I don't have a
19 specific paragraph citation for you. I'm just
20 asking a general methodological question.

21 A. Let me just make sure I have the
22 right -- let me just make sure I have the right
23 section that you're referring to.

24 Q. Absolutely. Yeah. I'm talking about
25 the analysis that you performed that you summarize

1 in III.D.

2 A. Yeah. So in III.D, as I explain -- let
3 me just get the exact place where I talk about
4 this. Well, let me go to the exhibits.

5 So in Exhibit -- Exhibit 11A, there's
6 the distributions and lag distributions. So for
7 the specification where there's distribution or
8 lag distribution, I believe that would encompass
9 56 days.

10 Q. Okay. And how does your answer that you
11 just provided relate to my question of whether or
12 not you checked to see whether or not the
13 distributions you analyzed were actually traded in
14 the market?

15 A. Well, that's not how I'm defining
16 distribution here. So I define distribution, as I
17 say in my report -- let me just go to the -- is --
18 let me -- I think it's in the appendix actually.

19 So on page C-7 of Appendix C, I define
20 the data distribution and the data. So I'm now
21 reading the third sentence: "For transfers
22 involving a reserved or custody account, the date
23 on which the transfer first occurred is used. I
24 understand this is also consistent with how Ripple
25 reports its data."

1 So, anyway, there's a lot more
2 discussion about how the distribution data was put
3 together, but that is one of the definitions of a
4 distribution that I use. That is to say, moving
5 from Ripple, if Ripple's what we're talking about,
6 to a non-Ripple account, an account under the
7 control of a party other than Ripple.

8 Q. Mm-hmm.

9 And after that XRP moved from Ripple to
10 a non-Ripple party, did you do anything to -- to
11 determine whether at that point the XRP entered
12 the market?

13 MR. KELLOGG: Objection.

14 A. No, I did not. In terms of the
15 definition of distribution, whether it's lagged or
16 not, in my analysis, that's how I'm defining
17 distribution.

18 Now, as I said this morning, given
19 Dr. [REDACTED] criticism, which I don't agree with,
20 but I also ran the distribution analysis, as we
21 discussed this morning, using just programmatic
22 and market maker and exchange sales and it doesn't
23 affect the results of my analysis. So, anyway,
24 that's something that we discussed this morning
25 and I, you know, would raise it again here.

1 Q. Turning to the next sentence after the
2 one you just read --

3 A. Oh, I just closed it. Okay.

4 Q. It's C-7, paragraph 13.

5 A. Okay.

6 Q. You wrote "For example, Ripple may set
7 up and transfer to a custody account one million
8 XRP on January 1st, 2015. The funds may stay in
9 that account until the relevant non-Ripple entity
10 directs Ripple to withdraw the XRP funds from the
11 custody account on May 1st, 2015."

12 Do you see that?

13 A. I do.

14 Q. As far as you know, are there any market
15 participants except for Ripple and the relevant
16 non-Ripple party that would be aware of the funds
17 being transferred to the custody account on
18 January 21st --

19 MR. KELLOGG: Objection.

20 THE REPORTER: You're going
21 to have to slow down.

22 MR. SYLVESTER: Okay.

23 THE REPORTER: Repeat.

24 BY MR. SYLVESTER:

25 Q. As far as you know, are there any market

1 participants besides Ripple and the non-Ripple
2 party aware of the funds being transferred to a
3 custody account on January 1st, 2015?

4 MR. KELLOGG: Objection.

5 A. Well, this is a -- this is a
6 hypothetical. Are you assuming -- so if this
7 hypothetical held true, is that -- I'm not quite
8 understanding the question.

9 Q. Let me reask a different question but
10 same topic.

11 Did you take any steps to determine, in
12 the circumstances where Ripple transferred XRP to
13 a non-Ripple party, to determine whether or not
14 market participants were aware of the transfer on
15 the date of the transfer?

16 MR. KELLOGG: Objection.

17 A. No. I don't have a view on that. I --
18 I do have a view that it's a distribution in the
19 sense that it's going from Ripple to a non-Ripple
20 party, albeit in a custody account, but it's under
21 the control of the non-Ripple party. And that --
22 that's how I'm defining a distribution; that is to
23 say, the movement of XRP from Ripple to a
24 non-Ripple party.

25 Q. In paragraph 14 on the next page, C-8,

1 you write "Last, in calculating net distributions
2 for use in the analyses, the record level data
3 were adjusted by: One, converting values in fiat
4 currencies to XRP (for a small set of the data)."
5 I just want to pause there.

6 What was the small set of the data
7 you're referencing?

8 A. Let me just read this full paragraph.

9 Q. Sure.

10 A. I would have to go back to the data to
11 review it. I don't recall offhand.

12 Q. Okay. Can your model distinguish
13 between the following two possible scenarios of
14 zero monthly net distributions: Scenario 1, no
15 Ripple distributions of XRP at all during the
16 month; Scenario 2, Ripple bought a lot of XRP at
17 the beginning of the month and then sold back the
18 same number of XRP at the end of the month?

19 MR. KELLOGG: Objection.

20 A. So -- let me just go back to my report.
21 I think this goes back to the question of net
22 distributions or net outflows, but I want to get
23 the relevant part of the report.

24 Q. And if you wouldn't mind when you get
25 there directing me to where you're looking.

1 A. Sure.

2 All right. So I'm looking at paragraph
3 113, page 53. And I state, in -- in terms of my
4 analysis, my factor analysis, "First" -- so I'm
5 looking at the second sentence. "First, I include
6 Ripple's monthly distribution of XRP, which is the
7 net outflows of XRP from Ripple over the last 28
8 days, and, second, I include the one-month lagged
9 XRP distributions to account for timing
10 differences in XRP distributions."

11 So the answer to your question is I'm
12 looking at net outflows --

13 Q. Okay.

14 A. -- for the 28-day period.

15 Q. Let me reask my question more precisely
16 in reference to paragraph 113.

17 When looking at net outflows of XRP from
18 Ripple over the last 28 days, does your model
19 distinguish from a 28-day period where Ripple made
20 no distributions of XRP from a period where Ripple
21 bought and sold back the same amount of XRP during
22 the 28-day period?

23 MR. KELLOGG: Objection.

24 A. In your hypothetical, the net outflow,
25 if I understand your hypothetical, would be zero.

1 Q. Okay. And could your model pick up the
2 difference between those two factual scenarios or
3 would it just be zero in those two cases?

4 A. So in your hypothetical, the net outflow
5 from Ripple would be zero. So on net, the supply
6 of XRP in both of your hypos, hypotheticals,
7 didn't increase at the end of the day.

8 Q. Okay. So applying your model to both
9 those scenarios, the net monthly outflow would be
10 zero for Scenario 1 and zero for --

11 THE REPORTER: You're going
12 to have to slow down.

13 Q. Applying your model to that
14 hypothetical, the net monthly outflows would be
15 zero for my first scenario and zero for my second
16 scenario?

17 MR. KELLOGG: Objection.

18 A. Correct, because -- well, because the
19 net is zero. So the net supply of XRP in your two
20 hypotheticals, you know, results in a net increase
21 in supply at the end of the 28-day period of zero.

22 Q. Okay. I have another two possible
23 scenarios for you. Again, hypothetically. The
24 first scenario is XRP's price does not change at
25 all during the 28-day period, and the second

1 scenario is that XRP's price declined at the
2 beginning of the 28-day period and rebounded to
3 the same price toward the ends of the 28-day
4 period.

5 Can your model distinguish between those
6 two factual scenarios?

7 MR. KELLOGG: Objection.

8 A. So -- okay. I just want to make sure.
9 We're not talking about distributions now, we're
10 talking about prices?

11 Q. Yes.

12 A. Okay. So in the 28-day window, it's
13 looking at price returns over the 28 days. So in
14 your situation, if it's 100 in the beginning --
15 just to normalize the price to 100 -- and it's 100
16 at the end, that would be a return of zero for
17 that 28-day increment.

18 So it is correct -- and I'll point to
19 the footnote on this just to be crystal clear. It
20 will take a second.

21 (Pause)

22 Footnote 163 on page 43. So that's the
23 specifics about how the 28-day price return's
24 being calculated. And, again, to answer your
25 question, if the price in the beginning of that

1 period, the 28-day period, is the same as the end,
2 that would be a price return of zero.

3 Q. Okay. And I just want to make sure I
4 understand. So there's -- let me pose two
5 different factual scenarios. One 28-day period
6 using XRP is \$100. It's \$100 the entirety of the
7 28-day period. It's a flat line.

8 A. Okay.

9 Q. Second factual scenario, XRP starts at
10 100, it goes up to 120 sometime during the month,
11 it goes back to 100 sometime later in the month,
12 end of the month it's 100.

13 Does your model distinguish at all
14 between the changes -- between those two factual
15 scenarios?

16 A. The return is the same. So it is 28-day
17 returns. So, yes, I am -- you know, as you can
18 see in the formula in Footnote 163, I'm using
19 price Day T plus 28 and I'm using price in the
20 denominator of Day T -- of Day T. So it is
21 working off of those two prices. To reiterate,
22 price of Day T plus 28 and price on Day T. And
23 that's the return that's being used in that 20-day
24 period.

25 So in your hypothetical, as I understand

1 it, in both of those hypotheticals, you're setting
2 price Day T plus 28 equal the price Day T in both
3 scenarios and, ergo, it would have the same
4 return.

5 Q. The -- the return would be zero for both
6 factual scenarios, correct?

7 A. Yes.

8 Q. Okay. Did you have access --

9 A. Just -- just to comment.

10 Q. Go ahead.

11 A. You know, we're talking about returns
12 and then we're -- I just -- the formula in
13 Footnote 163 is in prices that converts it into
14 returns. So I just want to make sure we're clear
15 that in the hypo we're using prices in our
16 hypothetical and then converting them into
17 returns.

18 Q. Okay. Did you have access to daily
19 disaggregated XRP distributions data, meaning
20 inflows and outflows?

21 A. So the data that we had was
22 multifaceted. Some of it was on a monthly basis.
23 I would just refer back to the data appendix in
24 all of this and the different data sources because
25 there's a number of different data sources with

1 different levels of frequency. So give me a
2 second here.

3 Yeah. So, I mean, this gets pretty
4 complicated in terms of the different data sources
5 that were used to construct the -- the -- the
6 flows, the distribution flows, whether they -- you
7 know, at different points in time.

8 And so paragraph -- Section F of my
9 Appendix C, starting on page C-6, walks through
10 some of the -- some of the data sources. So there
11 is record -- record level data for some of the --
12 the distributions or some of the flows. There is
13 monthly account balances.

14 THE VIDEOGRAPHER: Counsel,
15 I'm sorry, I'm getting some
16 interference with your microphone
17 rubbing against your jacket. Sorry
18 for the interruption. Thank you.

19 A. And there's monthly changes in balances
20 that supplement the record level data.

21 So some of the distribution data is
22 monthly and all those data sources were -- were
23 utilized, not just the record level data.

24 Q. Why was it that you chose to perform
25 your distributions analysis using monthly net

1 data?

2 A. Well, I mean, there's -- there's two
3 answers to that question. One is my
4 specification, as we've been discussing, is using
5 a 28-day period. So the factor model that we've
6 been talking about is using these 28-day periods.
7 So if I'm to incorporate the distributions into
8 the factor model, it's natural to also have it be
9 the same increment of time.

10 The second answer is, and I won't read
11 the de -- the details, but constructing the
12 distribution data was a nontrivial exercise. And
13 using, in addition to the record level data, the
14 monthly account balances, monthly changes in the
15 balances, was part of the process as well as the
16 record level data.

17 So the data sources have different
18 levels of frequency associated with it. And --
19 and so that -- that's -- that's, you know, how the
20 data was put together.

21 Q. Okay. Are you aware of any academic
22 literature that uses dollar value of net
23 distributions to measure the impact of
24 distributions on a stock price?

25 MR. KELLOGG: Objection.

1 A. I don't recall either way. I would have
2 to take a look. I -- yeah. I just don't have a
3 specific recollection sitting here.

4 Q. Okay. Was your original distributions
5 data in number of XRP or in dollars?

6 A. So I believe a lot of the data was in
7 XRP. So we have reserved accounts that are set in
8 XRP funds. There is another data source that we
9 used, you know, in constructing the data.

10 I just want to get the exact language
11 here. I know it's here somewhere. I just can't
12 find it right away. Give me a second.

13 So maybe I'll just point you to the
14 exhibit where the data's reflected.

15 Q. Perhaps Exhibit 8?

16 A. What's that?

17 Q. Perhaps Exhibit 8?

18 A. Not quite. Yeah, so that's not exactly
19 what I was thinking about.

20 Exhibit 10. So CoinMarketCap has data
21 on -- on -- on what they label a circulating
22 supply. And so another -- another data source,
23 going to your question for this, which is
24 denominated or in -- in XRP, you can see the Y
25 axis here, is CoinMarketCap circulating supply and

1 then we obviously have the XRP distributions in
2 XRP here.

3 So I guess two points here. One is,
4 it's -- it is in XRP units and it's yet another
5 data source in addition to what I was describing
6 later that was utilized to make sure that what we
7 were seeing in the XRP distributions was
8 consistent with this other source of data; that is
9 to say, the CoinMarketCap circulating supply.
10 Again, going to your question, that is in XRP.

11 Q. Okay. And to convert the number of XRP
12 to dollars for purposes of -- of your analysis, I
13 believe, according to Exhibit 9, Footnote 2 --

14 A. Just give me one second.

15 Q. Sure.

16 A. Let me just familiar -- we're skipping
17 around a lot so let me just take a moment to look
18 at what you're looking at.

19 Q. Sure. And just to orient us, I'm at
20 Exhibit 9, Footnote 2.

21 A. Okay.

22 Q. So I read Footnote 2 to mean that for
23 your distributions analysis to convert the number
24 of XRP to dollar values, you used, depending on
25 the period of time, CryptoCompare and

1 CoinMarketCap prices, is that right?

2 A. Yes.

3 Q. Okay. In your view, could this
4 conversion from number of XRP distributed into
5 dollar values have introduced inaccuracies in the
6 data since you didn't use actual prices at which
7 the XRP were distributed?

8 MR. KELLOGG: Objection.

9 A. No. I view this as the market price of
10 the XRP in question. So I don't view it as
11 inaccurate.

12 Q. And the -- the price of XRP varied
13 substantially in the period from 2013 to 2020,
14 correct?

15 MR. KELLOGG: Objection.

16 A. Well, it depends on -- you know, are you
17 talking about over a long period of time or are
18 you talking about on a daily basis?

19 Q. I meant over the -- the entire period,
20 it sort of increased substantially, right?

21 A. It -- it definitely changes over time.

22 Q. And -- and fair to say that change in
23 the 2013 to 2020 period is an increase in price,
24 right?

25 A. Yes.

1 Q. Okay.

2 A. And I think we saw earlier the market
3 cap of -- of XRP, which is not only about price,
4 but about, you know, the -- the XRP units out
5 there. But, yes, it did increase in price.

6 Q. Okay.

7 A. Oh.

8 Q. Go ahead.

9 A. Let me just -- let me take another crack
10 at my earlier answer, which is the price is
11 increasing and the supply in the marketplace of
12 XRP is increasing, too, as we can see in Exhibit
13 10. That's -- that's what I was trying to say
14 with my earlier answer.

15 Q. Okay. So -- so that I understand your
16 distributions analysis, let me introduce another
17 hypothetical. And let's use completely
18 hypothetical price numbers to make the math easier
19 on me.

20 So let's say in 2015, XRP was trading at
21 a dollar and Ripple distributed one million XRP.
22 Using your distributions calculations, you would
23 convert that to \$1 million, correct?

24 A. Yes, if that's the price in
25 CryptoCompare or CoinMarketCap, depending on

1 exactly when in 2015 you're talking about.

2 Q. Okay. So let's say again, totally
3 hypothetically, in 2018, XRP's price --

4 A. 2018 now?

5 Q. Yes.

6 A. Okay.

7 Q. Totally hypothetically. XRP's price is
8 \$5. Ripple distributes again one million XRP. In
9 that case, your distributions figure would be \$5
10 million, correct?

11 A. Yes. So the -- just to be clear, it's
12 converting to dollars on the date of distribution
13 and it's using the average of the opening and
14 closing price as reported in CryptoCompare.

15 Q. Okay. And for both of those
16 circumstances in my hypothetical, Ripple was
17 distributing the same amount of XRP, one million
18 XRP, right?

19 A. Yes. I think that's right.

20 Q. Okay. Would you agree that the
21 conversion of distributions into dollar values
22 introduces additional variation into the net
23 distributions data that makes it more difficult to
24 detect the relationship between XRP returns and
25 Ripple's actions?

1 MR. KELLOGG: Objection.

2 A. No, I don't agree with that. I'm --
3 I'm -- I'm using the market value of the XRP
4 distribution based on the pricing. And so I view
5 that as an accurate way to track the -- the
6 outflows or the net outflows.

7 But as we discussed earlier today in
8 response to Dr. [REDACTED] criticism on this score,
9 not that I agree with it, is I reran the
10 distribution analysis and the -- and the -- and
11 the -- and how it's measured using XRP units
12 rather than converting it into the -- into dollars
13 using market values and it doesn't change the
14 results.

15 Q. Is it fair to say that in no place in
16 your report are you providing an expert opinion as
17 to Ripple's motivations with respect to any of its
18 actions?

19 MR. KELLOGG: Objection.

20 A. Agreed.

21 Q. Okay.

22 A. I am not, as an economist, opining on
23 what somebody was thinking, what somebody was
24 feeling, what somebody thought. I'm not a fact
25 witness.

1 Q. Okay. Let's turn to paragraph 119,
2 please.

3 A. Let me just familiar my -- familiarize
4 myself with the paragraph --

5 Q. Sure.

6 A. -- for a moment.

7 Okay.

8 Q. The last sentence of 119 says "The cap
9 on XRP distributions introduced by the escrow is
10 therefore not a binding constraint on the amount
11 that Ripple can distribute per month."

12 Do you see that?

13 A. I do.

14 Q. Can you explain in what way the escrow
15 is not a binding constraint on the amount of XRP
16 that Ripple can distribute per month?

17 A. Well, I'll just refer to the discussion
18 earlier in that paragraph. So my understanding of
19 the escrow is that they can distribute up to one
20 billion per month in XRP. So that is -- that is
21 the -- the limit, as I understand it, on the
22 escrow. So they can do up to a billion. They
23 don't have to do a billion, but they can do up to
24 a billion as I understand it.

25 And so, you know, in the sentence that

1 begins "I analyzed" on page 55, I'm just simply
2 observing that the monthly ratio, you know,
3 ranged, you know, up to 55.8 percent. And then
4 for the next time period, it ranged up to 55.9
5 percent.

6 So I'm just making the observation that
7 in the distribution data that monthly limit of one
8 billion wasn't binding because they're doing less
9 than -- less than 100 percent.

10 Q. Did you calculate the monthly ratio for
11 the years ending 2019 and 2020?

12 A. I don't recall that offhand. I do have
13 the distribution net outflows in dollar numbers of
14 Exhibit 9. I have the monthly net outflows in XRP
15 on Exhibit 8. So I would reference that for the
16 2019/2020 period. But, again, this is in XRP
17 units.

18 You see here in that Y axis of Exhibit
19 8?

20 Q. Mm-hmm.

21 A. There is a one billion XRP. And you can
22 just take a look at the net outflows in XRP in
23 Exhibit 8 for 2019 and 2020. I believe that it's
24 all below that monthly cap of a billion.

25 Q. Okay. Let's go back to paragraph 1 --

1 THE WITNESS: How long have
2 we been going? I don't want to take a
3 break too often.

4 MR. SYLVESTER: It's been
5 about an hour.

6 MR. KELLOGG: A little over
7 an hour. Do you want to take a break?

8 THE WITNESS: Yeah. Maybe --
9 I hate keeping people here in the
10 evening, but maybe a break.

11 MR. SYLVESTER: It's fine by
12 me.

13 THE VIDEOGRAPHER: Okay.
14 Thank you. The time is approximately
15 4:20 -- make that 4:30. We're going
16 off the record.

17 (Whereupon, a recess is taken)

18 THE VIDEOGRAPHER: And the
19 time is 4:50 p.m. We're back on the
20 record.

21 BY MR. SYLVESTER:

22 Q. Professor, are you familiar with the
23 term "liquidity premium"?

24 A. I believe so in the sense of a
25 premium -- a potential premium for liquidity. So

1 in that general sense, yes.

2 Q. Okay. What is your understanding of the
3 term "liquidity premium"?

4 A. So the way I just defined it is the idea
5 that, all else being equal, a more liquid asset
6 can have more value than an illiquid asset, all
7 else being equal.

8 Q. Okay. Are you aware of any economics
9 literature that suggests that digital assets are
10 not subject to a liquidity premium?

11 A. No.

12 Q. Okay. Did you do any testing in this
13 case to determine whether XRP's listing on any new
14 digital asset platform had any impact on XRP's
15 price?

16 A. Yes, in -- in -- in the sense that I --
17 I framed the hypothesis that I tested earlier,
18 which is the net effect of the actions that the
19 SEC identifies, which includes listing on
20 exchanges, did not have a statistically
21 significant excess return.

22 Q. Other than the testing that you just
23 mentioned, did you do any additional testing to
24 determine whether XRP's listing on any particular
25 digital asset platform had any impact on XRP's

1 price?

2 MR. KELLOGG: Objection.

3 A. So the work I did is reflected in -- in
4 those regressions.

5 Q. Okay. Over the period of 2013 to 2020,
6 has Ripple sold XRP every year?

7 MR. KELLOGG: Objection.

8 A. So in your question you used the word
9 "sold." What I can talk about is distributions in
10 the way that I defined it, and we were discussing
11 earlier. So I think the most responsive answer to
12 your question would be Exhibit 8, which is the net
13 outflows from Ripple. And this is denominated in
14 XRP and -- anyway, you can see the -- the net
15 outflows over time.

16 Q. You also reviewed Ripple's financial
17 statements from 2014 to 2020, is that correct?

18 A. Yes.

19 Q. Okay. Do you recall from that review
20 whether Ripple sold XRP each of those years?

21 A. I don't have a specific recollection.
22 You know, I do track -- I do track outflows from
23 Ripple and that's reflected in Exhibit 8 and
24 Exhibit 9, as well as Exhibit 10. So that's --
25 that's the work I did, again, in the context of

1 distributions based on the data sources that we
2 discussed earlier.

3 Q. Okay. Let's -- so -- strike that.

4 Do you have any sense, let's say just
5 for 2020, how frequently Ripple sold XRP? Daily?
6 Weekly? Monthly?

7 A. You keep -- you keep using the word
8 "sold." So I'm -- I'm looking at distributions,
9 which obviously include sales, and Exhibit 8 does
10 have data for 2020.

11 So, again, in terms of net outflows, you
12 know, I would again go back to my Exhibits 8 and
13 9.

14 Q. Okay. And remind me, Professor, how you
15 define outflows for purposes of Exhibit 8.

16 A. It's exactly the net outflow -- net
17 distribution outflows that we were talking about
18 earlier.

19 Q. Okay.

20 A. So there's various data sources that
21 went into that, including monthly account data,
22 record level -- record level data, checked against
23 CoinMarket circulating supply. So rather involved
24 construction. "Involved" in the sense of multiple
25 data sources to construct what's reflected in

1 Exhibit 8 and Exhibit 9.

2 Q. Okay. Let -- let's go to paragraph 141
3 of your report, please.

4 A. Let me just -- give me a minute to get
5 the context of the paragraph.

6 Q. Sure.

7 (Pause)

8 A. Okay. I've -- I've reviewed that
9 section.

10 Q. Okay. The first sentence, you'll see it
11 says "There was no pooling of the funds."

12 Do you see that?

13 A. I do.

14 Q. By "funds," do you mean XRP or dollars
15 or something else?

16 A. I'm referring to pooling of funds by
17 investors that are then going to be used for the
18 purposes of increasing profits or earnings that
19 then are -- the benefits of which are then going
20 to be shared for the contributors to the pool.

21 Q. Okay. And the -- the sentence "There
22 was no pooling of the funds" is in passive voice.

23 Who was it that was not doing the
24 pooling in your view?

25 A. Well, again, in part, this is a

1 reference to the earlier discussion of the
2 contracts and was there pooling of funds in an
3 enterprise with then some kind of claim on those
4 funds and some kind of promise, increased profits
5 or earnings.

6 Q. Okay. And I want to go back to your
7 previous answer where you said you were referring
8 to pooling of funds by investors.

9 Are you talking about sales of XRP?
10 Like, I want to locate this in the facts of this
11 case. When you say there was no pooling of the
12 funds, do you mean funds that XRP purchasers paid
13 to receive the XRP?

14 MR. KELLOGG: Objection.

15 A. No. I mean -- again, you know, maybe
16 it's helpful to go to the -- the next paragraph.
17 142 I think helps elucidate what I'm -- I'm
18 talking about here, which is that there's not a
19 pooling of funds by investors who receive the XRP
20 where those investors now have some sort of right
21 to enjoy the benefits of that pooling as a result
22 of -- of that relationship.

23 So, again, I think what I'm talking
24 about 141 is elucidated by -- you know, is clar --
25 you know, elaborated upon in paragraph 142.

1 Q. Are you expressing an opinion in this
2 case that Ripple did not pool funds it received
3 from its sale of XRP?

4 A. I'm not providing that opinion.

5 Q. Okay. Turning back to paragraph 141,
6 you'll note, Professor, there's not a citation.

7 Can you tell me where you --

8 A. I'm sorry, I -- what paragraph are we
9 on?

10 Q. 141.

11 A. Okay.

12 Q. There's not a citation in that
13 paragraph.

14 Can you tell me how -- how or where you
15 obtained the information for -- in paragraph 141?

16 A. Well, 141, as I explained, is elaborated
17 upon in 142. So it referenced back -- it
18 references back to my economic analysis of the
19 substance of the contracts we viewed in Section II
20 and then it also references the factor model in
21 Section III. So, again, it's referencing that
22 earlier work that I did in separate sections of
23 the report.

24 Q. Okay. So let me just ask specific to
25 the sentences. You write "Specifically, Chris

1 Larsen, Jed McCaleb and Arthur Britto collectively
2 held the remaining 20 billion XRP units and gave
3 80 billion XRP units to Ripple."

4 Where did you get that information?

5 A. The 20 billion and 80 billion?

6 Q. The contents of that sentence.

7 A. So that's my understanding. I believe
8 it's in the distribution data, this 20 billion/80
9 billion. That's -- that sentence, that second
10 sentence, is my understanding of the -- of the
11 basic facts of this case; that there's a total of
12 100 billion XRP units, 80 billion with Ripple and
13 then later obviously there's an escrow account
14 for -- involving XRP.

15 So that second sentence is -- you know,
16 is my understanding of sort of the basic
17 background facts of the case, but the analysis
18 is -- you know, I would point to paragraph 142,
19 which invokes work that I did in earlier sections
20 of the report.

21 Q. Turning to the last sentence of 141, you
22 write "Furthermore, Chris Larsen, Jed McCaleb, and
23 Arthur Britto did not pool their XRP holdings and
24 were free to behave independently from each other
25 and independently from Ripple."

1 Do you see that?

2 A. I do.

3 Q. What is your basis for that sentence
4 that I just read?

5 A. So when you look at the distribution
6 data and the exhibit, Appendix C, you know, the --
7 the distribution data from Ripple, the outflows
8 from Ripple, it is not incorporating these
9 individuals and what they decide to do with
10 their -- their XRP.

11 And there might be something -- just
12 give me one second here.

13 (Pause)

14 And I would also reference in the
15 context of this discussion Footnote 54 on page 15
16 in my report, where I say -- and now I'm just
17 reading from the report -- "I was informed by
18 counsel that distributions by Founders and the
19 bounty program identified in the complaint are
20 outside the scope of my assignment."

21 So I would -- and then there's a
22 citation to the complaint referencing the -- you
23 know, the -- with a reference. So, anyway, you
24 know, I would also point to that -- that
25 definition of my assignment.

1 Q. Did you have distributions data for
2 Mr. McCaleb or Mr. Britto?

3 A. It was just something I wasn't focused
4 on. I -- I don't recall offhand if that's in the
5 distribution data or not. I mean, the
6 distribution data that I was using is reflected in
7 the appendix. So I'll just go back to that. Give
8 me one moment.

9 So, you know, for the distribution
10 data -- and now I'm on page C-6 of my appendix.
11 And, you know, I'm talking about the monthly
12 account balances for Ripple's accounts and sort of
13 how -- and, also, I'm looking at the financial
14 statements of Ripple.

15 So those data sources are about Ripple's
16 distributions. My understanding of that is that
17 doesn't include what these individuals
18 independently might be doing.

19 Q. So how is it that you formed the
20 conclusion that they did not pool their XRP
21 holdings and were free to behave independently
22 from each other and independently from Ripple?

23 A. So that's my understanding of the
24 background, which is the individuals are separate
25 entities, so to speak, from Ripple. They're in --

1 I mean, I don't -- that Ripple's distribution data
2 and how it dealt with its XRP, how it dealt with
3 the escrow account, were issues for Ripple.
4 There's nothing in the Ripple distribution data
5 that has anything, in my memory, about, well,
6 we're going to tell this or that individual what
7 to do with their own separately owned XRP.

8 So the distribution data that I had
9 about Ripple was about their XRP. I don't recall
10 offhand that Ripple was treating their holdings as
11 part of their holdings for purposes of these
12 different data sources such as Ripple's monthly
13 account balances.

14 Q. Other than whatever access to Ripple's
15 distribution data that you had, do you have any
16 other basis for the statements you make in the
17 third sentence of paragraph 141?

18 A. Well, as I said, the -- the -- that
19 first sentence in paragraph 141 -- you know, 141
20 more generally, is elaborated upon in 142, which
21 is invoking earlier work with the academic and
22 data sources that I use there.

23 The fact that XRP had 80 billion and
24 these individuals had 20 billion is just a basic
25 understanding of the facts of the case. I didn't

1 understand that to be at issue. It is my basic
2 understanding. And of course the 80 billion is
3 reflected in that Ripple data that I did use for
4 the construction of -- of the distribution data.

5 Q. And my question is, how did you obtain
6 the understanding that Mr. Larsen, Mr. McCaleb and
7 Mr. Britto did not pool their XRP holdings and
8 were free to behave independently from each other
9 and independently from Ripple?

10 A. I gave you the -- the answer, the basis
11 for that, which is the Ripple -- how Ripple
12 treated its XRP. My recollection is that the
13 private holdings of these individuals was not
14 treated as Ripple XRP for those purposes, for the
15 distribution purposes.

16 My understanding is that they had 20 and
17 Ripple had 80. That's a basic background
18 understanding of the facts of the case. And
19 that -- I guess the last thing I would add is that
20 they're individuals who own the XRP and, you know,
21 didn't have -- my understanding, and I haven't
22 seen anything to the contrary, that Ripple somehow
23 owned or controlled the 20 billion that they had.

24 So, again, part of this is just sort of
25 basic background to the case; that is, the 80 and

1 20 billion division. I would also reference the
2 Ripple treatment of XRP and its internal data and
3 the data sources that are used. And then,
4 obviously, the work that is referenced in
5 paragraph 142.

6 Q. I'm struggling to see how any of the
7 data sources you just named would inform you as to
8 what Mr. Larsen, Mr. McCaleb and Mr. Britto
9 actually did with their XRP holdings or were free
10 to do with their XRP holdings.

11 Can you identify any data sources that
12 you have with respect to Mr. Larsen, Mr. McCaleb
13 or Mr. Britto's combined actions with respect to
14 their XRP holdings?

15 MR. KELLOGG: Objection.

16 A. So as I mentioned before, I explicitly
17 state in Footnote 54 that the distribution by the
18 founders identified in the complaint are outside
19 the scope of my assignment. So it is true that I
20 did not analyze the distributions of these
21 individuals; rather, I was focused on the
22 distributions of Ripple.

23 So part of this has to do with the scope
24 of my assignment.

25 Now, I -- I do want to add -- obviously

1 I do, in my rebuttal to Mr. [REDACTED] I do talk
2 about some hop analysis and that does get into a
3 set of issues there. But here, in this initial
4 report, I don't claim to be doing a distribution
5 analysis by -- let me just go back to the relevant
6 paragraph -- by Mr. Larsen, McCaleb or Britto.

7 Q. Okay. Let's move to paragraph 143,
8 further down on the page. The second-to-last
9 sentence is "In fact, a majority of XRP are not
10 purchased directly from Ripple but are traded
11 anonymously at the cryptocurrency exchanges."

12 Do you see that?

13 A. I do.

14 Q. Is that statement true for the entire
15 period of 2013 to 2020?

16 A. Give me one moment. I just want to
17 check one more thing and I'll get back to you to
18 get to the relevant -- we're skipping around in
19 the report a little bit.

20 So, yeah, as I discuss in my report, I
21 do agree that the trading volume was definitely
22 lower earlier in the time period, you know. And I
23 would reference here Exhibit 14 on page 97 where I
24 talk about the number of exchanges. You know,
25 there's a little bit of a bump in 2015 and then it

1 starts, you know, to visually -- 2017 it starts to
2 go up at a -- at a -- at a decent pace.

3 You know, if you look at, you know,
4 trading volume, which is reflected in velocity on
5 Exhibit 15 -- so, again, velocity is being defined
6 as trading volume divided by the circulating
7 supply.

8 It is true in the early period it is low
9 in that Exhibit 15 and picks up around, you know,
10 starting at 2016 or so. Yeah, so I definitely
11 agree earlier in the period the trading volume is
12 lower, significantly lower. The -- listing on
13 exchanges or exchange trading is -- is definitely
14 lower.

15 Q. And was it true earlier in the period
16 that a majority of XRP were not purchased directly
17 from Ripple?

18 A. What paragraph are we on again?

19 Q. 143, the second-to-last sentence.

20 A. Yes. So this is -- this is -- this is a
21 statement about looking at it over the entire
22 period. And, obviously, in the last sentence of
23 143, in particular the later period. So I'm not
24 making that representation about trading
25 anonymously for cryptocurrency exchanges confined

1 to 2013 or 2014.

2 Q. Okay. Let's go back to the pooling of
3 funds in 141.

4 A. Yes.

5 Q. I want to make sure I understand your
6 testimony.

7 When you say there was no pooling of the
8 funds, are you referring to people's holdings of
9 XRP?

10 A. Well, again, 141 is talking about the
11 pooling of funds. And then the next, you know,
12 two sentences in that paragraph are talking about
13 these three individuals that own 20 billion XRP,
14 20 percent of the total supply, and that their --
15 their holdings of XRP are separate from that of
16 Ripple. So that's point one.

17 And then point two would be the other
18 issues that I reference in paragraph 142 that is,
19 again, referencing work that I had done earlier.

20 Q. Okay. So with respect to the reference
21 to pooling of funds in 141, you're referring to
22 Mr. Larsen, Mr. McCaleb and Mr. Britto's funds, is
23 that right?

24 A. Well, as -- as the sentence says, they
25 have 20 billion of XRP. My understanding is that

1 was not treated as part of Ripple's XRP. That is,
2 it was treated, at least in the data that I saw in
3 the distribution sources, that these are treated
4 as private holdings by these individuals.

5 So in that sense, there's no pooling in
6 the sense that they have XRP and are -- are
7 independent of -- of XR -- are independent of --
8 forgive me, what was the question again? I got a
9 little distracted.

10 Q. It's okay.

11 Let me reask it because -- strike that.

12 When you write "There was no pooling of
13 the funds" in your first sentence of 141, are you
14 referring to Mr. Larsen's, Mr. McCaleb's and
15 Mr. Britto's XRP?

16 A. Yes, in part, but I also then talk about
17 the issues in one -- in paragraph 142.

18 Q. And -- and will you explain to me, if
19 there is another meaning of "there was no pooling
20 of the funds," other than reference to
21 Mr. Larsen's, Mr. McCaleb's and Mr. Britto's XRP,
22 what is that other meaning?

23 A. Well, there's a broader discussion now
24 in paragraph 142 about, you know, the operation of
25 Ripple and whether any XRP, any XRP purchases,

1 create a pooling of funds where there's been a
2 contractual obligation on the part of Ripple to
3 expend efforts, a contractual obligation on the
4 part of Ripple to increase XRP's price, a
5 contractual obligation to share in any profits
6 from the management of the enterprise.

7 Q. Okay. Let's move to paragraph 144 on
8 the next page.

9 A. So just give me a moment to situate
10 myself.

11 Q. Sure.

12 (Pause)

13 A. Okay.

14 Q. Okay. The first sentence of paragraph
15 144 says "Some parties that received XRP directly
16 from Ripple sell rather than hold XRP." And the
17 second sentence, "For example, market makers use
18 their XRP to quote bids and offers, and improve
19 market liquidity," and it goes on to talk about
20 ODL customers.

21 My question is, isn't it true that
22 Ripple employs market makers to sell XRP
23 programmatically on its behalf?

24 A. There -- there is programmatic sales on
25 behalf of Ripple, is my understanding. And I

1 would reference back to my discussion of various
2 contracts, including the section on programmatic
3 sales. Let me just get the exact section here.

4 So I would reference you back to --
5 well --

6 Q. One place --

7 A. Well, paragraph 42, page 18, I state
8 "Ripple also entered into contracts with
9 programmatic sellers," and then I -- I have some
10 discussion of that, including GSR. I also, in
11 paragraph 46, on page 20, talk about market
12 makers.

13 So, yes, there is programmatic --
14 contracts governing programmatic sales.

15 Q. Okay. And in those contracts governing
16 programmatic sales, Ripple is employing, for
17 instance, GSR to sell XRP on its behalf, correct?

18 A. That's my understanding. And, you know,
19 I would reference paragraphs 43 through 45 where I
20 believe I talk about that particular issue.

21 Q. And do you have a sense over what period
22 of time Ripple employed GSR to sell XRP
23 programmatically on its behalf?

24 A. I do -- I do -- we -- I did -- I'm
25 trying to remember the dates. You know, I know

1 that in 2017 -- and, obviously, Dr. [REDACTED]
2 report is focused on programmatic sales by GSR.

3 Give me one second here.

4 So I'm returning to my rebuttal report
5 where I discuss -- I think I have that data there.
6 It's in the latter period, I think, including
7 2017, but let me give you a specific answer. This
8 may take a moment.

9 Yeah. So back -- yeah, in 2016 and 2017
10 there's GSR activity. Let me just make sure
11 there's nothing else I want to say on this.

12 (Pause)

13 Yeah. So just to elaborate on my
14 earlier answer. So that -- was the question is
15 Ripple using GSR?

16 Q. Do you have a sense over what period of
17 time Ripple employed GSR to sell XRP
18 programmatically on its behalf?

19 A. Okay. So in terms of GSR when it was
20 active, you know, I would reference Exhibit 6B in
21 my rebuttal. Now, this includes acting for
22 non-Ripple entities, including Mr. Larsen. So I
23 believe it's 2017 is my best recollection. The
24 contract that I reference between Ripple and GSR
25 in my report is dated June 2nd, 2017.

1 Q. Do you know if Ripple ever stopped
2 employing GSR to sell XRP on its behalf?

3 A. Stopped employing GSR. I know there's a
4 termination provision with the GSR programmatic
5 contract that I talk about in the report,
6 paragraph 44, but I don't know if that was, in
7 fact, terminated or not.

8 Q. Okay. Let's move to the first sentence
9 of paragraph 145 in the same section.

10 A. Oh, I'm sorry. Just to give a complete
11 answer, there's also a contract in 2019 with GSR
12 and Ripple that I reference in paragraph 49
13 actually dated July 1st, 2019. And this is using
14 GSR as a -- as a market maker.

15 Q. Okay. Let's turn to paragraph 145. The
16 first sentence says "In contrast, Ripple holds XRP
17 over a long-term horizon."

18 Do you see that?

19 A. I do.

20 Q. What do you mean by "long-time horizon"?

21 A. I would reference here the net outflows
22 from Ripple reflected in Exhibit 8. And we look
23 at this later time period, you know, we see
24 distributions far less than a billion in a month.
25 We looked at the net outflows in dollar amounts

1 reflected in Exhibit 9.

2 So I would reference that data for the
3 proposition that -- that Ripple is holding XRP for
4 long periods of time, multiple years. It is,
5 obviously, engaged in net outflows, but it's
6 far -- it's just a fraction in any given month of
7 the total holdings.

8 Q. Okay. But at least according to your
9 Exhibit 9, it is engaged in net outflows at least
10 from late 2013 to late 2020, is that fair?

11 MR. KELLOGG: Objection.

12 A. That is fair. So the monthly net
13 outflows from Ripple, there is a little bit of
14 blue early on denominated in U.S. dollars. And
15 the net outflows in Exhibit 9 are -- at least when
16 denominated in dollars, is larger in the later
17 period.

18 Now, when we look at the XRP units, you
19 don't see that spike in the later period looking
20 at Exhibit 8.

21 Q. And turning back to paragraph 145, the
22 same sentence, "In contrast, Ripple" --

23 A. One second. Let me just get there.

24 Q. Sure.

25 A. Okay.

1 Q. Same sentence. "In contrast, Ripple
2 holds XRP over a long-term horizon."

3 When you write "In contrast," are you
4 contrasting Ripple with other market participants
5 who hold XRP?

6 A. The contrast is with the velocity
7 calculation that I discuss in the prior paragraph,
8 paragraph 144, and is reflected in Exhibit 15.

9 Q. Are Ripple's programmatic sales included
10 within your velocity calculation in paragraph 144?

11 A. So the Exhibit 15 -- so this would be
12 all trading volume. So as reported by -- with the
13 top tier or with the CryptoCompare volume data.
14 The actual distributions by Ripple we know from
15 those earlier exhibits.

16 Q. What steps, if any, did you take to
17 disaggregate Ripple's trading from the rest of the
18 market's trading to compare velocity?

19 A. Well, I did disaggregate it in the sense
20 that I identified, both in dollars and XRP,
21 exactly the quantum of distributions by Ripple
22 whether it's via GSR or some other entity. So I
23 do have that disaggregation.

24 The trading volume here is going to be
25 all the -- the entire trading volume for the

1 market as reported by CryptoCompare or as reported
2 by these top-tier exchanges.

3 Q. So your trading volume figure described
4 in 144 would include any Ripple trading that took
5 place on digital asset platforms, is that fair?

6 A. If -- if there were sales by -- by
7 Ripple that enter the trading volumes, it would be
8 reflected in the calculation of the velocity, you
9 know, just by -- you know, in terms of the trading
10 volume if it's being reported into the -- into
11 the -- into these figures.

12 Now, again, the point of comparison is
13 we know exactly how much distributions are
14 actually happening in total and that's reflected
15 in Exhibits 8 and 9.

16 Q. Does your velocity figure tell us
17 anything about how many non-Ripple XRP holders are
18 holding their XRP over a long term?

19 A. Exhibit 15 is not about on a per-person
20 basis. It's on a per-XRP basis. So that is
21 consistent with how velocity is normally defined.

22 Q. Okay. If I understand your answer, I
23 think that means that your velocity analysis does
24 not exclude the possibility that some XRP
25 purchasers hold their XRP over a long-time

1 horizon?

2 MR. KELLOGG: Objection.

3 A. That's correct. So paragraph 144 says
4 "a higher velocity means that the asset is traded,
5 (turned over) or used more often."

6 So it's not at the individual trader
7 level, I don't -- I'm not aware of data that would
8 enable one to do that. It's, rather, how often
9 does the asset -- here XRP -- get turned over? So
10 very standard traditional method of looking at,
11 you know, turnover in the market.

12 Q. Can we flip back to the heading on page
13 67? This is Section F. We talked about this
14 briefly earlier in the day.

15 A. Page 67?

16 Q. Yes. Section F, the heading is
17 "Economic Assertions for Commonality are
18 Fundamentally Flawed."

19 A. Yes.

20 Q. Do you see that?

21 And "commonality" as used in the heading
22 for Subsection F is referring to the commonality
23 element of the Howey test, is that right?

24 MR. KELLOGG: Objection;
25 calls for a legal conclusion.

1 MR. SYLVESTER: Let me finish
2 my question, but okay.

3 Q. Go ahead.

4 A. Calls for -- I'm not providing a legal
5 opinion. So the answer to your question is, no,
6 I'm not opining on "commonality" as that phrase is
7 used in the Howey decision, but rather the SEC's
8 economic assertions in this portion of their
9 complaint.

10 Q. Okay. Are you opining on the SEC's
11 economic assertions in the commonality portion of
12 the SEC's complaint?

13 A. Well, we should turn to the complaint.
14 I do have citations here to paragraph 291 of the
15 complaint, paragraph 317 of the complaint, 291,
16 293 of the complaint. Yeah. So I would just at
17 least point to the portions of the complaint that
18 I actually cite here in this particular section.

19 Q. Okay. And at least in your quoted
20 citations, I don't see the word "commonality."

21 So am I to assume that the word
22 "commonality" is drawn from the SEC's complaint?

23 A. We would have to -- I mean, I would like
24 to see the complaint to refresh my recollection on
25 that. But it is these particular paragraphs that

1 I'm referencing here in terms of the subject
2 matter of this section.

3 Q. Particular paragraphs of the complaint
4 you mean?

5 A. Yes. So I identify different portions
6 of the complaint in the context of the first
7 paragraph in this section and what I'm going to
8 discuss.

9 In other words, the economic assertions
10 by the SEC is reflected not just in the citations
11 to the complaint, but in that first paragraph
12 where I lay it out, lay out in quotations what the
13 S -- SEC is saying here.

14 Q. Let's turn back to paragraph 145. The
15 second sentence of paragraph 145 says "Because of
16 the differences in both the timing and the
17 duration of holding periods between Ripple and
18 direct and indirect purchasers of XRP, their
19 exposure to XRP price volatility and therefore to
20 risk is different."

21 Do you see that?

22 A. I do.

23 Q. Okay. Does that sentence that I just
24 read bear on the question of whether the SEC's
25 economic assertions for commonality are

1 fundamentally flawed?

2 MR. KELLOGG: Objection.

3 A. I think it is part of my analysis of the
4 economic assertions by the SEC.

5 Q. Can you explain how in your view, if I
6 understand you correctly, the statements in that
7 sentence undercut the SEC's economic assertions?

8 A. Well, I would go to the third sentence
9 in paragraph 140 on page 67. And now I'm just
10 reading from my report. "The SEC also argues that
11 the 'fortunes' of XRP purchasers were aligned with
12 each other and with Ripple because Ripple 'pooled
13 the funds it raised in the offering.'"

14 So there's this assertion, economic
15 assertion, that XRP purchasers at large are
16 aligned with Ripple. And the point here is that,
17 you know, if your holding periods for a volatile
18 asset are different, you're differently situated,
19 you know, in that respect.

20 Q. In your view, are Microsoft shareholders
21 in a common enterprise with Microsoft?

22 MR. KELLOGG: Objection.

23 A. Calls for a legal conclusion if what you
24 mean by "common enterprise" is you're invoking the
25 Howey test.

1 Q. Okay. I mean, I didn't hear an
2 instruction not to answer. So in your view, are
3 Microsoft shareholders in a common enterprise with
4 Microsoft?

5 MR. KELLOGG: Objection;
6 calls for a legal conclusion.

7 A. If you're asking me for my legal
8 conclusion as to whether Microsoft stock is stock,
9 I believe the answer is yes. I'm not here to
10 opine on that. The word "stock" appears in the
11 definition of security in the '33 Act, so I'm not
12 here to provide that legal opinion, but I do agree
13 that it's stock if you're asking me the question
14 and want -- want my view on it.

15 Q. From an economic perspective, are
16 Microsoft shareholders in a common enterprise with
17 Microsoft?

18 A. Well, I would -- common -- well, I
19 would -- I guess I would want to explore exactly
20 what you mean in your question about common
21 enterprise. My earlier response was simply
22 agreeing that it is stock, for what it's worth.
23 But in terms of the economic substance of that
24 relationship, I guess I would want to know more
25 about how you're defining common enterprise in

1 your question.

2 Q. Is there a generally accepted definition
3 in the economics literature of the term "common
4 enterprise"?

5 MR. KELLOGG: Objection.

6 A. Not as such, no. I mean, there are
7 academic economic literature on velocity, on
8 different time horizons, but I would not say
9 commonality or common enterprise is a -- you know,
10 is a -- is a phrase that's used in a way like
11 asset pricing models are. It does have a strong
12 legal connotation.

13 That's not to say you can't talk about
14 economic assertions that underpin the claim of
15 commonality.

16 Q. Okay. And, again from an economic
17 perspective, are Microsoft shareholders in a
18 common enterprise with Microsoft regardless of
19 whether they're day trading or long-term holders
20 of the stock?

21 MR. KELLOGG: Objection.

22 A. So, again, what I'm doing in this
23 section is the economic assertions by the SEC. If
24 you're asking me -- I guess in your question, I
25 would want to know how you're defining "common

1 enterprise" for -- you know, in your question.

2 I don't need to -- you know, the
3 commonality that I'm dealing with in my report is
4 really working off of the economic assertions that
5 the SEC makes in the context of commonality. I'm
6 not directly opining on commonality as such.

7 Q. Okay. Let's move to --

8 THE WITNESS: May I ask how
9 much time we have on the record? Just
10 kind of pace -- pace myself. I'm
11 sorry to interrupt.

12 THE VIDEOGRAPHER: We have
13 about 57 minutes left.

14 BY MR. SYLVESTER:

15 Q. Okay. Let's move to your rebuttal
16 report, AF-2.

17 A. Rebuttal? Oh, okay. AF-2?

18 Q. Yes.

19 A. So I might take one last break just so I
20 don't fade.

21 Q. Do you want to take it now? That's
22 fine.

23 A. It sounds like we're at a natural break
24 point.

25 Q. Fine by me.

1 A. Does that make sense? So, yeah, maybe
2 take a break just to stretch my legs.

3 THE VIDEOGRAPHER: Okay.

4 Thank you. The time is 5:36. We're
5 going off the record.

6 (Whereupon, a recess is taken.)

7 THE VIDEOGRAPHER: And the
8 time is approximately 5:55 p.m. We're
9 back on the record.

10 BY MR. SYLVESTER:

11 Q. Professor, when you address the pooling
12 of funds in Subsection F of your opening report,
13 is there any portion of that section that
14 addresses whether Ripple pooled funds it received
15 in its sales of XRP?

16 A. So paragraph 141, that first statement,
17 is referring to, A, the fact that there's
18 individuals that own XRP that are not Ripple, that
19 owned the 20 billion XRP units. So there's these
20 separate holdings of XRP. Again, this is a basic
21 background assumption of the case as I understand
22 it. That is to say, these individuals held 20
23 billion, whereas Ripple had 80 billion.

24 And the second point on the pooling is
25 really what I referred to in 142. There's not

1 pooling and sharing of the benefits of that
2 pooling with the XRP purchasers in the sense of a
3 contractual relationship or obligation or
4 distribution of the profits thereby generated.

5 Q. Okay. Focusing just on dollars Ripple
6 received from its sales of XRP, does any part of
7 Subsection F discuss whether or not Ripple pooled
8 the dollars it received from sales of XRP?

9 A. No.

10 Q. Okay.

11 A. Again, with the caveat that -- I mean,
12 there's a couple -- I want to be clear on the
13 record about this. I think there's a couple
14 different senses of pooling floating around here
15 that might create a lack of clarity in the record.

16 I am addressing whether this pooling by
17 Ripple of the funds that it receives in the sense
18 of it's pooling these funds received and the XRP
19 purchasers then get the benefit in the form of a
20 distribution, the benefit in the form of a claim,
21 on whatever profits, if any, are generated by that
22 pooling.

23 So if we're defining pooling in that
24 way, I most certainly do talk about it, as
25 paragraph 142 indicates. So I just want to be

1 clear on the record about -- you know, to be clear
2 on what is meant and what is not meant by
3 "pooling."

4 Q. I don't quite understand your answer.
5 You're opining, I think, if I understand it
6 correctly, on whether or not Ripple pools funds
7 and that pooling results in certain rights in XRP
8 purchasers that you identify in paragraph 142, is
9 that correct?

10 MR. KELLOGG: Objection.

11 A. Well, to be clear, I'll just read the
12 relevant portion of paragraph 142. "That these
13 contracts" -- such as the programmatic sales
14 contract. "That these contracts do not have any
15 contractual rights entitling these counterparties
16 to a share of Ripple's profits if Ripple is
17 successful in its ongoing efforts to manage and
18 develop its business operations. There are no
19 such contractual rights and no ongoing obligations
20 for Ripple to expend efforts to increase XRP's
21 price." The first part of that sentence is I -- I
22 reference the work that I did in Section II.

23 So, again, if that's what is meant by
24 "pooling" -- that is, funds are put together and
25 then there's these rights in the pooled -- in the

1 profits, if any, that are generated by the pool --
2 then that is addressed and I do have an opinion on
3 that and that's reflected in paragraph 142.

4 Q. Okay. Let's use a hypothetical.
5 Same -- same pooling concept. Let's say Ripple
6 sells \$10 worth of XRP on Tuesday and then sells
7 \$10 worth of XRP on Wednesday.

8 Is your opinion expressing any view as
9 to whether or not Ripple pools that \$20 of XRP --
10 \$20 of proceeds from its XRP sales?

11 A. If what you mean by "pooling" is
12 ignore -- you know, is just putting the money
13 together or not putting the money together in an
14 account or accounts, I'm not providing an opinion
15 on that. If what is meant by "pooling" is that
16 those relationships, those contractual
17 relationships, pursuant to which Ripple gets those
18 funds, the \$20 in your example, whether those
19 contractual relationships create a right to a
20 portion of the profits if Ripple's successful in
21 its ongoing efforts, then I do have an opinion on
22 it.

23 Q. Does the company have a fiduciary
24 obligation to its shareholders to maximize the
25 value of its assets?

1 MR. KELLOGG: Objection;

2 calls for a legal conclusion.

3 A. Yeah, that's a legal opinion.

4 Q. Be that as it may, do you know?

5 A. So under Delaware corporate law, there
6 are fiduciary obligations of the directors that
7 run to the corporation, as I understand it, which
8 would, you know, involve acting in the best
9 interests of the corporation.

10 Q. And in your view as an economist, would
11 acting in the best interests of a corporation
12 include maximizing the value of its assets?

13 MR. KELLOGG: Objection.

14 A. So as a policy matter, if you're asking
15 my personal view on this as an economist, that is
16 a -- assuming that we're talking about a
17 for-profit organization, sure, maximizing assets
18 would be certainly something that you would want
19 to think about in terms of a fiduciary obligation
20 by a corporation to its shareholders. So I'm --
21 or to its claims on the firm's assets.

22 So, you know, again, obviously what
23 fiduciary obligations a corporate board has is
24 ultimately a question of Delaware corporate law
25 assuming it's incorporated in Delaware.

1 Q. Okay. Let's turn now to your -- AF-2,
2 your rebuttal report. I want to start with
3 paragraph 7, please.

4 MR. KELLOGG: I'm sorry,
5 where are we?

6 MR. SYLVESTER: Paragraph 7.

7 MR. KELLOGG: Of the main
8 report?

9 MR. SYLVESTER: Of the
10 rebuttal report.

11 THE WITNESS: Do you have a
12 copy?

13 MR. KELLOGG: Of the
14 rebuttal?

15 MR. SYLVESTER: You should
16 have it.

17 MR. KELLOGG: Yeah.

18 THE WITNESS: I'm at
19 paragraph 7.

20 BY MR. SYLVESTER:

21 Q. Okay. Great. The first sentence of
22 paragraph 7 is "I have been asked by counsel for
23 Ripple to assess the claims, summarized above,
24 made in the [REDACTED] report."

25 Do you see that?

1 A. Yes.

2 Q. Okay. So my first question is, was your
3 assignment with respect to your rebuttal opinion
4 limited to assessing the claims made in the
5 [REDACTED] report?

6 MR. KELLOGG: Objection.

7 A. Yes. So this rebuttal report is a
8 rebuttal to his -- his report, so it is assessing
9 the opinions reflected in paragraph 6.

10 Q. Okay. Can --

11 A. I would also note that, you know,
12 obviously I read the entire report and, as we
13 discussed this morning, I did consider his -- this
14 isn't -- I'm sorry.

15 I was just going to note that
16 Dr. [REDACTED] has a rebuttal report, you know, a
17 report where he criticizes me. Obviously I have
18 views on that. But here, in this -- so -- but in
19 this rebuttal report, I was asked to assess these
20 opinions in his initial report.

21 Q. Okay. Turning to paragraph 8 on the
22 next page.

23 A. Just give me a second to read it.

24 Q. Sure. It's probably worth reading the
25 entire thing because most of it is just one

1 sentence.

2 (Pause)

3 A. Okay.

4 Q. So my question is, did Dr. [REDACTED] opine
5 that any of the XRP price movements he observed
6 resulted in any sustained impact on the market
7 price of XRP?

8 A. So it was -- reading his report, it was
9 unclear about whether he thought it was -- his --
10 it is fair to say that his report -- and I think I
11 mention this later -- just give me one second
12 here. He does reference short term -- let me just
13 get the language here. Just give me one more
14 second.

15 (Pause)

16 So the way he characterizes his
17 findings I think I, in part, summarize in
18 paragraph 10, where he uses language like it's
19 "consistent" with Ripple attempting to influence
20 prices or the actions "coincided" with price
21 changes.

22 As I understand from his deposition,
23 he -- he -- and it's consistent with this summary
24 or this -- these statements that I make in
25 paragraph 10, quoting him, is that he's making no

1 claim of causation. That is to say, as I
2 understand his position -- and, again, it's
3 consistent with this language here -- he's not
4 making any claim that the actions that he
5 analyzes, in fact, caused an XRP price change, let
6 alone an XRP price change that's permanent.

7 So that's my best understanding of -- of
8 what his position is.

9 Q. Did -- did you read Dr. [REDACTED]
10 deposition transcript?

11 A. I did not.

12 Q. Let's go to paragraph 9 of your report.
13 I'm looking at the second sentence. That says "As
14 an initial matter, Dr. [REDACTED] does not (and
15 cannot) explain why a handful of trades on just a
16 few cherry-picked dates would have resulted in any
17 long-term impact on the market price of XRP, much
18 less caused purchasers of XRP to have any
19 reasonable expectation of profits from Ripple's
20 conduct."

21 Do you see that?

22 A. I do.

23 Q. Did Dr. [REDACTED] opine on the reasonable
24 expectations of XRP purchasers?

25 A. He opined -- I don't think he uses that

1 phrase. He opined -- you know, he's discussing
2 XRP price changes, which obviously XRP price
3 changes do reflect the expectations of the
4 marketplace. But I don't believe he used that
5 particular phrase.

6 Q. Can you explain what you mean by "XRP
7 price changes do reflect the expectations of the
8 marketplace"?

9 A. Well, XRP has a market price, right? It
10 trades in the markets and has a market price that
11 changes over time. And the market is going to
12 have a -- a view, a consensus view, as to the
13 market value of that asset, just like it does for
14 any asset.

15 So the market value is going to reflect
16 the market consensus at that point.

17 Q. As part of your assignment for your
18 rebuttal report, did counsel ask you to examine
19 the relationship, if any, between Dr. [REDACTED]
20 opinions and the reasonable expectations of XRP
21 purchasers?

22 A. What counsel asked me to do was -- is
23 reflected in paragraph 7.

24 Q. Okay. I don't see any reference to the
25 reasonable expectations of XRP purchasers in

1 paragraph 7., is that right?

2 A. That's correct. So, again, the
3 expectations of the market, you know, is going to
4 be reflected in the price of XRP; that it's going
5 to reflect the consensus view as to the market
6 value of this particular asset, XRP, and he does
7 analyze or discuss XRP prices.

8 So it's only in that sense that, you
9 know, this -- that it intersects with
10 Dr. [REDACTED] analysis.

11 Q. Okay. So when you refer in your report
12 to "reasonable expectations of profits from
13 Ripple's conduct," are you talking about -- strike
14 that.

15 When you refer to "reasonable
16 expectations of profits from Ripple's conduct," is
17 that limited to any such expectations that might
18 show up in XRP's market price?

19 A. Yes.

20 MR. KELLOGG: Objection.

21 A. So any reference to "reasonable
22 expectations of profit" -- and we can certainly
23 look at other parts of my rebuttal where that
24 phrase might be used -- is solely focused on
25 conducting the assignment in paragraph 7. That

1 is, his actual analysis.

2 Q. Okay. Let's turn to paragraph 11 on
3 page 6. And there are some dark bullets and some
4 clear bullets. I want to look at the first clear
5 bullet. The last sentence of the first clear
6 bullet is "The fact that market actors attempt to
7 minimize the price impact associated" --

8 A. Oh, I'm sorry. I'm in the wrong place.
9 Where -- where should I be?

10 Q. Paragraph 11, page 6. Do you see how
11 the first two bullets are filled in and the
12 remaining three are clear?

13 A. Yes.

14 Q. So the first clear bullet.

15 A. Oh, I see. Okay.

16 Q. And the last sentence of that first
17 clear bullet is "The fact that market actors
18 attempt to minimize the price impact associated
19 with their sales is hardly surprising or novel,
20 and does not support an opinion that XRP is a
21 security."

22 Do you see that?

23 A. I do.

24 Q. Did Dr. [REDACTED] offer any opinion as to
25 whether or not XRP is a security?

1 A. I think he avoided opining directly on
2 that, as -- as I am -- as I am. I'm only -- the
3 reference in this bullet is just to the -- the
4 idea that best ex, best execution, is something
5 that occurs in many different markets, many
6 different asset classes.

7 I am not opining anywhere, whether it be
8 in the rebuttal or my initial report, on whether
9 or not XRP is a security. It's a legal question.
10 Nothing that I've written should be construed as
11 providing an opinion on that ultimate legal
12 question.

13 Q. Let's look at the next page. We're
14 still on paragraph 11. There's the first full
15 bullet on paragraph -- sorry, on page 7, that says
16 "As the factor analysis presented in my opening
17 report shows, the long-run prices of XRP were
18 influenced not by the efforts of Ripple, but by
19 the changes in the value of cryptocurrencies
20 generally; focusing, instead, on a handful of
21 select days does not constitute a reliable
22 scientific methodology."

23 Do you see that?

24 A. I do.

25 Q. Okay. So when you say "not by the

1 efforts of Ripple," are you expressing an opinion
2 here that Ripple's efforts in no way influence the
3 long-run prices of XRP?

4 THE REPORTER: You're going
5 to have to slow down.

6 MR. KELLOGG: Objection.

7 A. So I need to hear the question again
8 now.

9 Q. Sure.

10 When you say "not by the efforts of
11 Ripple" in the sentence I just read, are you
12 expressing the opinion here that Ripple's
13 efforts in no way influence the long-run prices of
14 XRP?

15 MR. KELLOGG: Objection.

16 A. What I'm referencing here, in this
17 particular sentence, is the various -- the factor
18 model and its various specifications that we
19 discussed that are contained in my initial report.
20 That is to say, there's no statistically
21 significant excess return associated --
22 associated -- associated with XRP above and beyond
23 or separate and apart from general movements in
24 cryptocurrency.

25 So I want to be very clear on the

1 record. The hypothesis that I was testing is the
2 null hypothesis: Is the alpha statistically
3 distinguishable from zero or is it -- or is it, in
4 fact, the same as zero, you know, in a statistical
5 sense?

6 So that -- that's the analysis that I
7 was referencing in this particular bullet.

8 Q. Okay. Is it possible in your view for
9 someone to take steps consistent with an attempt
10 to influence the price of an asset and yet be
11 unsuccessful in influencing the price?

12 MR. KELLOGG: Objection.

13 A. Stated at that level of generality, yes.

14 Q. Okay. Separate and apart from whether
15 or not it may have been successful, are you
16 offering any opinion that Ripple did not take
17 steps to influence the price of XRP?

18 MR. KELLOGG: Objection.

19 A. As I understand your question, you're
20 asking me -- or the question is asking me the
21 motivations of Ripple, the motivations of Ripple
22 with respect to the trading activity that
23 Dr. [REDACTED] focuses on. And the answer to the
24 question is no. I'm not going to opine on the
25 motivations, feelings, personal thoughts of

1 individuals.

2 Q. Okay. Slightly different question.

3 Again, separate and apart from whether
4 or not Ripple may have been successful in any
5 efforts, are you offering any opinion here that
6 Ripple did not take steps consistent with
7 influencing the price of XRP?

8 MR. KELLOGG: Objection.

9 A. Same answer. So as I understand the
10 question, the question is ask -- is saying -- is
11 asking, am I going to opine on the motivations of
12 individuals, such as individuals at Ripple, and
13 what their thought processes were? And the answer
14 to the question is no.

15 Q. Do you disagree with any of the
16 Dr. [REDACTED] conclusions -- strike that.

17 Separate and apart from Dr. [REDACTED]
18 analysis of any impact on XRP's price, do you
19 disagree with Ripple -- with Dr. [REDACTED]
20 conclusions that on certain occasions Ripple
21 employees took steps consistent with influencing
22 the price of XRP?

23 MR. KELLOGG: Objection.

24 A. So I want to be careful here. So
25 insofar as you're asking me about these emails and

1 Dr. [REDACTED] citing emails to -- and any use of
2 emails to opine on motivations or purposes, I'm
3 not providing an opinion on that. That -- that's
4 not my role as an economist.

5 I obviously do analyze the particular
6 days that he chooses, but that's using market
7 data, not opining on personal motivations of
8 individuals, whether it be at Ripple or elsewhere.

9 Q. Okay. You may have anticipated my next
10 question.

11 Separate and apart from whether or not
12 they may have been successful, are you offering
13 any opinion that Mr. Larsen or Mr. Garlinghouse
14 did or did not take steps to influence the price
15 of XRP?

16 MR. KELLOGG: Objection.

17 A. So, again, my understanding of your
18 question is, am I going to opine on the
19 motivations, beliefs, feelings, opinions of those
20 individuals? And the answer to -- answer to that
21 question is no.

22 Q. Okay. Let's look at -- let's look at
23 Exhibit 1 to your AF-2.

24 A. Exhibit 1?

25 Q. Yes.

1 A. Just give me a moment to situate myself.

2 Q. Sure.

3 A. Okay.

4 Q. The right-hand panel of Exhibit 1 to
5 AF-2 displays data for cryptocurrency exchanges.

6 Do you see that?

7 A. I do.

8 Q. Do you know whether or not any GSR
9 trading is within the volume reflected in the
10 right-hand panel for cryptocurrency exchanges?

11 A. So this is the crypto -- cryptocurrency
12 exchanges being reported by CryptoCompare. Beyond
13 the -- the net outflows that we were talking about
14 earlier that's reflected in my exhibits and my
15 initial report, I have the same answer that --
16 that -- from previously when you asked me about
17 trading volume. So I -- I don't disaggregate
18 here, you know, GSR trading -- well, I'm using the
19 full trading volume on the cryptocurrency
20 exchanges. Obviously, I have the GSR XRP Ledger
21 trading on the left-hand side.

22 Q. Mm-hmm. But to the extent that GSR
23 trading is included -- strike that.

24 To the extent GSR was trading on
25 cryptocurrency exchanges during this time period,

1 that trading would be included in the volume on
2 the right-hand side?

3 A. Yes, I would assume so. Whether, you
4 know, in that -- you know, that would include GSR
5 trading for -- hypothetically would include GSR
6 trading for clients other than -- than Ripple.
7 I'm not saying that happened. I'm just saying it
8 would -- this trading, as I understand the
9 CryptoCompare data, would be reflected in the
10 cryptocurrency exchange volume.

11 Q. Okay. Let's turn back to paragraph 18
12 of your rebuttal report.

13 A. Paragraph 018?

14 Q. Eighteen.

15 A. Just give me a moment.

16 Q. Sure.

17 A. Yes.

18 Q. Okay. In paragraph 18 you describe
19 using a square root model.

20 Do you see that?

21 A. Yes.

22 Q. Okay. My question is, did you use the
23 square root impact model that -- you'll have to
24 excuse my pronunciation -- Donier and Bonart used
25 in 2015 referenced in Footnote 33?

1 A. There's a formula that I used. It, you
2 know, involves the square root of the volume of
3 the trade or the order -- I think it's called the
4 meta order -- over the volume, the trading volume.
5 And there's a parameter that's estimated at 0.9.

6 Q. And did you --

7 A. And there's a volatility -- there's a
8 price volatility term there, too.

9 Q. Did you obtain that 0.9 figure that you
10 just testified about from the Donier and Bonart
11 paper referenced in Footnote 33?

12 A. Yes. I believe that's from the Bitcoin
13 paper, if that's what you're referring to.

14 Q. Did you perform any calculations using
15 XRP prices to determine any components of the
16 square root model that you used as described in
17 paragraph 18?

18 A. I don't understand the question. Is the
19 question is am I using -- am I calculating inputs
20 into the -- into the formula?

21 Q. Yes.

22 Did you perform any calculations using
23 XRP prices to determine any inputs that you then
24 used to put into the formula that you found from
25 the paper we've been discussing?

1 MR. KELLOGG: Objection.

2 A. Yes.

3 Q. What -- what calculations do you recall?

4 A. Well, there's -- in the formula there's
5 the order size. There's the volat -- the price
6 volatility. There's the trading volume. So those
7 are all inputs into the square root calculation.

8 Q. And you reference the 0.9 figure. What
9 does that refer to?

10 A. It's a parameterization in the formula.
11 I think it's the Y term in the formula. So that's
12 another component of the formula, which I did get
13 from the Bitcoin paper.

14 And I want to be very clear on the
15 record. The point of this square root calculation
16 is simply illustrative of the point that I make in
17 the second sentence of Footnote 33, that "total
18 trading volume and price volatility are important
19 when assessing the price impact of a trade." That
20 is to say, these are important factors. I'm using
21 this as an illustrative example of how it could be
22 important.

23 I'm not saying -- I'm not saying that
24 the price impact is 1.6 percent or 2 percent.
25 It's illustrative of this point that these factors

1 can be important if one is interested in assessing
2 price impact of a trade. It's illustrative of
3 that general point. It's not a calculation of the
4 actual price impact of any particular trade on any
5 particular -- you know, on this day. And the same
6 comment would hold for the square root estimates
7 that I utilize in the exhibit at a later point.

8 Q. Okay. I want to make sure I understand
9 your testimony.

10 You're saying with respect to the
11 concluding sentence of paragraph 18 that you're
12 not opining that the price impact in this
13 particular case is 1.6 percent, is that right?

14 MR. KELLOGG: Objection.

15 A. So what I say in paragraph 18 is the
16 potential XRP price impact using the square root
17 model is approximately 1.6 percent. So it's --
18 and this point, the 1.6 percent, is in service of
19 the general point that total trading volume and
20 price volatility can be important in assessing the
21 price impact. So it's just illustrative of that
22 general point.

23 I'm not saying for this trade or these
24 trades it is, in fact, 1.6 percent. It's a
25 potential price impact. It's illustrative of the

1 general point that you would want to think about
2 these factors in assessing price impact.

3 And the same comment would hold for the
4 illustrative calculations using the square root
5 model that are provided later in the report as
6 well.

7 Q. Looking at paragraph 20 -- I'll give you
8 a second to read that and then I'll ask my
9 question.

10 A. Okay. Thank you.

11 (Pause)

12 Yes.

13 Q. Are you offering the opinion that GSR's
14 purchases during the one-hour period described in
15 paragraph 20 were inconsistent with implementation
16 of a price floor as directed by Ripple?

17 A. Can you repeat the question?

18 MR. SYLVESTER: Bridget,
19 would you mind reading that one back.
20 Thanks.

21 (Whereupon, the record was
22 read back.)

23 A. I guess what I would say is I would
24 reference my paragraph 21. So this notion of a
25 price floor doesn't seem to hold up in the data if

1 you look at pre-November 1st and post-November
2 1st.

3 So, you know, in your question, you were
4 referencing the price floor and that seems
5 inconsistent with the fact that prices were more
6 often below that price floor -- now I'm reading
7 from my report -- in November and December than
8 they were before. So I guess I do view the data
9 as inconsistent or Dr. [REDACTED] ignores this when
10 he talks about a price floor.

11 Q. Okay. Again, sort of reverting to our
12 principles. Setting aside whether or not GSR was
13 or was not effective in implementing a price
14 floor, are you opining as to whether GSR's
15 purchases during that one-hour period referenced
16 in paragraph 20 are or are not consistent with the
17 implementation of a price floor?

18 MR. KELLOGG: Objection.

19 A. Well, again, I -- just to go to what
20 Dr. [REDACTED] says, and I quote it in paragraph 21,
21 he says "GSR seems to have succeeded" in this
22 price floor. So, again, I would reference that
23 data.

24 I'm sorry, what -- what's the question?

25 Q. I think you answered it. Let -- let's

1 go to the data. Let's go to Exhibit 2, please.

2 A. Okay.

3 Q. My question on Exhibit 2 is, did you
4 examine intraday price data for XRP to prepare
5 this exhibit?

6 A. These are the daily low price.

7 Q. Okay. So I think that means, yes, you
8 did examine intraday data, is that right?

9 A. Yes. My understanding of daily low
10 prices is it would include intraday in that -- in
11 that way, in identifying the low price.

12 Q. Okay. For each of the day that's
13 included within the blue bars shown in your
14 Exhibit 2, did you conduct any analysis of what
15 percentage of the day XRP's price was below .008
16 dollars?

17 MR. KELLOGG: Objection.

18 A. No. So I believe the -- the data has
19 the close -- the -- the open, the close, and the
20 daily low. Maybe the daily high. I can't
21 remember. So the answer to your question is, no,
22 this is just reporting the number of days where
23 this -- where the low price breached the so-called
24 price maintenance floor.

25 Q. Okay. Let's go back to paragraph 45 of

1 AF-2.

2 A. Forty-five?

3 Q. Yes.

4 A. Paragraph 45?

5 Q. Paragraph 45, page 23. And my question
6 is about the concluding sentence, so it's probably
7 worth you reading the whole paragraph.

8 A. Yeah.

9 (Pause)

10 A. Okay. I've read the paragraph.

11 Q. Okay. The last sentence says "In order
12 for this claim to be true, the regression
13 coefficient on the prior returns must be
14 statistically significant, and my return
15 regression specification demonstrates that this is
16 not the case."

17 My question is, why is it that the
18 regression coefficient on the prior returns needs
19 to be statistically significant in order for
20 Dr. [REDACTED] claim that these sellers on behalf
21 of Ripple sold more XRP when the price of XRP was
22 increasing and relatively less when the price was
23 decreasing on the previous day? Why -- why does
24 your regression coefficient need to be
25 statistically significant in order for that to be

1 true?

2 MR. KELLOGG: Objection.

3 A. Yeah, that's -- that's -- that's a long
4 question. Let me make sure I -- I want to make
5 sure I'm answering it.

6 So Dr. [REDACTED] in his report says
7 that -- well, I have the quote here. That "These
8 sellers, on behalf of Ripple, sold more XRP when
9 the price was increasing and relatively less when
10 the price was decreasing the previous day." No,
11 that's not the quote I wanted.

12 So in his report -- Dr. [REDACTED]
13 report, that is -- my understanding of what he was
14 saying is that this selling activity, the selling
15 of more XRP, is associated with increasing returns
16 on -- contemporaneously increasing returns. That
17 is, his claim is not just confined to the previous
18 day's returns, but I read him in his report to be
19 making a claim about selling more XRP when the
20 price is contemporaneously rising.

21 What his regression is about -- and we
22 can talk about his regression -- is he's using lag
23 returns. So I'm making the observation that a lag
24 return coefficient is not going to address the
25 question of whether there was contemporaneous

1 increases in the prices during the sale activity.

2 Now, this leads directly into the last
3 sentence of that paragraph, which is "If there was
4 a statistical association in return..." So if
5 returns are falling today, returns are falling on
6 average statistically, then there would be a
7 relationship between that previous return that
8 Dr. [REDACTED] is using and contemporaneous return.
9 So there might be a -- a basis for an inference
10 there, but there is no statistical association
11 between contemporaneous returns and prior returns.

12 And, therefore, a lag regression, a
13 regression that's using lag returns, is not going
14 to be able to ascertain whether, in fact, Ripple
15 was selling more when prices contemporaneously
16 were increasing.

17 Q. Okay. Let's move to Exhibit 8 of AF-2.

18 A. Exhibit 8?

19 Q. Yes. This is labeled, for the record,
20 "Examples of Alleged Indirect Transfers of XRP
21 from Mr. Larsen and Mr. Garlinghouse to GSR Traced
22 by Dr. [REDACTED]"

23 You'll see, Professor, that a number of
24 addresses are noted as belonging to "another
25 party."

1 Do you see that?

2 A. Are you looking -- I'm sorry. Oh, okay.
3 So you're looking at the second column. Yes, I
4 do.

5 Q. Okay. And you say in your note, the
6 last sentence, "When the address I.D. has not been
7 provided, another party is indicated above."

8 Did you see that?

9 A. Yes.

10 Q. Did you ask counsel to supply you with
11 any documents that might answer the question of
12 who controlled these destination addresses?

13 MR. KELLOGG: Objection.

14 THE REPORTER: I'm sorry.

15 Repeat.

16 MR. SYLVESTER: Sure.

17 BY MR. SYLVESTER:

18 Q. Did you ask counsel to supply you with
19 any documents that might answer the question of
20 who controlled these destination addresses?

21 A. No. I want to be clear here. In this
22 exhibit, Exhibit 8, I'm using -- I'm assessing
23 Dr. [REDACTED] work. And the address I.D., that
24 second column that we were discussing, is drawn
25 from the identification of the wallets, or the

1 addresses, from Dr. [REDACTED] work.

2 So this is a product of his backup
3 materials that he produced in terms of his
4 identification of the address I.D. And so I'm
5 assessing the work that he did including what's
6 reflected in this table.

7 So this table is really drawn very
8 directly from his backup. Obviously, I calculated
9 the cumulative number of days from Larsen or
10 Garlinghouse wallet transfer, which is a trivial
11 calculation, but this is a reflection of his --
12 his work, his backup, and his identification.

13 Q. Okay. Looking just at the first example
14 regarding Mr. Larsen, the way I read the first row
15 is that Mr. Larsen transferred 20 million units of
16 XRP to the destination address in the first row
17 starting with "[REDACTED]"

18 Do you agree?

19 A. Yes.

20 Q. Okay. And then the next transfer is
21 from [REDACTED] of 2,083,313 XRP to the following
22 destination address of R -- well, no. Strike
23 that.

24 This is what I'm having trouble
25 understanding. It looks like, if I'm reading your

1 chart correctly, the units of XRP traced by
2 Dr. [REDACTED] goes from 20 million to 2,083,313 and
3 then back up, in the next row, to 2,083,333.

4 Do you see that?

5 A. I -- I'm not following you.

6 Q. Okay. Do you see "Units of XRP
7 transferred, 20 million"?

8 A. Yes.

9 Q. Okay. If you go all the way to the
10 right on that same row, do you see "Units of XRP
11 traced by Dr. [REDACTED]"

12 A. Yes.

13 Q. Okay. And that value is 2,083,313?

14 A. Yes.

15 Q. Okay. So the next entry under "Units of
16 XRP transferred" is 2,083,333.

17 Do you see that?

18 A. So I'm supposed to be looking at the
19 second row now?

20 Q. Yes.

21 A. Okay.

22 Q. So my question is, it appears that this
23 chart is suggesting that 20 million XRP were
24 transferred, 2,083,313 were traced, but then the
25 number of XRP units transferred goes back up to

1 2,083,333.

2 Can you explain how -- how that works?

3 MR. KELLOGG: Objection.

4 A. I think you're make --

5 MS. PROSTKO: Objection.

6 A. I think you're mis -- I think you're
7 misreading the chart a little bit, or the -- or
8 the figure or the exhibit, I should say.

9 Q. Yeah. Please explain.

10 A. So Dr. [REDACTED] is -- is tracing for --
11 first, let me note that I was not provided with
12 his hop program pursuant to which he's doing this
13 hop analysis. So that was a black box that I was
14 not able to access.

15 According to his tracing algorithm,
16 which I don't have access to, he ultimately traces
17 for this first hop -- the hop -- the first hop
18 consisting of three hops, ultimately traces the
19 2,083,313. So that's why that number in the
20 second-to-last column is the same because that's
21 what he ultimately ascribes in terms of the hop
22 analysis from Larsen to the final destination,
23 which is GSR.

24 But as you're pointing out, the units of
25 XRP transferred per hop or per -- or per

1 transaction does vary. But, really, the question
2 is -- well, what's reflected in that
3 second-to-last column is what Dr. [REDACTED] ascribes
4 to Dr. -- or Mr. Larsen in terms of the ultimate
5 destination of GSR.

6 But you are right that the individual
7 hops -- one, two and three -- would -- you know,
8 they're not all the same.

9 Q. Okay.

10 MR. SYLVESTER: Can we take
11 five minutes off the record before we
12 end for the day? Is that all right
13 with you?

14 THE WITNESS: Sure.

15 MR. KELLOGG: Sure.

16 MR. SYLVESTER: Great. Thank
17 you very much.

18 THE VIDEOGRAPHER: Okay.
19 Thank you. The time is approximately
20 6:39. We're going off the record.

21 (Whereupon, a recess is
22 taken.)

23 THE VIDEOGRAPHER: The time
24 is approximately 6:47 p.m. We're back
25 on the record.

1 BY MR. SYLVESTER:

2 Q. Okay. Professor, are you expressing the
3 opinion in this case that defined that an
4 instrument was offered and sold as an investment
5 contract, that instrument must entitle its holder
6 to a share of the profits of the company that sold
7 the instrument?

8 MR. KELLOGG: Objection.

9 A. So as I understood, if I heard your
10 question that -- the first part was it -- was in
11 order to be defined as a security, am I correct?

12 MR. SYLVESTER: Do you want
13 to read it back, Bridget? No, you
14 don't want to. You want me to say it.
15 Okay. I'll say it again.

16 BY MR. SYLVESTER:

17 Q. I said investment contract, but let me
18 just restate the question.

19 Are you expressing the opinion in this
20 case that defined that an instrument was offered
21 and sold as an investment contract, that
22 instrument must entitle its holder to a share of
23 the profits of the company that sold the
24 instrument?

25 MR. KELLOGG: Objection.

1 A. That calls for a legal opinion. The
2 answer to that question is no.

3 Q. Okay. Are you expressing the opinion in
4 this case that defined that an instrument was
5 offered and sold as an investment contract, that
6 instrument must require the company that sold the
7 instrument to expend efforts in some way?

8 MR. KELLOGG: Objection;
9 calls for a legal conclusion.

10 A. As I understand the question, it calls
11 for a legal conclusion. I'm not providing that
12 opinion.

13 Q. Okay. Are you providing the opinion in
14 this case that it is not possible for a virtual
15 currency to be offered and sold as an investment
16 contract?

17 MR. KELLOGG: Objection.

18 A. As I understand the question, it calls
19 for a legal opinion, so I'm not providing that
20 opinion.

21 MR. SYLVESTER: Okay. That
22 is all the questions I have for you,
23 Professor Ferrell.

24 I just want to again -- you
25 know, we've -- this is to Ripple's

1 counsel.

2 We've heard today about
3 analysis that Professor Ferrell
4 conducted that was not disclosed in
5 his opening expert report. We've also
6 heard about analysis that he conducted
7 subsequent to reviewing Dr. [REDACTED]
8 work. I just want to put on the
9 record that we reserve all rights
10 depending on what defendants do or
11 don't do with that information. That
12 could include calling Dr. -- Professor
13 Ferrell back. That's our reservation
14 of rights.

15 I have nothing further for
16 you. Thank you very much. I
17 appreciate your time, Professor.

18 THE WITNESS: Thank you.

19 THE VIDEOGRAPHER: May I
20 close out the deposition for today?

21 MR. KELLOGG: You may.

22 THE VIDEOGRAPHER: Thank you.
23 We are off the record at 6:49 p.m. and
24 this concludes today's testimony by
25 Dr. Allen Ferrell. The total number

1 of media units used was seven and will
2 be retained by the court reporting
3 agency. Thank you.

4 THE WITNESS: Thank you.

5 (Whereupon, the deposition
6 concluded at 6:49 p.m.)
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1 STATE OF NEW YORK)

2) ss:

3 COUNTY OF NEW YORK)

4 I hereby certify that the witness in the
5 foregoing deposition, FRANK ALLEN FERRELL, III, Ph.D.,
6 was by me duly sworn to testify to the truth, the whole
7 truth and nothing but the truth, in the within-entitled
8 cause; that said deposition was taken at the time and
9 place herein named; and that the deposition is a true
10 record of the witness's testimony as reported by me, a
11 duly certified shorthand reporter and a disinterested
12 person, and was thereafter transcribed into typewriting
13 by computer.

14 I further certify that I am not interested in
15 the outcome of the said action, nor connected with nor
16 related to any of the parties in said action, nor to
17 their respective counsel.

18 IN WITNESS WHEREOF, I have hereunto set my hand
19 this 25th day of February 2022.

20 Reading and Signing was:

21 ___ requested ___ waived _X_ not requested.
22
23

24 _____
25 BRIDGET LOMBARDOZZI, CSR, RMR, CRR

Transcript Word Index

[& - 20]

&	1 (cont.)	113	1615
& 2:17 4:3,10 5:5,15 10:16 39:18	219:11 220:14 228:8 241:1 241:3,10,21 242:7,14,18,24 250:14 252:10 261:23 265:25 313:23,24 314:4	251:3,16 119 264:1,8 11a 198:5 246:5	4:17 162 161:22,23 162:14 163 253:22 254:18 255:13
0	1,250	11b	17
0.001 147:22,25	46:21	198:10	27:7 182:21 198:21
0.022 193:23 200:2	1.6 33:15,17,21 317:24 318:13 318:17,18,24	11th 162:24 169:17	171 138:17,19 139:16
0.058 193:22	1:16 170:14	12 7:19,24	174 177:3,4,7
0.058. 218:4	10 107:14,15 108:1,2,5,7,19 109:9 198:4 258:20 261:13	12:15 122:11	175 175:22
0.398 148:11	268:24 300:6,7 304:18,25	120 207:7,8 254:10	18 7:12 198:21 284:7 315:11 315:18 316:17 318:11,15
0.398. 148:8,24	10:24 59:20	1285 5:18	19 107:13 198:21
0.541 177:22	10:44 59:25	12a 198:14	1960s 69:20 209:10 211:12
0.629 180:19	100 62:7,10,14 67:2 125:2,10 126:2,6,8 150:10 165:3	12b 198:15	1st 248:8,11 249:3 286:13 320:1,2
0.661 172:23	207:2,7,8,9,10,14,14,23,23 232:22 253:14,15,15 254:6	13 114:17,19 234:11 248:4	
0.661. 173:3	254:6,10,11,12 265:9 273:12	133 7:15	2
0.9 316:9 317:8	100,000 162:7,15 165:7,24 166:9,13 167:2 168:4	14 217:23 218:10,15 219:9,13 220:3,12,15 221:16 228:5,6 249:25 279:23	2 7:17 23:24 24:2,5,10 28:5 33:21 54:4 60:2 61:14 87:10,11 92:7 110:5,10 113:24 114:1,6,9,18,21 115:21 116:8,13 156:13 172:18,20 173:12 174:1,8 174:16 175:7 176:6,13 183:19 184:18 185:3 193:23 198:17 200:2 213:15 228:14 241:12 243:10,16 250:16 259:13 259:20,22 296:16,17 302:1 313:23 314:5 317:24 321:1 321:3,14 322:1 324:17
0.9. 316:5	10019-6064 5:19	140 21:5,10,24 22:3,18 236:15 293:9	2,083,313 326:21 327:2,13,24 328:19
008 321:15	10022 4:6	141 20:18 21:15 235:18 270:2 271:24 272:5,10,15,16 273:21 276:17,19,19 281:3 281:10,21 282:13 297:16	2,083,333 327:3,16 328:1
058 205:14 212:6,24 214:3	102 155:18,22 191:17,20,21 192:13,19,23 194:3,8,21 208:9,13 225:21 226:2 227:8	142 20:20 271:17,25 272:17 273:18 276:20 278:5 281:18 282:17,24 297:25 298:25 299:8,12 300:3	2:04 171:4
1	1	143	20
1 7:12 8:6 18:3,5,21 19:2 21:18 24:10 27:24 28:20,24 29:6,17 31:3,7,12 32:9 34:2 34:5,25 35:6,14 36:1,6,10 36:12,13 54:3 55:8,19 57:7 57:14 61:13 68:4 86:4,23 105:11,13 107:22 108:20 110:2,13 111:21 112:11,25 113:17 114:15 115:11,12 115:20 116:1,2,5 124:3 137:19,23 140:14 147:12 148:4,17 156:12 168:8 171:3 173:25 174:1,7,15 175:4,12,14,19 176:1,8,13 176:23 177:21,23 178:10 178:19,19 179:4,9 180:21 183:19 193:22 197:7,9 199:3 200:4 207:24 212:1,7 214:2 215:11,20 216:8 217:10,15,23 218:12	10281-1022 3:14 106 7:22 107 236:1 108 236:6 10832 1:6 2:6 10:14 10b 40:14 11 7:5 9:12 94:25 137:23 308:2,10 309:14 11:58 122:7	144 283:7,15 288:8,10 289:4 290:3 145 21:15 286:9,15 287:21 292:14,15 15 9:12 231:6 274:15 280:5,9 288:8,11 289:19 150 207:2	20 1:6 2:6 10:14 67:17 77:1 90:11 129:19 197:12 198:21 254:23 273:2,5,8 276:24 277:16,23 278:1 281:13,14,25 284:11 297:19,22 300:9,10,18 319:7,15 320:16 326:15 327:2,7,23

[200 - 52]

200 3:12 62:16 166:1	2112 5:7	3	4:50 266:19
200,000 167:10	212.336.1060 3:15	3 8:5 115:11,13,14,21 122:13 137:21 138:23 139:4 142:10 143:12 145:14,14 155:24 156:19,24 163:8,13 163:20,24 164:4 166:19,20 168:8,23 173:24 178:11,12 180:4 185:14 186:20 191:12 192:14 193:21 195:19 196:7,15 197:11 198:19 199:1,2 205:13 206:3 211:25 212:4 213:15 213:21 225:22 226:7,25 239:17	40 91:19 225:14 227:2,6,12
2003 209:25	212.373.2491 5:20		400 3:13 4:18 10:22 166:1
20036 4:19	212.909.6000 4:7		41 109:12 129:22
20037 5:8	21st 108:9 164:11 248:18	3:09 222:10	42 161:22 284:7
2013 75:6 89:18 90:10 92:6 96:25 98:6 102:6,13 133:7 134:7 169:25 170:5 175:20 260:13,23 268:5 279:15 281:1 287:10	22 108:4 114:14,15 198:22	3:26 222:15	43 227:25 253:22 284:19
	2202232blo 1:25	30 31:13,14,22 34:1,20 112:2 112:9 113:9	44 185:21,25 186:2 187:15 229:13 231:2 286:6
	22nd 108:10	300 165:3	45 284:19 321:25 322:4,5
2014 268:17 281:1	23 1:16 2:19 7:17 10:3 108:4 164:6,10 322:5	31 7:25	46 175:2 284:11
2015 75:24 77:23 92:8 110:6 162:24 169:17,23 170:1,3,7 176:8 184:8,13 248:8,11 249:3 261:20 262:1 279:25 315:25	239 8:4	317 291:15	47 125:7 150:11 182:24
	23rd 10:7 108:10	32 228:23 229:10 230:25	48 155:19,20 191:20 208:14
2016 182:25 183:5,17 280:10 285:9	243 23:9	33 231:5 232:1 294:11 315:25 316:11 317:17	49 286:12
	244 23:10	34.2 243:16	4th 28:20
2017 108:4 182:7,13,22 183:16 280:1 285:1,7,9,23,25	245 23:10	34178 243:11	5
	25th 334:19	36 234:23	5 27:9 40:14 103:15 111:20 113:13 140:13,15,18 141:1 141:6,10,21 142:1,8 164:22 166:3 171:24 172:8,13,15 179:13 197:15 200:24 212:12 213:17 222:17 226:12 262:8,9
2018 262:3,4	260 164:6	38 107:25	5.8 199:4 200:5
2019 265:11,23 286:11,13	27 182:24	39 86:23,24 87:7,8 91:3,9	5:36 297:4
2019/2020 265:16	274 162:24	398 148:18	5:55 297:8
202.326.7999 4:20	28 31:17 34:8,11 35:1 96:3,6 97:7,11,12 108:11 110:14 110:17 111:3 112:7 116:14 117:1,3,7 118:1 122:25 129:9,12 228:6,12 251:7,14 251:18,19,22 252:21,25 253:2,3,12,13,17,23 254:1 254:5,7,16,19,22 255:2 257:5,6	4 7:14 138:23 145:14,15 162:17,17,20,22 169:16 196:16,17 197:11 222:11	50 62:4,5 64:20 66:25 67:14 67:16 123:7 175:6 206:17 206:21 207:2,3 236:1
202.974.1500 5:9	291 291:14,15		500 131:22 147:18 148:6,7,15 148:17 156:14 157:13,22 158:4,13 159:1,10,20,24 160:9 179:19 180:10,14 223:3,16
2020 30:7 41:17,19 42:21 75:6 75:24 77:23 89:18 90:11 92:7,8 102:13 110:6 133:8 163:3 164:11 170:3 260:13 260:23 265:11,23 268:5,17 269:5,10 279:15 287:10	293 291:16	4:20 266:15	500,000 167:10
	2nd 285:25	4:30 266:15	52 7:20
2021 2:19 7:14,19,24 28:20 166:23			
2022 1:16 10:3,7 334:19			
21 8:4 108:4 198:21 239:7,9 239:15 240:21,23 241:9 319:24 320:20			

[53 - actual]

53 180:7 251:3	7 (cont.) 157:24 179:14 192:15 195:19 197:24 222:24 224:18 225:22 226:7 228:12,17 229:25 230:20 231:13 232:8 233:15 237:3 237:6 238:1 246:19 248:4 302:3,6,19,22 306:23 307:1 307:25 309:15	919 2:17 4:5 10:17	academic (cont.) 276:21 295:7
53.2 242:25		92 129:21,24 131:19 168:9 174:6 198:6	academically 74:12 119:25
53246 242:19		93 137:11 198:11	academics 153:12
54 178:20,24 179:5 180:3,7,22 274:15 278:17		94 137:13 174:5	accepted 13:21 14:5 17:11 21:1 100:23 116:15 135:24 212:14 295:2
55 265:1	70 20:2,11	95 212:4,23 213:21,25 216:23	access 255:8,18 276:14 328:14,16
55.8 265:3	75 207:3	950 10:22	account 81:7 82:11 244:15 246:22 247:6,6 248:7,9,11,17 249:3,20 251:9 256:13 257:14 269:21 273:13 275:12 276:3,13 300:14
55.9 265:4	79 75:8	96 185:18,22 186:2,10,18,22 187:6,12,17 191:7 193:7 211:19 228:1 229:6	accounted 169:8
56 246:9	8 166:18 249:25 258:15,17 265:15,19,23 268:12,23 269:9,12,15 270:1 286:22 287:20 289:15 303:21 324:17,18 325:22	97 279:23	accounting 187:7 198:17
57 296:13		98 174:23 175:2	accounts 30:15 125:21 258:7 275:12 300:14
58 9:5		a	accurate 90:14 213:3,4 214:5 215:14 263:5
6	8,916 109:16	a.m. 2:18 10:2,7	accused 108:25
6 7:22 106:24 107:2,8 156:19 163:10,13,20 164:3 179:17 179:24 180:2,7 181:9 197:19 221:25 228:5,6,10 228:17 229:25 230:20 231:13 232:8 237:3,6 238:1 256:9 275:10 303:9 308:3 308:10	80 273:3,5,8,12 276:23 277:2 277:17,25 297:23	able 46:9 76:12 102:14 131:12 160:12 201:2 236:25 324:14 328:14	acquire 46:15
6,700 26:21 105:6 106:12 109:18 109:22	82 75:8	abnormal 70:15 71:6,15 72:7,16,19	act 294:11
6,39 329:20	83 234:23	abnormally 105:6	acting 285:21 301:8,11
6:47 329:24	84 235:14	absolute 207:5	action 66:10 334:15,16
6:49 2:18 332:23 333:6	9 9:5,6 75:9 77:23 110:3,7 119:6 121:8,11 151:9 152:12 154:8,8 160:20 170:5,5 174:8 259:13,20 265:14 268:24 269:13 270:1 287:1,9,15 289:15 305:12	absolutely 130:11 209:7 210:25 245:24	actions 93:2,6 94:2 98:22 99:7 180:24 230:1 231:11,25 232:3 234:18 237:7,10,17 237:20,22,22 238:3 262:25 263:18 267:18 278:13 304:20 305:4
60 9:6	9:27 2:18 10:2,7	academic 32:22 35:22 67:25 68:2,9 69:4,18,23 70:3 81:18,22 82:1,5,9 100:16,17,19,21 100:23 101:7,10,18,24 102:1,2,7,10,18,23 103:3,8 103:18 104:3,7,15 105:20 112:13 116:19 117:3,10 118:14,17 127:24 128:8,10 128:20 129:2,3,12,15 130:18,21,23,25 131:2 132:5,6,15,19,20,20,21,22 132:23 133:9,12 134:12,13 134:23 135:10 136:12 139:12 140:10 147:8 154:4 157:18 158:23 160:10,14 166:7,22 179:25 185:10,16 199:12 209:7,14,17 210:25 211:8 224:22 239:3 257:21	active 285:20
67 20:2,10 236:15 290:13,15 293:9	90 86:22 87:1,8,19 91:2,19 124:3 175:8 235:19		activities 66:11 75:4 126:17
68 20:2	90s 65:24		activity 285:10 311:22 323:14 324:1
69 20:2	91 77:22 110:5,12 114:11,25 115:6,8 116:11,11,13 119:6 119:16 121:8,11 151:10 152:12 154:7 160:21 168:9 170:6 174:9		actors 235:1 308:6,17
6b 285:20			actual 20:9 44:7 177:21 191:1,4
7			
7 147:11,12,17 148:16 155:24 156:20,24 157:11			

[actual - anonymously]

actual (cont.) 193:4 229:1,24 237:14,16 260:6 288:14 308:1 318:4 add 137:9 138:6 161:16 222:25 277:19 278:25 added 49:6,9 134:8 184:19 adding 138:12 197:20 addition 24:12 27:4,11 30:2 52:16 101:10 109:8 114:22 227:19 244:22 257:13 259:5 additional 27:11 28:18 29:4,15,18 30:4,10 141:17 155:25 156:14 161:10 174:19 175:18 179:18 183:9 223:2 223:11,19 224:17,22 262:22 267:23 address 16:25 81:23 82:2,6,10 84:17 159:1 189:11 230:11 234:12 237:23 297:11 323:24 325:6,23 326:4,16 326:22 addressed 68:3 81:19 145:7 191:15 237:13 300:2 addresses 71:5 191:9,11 297:14 324:24 325:12,20 326:1 addressing 96:21 99:13 144:25 145:3 298:16 adequate 183:11 adjust 96:22 98:9 207:6 adjusted 123:13,16,25 124:2,6,8,17 124:20 168:9 174:2,4,15 175:3,7,12 176:7,14,20,23 177:9,16,21 178:1,3,18,25 179:4 180:6,17 184:18 185:3,6,15 190:7 232:21 250:3 advantage 103:11,23 104:2 111:6 167:16 af 7:10,12,17,22 8:2,4 18:3,5 18:21 19:2 21:18 23:24 24:2,5,10,10 27:24 28:5	af (cont.) 29:6,17 31:3,7,12 32:9 34:2 34:5,25 35:6,14 36:1,6,10 36:12,13 54:3,4 55:8,19 61:13,14 68:4 86:4,23 105:11,13 106:24 107:2,8 107:22 108:20 110:2,13 111:21 112:11,25 113:17 114:15 115:11,12 140:14 147:12 173:25 228:5 239:7 239:9,15 240:21,23 241:9 296:16,17 302:1 313:23 314:5 322:1 324:17 affect 27:2 94:16 95:13 96:8 105:8 112:21,23 127:5,8 133:1 152:16 238:4 244:16 245:2 247:23 affirmative 233:19 agency 333:3 aggregate 75:6 90:9 ago 40:15 64:7 232:23 agree 17:4 30:16 34:15 109:16 118:24 130:10 132:18 144:24 148:25 149:21 171:16 199:2,7,16,20 201:4 201:9,17 202:11 207:14,16 212:8 215:6,23,24 216:21 217:13 218:2,6 219:18 220:19 221:8,20 231:14 244:1 247:19 262:20 263:2 263:9 279:21 280:11 294:12 326:18 agreed 263:20 agreeing 294:22 agreement 47:23 48:5,8,23 171:11 ahead 38:25 41:11 106:23 107:18 121:5 210:23 233:22 255:10 261:8 291:3 al 207:21 albeit 25:1,2 249:20 albert 7:23 algorithm 328:15	aligned 293:11,16 allegations 43:5 44:3 85:5 93:2 97:2 alleged 45:8 93:6 233:17 234:3 324:20 allegedly 236:3 alleges 235:21 alleging 126:16 183:12 allen 1:15 2:15 7:4,13,18 10:9 12:2 171:16 332:25 334:5 allen's 171:10 allow 155:24 167:19 171:16 allowed 161:1,7,18 167:5 alpha 27:6 31:21 111:19 113:12 124:15,19,24 125:17 126:1 126:13 181:5,7,10,11,17 182:3,3 183:2 187:3,6,10 187:13,16 188:6,10,20,20 188:24 189:4 190:24 193:14,17,22 194:10 195:10,14 196:1,9 197:1,3 197:16 198:2,8 200:5 202:23 203:3 206:13,23 207:11,18,18 208:1,3 209:5 209:8,10,11,12,15,18,22,25 210:4,6,7 211:1,21 219:24 221:1 222:20 224:8 225:7 226:24 227:13,17,19,21,21 227:24,25 228:22 229:11 229:15,19 231:1 238:22 239:1,5 311:2 alphas 27:6,7 183:2,3,4,16 altern 219:21 alternative 112:5 196:12 amazon 52:25 americas 5:18 amount 49:19 251:21 262:17 264:10,15 amounts 286:25	analyses 29:9 30:10 54:2 78:23 88:23 89:6 118:18 150:15 174:20 250:2 analysis 20:7 21:11,14 25:15 26:1,2 26:11,12,15,22 27:16,17 28:19 29:3,5,18 30:22 32:2 34:2,4,19 36:2,10 45:19 51:21 55:16 61:10,15 70:3 72:20 77:10,13 78:1,5,6,9 78:14 79:5 85:16 88:2,6,14 88:24 89:2,5,8 91:6,11,14 92:9 94:7,9 95:10,11 96:8 96:16 98:15 99:20 100:2,8 103:19 108:15,25 109:5,15 110:2,14 111:7,7 113:16 114:2 115:4,23 119:2,4,23 120:3 122:16,23 124:5,11 126:6,7,9 127:8,9,16 128:6 130:8,23 136:23 137:17,20 141:8,17,18 142:12 145:5,9 145:19 146:7 149:5,12 150:2 151:11,13,18,23 152:14,21 153:10 154:16 156:16,24 159:17 164:14 166:15 168:5 169:2 174:11 183:18,19 186:11 199:24 200:9,15 203:22 205:5 218:23 219:23 220:24 235:20 240:10 245:10,25 247:16,20,23 251:4,4 256:25 259:12,23 261:16 263:10 272:18 273:17 279:2,5 289:23 293:3 307:10 308:1 309:16 311:6 312:18 321:14 328:13,22 332:3,6 analyze 75:14,23 93:12 278:20 307:7 313:5 analyzed 30:17 75:24 95:4 122:24 168:2 246:13 265:1 analyzes 305:5 analyzing 95:6,7 104:4 233:8 andria 50:21 announcement 206:17,20 announces 206:16,19 anonymously 279:11 280:25
---	--	--	--

[answer - association]

answer 9:3 14:2,15 17:22 23:12 24:16 25:25 28:15 29:13,20 32:4 33:22,24 36:5 37:16 38:21 40:9 44:8 45:14 46:24 48:4,10 49:13 56:22 56:25 57:10,10 58:5,10,12 58:22 59:1,7 60:6,10,21 61:23 67:19 70:1 75:21 78:25 89:9,12,21 92:13 94:12 95:16 105:16 111:24 113:5,21 120:25 124:8 137:16 144:18 145:4 146:17 149:14 178:15 198:24 199:15,17 202:5,16 204:13 205:3 214:10 217:5 220:20 230:24 233:13 241:7 244:20 246:10 251:11 253:24 257:10 261:10,14 268:11 271:7 277:10 285:7,14 286:11 289:22 291:5 294:2,9 299:4 311:23 312:9,13 313:20,20 314:15 321:21 325:11,19 331:2	appendix 86:3,5,12 163:8,11,13,14 163:24 246:18,19 255:23 256:9 274:6 275:7,10 application 83:7 202:17 applied 132:15 apply 47:14 applying 252:8,13 appreciate 108:25 332:17 approach 74:17,20 75:22,23 86:1 96:20 100:23 127:24 159:13,13 219:19 220:4,10 220:19 221:9 appropriate 73:13,19,23 74:14 75:13 76:13,16 89:19 90:13,16,20 98:8 117:25,25 130:7 133:21 appropriately 125:21 approx 59:19 approximate 63:1 approximately 26:20 59:20,25 61:21 64:11 66:19 77:4 109:18 122:6,11 170:13 171:3 178:20 180:3 180:22 212:5 222:9,15 242:25 243:16 266:14 297:8 318:17 329:19,24 approximating 106:11 apropos 23:11 arguably 175:5,14,21 argues 236:15 293:10 argumentation 17:7 arthur 273:1,23 article 43:15 211:6,7 articles 42:2 81:18,22 82:1,5,9 112:13 130:18 135:10 articulate 225:20	articulated 21:7,13 22:19 23:13 74:5 75:1 76:15 89:13 99:14 126:11 152:6 articulation 21:25 artur 3:10 12:6 ascertain 124:14 324:14 ascribes 328:21 329:3 aside 40:13 69:16 78:11,16 85:1 95:10 104:25 105:4 108:17 133:23 134:22 176:22 216:4 239:11 320:12 asked 24:22 25:13 27:19 28:16 45:5 56:24 113:20 145:25 152:19 154:23 155:4 190:16 203:25 220:18 221:19 302:22 303:19 306:22 314:16 asking 14:1 43:17 72:3 114:20 120:9,10 146:19 158:1 204:16 214:21 220:10 230:5 245:20 294:7,13 295:24 301:14 311:20,20 312:11,25 assertion 234:12 293:14,15 assertions 19:5,18 21:23 22:9 23:1,2 23:13 44:11,18 290:17 291:8,11 292:9,25 293:4,7 295:14,23 296:4 assess 16:8 74:4 89:13,20 90:20 302:23 303:19 assessing 71:10 73:9 303:4,8 317:19 318:1,20 319:2 325:22 326:5 assessment 24:17 29:14 123:20 124:18 asset 13:15 16:9 38:3 73:5 80:19 80:23 81:2,6,11,19,23 82:2 82:6,10 83:19 84:9 121:20 127:11 128:2 129:10 130:13,16 131:1 132:9,23 133:1 135:25 136:4,8,13 146:6 147:4 149:22 152:1 153:22 154:3,6 155:1,10,11	asset (cont.) 157:5,6 158:17 159:18 162:6 164:16 165:6,13,21 166:9 168:14 267:5,6,14,25 289:5 290:4,9 293:18 295:11 306:13,14 307:6 309:6 311:10 assets 77:24 78:3 82:14,17,25 83:8,20 84:20 85:9,13,17 115:10 116:22 123:1,5 127:3,3 133:14 134:1,8 135:19 141:10,11,14 145:11,23 146:4 147:14 149:8 150:4,24 152:3,17 153:6,6,16,25 154:8,13 156:9 157:3,8 158:11,19,20 160:6,18,20 161:12,13 164:18 167:8 168:1 169:4 169:25 170:6 267:9 300:25 301:12,17,21 assigning 84:14,21,24 assignment 25:12 154:10 155:6,6 274:20,25 278:19,24 303:3 306:17 307:25 assist 50:16 53:15 54:21 assistance 51:20 53:2,9 55:13,22 56:4 56:14,19,21 131:13 assistants 51:24 54:6,12 assisted 51:11 assisting 49:12 associate 190:21 associated 75:7,16 77:25 83:10 89:17 90:5,9,23 99:11,16 124:6 181:25 208:7 210:1 215:7,8 215:10 216:22 219:7 220:22 230:8 231:21 232:17,19 233:2 234:19 235:7 257:18 308:7,18 310:21,22,22 323:15 association 142:23 143:2,8 149:25 151:25 153:20 158:21,21 165:18 167:25 168:11 169:6 178:6 182:6 203:20 204:1 205:6 223:4,8 224:3 224:15,24 324:4,10
---	--	---	--

[associations - bids]

associations 150:8 151:20 152:10,22,25 153:11 154:5,21 155:14,16 169:9 181:16	average (cont.) 196:3 199:3,4 206:22 207:10 209:6 225:3,15,23 226:9,14 227:7 230:7 232:15 262:13 324:6	balances 256:13,19 257:14,15 275:12 276:13	believe (cont.) 81:13 82:4,8,12,15 84:10 85:7,14,18 86:19 90:3 102:14 104:13 108:11 109:6 110:6,10 113:22,25 114:4 117:6,17 125:15 128:18 136:7,7,9 137:20 156:8 170:6 182:18,24 194:9 213:2,4 214:5 215:13 215:14 228:25 243:19,21 246:8 258:6 259:13 265:23 266:24 273:7 284:20 285:23 294:9 306:4 316:12 321:18
assume 50:2,7 55:3 72:12,14 122:23 123:1,5 127:22 218:9,9 220:12 232:1 237:25 291:21 315:3	avoid 110:22,23	bar 65:23 66:1,3	believes 90:8 92:17
assumed 68:14,17,24	avoided 309:1	bars 321:13	belonging 324:24
assuming 68:18 76:4 92:20 215:17 217:6,7 219:9 249:6 301:16 301:25	avoiding 111:1	base 200:18	benefit 138:13 298:19,20
assumption 50:8 68:19,20 127:2 176:15 231:4 297:21	aware 14:21 16:7 17:14 93:25 96:21 106:6,17 107:19 108:17 133:16 134:13,19 134:23 135:4 152:7 182:7 248:16 249:2,14 257:21 267:8 290:7	based 43:18 44:1 45:6 47:7 48:5 88:2 105:20 116:3 123:24 126:22 166:21 192:21 202:8,19 203:2 210:11 213:9 263:4 269:1	benefits 112:14 270:19 271:21 298:1
assumptions 94:9	awareness 244:23	basically 128:2	berg 4:13
assured 204:5	axis 258:25 265:18	basis 70:7 75:11 88:11 110:25 200:10 216:20 233:7 255:22 260:18 274:3 276:16 277:10 289:20,20 324:9	best 31:17 34:9,9 35:19 36:24 40:3,15 42:12,14,22 52:10 52:11 57:22 65:2 67:18 68:13,15 69:11 70:1 81:16 86:20,21 110:20 111:4 112:7 117:1,12,23 123:23 136:8 159:8 215:24 216:21 221:13 285:23 301:8,11 305:7 309:4,4
asterisk 147:22,25 213:16	b	bates 7:15,20,25 8:6	beta 207:24
attempt 141:19 145:20 308:6,18 311:9	back 12:23 20:6 59:25 61:5 69:19 78:22 84:12 91:2 96:23 99:24 102:5,8 105:16 112:24 122:12 124:7 125:15 133:5 137:15 142:10 145:16,17 150:10 168:8,24 171:4,24 186:22 193:20 194:4 199:1 202:1,3 202:7 205:13 208:9 210:18 210:21 211:19 222:16 225:7 227:1,23 230:23 233:16 237:2 238:13 250:10,17,20,21 251:21 254:11 255:23 265:25 266:19 269:12 271:6 272:5 272:17,18 275:7 279:5,17 281:2 284:1,4 285:9 287:21 290:12 292:14 297:9 315:11 319:19,22 321:25 327:3,25 329:24 330:13 332:13	bayesian 138:4,19	betas 149:18
attempting 159:8 304:19	back 12:23 20:6 59:25 61:5 69:19 78:22 84:12 91:2 96:23 99:24 102:5,8 105:16 112:24 122:12 124:7 125:15 133:5 137:15 142:10 145:16,17 150:10 168:8,24 171:4,24 186:22 193:20 194:4 199:1 202:1,3 202:7 205:13 208:9 210:18 210:21 211:19 222:16 225:7 227:1,23 230:23 233:16 237:2 238:13 250:10,17,20,21 251:21 254:11 255:23 265:25 266:19 269:12 271:6 272:5 272:17,18 275:7 279:5,17 281:2 284:1,4 285:9 287:21 290:12 292:14 297:9 315:11 319:19,22 321:25 327:3,25 329:24 330:13 332:13	bear 118:13 292:24	better 65:15 96:20,24 97:3 102:16 144:3 205:24 206:1
attention 161:21	back 12:23 20:6 59:25 61:5 69:19 78:22 84:12 91:2 96:23 99:24 102:5,8 105:16 112:24 122:12 124:7 125:15 133:5 137:15 142:10 145:16,17 150:10 168:8,24 171:4,24 186:22 193:20 194:4 199:1 202:1,3 202:7 205:13 208:9 210:18 210:21 211:19 222:16 225:7 227:1,23 230:23 233:16 237:2 238:13 250:10,17,20,21 251:21 254:11 255:23 265:25 266:19 269:12 271:6 272:5 272:17,18 275:7 279:5,17 281:2 284:1,4 285:9 287:21 290:12 292:14 297:9 315:11 319:19,22 321:25 327:3,25 329:24 330:13 332:13	began 100:22 169:23	beyond 32:21 34:7 99:3 126:21 144:12 150:7 152:25 154:19 155:13 173:17,22 181:15 183:10 210:10 211:3,23 223:20 224:20 310:22 314:12
attorney 12:4 64:3,3	background 233:16 273:17 275:24 277:17,25 297:21	beginning 21:5 22:18 37:11,13 60:1 102:9 122:13 134:7 183:25 184:4 195:20 222:17 235:20 250:17 253:2,14,25	bic 137:22,25 138:14,23 139:2 139:5,9,10,17,24 140:23,24 141:19 142:2
attorneys 51:16 57:6,13	backing 64:8	behalf 2:16 283:23,25 284:17,23 285:18 286:2 322:20 323:8	bids 283:18
august 108:4,9,13 162:15,23 169:17 170:6	backup 34:17 35:25 240:8 326:2,8 326:12	behave 273:24 275:21 277:8	
authentication 18:20	bad 38:22 104:8	behavior 151:22 208:8 224:16	
author 146:11,12,24,25		beliefs 313:19	
authored 81:18,22 82:1,5,9		believe 12:20 25:25 27:10 33:22 34:13 35:13,18 36:15,21,22 39:8,24 40:14 41:6,16 42:21 58:16 62:17 66:8 68:8 69:7 76:15 80:16	
authoritative 14:12,22			
authors 134:14,24 135:10			
available 159:22 161:6,20 170:5 184:13			
avenue 2:17 4:5 5:7,18 10:17			
average 155:25 187:7 189:5 191:23 192:1,20 194:15,22 195:2,8			

[big - certainly]

big 203:18	box 328:13	calculation 188:19 214:21 215:18	careful 29:11 202:15 312:24
billables 47:10,12	bradley 1:7 2:7 5:3 10:12	216:1,2,5 217:9 288:7,10	carefully 27:4,12 30:3 216:19
billed 49:4,23 50:4	brand 10:22	289:8 317:7,15 318:3	case 1:6 2:6 10:13 12:16 13:1
billing 55:4	breached 321:23	326:11	16:3,18 17:7 18:24 23:21
billion 164:6,10 264:20,22,23,24	break 59:12 122:2 170:9 182:21	calculations 215:22 261:22 316:14,22	24:6,9,20,25 27:25 28:6
265:8,21,24 273:2,3,5,5,8,9	183:3 184:10 222:3 266:3,7	317:3 319:4	36:19 37:2,3,8,9,21 38:9,19
273:12,12 276:23,24 277:2	266:10 296:19,23 297:2	calendar 31:14,23 110:25 112:2,3,10	39:5 40:16,25 41:7 42:24
277:23 278:1 281:13,25	breakdown 54:10	113:7,9	42:25 44:2,16 46:3,18
286:24 297:19,23,23	bridget 1:24 2:19 201:25 319:18	california 10:23	50:10,14,17 51:12 53:16
binders 47:4 53:20	330:13 334:25	call 135:20 207:1	54:8 61:19 62:11 63:7,8,17
binding 264:10,15 265:8	brief 233:16	called 21:22 78:18 79:3 316:3	63:22 64:4,6,23 71:22 73:2
bit 120:18 159:12 182:23	briefly 290:14	321:23	73:8,15 74:15 75:13 76:17
279:19,25 287:13 328:7	bringing 118:13	calling 332:12	77:6,9 79:12 80:15,18,22
bitcoin 158:19 169:18 172:23	britto 273:1,23 275:2 277:7 278:8	calls 13:24 23:19 43:9,10,20	81:1,5,9 84:4,10,12,17,21
173:1 316:12 317:13	279:6	45:12 290:25 291:4 293:23	84:25 85:1,5,7,11,12,15,20
bitlicense 182:23 183:4	britto's 278:13 281:22 282:15,21	294:6 301:2 331:1,9,10,18	86:18 94:15 97:24 98:21
black 328:13	broad 118:24 146:19 205:1	camera 15:21	112:18 123:9,24 153:15,23
block 83:23	broader 146:4 185:1 282:23	cap 140:19 141:5 142:5 161:17	154:11 160:8 167:14
blockchain 38:3 83:23	brought 84:8	162:1,5,23 163:3 164:20,22	186:24 191:14 210:14
bloomberg 223:18	buckets 53:19	165:6,8,16,16,22 166:5,10	212:20 232:3 238:15 262:9
blue 287:14 321:13	building 144:10	166:21,24 172:9 261:3	267:13 271:11 272:2
board 301:23	bullet 20:5 91:18 225:14 227:1,5	264:8 265:24	273:11,17 276:25 277:18
bolded 19:14	308:5,6,14,17 309:3,15	capable 45:22 134:2 221:10,15	277:25 297:21 318:13
bonart 315:24 316:10	311:7	capital 62:2 83:12	322:16 330:3,20 331:4,14
book 84:10,12 85:7	bullets 308:3,4,11	capitalization 164:5	cases 39:9 62:2 64:9,25 65:2,7
bottom 19:4,4,15 91:3,9 180:7	bump 279:25	capm 131:21 132:3 133:19	80:6 84:7,13,15 252:3
241:11 243:8	business 209:9 234:16 299:18	134:21 135:6	category 36:10
bought 250:16 251:21	c	caps 164:17	causal 150:3 154:24
boulevard 10:22	calculate 200:23 202:9,20,24 214:13	capture 119:10 120:1	causation 149:1 305:1
bouncing 189:17 209:1 210:8 230:6	214:15 215:10 265:10	captured 119:16 151:10 159:5,23	cause 334:8
230:12,19 232:7 237:5	calculated 27:5 201:1 253:24 326:8	captures 123:23	caused 99:11 153:17,24 237:20,20
bounty 274:19	calculating 250:1 316:19	capturing 76:1 77:17,20 158:10	237:23 305:5,18
		caravello 4:4	causing 235:16
		care 204:2,3	cautious 39:22
			caveat 40:4 298:11
			ccr 2:20
			cent 108:3
			certain 143:8 144:21 149:7 150:4
			160:6 220:25 299:7 312:20
			certainly 23:20 24:15 32:23 44:9

[certainly - commonality]

certainly (cont.) 48:25 55:11,12,17 57:16 69:18 71:20 73:12 135:18 160:8 164:20,21,22 244:10 298:24 301:18 307:22	cherry 305:16	clarity 60:15 102:19 135:8 298:15	coinmarketcap (cont.) 260:1 261:25
certainty 213:25	choice 32:13 112:22	class 82:21,22 83:3,3,5,14 84:4,7 84:16,22,23 85:2	coins 115:2 134:8 140:19 141:5 142:6,6 164:22 165:22 166:5,14,23 167:7,8,13,20 168:1 169:17,24 172:9,14 173:14,16 197:16
certified 10:20 334:11	chooses 313:6	classes 82:16,19 309:6	colleagues 12:5,7
certify 334:4,14	chose 142:4 256:24	clean 56:3	collected 99:19
cetera 75:3	chris 272:25 273:22	clear 14:17 25:18 28:7 29:23 33:14 39:1,23 41:25 48:15 48:21 58:21 63:12 81:15 92:19 100:19 109:25 110:4 114:23 125:20 150:14 172:22 173:4 181:6 188:22 189:2 202:24 253:19 255:14 262:11 298:12 299:1,1,11 308:4,4,5,12,14 308:17 310:25 317:14 325:21	collection 100:22 101:14
cgsh.com 5:10	christian 1:8 2:8 5:13 10:13	clearer 33:16	collectively 273:1
chain 117:6,15,18 118:2	circulating 258:21,25 259:9 269:23 280:6	cleary 5:5 13:8	collin 4:15
change 27:6 32:15 72:21 76:4 95:25 96:14 97:5 111:18 112:6 122:23 123:8 148:18 183:2 221:6 252:24 260:22 263:13 305:5,6	circumstance 206:22 207:9	clients 13:4 315:6	colloquy 60:5
changed 30:19	circumstances 71:12,22 72:2 73:14 74:15 75:12 76:17 79:12 249:12 262:16	close 321:19,19 332:20	column 147:17,21 148:5 181:12,13 325:3,24 328:20 329:3
changes 33:20 113:12 148:17 151:15 179:8 254:14 256:19 257:14 260:21 304:21 306:2,3,7,11 309:19	citation 17:15 236:18 245:19 272:6 272:12 274:22	closed 248:3	columns 225:22 226:8
changing 37:12	citations 22:15,16 23:11 32:22 130:22,23 135:15 175:22 211:14 234:8 291:14,20 292:10	closely 54:2	combination 35:20 229:20
characteristics 16:5 83:19	cite 21:5,25 22:11 117:15 118:4 118:15 127:25 128:2,8,10 128:13 129:2,6 136:3,7,9 139:16 166:12 176:25 209:18 236:10 291:18	closing 95:2 262:14	combined 278:13
characterization 130:11 135:18,22 233:25	cited 209:21 210:12	closure 210:24	comfortable 175:23
characterize 225:14	cites 131:2	clr 1:24 2:20	coming 104:12
characterizes 108:18 304:16	citing 21:8 104:13 235:25 313:1	coefficient 172:16,17,23 173:1,4,5,14 173:15 188:6 322:13,18,24 323:24	commencing 2:18
charging 46:17 54:25	civ 1:6 2:6	coefficients 173:6 189:19 190:23 241:3	comment 31:10 108:8 225:6 255:9 318:6 319:3
chart 148:1 327:1,23 328:7	claim 80:7,11,12 99:10 152:7 204:12 234:24 237:19 271:3 279:4 295:14 298:20 305:1,4 322:12,20 323:17 323:19	coincided 231:11 304:20	commentary 37:24 108:17 173:23
check 40:17 68:11 69:5,23 70:14 71:6 100:6 101:4 141:7,16 151:13 157:1 170:3 179:7 184:14 185:2 213:3,6 214:6 214:11 240:13,16 241:5 245:12 279:17	claims 22:4,5 84:8 105:2 301:21 302:23 303:4	coinmarket 32:10,14 35:9,10 102:7,8 102:10,12,16 103:10,12,25 104:8 105:17 112:15 269:23	comments 32:20 55:8,10 57:6,13,15 57:21 58:4,8,13,24 59:9 86:1
checked 246:12 269:22	clar 271:24	coinmarketcap 35:5,8,11,16,21 36:3 54:16 100:20 101:3 104:22 109:21 258:20,25 259:9	commission 1:4 2:4 3:7 10:11
checks 100:14 101:11 160:16 161:10	clarify 97:23 163:17		commodities 179:20 180:11 224:23
			commodity 157:15 223:18
			common 146:22,24 293:21,24 294:3 294:16,18,20,25 295:3,9,18 295:25
			commonality 17:10,13,16,17,24 19:6,19

[commonality - contemporaneous]

commonality (cont.) 19:22 20:12 21:1,17,23 22:9,13,22 23:1,13,16,22 290:17,21,22 291:6,11,20 291:22 292:25 295:9,15 296:3,5,6	component 14:10,17,21 15:2,4,7 46:24 114:2,9,21 115:20,21 116:1 116:8 136:22,25 137:3,19 142:24 148:4 151:11 158:10 169:1 317:12	conduct 72:12,14 73:1 75:4,10,14 90:22 183:18,19,20 305:20 307:13,16 321:14	consistent 35:22 102:9 116:18,25 129:9 133:11 149:22 153:21 155:10 157:18 159:18 160:10,14 179:25 185:10 191:23 214:7 224:21 246:24 259:8 289:21 304:19,23 305:3 311:9 312:6,21 320:16
commonly 135:24 154:4 159:3	components 77:10,13 78:4,9,14 110:2 113:23 115:5,15 136:18,21 137:22 139:3,6,10,20,25 140:4,25 141:8 142:14,15 142:16,18 144:16,22 147:13 157:2,23 158:3,6,8 158:14 159:8 160:1,4 178:13 195:5 199:5 223:1 316:15	conducted 27:16 66:16 67:6,20 69:4 73:4 77:9 78:8,12,17 79:5 85:16 99:22 122:18 332:4,6	consisting 328:18
communicate 52:5 54:7	comprehensive 198:23	conducting 71:2,10,13 72:8 77:13 136:16 307:25	constant 181:5,7,9 191:23 192:22 193:13,14,18 194:2,8,15 196:9,15,15 197:17,22 198:2 199:13 200:19 201:22 202:23 203:3 205:14,23 206:10 207:25 208:22 209:5 211:2,22 212:1,5,24 214:1 215:2,11 215:20 216:8 217:10,15,22 218:11,16 219:11,13,14 220:13,15 221:16 226:20 226:24 241:3 243:7
companies 69:9,12	computer 241:18 334:13	confidence 212:4,9,9,12,15,18,19,23 213:9,12,22,25 214:14,15 214:17,20 215:7,10,25 216:7,23 217:18 218:1,3,7 219:7 220:22,25 221:21	constitute 16:11,14 44:4 309:21
company 52:22,24,25 53:1 206:15,19 300:23 330:6,23 331:6	concept 19:23 196:25 197:7 203:7 242:4 300:5	confidential 1:12 9:15 47:16,24 48:9,24	constitutes 16:10 45:21
compare 176:12,19 288:18	conceptual 204:19	confidentiality 47:18 48:5	constraint 264:10,15
comparison 164:4 176:22 289:12	conceptually 149:15 216:5	confine 88:19	construct 16:20 116:2,5 130:13,17 133:13,22,25 134:14,17,24 135:10 169:10 256:5 269:25
compass 12:22 13:6 47:1,5,13,17,23 48:8,15 49:25 50:3,23 51:2 51:19,20 52:10,19 53:24 54:6,25 55:7,11,23,25 56:4 56:7,11,14,19 57:3 99:21 100:1,10 171:11,15	concern 29:16	confined 280:25 323:17	constructed 158:2 183:10
compatibility 104:20 105:14	concerned 128:16,17	confining 30:22	constructing 105:24 115:4 133:2,9 157:6 159:7,25 160:3 182:12 183:9 257:11 258:9
compensation 46:23,25 47:7,9 50:9,13 171:11	concerning 80:11	confirm 48:25 138:24	construction 157:8,22 158:5,14 269:24 277:4
complaint 15:2 21:6,7,9,13,25 22:1,19 23:2,11,14,15,20,21 40:25 41:18 42:1,5,9,11 43:15,16 44:2,8,10,11,18,22 45:1,7 73:16 74:6 75:1,9,9,11,15 76:19,22 77:4 84:22,24 88:10 89:14 90:1,2,6,23 92:22 93:1,7,11 94:20 97:2 99:10,14 126:11 163:6 181:20,23 183:12 233:10 233:19 234:9 235:13,17,25 236:10,18 274:19,22 278:18 291:9,12,13,15,15 291:16,17,22,24 292:3,6,11	conclude 190:24 212:3	conjunction 173:6 229:20	construed 309:10
complaint's 92:16	concluded 197:1 333:6	connected 334:15	contained 154:16 310:19
complete 32:4 33:3,22 46:24 68:8 75:20 97:15 286:10	concludes 186:2 332:24	connection 25:15,24 26:8,13 30:7 34:21 36:1,11 49:22 51:25 52:7 77:5 94:9 210:13	contains 36:2
completely 108:16,24 121:19 261:17	concluding 318:11 322:6	connotation 295:12	contemplating 134:11
complicated 256:4	conclusion 13:24 23:19 43:9,10,20 44:7 45:5,12 75:11 176:21 180:14 192:19 194:9,20 195:7,10,16,21,25 196:2,8 200:18 225:19,20 275:20 290:25 293:23 294:6,8 301:2 331:9,11	consensus 129:25 131:14 132:12 133:18,20,23 134:19,23 158:23 306:12,16 307:5	contemporaneous 41:3 323:25 324:8,11
	conclusions 27:1 30:24 72:20 126:2 215:5 312:16,20	consider 182:12 183:9 206:14 303:13	
	conditional 172:24 173:2,18 224:2,2	considerations 111:14	
		considered 11:18 68:12 69:6,24 86:8 245:13	
		considering 30:3	
		consistency 127:23	

[contemporaneously - crystal]

contemporaneously 323:16,20 324:15	controlling (cont.) 226:10	corresponds 242:18	criticizes 303:17
content 20:10 121:17 165:23 168:13	conversation 32:6 53:6,7 99:25 105:22 168:24,25 174:22	counsel 27:19 28:17 45:23 51:6 57:16,21 58:1,4,8,14 59:9 60:12,22 61:2 62:23 63:2 94:8 240:7 256:14 274:18 302:22 306:18,22 325:10 325:18 332:1 334:17	critique 28:8 29:12 30:5,8,10,16 32:2,24
contents 19:2 20:6 273:6	conversations 51:16 55:18 60:11,16,22,24		critiques 26:18,22 28:11 30:11,13 31:9 32:18
context 67:24 68:13 69:23 71:11 72:1 79:9 80:10 83:8,14 84:20 95:8 125:20 132:9 134:6 203:14 204:12,13 205:3,10 223:9 268:25 270:5 274:15 292:6 296:5	conversely 218:25	counselor 14:1 43:22	critiquing 67:6
	conversion 260:4 262:21	counsel's 24:11 60:5,21	crr 1:24 2:20 334:25
	convert 259:11,23 261:23	counterparties 299:15	crypto 26:20 38:2 77:23 83:20 84:20 85:8 106:12 110:11 115:10 116:22,24 117:11 117:23 118:6,20 119:18 120:22 125:22 129:16 133:6 134:8 135:4,15,19 141:10,11,14 146:4 150:24 151:22 152:22 154:8,22 156:9 158:11,19,20 160:13 160:13 167:8 168:1 169:3 169:20,25 170:6 175:20 179:13 223:16 314:11
contexts 67:21 69:4 79:11 153:13	converting 250:3 255:16 262:12 263:12	county 334:3	cryptocompare 32:11 33:19 35:21 54:17 100:20 101:25 102:5,8,17 103:4,6,19 104:6,10,13,16 108:6 112:14,19 259:25 261:25 262:14 288:13 289:1 314:12 315:9
contingent 236:20	converts 255:13	couple 30:10 53:18 64:6 158:16 298:12,13	cryptocurrencies 38:4 115:16 134:15,25 135:11 147:14 159:6 178:14 197:12 235:9 309:19
continuation 185:21	copies 163:22	course 217:16 277:2	cryptocurrency 75:19 77:15,18 78:3 91:1 91:21 99:4 119:9,22 120:5 120:6,12 121:14 125:4 126:22 128:11 137:3,6 143:14 144:14 145:2 147:18 148:6 149:11,24 150:9,18 151:2,14 152:11 156:2,6 159:16,23 160:1 166:8 175:5,13 176:10 178:7 181:13,14 182:5 187:8 191:25 194:18 195:6 224:21 225:17 226:11 279:11 280:25 310:24 314:5,10,11,19,25 315:10
continue 171:17	copy 18:16 302:12	courses 83:1,25	cryptos 179:14
continued 4:1 5:1 56:18	corporate 82:20 83:17 210:2 301:5,23 301:24	court 1:1 2:1 10:21 11:1 18:15 65:13,19 333:2	crystal 253:19
contract 13:18,20 14:5,8,13,16,19 14:23,25 15:6,9 16:5,10,17 16:19 17:2,5,25 47:16 48:18 233:24 234:22,25 285:24 286:5,11 299:14 330:5,17,21 331:5,16	corporation 301:7,9,11,20	covariance 77:25 78:2 114:4,12,25 115:6,24 116:2,4,10,11 119:6,16 120:20 121:2 167:22	
contracts 15:7 20:8,20 88:8,9 271:2 272:19 284:2,8,14,15 299:13,14	correct 12:9 21:24 25:8,9 27:18 28:14 35:7 41:24 49:1 60:9 60:17 69:16 74:3,4,8,16 98:19 101:5 106:3 110:2 113:2,25 122:21 139:1 142:4 162:3 187:3 188:15 194:12,23 206:23 224:11 241:14 243:2,19,22 252:18 253:18 255:6 260:14 261:23 262:10 268:17 284:17 290:3 299:9 307:2 330:11	cover 82:16,20,21,24 83:6 102:12	
contractual 283:2,3,5 298:3 299:15,19 300:16,19	correction 15:23	covered 174:21	
contrary 277:22	correctly 35:4 42:20 104:14 123:11 144:19 206:6,8 293:6 299:6 327:1	crack 261:9	
contrast 286:16 287:22 288:1,3,6	correlate 149:18	create 126:7 219:20 220:2 235:22 239:16 283:1 298:15 300:19	
contrasting 288:4	correlation 76:3 94:2 95:24 144:6 146:11,13,24 147:1 149:1,6 149:14,19	created 239:25 240:5	
contributed 56:7 179:8	correspond 164:11 186:19 242:14	criminal 64:4	
contributors 270:20	corresponding 155:23 192:14	criteria 137:22 138:1,4,5,11,23 139:2,5,11,19,24 140:3,8 140:10,23,24 141:4,15,20 141:25 142:3,5,7 160:23 161:17 162:1,14	
control 91:22 98:9 125:5 150:19 225:18 235:8,11 247:7 249:21		criterion 138:20	
controlled 277:23 325:12,20		criticism 34:13,15 247:19 263:8	
controlling 156:1,5 194:17 225:17			

[crystallize - describe]

crystallize 28:13	data (cont.) 246:20,20,25 247:2 250:2,4	dealing 23:12 296:3	defining (cont.) 298:23
csr 1:24 334:25	250:6,10 255:19,21,23,24	dealt 276:2,2	definitely 67:11 156:10 232:5 260:21
cumulative 75:14 326:9	255:25 256:4,10,11,20,21	debevoise 2:17 4:3 10:16 12:20 39:18	279:21 280:10,13
currencies 197:21 250:4	256:22,23 257:1,12,13,16	39:25 40:10,12,14,18	definition 20:12 22:12 34:9 96:4
currency 19:15 80:20,24 81:20,24	257:17,20 258:5,6,8,9,20	debevoise.com 4:8	97:16 151:6 188:18 189:16
331:15	258:22 259:5,8 260:6	deborah 6:3	247:15 274:25 294:11
current 68:5	262:23 265:7 269:1,10,20	decade 210:20	295:2
custody 30:14 244:15 246:22 248:7	269:21,22,25 273:8 274:6,7	decades 210:20	definitionally 188:20
248:11,17 249:3,20	275:1,5,6,10,15 276:1,4,8	december 41:17,19,20,22 42:7,19,21	definitions 247:3
customers 283:20	276:12,15,22 277:3,4 278:2	162:15 163:3 164:11 320:7	delaware 301:5,24,25
cutoff 164:6	278:3,7,11 282:2 285:5	decent 280:2	delta 229:2
cv 10:14	287:2 288:13 290:7 313:7	decide 45:24 274:9	demand 235:15 236:21
cwhite 4:25	314:5 315:9 319:25 320:8	decided 167:1 169:10	demonstrate 43:6 45:9
d	320:23 321:1,4,8,18	deciding 139:25	demonstrated 225:2
d.c. 4:19 5:8	data's 258:14	decision 130:14 166:20 291:7	demonstrates 322:15
daily 94:16 95:13 122:19,24	date 26:19 36:20,23 61:16 105:1	declined 253:1	denominated 258:24 268:13 287:14,16
126:25 127:10,19 128:12	109:11 113:2,17 246:22	declining 48:4	denomination 31:6
128:24 255:18 260:18	249:15 262:12	decreased 97:11	denominator 254:20
269:5 321:6,9,20,20	dated 285:25 286:13	decreasing 322:23 323:10	depend 71:20 72:1 195:9 236:16
daniels 3:11 12:6	dates 108:4,12,19 113:6 284:25	deemed 92:21 233:20,23	dependent 177:14,14 178:2,9,15 179:1
dark 308:3	305:16	defendant 4:2 5:3,13 11:18	depending 97:14 209:2 212:18 259:24
data 30:7 32:3,10,14 34:15 35:6	day 31:13,14,22 34:1,11,20	defendants 1:9 2:9 11:19 13:1 38:18	261:25 332:10
35:8,16 36:3 53:22,23	35:1 54:20 78:13 88:23	54:25 86:17 332:10	depends 58:7 70:22 71:9 79:11
54:16,21 99:19,23 100:3,4	94:21 95:2 96:3,6 97:7,11	defense 63:5 65:9	147:3 244:6,8 260:16
100:7,10,11,14,18,22 101:4	97:12 103:13 108:11	define 246:16,19 269:15	deploying 210:11 211:5
101:8,11,14,15,15,19,22	110:14,17 111:3,10 112:2,9	defined 45:21 90:22 168:13 169:3	deposition 1:14 2:15 9:1 10:8,15 12:8
102:3,17,20,25 103:12,12	116:14,24 117:1,3,7,10,23	188:9 267:4 268:10 280:5	27:23,25 28:1 215:16 216:3
103:24,25 104:6,7,8,18,20	122:25 129:12,18,18	289:21 330:3,11,20 331:4	216:18 304:22 305:10
104:20,24 105:3,15,15,18	206:18,21 207:23 228:6,12	defines 14:13,22 22:21	332:20 333:5 334:5,8,9
105:19,21,22,25 106:2,7	251:14,19,22 252:7,21,25	defining 117:25 246:15 247:16	der 50:22 51:25 53:15 54:15,24
108:6,14,24 109:1,3,14,19	253:2,3,12,17,23 254:1,5,7	249:22 294:25 295:25	57:4 100:1
111:11 112:15,15,20,22	254:16,19,20,20,22,22,23		describe 32:12 58:8 77:14 88:2 89:5
115:25 120:13,14,19	255:2,2 257:5,6 290:14		112:7 127:12 140:12
121:18,23 122:19,24 127:1	295:19 318:5 321:12,15		315:18
127:13,20,25 128:4,12,15	322:23 323:10 329:12		
128:21,24 129:5,17 143:15	334:19		
151:8 160:25 161:6 167:21	days 31:17 34:8 70:15 71:7,16		
185:4 190:4 199:25 200:17	71:16 72:7,17 94:25 96:1		
204:6 205:5,7 238:16	110:23 112:4,7 118:1 129:9		
239:15 240:17,22 241:9	164:5 246:9 251:8,18		
	253:13 309:21 313:6		
	321:22 326:9		
	day's 323:18		
	de 257:11		
	deal 203:18		

[described - doing]

described 29:19 33:25 34:4 36:7,13 56:13,21 80:15 87:23 89:9 91:12 94:10,17 95:11 96:12 127:19 155:7 161:9 186:11 289:3 316:16 319:14	differences 251:10 292:16 different 34:14 42:3 52:4,6 53:19 83:6,24,25 110:23 115:1 123:15,16 128:15,21 158:16 160:17,19 161:11 166:13,14 174:2,5 179:16 182:14 189:2 197:20 198:1 198:20,20 199:18 205:18 206:2,6,11 219:21 223:9 225:16,20 227:7,10,10 236:12 249:9 254:5 255:24 255:25 256:1,4,7 257:17 276:12 292:5,20 293:18 295:8 298:14 309:5,6 312:2	directors 301:6 directs 248:10 disaggregate 288:17,19 314:17 disaggregated 255:19 disaggregation 288:23 disagree 220:7 231:15,16 312:15,19 disciplinary 66:10 disclosed 332:4 disconfirm 48:25 discuss 21:14,20 25:4 29:17 32:21 40:20 51:15 136:20 172:3 184:10 279:20 285:5 288:7 292:8 298:7 307:7 discussed 16:4 29:4,24 55:11 85:3 102:15 104:24 156:10 174:18 179:12 182:17 183:14 190:7 196:11 217:19 219:3 247:21,24 263:7 269:2 303:13 310:19 discussing 21:9 22:25 23:9 29:24 107:11 114:17 196:25 199:25 257:4 268:10 306:1 316:25 325:24 discussion 20:1,4,10,16 28:10 36:16 100:5 110:9 136:24 143:12 143:18 144:1 171:10 185:13 247:2 264:17 271:1 274:15 282:23 284:1,10 discussions 55:15 226:21 disinterested 334:11 displayed 213:21 240:22 241:9 displays 314:5 dispute 45:20 69:14 distinction 149:13 225:5 226:14,16 distinguish 88:22 250:12 251:19 253:5 254:13	distinguishable 194:25 200:12,19 203:4 219:1,25 224:5 311:3 distracted 282:9 distribute 239:13 264:11,16,19 distributed 235:22 260:4,7 261:21 distributes 262:8 distributing 262:17 distribution 30:12,14,14,22 32:2 156:23 244:11,21,23 246:7,8,16,16 246:20 247:2,4,15,17,20 249:18,22 251:6 256:6,21 257:12 262:12 263:4,10 265:7,13 269:17 273:8 274:5,7 275:5,6,9 276:1,4,8 276:15 277:4,15 278:17 279:4 282:3 298:4,20 distributions 30:20,23 31:4 75:3 89:15 89:16,23 90:3,7 93:10 156:16 181:22 198:16 235:12 236:9 244:1,3,7,12 244:14 245:7,9,11,13 246:6 246:6,13 250:1,14,15,22 251:9,10,20 253:9 255:19 256:12,25 257:7,23,24 258:4 259:1,7,23 261:16,22 262:9,21,23 264:9 268:9 269:1,8 274:18 275:1,16 278:20,22 286:24 288:14 288:21 289:13 district 1:1,2 2:1,2 64:4 divergence 174:14 divided 149:19 280:6 division 278:1 doc 28:7 documents 9:20 325:11,19 doing 21:21 22:8 36:23 40:14 52:4,6 68:18 70:10,12 71:24 109:1 119:3 121:14 124:22 134:3 136:23 143:24 145:4 176:16 199:23 200:9 206:12 208:5
describing 259:5 description 7:10 8:2 descriptions 45:3 descriptive 197:13 design 89:8 designed 89:13 220:20 designing 53:9 destination 325:12,20 326:16,22 328:22 329:5 detail 57:19 74:25 137:12 details 257:11 detect 262:24 determine 71:14 72:6 73:24 98:16 130:7 154:11,24 180:24 215:19 229:22 247:11 249:11,13 267:13,24 316:15,23 determining 132:25 139:19 140:4 212:14 develop 234:16 299:18 developing 184:11,12 deviation 217:7 deviations 212:6,13,25 214:3,7,20 215:14,18,24 216:22 217:8 devine 6:5 10:19 dictate 236:21 difference 30:24 31:8 34:16 103:10 104:1 105:18 109:23 113:10 115:20 203:10 204:20 252:2	differently 125:4 150:18 293:18 difficult 262:23 digital 13:14 73:5 82:14,17,25 83:7 84:8 85:13,17 123:1,5 127:3 133:1,14 134:1 145:11,23 149:8 150:4 152:1,3,17 153:5,6,16,25 154:12 155:1 157:3,8 160:6 160:18,20 161:11,13 162:6 164:16,17 165:6 267:9,14 267:25 289:5 diligence 105:3 109:1 dimension 115:25 120:20 121:16,17 dimensional 120:19 dimensions 121:12 dipped 162:6 direct 11:21 18:19 40:20 57:9 58:10 60:10 112:16 135:2 183:6 292:18 directed 319:16 directing 250:25 direction 9:3 212:6,25 directionally 218:6 directly 35:1 52:5 54:7 99:9 279:10 280:16 283:15 296:6 309:1 324:2 326:8		

[doing - enables]

doing (cont.) 209:3,4 216:4 218:22 220:24 265:8 270:23 275:18 279:4 295:22 328:12	drawing 130:24 132:18 136:11 225:5 226:16	economet 199:10	eigenvalue 121:15
dollar 157:16 223:18 257:22 259:24 260:5 261:21 262:21 265:13 286:25	drawn 291:22 325:24 326:7	economic 16:4,9 17:1 19:5,18,23 20:8 20:23 21:6,11,12,14,22 22:1,5,6,9,18,25 23:2,13 44:11,18 69:21,24 71:21 73:16 74:5 75:1 87:5,12,23 87:25 89:13,20 99:14 118:20 119:18 126:11 137:1 142:19 143:1,7 146:12 152:6 205:4 231:18 231:22 232:25 233:6 234:15,24 235:6 272:18 290:17 291:8,11 292:9,25 293:4,7,14 294:15,23 295:7 295:14,16,23 296:4	eighteen 315:14
dollars 31:4,5 108:6 165:9 167:2 179:20 258:5 259:12 262:12 263:12 270:14 287:14,16 288:20 298:5,8 321:16	drive 126:17		either 24:10 78:10 162:15 212:6 212:25 214:3 258:1
donier 315:24 316:10	driven 176:9 234:4		elaborate 23:4 285:13
double 40:17 213:3,6 214:6	drivers 77:14		elaborated 271:25 272:16 276:20
dr 24:14,15,24,24 25:3,5,7,14 25:19,23 26:2,5,7,12,17 27:4,13,17 28:4,8 29:8,10 29:11,12,14,24 30:1,8,9,25 31:1,24 32:2,17,18 33:7,9 34:14 93:25 96:21 104:25 106:1,5,19 107:9,20 108:18 111:16 113:11 128:14 182:16,20 183:15 185:13 196:12 221:24 228:2,7,13 228:17 229:4 230:20 231:6 232:9 237:2 238:2 247:19 263:8 285:1 303:16 304:4 305:9,14,23 306:19 307:10 308:24 311:23 312:16,17 312:19 313:1 320:9,20 322:20 323:6,12 324:8,22 325:23 326:1 327:2,11 328:10 329:3,4 332:7,12,25	drives 236:21		elect 128:23
	dropping 105:7		element 19:24 290:23
	drops 206:21		elements 17:19 23:16
	due 105:3 109:1	economically 203:8,11 204:1,8,20,23 205:8,8	eliana 4:14
	duly 11:6 334:6,11	economics 13:22 14:2,6,12,12,22 15:3 16:3,7,24 17:12,14,19 20:25 21:2 22:11,21 83:4 116:16 139:17 146:10,20 146:20,23 204:19 205:2 209:24 267:8 295:3	elucidate 271:17
	duration 292:17		elucidated 271:24
	e		email 3:16
	earlier 23:12 29:23 36:16 38:4 44:25 49:13 56:13 78:22 85:25 94:18 99:25 100:4 101:1 102:15 103:5,9 104:17,24 105:16 109:11 109:23 112:1 113:5,22 124:7 135:22 136:24 156:10 157:13 167:15 171:10 174:18 176:21 178:5 179:12 183:1 193:2 196:11 205:3 217:4 219:3 227:22 230:24 238:13 261:2,10,14 263:7 264:18 267:17 268:11 269:2,18 271:1 272:22 273:19 276:21 279:22 280:11,15 281:19 285:14 288:15 290:14 294:21 314:14		emails 312:25 313:1,2
	early 36:21 108:13,13 111:13 183:23 280:8 287:14	economist 118:14,17 130:25 134:1 136:12 199:11 220:11 263:22 301:10,15 313:4	embedded 78:2 144:15 176:15
	earnings 83:11 270:18 271:5	effect 75:14 89:16 94:21,22,25 97:17 152:6 203:19 211:22 224:2 244:11,13 267:18	emerging 157:14 179:19 180:10 223:17
	easier 88:22 261:18	effective 320:13	empirical 91:5 144:25 145:3,5 146:2 146:5,9 150:15 167:23 169:5
	easily 40:1	effectively 62:12	empirically 173:19
	econo 119:17	effects 93:19 95:3 111:1 116:22,24 117:10,23 129:18 135:14	empirics 147:6
	econom 179:25	efficiency 69:10,14,16,19,22 76:8,9 79:13 85:20 97:24	employ 73:23 140:24
		efficient 68:12,15 69:1,6,24 70:9 119:5 120:21 164:25	employed 73:22 140:3 165:23 243:10 284:22 285:17
		efforts 87:5,12 88:1 89:10 92:10 94:15 95:13 99:10,15 181:21 231:19 233:1 234:5 234:7,15 235:2 236:2 283:3 299:17,20 300:21 309:18 310:1,2,10,13 312:5 331:7	employees 312:21
			employing 284:16 286:2,3
			employs 283:22
			enable 290:8
			enables 141:10 169:24

[encapsulates - exchanges]

encapsulates 36:17	epfeffer 4:24	estimate 62:4,8 67:13 148:21,22	ex 10:10 239:18 309:4
encompass 29:13 246:8	epsilon 187:17,21 188:2,6,9,15	180:19 188:20 193:16,17	exact 26:19 36:20,23 41:5 51:1
encompassed 28:22	189:9	193:21 199:8,21 200:1,1,11	108:12 184:5 213:9 218:4
ends 126:8 253:3	equal 149:1 201:5,9,17 202:11	200:16 203:16 212:1 215:6	227:11 246:3 258:10 284:3
engage 141:20	244:18 255:2 267:5,7	218:2,8 219:8 228:22 229:1	exactly 42:8 53:13 111:11 226:22
engaged 49:9 287:5,9	equally 205:16 235:3	229:11,18 231:1	227:11 258:18 262:1
engagement 12:21,22,24 13:2,4,5 36:24	equation 138:20 144:17 159:4	estimated 188:6 201:6,11,19 202:13	269:16 288:21 289:13
39:25 41:3,4,6 42:25 44:24	180:12 186:3,9,10,18,23,24	227:24 316:5	294:19
62:15 79:14	187:12,14,17,22 188:11,16	estimates 199:23 225:23 226:9	examination 7:2 11:21
engagements 62:22 63:3 67:21 78:7,17	191:5,9 227:22 229:6,12	227:13 318:6	examine 144:20 155:25 174:13
79:2	231:2,2	estimation 92:2,5,7 95:9 110:5,10	223:21 306:18 321:4,8
english 144:3 190:5,13	equilibrium 244:19	113:24 124:3 137:23	examined 11:6 151:15
enjoy 271:21	equities 153:14	156:12,12 161:14 168:7	examining 70:16
entail 62:15	equity 132:4	169:11 172:18,19 173:11	example 20:18 47:3 55:23 57:25
enter 180:11 289:7	ergo 227:15 255:3	173:25 174:1,7,8 175:4,7	70:5,24 75:8 83:9 93:14,19
entered 159:3,24 244:3 247:11	error 187:10,12,23 188:1 189:5,6	175:19 176:5,8,13,13	95:23 98:6 110:24 113:7
284:8	189:8,11,13,15,17,21 190:2	182:13 183:9 193:22,23	116:21 139:14 158:13
enterprise 271:3 283:6 293:21,24	190:14,20,22 191:1,3,5,9	197:25 198:11,17 200:2	160:25 166:23 180:15
294:3,16,21,25 295:4,9,18	191:14 193:8,10 201:16,18	214:2 216:8 220:13 228:8	210:5 222:24 238:18 248:6
296:1	201:22 202:12,17 208:22	228:14 241:1,2	283:17 300:18 317:21
entire 62:19 75:23 102:12 114:3	208:25 213:10 214:18,19	et 75:3	326:13
115:5 116:10 165:1 260:19	215:2 227:19 228:18 229:5	ether 158:19 169:12,13,17,20,22	examples 324:20
279:14 280:21 288:25	229:16 230:12,14,18 231:3	184:1,7	exceeded 164:5
303:12,25	232:12 238:15 242:1,5,8,19	euro 179:20 223:18	exceeds 175:6,7
entirely 38:23,23 207:20	242:22 243:11,14	evaluate 92:9	exception 57:1
entirety 62:21 64:9 76:1 254:6	errors 200:23,25 201:6,11,19	evaluates 94:1	excess 75:16 90:23 93:21 95:5
entities 275:25 285:22	202:9,13,20,24 203:2	evening 266:10	99:1 103:14 126:12 143:16
entitle 330:5,22	escrow 264:9,14,19,22 273:13	event 66:13,16,21 67:6,20,25	144:11,12 169:7 177:19
entitled 334:7	276:3	68:3,10,14,23 69:3,3,4,7,22	178:6 182:4,4 189:4 192:1
entitling 299:15	esquire 3:9,10,11 4:4,11,12,13,14	70:2,8,13,18,20,23,24 71:2	192:20 194:22,24 195:8
entity 63:8,18 83:11 248:9 288:22	4:15 5:6,16,17	71:3,4,9,12,13,25 72:8,13	196:3 208:21 209:6,13,16
entry 147:21 148:7 327:15	essentially 110:21	72:14,16 73:1,4,8,17 74:17	209:19,22 210:1,9 211:2
	establish 149:6 150:2	74:19 75:21 76:3,11,13	224:4,14 225:1,3,8 226:14
	established 43:13 116:21 119:23 121:6	78:19,23 79:4,6,9,16 80:3	226:15 227:15,18,20 230:5
	130:15,16 131:24 132:2	86:1 94:1 95:24 96:10,13	230:7,15 232:15,19 233:8
	133:6,8 135:5 138:5 139:11	96:14,22 97:5 98:7,8	237:11 267:21 310:21
	139:24 140:8	events 72:21 75:2,4 80:11 89:15	exchange 1:4 2:4 3:7 10:11 69:13
	establishes 234:24	89:22,24,25 90:7,21,21	70:5 81:12 82:3 247:22
		92:14,15,20,21 93:5,11,13	280:13 315:10
		93:18 94:20 96:8 97:14	exchanges 30:21 33:18 267:20 279:11
		183:13 234:18	279:24 280:13,25 289:2
		evidence 236:8	

[exchanges - factors]

exchanges (cont.) 314:5,10,12,20,25	exhibits (cont.) 157:11 192:14 195:19 196:6 197:6 198:21,24 225:22 226:7,25 227:13,17 246:4 269:12 288:15 289:15 314:14	explain (cont.) 124:25 127:3 141:5 145:21 157:2 159:9 177:8,23,25 190:13 191:22 222:21 223:12 224:10 227:12 244:17 246:2 264:14 282:18 293:5 305:15 306:6 328:2,9	extracted 121:1 167:24
exclude 165:21 218:14,15 237:4,9 237:15 289:24	exist 64:11 103:6 104:18	explainable 75:18	extracting 114:3,11,24 115:4,23,25 116:10 119:4,20 120:21 121:11 137:4 169:4
excluded 65:13,18 184:19	existing 206:19	explained 21:10 90:25 91:20 115:22 125:3 150:17 169:8 180:25 190:10 191:25 272:16	extracts 121:10
excluding 151:12	exists 73:9 74:21 230:16	explaining 110:19 177:13	f
excuse 51:5 101:21 171:3 315:24	exogenous 91:21 125:3 150:17,22 151:3	explains 178:20 179:5 180:22 232:6	fact 31:25 45:20 75:16 105:1 117:24 151:3 168:8 180:18 190:3 193:14 218:21 219:22 220:3 221:4,7 235:7 238:2 244:13 263:24 276:23 279:9 286:7 297:17 305:5 308:6,17 311:4 318:24 320:5 324:14
executing 236:17	expect 109:24 126:12,22 154:20 181:17 210:10	explanation 144:5 146:13,25 172:14 173:12	factor 20:21 31:12,18,20 32:9 33:25 34:20 35:5,15 36:3 53:6,10,11 70:2 73:13,18 73:22 74:3,16 75:22 76:16 77:19 78:5,19 79:4,10,15 79:16 80:2,3,10 86:2 88:12 88:15,16,19,21 89:19 90:12 90:15 91:15 93:17 95:6 96:8,19,24 97:8 99:20 100:8 105:24 108:10 111:22 112:10 113:2 122:19 126:25 127:1,14,18 128:1 129:4,11,15 130:20 132:10,24 133:20 143:23 145:16 154:18 155:17,23 156:11,13 166:6 192:13 193:3 210:11 211:4,23 232:5 235:5,20 251:4 257:5 257:8 272:20 309:16 310:17
execution 309:4	expectation 236:4 305:19	explanatory 123:17 138:13 179:18 232:20	factoring 96:16
executive 50:25	expectations 237:22 244:9 245:4 305:24 306:3,7,20,25 307:3,12,16 307:17,22	explicitly 278:16	factors 91:21 118:20 119:18 120:12 122:16 125:5 130:1 130:6,7,14,17,19 131:14,15 131:20,24 132:13 133:1,9 133:22 134:17 135:25 136:4 150:19 156:2,6 157:7 157:12 159:9 160:5 176:9 176:10 179:7,19,22 181:13 187:8 192:1 194:18 208:6 209:3 222:21,25 223:1,2,7 223:10,11,14,16,20,25 224:3,10,16,17,21,23 225:18 226:11 235:8,10 317:20,25 319:2
exercise 134:10,11 154:3 160:2 161:4 257:12	expected 238:21	explore 155:12 157:12,17 179:15 179:16,21 223:1,8 294:19	
exhibit 7:12,17,22 8:4,5 18:4,5 23:23,24 28:20,24 57:7,14 106:25 107:2 115:11,13,14 115:21 137:21 138:23 139:4 140:13,15,18 141:1,6 141:10,21 142:1,8,10 145:13,14,14,15 147:11,12 147:17 148:16 156:19,19 156:20 157:11,24 162:17 162:20,22 164:22 166:3 168:8,22 169:16 171:24 172:3,8,13,14 173:24 178:11,11 179:13,14,17,24 180:2,4,7,9 181:9 186:20 191:12 193:21 196:7,15,16 196:17,17 197:7,8,9,11,11 197:15,19,24 198:4,5,10,14 198:15,19 199:1,2 205:13 206:3 211:25 212:4 213:15 213:21 215:4 216:11 221:25 222:24 224:18 226:20,25 239:8,9,17,22 240:5 246:5,5 258:14,15,17 258:20 259:13,20 261:12 265:14,15,18,23 268:12,23 268:24,24 269:9,15 270:1,1 274:6 279:23 280:5,9 285:20 286:22 287:1,9,15 287:20 288:8,11 289:19 313:23,24 314:4 318:7 321:1,3,5,14 324:17,18 325:22,22 328:8	expend 283:3 299:20 331:7	explored 157:10	
	experience 118:16 130:25 136:12 189:1	exploring 119:7 159:14	
	expert 7:12,17,22 12:15 16:2 17:18,22 18:23 24:5,8,18 24:20,25 28:5 36:19 37:1,3 37:7,9,11,14,15,16,20 38:8 39:6,18 40:12 44:19 46:17 46:21 50:13,17 51:12 52:1 52:8 53:3,16 54:8 59:10 61:13,18,22 62:11,21 63:25 64:10,22 65:5,8,12,17 66:17,22 67:6,7,21 68:20 70:19 71:23 74:18 77:5 78:8 79:2,5 80:19,23 81:2,6 81:10 85:12 105:10 107:9 107:22 108:20 110:18 112:11 117:16,19 118:3,4 118:10 125:1 140:2 174:12 210:14 238:4 239:19 240:1 240:9 263:16 332:5	exposure 187:7 292:19	
	expert's 70:24 71:24	express 144:4	
exhibits 7:9 8:1 55:24 56:2,15 145:17 155:24 156:8,24	explain 16:15 22:4 31:16 74:24 90:9 97:18 99:16 111:4 112:14 115:19 123:1,6	expressed 194:20 212:19 229:6	
		expressing 94:14 98:20 233:5 272:1 300:8 310:1,12 330:2,19 331:3	
		expressly 74:19	
		extended 175:19	
		extensively 233:24 235:17	
		extent 61:8 314:22,24	
		extra 195:2	
		extract 78:1,3 121:7,9,22 164:25 167:21	

[facts - form]

facts 45:8 71:12,22 72:1 73:14 74:15 75:12 76:17 79:11 271:10 273:11,17 276:25 277:18	feelings 311:25 313:19	finding 99:9 168:10 175:12	floating 298:14
feels 92:17	findings 304:17	floor 319:16,25 320:4,6,10,14,17 320:22 321:24	flow 53:20
felt 31:16 34:7 75:13 102:16 111:3 112:7 117:21 183:11 185:9,15	finds 202:10 203:15	flows 256:6,6,12	focal 25:2 26:4
factual 252:2 253:6 254:5,9,14 255:6	fine 15:22 59:14 61:25 122:3 222:4 266:11 296:22,25	focus 209:15 234:3	focused 22:17 25:18,20 26:5,6 110:10 124:16,23 125:16 144:9 275:3 278:21 285:2 307:24
fade 296:20	ferrell 1:15 2:15 7:4,13,18 10:9 12:2 18:5 23:24 58:22 61:9 107:1,10 239:9 240:5 331:23 332:3,13,25 334:5	firm 40:8	focuses 311:23
failure 236:19	ferrell's 228:7,13	firms 13:3 39:10 40:5	focusing 14:11 36:9 43:24 44:15 69:21 74:7 94:7 173:11 177:20 298:5 309:20
fair 16:24 42:23 43:2 67:10 88:15 92:24 93:2 109:15 114:7 130:5 135:17 137:17 145:8 153:3 186:17 212:22 223:23 241:8 260:22 263:15 287:10,12 289:5 304:10	fiat 197:21 250:3	firm's 301:21	folks 112:18 135:3
falling 324:5,5	fiduciary 300:23 301:6,19,23	first 21:7 23:8 55:19 56:5,13 63:15 111:10 129:24 155:22 158:18,25 161:14 181:12 192:11,12 218:22 235:21 240:24 241:21 242:10,13,17 246:23 251:4 251:5 252:15,24 270:10 276:19 282:13 283:14 286:8,16 292:6,11 297:16 299:21 302:21 303:2 308:4 308:5,11,14,16 309:14 326:13,14,16 328:11,17,17 330:10	follow 60:20 61:1 131:18 234:14
falls 207:3,7	field 13:21 14:2,6,11 17:11	fit 177:13 190:4 232:13	following 72:16 101:6 102:4 206:16 206:20 250:13 326:21 327:5
fama 122:15 131:22,23 132:4 133:19 134:21 135:6	figel 4:10,12 47:19 59:16	fitness 185:7	follows 11:7 97:12 200:7
fama's 69:19	figure 17:1 27:7 107:14,15 108:1 108:2,7,19 109:9 114:17,19 164:10 176:23 177:9 178:18 179:4 182:21 185:14 213:14 228:6,10,12 242:23 243:14 262:9 289:3 289:16 316:9 317:8 328:8	fits 238:16	footnote 23:10 32:22 110:19 111:3 116:20 138:3,16,17,19,23 138:25 139:15 161:21 162:14,17 166:12,16,18 175:22 176:25 177:4,7 182:24 213:15 235:17 253:19,22 254:18 255:13 259:13,20,22 274:15 278:17 315:25 316:11 317:17
familiar 13:11,14,17 42:24 66:13 203:7 242:4 259:16 264:3 266:22	figures 228:17 229:5,25 230:20 231:13 232:8 237:3,6 238:1 289:11	fitting 243:6	footnotes 23:8,9,9,10 140:22
familiarize 264:3	figuring 216:6	five 59:12 79:24 138:9 151:21 156:21 212:21 230:9 231:20 233:2 322:2 329:11	foregoing 334:5
famous 209:10	filed 41:19 42:13	fixed 31:13,14 34:1,21	forget 26:19 51:1 53:1 111:10 113:5,7
fanciful 238:7	filing 31:2,7,11,19 32:8,8 33:13 38:5 42:11 101:2	flawed 19:6,19 21:24 22:6,10 290:18 293:1	forgive 282:8
far 21:16 49:5 164:5 191:13 248:14,25 286:24 287:6	filled 308:11	flip 177:1 233:9 290:12	form 44:2,6 45:4,8 149:20
feature 124:4,9 129:17	final 55:16 194:2,8 328:22	flipping 236:24	
features 129:16	finance 82:20,22 83:4,17,21 100:18 101:18 104:12,12 166:25		
february 1:16 2:19 10:3,7 36:22 41:22 42:7,19 334:19	financial 83:18 139:16 199:11 210:3 268:16 275:13		
fee 46:17,20,21	find 135:16 138:15 159:8 172:2 177:2,2 203:16,19 205:5 227:4 234:5 238:21 258:12		
feel 31:17 34:8 117:21,22			
feeling 263:24			

[form - gold]

form (cont.) 235:23 236:4 298:19,20	french 122:15 131:22,23 132:4 133:19 134:21 135:6	general 37:23 45:2 61:25 75:18 77:14 90:25 99:4 126:22	glendale 10:23
formatted 56:3	french's 131:23	generalized 130:25 131:1 135:19 136:12 137:5 144:13 145:2 148:25 149:11,24 151:9,10 159:15 160:13 165:15 245:20 267:1 310:23 318:3 318:19,22 319:1	go 15:14,19 18:8 24:3 38:25 41:11 57:19 59:15 97:3 99:24 102:5,8,16 105:16 107:4,18 121:5 131:22 133:5 137:15 145:16,17 148:6 150:10 163:8,9 168:8 168:24 169:14 170:11 178:11 191:17 193:20 197:19,24 198:10 202:7 209:20 210:23 211:19 216:6 218:19 219:20 222:24 225:7 227:23 230:23 233:22 238:13 245:17 246:4,17 250:10,20 255:10 261:8 265:25 269:12 270:2 271:6,16 275:7 279:5 280:2 281:2 291:3 293:8 305:12 320:19 321:1,1,25 327:9
formed 43:17 44:12 45:25 61:12 275:19	frequency 31:18 32:3 34:15 127:13,25 128:3,15,21 256:1 257:18	generality 38:7 71:19 73:19 84:25 85:10 114:7 311:13	goes 96:23 103:20 204:4 207:2,7 207:22 250:21 254:10,11 283:19 327:2,25
forming 36:11 48:16 77:8 140:1	frequently 269:5	generally 13:21 14:5 17:11 21:1 116:15 132:10 135:4 138:13 212:14 276:20 295:2 309:20	going 10:6 15:23 24:11 34:7 35:1 37:11 39:22 46:9 50:20 52:12 58:9 59:20 60:20 61:1 69:19 75:7 78:22 80:5 92:14,15 96:25 97:19 98:7 99:24 104:25 105:4 107:24 108:12 116:3 118:6 121:15 122:7 123:3,14 124:7 138:15 139:6 147:7 148:5 170:14 175:1 177:1 181:23 182:19 190:1,20 193:9,10 195:5 201:2 206:25 208:25 209:1,5 211:19 214:19 215:15,22,25 216:10,17,18 216:24 217:4 219:6,24 220:21 221:3,6 222:2,10 227:16,16 230:14 231:21 232:11,12,13,22 233:3,12 234:9,21,22 235:14 238:14 239:14 243:4 245:6 248:20 249:19 252:11 258:23 259:10 266:2,15 270:17,19 276:6 288:24 292:7 297:5 303:15 306:11,15 307:3,4 310:4 311:24 312:11 313:18 323:24 324:13 329:20
forms 216:20	friday 111:9	generate 196:7,13	gold 157:15 179:20 197:21
formula 33:21 138:2,3,14 202:7,17 254:18 255:12 316:1,20,24 317:4,10,11,12	full 12:2 77:24 89:12 90:7 110:7 143:18 156:20 160:20 173:18 176:5,16 183:24 184:15 186:5 188:5 192:15 233:13,18 250:8 309:14 314:19	generated 237:11 298:4,21 300:1	
forth 16:8 26:2 28:4 29:6 36:12 51:23 53:23 61:13 93:24 94:8 116:5 125:22 138:10 138:19 149:5 150:2 158:20 180:11 181:22 245:11	fully 12:12 17:23	generates 189:18	
fortunes 236:16 293:11	func 190:2	generating 189:19	
forty 186:1 322:2	function 81:3,7,11 119:2 123:13 124:12 147:9 173:18 180:17,18 190:3 208:4 214:18 243:5	genie 220:2	
forward 96:25 234:21	functions 82:3,7,11	gertzman 5:17	
found 27:2 30:23 208:6 225:11 316:24	fundamentally 19:6,19 21:23 22:10 290:18 293:1	getting 198:19 256:15	
founders 274:18 278:18	funds 20:19 248:8,10,16 249:2 258:8 270:11,14,16,22 271:2,4,8,12,12,19 272:2 281:3,8,11,21,22 282:13,20 283:1 293:13 297:12,14 298:17,18 299:6,24 300:18	give 20:3 32:4 33:1,4 46:9 47:19 75:20 107:5 109:7 138:16 138:25 140:17 156:17,21 161:23 169:15 172:6 182:18 208:15 209:6 217:9 225:11 233:13 256:1 258:12 259:14 270:4 274:12 275:7 279:16 283:9 285:3,7 286:10 303:23 304:11,13 314:1 315:15 319:7	
four 137:22 138:9 158:9 186:1	further 76:5 126:5,9 173:23 179:21 179:22 279:8 332:15 334:14	given 16:22 34:12 71:21,22 73:14 73:16 74:14 75:12 76:11 97:1 116:23 119:6 123:21 128:21 131:14 154:20 158:22 179:3 180:21 182:24 183:11 184:1,7 190:2 200:4 206:15 212:16 221:17 238:11 247:18 287:6	
fraction 287:6	furthermore 152:24 273:22		
fractions 108:3	future 234:6		
frame 41:23 42:7 44:22,25 98:25 98:25 140:7 146:1 149:10 153:18	garlinghouse 1:8 2:8 5:3 10:12 38:9 313:13 324:21 326:10		
framed 175:24 267:17	garrison 5:15		
framing 118:25	gene 69:19		
frank 1:15 2:15 7:4 12:2 334:5	g		
frankly 45:4			
frederick 4:10			
free 191:24 194:16 226:10 273:24 275:21 277:8 278:9			

[gold - hypotheticals]

gold (cont.) 223:18	gsr (cont.) 285:17,19,24 286:2,3,4,11	hear 294:1 310:7	holds 286:16 288:2
gomphers 209:23 210:17 211:7	286:14 288:22 314:8,18,20	heard 203:9 330:9 332:2,6	holidays 110:22
good 10:5 11:10,20,23,24 15:24 59:12 122:2 170:9 210:1 211:15	314:22,24 315:4,5 320:12 320:21 324:21 328:23 329:5	held 2:16 10:15 65:21 249:7 273:2 297:22	hop 279:2 328:12,13,17,17,17 328:21,25
goodness 177:12	gsr's 319:13 320:14	help 99:16	hope 234:4
gotten 85:4	guess 41:21 100:22,24 101:6 118:24 119:12 120:17 123:13,18 128:7 133:5,16 136:23 184:23 188:7 204:16 213:13 214:9 220:7 226:13 259:3 277:19 294:19,24 295:24 319:23 320:8	helped 53:18,19 56:15	hops 328:18 329:7
gottlieb 5:5		helpful 33:7 184:16 271:16	horizon 286:17,20 288:2 290:1
governance 210:2		helping 126:17	horizons 295:8
governing 284:14,15	h	helps 90:9 271:17	hour 222:2 266:5,7 319:14 320:15
government 63:13,16,22,25 64:9	hamilton 5:5	hereunto 334:18	hourly 46:23 47:8
governmental 63:8,18	hand 18:2,3 24:2 141:15 144:17 155:1,2 159:4 172:25 187:14 188:10 191:5,6 193:8 229:15 241:22 314:4 314:10,21 315:2 334:18	hesitant 119:12	hours 49:7,8,9,11,22 50:4
government's 63:14	handful 65:10 305:15 309:20	high 38:2 64:16,20 71:19 146:15 146:18 177:17 217:23 321:20	howey 17:20 19:24 23:16 42:24 43:13 290:23 291:7 293:25
gradillas 10:21	handing 107:8	higher 120:18 121:16 128:15 199:4 290:4	hu 136:7 137:14
granular 139:23	hansen 4:10	highest 164:21	huber 12:20 200:21
great 172:12 182:17 197:6 208:18 302:21 329:16	happen 64:14 155:15 211:5	highly 9:15	hundred 49:8,11 119:24
	happened 64:12 162:11,14 315:7	hired 37:14	hundreds 165:8
	happening 58:2 65:11 159:15 289:14	historically 98:22	hypo 97:10 207:1,13,14 255:15
	happens 39:12	history 63:3	hypos 252:6
	happy 114:12,14 154:17 155:8 171:17 185:14 233:9	hmm 171:13 172:21 247:8 265:20 314:22	hypothesis 194:14 203:6 218:20,20,21 219:2,20,21,22 220:2,6,21 220:23 221:1,3,6,23 231:17 231:23 238:25 239:4 267:17 311:1,2
	hard 238:10	hold 283:16 288:5 289:25 318:6 319:3,25	hypothetical 72:13 95:23,25 96:12 122:22 123:18 126:24 127:7,10,16 128:5 206:8,15 207:6 221:17 238:7,12 249:6,7 251:24,25 252:4,14 254:25 255:16 261:17,18 262:16 300:4
ground 140:9	harvard 209:9	holder 330:5,22	hypothetically 94:22 96:1 252:23 262:3,7 315:5
grounded 119:25 132:19 133:11 134:11	hate 266:9	holders 289:17 295:19	hypotheticals 252:6,20 255:1
grounding 100:22	hbs 209:9	holding 287:3 289:18 292:17 293:17	
grounds 51:14	head 52:3 118:7 201:3 202:6,18 211:14 216:16	holdings 273:23 275:21 276:10,11 277:7,13 278:9,10,14 281:8 281:15 282:4 287:7 297:20	
gsr 284:10,17,22 285:2,10,15	heading 228:10,12 290:12,16,21		

[hypothetical's - informed]

hypothetical's 127:15	immediate 93:14 94:20	includes (cont.) 285:21	indicating 197:5
i	immediately 19:17 194:13	including 30:12 32:7 60:24 79:12 83:22 88:8,11 89:15,22 100:3,12 130:22 134:18 153:13 156:11 176:17 195:19 235:11 269:21 284:2,10 285:6,22 326:5	indices 131:24 132:2 156:14 157:12,18 158:23
i.d. 325:6,23 326:4	impact 32:19,25 33:16,17 71:3 76:9 87:6,13 88:1 89:10 90:17 92:10 93:14 165:7 176:1 244:2,21 257:23 267:14,25 304:6 305:17 308:7,18 312:18 315:23 317:19,24 318:2,4,12,16,21 318:25 319:2	inclusion 30:13 166:10	indirect 292:18 324:20
i.e. 89:14 90:24 118:1 126:20 160:24 213:11 220:2	impacted 235:2	inconsistent 319:15 320:5,9	indistinguishable 193:15,19 194:10 195:11 195:15 196:1,10 197:4,17 197:23 198:3,9,12,18 199:9 199:14 200:3 207:19 212:11 213:11 215:3 217:21 218:24 219:5 224:9
icos 83:8	impacting 80:13 92:17	incorporate 83:4 117:24 126:9 159:15 167:6 257:7	indistinguishably 224:8
idea 267:4 309:4	impacts 98:10	incorporated 109:5,15 301:25	individual 12:25 141:11,14 156:9 276:6 290:6 329:6
identifiable 177:19	implementation 319:15 320:17	incorporates 231:1	individuals 56:6 274:9 275:17,24 276:24 277:13,20 278:21 281:13 282:4 297:18,22 312:1,12,12 313:8,20
identification 18:6 23:25 92:16 107:2 239:10 325:25 326:4,12	implemented 101:19	incorporating 274:8	inefficient 93:16 94:24 97:22 98:5,12 98:17
identified 33:19 75:15 90:22 93:11 106:11 109:1 237:10 274:19 278:18 288:20	implementing 320:13	incorrect 49:2 74:20	inference 324:9
identifies 90:2 94:19 105:1 107:21 109:10 267:19	implied 116:12 141:9	increase 99:11,12 236:7 237:21 245:8 252:7,20 260:23 261:5 283:4 299:20	inflows 255:20
identify 76:13 105:5 118:19 136:4 200:10,15 224:18 233:5 237:1 278:11 292:5 299:8	important 40:4 47:11 118:20 119:17 139:18 140:2 161:2,7,19 164:14 169:12,20 180:9 317:18,20,22 318:1,20	increased 97:10 182:8 235:23 236:22 260:20 271:4	influence 304:19 310:2,13 311:10,17 313:14
identifying 135:25 183:13 230:15 232:18 321:11	impossible 70:11	increases 89:17 90:10 206:17 324:1	influenced 78:19 79:4,17 80:4 309:18
ignore 300:12	imponded 142:24	increasing 90:5 182:1 234:14 236:4 244:17 245:2 261:11,12 270:18 322:22 323:9,15,16 324:16	influencing 311:11 312:7,21
ignores 320:9	improve 283:18	increment 253:17 257:9	inform 278:7
ii 20:7 272:19 299:22	inaccuracies 260:5	independent 138:6 173:1 282:7,7	information 77:17,21,21 78:2 80:8 114:3,12,24 115:5 116:1,4 116:10 118:25 119:1,5,11 119:15,17,20 120:1,4,11,21 120:24,25 121:7,9,13,23 137:5 138:4,20 142:23 144:14 158:11 159:5 164:25 167:6,21,23 168:12 168:16,19,21 169:4 171:19 215:4 272:15 273:4 332:11
iii 1:15 2:16 7:4 11:5 12:3 19:1,3,12 88:3,6 143:18,19 143:21 186:13,14,15,16 234:12 272:21 334:5	inaccurate 109:14 216:16 260:11	independently 273:24,25 275:18,21,22 277:8,9	informational 85:20 121:17 165:23 168:13
iii.c 88:14,20,25 89:3,4,9 91:12 91:14 94:8,10 143:22 149:5 150:2 186:11 235:4	include 24:16 34:17 139:7,7,8 142:2 157:7,21 158:4,13 159:10 184:1,6,16 188:5,19 188:24 189:15 227:18 235:5 251:5,8 269:9 275:17 289:4 301:12 315:4,5 321:10 332:12	index 7:1 9:1 131:21 133:2,6,14 133:25 134:5,14,20,24 135:5,11,20 157:14,15,15 159:2,20,21 223:17	informed 132:15 136:22 176:4
iii.d 88:17,25 143:23 245:12,17 246:2	included 24:9 162:5 173:3 288:9 314:23 315:1 321:13	indicate 126:18 153:1 155:15	
iii.d. 91:17 246:1	includes 60:15 175:4 183:15 212:10 213:12 217:19 267:19	indicated 3:1 178:5 325:7	
illiquid 267:6		indicates 173:20,21 213:16 298:25	
illustrative 317:16,21,25 318:2,21,25 319:4			

[informed - kellogg]

informed (cont.) 274:17	interchangeably 115:9 181:8	investment (cont.) 331:15	jensen's 211:11
informs 70:21,25 196:2	interested 88:20 119:1,7 124:18 128:22 147:5 206:12 318:1	investors 236:22 270:17 271:8,19,20	jersey 2:21
infre 64:14	334:14	invokes 273:19	job 1:25 205:24
infrequent 64:14	interests 301:9,11	invoking 118:16 276:21 293:24	join 53:5
infrequently 64:15	interfaced 50:23 52:4 53:4 54:11 57:1 99:25	involve 16:22 17:8 301:8	joining 12:7
inherent 211:17	interfacing 52:16 53:22	involved 39:9,11 63:14 269:23,24	jon 3:11 12:6
initial 25:3,5 233:13 279:3 303:20 305:14 309:8 310:19 314:15	interference 256:16	involves 38:3 70:3 316:2	journal 104:11,12 139:16 166:25 209:24
inputs 105:25 185:4 316:19,23 317:7	internal 278:2	involving 85:12 246:22 273:14	judge 44:13 45:23
inquiry 146:1 157:5	interpret 76:10 148:16 149:4 150:1	irrelevant 108:16,24	judgment 106:13 130:6 139:9 169:13
insignificant 113:13 183:5 197:2 204:8 204:23 205:14 222:20	interpretation 137:2 143:2,7 228:22	irrespective 98:22 99:7	july 286:13
insofar 312:25	interpreting 228:21	ish 83:18	jump 106:23
inspected 105:18	interrupt 15:12 23:5 41:10 118:9 296:11	ishii 209:23 210:17	june 285:25
instance 157:21 165:19 168:5 172:24 244:15 284:17	interruption 51:8 256:18	issue 38:6 80:14 84:22 102:5 147:10 205:12 237:24 277:1 284:20	junior 46:25 47:5,13 48:12 52:3,6 54:5
instruct 58:25 59:7	intersects 307:9	issuer 84:9	justin 4:13
instructed 105:19	interval 95:2 97:15 122:25,25 127:1 129:13 212:9,10,15,23 213:9 214:1,14,16,17,20 215:7,10,25 216:7,23 217:18 218:1,3,7 219:7 220:22,25 221:21	issues 29:16 45:19 83:6 85:8 198:20,22 236:13,13 276:3 279:3 281:18 282:17	k
instruction 48:13 60:6,21 61:1 294:2	intraday 94:16 95:1,13 321:4,8,10	issuing 83:11	keep 115:8 234:9,21 269:7,7
instructions 47:2,6 51:23 53:12,13,24 54:13,22 55:24 56:16 100:2	introduce 261:16	italicize 235:24	keeping 266:9
instrument 207:22 208:5 330:4,5,7,20 330:22,24 331:4,6,7	introduced 260:5 264:9	items 90:16	kellogg 4:10,11 11:12,15 12:19,20 13:23 15:11,17,24 17:3 18:13 19:25 20:15 21:3,19 22:14,23 23:18 25:11 28:23 29:7 34:23 35:17 36:4,14 37:4 38:20 39:7,11,14 40:19 43:1,8,19 44:5,20 45:11 47:22 48:14 51:13 53:17 54:9,18 55:9 56:9,23 57:8,18 58:5,9,15,19 59:3 60:9,17 69:17 70:17 71:8 71:18 72:9,23 73:11 74:1 74:10,23 77:16 78:21 79:7 79:18 87:16 88:4 89:11 90:19 91:13 92:12 94:4,11 95:15 96:17 97:9 98:1,18 98:23 107:23 108:22 113:3 113:19 117:5 118:12,22 119:19 120:8,16 122:1 123:10 126:4 127:6,21
instruments 83:15	introduces 262:22	jacket 256:17	
intend 24:9,19 27:15 28:12	intuition 142:19	january 248:8,18 249:3	
interact 85:9	invalidates 220:4	japanese 157:16	
interacted 50:20 51:25	invest 14:16	jberg 4:23	
interactions 51:21 55:10 56:11 60:12	investment 13:18,20 14:4,8,13,16,19 14:23,25 15:6,9 16:5,10,16 16:19 17:2,5,25 233:23 234:1,25 330:4,17,21 331:5	jdaniels 3:18	
intercept 205:22 206:10		jed 273:1,22	
		jensen 209:9	

[kellogg - level]

kellogg (cont.)	know (cont.)	know (cont.)	late
129:1 130:9 131:16 132:17	35:24 36:5,20,23 37:21,25	307:3,9 311:4 314:8,18	287:10,10
133:3,15 134:4 135:1,12	39:11 40:5,6,17 41:4,20	315:4,4 316:2 318:5 320:3	law
136:19 139:21 140:6 141:3	44:9,24 45:4 49:16,17,18	329:7 331:25	13:3 16:18 17:7 40:5 66:4
141:22 142:21 143:3,10	52:3 53:18 54:11,23 55:4	knowledge	82:22 83:3,21 84:4 301:5
144:8,23 145:12,24 146:14	56:3,17,17 57:24 62:20	14:14 38:15 55:2,3 118:13	301:24
147:2 148:19 149:2,9,16	64:1,5,12 67:4,16 68:19	131:1	laws
151:5,17 152:4,18 153:8	70:6,18,19 71:11 74:11,24	known	43:7 44:4 45:10,22 83:7
154:14 155:3 159:11 160:7	76:8,12 83:9 85:8 86:14	31:6 132:7 169:22 210:16	85:10
162:8 163:16,25 164:19	88:6,7,9 93:12 95:22 96:9	210:20	lawsuit
165:10 166:11 167:18	96:11 99:12,22 101:17,17	knows	38:6 42:2,14,16
170:8 171:5,9,14 174:17	103:7 104:24 105:20	146:19	lawyers
175:15 176:11 177:24	108:15 109:20 111:2,12,15	I	38:18
178:23 179:10 181:2 182:9	112:3,17,18,20 113:6,6	label	lay
182:15 184:21 190:15	114:5,11,20 115:2,3 116:12	163:12 258:21	292:12,12
192:25 195:13 196:5,18	116:12 119:13 120:19	labeled	layman's
199:19 200:6 201:12,20	121:23 123:22 124:13,16	86:8 115:14 140:18 147:12	177:8
202:4,14 203:13 204:10,25	128:13,16,21 129:5,5,16	228:6 324:19	layperson's
205:17 206:4,24 207:12	131:19 134:5,9,10 135:15	labs	133:24
208:11,24 212:17 213:1	135:21 136:6 138:8 139:16	1:7 2:7 4:2 10:11	lead
214:4,25 215:12,21 216:9	141:9,10,13,13,17 145:4,17	lack	181:16 238:24 244:18
216:14 217:3,11,24 218:17	147:4 149:17,18,19,19	49:17 158:22 175:25	leads
219:15 220:17 221:12,18	152:8,11 154:2 155:8,15	298:15	324:2
222:7 223:24 224:12 225:4	156:15 159:2 160:24	lag	leakage
229:8 230:2,22 232:10	162:11,12,13,16 163:2,4	246:6,8 323:22,23 324:12	80:8
237:8,18 238:6,23 239:21	165:2 167:8,21 168:6,9	324:13	leave
239:24 240:12 241:13	169:12,18 175:18 179:22	lagged	41:21 175:16 214:10
242:3 243:1,18 244:5,25	180:8,15 182:16 184:17	247:15 251:8	216:10 223:5
245:15 247:13 248:19	185:8,13 187:11 189:7,15	land	ledger
249:4,16 250:19 251:23	189:24 190:6,17,21,23	72:13	314:20
252:17 253:7 257:25 260:8	191:14 192:10 193:10,12	language	left
260:15 263:1,19 266:6	195:17 198:24 200:10,14	125:13 258:10 304:13,18	188:10 190:22 191:5
268:2,7 271:14 278:15	200:22,25 201:13 205:11	305:3	208:23 229:15 296:13
287:11 290:2,24 293:2,22	207:16 209:1 210:20	lapse	314:21
294:5 295:5,21 299:10	211:15,21,23 212:12 213:8	66:6	legal
301:1,13 302:4,7,13,17	213:9,10 214:8,9,13 215:9	lapsed	10:20 13:24 14:8,10,17,20
303:6 307:20 310:6,15	216:12,15 217:6,8,25 219:4	66:7	15:2,7 16:12,14,18,20,20
311:12,18 312:8,23 313:16	219:21 221:5,6 222:24	large	16:21,22 17:7,8 23:19 43:9
317:1 318:14 320:18	223:3,5,6,9 225:25 227:9	47:13 66:24 69:8,11 105:7	43:10,20 44:6,12 45:5,6,12
321:17 323:2 325:13 328:3	229:12 230:13 232:1 238:8	106:13 109:17 165:16	45:18,19,23,25 48:16 69:9
329:15 330:8,25 331:8,17	240:25 241:2 243:4 244:7,8	293:15	69:16 75:11 290:25 291:4
332:21	244:17 245:3 247:25	larger	293:23 294:6,7,12 295:12
kelloggghansen.com	248:14,25 252:20 254:17	38:4 167:13 287:16	301:2,3 309:9,11 331:1,9
4:21,22,23,24,25	255:11 256:7 257:19 258:9	largest	331:11,19
ken	258:11 260:16 261:4	140:19 141:4,16 142:5,6	legs
131:22	264:25 265:2,3 268:22	166:4 169:16,18 172:9	297:2
kept	269:12 271:15,24,25	197:12,16	letter
53:20	273:15,18 274:6,23,24	larsen	12:22,24 13:5,6,9 36:24
kind	275:9,11 276:19 277:20	1:8 2:8 5:13 10:13 38:12	letters
70:2 83:15 189:7 220:4	279:22,24 280:1,3,3,9	273:1,22 277:6 278:8,12	13:3
271:3,4 296:10	281:11 282:24 284:18,25	279:6 281:22 285:22	letter's
knew	284:25 285:20 286:1,3,6,23	313:13 324:21 326:9,14,15	12:21
31:19 210:17	288:14 289:9,9,13 290:11	328:22 329:4	level
know	293:17,19 294:24 295:9,25	larsen's	27:9 31:17 38:2,6 71:19
13:8 15:22 24:11 31:11,13	296:1,2 299:1 300:12 301:4	282:14,21	73:19 84:25 85:10 103:16
31:23 32:18,20 34:24 35:2	301:8,22 303:11,16 306:1		111:20 113:14 114:6

[level - market]

level (cont.) 146:15,18 200:24 204:19 212:12,18,19 213:12,17,22 216:23 226:12 250:2 256:11,20,23 257:13,16 269:22,22 290:7 311:13	liquidity 266:23,25 267:3,10 283:19	long (cont.) 209:11 235:7 238:19 260:17 266:1 286:17,20 287:4 288:2 289:18,25 295:19 305:17 309:17 310:3,13 323:3	lowanski 54:24
levels 256:1 257:18	list 33:3 40:6 52:2 68:9 90:7 118:6 145:15	longer 15:23 52:22 154:9	lower 115:24 120:20 121:17 162:6 167:12,17 176:7 186:24 244:19 279:22 280:12,12,14
levinson 68:22	listed 27:24 28:2,2 68:3,6,7 69:12 70:5 86:12 90:17 108:19	look 13:4 29:11 30:6,19 68:6 70:21 84:12 91:2 101:24 106:10,19,20,24 109:6 114:13,14,19 115:11 127:17 135:14,19 146:16 147:11 155:18 163:15 172:19 176:16 185:18 199:1 205:13 208:9 209:8 209:21,22 210:4 211:19,25 213:13 221:24 223:15 228:2 236:14 258:2 259:17 265:22 274:5 280:3 286:22 287:18 307:23 308:4 309:13 313:22,22 320:1	lunch 170:9
lewinski 52:13	listing 197:12 267:13,19,24 280:12	looked 92:3 101:15 103:1 135:3 152:2,17 161:5 183:15 224:1 227:22 286:25	luncheon 170:15
lewon 52:13	litecoin 169:19	looking 19:8,10 105:22 128:19 129:7 143:21 150:24 151:7 151:8 154:5 166:16 172:17 175:2 177:4,6 181:12 186:22,23 187:11 190:5 199:2 206:2 208:19 210:21 212:3 223:9 240:13,24 242:9,17 250:25 251:2,5,12 251:17 253:13 259:18 269:8 275:13 280:21 287:19 290:10 305:13 319:7 325:2,3 326:13 327:18	m
lewonski 52:13,14 53:2	literature 16:4,8,25 20:25 21:2 22:12 22:21 35:22 69:18 100:17 100:18,19,24 101:7,10,25 102:2,7,10,23 103:3,8,18 104:4,4,7 112:19 116:16,19 116:25 117:3,10 118:15 127:24 129:10,25 130:13 130:17 131:2,13,15 132:6,6 132:12,16,19,20,21,21,22 132:23 133:9,12,18 134:12 134:13,19 135:7,22 136:14 139:13 140:8,10 146:10,20 146:21,23 149:22 153:22 154:4 155:11 157:19 159:3 159:19 160:10,15 166:7,22 179:25 204:19 209:8,11,15 210:6 211:1,8 224:22 239:4 257:22 267:9 295:3,7	looks 105:6 326:25	magnitude 204:4
lexecon 12:22 13:6 47:1,5,13,17 48:8,16 49:25 50:3,23 51:2 51:19,20 52:11,20 53:5,24 54:6,25 55:7,11,23,25 56:5 56:7,12,14,19 57:3 99:21 100:1,10 105:19 171:12,15	litigation 15:1 68:21,25 152:7 169:22 233:16	losses 236:23	mail 4:8,21 5:10,21
license 66:1	little 15:17 23:7 33:16 62:12 108:9 120:17 137:11 159:12 210:24 266:6 279:19,25 282:9 287:13 328:7	lost 197:2	main 77:14 100:24 302:7
licenses 65:22,25	liu 104:11 137:14 166:23	lot 40:5 46:6 53:22 100:12 117:20 134:8 169:24,24 247:1 250:16 258:6 259:17	maintenance 321:24
life 62:19	llp 4:3 5:15	lots 121:10	majority 63:5 279:9 280:16
lifetime 62:6,9	locate 271:10	low 177:17 280:8 321:6,9,11,20 321:23	maker 30:20 247:22 286:14
likelier 220:15 221:15	located 10:21		makers 283:17,22 284:12
likewise 197:22	logical 158:18,25		making 20:23 101:18 140:25 225:6 265:6 280:24 304:25 305:4 323:19,23
limit 105:9 118:9 264:21 265:7	lombardozzi 1:24 2:19 334:25		manage 234:15 299:17
limited 89:16,22 303:4 307:17	long 32:6 91:6,20,25 95:19 97:1 125:2 128:17 150:16		management 283:6
line 9:4,11,16,21 190:4 254:7			manner 120:21
linear 8:4 240:24 241:4,6 242:10 242:13,17 243:9			mark 3:9 11:13 12:4 87:16 122:1 123:4 163:16 170:8 171:5
lines 31:10 52:15			marked 9:15 18:3,5 23:24 24:2 107:1,8 239:7,9
lingering 42:4			market 30:20 37:23 62:2 68:11,25 69:5,15,22,24 70:9 76:8,9 79:13 85:21 91:21 93:16 96:10 97:22,25 98:4,5,11 98:17 99:4 118:21 119:18 120:5,12,22 126:22 131:21 133:2,6,13,25 134:5,14,20 134:24 135:4,5,11,14,19,20 137:3 140:19 141:5 142:5 146:4 149:11,20 150:9 151:22 153:11 154:7,22 156:2,6 157:14 158:23,23 161:17 162:1,5,23 163:3
lining 241:1			
link 73:10,24 74:21			
liquid 267:5			

[market - mischaracterizing]

market (cont.) 164:5,17,20,22 165:6,8,15 166:5,9,21,24 172:9 176:10 179:19 180:10 182:5 184:11 187:8 194:18 207:24 222:25,25 223:2,11 223:16,17,19 224:10,16,17 225:17 234:25 236:7 244:3 244:7,9,16,23 245:1,2 246:14 247:12,22 248:14 248:25 249:14 260:9 261:2 263:3,13 283:17,19,22 284:11 286:14 288:4 289:1 290:11 304:6 305:17 306:9 306:10,11,13,15,16 307:3,5 307:18 308:6,17 313:6	maxim 148:25 maximize 300:24 maximizing 301:12,17 mccaleb 273:1,22 275:2 277:6 278:8 278:12 279:6 281:22 mccaleb's 282:14,21 mccrimmon 6:3 mcsi 157:14 mean 16:15 23:5 35:8 37:16 41:9 45:15 58:7 77:21 78:14,22 92:1 99:5 101:13 103:2 106:23 114:10 120:17 124:4 127:11 128:13 133:4 133:5 134:6 136:18,21 144:10,24 150:23 156:7 169:3 176:8,24 177:5,11,25 179:12 185:5 187:13 188:4 188:4 189:23 190:17,17 191:2,10 197:10 201:13 205:1 208:25 210:15,15 211:10,11 213:20 224:13 227:9 238:13 242:1,5,8,19 242:22 243:11,13 244:8 256:3 257:2 259:22 270:14 271:12,15 275:5 276:1 286:20 291:23 292:4 293:24 294:1,20 295:6 298:11 300:11 306:6	mechanism 244:10,21 media 60:2 122:13 222:11,17 333:1 medium 81:11 82:3 mem 39:2 member 65:23 66:3 memorized 116:9,12 138:3 memory 37:12 38:22 39:9,13 41:18 41:23 42:12 44:21 52:9,23 55:14 64:2 80:17 136:6,8 183:22,23,25 184:3 214:8 215:24 216:22 276:5 mention 20:19 31:25,25 32:5 35:14 84:22 85:5 137:13,14 209:23 304:11 mentioned 35:3 36:16 84:19 85:6,7 97:20 183:1 211:11 223:20 235:12 267:23 278:16 mentions 31:24 84:11,13 merging 53:23 54:16,21 merwe 50:22 51:25 53:15 54:15,24 57:4 100:1 met 38:9,12,15,18 meta 316:4 method 212:14 290:10 methodological 245:20 methodology 73:9,18,18 103:21 116:15 132:14 135:25 140:3 165:21 220:5 239:3 309:22 metric 177:11,12,12 232:22 metrick 209:23 210:17 [REDACTED] 7:23 24:15,24 25:5 26:5,17 27:4,13 29:8,10 96:21 104:25 107:9,10,20 108:18 111:16 114:17,19 182:16 182:20	[REDACTED] 25:7,14,19,23 26:2,7,12 27:17 29:14,24 93:25 106:1 106:5,19 113:11 183:15 185:13 196:12 221:24 228:2,17 229:4 230:20 231:6 232:9 237:2 238:2 mgertzman 5:22 mic 51:6 michael 4:11 5:17 18:10 microphone 256:16 microsoft 293:20,21 294:3,4,8,16,17 295:17,18 mid 226:4 middle 183:5 215:16 216:1,2,17 mike 209:8 211:11 million 108:5 162:24 164:6 165:3,3 166:1,2,25 167:2 248:7 261:21,23 262:8,10,17 326:15 327:2,7,23 millions 165:9 mind 40:6 64:2,6 103:23 111:6 111:14 112:17 198:25 202:1 205:11 250:24 319:19 mine 56:5 minimize 308:7,18 minimum 161:17 165:24 166:9 minkin 3:10 12:6 minkina 3:17 minute 59:12 270:4 minutes 296:13 329:11 mis 328:6 mischaracterizes 56:10 mischaracterizing 131:17
marketcap 197:16 marketplace 80:8 83:16 237:23 244:12 245:5 261:11 306:4,8 markets 75:19 77:15,18 91:1 119:9 119:22 120:6 121:14 137:6 143:13,14 144:14,15 145:2 149:24 151:11,12 152:11 152:23 159:16,24 160:1,14 175:5,13,20 178:8 181:14 195:6 306:10 309:5 market's 68:15 94:24 175:25 288:18 markup 57:25 materials 28:2 34:18 35:25 53:20,21 86:8,12 326:3 math 216:4,24 261:18 matrix 77:25 78:2 114:4,12,25 115:6,24 116:2,5,11,11 119:6,16 120:20 121:2,16 167:22 matter 10:9 22:6 40:13,14 47:6 48:13 49:5,23 50:5 76:19 95:18 103:14 155:12 206:9 234:14 292:2 301:14 305:14 matters 39:14 45:6 80:2,7 160:9 mature 175:6,14,21 maturity 175:25	maxim 148:25 maximize 300:24 maximizing 301:12,17 mccaleb 273:1,22 275:2 277:6 278:8 278:12 279:6 281:22 mccaleb's 282:14,21 mccrimmon 6:3 mcsi 157:14 mean 16:15 23:5 35:8 37:16 41:9 45:15 58:7 77:21 78:14,22 92:1 99:5 101:13 103:2 106:23 114:10 120:17 124:4 127:11 128:13 133:4 133:5 134:6 136:18,21 144:10,24 150:23 156:7 169:3 176:8,24 177:5,11,25 179:12 185:5 187:13 188:4 188:4 189:23 190:17,17 191:2,10 197:10 201:13 205:1 208:25 210:15,15 211:10,11 213:20 224:13 227:9 238:13 242:1,5,8,19 242:22 243:11,13 244:8 256:3 257:2 259:22 270:14 271:12,15 275:5 276:1 286:20 291:23 292:4 293:24 294:1,20 295:6 298:11 300:11 306:6 meaning 13:21 14:5 16:21 17:11 96:13 136:21 143:15,24 209:11 255:19 282:19,22 meaningful 204:2 205:8,9 meaningfully 76:10 means 45:14 104:8 150:24 154:23 177:9 178:15 217:19 242:23 243:13,14 289:23 290:4 321:7 meant 260:19 299:2,2,23 300:15 measure 185:6 208:21 209:13,16,18 210:7 211:2 257:23 measured 263:11	mechanism 244:10,21 media 60:2 122:13 222:11,17 333:1 medium 81:11 82:3 mem 39:2 member 65:23 66:3 memorized 116:9,12 138:3 memory 37:12 38:22 39:9,13 41:18 41:23 42:12 44:21 52:9,23 55:14 64:2 80:17 136:6,8 183:22,23,25 184:3 214:8 215:24 216:22 276:5 mention 20:19 31:25,25 32:5 35:14 84:22 85:5 137:13,14 209:23 304:11 mentioned 35:3 36:16 84:19 85:6,7 97:20 183:1 211:11 223:20 235:12 267:23 278:16 mentions 31:24 84:11,13 merging 53:23 54:16,21 merwe 50:22 51:25 53:15 54:15,24 57:4 100:1 met 38:9,12,15,18 meta 316:4 method 212:14 290:10 methodological 245:20 methodology 73:9,18,18 103:21 116:15 132:14 135:25 140:3 165:21 220:5 239:3 309:22 metric 177:11,12,12 232:22 metrick 209:23 210:17 [REDACTED] 7:23 24:15,24 25:5 26:5,17 27:4,13 29:8,10 96:21 104:25 107:9,10,20 108:18 111:16 114:17,19 182:16 182:20	[REDACTED] 25:7,14,19,23 26:2,7,12 27:17 29:14,24 93:25 106:1 106:5,19 113:11 183:15 185:13 196:12 221:24 228:2,17 229:4 230:20 231:6 232:9 237:2 238:2 mgertzman 5:22 mic 51:6 michael 4:11 5:17 18:10 microphone 256:16 microsoft 293:20,21 294:3,4,8,16,17 295:17,18 mid 226:4 middle 183:5 215:16 216:1,2,17 mike 209:8 211:11 million 108:5 162:24 164:6 165:3,3 166:1,2,25 167:2 248:7 261:21,23 262:8,10,17 326:15 327:2,7,23 millions 165:9 mind 40:6 64:2,6 103:23 111:6 111:14 112:17 198:25 202:1 205:11 250:24 319:19 mine 56:5 minimize 308:7,18 minimum 161:17 165:24 166:9 minkin 3:10 12:6 minkina 3:17 minute 59:12 270:4 minutes 296:13 329:11 mis 328:6 mischaracterizes 56:10 mischaracterizing 131:17

[misimpression - non]

misimpression 126:7	model (cont.) 192:2,5,8,21 193:1,3,16	motivated 128:19	necessarily 207:13 244:6
mispronounce 52:12	194:23 195:4,9,11,17,25	motivation 140:12	necessary 215:5 218:22
misreading 328:7	196:4 202:20 205:15,18,20	motivations 263:17 311:21,21,25	need 15:21 76:8 127:16 139:20
misrepresenting 213:8	205:22 208:23 210:11	312:11 313:2,7,19	171:20 172:10 182:19
misstatement 159:13	211:4,17,18,20,24 221:22	move 149:23 170:5 224:20 279:7	204:11,13 218:19 238:9
mistaken 235:3	228:7,13,18 230:3,4,14,15	283:7 286:8 296:7,15	296:2 310:7 322:24
misunderstanding 92:23	232:5,11,13,14,18,20 235:5	324:17	needed 160:11
misunderstands 165:13	237:15 238:14 250:12	moved 52:23 153:5,6 154:12 247:9	needs 159:14 322:18
misunderstood 158:7	251:18 252:1,8,13 253:5	movement 85:16 153:1 154:19 249:23	negative 147:22,25 172:17,23 173:3
mixes 113:7	254:13 257:5,8 272:20	movements 75:18 90:25 99:4 119:8	173:15 180:19 193:23
mixing 110:23	192:13 193:21 196:11	125:22 126:23 137:7	199:21 200:2 207:17 208:1
mkellogg 4:21	203:1 295:11	143:12 144:13 150:9 151:9	208:3 210:9 211:3 232:16
mm 171:13 172:21 247:8	model's 124:18 177:23	151:10 152:11,13,16,16,23	net 228:6,13 250:1,14,21,22
265:20 314:22	moment 33:4 138:15 156:17 172:6	153:11,16,17,21,21,24,25	251:7,12,17,24 252:4,5,9
mod 127:1	177:1 259:17 264:6 275:8	154:7,12,22,25 155:1	252:14,19,19,20 256:25
model 20:21 26:24 31:12,18,20	279:16 283:9 285:8 314:1	165:14,15,18 167:9 168:14	257:22 262:22 263:6
32:9,13,19,25 33:25 34:20	315:15	304:5 310:23	265:13,14,22 267:18
35:5,15 36:3 53:6,10,11	monday 111:12	moves 149:10	268:12,14 269:11,16,16
73:13,14,18,22,23 74:3,4	mondays 110:23	moving 61:18 69:2 141:13 188:10	286:21,25 287:5,9,12,15
74:16 75:22 76:16 77:19	money 300:12,13	229:15 247:4	314:13
78:5 79:10,15 80:2,10 86:2	moneygram 30:6 198:22	msc 157:14	nevertheless 30:17 132:14
88:12,15,16,20,21 89:19	month 44:24 112:2,3,10 206:15,18	mse 241:23	new 1:2 2:2,17,17,21,21 3:8,14
90:12,15 91:16 93:17 95:6	209:3,6 250:16,17,18 251:8	multifaceted 255:22	3:14 4:6,6 5:19,19 10:17,18
96:19,24 97:8 105:24	254:10,11,12 264:11,16,20	multiple 49:16 269:24 287:4	69:12 70:4 83:18,18 206:16
108:10 109:21 111:13,22	286:24 287:6	n	215:15,22 216:2,5,17,24
113:2 122:19 123:12,14,15	monthly 31:15 128:1 129:4,8 184:20	n.w. 4:17	220:2 267:13 334:1,3
123:17,19,25 124:4,9,10,10	191:23 194:15 199:3,4	name 10:19 11:25 12:2 50:21	news 70:15 71:3,7,17 72:7,16,18
124:12,22 125:21 126:25	206:23 207:11 225:24	52:13	72:21 73:10,25 74:21 76:3
127:10,11,19 128:3,23	226:9,15 227:14,16 230:5	named 278:7 334:9	90:8 92:14 94:2,18 95:24
129:10,15 130:13,17,20	242:23 243:14 250:14	narrow 14:1	96:9,13,14 97:5 126:16
131:1 136:1,5,9,13 138:7	251:6 252:9,14 255:22	national 110:22	231:11,25 232:3
142:14 143:23 144:10	256:13,19,22,25 257:14,14	natural 184:9 257:8 296:23	nicole 5:6
145:17 146:6 147:5 149:22	265:2,7,10,14,24 269:6,21	nature 40:21 48:17,22 130:1	night 76:20
153:22 154:3,18 155:11,11	275:11 276:12 287:12	131:15 132:13 232:14	nine 96:1
155:17 157:5,6 158:17	months 216:19	near 19:4	ninety 115:9
159:18 165:14,21 166:6,10	morning 10:6 11:10,23,24 168:25		nitpick 149:17 207:1
167:3 168:14,19,22 173:20	174:22 182:17 183:14		non 30:6,12 77:18 90:25 119:22
174:6,7,7 176:16 178:20	247:18,21,24 303:13		120:6,22 125:3,21 127:3
179:2,5 180:2,4,21 184:17			137:5 143:13 144:13
185:6,7 188:5 189:20,22			150:17 151:2,8,14,22
190:1,10,14,18,21 191:3,16			

[non - okay]

non (cont.) 152:22 154:21 156:2,6 159:5,23 160:1,13 178:7 187:8 191:25 194:17 195:6 223:16 224:21 226:11 235:9 247:6,10 248:9,16 249:1,13,19,21,24 285:22 289:17	numbers 261:18 265:13 nw 5:7	objection (cont.) 293:2,22 294:5 295:5,21 299:10 301:1,13 303:6 307:20 310:6,15 311:12,18 312:8,23 313:16 317:1 318:14 320:18 321:17 323:2 325:13 328:3,5 330:8 330:25 331:8,17	occur 42:17 occurred 55:16 60:16,25 63:11 75:5 96:12 182:25 184:8 237:6 246:23 occurring 96:3 244:14 occurs 14:24 205:3 309:5 october 7:14 28:20 odl 198:22 283:20 offend 39:3 offer 24:9 308:24 offered 28:20 80:19,23 81:2,6,10 330:4,20 331:5,15 offering 71:25 73:7 85:19 97:23 153:15,23 222:19 293:13 311:16 312:5 313:12 319:13 offers 283:18 offhand 17:15 34:24 35:2 36:6 70:10 162:12,13 163:2,4,7 217:25 230:24 250:11 265:12 275:4 276:10 office 3:8 offices 2:16 10:16 oh 18:14 32:5 33:10 82:21 107:17 114:10,16 137:13 158:7 196:22 197:10 211:10 248:3 261:7 286:10 296:17 308:8,15 325:2
noncryptocurrency 143:13 nontrivial 257:12 normalize 253:15 normally 289:21 north 62:4,5,7,9,14,16 66:25 67:2 67:13,16,17 notary 2:20 note 62:10 91:15 272:6 303:11 303:15 325:5 328:11 noted 10:24 324:24 notice 2:21 noting 34:13 notion 319:24 novel 121:22 136:14 308:19 november 7:19,24 320:1,1,7 ntatz 5:10 null 194:14 200:13 203:5 218:21 219:2,20 220:23 311:2 number 7:10 8:2 10:13 33:16,17,20 39:10 40:7 49:6,18 61:24 62:2,3 63:1 64:16,19 65:1,2 65:3 66:24 67:10,11,15,19 72:17 79:21 93:1 114:9 130:1,21 131:15 132:13 139:3,9,10,25 140:4 148:23 196:6 218:3,4 233:10 250:18 255:25 258:5 259:11,23 260:4 279:24 321:22 324:23 326:9 327:25 328:19 332:25	o o18 315:13 object 58:25 59:3,6,6 239:21 objection 11:17,18 13:23 17:3 19:25 20:15 21:3,19 22:14,23 23:18 25:11 28:23 29:7 34:23 35:17 36:4,14 37:4 38:20 43:1,8,19 44:5,20 45:11 51:13 53:17 54:9,18 55:9 56:9,23 57:8,18 69:17 70:17 71:8,18 72:9,23 73:11 74:1,10,23 77:16 78:21 79:7,18 88:4 89:11 90:19 91:13 92:12 94:4,11 95:15 96:17 97:9 98:1,18 98:23 107:23 108:22 113:3 113:19 117:5 118:12,22 119:19 120:8,16 123:10 126:4 127:6,21 129:1 130:9 131:16 132:17 133:3,15 134:4 135:1,12 136:19 139:21 140:6 141:3,22 142:21 143:3,10 144:8,23 145:12,24 146:14 147:2 148:19 149:2,9,16 151:5,17 152:4,18 153:8 154:14 155:3 159:11 160:7 162:8 164:19 165:10 166:11 167:18 174:17 175:15 176:11 177:24 178:23 179:10 181:2 182:9,15 184:21 190:15 192:25 195:13 196:5,18 199:19 200:6 201:12,20 202:4,14 203:13 204:10,25 205:17 206:4,24 207:12 208:24 212:17 213:1 214:4,25 215:12,21 216:9,14 217:3 217:11,24 218:17 219:15 220:17 221:12,18 223:24 224:12 225:4 229:8 230:2 230:22 232:10 237:8,18 238:6,23 241:13 242:3 243:1,18 244:5,25 245:15 247:13 248:19 249:4,16 250:19 251:23 252:17 253:7 257:25 260:8,15 263:1,19 268:2,7 271:14 278:15 287:11 290:2,24	objective 139:5,19 140:3 obligation 283:2,3,5 298:3 300:24 301:19 obligations 299:19 301:6,23 observation 175:18 238:14 265:6 323:23 observations 184:20,25 observe 72:15,17 76:2 83:16 103:18 104:6,9 126:12 142:13 145:9 195:1 observed 137:18 142:17 145:21,22 194:15 237:5 304:5 observes 146:11,24 observing 146:5 210:8 265:2 obtain 277:5 316:9 obtained 195:24 239:15 272:15 obvious 159:17 183:24 obviously 15:6 16:17 25:3 27:4 28:9 29:16 30:2 31:5,8 32:21 36:6 44:10 45:22 56:16 75:24 104:16 111:12 123:15 124:11,14,21 126:5 144:10 147:8 156:15 159:14 165:23 166:3 195:16 200:22 219:6 223:15 226:23 229:19 245:6 259:1 269:9 273:13 278:4,25 280:22 285:1 287:5 301:22 303:12,17 306:2 313:5 314:20 326:8 occasion 62:11 63:6 64:13 occasions 312:20	offer 24:9 308:24 offered 28:20 80:19,23 81:2,6,10 330:4,20 331:5,15 offering 71:25 73:7 85:19 97:23 153:15,23 222:19 293:13 311:16 312:5 313:12 319:13 offers 283:18 offhand 17:15 34:24 35:2 36:6 70:10 162:12,13 163:2,4,7 217:25 230:24 250:11 265:12 275:4 276:10 office 3:8 offices 2:16 10:16 oh 18:14 32:5 33:10 82:21 107:17 114:10,16 137:13 158:7 196:22 197:10 211:10 248:3 261:7 286:10 296:17 308:8,15 325:2 okay 12:11 13:11 14:9 15:3,10 16:13,24 18:23 19:1,14,21 21:16 24:8 25:6 26:1,11 27:21 28:3,11,18 29:1 35:3 35:10,14 36:18 37:18 40:22 40:24 43:3 45:17 48:1,3 49:15,25 50:3 51:17 55:21 56:6 57:23 58:20 59:18 60:3,18 61:3 62:7,16,21,25 63:7,21,24 64:8,20,22 65:21 66:1,9,16 67:13,20 67:24 68:10 72:12 73:7

[okay - paragraph]

okay (cont.)	okay (cont.)	opinions (cont.)	p
77:3,8,12 78:14,16 81:14	330:2,15 331:3,13,21	36:12 53:3 54:8 61:12	p.m.
85:23 86:17,22 87:3,14,15	ols	101:9 102:19 303:9,20	2:18 122:11 171:4 222:10
87:22 88:13,18 89:4 91:10	189:25 190:19 193:9	306:20 313:19	266:19 297:8 329:24
91:18,25 93:4,9 94:7,14	238:17	opposing	332:23 333:6
95:17 97:20 98:3,20 102:23	once	24:18 70:24 71:24	pace
105:12 107:4,13,17,24	159:4,23 198:6 204:4	opposite	280:2 296:10,10
108:7,8 109:13 112:13	224:20	95:23	page
114:8 115:19 122:5,22	ones	opt	7:10 8:2,6 9:4,11,16,21
125:12,19 126:24 129:23	101:5 223:20	101:22 110:17	19:5,15 20:11 27:7 86:23
132:11 135:8 137:25	ongoing	opted	86:24 87:7 91:3,9,19
138:22 140:13 142:16	299:17,19 300:21	158:12	107:13 114:13,15 125:6
147:17,25 148:5,11 150:1	open	oral	129:22 150:11 155:19,20
150:22 151:1 156:5 157:1	41:21 223:5 321:19	59:2,8	161:22 163:8,13,24,24
159:12 162:4,10,22 163:2	opening	orally	164:4 175:2 182:24 185:21
163:21,25 164:1,14 170:12	20:14 24:13 25:7,16,19,24	58:4,14	185:25 186:2 187:14
171:21 172:11,12 173:24	26:3 28:4,9,24 30:5,18	order	191:20 198:6,10 208:13
174:11 177:20 178:18	34:21 36:1 74:25 86:3	1:12 146:17 183:21 184:5	225:14 227:2,6,12,25 228:5
179:3 182:12 186:6,7,8,22	93:25 129:22 171:25	316:3,4 317:5 322:11,19,25	228:6,11 229:12,12 231:2,6
187:5,5,16 188:2,12 189:11	184:10 185:19 230:11	330:11	234:23 236:1,15 246:19
190:5,12 191:17 192:5,18	262:13 297:12 309:16	ordinary	249:25 251:3 253:22 256:9
193:20 194:1,6,19 197:6	332:5	189:25 190:19	265:1 274:15 275:10 279:8
198:5 199:1 201:4 203:10	operation	organization	279:23 283:8 284:7,11
203:25 206:14 208:17,18	282:24	301:17	290:12,15 293:9 303:22
212:3,22 213:24 216:4	operations	organized	308:3,10 309:13,15 322:5
217:13,17 218:5 219:9	299:18	53:21	pages
221:24 222:5,8 224:6	opine	orient	7:15,20,25 20:1,10
225:11,13 226:3,7 227:1	24:12 78:18 79:3,15 80:3	259:19	paid
228:2,2,4,11,17 229:4	294:10 304:4 305:23	original	271:12
231:5 233:12 237:2 239:6	311:24 312:11 313:2,18	109:19 258:4	panel
239:20 241:8,15,20,25	opined	outcome	241:10,11,21,22 243:8
242:4,7,12,17,22 243:3,8	305:25 306:1	109:24 145:18 205:19	314:4,10
243:13,20,23 246:10 248:3	opining	334:15	panoply
248:5,22 250:12 251:13	15:8 16:21 263:22 291:6,10	outflow	74:11 83:15
252:1,8,22 253:8,12 254:3	296:6 299:5 309:1,7 313:7	251:24 252:4,9 269:16	paper
254:8 255:8,18 257:21	318:12 320:14	outflows	68:7 104:11,14 112:17
258:4 259:11,21 260:3	opinion	250:22 251:7,12,17 252:14	117:6,15,18 118:3 128:18
261:1,6,15 262:2,6,15,20	14:18 16:12,14,23 17:8,24	255:20 263:6,6 265:13,14	135:3 136:8 137:14,14
263:21 264:1,7 265:25	18:1 25:7 34:8 35:20 43:4	265:22 268:13,15,22	139:17 146:16 147:8
266:13 267:2,8,12 268:5,19	43:11,17 44:2,12,14 45:8	269:11,15,17 274:7 286:21	209:10,24,25 210:3,18
269:3,14,19 270:2,8,10,21	45:25,25 48:17 52:8 65:12	286:25 287:5,9,13,15	211:12 240:14 316:11,13
271:6 272:5,11,24 279:7	65:18 67:6 73:7,12,20,21	314:13	316:25 317:13
281:2,20 282:10 283:7,13	74:2,16,18 77:9 80:19,23	outlier	papers
283:14 284:15 285:19	81:2,6,10 85:19,24 91:16	108:18 109:3	25:14,23 26:7 101:18
286:8,15 287:8,25 289:22	94:14 97:24 98:20 123:8,24	outliers	103:19 104:9,15 117:21
291:2,10,19 292:23 294:1	125:1 127:5,9 128:24 140:2	107:21	118:2,6,15 128:3,8,10,14
295:16 296:7,15,17 297:3	144:5 153:4,15,23 174:13	output	128:20 129:2,6 134:16,23
298:5,10 300:4 302:1,21	216:20 220:10 222:19	124:10 174:6 240:10	135:14,18 136:7 209:17,21
303:2,10,21 304:3 306:24	238:4 263:16 272:1,4 291:5	241:10,11	209:22 210:12,16,18,19
307:11 308:2,15 309:25	294:12 300:2,8,14,21 301:3	outside	211:10,15 239:18
311:8,14 312:2 313:9,22	303:3 308:20,24 309:11	29:19 91:22 125:5 150:19	paragraph
314:3 315:11,18,22 318:8	310:1,12 311:16 312:5	235:8 274:20 278:18	20:18,20 21:5,10,15,21,24
319:10 320:11 321:2,7,12	313:3,13 319:13 330:3,19	overall	22:3,18 75:8,9 86:22 87:1,8
321:25 322:10,11 324:17	331:1,3,12,13,19,20	245:7	87:19 91:2,19 107:25
325:2,5 326:13,20 327:6,9	opinions	owned	109:12 125:1,10 126:2,6,8
327:13,15,21 329:9,18	16:2 24:8 28:5,19 29:5	46:12 276:7 277:23 297:19	129:19,21,24 131:19,19

[paragraph - personal]

paragraph (cont.) 137:11,13 139:15 150:10 155:18 163:10,13,20 164:3 174:23 175:2,24 185:18,22 186:2,6,9,18,22 187:6,12 187:17 191:7,8,17,20,21 192:12,13,17,19,23 193:4,7 194:3,8,21 195:20 208:9,12 211:19 225:21 226:2,4 227:8 228:1,23 229:6,10 230:25 231:5 232:1 233:15 233:18 234:11,23 235:14 235:19 236:1,6,15 245:19 248:4 249:25 250:8 251:2 251:16 256:8 264:1,4,18 265:25 270:2,5 271:16,25 272:5,8,13,15 273:18 276:17,19 278:5 279:6,7 280:18 281:12,18 282:17 282:24 283:7,14 284:7,11 286:6,9,12,15 287:21 288:7 288:8,10 290:3 291:14,15 292:7,11,14,15 293:9 297:16 298:25 299:8,12 300:3 302:3,6,19,22 303:9 303:21 304:18,25 305:12 306:23 307:1,25 308:2,10 309:14,15 315:11,13,18 316:17 318:11,15 319:7,15 319:24 320:16,20 321:25 322:4,5,7,10 324:3	participants 248:15 249:1,14 288:4 particular 26:25 112:17 128:18 137:2 154:6 170:3 186:23 267:24 280:23 284:20 291:18,25 292:3 306:5 307:6 310:17 311:7 313:5 318:4,5,13 particularly 167:14,15 210:15 particulars 46:9 parties 13:9 283:15 334:16 parts 307:23 party 30:13 48:6 63:9,18 64:10 64:23 65:9 247:7,10 248:16 249:2,13,20,21,24 324:25 325:7 pass 18:11 239:12 passing 84:13 passive 270:22 paul 5:15 13:8 paulweiss.com 5:21,22 pause 47:21 137:8 250:5 253:21 270:7 274:13 283:12 285:12 304:2,15 319:11 322:9 pc 114:1 pca 26:22 78:1,12,13,17 114:5 114:18,23 115:3,4,23 116:2 116:5,13 118:19 119:4,23 120:7,10,18 121:15,22 130:23 132:7,8,21,25 133:10,21 134:18 135:24 136:4,8,16,22,24 137:4,14 139:17 141:7,8,13,18 144:15 156:7,19 157:9 158:24 159:17,21,25 160:15,17 161:1,7,11,19 164:24,24 165:25 167:5,19 168:2,25 170:4 223:1 pcas 132:22 136:13 176:17 243:6	pcs 143:9 144:7 peer 74:12 100:17,21 101:25 102:1,2,18 103:3,18 104:3 104:7,15 112:19 119:25 239:4 penalizes 138:11 pending 57:12 pennsylvania 5:7 people 15:12 47:1,5 56:20 131:21 188:21,23,25 266:9 people's 281:8 percent 27:9 33:15,17,21 103:16 109:16 111:20 113:13 123:7 124:3 148:17,18 168:9,9 175:6,8 178:20,25 179:5 180:3,7,22 199:4 200:5,24 206:18,21 207:2,3 212:4,12,21,23 213:17,21 213:25 216:23 217:23 218:10,15 219:9,13 220:3 220:12,16 221:16 226:12 232:22 242:25 243:16 265:3,5,9 281:14 317:24,24 318:13,17,18,24 percentage 46:25 47:10,15 48:12 63:1 178:1 179:1 190:8 321:15 perfect 232:13 perfectly 43:12 238:16 perform 26:1,11,15 34:2 70:13 92:9 95:11 100:15 151:13 160:16 161:10 186:10 214:21 215:19 217:8 231:10 256:24 316:14,22 performed 13:7 25:15 26:12 28:18 29:4 36:11 61:10 70:8 88:14,24 89:5 91:12 94:10 98:21 99:6 101:12 245:25 performing 68:10 69:22 100:8 period 31:14 34:11 42:18,19 43:3 43:24 44:15 49:8 70:16 75:6,24 77:23,24 80:9,12	period (cont.) 89:18,18 90:4,10,11,21 92:4,7,7 95:9 96:6 97:11,13 97:13 98:6 99:12 102:11,12 103:6 104:5,5,17 108:11 110:5,6,8,10,15,18 111:14 113:24 117:4 118:1,11 124:3 129:7 133:7 134:20 135:5 137:23,24 142:7 151:20 154:9 156:12,13,20 156:21 158:24 160:20,21 161:6,14 162:5 166:13 168:7 170:3 172:18,20 173:12 174:1,1,7,8,16 175:4,4,7,12,14,19,19 176:1,2,5,6,8,13,13,21,23 177:21,23 178:3,9,11,19,19 179:2,4,9,16 180:21 181:24 181:24 183:13,17,18,19,24 184:14,15,18 185:3,7 190:2 193:22,23 195:3 197:25 198:11,17 199:3,6,22 200:2 200:4 212:1,7 214:2 215:11 215:20 216:8 217:10,15,23 218:11 219:11 220:14 225:8 228:8,14 230:6,9,9 231:19,20,20 233:1,2 237:11,21 241:1,3,10,12 242:7,14,18,24 243:10,16 251:14,19,20,22 252:21,25 253:2,4 254:1,1,5,7,24 257:5 259:25 260:13,17,19 260:23 265:4,16 268:5 279:15,22 280:8,11,15,22 280:23 284:21 285:6,16 286:23 287:17,19 314:25 319:14 320:15 periods 92:3,6 103:4 112:20 134:17 167:15 169:11 174:15 176:17 182:13 183:10 257:6 287:4 292:17 293:17 permanent 93:15,18 94:23,25 95:3,19 97:17 305:6 permit 58:22 permutations 111:15 113:11 181:18 person 50:22 51:2,19 52:11,17 53:5 54:11 57:2 203:21 289:19 334:12 personal 49:19 55:2,3 301:15 311:25 313:7
---	---	---	---

[personally - price]

personally 86:11 99:22 100:6,9,13	please 11:2,25 23:6 59:4 106:24 107:16 115:13 191:18 219:16 225:10 228:5 264:2 270:3 302:3 321:1 328:9	pooling (cont.) 300:5,11,15	predict 180:2 205:15
perspective 133:24 294:15 295:17	plimpton 2:17 4:3 10:17 39:19	pools 100:18 299:6 300:9	predicted 199:5 228:20,24 229:9 230:25
pertained 73:5	pllc 4:10	portion 9:15 33:24 87:11,15,20 91:8 123:6 127:4 291:8,11 297:13 299:12 300:20	preexisting 48:5
pertaining 28:19 82:14 95:12	plotting 229:2	portions 291:17 292:5	premium 266:23,25,25 267:3,10
pfeffer 4:14	plural 106:9,14	pose 254:4	preparation 16:2 36:9 52:1,7 54:7 118:3 118:10
ph.d. 1:15 7:4,13,18,23 11:5 334:5	plus 49:12 124:4 187:10 254:19 254:22 255:2	poses 182:22	prepare 28:17 174:12 321:4
phenomenon 230:18 232:7	point 25:2 26:5 41:18 70:20 100:25 109:14 117:8 122:18 134:9 143:6 148:20 148:22 160:2 162:4 165:13 169:14 176:22 180:18 182:17,21 183:3 184:10 193:16,17,21 194:12 199:8 199:20,22,23 200:1,1,8,11 200:14 203:16 209:25 212:1 215:6 218:1,8 219:7 225:13,14 228:22 229:1,11 229:18 231:1 233:4 234:6 236:11 247:11 253:18 258:13 273:18 274:24 281:16,17 289:12 291:17 293:16 296:24 297:24 306:16 317:15,16,25 318:3 318:7,18,19,22 319:1	position 60:7 305:2,8	prepared 18:24 25:23 26:8 35:25 118:18 214:22,23
phrase 14:7,16,25 16:16,17,19 17:6,6,13 91:10 92:15 97:21 188:23 189:1 194:2,7 201:16 203:9 227:11 291:6 295:10 306:1,5 307:24	pointed 227:2	positive 126:15,19 144:12 172:15 173:13 199:9,21 207:18 208:3 210:9 211:4 232:16	preparing 54:2 77:5 117:19 210:13
phrased 17:4	pointing 108:14 328:24	possibility 152:15 157:10 165:22 223:6 237:4,16 289:24	present 6:1 155:24 192:14 200:17
physically 240:21	points 20:23 211:16 233:11 236:2 236:7 256:7 259:3	possible 38:23 39:10,15 40:16 64:18 71:20 72:10 84:12 97:4 103:5 127:18 146:12,25 151:24 162:4,9,12 204:7,22 224:6,7 229:23 250:13 252:22 311:8 331:14	presented 309:16
pick 252:1	policy 85:8 301:14	possibly 67:1	presents 111:16
picked 93:17 96:15 305:16	pool 270:20 272:2 273:23 275:20 277:7 300:1	post 183:4,16,17 320:1	president 50:25
picking 96:7	pooled 293:12 297:14 298:7 299:25	potential 33:17 119:13 179:18 222:25 266:25 318:16,25	press 41:14 42:1,13,15 43:15 45:3 46:2,6
picks 280:9	pooling 20:19 270:11,16,22,24 271:2,8,11,19,21 281:2,7 281:11,21 282:5,12,19 283:1 297:11,24 298:1,2,14 298:16,18,22,23 299:3,7,24	potentially 167:6 244:16	pretty 33:3 256:3
picture 245:7		power 123:17 138:13 177:23,25 232:20	prevent 12:12
place 233:4 246:3 263:15 284:6 289:5 308:8 334:9		practice 11:17 124:22 185:11,17 199:12	previous 28:22 78:7 112:24 271:7 322:23 323:10,17 324:7
plain 190:13		practicing 66:4	previously 314:16
plainer 144:3		pre 176:8 320:1	price 32:14,19,25 33:16,17 54:16 71:4 72:16,19,21 73:10,25 74:22 75:7 76:1,4 78:19 79:4,17 80:4,13 85:16 89:17 90:10,17 91:6,20 93:18 94:3,21,22,25 95:20 95:25 96:14 97:1,6,6,10,15 97:17,19 98:10 99:2,2,11 99:12,16 101:22 102:3 104:20 105:14 106:6,18 109:3,14 115:15 116:16 119:8 120:5,13,23 122:19 122:24 123:6 125:2,4,22 126:8,18,19 127:4 128:24 137:6,7 142:25 143:9,15 144:7,13,22 145:10,22
plaintiff 1:5 2:5,16 3:4		precise 50:4	
plaintiffs 63:6		precisely 251:15	
plaintiff's 62:23 63:2		preclude 61:15	
planned 236:8			
plans 46:15 50:12			
platform 267:14,25			
platforms 289:5			

[price - purchases]

price (cont.)	pricing (cont.)	produce	properly
146:11,24 148:4 149:6,7	224:2 244:16 245:3 263:4	174:1 184:18	56:3 101:19
150:3,4,6,7,9,16,18 151:8	295:11	produced	properties
151:15,22 152:15,15,16,23	primarily	55:24 124:1 240:7,8,11	137:7
152:24 153:2,6,16,17,20,21	55:25 124:16,23 125:16	326:3	proposing
153:24,24 154:11,19,22	234:14	product	220:8
155:13 156:1 157:2 159:9	princ	51:14,21 54:14 55:15	proposition
160:25 164:15,16 165:7,14	139:9	206:16,20 326:2	99:17 149:21 182:2 287:3
167:8,11 168:3,21 176:1	principal	production	prostko
178:12,16,21 179:6,8	77:10,13 78:4,9,14 110:1	34:18 55:17	5:16 328:5
180:16,23 181:1,15,25	113:23 114:2,9,21 115:15	professional	protective
191:4,24 192:2,20 194:16	115:20,21 116:1,7 137:2,18	65:22,25 66:11	1:12
194:22 195:8 196:3 206:17	137:22 139:3,10 141:8,18	professor	proved
206:21 207:2,3,5,7 208:4,7	142:13,15,16,18,24 144:16	11:23 18:19 24:5 42:23	43:5 44:4 45:9
208:21 222:22 223:22	144:21 147:13 148:3	58:22 60:20 61:8 87:22	provide
224:10,16 225:16,24	151:11 157:2,22 158:2,5,8	107:10 122:15 163:19	12:15 25:6 36:18 37:1,7
231:21 232:4 233:3 234:6	158:10,14 159:7 160:4	166:17 171:24 222:19	53:2 55:7 57:6,13 131:3
234:13,20 235:1,2,7,9	169:1 178:13 195:5 199:5	231:10 232:23 239:6,14	137:1 143:1,7 146:12,25
236:5,8 237:14,20 238:20	principles	240:4,20 266:22 269:14	294:12
242:24 243:15 244:2,19	320:12	272:6 297:11 324:23 330:2	provided
252:24 253:1,3,13,15,23,25	prior	331:23 332:3,12,17	34:18 53:12 56:20 149:14
254:2,19,19,22,22 255:2,2	11:17 31:6,18 32:7,8 34:2	profit	168:22 239:17 246:11
257:24 260:9,12,23 261:3,5	35:6 37:2,8,20,25 38:8,11	234:13 236:4 301:17	319:5 325:7 328:11
261:10,18,24 262:3,7,14	38:14,17 39:5,17,24 40:21	307:22	provides
267:15 268:1 283:4 292:19	40:24 41:6 42:24 43:3,14	profits	120:7,11
299:21 304:5,7,20 305:5,6	43:16,24 44:16,19 46:3	83:10 235:22 236:22	providing
305:17 306:2,2,7,9,10	61:19 63:7 72:4 78:17 79:2	270:18 271:4 283:5 298:4	14:18 17:9,24,25 43:11
307:4,18 308:7,18 311:10	79:14 80:18,22 81:1,5,9,9	298:21 299:16 300:1,20	44:14 45:18,24 50:16 51:12
311:11,17 312:7,18,22	85:11,15 105:10,13 106:5	305:19 307:12,16 330:6,23	73:12,21 74:2 85:24 263:16
313:14 316:8 317:5,18,19	107:21 108:20 111:21	program	272:4 291:4 300:14 309:11
317:24 318:2,4,12,16,20,21	112:10,25 113:17 117:18	8:4 241:19 274:19 328:12	313:3 331:11,13,19
318:25 319:2,16,25 320:4,6	194:13 288:7 322:13,18	programmatic	provision
320:10,13,17,22 321:4,6,11	324:11	30:20 247:21 283:24 284:2	286:4
321:15,23,24 322:21,22	priori	284:9,13,14,16 285:2 286:4	public
323:9,10,20	205:21 206:9	288:9 299:13	2:20 153:13
prices	private	programmatically	publications
35:8 73:5 79:10 87:6,13	48:6 277:13 282:4	283:23 284:23 285:18	68:2,4,5 82:13
88:1 89:10 90:5 92:11	privy	programs	publicly
94:16 95:14 107:20 108:2,4	50:6	239:16 240:6	69:8,11 70:4 80:16,17
108:19 127:10 152:2 153:5	prob	project	pull
154:12,25 155:2 160:6	96:18	121:16 144:19	99:23 100:3,3 105:19
166:9 176:8 182:7,14	probably	projecting	131:23
235:16,24 236:22 244:22	67:19 76:25 77:2 79:25	120:18	pulled
253:10 254:21 255:13,15	303:24 322:6	projection	100:11
260:1,6 304:20 307:7	problem	115:24	pulling
309:17 310:3,13 316:15,23	51:9 89:3 96:18 98:8	prominence	101:14
320:5 321:10 324:1,15	proceed	184:2,7	purchased
pricing	11:3,9	promise	279:10 280:16
92:18 93:15 95:3 102:25	proceeds	271:4	purchasers
119:21 121:20 127:11,20	300:10	promoting	235:23 236:3,16 271:12
128:3,12 129:10 130:13,17	process	234:16	289:25 292:18 293:11,15
131:1 132:9,23 136:1,5,9	60:13,23 101:14,16 105:23	pronunciation	298:2,19 299:8 305:18,24
136:13 146:6 147:5 149:22	141:20 257:15	315:24	306:21,25
153:22 154:3 155:10,11	processes	propelling	purchases
157:5,6 158:17 159:18	312:13	236:20	282:25 319:14 320:15
165:14,21 167:20 168:14			

[purely - received]

purely 123:12	question (cont.) 188:12 196:19 198:25	ran (cont.) 104:22 105:17 112:9	reality (cont.) 235:6
purpose 70:22,23 71:24 77:12 141:6	201:14,15,22,24 203:18,24	200:21 205:18 247:20	realize 87:14
purposes 21:18 22:17 48:3 68:25	204:4,14,16 205:20,21	range 167:7 180:7 212:5,24	really 20:16,22 39:1 54:1 55:14
71:11 119:10 121:21	206:5,8 207:20 208:2	215:19 216:7 217:9,14	70:22 72:1 84:25 98:13
123:21 128:16,24 140:1	218:10 220:1,8 221:11	218:7,11 219:10 220:13	99:13,17 101:5 108:16
164:24 165:25 169:21	226:13 230:5,11 231:14	ranged 265:3,4	118:25 132:1 147:3 173:22
259:12 269:15 270:18	237:13 238:11 240:18	rank 165:25	180:9 204:4,15 205:5 296:4
276:11 277:14,15 313:2	243:25 245:20 246:11	rate 46:23 47:8 191:24 194:17	297:25 326:7 329:1
pursuant 2:21 13:6 47:1 48:12 53:24	249:8,9 250:21 251:11,15	226:10	reask 65:15 188:12 201:15 249:9
54:13,21 55:24 56:15	253:25 257:3 258:23	rates 55:4	251:15 282:11
300:17 328:12	259:10 260:10 268:8,12	ratio 265:2,10	reason 34:6 96:19,23 117:11 174:3
put 11:16 47:4 53:19 56:15	277:5 282:8 283:21 285:14	reach 108:5 195:16	218:14 219:12,23
61:6 101:20 104:25 105:4	291:2,5 292:24 294:13,20	reached 126:2 171:14 194:19	reasonable 305:19,23 306:20,25
125:4 144:2 150:18 171:6	295:1,24 296:1 301:24	reaction 72:21	307:12,15,21
205:21 210:24 239:11	303:2 304:4 309:9,12 310:7	reactions 32:23	reasons 32:12 34:12 76:14,15 111:2
247:2 257:20 299:24	311:19,20,24 312:2,10,10	read 23:20 24:24 25:1,2,5,19	112:6 116:19 118:15
316:24 332:8	312:14 313:10,18,21	37:23 40:25 41:2,3,7,17,19	184:16 219:3
puts 47:4	315:22 316:18,19 319:9,17	41:20,22 42:5,8,11 43:15	rebounded 253:2
putting 40:13 300:12,13	320:3,24 321:3,21 322:5,17	43:18 44:1,7,25 45:2,7 46:2	7:17,22 24:5,13,14,23 25:4
q	323:4,25 325:11,19 327:22	46:6 76:18,21 77:3 91:11	25:7,20 26:6,8,13,17 27:17
qualification 47:12	329:1 330:10,18 331:2,10	104:3 107:24 118:5 150:13	28:3 29:10,11,15,15,25
quality 100:7,14 101:11	331:18	164:10,12 172:7 186:5	30:5 31:24 33:8,13 67:5
quantum 288:21	questioning 61:5,5	192:15 202:3 208:20 227:6	68:8 106:5,19 107:9,11
quarterly 209:24	questions 42:4 60:11,21 70:25 71:21	233:18 235:14 248:2 250:8	174:20 182:25 221:24
question 14:4 16:22,25 17:23 19:21	78:23 101:6 119:13 137:16	257:10 259:22 274:4	228:3 230:21 231:6 232:9
20:24 29:1 33:23 34:7 35:2	147:7 158:16 331:22	292:24 299:11 303:12,23	237:3 238:2 279:1 285:4,21
37:5 39:12 40:9 42:4,6,10	question's 70:19 120:9	305:9 310:11 319:8,22	296:15,17 302:2,10,14
43:22 44:8 48:4,10 49:13	quick 68:6 222:3 236:14	322:10 323:18 326:14	303:3,7,8,16,19 306:18
57:12 58:11,23 62:5 63:12	quickly 131:6	330:13	307:23 309:8 315:12
63:15 65:15 66:20 71:5	quite 45:4 79:8 98:24 100:19	reader 141:11	rebutting 28:6
74:13 76:5 79:16 89:9	249:7 258:18 299:4	readily 159:22 236:25	recalculated 33:15,18
92:10 94:1 95:8,12,16	quotations 292:12	reading 27:12 30:2 38:5 41:16	recall 42:12 45:15 52:18 57:2,15
103:20 105:9 107:18,19	quote 235:17 236:9 283:18	42:13,15 44:9,21 46:8	57:20 58:1,2 65:10 70:10
111:25 112:24 115:3 117:9	320:20 323:7,11	87:15 101:17 106:5 125:9	71:13 72:5 78:10 80:1,14
118:10 120:2 122:22	quoted 291:19	180:1 187:5 192:18 202:1	94:6 108:23 111:24 113:16
123:11,12 125:13,14 127:7	quotes 234:8	225:9 226:1 228:19 246:21	114:8 201:3 206:19 250:11
128:22 139:12 141:23	quoting 87:10 125:1 304:25	274:17 293:10 303:24	258:1 265:12 268:19 275:4
144:2,20,25 145:3,5,6	r	304:8 319:19 320:6 322:7	276:9 317:3
146:3,9,17,18 147:4,9	raise 83:12 247:25	326:25 334:20	receive 50:12 58:3 271:13,19
152:9 158:2,7,17,18,25	raised 293:13	reality 87:5,12,23,25 234:15,24	received 18:4 23:23 50:9 58:13,23
160:15 165:13,17 167:23	ran 32:9 35:5,15 36:2 101:1		59:2,8 61:11 70:6 107:1
169:5 173:9 174:14 176:15			239:8 272:2 283:15 297:14
177:18 178:4 182:22 183:7			
183:8 184:24 185:1 186:3			

[received - remember]

received (cont.) 298:6,8,18	reference (cont.) 274:14,23 278:1 279:23	reflective 133:11 155:10	related 25:15 37:2 65:15 66:10
receives 298:17	281:18,20 282:20 284:1,4	reflects 132:20	82:24 111:25 207:17
receiving 57:15,20	284:19 285:20,24 286:12	refresh 156:18 291:24	236:13 334:16
recess 59:22 122:8 170:15 222:12	286:21 287:2 299:22	refuse 217:1	relates 24:18
266:17 297:6 329:21	304:12 306:24 307:21	regard 100:5 205:11	relating 83:6
recognize 18:21 241:9	309:3 317:8 319:24 320:22	regarding 27:17 29:5 34:19 60:22	relation 119:8 149:11,23
recognized 236:22	referenced 20:5 47:10 75:10 88:9	73:8 128:11 326:14	relationship 124:25 125:25 137:18
recollection 25:17 36:25 38:24 39:4,15	89:21 106:1 162:2 192:16	regardless 63:18 165:2,2 295:18	142:13,17,19 143:14
39:23 40:3,16 41:13,15,16	192:22 193:7 195:19	regional 3:8	144:21 145:1,9,22 146:3,5
42:8,12,14,22 46:6,8 52:10	229:10 272:17 278:4	regressed 191:3	148:3,14 150:3 154:25
57:22 62:18 63:4 65:2 67:3	315:25 316:11 320:15	regression 8:5 78:5 115:14 140:18	159:1 160:12 164:15 167:9
68:13,16 69:11 70:2,12	references 272:18,20	147:12 166:4 171:25 172:8	175:11 180:16 190:25
72:4,11 79:19 81:16 84:14	referencing 19:22,23 20:1,2 21:4 85:25	173:20 178:12 186:3,9	203:23 204:6 229:5 262:24
84:23 86:20,21 156:18	91:14 101:10 107:25	189:7,14,15,18,25,25	271:22 294:24 298:3
182:11 258:3 268:21	109:11 124:17 131:20	190:19,20 191:12,13,22	306:19 324:7
277:12 285:23 291:24	185:12 234:17 250:7	192:9,22 193:2,3,5,7,9,13	relationships 147:6 300:16,17,19
record 10:6,25 11:16 12:1 15:15	272:21 274:22 281:19	194:2,7 197:11,14,15	relative 178:7 181:11,14 182:4
15:19 25:19 27:14 41:25	292:1 310:16 311:7 320:4	198:15 199:6 200:4,8,8	208:5 211:4
46:24 48:4 58:18,21 59:5	referred 138:22 192:11 297:25	201:5,10,18 202:12 211:18	relatively 64:13,14,15 322:22 323:9
59:15,21 60:1,4 61:7 77:3	referring 17:18 22:8 88:23 114:13,15	211:20 220:24 226:22	released 71:17
81:16 97:23 109:25 122:7	148:23,24 156:11 181:7	227:25 230:13,15 238:14	relevance 160:5
122:12 135:9 150:14	184:23 192:7 194:9 226:19	238:17 240:25 241:4,6,10	relevant 70:15,21 71:1,7,17,21
170:11,14 171:4,7 172:7	226:20,22,23 227:12,14,20	241:11 242:10,14,15,18,24	91:16 92:17,21 120:2,11
196:14 202:2 222:10,16	231:12 232:1 245:16,23	243:5,9,15 322:12,15,18,24	132:5,6 157:5 248:9,15
250:2 256:11,11,20,23	270:16 271:7 281:8,21	323:21,22 324:12,13	250:23 279:5,18 299:12
257:13,16 266:16,20	282:14 290:22 297:17	regressions 164:21 179:12 186:14,15	reliable 200:10,16 239:3 309:21
269:22,22 296:9 297:5,9	316:13	186:19 191:15 193:6	relied 34:24 36:6 102:9 236:3
298:13,15 299:1 311:1	refers 75:10	209:16 268:4	relies 233:24
317:15 319:21 324:19	reflect 88:5 116:18 176:24 195:5	regression's 191:6	rely 34:11 130:18 216:18
329:11,20,25 332:9,23	306:3,7,15 307:5	regulation 82:21,25 83:2,5,14 84:4,7	remain 195:8 207:4
334:10	reflected 54:3 110:2 114:5 121:7	84:20	remaining 180:25 187:6 192:1,20
recordkeeping 50:6	139:4 143:17 149:12	regulations 85:6	194:21 195:7 196:3 273:2
records 50:1,4	151:18 161:18 168:22	reid 4:12	308:12
refer 12:23 17:22 87:4 89:2	178:3 179:24 180:4 182:3	reiterate 48:11 152:8 153:9 154:2,17	remains 229:16
143:11,21,22 156:5 255:23	199:12 216:11 223:6	254:21	remember 13:2,10 25:22 33:10 38:5
264:17 307:11,15 317:9	227:17 229:25 230:20	reject 123:12 194:14 221:1	40:13 44:23 52:12 53:7
reference 15:6 20:6,9,22 21:14 87:11	231:13 238:1 258:14 268:3	relate 45:19 246:11	80:5,6,6,10 84:21 113:8
88:7 90:1,6 91:5,11 92:2,5	268:23 269:25 275:6 277:3		
92:15 100:4 106:2 111:3	280:4 286:22 287:1 288:8		
113:5 115:22 117:9 136:23	289:8,14 292:10 300:3		
137:10 140:23 143:25	303:9 306:23 307:4 314:9		
145:13 179:17 193:12,13	314:14 315:9 326:6 329:2		
195:18 223:14 231:9 232:2	reflecting 27:16 55:14 124:21 136:25		
251:16 265:15 271:1	155:16,17		
	reflection 326:11		

[remember - returning]

remember (cont.) 163:7 184:4 190:11 230:24 284:25 321:21	report (cont.) 228:3 229:7 230:11,21 231:3,6 233:5,9,13 234:10 234:11 236:24 237:3 238:2 239:19 240:9 244:17 245:12,17 246:17 250:20 250:23 263:16 270:3 272:23 273:20 274:16,17 279:4,19,20 285:2,4,25 286:5 293:10 296:3,16 297:12 302:2,8,10,24 303:5 303:7,8,12,16,17,19,20 304:8,10 305:12 306:18 307:11 309:8,17 310:19 314:15 315:12 319:5 320:7 323:6,12,13,18 332:5	requires 195:16,17 reran 26:24 263:9 rerun 105:7 research 100:21 102:1,18 103:8 104:3 105:20 119:13 120:2 128:22 146:16 147:4,9 researcher 136:17 reservation 61:6 332:13 reserve 61:14 332:9 reserved 246:22 258:7 resides 116:4 residual 188:3,4,16,18,19,24 189:1 residuals 201:5,10,14 respect 26:16 27:3,12 28:11 30:1,4 30:9 42:5,15 88:24 109:4 141:21 166:8 212:23 263:17 278:12,13 281:20 293:19 303:3 311:22 318:10 respective 334:17 respectively 164:7 response 152:9 174:19 183:7 208:2 263:8 294:21 responsible 54:15,19,20 responsive 233:13 268:11 rest 288:17 restart 188:8 restate 68:22 104:14 330:18 restrict 166:21 restriction 205:22 restricts 166:23 result 54:3 111:18,18 113:12	result (cont.) 117:14 145:8 185:3 195:22 195:24 196:13 198:1,14 203:16,17 204:7,22 208:1 229:25 234:7 238:3 271:21 resulted 181:25 304:6 305:16 resulting 97:5 234:19 results 30:18,18 31:20,21 76:11 103:14 110:14 112:6,23 142:8,9 149:4 150:1 155:17 155:23 160:17 161:11 174:2 179:24,24 180:1 186:19 189:14 192:14 198:12 203:22 213:20 239:17 241:2 247:23 252:20 263:14 299:7 retained 12:15,18,25 36:18 37:1,7 39:6,14,18,25 40:10 46:22 61:22 62:1,11,22 63:2,6,8 63:13,17,19,21,25 64:2 65:4,8 85:12 333:2 retention 37:3,8,20 38:1,8,11,14,17 39:5,17 40:11,24 43:4,14 43:16,25 44:16,19 46:4 return 26:19,23,25 32:10,14 34:9 35:19,19 36:7 72:16 76:1 80:13 91:6,20 93:20 96:4,9 100:18 102:3 105:5 109:11 109:17,17,22,22 110:14,17 115:15 116:15 117:3 120:23 122:24 123:6 125:2 126:19,21 127:4 129:4 143:15 148:7,18 150:16 151:22 157:15 158:4 160:25 178:13,16 179:6,8 180:3,10,15,16,23 181:1,15 187:7 188:3,16,24 189:1,4 189:5 194:16 195:2 199:3,4 206:23 207:11,15 208:7,21 209:6 223:17 224:4,16 226:9 227:15,16,18,20 228:7,13,21,24 229:2,10 230:6,7,15,25 232:16 241:3 242:24 243:15 253:16 254:2,16,23 255:4,5 267:21 310:21 322:14 323:24 324:4,7,8 returning 20:24 33:24 101:8 126:24 285:4
remembered 33:11 remembering 39:2 42:19 remind 125:6,8 269:14 remittance 30:6 remote 3:1 4:4,14,15 5:6,16,17 6:3 6:4 renders 98:11 repeat 19:9 29:1 37:5 152:20 173:8 201:8,24 205:3 217:4 248:23 319:17 325:15 rephrase 185:24 replaced 205:14 report 7:12,17,22 17:18,22 18:23 20:14,17 22:12,16 24:6,13 24:13,20 25:3,5,7,16,19,24 26:3,9,13,17 27:8,15,18,20 28:2,4,9,13,17,24 30:5,6,18 30:19 31:2,2,7,7,11,12,16 31:19 32:8,12 33:13 34:12 34:22,25 36:1,7,8 52:1 55:17 56:2,8 59:10 60:13 60:23 74:25 76:15 77:5 86:4 88:3,8,14,25 93:25 101:2,5,9 102:20 103:22 105:11 106:6,10,20,21 107:9,11,14,22,25 108:20 109:7 110:13,13,18 111:5 111:16,21 112:7,11,25 117:16,19 118:4,4,10,16 127:12,19 128:9,11 129:22 130:22 132:12 133:5,17 136:3,20 137:1,16 138:16 141:6 143:5,6,25 144:4 145:18,21 147:11 149:6 150:6,11 151:19 154:1 155:19 160:24 161:18 164:20,21 168:7 169:14 171:25 172:3 174:20,24 175:17 177:2 182:25 184:11 185:9,19 186:12 189:12 191:8,11 209:18 210:14 215:1 223:13,15 224:1 225:7,15 226:17	reported 1:23 41:13 108:5 142:9 262:14 288:12 289:1,1,10 314:12 334:10 reporter 11:1,8 18:15,17 92:4 123:3 131:7,10 187:24 201:8 233:21 248:20,23 252:11 310:4 325:14 334:11 reporters 10:21 reporting 45:6 185:15 321:22 333:2 reports 24:14,18,23,25 29:15 54:3 61:13 154:16 174:21 203:21 215:2,2 240:2 246:25 represent 48:15 188:3 239:14 245:9 representation 40:21 280:24 represented 154:7 240:4 representing 38:18 represents 173:5,5 181:11 182:4 211:21,21 reproduce 181:23 reproducing 241:16 request 9:20 requested 334:21,21 require 331:6	result 195:16,17 reran 26:24 263:9 rerun 105:7 research 100:21 102:1,18 103:8 104:3 105:20 119:13 120:2 128:22 146:16 147:4,9 researcher 136:17 reservation 61:6 332:13 reserve 61:14 332:9 reserved 246:22 258:7 resides 116:4 residual 188:3,4,16,18,19,24 189:1 residuals 201:5,10,14 respect 26:16 27:3,12 28:11 30:1,4 30:9 42:5,15 88:24 109:4 141:21 166:8 212:23 263:17 278:12,13 281:20 293:19 303:3 311:22 318:10 respective 334:17 respectively 164:7 response 152:9 174:19 183:7 208:2 263:8 294:21 responsible 54:15,19,20 responsive 233:13 268:11 rest 288:17 restart 188:8 restate 68:22 104:14 330:18 restrict 166:21 restriction 205:22 restricts 166:23 result 54:3 111:18,18 113:12	result (cont.) 117:14 145:8 185:3 195:22 195:24 196:13 198:1,14 203:16,17 204:7,22 208:1 229:25 234:7 238:3 271:21 resulted 181:25 304:6 305:16 resulting 97:5 234:19 results 30:18,18 31:20,21 76:11 103:14 110:14 112:6,23 142:8,9 149:4 150:1 155:17 155:23 160:17 161:11 174:2 179:24,24 180:1 186:19 189:14 192:14 198:12 203:22 213:20 239:17 241:2 247:23 252:20 263:14 299:7 retained 12:15,18,25 36:18 37:1,7 39:6,14,18,25 40:10 46:22 61:22 62:1,11,22 63:2,6,8 63:13,17,19,21,25 64:2 65:4,8 85:12 333:2 retention 37:3,8,20 38:1,8,11,14,17 39:5,17 40:11,24 43:4,14 43:16,25 44:16,19 46:4 return 26:19,23,25 32:10,14 34:9 35:19,19 36:7 72:16 76:1 80:13 91:6,20 93:20 96:4,9 100:18 102:3 105:5 109:11 109:17,17,22,22 110:14,17 115:15 116:15 117:3 120:23 122:24 123:6 125:2 126:19,21 127:4 129:4 143:15 148:7,18 150:16 151:22 157:15 158:4 160:25 178:13,16 179:6,8 180:3,10,15,16,23 181:1,15 187:7 188:3,16,24 189:1,4 189:5 194:16 195:2 199:3,4 206:23 207:11,15 208:7,21 209:6 223:17 224:4,16 226:9 227:15,16,18,20 228:7,13,21,24 229:2,10 230:6,7,15,25 232:16 241:3 242:24 243:15 253:16 254:2,16,23 255:4,5 267:21 310:21 322:14 323:24 324:4,7,8 returning 20:24 33:24 101:8 126:24 285:4

[returns - sales]

returns 26:21 31:13,14,15 34:1,1 34:20,21 35:1 70:15 71:7 71:16 72:7,19 75:16,17 78:20 79:4,17 80:4,9 90:24 90:24 93:21,22 94:3 95:4,5 99:1,2,2 103:15 105:2 106:12 109:4,18 116:17 125:4 126:8,12,14 128:11 128:18 133:1 140:19,19 142:25 143:9,16 144:7,11 144:12,22 145:10,10,23,23 147:13,14 148:4,15 149:7,7 149:23 150:3,4,6,7,18 151:2,3,8,14,16 152:1,1,24 155:13 156:1 157:2 158:22 159:9,10,14 164:15,16 167:11 168:3,21 169:7 172:1,1,9,9,25 173:2 177:15,19 178:6,21 179:16 182:4 190:9 191:1,2,4,24 192:2,20 194:22,25 195:8 196:3 198:16 205:15 208:4 209:2,13,16,19,22 210:1,10 211:2,2 222:22 223:12,23 224:10,14 225:1,3,8,16 226:14,15 227:15 229:24 229:24 231:12,13 232:19 233:8 235:7,9,10 237:5,11 237:14,16 238:1 253:13 254:17 255:11,14,17 262:24 322:13,18 323:15 323:16,18,23 324:5,5,11,11 324:13	review 16:3 24:17 25:1,14 26:7 28:8 29:14 86:11,17 88:8 103:17 117:18 118:3 210:3 210:13 250:11 268:19 reviewed 24:14 25:22 27:24 28:9 74:12 86:19 100:16,17,21 101:25 102:1,2,18 103:3,18 104:3,7,15 112:19 117:20 119:25 186:7 239:4 268:16 270:8 reviewing 27:5 30:7 104:23 332:7 revoked 66:1 rfigel 4:22 rfu66 326:17,21 rifkind 5:15 right 18:12 21:18 23:17 32:13 35:6 39:13 41:8 77:10,15 79:6,8 83:10 86:6,15 87:2 89:4,7 90:18 102:21 103:20 110:3,15 113:18,24 119:10 122:20 125:17,23 126:5 138:20 141:15 142:3,14 144:17,22 159:4 163:12,22 167:4 172:25 178:16 180:5 182:10 184:4 186:5,24 187:9,14,21 188:21 189:9 190:10 191:6 192:24 193:8 193:24 194:11 201:23 206:25 211:18 213:13 217:15 225:3 227:3,8 241:22 242:15,25 243:17 244:24 245:1,22,22 251:2 258:12 260:1,20,24 262:18 262:19 271:20 281:23 290:23 300:19 306:9 307:1 314:4,10 315:2 318:13 321:8 327:10 329:6,12 rights 61:7,14 299:7,15,19,25 332:9,14 ripple 1:7 2:7 4:2 6:3 10:11 30:12 37:22,25 38:15 41:1,8 42:16 46:3 73:10,24 74:21 84:18 85:2,3 94:18 96:13 97:5 99:15 126:17 181:21 191:24 198:16 225:18 231:11,18,25 232:3,25	ripple (cont.) 234:19 235:21 236:2,17,20 238:19 246:24 247:5,6,7,9 247:10 248:6,9,10,15,16 249:1,1,12,13,19,19,21,23 249:24 250:15,16 251:7,18 251:19,20 252:5 261:21 262:8,16 264:11,16 268:6 268:13,20,23 269:5 272:2 273:3,12,25 274:7,8 275:14 275:22,25 276:3,4,9,10 277:3,9,11,11,14,17,22 278:2,22 279:10 280:17 281:16 282:25 283:2,4,16 283:22,25 284:8,16,22 285:15,17,22,24 286:1,12 286:16,22 287:3,13,22 288:1,4,14,21 289:4,7,17 292:17 293:12,12,16 297:14,18,23 298:5,7,17 299:6,16,20 300:5,9,17 302:23 304:19 309:18 310:1,11 311:16,21,21 312:4,6,12,19,20 313:8 315:6 319:16 322:21 323:8 324:14 ripple's 60:5 87:5,12 88:1 89:10 91:22 92:10 93:2,6 94:2,15 95:13 98:22 99:7,10 125:5 150:19 180:24 230:1 234:4 234:15 235:2,8,11 236:8,19 237:6,10,17,19,20 238:3 244:1 245:10 247:5 251:6 262:25 263:17 268:16 275:12,15 276:1,12,14 282:1 288:9,17 299:16 300:20 305:19 307:13,16 310:2,12 331:25 rise 99:17 234:7 235:16 rising 323:20 risk 191:24 194:16 226:10 292:20 rmr 1:24 2:20 334:25 robust 27:1 30:22 31:19,22 robustness 101:3 141:7,16 170:2 184:14 role 52:19 54:5 313:4	romanette 19:1,3,12 ron 52:12 ronald 52:14 room 222:21 root 32:19,25 241:23,25 242:5,8 242:19,22 243:10,13 315:19,23 316:2,16 317:7 317:15 318:6,16 319:4 roughly 26:21 rounding 129:9 180:8 row 148:7 326:14,16 327:3,10 327:19 rubbing 51:7 256:17 rule 44:13 152:14 run 31:3,3,12 32:13 69:9 70:18 91:6,20,25 92:11 102:4,15 103:9 110:24 111:13,22 112:1,5 113:2,9,16 125:2 127:18 128:17,23 129:14 150:16 166:4,4 205:19 235:7 301:7 309:17 310:3 310:13 running 33:25 34:19 109:21 110:21 110:25 111:17 124:9 126:25 156:9 195:25 203:2 239:16 240:6 243:5 runs 8:5 108:12,13 s s&p 131:22 147:18 148:6,7,14 148:17 156:14 157:13,21 158:4,13 159:1,10,20,24 160:9 179:19 180:10,14 223:3,16 sake 218:10 sale 244:11 272:3 324:1 sales 30:21 245:8 247:22 269:9 271:9 283:24 284:3,14,16 285:2 288:9 289:6 297:15 298:6,8 299:13 300:10
---	--	--	--

[sales - seven]

sales (cont.) 308:19	sec (cont.) 292:10,13 293:4,10 295:23	seeing 108:23 169:5 259:7	sentence (cont.) 235:21 236:6 246:21 248:1
sample 166:21,24	296:5	seen 96:20 152:5 203:14 240:17	251:5 264:8,25 270:10,21
sarah 5:16	sec.gov 3:16,17,18	240:21,22 277:22	273:6,9,10,15,21 274:3
saw 261:2 282:2	second 15:16 20:3 23:5 27:3 33:1	select 309:21	276:17,19 279:9 280:19,22
saying 35:11 70:11 98:4 115:8	42:10 47:20 87:4,18 109:7	selected 103:21	281:24 282:13 283:14,17
126:10 132:1 135:13	137:24 138:17,25 140:17	selecting 131:13 139:3	286:8,16 287:22 288:1
169:21 193:16 204:17	156:22 160:21 161:15,16	selection 130:19 140:10 141:4,15,20	292:15,23 293:7,8 299:21
214:6 222:23 227:7,8	161:23 162:18 169:15	141:25 142:5,7 160:23	302:21 304:1 305:13 308:5
229:14 292:13 312:10	172:10 174:25 182:18,19	selections 140:25	308:16 310:11,17 317:17
315:7,7 317:23,23 318:10	197:25 198:11 199:22	sell 236:23 283:16,22 284:17	318:11 322:6,11 324:3
318:23 323:14	208:15 225:12 228:23	284:22 285:17 286:2	325:6
says 26:6 27:5 91:19 147:18	233:17,21 236:6 241:6	sellers 284:9 322:20 323:8	sentences 131:18 272:25 281:12
148:7 164:4 175:3 178:12	251:5,8 252:15,25 253:20	selling 323:14,14,19 324:15	separate 115:3 169:11 177:18 178:4
181:9 191:22 213:15 231:9	254:9 256:2 257:10 258:12	sells 300:6,6	207:20 239:25 272:22
241:23 264:8 270:11	259:14 273:9,15 274:12	semantically 188:25	275:24 281:15 297:20
281:24 283:15 286:16	279:8 280:19 283:17 285:3	seminar 83:21	310:23 311:14 312:3,17
290:3 292:15 305:13	287:23 292:15 297:24	sends 47:4	313:11
309:15 320:20,21 322:11	303:23 304:11,14 305:13	senior 50:22,25 51:2	separately 75:25 276:7
323:6	317:17 319:8 325:3,24	sense 49:21 69:14 72:3 92:13	september 108:13
scaravello 4:8	327:19 328:20 329:3	93:13 94:17 104:2 124:5,11	series 34:10 35:19,20 36:7 75:2,4
scenario 98:7,14 250:14,16 252:10	secondhand 45:6	132:3 199:8,16,17 205:7	76:1 80:13 89:14,22,25
252:15,16,24 253:1 254:9	sec's 22:4 40:25 41:7 42:16 43:5	206:7 222:3 230:3 249:19	95:8,21 97:1,18 101:3
scenarios 250:13 252:2,9,23 253:6	44:3 45:3 46:3 75:1 76:19	266:24 267:1,16 269:4,24	119:21 120:6,13,23 121:8
254:5,15 255:3,6	84:17 85:1 90:4 99:9	282:5,6 284:21 285:16	121:11,12 128:17 189:5
school 83:3 209:9	126:10 231:17 232:2,24	288:19 297:1 298:2,17	served 61:18 64:22
scientific 309:22	233:8,19 234:12,23 235:12	307:8 311:5	service 6:5 221:22 318:18
scope 274:20 278:19,23	291:7,10,12,22 292:24	senses 298:14	services 12:16 36:19 37:2,8 46:18
score 263:8	293:7	sensitive 185:2,5	49:5 50:13,17 51:12 53:16
scott 4:4	section 19:5,18 20:7,17,23 21:8,22	sensitivity 160:16 161:10	55:1
se 124:2	21:22 22:7,17,25 88:3,6,14	sentence 21:8 87:4,10,11,15,19,23	set 26:2 28:4 29:5 36:12 61:13
searching 33:10	89:9 91:12 143:20 149:5	91:8 92:1 125:11 129:24	93:24 94:8 104:18 106:2,7
sec 6:4 7:10 8:2 12:5,6 18:5	186:11,13,14,15,16 234:12	131:18 132:1 150:23	112:22 121:24 149:5 150:2
21:6 22:1,19 23:14,15,24	234:22 236:11 245:11,23	155:22 164:3 175:3 191:21	236:13 245:11 248:6 250:4
34:19 38:5 42:11,13 61:11	256:8 270:9 272:19,21	192:5,8,12,12,15,23 194:3	250:6 258:7 279:3 334:18
64:23 65:4,8 84:8,24 89:14	284:2,3 286:9 290:13,16	228:23 231:5 233:17 235:3	sets 16:8 102:25 103:11 104:20
90:8 92:16 94:19 107:1	291:18 292:2,7 295:23		105:15 138:19 160:17,20
126:15 233:5 234:18	297:13 299:22		161:11 220:23
235:16,21 236:1,7,15,18	sections 88:25 235:4,5 236:25		setting 69:16 78:11,16 85:1 95:10
237:10 239:9 267:19	272:22 273:19		133:23 134:22 176:22
	securities 1:4 2:4 3:7 10:10,10 43:6		206:9 216:4 255:1 320:12
	44:4 45:10,22 62:2 64:4		settled 62:12
	70:4,5 82:21,25 83:2,5,7,13		seven 49:10 75:5 129:7 139:8
	84:3,6,20 85:6,9		
	security 45:21 68:12 69:6 71:4		
	80:14,17 294:11 308:21,25		
	309:9 330:11		

[seven - sprotko]

seven (cont.) 151:20 161:6 181:24 183:13 184:15 230:9 231:19,20 233:1 333:1	significant (cont.) 157:20 160:11 165:17 167:24 168:11 172:15,17 173:13,15 180:12,20 181:18 195:4 202:21 203:4 203:8,11,12,15,17 204:9,21 204:21,24 224:19,24 226:12 238:21 267:21 310:21 322:14,19,25	small (cont.) 250:4,6 smaller 165:22 201:6,10,11,18,19 sn 1:6 2:6 10:14 sold 250:17 251:21 268:6,9,20 269:5,8 322:21 323:8 330:4 330:6,21,23 331:5,6,15 solely 307:24 somebody 47:3 203:15 220:11 263:23 263:23,24 something's 217:20 sorry 11:14 15:11 21:21 23:4 38:25 41:9 51:7 66:7 87:16 87:24 106:23 107:17 121:5 128:9 129:19 139:15 145:14 161:3 168:19 173:8 185:23 187:24 191:19 192:10 196:22 208:11 225:25 256:15,17 272:8 286:10 296:11 302:4 303:14 308:8 309:15 320:24 325:2,14 sort 38:22 39:2 51:6 76:7 83:18 83:19 131:20 146:8 155:9 157:12 165:24 204:18 211:22 260:20 271:20 273:16 275:12 277:24 320:11 sorts 153:13 sounds 11:20 296:23 source 102:2,6,18 104:8 258:8,22 259:5,8 sources 101:4,8,23 102:20,25 103:24 136:3 255:24,25 256:4,10,22 257:17 269:1 269:20,25 275:15 276:12 276:22 278:3,7,11 282:3 southern 1:2 2:2 64:3 space 83:20,23 131:25 132:4,10 spanned 80:12	speak 29:16 99:9 119:12 190:22 275:25 speaking 26:21 131:5 138:14 146:15 speaks 76:7 spec 233:17 specialist 10:20 specific 23:7 42:8 46:5 49:18 62:18 63:4 64:19 65:1,3 67:3,11 67:15,18 72:10 75:17 78:19 79:4,16,19 80:3 93:22 95:5 99:2,3,15 118:15 126:14,14 126:19 143:20 150:7 154:19 158:1 174:3 181:15 182:11 195:2 212:8 245:19 258:3 268:21 272:24 285:7 specifically 84:14 103:1 169:7 272:25 specification 110:20 111:4 112:8 117:1 117:12,24 123:22 148:14 173:7,19 246:7 257:4 322:15 specifications 112:5 113:11 117:13 181:19 183:15 196:12 197:20 198:1,7 203:1 230:4 310:18 specifics 253:23 speculate 174:4 speculated 235:1 speculating 234:13 speculation 234:3 speculative 233:25 235:15 spell 50:21 spike 287:19 spikes 106:7,8 spot 194:4 225:11 241:16 sprotko 5:21
share 206:17,20 283:5 299:16 330:6,22 shared 270:20 shareholders 293:20 294:3,16 295:17 300:24 301:20 sharing 298:1 sheet 240:14 shelf 131:20 133:20 shereck 6:5 shirt 51:7 short 76:3 92:11 93:12 95:18,19 304:12 shorthand 88:13 334:11 show 93:20,21 95:3,4,20 96:4,5 97:7 150:15 176:4 197:7 224:13 225:1,9 228:18 235:4 239:6 307:18 showing 149:21 shown 108:2 238:9 321:13 shows 195:3 309:17 side 63:5 141:15 144:17 159:4 172:25 186:24 187:14,22 188:10 191:5,6 193:9 214:3 229:15 241:22 314:21 315:2 sides 218:1 significance 124:15,19,24 125:16 126:1 200:24 202:25 205:4 213:16 significant 27:9 31:22 49:19 70:14 71:6,15 72:7,15,19 93:23 103:15 111:19 126:20 144:6 148:3,13,21 149:25 150:8 151:25 153:19	significantly 280:12 signing 334:20 silly 108:9 similar 184:18 simple 175:17 simply 26:24 101:17 103:5 176:19 193:13 265:1 294:21 317:16 sitting 14:24 22:20 24:21 25:21 27:22 28:12,16 35:24 39:13 39:15 40:3 46:14 48:7,9,23 52:9,18 62:18,20,25 64:1,5 70:12 80:1 81:16 86:21 94:5 96:11 102:24 103:2,7 113:15 117:2 135:9 153:3 205:4 211:8 213:2,8 214:8 214:22 215:9,15,23 216:1,2 216:24 258:3 situate 283:9 314:1 situated 293:18 situation 68:24 76:2 138:8 204:22 207:25 253:14 size 317:5 skip 234:22 skipping 235:3 259:16 279:18 slightly 312:2 slope 190:4 238:16 slow 123:4 131:9 248:21 252:12 310:5 small 65:2 123:2,6 127:4 165:16		

[square - successful]

square 4:16 32:19,24 242:1,5,8,19 242:22 243:11,14 315:19 315:23 316:2,16 317:7,15 318:6,16 319:4	statement (cont.) 231:15,16 279:14 280:21 297:16	statistics 174:10 176:4 188:13 200:20 220:12,20	strongly 220:7
squared 123:13 124:2,6,8,17,20 168:10 174:2,15 175:3,7,12 176:7,14,20,23 177:3,9,16 177:22 178:1,4,18,25 179:4 180:17 184:19 185:3,6 190:8 232:21	statements 75:3 90:2,8 93:10 181:22 268:17 275:14 276:16 293:6 304:24	status 17:25	struggling 278:6
squares 123:16,25 174:5 176:20 180:6 185:15 189:25 190:19	states 1:1 2:1,20 3:7 74:19 155:22 192:13	stay 248:8	studies 66:16 67:20 68:1,3 69:3,5,7 79:9 136:9 210:4
ss 334:2	statist 238:25	staying 207:25	study 66:14,21 67:6 68:10,14,23 69:23 70:2,8,13,18,20,23 70:25 71:2,5,9,12,13,25 72:8,13,15 73:1,4,8,18 74:17,19,20 76:11 78:23 79:6 86:1 94:1 96:22 98:7
staff 47:13 48:12 49:12,22 51:20 52:3,6,11	statistic 185:8	stays 207:23	studying 116:16
standard 121:19 130:12 146:7 157:12,17 185:8,10,16 189:13 199:12 200:23,25 201:6,11,19 202:9,13,17,19 202:24 203:2 208:21 209:7 210:25 212:6,13,25 213:10 214:2,7,14,18,18,19 215:1 215:13,17,23 216:22 217:6 217:8 290:10	statistical 52:24 73:13,23 74:3,4,8,12 74:14 76:16 89:5,6,20 124:14,19,24 125:16 126:1 132:8 142:23 143:2,8 149:12 151:19 152:10,21 152:25 153:10 154:5,20 155:12,14,16 158:21 167:9 168:5 169:6,9 178:6 180:16 181:16 182:6 199:7,16,23 200:9,15,23 202:25 203:20 203:22,23 204:5 205:6 213:16 218:18,23 219:11 219:19,23 220:5 221:2,22 223:3,8 224:15 232:14 239:2 311:4 324:4,10	steen 5:5	stuff 52:24
start 18:20 82:23 83:22,22 113:1 113:5,17 168:20 171:6 207:10 302:2	statistically 27:8 31:21 70:14 71:6,15 72:6,15,18 93:22 103:15 111:19 113:13 126:20 144:6 148:2,13,21 149:25 150:8 151:25 153:19 157:19 160:11 165:17 167:24 168:10 172:15,16 173:13,14 177:19 180:12 180:20 181:17 183:5 193:15,18 194:10,25 195:4 195:11,15 196:1,8,10 197:2 197:4,17,22 198:3,8,12,18 199:9,13,24 200:3,11,16,17 200:19 202:10,21 203:3,4 203:12,15,17 204:8,21,23 207:19 208:7 212:11 213:11 215:3 217:20 218:23,25 219:5,25 220:14 222:20 224:4,8,18,24 225:16 226:12 238:21 267:20 310:20 311:2 322:14,19,25 324:6	stella 6:4	subject 1:12 66:9 160:23 267:10 292:1
started 36:21,23 169:13 199:15 211:12	statistician 52:21 199:10	stenographic 10:25	subjective 130:14 139:8
starting 100:24 111:7,22 169:23 211:16 256:9 280:10 326:17		step 218:22	submission 86:14,20
starts 111:11 125:10 226:4 254:9 280:1,1		steps 71:14 72:5 105:9 151:1 174:12,13 179:7 180:23 181:4 229:22 249:11 288:16 311:9,17 312:6,21 313:14	submissions 86:18
stata 8:4 239:16		stick 133:17	submit 24:19 27:15,20
state 11:25 116:19 155:8 162:23 233:17 234:11 251:3 278:17 284:7 334:1		stipulations 9:10	submitted 24:6 67:5
stated 311:13		stock 69:13 70:4 80:17 257:24 294:8,8,10,13,22 295:20	submitting 28:14 34:2 35:6 105:10,13 107:21 108:20 111:21 112:11,25
statement 17:5 43:2 106:9 114:7 175:13 194:13 205:1		stopped 66:3 286:1,3	subsection 19:18 20:13,25 21:12 23:8 290:22 297:12 298:7
		store 81:3 82:7	subsequent 332:7
		strategy 236:17,19	substance 16:9 17:1 20:8 22:6 272:19 294:23
		street 3:12 4:17	substantial 49:7
		stretch 297:2	substantially 260:13,20
		strike 49:10 54:23 58:17 69:2 78:12 79:1 84:1,2 87:24 106:18 125:24 128:9 129:20 135:23 162:16 168:15,17 186:8 192:6 195:23 213:14 230:17 269:3 282:11 307:13 312:16 314:23 326:22	subtracting 194:16 226:10 228:24 229:1,14
		strikes 238:10	succeeded 236:9 320:21
		strong 129:18 295:11	success 236:19
			successful 299:17 300:20 311:15

[successful - testify]

successful (cont.) 312:4 313:12	sure (cont.) 177:3 184:22 185:24	talk (cont.) 143:12,23 185:14 204:15	tend 155:14
successfully 236:17	191:10 194:5 204:15	233:10 246:3 268:9 279:1	ter 188:4
sufficient 117:21,22	208:16 213:7 214:12	279:24 282:16 283:19	term 13:11,14,17 14:8,20 17:10
suggesting 220:9 327:23	218:13 222:7 245:18,21,22	284:11,20 286:5 295:13	17:19 21:1 22:21 66:13
suggests 267:9	250:9 251:1 253:8 254:3	298:24 323:22	76:3 91:25 93:13 95:18,19
suitability 73:8	255:14 259:6,15,19 264:5	talked 29:8,9 53:8 57:16 100:10	95:19 97:1 181:5 187:10,12
suite 3:13 4:18 10:22	270:6 281:5 283:11 285:10	137:11 196:14 290:13	187:16,23 188:1 189:5,6,8
summarize 155:9 245:25 304:17	287:24 301:17 303:24	talking 17:23 20:18 23:1 35:11	189:11,13,16,17,21 190:2
summarized 302:23	310:9 314:2 315:16 318:8	42:1 62:19 68:20 69:10	190:14,20,22 191:1,3,5,9
summary 125:11 150:15 304:23	323:4,5 325:16 329:14,15	71:23 92:20,21,25 93:5	191:14 193:8,11 201:16,18
sumner 4:16	surprising 121:21 136:15 308:19	96:24 97:1 98:13 106:14	201:22 205:22,23 206:10
supervision 47:2,6 48:13 51:23 54:13	suspended 66:2	109:9 114:18 134:6 145:16	206:10 208:22,25 226:24
54:22 55:25 56:16	sustained 304:6	157:13 184:25 189:9,24	227:17,19,25 228:18 229:5
supplement 256:20	swear 11:2	192:9 193:2,4,5 201:21	229:17 230:12,14,18 231:3
supplemental 24:19 27:15,20 28:13,17	sweeping 176:21	204:18 207:22 236:12	232:12 238:15,19 243:7
supplemented 156:13	sworn 11:6 334:6	238:17 245:24 247:5 253:9	266:23 267:3 286:17 288:2
supplies 245:1	sylvester 3:9 7:5 11:10,14,20,22 12:4	253:10 255:11 257:6	289:18 295:3,19 304:12
supply 244:17 245:5,8 252:5,19,21	13:25 14:3 15:14,20 16:1	260:17,18 262:1 269:17	305:17 316:8 317:11
258:22,25 259:9 261:11	18:7,10,18 24:1 40:23	271:9,18,23 275:11 281:10	terminated 286:7
269:23 280:7 281:14	43:21,23 48:2,19 49:3 51:9	281:12 301:16 307:13	termination 286:4
325:10,18	51:10 58:12,16,20 59:4,14	314:13	terms 20:17 24:17 26:5 33:14
support 9:1 130:19 308:20	60:3,14,18,19 61:4,17	talks 177:3 235:15 320:10	44:9 51:20,22 52:10 55:13
supported 166:22	87:18,21 107:3,7 122:3,14	tasks 52:4,7	56:12 61:25 69:25 98:13
supports 209:15 211:9	131:11 163:18,23 164:1,2	tatz 5:6	112:4 115:1 123:16 140:12
supposed 327:18	170:10 171:8,13,21,23	taught 82:16 84:1,7,16 85:2	153:1 154:21 166:1 176:14
supposedly 234:4	196:20,23 201:25 208:13	teach 67:25 84:3,4	177:8,13 185:15 188:18
sure 17:13 19:11 29:2 32:4 33:6	219:16 222:4,18 239:23	technique 74:4,8 120:1 121:7 130:12	198:25 202:12 207:5
37:6 45:14 47:18 67:16	240:3,15,19 248:22,24	130:12 132:8 133:8,21	247:14 251:3 256:4 269:11
69:20 74:24 79:25 92:24	266:4,11,21 291:1 296:14	techniques 74:12,14 130:15,16	285:19 289:9 292:1 294:23
100:9 101:13,18 120:9	297:10 302:6,9,15,20	telephone 3:15 4:7,20 5:9,20	301:19 326:3 328:21 329:4
122:3 125:7,10 135:3,13	319:18 325:16,17 329:10	tell 92:22 137:25 148:1,11	terrible 39:2
143:4 162:19 163:12,18,21	329:16 330:1,12,16 331:21	161:1,7,19 167:19 168:6	test 17:20 19:24 43:13 69:10
167:5 171:8 172:5 173:10	sylvesterm 3:16	174:10 177:22 189:21,23	76:16 89:20 90:13,16 99:8
	system 45:24 50:7	196:24 214:19 216:5	136:6 154:18 160:9,12
	t	220:14 272:7,14 276:6	231:24 232:5,15 237:9
	table 19:2 20:5 326:6,7	289:16	239:1,2 290:23 293:25
	tables 185:9 239:15	telling 148:12 221:15	testable 182:2
	taken 2:16 12:8 59:23 122:9	tells 138:7 148:2 177:10 178:19	tested 219:22 237:12 267:17
	170:16 222:13 266:17	179:4 190:8,14,18	testified 11:6 41:7 113:22 224:25
	297:6 329:22 334:8	ten 64:17 76:24 77:4 79:22	316:10
	talk 20:20,21 22:16 23:21 83:17		testifies 61:9
	83:22 120:17 134:16 143:4		testify 171:16 334:6

[testifying - traditional]

testifying	think (cont.)	time (cont.)	tokens (cont.)
12:12 37:16	116:18,25 117:2 118:23,23	49:19,20 59:12,19,24 63:1	114:21 115:6,8,9 116:3,13
testimony	119:10,14,23,24 123:22	75:23 76:18 80:9,12 89:17	119:6,17 121:8 152:12,12
27:25 28:1 35:4 56:10	127:17 128:6,13,15 131:17	89:18 90:4,10,21 95:2,8	154:7 160:22 161:1,5,20
61:16 97:21 224:7 281:6	135:9 137:15 154:23	97:15,18,19 98:6 99:12	165:1 169:2,3 170:2,4,5
318:9 332:24 334:10	161:17 163:5,6 165:11,12	101:2,16 102:11 103:4	174:8 184:1,12
testing	165:12,12,20 166:8 168:18	104:5 110:7 111:14 112:20	told
71:3 99:18 123:21 169:5	170:10 174:18 175:16,23	118:1,11 119:21 120:5,13	141:25 151:6
200:12 218:18 219:3,19	176:14 178:15 179:22	121:8,10,11,21 122:2,6,11	top
220:6,23 221:2,5,22 231:10	188:25 189:16 200:7 202:7	128:17 133:7 134:17,20	33:18 52:2 91:18 118:7
231:17,22,23 232:14,24,24	202:15 205:24 207:15,16	135:5 142:7 151:20 154:9	201:3 202:6,18 211:14
239:4 267:12,22,23 311:1	209:8 211:7,13,20 217:12	156:20 158:24 166:13	216:15 241:9,21 288:13
tests	219:12 220:3,9 221:4	170:9,13 171:3 172:5	289:2
69:15,16,21	224:25 225:5 227:2 230:10	181:24 183:20,24 184:12	topic
text	235:19 236:11 238:9,24	184:13 185:7 195:3 222:9	68:3 81:19,23 82:2,6,10,17
14:13,22	243:2 245:4,4 246:18	222:15 225:8 229:3 230:6	84:17 249:10
texts	250:21 261:2 262:19	232:20 237:11,21 238:11	topics
16:18	268:11 271:17,23 285:5,6	245:2 256:7 257:9 259:25	82:24
thank	289:23 293:3 298:13 299:5	260:17,21 265:4 266:14,19	total
11:8 15:25 18:9,13,17 24:4	301:19 304:10,17 305:25	268:15 279:22 284:22	273:11 281:14 287:7
59:19 107:3 122:6 131:10	309:1 316:3 317:11 319:1	285:17 286:20,23 287:4	289:14 317:17 318:19
170:13 171:21 222:9	320:25 321:7 328:4,6,6	289:25 295:8 296:9 297:4,8	332:25
256:18 266:14 297:4	thinking	306:11 314:25 329:19,23	totally
319:10 329:16,19 332:16	55:16 79:9 98:10 146:8	332:17 334:8	221:8 262:2,7
332:18,22 333:3,4	195:21 245:7 258:19	times	traced
thanks	263:23	39:21,24 40:3,7 61:21	324:21 327:1,11,24
222:6 319:20	third	63:11,24 65:10 66:19,21,24	traces
thc	2:17 4:5 10:17 147:21	67:9,10 76:21,23 77:4	328:16,18
26:19,20,25 106:2,7 107:20	169:18 225:13 227:5	79:14 97:21 106:1 119:21	tracing
108:3,4 109:4,11,14,25	246:21 276:17 293:8	208:20	328:10,15
110:6 113:22 114:22 116:7	thirty	timing	track
theories	231:7,8	41:5,24 97:14 251:9 292:16	263:5 268:22,22
44:18	thomas	title	trade
theory	6:5 10:19	19:18,22 50:24 51:1 172:8	169:23 316:3 317:19 318:2
21:6,13 22:1,5,19 44:11	thought	178:12 233:16	318:4,23
45:3 73:16 74:5 75:1 89:13	114:16,16 117:11 118:17	today	traded
89:20 99:14 126:11,18	184:9,13,15 225:1 263:24	12:13 22:20 24:21 25:21	69:8,12 70:4 80:16,17
152:5,6 181:20 183:12	304:9 312:13	27:22 28:12,16,22 29:4	169:14 246:13 279:10
231:18,18,22 232:2,25,25	thoughts	35:24 46:14 48:7,10,23	290:4
233:6,9,19 234:17	184:3 311:25	52:9,18 61:9 62:25 64:5	trader
thing	three	70:12 80:1 81:17 96:11	290:6
11:16 27:3 30:25 32:1,5	23:8 105:1,1 108:3,19	101:1 102:24 103:2,7	trades
33:12,14 35:12 38:23 39:3	109:9 138:9 139:7 158:9	104:24 113:15 117:2 135:9	245:14 305:15 306:10
92:25 106:15 127:12 171:6	198:7 231:7,8 281:13	153:4 174:18 183:1 196:11	318:24
181:10 211:12 226:19,23	308:12 328:18 329:7	211:8 213:2 215:9 219:4	trading
227:14 235:15 277:19	threshold	240:21,23 241:19 263:7	128:19 184:8 236:20 244:4
279:17 303:25	166:14 167:12,17 168:4	324:5 332:2,20	244:22 261:20 279:21
things	thursday	today's	280:4,6,11,13,24 288:12,17
26:16,18 27:11 94:19 245:6	111:8,17 113:17	332:24	288:18,24,25 289:3,4,7,9
think	tier	todd	295:19 311:22 314:9,17,18
21:16 22:20 32:3,12,16	33:18 288:13 289:2	4:10	314:19,21,23,24 315:1,5,6
33:1,2,3,8 36:16 41:17,20	tilt	token	315:8 316:4 317:6,18
43:12 55:15 69:13 70:25	15:21	106:2 107:20 108:6 110:11	318:19
72:25 84:11 85:4 92:24	time	168:12,19 184:7	traditional
97:11,21 101:4 102:24	38:4 41:2,22 42:7,18,19	tokens	290:10
105:6 110:20 114:6,7	44:22,23,25 46:21 49:12,14	77:22 83:9 110:1,5,7 114:9	

[transaction - value]

transaction 16:10 329:1	tuesday (cont.) 116:14,15 117:11,12 300:6	understand (cont.) 184:24 188:13 205:20	universe (cont.) 169:2
transcribed 334:12	turn 19:1 86:22 107:13 129:19	206:5,7 220:8 221:8,14	unrelated 176:9 235:10
transcript 305:10	129:21 137:21 140:13	224:7 228:20,25 229:13,14	unsuccessful 311:11
transcripts 27:23	157:11 161:21 171:24	240:20 241:20,25 242:13	unusual 106:6 136:14
transfer 246:23 248:7 249:14,15	174:23 185:25 227:1 228:5	243:9 244:20 246:24	ups 82:23 83:22,22
326:10,20	237:2 243:23,24 264:1	251:25 254:4,25 261:15	usage 17:16 26:22
transferred 248:17 249:2,12 326:15	286:15 291:13 292:14	264:21,24 277:1 281:5	use 22:15 32:19,24 34:10,12
327:7,16,24,25 328:25	302:1 308:2 315:11	289:22 293:6 297:21 299:4	77:19,22,24 78:4 84:11
transfers 246:21 324:20	turned 290:5,9	299:5 301:7 304:22 305:2	92:15 93:4 101:4,22 102:17
translates 115:1	turning 86:3 112:24 142:10 172:13	311:19 312:9 315:8 316:18	103:5 104:17 105:2,3 108:9
translation 190:6	173:24 182:16 241:21	318:8 331:10,18	108:11 110:17 112:19
transpired 42:20	243:8 248:1 272:5 273:21	understanding 13:5 14:7 16:19 30:11	113:1 116:14 121:25
treated 277:12,14 282:1,2,3	287:21 303:21	37:10,13,19 48:7,9,22 49:1	122:15 124:5 128:12,20
treating 276:10	turnover 290:11	51:18 62:14 106:9 144:18	129:6 130:11 131:21 132:7
treatment 278:2	turns 219:4	182:20 217:1 249:8 264:18	132:8,9,25 133:20 136:4
tried 111:12 198:23	tweets 90:3	267:2 273:7,10,16 275:16	139:2,19,25 140:2,5 141:19
tries 136:17	type 30:13 70:3 100:2 146:7	275:23 276:25 277:2,6,16	156:7 167:1 169:24 188:17
trivial 206:6 326:10	types 93:5 128:19	277:18,21 281:25 283:25	188:21,23,25 191:12 194:1
trouble 238:8 326:24	typewriting 334:12	284:18 305:7 313:17 321:9	194:7 207:5 209:18 217:7
true 76:4 88:12 112:25 122:18	typical 146:11,21 242:23 243:14	323:13 326:25	227:11 230:19 232:8,21
126:12 136:16 200:1 212:5	typically 68:23 121:14 136:17 147:5	understands 220:11	234:5 239:22 247:4 250:2
212:24 214:1 215:20 216:8	u	understood 35:4 43:12,13 48:19 78:15	260:6 261:17 276:22 277:3
217:10,14,22 218:11,15,24	u.s. 31:4,5 64:3,3 108:6 157:16	158:1 241:18 330:9	283:17 300:4 313:1 315:22
219:10,13,13 220:13,15	179:20 287:14	undertake 152:14	useful 184:14
221:1,16 240:4 249:7	ultimate 54:14 309:11 329:4	undertook 105:24 232:4 239:2	uses 102:24 103:3,4 104:13
278:19 279:14 280:8,15	ultimately 301:24 328:16,18,21	unexplained 180:25 192:2,21 194:23	117:3,7 128:14 137:14
283:21 322:12 323:1 334:9	unclear 304:9	195:9 196:4 208:23 228:7	139:17 141:18 166:9
truth 334:6,7,7	undercut 293:7	228:13,18 229:23,24	182:21,23 257:22 304:18
truthfully 12:12	underlying 13:3 101:9 102:19 120:14	231:12 237:15,25 242:23	305:25
try 18:3 74:24 144:2	underperforming 207:24	243:15	utilize 318:7
trying 33:8 125:23 135:16 190:3	underpin 295:14	unfolded 101:16	utilized 256:23 259:6
213:14 261:13 284:25	understand 17:6 21:17 77:12 78:25	uninformative 168:3,4	utilizing 170:4
tuesday 110:21,22,25 111:1,8,10	123:11,19 133:24 136:17	unique 129:16	uvaydova 6:4
	142:12 144:3 164:16 179:3	unit 81:7 82:11	v
		united 1:1 2:1 3:7	valid 220:4
		units 31:5 259:4 261:4 263:11	value 81:3 82:7 177:21 200:5
		265:17 273:2,3,12 287:18	214:1 217:22 218:25
		297:19 326:15 327:1,6,10	243:11 257:22 263:3 267:6
		327:15,25 328:24 333:1	300:25 301:12 306:13,15
		universal 167:20	307:6 309:19 327:13
		universe 161:8,19 165:1 167:13	

[values - words]

values 108:5 215:19 216:8 217:10 217:14 219:10 243:6 250:3 259:24 260:5 262:21 263:13 van 50:22 51:25 53:15 54:15,24 57:4 100:1 variable 138:12 173:1 177:14,14 178:2,9,16 179:2 variables 138:6,6 variation 91:19 123:7 125:2 127:4 150:16 177:13 178:2,21 179:1,6 180:22 181:1 190:9 262:22 variations 180:4 varied 260:12 various 90:2,7 93:5,11 94:19 134:18 181:21 202:25 203:1 230:4 231:18 232:25 234:8 235:11 236:2 269:20 284:1 310:17,18 vary 329:1 velocity 280:4,5 288:6,10,18 289:8 289:16,21,23 290:4 295:7 verify 104:19 105:14 151:2 versus 68:21 76:2 86:1 96:9 103:12,24 111:8 112:15 122:25 vesey 3:12 vice 50:25 video 6:5 10:20 videographer 6:5 10:5 15:18 51:5 59:18 59:24 122:5,10 170:12 171:2 222:8,14 256:14 266:13,18 296:12 297:3,7 329:18,23 332:19,22 videotaped 1:14 2:15 10:8 view 22:24 35:23 45:13 70:9 72:24 73:15,17 74:9 87:22	view (cont.) 87:25 90:4,12,15 96:19 97:2,4 99:5,6 109:13 118:19 119:15 129:8 133:18 135:7 139:18,22,23 142:20 157:24 160:3 161:4 165:5 167:16 173:25 176:3 176:3 199:13 205:25 211:1 211:1,9 229:4 232:6 238:20 238:24 249:17,18 260:3,9 260:10 263:4 270:24 293:5 293:20 294:2,14 300:8 301:10,15 306:12,12 307:5 311:8 320:8 viewed 272:19 views 24:16 44:10,17 244:7 245:1 303:18 violating 47:18 violation 43:6 44:4 45:9 virtual 19:15 80:24 81:24 331:14 virtue 75:21,25 170:1 237:21 visually 105:18 280:1 voice 270:22 volat 317:5 volatile 293:17 volatility 149:20 189:18 198:17 292:19 316:7,8 317:6,18 318:20 volume 33:20 279:21 280:4,6,11 288:12,13,24,25 289:3,10 314:9,17,19 315:1,10 316:2 316:4,4 317:6,18 318:19 volumes 289:7	walks 256:9 wallet 326:10 wallets 325:25 want 15:5 39:1,3 40:1,2 41:21 47:17 48:21 58:17 61:6 62:10 63:12 71:10 89:2 92:19 97:23 107:5 118:8,9 123:14,19 126:6 128:7 135:20 137:9 139:8 146:16 161:16 163:21 172:2,19 176:16 181:6 188:17,17,22 189:2 202:5,6,15,15,16 210:22 212:8 213:3,5,7 214:6,9,12,13 216:15 217:12 232:21 239:6 244:8 245:3,4 250:5,22 253:8 254:3 255:14 258:10 266:2 266:7 271:6,10 278:25 279:16 281:5 285:11 294:14,14,19,24 295:25 296:21 298:12,25 301:18 302:2 308:4 310:25 312:24 317:14 318:8 319:1 323:4 325:21 330:12,14,14 331:24 332:8 wanted 32:1 53:13 55:12 100:2,11 133:13,25 140:9 158:15 167:4,4,19 173:4 179:17 184:6 234:3 323:11 wanting 183:23,25 wants 18:15 washington 4:19 5:8 ways 83:24 134:18 189:2 website 131:23 wednesday 1:16 2:19 111:8,17,23 113:1,8,16 300:7 week 44:24 97:13 110:24 112:4 116:24 117:10,23 129:18 weekend 111:1,12 116:22 weekly 31:13,22 34:1,20 96:5 112:1,9 113:9 128:1 129:6 269:6	weight 116:7 weighted 114:5 115:2 weighting 116:3,13 141:9 weiss 5:15 13:8 wells 86:14,18,19 went 31:5 60:4 100:9,12 101:13 105:20 269:21 we've 23:9 29:3 43:12 59:13 107:11 109:9 171:14 196:14 199:25 208:20 222:1 226:21 257:4,5 316:25 331:25 332:2,5 wharton 5:15 whereof 334:18 white 4:15 200:21 wide 167:6 widely 100:20 101:25 120:1 159:22 window 76:13 96:3 97:7 98:8 117:7 117:25 253:12 withdraw 248:10 withdrawn 168:20 witness 7:2 9:3 11:2 15:13 18:14 37:3,9,21 39:6,18 40:12,20 40:22 48:1,20 51:17 57:9 58:10 59:11 60:10 61:19,22 63:25 64:10,23 65:5,8,9 66:17,22 67:7,22 78:8 107:5 131:5,8 188:1 196:22 222:1,6 263:25 266:1,8 296:8 302:11,18 329:14 332:18 333:4 334:4,18 witness's 334:10 word 17:16,17 37:15 54:19 93:4 106:8 150:13,22 268:8 269:7 291:20,21 294:10 words 57:24 155:5 194:14 216:6
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words (cont.)	xrp (cont.)	xrp (cont.)	z
227:10 230:19 232:8 292:9	46:10,12,15 50:10,12 73:10	277:12,14,20 278:2,9,10,14	zero
work	73:25 74:22 75:7,17 76:4	279:9 280:16 281:9,13,15	187:13 191:22 192:22
13:7 24:17 25:13,14,23	77:18 85:3,20 87:6,13 88:1	281:25 282:1,6,15,21,25,25	193:1,12,15,17,19 194:2,7
26:7 29:12,24 30:4,8 32:7	89:10,17 90:5,9,24,24,25	283:15,16,18,22 284:17,22	194:11,17,25 195:12,15
33:15 36:17,21,23 40:5	91:6,20 92:11,18 93:14,20	285:17 286:2,16 287:3,18	196:2,10 197:4,18,23 198:3
47:1 50:10 51:14,21 53:23	93:22 94:3,16 95:5,13,25	288:2,5,20 289:17,18,20,24	198:9,13,18 199:10,14
54:14 55:14 66:17,22 68:20	96:14,25 97:6,6,18,25 98:5	289:25 290:9 292:18,19	200:3,13 202:12,13 203:5
69:8,19 70:3 71:23 72:4	98:16,21 99:1,3,6,16	293:11,15 297:15,18,19,20	205:15,23 206:10,23
73:2 88:7 89:1 100:12	115:14 119:8,22 120:6,22	298:2,6,8,18 299:7 300:6,7	207:11,15,19 212:10,11
121:15 123:19 129:3,12,15	123:6 125:2,3,21 126:13,14	300:9,10 304:5,7 305:5,6	213:11,12 217:19,21
154:15 157:25 164:23	126:15,19 127:3,4 137:5,19	305:17,18,24 306:2,2,6,9	218:15,24 219:1,5,12,25
174:19 179:11,14,18,22	140:18 142:14,18,25 143:9	306:20,25 307:4,6,7 308:20	220:15 221:1,16 224:5,9
195:17,18 209:12 212:20	143:13,15 144:7,11,12,13	308:25 309:9,17 310:3,14	225:17 250:14 251:25
215:15 216:10,17,18 223:7	144:22 145:1,10,22 146:3	310:22 311:17 312:7,22	252:3,5,10,10,15,15,19,21
223:13,25 224:13,25	147:12 148:4,15,17 149:6	313:15 314:20 316:15,23	253:16 254:2 255:5 311:3,4
230:10 239:18 268:3,25	149:10,23 150:3,7,16,17,25	318:16 321:4 322:21,21	zoom
272:22 273:19 276:21	151:2,3,8,12,14,15,22,23	323:8,15,19 324:20 326:16	12:7 15:12
278:4 281:19 299:22	151:25 152:2,13,15,22,23	326:21 327:1,6,10,16,23,25	
325:23 326:1,5,12 332:8	152:24 153:1,5,7,12,17,21	328:25	
worked	153:24 154:6,11,19,21,25	xrp's	
12:19 38:15 40:7,18 51:3	155:13 156:1,2,6 157:3,6	90:17 163:3 180:23 234:6	
54:1 56:18	158:21 159:5,9,14,23 160:1	234:13 235:1,2,6 236:5	
working	160:12,13 162:23 164:5,15	252:24 253:1 262:3,7	
22:2 47:5 48:12 49:22	164:17 165:7,19 167:11	267:13,14,24,25 283:4	
171:18 195:14 200:22	168:3,14,21 169:7 172:1,8	299:20 307:18 312:18	
210:18 254:21 296:4	176:1,8 177:15,19 178:7,7	321:15	
works	178:12,16,21 179:6,8,23	y	
328:2	180:3,16 181:1,15,25 182:4	yeah	
world	182:7,13 187:8 190:9 191:1	20:4 41:9,12 43:10 54:1	
157:14 223:17	191:2,4,25 192:1,20 194:16	109:8 115:2 121:6 135:17	
worried	194:17,22 195:2,6,8 196:3	137:10 145:15 146:1	
127:23	198:16,16 199:3 205:15	152:20 156:23 163:13,23	
worse	222:22 223:12,16,22	169:16 172:2 175:1 178:24	
205:24 206:1	224:10,16,21 225:15,24	197:9 202:5 214:9 226:6	
worth	226:9,11 228:6,12,21,24	228:10 239:12 245:24	
294:22 300:6,7 303:24	229:10,24,24 230:8,25	246:2 256:3 258:2,18 266:8	
322:7	231:21 232:4,17,19 233:2	279:20 280:10 285:9,9,13	
write	233:20,25 234:5,16,25	291:16 297:1 301:3 302:17	
250:1 272:25 273:22	235:9,10,12,16,22,24 236:3	322:8 323:3 328:9	
282:12 288:3	236:8,9,16,17,19,20,21,23	year	
writing	237:5,12,14,20 238:1,20	36:22,22 65:24 75:5 129:7	
67:25	242:24 243:15 244:2 247:9	156:21 161:6 181:24	
writings	247:11 248:8,10 249:12,23	183:13 184:15 230:9,9	
68:9	250:4,15,16,18 251:6,7,9	231:19,20,20 233:1,2 268:6	
written	251:10,17,20,21 252:6,19	years	
58:24 82:13 309:10	254:6,9 255:19 258:5,7,8	40:15 62:1 64:7 118:5	
wrong	258:24 259:1,2,4,7,10,11	119:24 151:21,21 265:11	
308:8	259:24 260:4,7,10,12 261:3	268:20 287:4	
wrote	261:4,12,20,21 262:8,17,18	yen	
55:19 210:19 248:6	262:24 263:3,11 264:9,15	157:16 179:20 223:18	
x	264:20 265:14,16,21,22	york	
xr	268:6,14,20 269:5 270:14	1:2 2:2,17,18,21 3:8,14,14	
282:7	271:9,12,13,19 272:3 273:2	4:6,6 5:19,19 10:17,18	
xrp	273:3,12,14,23 274:10	69:12 70:4 334:1,3	
13:12 19:14 30:14 31:4	275:20 276:2,7,9,23 277:7		

Exhibit 25

CHAPTER 17A

EVENT STUDY METHODS: DETECTING AND MEASURING THE SECURITY PRICE EFFECTS OF DISCLOSURES AND INTERVENTIONS (NEW)

M. Laurentius Marais, PhD
Katherine Schipper, PhD

CONTENTS

17A.1 Introduction 17A.1	(b) Extensions to More Complicated Settings 17A.17
(a) Definition of Event Study 17A.2	17A.4 Design Issues in Event Studies 17A.18
(b) Illustrative Example 17A.2	(a) Inferences about Magnitude and Statistical Significance 17A.18
(c) Inference Based on Market-Model-Adjusted Abnormal Returns 17A.6	(b) Residual Return for a Single Firm 17A.19
17A.2 Applying Event Studies to Litigation Questions 17A.8	(c) Choice of Event Period 17A.19
(a) Conditions for Using Event Studies in Litigation 17A.9	(d) Choice of Estimation Period 17A.20
17A.3 Statistical Specification and Estimation of Event Studies 17A.10	(e) Choice of Indexes 17A.20
(a) Estimating the Market Model by Statistical Regression Analysis 17A.11	17A.5 Linking the Event Study to Peer-Reviewed, Published Research 17A.21
(b) Interpreting the Strength of the Market-Model Relation 17A.12	(a) Benchmark Values 17A.21
(c) Inferring the Effect of the Event: The Event Parameter Approach 17A.14	(b) Adapting Methods for Nonstandard Situations 17A.22
(d) The Statistical Power of the Event Study Method 17A.15	
(e) Confidence Interval for the Price Effect 17A.17	APPENDIX: EVENT STUDY TERMINOLOGY 17A.23
	NOTES 17A.24
	BIBLIOGRAPHY 17A.25

17A.1 INTRODUCTION. A dispute or litigation involving the value of a company often requires analysis of price changes of public securities in response to news about, for example, product recalls, takeover offers, regulatory and legislative changes, and earnings. In particular, substantial litigation arises in the area of

securities fraud: Typically, a class of investors sues a company and some or all of its officers, directors, and professional advisors for losses suffered when the security price declines, usually after the release of adverse information.

When a dispute or litigation requires an analysis of security price changes in response to a news disclosure, it is often appropriate to distinguish two related questions: (1) Does the price history establish that the disclosure caused any price reaction at all?, and (2) if so, what was the size and direction of the net price reaction to the disclosure alone, after accounting for the effects of other factors operating at the same time? This chapter describes a statistical approach, often referred to as an *event study*, for analyzing these questions. We outline the creation and interpretation of a generic, market-model-based event study without specifying a particular context or purpose. Chapters 18 and 19 of the third edition of the *Litigation Services Handbook* describe potential litigation contexts for such calculations, such as the quantification of damages by combining event study results with information about trading.

Computing damages in securities cases is an important, litigation-related application of event studies. The literature reviewing the legal and economic theories supporting this application include Gilson and Black (1993), Macey and Miller (1990), Koslow (1991), Cooper Alexander (1994), and Macey et al. (1991). Other articles provide additional details concerning event studies and the translation of an event study result to a dollar damage figure: Cone and Laurence (1994), Furbush and Smith (1994), and Gould and Kleidon (1994).

(a) **Definition of Event Study.** An *event study* is an empirical analysis of an intervention in a time series. In its most common form, an event study involves a statistical regression analysis of a time series of security returns, with the objective of identifying and measuring firm-specific effects of identifiable information releases (events). (Unless otherwise noted, we will use the terms *stock*, *share*, and *security* interchangeably). While many event studies analyze common stock or securities, the approach also applies in other contexts, some of which this chapter describes.

(b) **Illustrative Example.** Exhibit 17A-1 lists the daily closing prices and returns of the shares of the hypothetical Firms A and B for a 51-day period surrounding a hypothetical announcement date. (The data are artificial but illustrate typical patterns.) Exhibit 17A-2 plots the time series of share prices for Firm A shown in Exhibit 17A-1. This display strongly suggests that some event positively affected the price of Firm A's shares at day 0 (zero), the day of the announcement. Day 0 is referred to as the *event day*. Such impressive interventions usually occur only in conjunction with extraordinary events such as receipt of a takeover offer. Large *negative* price adjustments may also occur, for example, in association with unexpected adverse earnings news. (See, for example, Francis et al. (1994) and Kasznik and Lev (1995).)

Simple displays of real-world data do not usually reveal such obvious features. To confirm or refute the hypothesis of an extraordinary intervention in a series, an analyst will usually have to do more than plot and inspect the data. Often, he or she will use formal statistical analysis both to decide whether an intervention has occurred and to measure the size of its effect.

Event Date	Firm A			Firm B			Market Return
	Closing Price	Stock Return		Closing Price	Stock Return		
-25	\$50.00	0.01%		\$34.00	-2.86%		-1.40%
-24	\$48.03	-3.94%		\$34.09	0.26%		1.41%
-23	\$45.22	-5.83%		\$35.16	3.14%		-0.85%
-22	\$47.31	4.62%		\$34.69	-1.34%		-0.30%
-21	\$46.94	-0.78%		\$34.59	-0.29%		-2.00%
-20	\$48.34	2.98%		\$34.25	-0.98%		-0.75%
-19	\$47.72	-1.28%		\$34.25	0.00%		-0.06%
-18	\$47.34	-0.80%		\$34.75	1.46%		1.49%
-17	\$47.78	0.93%		\$34.69	-0.17%		-0.45%
-16	\$47.16	-1.30%		\$34.81	0.35%		-0.92%
-15	\$48.16	2.12%		\$34.69	-0.34%		0.63%
-14	\$48.66	1.04%		\$35.56	2.51%		-0.44%
-13	\$48.34	-0.66%		\$36.69	3.18%		1.60%
-12	\$47.38	-1.99%		\$38.25	4.25%		-0.66%
-11	\$48.44	2.24%		\$37.69	-1.46%		-0.81%
-10	\$47.72	-1.49%		\$37.97	0.74%		-0.34%
-9	\$46.91	-1.70%		\$38.00	0.08%		-0.79%
-8	\$46.84	-0.15%		\$38.28	0.74%		1.62%
-7	\$48.44	3.42%		\$37.63	-1.70%		1.33%
-6	\$49.47	0.32%		\$37.50	-0.35%		-0.31%
-5	\$48.50	-1.98%		\$38.28	2.08%		0.38%
-4	\$48.34	-0.33%		\$38.53	0.65%		1.10%
-3	\$50.03	3.50%		\$38.63	0.26%		1.18%
-2	\$50.72	1.38%		\$39.75	2.90%		0.13%
-1	\$50.72	1.38%		\$40.47	1.81%		0.16%
0	\$56.81	12.01%		\$59.97	-1.24%		-0.64%
1	\$57.03	0.39%		\$40.23	0.70%		
2	\$55.28	-3.07%		\$39.72	-1.32%		
3	\$54.88	-0.73%		\$39.47	-0.63%		
4	\$54.47	-0.75%		\$39.97	-3.80%		
5	\$53.16	-2.40%		\$37.44	-1.40%		
6	\$53.88	1.35%		\$37.03	-1.10%		
7	\$55.03	2.13%		\$37.66	1.70%		
8	\$57.31	4.14%		\$37.19	-1.25%		
9	\$56.25	-1.85%		\$36.91	-0.75%		
10	\$57.22	1.72%		\$37.22	0.84%		
11	\$57.59	0.63%		\$37.16	-0.16%		
12	\$58.94	2.34%		\$37.84	1.83%		
13	\$58.97	0.05%		\$37.50	-0.90%		
14	\$59.97	1.70%		\$37.53	0.08%		
15	\$60.09	0.20%		\$37.56	0.08%		
16	\$60.41	0.53%		\$36.94	-1.65%		
17	\$61.16	1.24%		\$36.91	-0.08%		
18	\$61.53	0.60%		\$38.38	3.98%		
19	\$60.69	-1.37%		\$37.81	-1.49%		
20	\$61.00	0.51%		\$37.84	0.08%		
21	\$60.09	-1.49%		\$40.19	6.21%		
22	\$61.97	3.13%		\$39.94	-0.62%		
23	\$62.59	1.00%		\$40.13	0.48%		
24	\$62.41	-0.29%		\$40.38	0.62%		
25	\$60.16	-3.61%		\$40.69	0.77%		

Exhibit 17A-1. Daily Closing Stock Prices and Returns for Periods of 51 Trading Days Surrounding Announcement Events Firms A and B

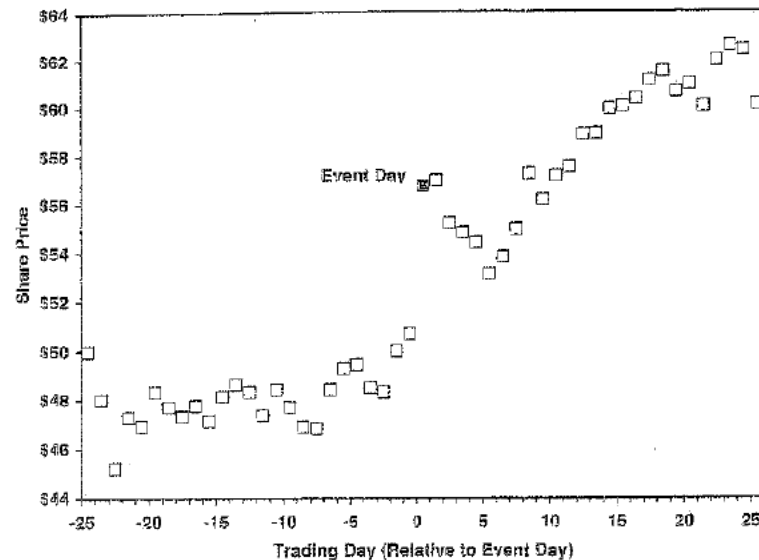


Exhibit 17A-2. Share Price of Firm A: Announcement at Day 0

Even absent specific, identifiable interventions, security price series display variation, as prices move in response to news about the economy in general, specific industries, and individual firms. Statistical methods provide objective interpretations of the evidence for—and estimates of the size of—the effect of a given intervention or shift in a price series, against its background variability. These statistical methods typically provide interpretations of the data that rely on an underlying statistical model which assumes *stationarity*: that each observed data point is drawn (independently) from a probability distribution of feasible values that does not change from one observation to the next. This clearly does not hold true of the prices in Exhibit 17A-2, in that the price on any given day tends to be closer to the prices at nearby dates than to those at remote dates. This indicates that the probability distribution of prices changes over time, in other words, it is *nonstationary*.

When referring to the stationarity assumption, one must distinguish between prices and price changes. Research on the behavior of security prices has shown that successive relative price changes, or *security returns*, are approximately independently drawn from a stationary distribution.¹ Thus the distribution of *returns* conforms well to the assumption underlying the statistical methods used in event studies, even though the distribution of *prices* does not. Exhibit 17A-3 shows the series of raw returns corresponding to the price series in Exhibit 17A-2. The return for any given nonevent day in Exhibit 17A-3 is no more likely to be similar to that for a nearby date than to that for a remote date. Thus, the structure of the return

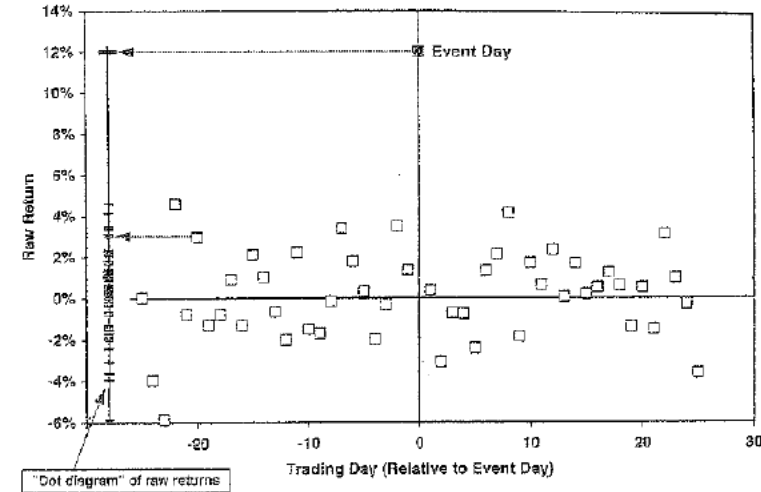


Exhibit 17A-3. Raw Returns to Firm A: Announcement at Day 0 (Dot Diagram of Raw Returns Obtained by Sliding All Data to Vertical Axis)

series is consistent with random sampling from a stationary distribution: the ordering of the nonevent returns in a time series does not relate to their values in Exhibit 17A-3.

The statistical analysis of the Firm A security return on the event day presents a formal method for comparing that return to the range of nonevent returns and their relative frequencies, which provide a benchmark for the range of normal return variation. Exhibit 17A-3 shows a vertical dot diagram obtained by projecting all the return observations onto the left-hand vertical axis, as indicated by horizontal arrows for an illustrative observation at day -20 and for the event date. The dot diagram visually displays frequency by density. An informal comparison of the event-day return to the nonevent dot diagram identifies the event-day return as highly unusual. The analyst can formalize this indication as a special case of a pooled, two-sample *t*-test. The intervention on the event day stands out as impressively in the returns series shown in Exhibit 17A-3 as in the price series shown in Exhibit 17A-2, so that formal statistical analysis will likely confirm what the data display appears to reveal on its face.

Often, analysts cannot easily discern the event-day return, as Exhibit 17A-4 illustrates. The event-day return to Firm B (shown in both the time series plot and the dot diagram in solid black) does not present the most extreme observation in Exhibit 17A-4.

Inspection alone does not reveal whether the event day return to Firm B is so unusual as to offer evidence of an intervention causing a material market reaction

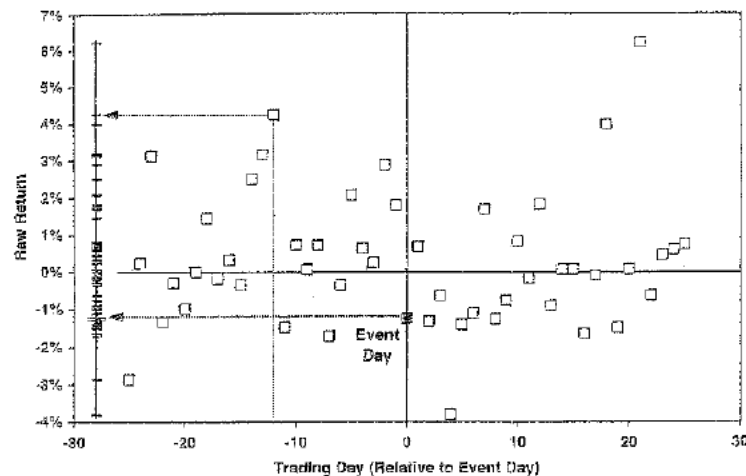


Exhibit 17A-4. Raw Returns to Firm B: Announcement at Day 0

to the announcement. Interpretation of the data underlying Exhibit 17A-4 must therefore rely on statistical inference. Again, assuming that the returns are independently drawn from a stationary distribution, their ordering has no relevance. Thus, the problem of assessing the evidence for a material market effect reduces to that of comparing the event-day return to the nonevent dot diagram of returns obtained by projecting all the data onto the vertical axis. Exhibit 17A-4 illustrates this projection by the horizontal arrows for the observation at the event day and day -12, which we use as an illustrative, nonevent observation.

(c) **Inference Based on Market-Model-Adjusted Abnormal Returns.** Clearly, security returns react to causes other than the announcement under consideration. To assess the effect of the announcement itself, especially in Exhibit 17A-4, the study should ideally identify those causes and remove their effects from the data. In most cases, however, analysts cannot identify all relevant factors, let alone measure their cumulative effect on each observed return. Instead, analysts could use a more practical approach of comparing the return series under consideration to a benchmark series that the same common causes, other than the announcement, will likely affect. The return to a market index offers such a convenient, theoretically defensible benchmark return series. Any factor that affects all securities in the market, including those of the subject firm, will be reflected in the market index return series as well as in the return series under consideration.

Exhibit 17A-5 shows a scatterplot of Firm B returns against those to a market index. Each observation reflects the intersection of the firm return (shown on the

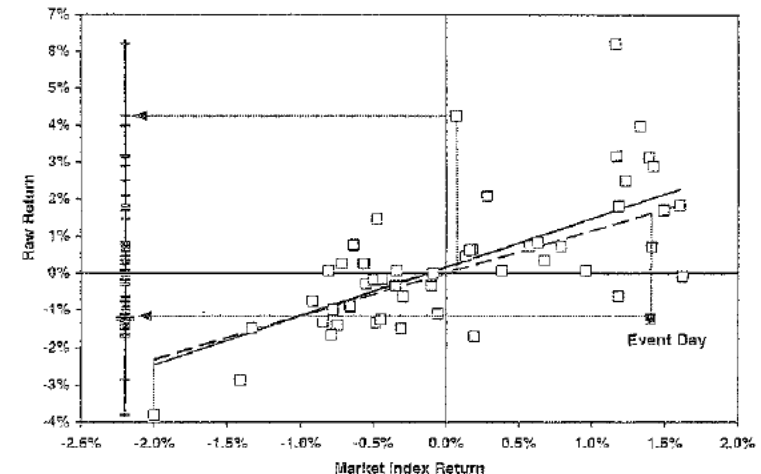


Exhibit 17A-5. Firm B Returns versus Market Index Returns

vertical axis) with the market return on the same day (shown on the horizontal axis). Exhibits 17A-4 and 17A-5 reduce to identical dot diagrams, but they have different horizontal axes. In Exhibit 17A-4, the horizontal axis carried information about which day (relative to the event day) related to a given return; this information bears no relevance for inferring the materiality of the event return. In Exhibit 17A-5, the horizontal axis carries information about market returns; the upward sloping configuration of the X-Y graph indicates that the market returns help explain variation in the firm's returns attributable to common, marketwide factors.

The dashed, sloping line in Exhibit 17A-5 shows the underlying, true regression of Firm B's returns on the market return—that is, the straight line that best explains the relation of the two return series. This line also provides a *forecast* of the firm's return, given only the market return and the joint history of returns. This forecast reflects the common factors that the market return indicates. (The solid sloping line in this exhibit reflects the approximate regression line that an analyst would calculate by applying a statistical estimation method to the available data shown in the exhibit. We discuss the distinction between the two lines in section 17A.3.)

An actual event-day return includes the effect of the announcement as well as the effects of the common factors. Therefore, the *difference* between the conditional forecast (i.e., the sloping line) and the actual return more nearly isolates the effect of the announcement alone than does the original raw return. The dotted vertical line connecting the event-day return to the regression line indicates this "residual" difference, which analysts often refer to as the *abnormal return* associated with the

announcement. The most negative nonevent market-adjusted return (in the lower left-hand corner of Exhibit 17A-5, and corresponding to event date +4 in Exhibit 17A-4) clearly becomes much less prominent than its raw return counterpart in Exhibit 17A-4. Exhibit 17A-5 largely attributes the unusual magnitude of this nonevent raw return to the effect of marketwide rather than firm-specific factors. Finally, Exhibit 17A-6 shows the time series and the corresponding dot diagram of abnormal (or "residual") returns to Firm B, confirming an unusual event-day return, once the analysis accounts for market-wide influences. Indeed, the market adjustment shown in Exhibit 17A-5 reveals the event-day abnormal return shown in Exhibit 17A-6 as the most extreme negative value observed during the sample period, unlike the corresponding raw return in Exhibit 17A-5. In contrast, Exhibits 17A-5 and 17A-6 show that the illustrative nonevent return on day -12 is little changed by market adjustment. (The day -12 return—like that on day 20—may or may not be associated with an identifiable disclosure of good news concerning Firm B but is, in any case, not associated with the day 0 event that we assume to be the analyst's focus.)

17A.2 APPLYING EVENT STUDIES TO LITIGATION QUESTIONS. Event studies may serve at least two related purposes in disputes or litigation that involve damages calculations. First, the analysis can address whether, as a threshold question, a statistically reliable link exists between the information event in question and stock price responses. For example, in securities litigation over allegedly defective disclosures, financial experts must link the share-price reaction to the alleged correction of the allegedly defective prior disclosures or omissions. Opposing experts will break this link if they can attribute the price change at the alleged correction

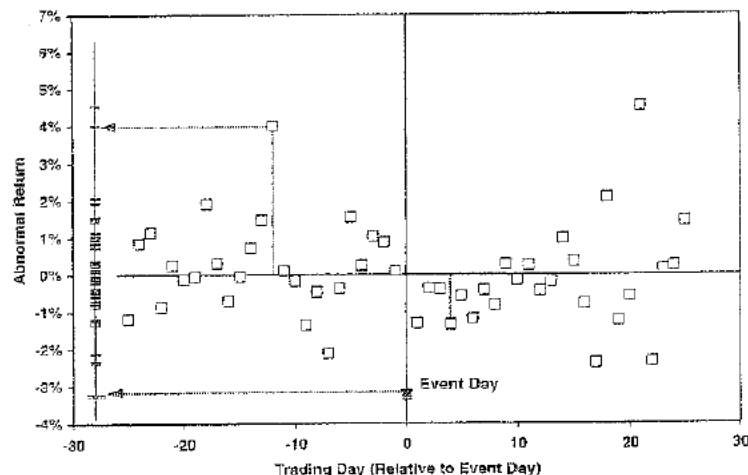


Exhibit 17A-6. Abnormal Returns to Firm B: Announcement at Day 0

date to other information revealed at the same time. Second, the analysis can address the magnitude of damages. An event study in this context proves most useful under the following three conditions:

1. A returns series is available that covers the event at issue and it is long enough to allow estimation of the market model (possibly augmented by an industry index, a size index, or a book-to-market index), including the firm-specific variability of returns (i.e., the standard deviation of returns after abstracting from market and industry effects).
2. The stock trades often enough so that each return covers just one day or at most a few days.
3. The parties can unambiguously identify the event in question with one or more announcements that have relatively certain timing, and the event announcement(s) do not contain a great deal of valuation-relevant information unrelated to the issue in question. Such unrelated information is commonly called *confounding events*. For example, a firm might announce a change in dividend policy concurrently with an earnings release; a study that focuses on the earnings release will have difficulty separating the earnings effect from that of the shift in dividend policy.

(a) Conditions for Using Event Studies in Litigation

(i) *Statistical Conditions.* As a practical matter, analysts will have more difficulty identifying interventions in return series for a thinly traded security because fewer returns exist and because (for multiday returns) all the news events during the several days covered by each return can affect that return. In addition, the variability inherent in a return series becomes a function of the time period covered by the return: that is, two-day returns have twice the variance of one-day returns and so on. Thus, analysts can most easily perform event studies for exchange-listed and NASDAQ common stocks that trade actively. Such studies become problematic for securities, such as debt and preferred stock, which tend to trade infrequently and at irregular intervals. In addition, analysts will find returns data much more readily available for common stocks than for many preferred stocks and most bonds.

(ii) *Theoretical Conditions.* Three theoretical conditions underlie the event study approach. First, the security of interest must be traded in an *informationally efficient market*: that is, one in which prices respond quickly and appropriately to valuation-relevant news. In such a market, current price provides the best estimate of intrinsic value for the security, conditional on publicly available information. Without this condition, it becomes difficult to argue that new information drives price changes. One party might propose, for example, that prices change not in response to underlying economic events but rather in response to fads or psychological factors that have little or no relation to economic events.

The efficient market condition provides the foundation of the fraud-on-the-market theory described in, for example, Koslow (1990). Plaintiffs in securities actions can rely on prices as measures of the intrinsic values of the underlying

securities, provided those prices appropriately impound public information. A person or entity that omits or falsifies information violates the integrity of prices; that is, the prices no longer represent intrinsic value. Under the fraud-on-the-market theory, an investor who relied on a price that did not reflect all relevant valuation information because of defective (i.e., false, misleading, or incomplete) disclosures can bring a claim, regardless of whether that person actually read or knew about the filings or other statements that contained the omission or false information. Note that if a defendant were to demonstrate that the security in question was not traded in an efficient market, the plaintiff's analysis would not meet an important condition for relying on event studies.

The second condition is that the analysts' statistical model of the return-generating process must be descriptively valid throughout the sample period. Event studies often use a form of market model as the assumed return-generating process, as illustrated in Exhibit 17A-5. Sections 17A.3 and 17A.4 of this chapter discuss the market model and issues related to the design of studies based on it.

The third condition applies most strongly where the plaintiff alleges that damages stem from a delayed disclosure. To base inferences on an event study of the actual disclosure, the abnormal return at the actual disclosure must be the same or nearly the same as the response that would have occurred had the disclosure happened at some other time. This condition requires stationarity in the reaction of the return series to disclosures, just as the second condition requires stationarity in the relation between the returns of the stock being analyzed and the market and industry index returns.

17A.3 STATISTICAL SPECIFICATION AND ESTIMATION OF EVENT STUDIES.

As illustrated in Exhibit 17A-5, an event study of security returns typically seeks to partition the variation of returns to a given security into two components. This partitioning corresponds to the *market model* equation for security s :

$$r_{st} = a_s + \beta_s r_{mt} + e_{st} \quad (1)$$

where

r_{st} = return to security s on day t

a_s = market model intercept for security s , that is, the intercept of the dashed sloping line in Exhibit 17A-5

β_s = market model beta for security s , that is, the slope coefficient of the dashed line in Exhibit 17A-5

r_{mt} = market index return on day t

e_{st} = firm-specific abnormal return to security s on day t , that is, the vertical deviation of the observation for day t from the dashed sloping line in Exhibit 17A-5

The variation over time of $(a_s + \beta_s r_{mt})$, the first component of r_{st} , reflects marketwide effects. Analysts refer to this component as the systematic (or predictable, conditional on knowledge of the market or industry effects) portion of the return. The second component, e_{st} , is the firm-specific effect, including that for $t = 0$ (the

event day), the effect of the intervention in the return series. This idiosyncratic return component corresponds to the dotted vertical line in Exhibit 17A-5; it numerically measures the abnormal return. This terminology has intuitive appeal because the firm-specific return at a given event indeed lies outside the normal expected return predicted by or associated with industry and market factors.

(a) **Estimating the Market Model by Statistical Regression Analysis.** Analysts compute systematic or predicted returns based on the historical relation between a given stock's return and the returns on one or more market, size, book-to-market and industry indexes.² The estimated coefficients obtained by regressing a series of stock returns on returns to the selected index(es) summarize this historical relation. The dashed regression line in Exhibit 17A-5 represents the underlying true regression line; that is, we assume that it is a stable attribute of the process that generated the underlying series of prices but that its intercept and slope are unknown and must be estimated using the available data series. We estimate the intercept and the slope of the regression line by applying a statistical estimation method such as ordinary least-squares (OLS) to a sample of returns taken from an estimation period.

The solid sloping line in Exhibit 17A-5 shows the OLS estimate of the regression line, based on all data in the exhibit except the event-day return. Thus the solid sloped line corresponds to the *estimated* market model equation.

$$\hat{r}_{st} = \hat{a}_s + \hat{b}_s r_{mt} + e_{st} \quad (2)$$

where \hat{a}_s and \hat{b}_s are the OLS estimates of a_s and β_s in (1). Given \hat{a}_s , \hat{b}_s , r_{st} , and r_{mt} , we can compute \hat{e}_{st} , the estimated counterpart of e_{st} . Whether \hat{e}_{st} is a *residual* or a *prediction error* depends on whether the estimation sample includes the return for day t . Because the analyst usually needs to estimate the market model as the normal benchmark for assessing the intervention in the return series, the study most often computes the estimated event-day abnormal return \hat{e}_{s0} as a prediction error. That is, we compute \hat{a}_s and \hat{b}_s from an estimation sample without the event-day return, and compute \hat{e}_{s0} as the deviation of r_{s0} from the estimated regression line shown as the solid line in Exhibit 17A-5:

$$\hat{e}_{s0} = r_{s0} - (\hat{a}_s + \hat{b}_s r_{m0}) \quad (3)$$

(Note that the dotted vertical line at the event day in Exhibit 17A-5 shows the deviation of r_{s0} , the event-day return, from the *true* regression line, whereas \hat{e}_{s0} is actually the deviation of r_{s0} from the *estimated* regression line. Both deviations are referred to as "abnormal returns," depending on the context.)

Analyses often specify the market model with a single, marketwide index (such as the Standard and Poor's [S&P] 500 or the value-weighted or equally weighted return on all New York Stock Exchange [NYSE] stocks). Studies can augment this basic model by including an industry index—for example, one composed of firms in the same Standard Industrial Classification (SIC) code which presumably react to the same industry-specific common factors. The resulting *augmented market model*

$$r_{it} = \alpha_i + \beta_{iM} r_{Mt} + \beta_{iI} r_{It} + \epsilon_{it} \quad (4)$$

has two slope coefficients, one for the relation of the stock return being analyzed with the market index and one for its relation with the industry index r_{It} . Both coefficients measure the sensitivity of stock returns to index returns. Fama and French (1992, 1993) have proposed a *three-factor market model*, which augments the marketwide index with indexes based on size (i.e., market capitalization) and book-to-market ratios. Studies include these additional factors (industry indexes, size-based indexes, and book-to-market indexes) to increase the proportion of the variance of total returns (the left-hand side variable) that they explain, thereby reducing the variance of the abnormal returns. Whether it is necessary or appropriate to include such additional factors depends on the context and is generally an empirical issue.

(b) **Interpreting the Strength of the Market-Model Relation.** Analysts use two measures of the estimated relation between individual security returns and returns to the index (or indexes): the magnitude (and statistical significance) of the regression slope (beta) coefficient(s), and the explanatory power of the regression expressed in terms of R^2 , the fraction of the variance of returns explained by the regression.

(i) **Beta Coefficient.** In the context of the market model, analysts refer to the slope coefficient (β_i in Equation 1) as the security's *beta* or systematic risk. A beta coefficient of 1.0 means that the security returns change, on average, exactly as much as the market index returns in response to the common factors captured in the index. Coefficients greater or less than 1.0 indicate securities whose expected returns vary more or less than average in response to the common factors. Exhibit 17A-7 summarizes the distribution of estimated betas for NYSE/AMEX and NASDAQ securities in the period 1985 to 1999, organized by size decile. Size Decile 1 in Exhibit 17A-7 refers to those 10 percent of exchange-listed firms having the smallest market capitalizations on the indicated exchange; similarly, decile 10 refers to those 10 percent of listed firms having the greatest capitalizations. The second of the three groups of columns of the exhibit summarizes, separately for each firm size group, the range of beta values for that group. Specifically, the exhibit shows the first quartile, median, and third quartile (i.e., the 25 percent, 50 percent and 75 percent points) of the range of calculated beta values. For example, the exhibit shows that the median calculated beta among all NYSE/AMEX firms was 0.67.

In principle, the weighted average measure of sensitivity of stock returns to market returns (i.e., the average beta) equals 1.0: few stocks have zero or negative estimated sensitivity measures, and few stocks (less than one-fourth) have sensitivity measures substantially greater than 1.0.

(ii) **Statistical Significance.** The statistical significance of the estimated coefficient measures the reliability of its estimated sign and magnitude, based on the coefficient's standard error. The OLS regression calculations produce a standard error for each estimated coefficient to gauge the size of the discrepancy between the estimated value and the underlying true value. (This discrepancy is the difference between the slopes of the solid OLS regression line in Exhibit 17A-5 and the dashed true regression line.)

Listing	Size Decile	Standard Deviation of Raw Returns (%)			Market Model Beta			Market Model R-Squared (%)		
		Q1	Median	Q3	Q1	Median	Q3	Q1	Median	Q3
NYSE/AMEX	1	3.0	4.8	6.7	0.24	0.49	0.78	0.2	0.5	1.4
	2	2.3	3.6	5.2	0.26	0.53	0.83	0.4	1.1	2.6
	All	1.7	2.3	3.4	0.37	0.67	1.00	1.1	3.5	9.0
	9	1.6	2.0	2.4	0.64	0.91	1.15	7.2	12.2	18.1
	10	1.6	1.8	2.1	0.81	1.01	1.20	15.2	23.0	28.5
NASDAQ	1	4.3	5.9	7.8	0.00	0.25	0.57	0.0	0.1	0.5
	2	5.0	6.4	8.5	0.12	0.37	0.71	0.0	0.2	0.6
	All	3.3	4.6	6.3	0.25	0.57	0.97	0.2	0.8	2.7
	9	2.5	3.4	4.6	0.55	0.91	1.28	1.6	3.4	5.9
	10	2.2	3.2	4.1	0.78	1.19	1.67	4.1	7.1	11.2

Notes: Data are taken from the files of the Center for Research in Security Prices (CRSP) at the University of Chicago, including Scholes-Williams estimates of market model betas based on the value-weighted CRSP index. Size is measured by market capitalization; the smallest firms are in decile 1. Q1 and Q3 denote the first and third quartiles of the data.

Exhibit 17A-7. Summary Statistics for Estimates of Beta, Standard Deviation of Raw Returns, and Market Model R^2 by Capitalization Decile: NYSE & AMEX NASDAQ Firms, 1985-1999

Statistical theory provides that a confidence interval centered at b , and extending for two standard errors in each direction will cover the true value β , approximately 95 percent of the time. Thus a finding that the two-standard-errors interval does not cover zero indicates at a 95 percent level of confidence that the estimated coefficient b , has at least the same sign as the true coefficient β . In many applications, one can restate this condition as that of requiring that the t ratio, that is, the ratio of the estimated coefficient to its standard error, equal at least two.

Most event studies have greater interest in the statistical significance of the estimated effect of the intervention (i.e., the significance of the abnormal return) than that of the slope coefficient, as discussed in section 17A.3(c), which explains event parameters.

(iii) *Standard Deviation of the Return Series.* The presence of return variability that differs substantially across stocks means that a return of a given magnitude may be unusual for one firm and frequently observed for another. A common measure of the variability inherent in a given return series is the *time-series standard deviation* of returns, which measures the typical dispersion of returns around their mean over some time period.³ Exhibit 17A-7 summarizes the standard deviations of daily returns for NYSE/AMEX and NASDAQ firms, overall and for extreme market-value deciles. These standard deviations decrease as firm size increases (larger firms have smaller variability of returns). The largest standard deviations occur for smaller firms on both the NYSE/AMEX and NASDAQ (with a median of about 4 to 5 percent for the smallest NYSE/AMEX firms and a median of about 6 percent for the smallest NASDAQ firms), while the smallest standard deviations occur for the largest firms on the NYSE (with a median of about 1.8 percent).

Statistical theory shows that approximately two-thirds of all returns should fall within plus-or-minus one standard deviation of the mean, and about 95 percent of all returns should fall within plus-or-minus two standard deviations. Thus, one would observe by chance (i.e., on a day selected at random) a return that exceeded two standard deviations from the mean no more than 5 percent of the time.

We can use this approximate rule and the data in Exhibits 17A-3 and 17A-4 to evaluate the likelihood of observing the event-day returns to Firms A and B by chance alone; that is, on the assumption that the information events had no effect on the return series. The sample standard deviations of nonevent returns for Firms A and B in the examples equal 2.13 and 1.84 percent; their sample average returns equal .16 and .35 percent. Firm A's event-day return of 12.1 percent deviates by more than five standard deviations from the average. Thus, we have over 95 percent (indeed, more than 99.9 percent) confidence that the event-day return is not simply a random observation from the distribution of nonevent returns, unaffected by the information event. Firm B's event-day return of -1.3 percent, however, lies less than one standard deviation from the average; one frequently observes returns as extreme as -1.3 percent even when no news announcement occurs.

(iv) *Explanatory Power: R^2 .* The second numerical measure of the estimated relation between returns of a stock under study and the returns to an index or indexes lies in the explanatory power of the regression. The regression's R^2 (R -squared) measures (in the case of a market model regression) the fraction of the variance in

stock returns that the index returns explain. The explanatory power appears as a reduction in the variance of abnormal returns (for example, the e_{it} in equation (2)) relative to the variance in raw returns. For example, the time-series variance of Firm B's raw returns plotted in Exhibit 17A-4 is approximately .000340 (excluding the event-day return), while that of the abnormal returns in Exhibit 17A-6 is .000179. Therefore the R^2 of the regression in Exhibit 17A-5 equals approximately 47 percent (i.e., $1 - .000179 / .000340$). The greater the R^2 , the greater the portion of a given stock's return that one would expect to arise from market and industry forces, as opposed to firm-specific news.

In a market model regression, the portion of a stock's return not explained by the chosen indexes is called *residual variation*. Both the amount of total variation in stock returns and the amount of residual variation in stock returns differ among stocks. Exhibit 17A-7 summarizes the market model R^2 for individual firms on the NYSE/AMEX and NASDAQ. For the largest NYSE firms the median R^2 equals about 23 percent. The overall median R^2 for NYSE/AMEX firms equals only about 3.5 percent, however, and for NASDAQ firms it equals only about .80 percent. Because of averaging effects, stock portfolios have much greater R^2 numbers than those for individual stocks.

(c) *Inferring the Effect of the Event: The Event Parameter Approach.* The event-day abnormal return of -3.0 percent shown in Exhibit 17A-6 deviates from the mean nonevent abnormal return (.24 percent) by about 2.4 times the standard deviation of the nonevent abnormal returns (1.34 percent). By this measure, the event-day abnormal return is statistically significant at the 5 percent level.

Although similar in form to the assessment of statistical significance for the raw event-day returns as outlined above, the calculation for abnormal returns as presented here is not feasible. In a real event study, analysts will not know the underlying, "true" regression represented by the dashed line in Exhibit 17A-5 and, therefore, will not know the length of the vertical line segment representing the "true" event-day abnormal return. Although analysts will know none of the ingredients of the sample calculation outlined here, they can approximate all of them by using the estimated, solid regression line in Exhibit 17A-5.

Using the *estimated* abnormal returns complicates the problem of statistical inference because the *estimated* event-day abnormal return has two components: (1) the true abnormal return, which includes the economic effect of the information event and an error component attributable to Firm B's inherent, residual return variation; (2) error attributable to the deviation between the known, estimated regression line and the unknown, true line shown in Exhibit 17A-5. Thus a straightforwardly computed t ratio for the event-day abnormal return cannot have the same interpretation as the t ratio for a raw return.

An exact formula exists for adjusting the t ratio for the abnormal return so as to give it the same interpretation as that for the raw return [see Patell (1976)]. The event parameters method provides an equivalent, alternative approach that may prove more computationally convenient for this and other purposes. Specifically, consider the augmented market model

$$r_{it} = \alpha_i + \beta_i r_{mt} + \gamma_{iA} d_{At} e_{it} \quad (5)$$

where d_{it} is an indicator variable for the date of the information event under study; that is, d_{it} equals one on the date of announcement a and zero on all other dates. Analysts often refer to the coefficient γ_{sA} as an *event parameter*, because it measures the sensitivity of returns of security s to information events of type A .

Let \hat{g}_{sA} be the OLS estimate of γ_{sA} in a regression that includes both the original estimation sample for Equation 2 and the event-date observation. This event parameter \hat{g}_{sA} equals the prediction error at the event date as defined previously, and its standard error and t ratio account for the effect of the estimation error in the regression line, thus applying the Patell (1976) adjustment automatically.

(d) **The Statistical Power of the Event Study Method.** The preceding discussion illustrates how one can estimate the market model and use it to adjust a raw return series for market and industry effects that obscure the firm-specific effect of a given announcement. Even if the investigator knew the precise market model coefficients, the residual variation of the return series would still obscure the announcement effect. Exhibit 17A-7 shows, moreover, that the market model has modest explanatory power. (The summarized R-squared data show that among the largest NYSE/AMEX firms the model explains 28.5 percent of the variance of the security returns or more for only one quarter of the firms in that size group.) Thus, one would naturally consider to what extent the market-model adjustment sharpens inferences regarding the presence of an announcement effect.

We can examine this issue by comparing the statistical power of tests for an announcement effect, with and without market adjustment. For a given true economic effect (for example, -2.05 percent, the true value of the "event-related" perturbation in the illustrative, simulated data underlying Exhibit 17A-4), the power of a statistical test is the probability of concluding that an effect did indeed occur. Thus, the power of the rule requiring a t ratio greater than 2 is the probability that a t ratio of this magnitude will actually occur, given the presence of a true effect of -2.05 percent.

Exhibit 17A-8 shows the theoretical values of such power probabilities under several assumptions regarding the R^2 of the market model, the magnitude of the true effect, and the value of the market index return r_{mt} on the event day relative to the mean market return. For example, if the true effect equals zero, then the probability of a t ratio greater than 2 is .046 in all cases. This simply reflects the 95 percent correctness of the approximate statistical rule: The probability of concluding that an effect is not present when, in fact, there is none is $1 - .046 = 95$ percent. For a true effect equal to twice the standard deviation of raw returns, r_{st} , the probability of detection ranges from .492 to .788, increasing as the explanatory power of the regression (R^2) increases. Comparing the empirical distributions of R^2 in Exhibits 17A-7 and 17A-8 suggests that for many firms, and in particular for most small firms, the market-model adjustment has little effect on the power of the test. (The benchmark for this comparison occurs when $R^2 = 0$; that is, no market adjustment.) Whether this will hold true in a given litigation setting is, of course, an empirical question.

(e) **Confidence Interval for the Price Effect.** Given the data shown in Exhibit 17A-5, the estimated event parameter \hat{g}_{sA} equals -3.49 percent, with a corresponding t ratio of -2.53. (The difference between the true abnormal return of -3.0 percent

R^2	"True Effect" ($\times \sigma(r_{st})$)			
	0	1	2	3
$\Delta r_{mt} = 0 \times \sigma(r_{mt})$:				
0%	0.046	0.158	0.492	0.834
1%	0.046	0.159	0.496	0.838
2%	0.046	0.160	0.500	0.841
5%	0.046	0.164	0.513	0.853
10%	0.046	0.171	0.535	0.871
20%	0.046	0.187	0.585	0.907
50%	0.046	0.275	0.788	0.986
$\Delta r_{mt} = 2 \times \sigma(r_{mt})$:				
0%	0.046	0.149	0.463	0.805
1%	0.046	0.150	0.467	0.809
2%	0.046	0.151	0.471	0.813
5%	0.046	0.155	0.483	0.825
10%	0.046	0.161	0.504	0.845
20%	0.046	0.176	0.553	0.885
50%	0.046	0.258	0.757	0.980

Exhibit 17A-8. Effects of Market Adjustment of Raw Returns on the Power of Tests for Event Responses in Security Returns

and the estimate of -3.49 percent results from the discrepancy between the true and the estimated regression lines at the event date.) The t ratio indicates that the difference of -3.49 percent between the return predicted for the event day by the estimated regression line (2.21 percent) and the event day return that actually occurred (-1.28 percent) is statistically significant at the 5 percent level. Thus the discrepancy will not likely have occurred as a random observation from the distribution of deviations from the regression line that occurred during the non-event period. This result offers evidence of the economic effect of the information event. We can use statistical measures to describe the precision of this evidence. In this example, the 50 percent confidence interval for γ_{sA} ranges from -4.43 percent to -2.56 percent and the 95 percent confidence interval from -6.26 percent to -.72 percent.

Suppose, for example, that the closing price of security s on the day before the information event was \$100. Since the total event-day return was -1.28 percent, security s closed at \$98.72 on the event day. Given the market return on the event day, the market-model regression predicts a return of 2.21 percent and, accordingly, a closing price of \$102.21. The statistical significance of the event parameter shows that we can conclude with 95 percent confidence that the value of security s declined as a result of the information event. Our point estimate of \$3.49 offers the

best linear unbiased estimate of the price effect of the announcement.⁴ We can also use statistical measures to describe the precision of this estimate. Specifically, given the estimate and its standard error, we can infer with 50 percent confidence that the true price effect (a decline) lies in the interval from \$2.56 to \$4.43 and with 95 percent confidence that the true effect lies in the interval from \$0.72 to \$6.26 per share. The wide range of prices in the 95 percent confidence interval reflects the inherent high variability of underlying price movements.

(f) **Extensions to More Complicated Settings.** One could also extend the event parameter approach to more complicated situations than that illustrated here. For example, an analyst can use the approach to examine the *cumulative abnormal return* (CAR) over multiple event days, as might be the case if the date of a disclosure were uncertain or if the study needed to consider several disclosures [see Marais, Schipper, and Smith (1989)]. In addition, analysts can estimate event parameters for portfolios of firms, weighting such portfolios to highlight various economic features of the securities involved. Examples of such weighting schemes include weighting by income effects of a given accounting disclosure or weighting by tax benefits to be received from an announced tax change. Schipper, Thompson, and Weil (1987) provide both a formula for computing economically weighted portfolios and an application that includes multiple event days. Finally, the regression structure of the event parameter approach can be exploited. Specifically, since the approach focuses on regression coefficients rather than residuals or prediction errors, one can apply a number of standard econometric methods derived for the regression framework.

We have found the event parameter approach relatively more convenient than the residual analysis approach for dealing with securities that are infrequently and nonsynchronously traded, such as bonds and preferred stock. These securities present their own special estimation problems (for an example, see Marais, Schipper, and Smith, 1989).

17A.4 DESIGN ISSUES IN EVENT STUDIES. The event study originated in academic research, so the conventional design features and assumptions of event studies fit academic research questions. They may not, however, fit litigation-based questions. The legal setting may present a problem or issue that seems familiar in the sense that it resembles a conventional research issue. But the special features that a litigation assignment presents may mean that the problem will not submit to conventional formulation. In such cases, the analyst must develop approaches that fit the legal setting. This section describes a number of design issues, some of which occur in both academic research and litigation applications of event studies, and some of which one will generally find only in litigation settings.

(a) **Inferences about Magnitude and Statistical Significance.** Event studies may serve both to establish whether any effect occurred and to quantify the effect, if any, including the margin of error of the measured effect. In the former purpose,

the question of *statistical significance* of firm-specific returns (abnormal returns or prediction errors) becomes fundamental. For the latter purpose, the *magnitude* of such returns becomes the basic input to the measurement calculation, and one can use statistical significance as an indicator of the confidence interval around the point estimate of the effect.

This chapter has already discussed the details of statistical inference. When considering design issues, it suffices to note that inference involves drawing conclusions about the likelihood that the analysis would yield the given result by chance, given assumptions about the data. Thus, if the abnormal return computed at a spin-off announcement is +2.6 percent, one question of inference involves the frequency with which one observes returns this large or larger in the absence of spin-off announcements. Analysts can answer this question by assessing the statistical significance of the abnormal return: one can do this by computing and interpreting a *t* ratio of the event period abnormal return divided by the time-series standard deviation of non-event period abnormal returns. A related question of inference involves quantifying our uncertainty about the number itself: that is, given the inherent error in any statistical estimate, how likely is it that the true abnormal return was, say, +1.5 percent or +3.2 percent?

It follows, then, that inferences about significance and magnitude are linked to the existence of economic effects. Suppose, for example, the event study produces an announcement-related abnormal return estimate of -50 percent and the standard deviation of such abnormal returns equals .39. This yields a *t* ratio of about -1.28, so in larger samples of returns, one would observe abnormal returns of this size or larger in absolute value about 20 percent of the time. In addition, we have approximately 95 percent confidence that the true return lies between -28 percent and +1.28 percent (that is, plus or minus two standard deviations from the estimated abnormal return). Given these results, one would find it difficult to argue for any discernible intervention in the return series at the event announcement. The most likely firm-specific effect of the event equals approximately zero.

(b) **Residual Return for a Single Firm.** When one performs an event study in the context of a dispute or litigation, the analysis frequently includes only one firm. In such an analysis, one cannot compensate for the idiosyncratic characteristics of the subject firm's return series as one would in academic studies that use large samples spread over time and industries. The variability in the return series, usually measured by the time-series standard deviation of returns, differs across firms and sometimes over time for a given firm. Trading patterns also differ across time and firms; even on the NYSE some listed firms trade relatively infrequently and, hence, one cannot obtain reliable daily prices.

The technical difficulties arising from the variability of returns are reduced to the extent that the study can attribute a portion of this variability to market or industry factors. The quantitative measure of this explanatory power is R^2 , discussed in section 17A.3(b)(iv). To the extent the analysis includes market factors, industry factors, or other factors that explain the variance in the stock or security returns being analyzed, *residual* or *idiosyncratic return* variance is smaller than the raw return variance. The measure of residual return is the error term in the (possibly augmented) market model regression. Residual return variability (the portion

of return idiosyncratic to that stock or security) increases the width of the confidence interval around any given abnormal return estimate. The greater the residual return variability, the greater the magnitude of any prediction error or abnormal return required to support the argument that a given information event affected the stock return.

(c) **Choice of Event Period.** The number of days around any information announcement for which the study will compute abnormal returns defines the length of the event period or event window.² One needs to choose an event window that is *both* known for certain to contain the information release of interest and believed to contain no other valuation-relevant information. The first objective implies a longer event window and the second implies a shorter one. The choice may involve trading off more variability in the series from choosing a longer window, against dealing with some uncertainty about precisely when the news in question reached market agents.

In an ideal case, one can trace the announcement to a time-stamped press release, so the study can use a single day as the event window. In other cases, however, a daily newspaper such as the *Wall Street Journal* becomes the source of event information. On any given day, the newspaper carries stories from the previous day; news in those stories will already have been reflected in share prices if the stories emerged during trading hours. News in stories released after the close of trade will affect share prices the day they appear in the newspaper. For this reason, studies conventionally use two-day event windows when a newspaper becomes the source of news announcements. Not all news events appear in newspapers, however. Such potentially important information sources whose contents rarely appear in newspapers include proxy statements containing information about compensation plan changes or antitakeover amendments; Form 10Ks containing detailed income statement information; analyst reports assessing the firm's future probability. Event studies based on such disclosures have used longer event windows.

(d) **Choice of Estimation Period.** Event studies usually involve the calculation of sensitivity measures (beta coefficients) using a market model, or possibly a market model augmented by some combination of an industry, size and/or book-to-market ratio indexes. Exceptions may occur in special circumstances, however. For example, analysts may occasionally conduct event studies when the available returns data are too limited to permit elaborate statistical estimation; in some such cases researchers and analysts have used the marketwide average sensitivity coefficient of 1.0, in which case they simply subtract the index return from the firm-specific raw return. Also, market model estimation and analysis may reveal that marketwide factors (possibly augmented) explain virtually none of the variance of returns of the series of interest. In such a case all, or nearly all, of the firm's return is idiosyncratic and the effect of extracting marketwide factors using an augmented market model may prove negligible.

If the study will estimate a market model, the length of estimation period becomes a design choice. A long estimation period may yield unstable results,

because the series includes a number of interventions unrelated to the litigation question at hand. Such interventions include major restructurings, write-offs, and acquisitions. A study that uses an excessively short series may lead to an imprecise estimation.

A litigation setting increases the difficulties of estimation period choice if the behavior of returns after the event being analyzed differs materially from that of returns before it, as would be the case, for example, if the firm filed for protection under the bankruptcy laws shortly after the event. In this case, the study cannot include returns after the event in the estimation period. Analysts also cannot include returns during a period of alleged fraud.

Clearly, analysts must consider the specific facts and circumstances of the given litigation question in choosing the estimation period. No specific rule or procedure will likely suit every situation. Based on academic research, however, it appears that estimation periods containing fewer than 50 returns will likely yield imprecise estimates.

(e) **Choice of Indexes.** A final design issue is the choice of indexes. Using commercially available data sources, one can match exchange-listed firms with an index of like firms and match NASDAQ firms with an index of all NASDAQ firms. The wealth of research demonstrating the effects of firm size on share returns indicates that it may be useful to take account of size explicitly in computing abnormal returns. One can do this either by including as an index a portfolio of firms of about the same size as the firm being analyzed, or by choosing appropriately between an equally weighted market index and a value-weighted market index. The former gives equal weight to all firms, so larger firms do not dominate the index value. The latter strongly reflects the return performance of the very largest firms.

If the study will include an industry index and commercial vendors of data do not provide a suitably specific industry index, a litigation setting may require that the analyst develop a specialized index and prepare extensive explanatory materials supporting the choices made in the development. The SIC code, which provides broad industry membership based on a dominant industry, offers a reasonable starting point. One could obtain a finer partitioning obtained from industry analyses provided by, for example, *Value Line* or *Standard and Poors*. The firm under study may also self-report a peer group in its proxy statement disclosures of performance-based compensation. In any case, the analyst must develop a peer group whose returns one would expect to move with the same industry forces as do the returns of the firm being analyzed. One can then more reasonably attribute the deviations of the subject firm's returns from the industry's returns to the firm-specific news.

Finally, Fama and French (1992, 1993) report that market model betas have relatively modest explanatory power for both cross-sections and time-series of stock returns and time-series of bond returns, relative to the explanatory power of size and the book-to-market ratio (the ratio of the book value of common equity to its market value) for stocks and term-structure factors for bonds. These results suggest that, in litigation settings, one may want to include controls for size and book-to-market ratios for stocks and for term-structure factors for bonds.

17A.5 LINKING THE EVENT STUDY TO PEER-REVIEWED, PUBLISHED RESEARCH. Applications of event studies abound in the finance and accounting research literature, which has long used them as a tool for measuring the shareholder wealth effects of announcements by and about firms, or of government actions affecting firms [see MacKinlay (1997)]. For example, Pincus (1997) performs an event study analysis of the Revenue Acts of 1938 and 1939 to assess the shareholder wealth effects of legislation that permitted last-in, first-out (LIFO) inventory valuations for tax purposes. Other examples of the wide variety of corporate events that the literature has studied include tender offers, spin-off announcements, leveraged buyout announcements, poison pill adoptions, golden parachute adoptions, and announcements of defensive tactics in takeover contests. Some of these published studies may pertain to the issues in a given dispute or litigation. Journals have also published numerous summaries and reviews of such potentially relevant literature: see, for example, Weston, Chung, and Siu (1998) and Binder (1998).

Some articles have extended event study methods to analyze price effects on securities other than common stock [see, for example, Marais, Schipper, and Smith (1989)]. Related methods have also been applied to nonprice effects of various kinds of interventions. For example, several studies have investigated the change in research and development spending after Generally Accepted Accounting Principles (GAAP) were changed in 1974 to require the immediate expensing instead of capitalization of such expenditures [Seltz and Clouse (1985) review this research]. Another example is Scholes, Wilson, and Wolfson's (1990) analysis of changes in the municipal bond holdings of banks after changes in tax rules disallowed part of the interest deduction on debt incurred to buy such bonds.

(a) **Benchmark Values.** Suppose, for example, that the issues in a dispute or litigation involved the market-value effects of qualified audit opinions. This might occur if a plaintiff were suing a CPA firm for failing to issue an audit opinion with a going-concern qualification for a firm that subsequently filed for bankruptcy [see, for example, Carcello and Palmrose (1994)]. The academic literature contains event studies [for example, Dodd et al. (1984)] that document the average effect of qualified audit announcements in large samples of firms overall, that is, without conditioning on firm-specific circumstances. Such research provides an informative benchmark value for the expected effect of a given qualified audit announcement, but for the effects of firm-specific circumstances. An application to a specific litigation setting should, of course, account for any special, case-specific circumstances which might imply an effect different from the averages in large samples.

(b) **Adapting Methods for Nonstandard Situations.** One could also benefit from consulting the academic research literature because this literature contains peer-reviewed solutions to specific technical problems arising from a variety of special circumstances, some of which may parallel the issues in a given dispute or litigation context. The literature relevant for this purpose includes not only accounting and finance research using event studies but also the broader statistical literature on related methods; for example, see Box, Hunter, and Hunter (1978) on *intervention analysis* and Yao (1993) on the detection of *change points*. An illustration of spe-

cial circumstances requiring nonstandard methods is provided by Marais, Schipper, and Smith (1989), who implement an event study method for analyzing multiple debt securities of a given firm. One could expect that a given event will similarly (if not identically) affect multiple bond issues of a single firm. Thus, the returns of different bonds of a single firm will likely exhibit cross-sectional correlation. Moreover, several other complications, including irregular and nonsynchronous trading, will hamper analyses of returns of these securities.

APPENDIX: EVENT STUDY TERMINOLOGY

This glossary defines various terms commonly used in the event study literature, including terms used interchangeably to describe the same (or nearly the same) concept.

Abnormal returns: See also *excess return*, *market-adjusted return*, *prediction error*, *residual return*. A firm-specific or idiosyncratic return, usually estimated at an event date or over an event period; the difference between the realized return during a period and the return expected given (1) returns to market (and possibly industry) indexes, and (2) the historical sensitivity of the firm's returns to the index returns.

Augmented market model: A market model with additional right-hand-side variables, such as industry indexes and indexes based on size or book-to-market ratios. See also *market model*.

Beta: Estimated slope coefficient from a time-series regression of common stock returns on market index returns; a measure of sensitivity of stock returns to market index returns. Sometimes called *systematic risk*; a parameter of the market model.

CAR: See *cumulative abnormal return*.

Confounding events: Information releases concurrent with, or very close in time to, a specific news announcement under investigation.

Cumulative abnormal return (CAR): Abnormal returns aggregated over some time interval. Over short periods, such as two or three days, analysts will often sum abnormal returns to compute cumulative abnormal returns. Over longer periods, analysts often use compounding.

Efficient market hypothesis: In its semistrong form, the view that stock prices quickly and unbiasedly move to reflect all relevant public information. Such a market makes arbitrage gains impossible. Alternatively, the view that prices measure intrinsic values unbiasedly (valuation errors, if they exist, are symmetric and centered on zero) and one cannot use public information to infer the existence and magnitude of any given stock's valuation error.

Estimation period, estimation window, estimation interval: Time period (measured in days, weeks, or months) over which returns are taken to estimate the parameters of the market model or augmented market model; can include returns before the event period, after the event period, or both.

Event parameter: An indicator variable included in a market model, taking on the value 1 for event periods and 0 (zero) otherwise. Captures the shift in returns on event days (weeks, months) as a measure of abnormal return.

Event period, event window: Time period (measured in days, weeks, or months) over which the study will compute abnormal returns. The study should choose the length of the period (window) to allow sufficient time for returns to impound information in the event announcement.

Event study: Empirical investigation and analysis of a time series of data, usually stock or security returns, for evidence of unusual behavior associated with identifiable news announcements.

Excess return: This term has two distinct uses. First, it may equal the difference between a firm's stock return and the return on a market index. In this usage, it becomes a synonym for *abnormal return* if the difference is computed as

$$[\text{stock return}] - [\text{beta}] \times [\text{market index return}].$$

Second, it may equal the difference between a firm's stock return or an index return and a proxy for the risk-free rate of interest.

Market-adjusted return: Loosely, any difference between a stock or security return and the return on a market index.

Market index: An equally weighted or value-weighted portfolio intended to proxy for aggregate wealth. Examples include the S&P 500 and the Center for Research in Securities Prices (CRSP) indexes of exchange-listed stocks and over-the-counter (NASDAQ) stocks.

Market model: A time-series regression model where the left side variable is returns to a given stock or security (sometimes a portfolio of such stocks or securities) and the right side variable is returns to a market index. See also *augmented market model*.

Predicted return: Systematic return, or return to a stock or security expected given the stock's (security's) sensitivity to market (and possibly industry) index returns and the realized returns to those indexes.

Prediction error: See *abnormal return*.

Raw return: See *return*.

Residual return: Firm-specific return, idiosyncratic return. Sometimes used as a synonym for *abnormal return*; strictly speaking, however, an estimated residual from a market model regression.

Residual variation: The time-series variability of a return series that one cannot attribute to or explain by movements in a market index (sometimes a market index combined with an industry index).

Return: The holding period return for a given security in the period from $t - 1$ to t is

$$([\text{Price at } t] + [\text{Distributions in period } t]) - [\text{Price at } t - 1] + [\text{Price at } t - 1]$$

Also referred to as *raw return*, to distinguish it from an abnormal return, or from the continuously compounded form

$$\ln ([\text{Price at } t] + [\text{Distributions in period } t]) - [\text{Price at } t - 1].$$

Systematic return, predicted return: The return on a stock or security that one can attribute to movements in a market index, or sometimes a market index combined with an industry index.

Systematic risk: Beta (slope) coefficient from a market model regression; measure of return sensitivity to movements in a market index.

t ratio: The ratio of an estimated coefficient or abnormal return to a measure of variability, such as the standard error of the estimated coefficient or the time-series standard deviation of abnormal returns.

NOTES

1. The total return to a share of common stock equals the percentage price change adjusted for cash dividends and for stock splits and stock dividends. Thus, if a cash dividend were paid on a given day, that day's return would include both the price change and the dividend. The percentage return would equal $(\text{price change} + \text{dividend}) / (\text{previous day's price})$. The treatment of stock splits and stock dividends becomes more complicated, in that these change the number of shares in an initial position. Commercial data services, such as the Center for Research in Security Prices at the University of Chicago Graduate School of Business, provide common stock returns series that fully account for cash dividends, stock splits and stock dividends. In addition, they provide documentation that would permit users to make their own adjustments to a price and dividend series.

2. Both the stock returns and the returns to the industry and market indexes can be raw, sometimes called *unadjusted*, or they can be returns in excess of a measure of the risk-free rate of interest (usually some return on a U.S. government treasury note). Analysts refer to returns adjusted by subtracting a risk-free rate as excess returns. Fama and French (1992, 1993) propose augmented market models which include size and book-to-market indexes.

3. The time-series standard deviation of the return series equals the square root of its time-series variance. Variance is a statistical measure of the spread or dispersion in a distribution. The mean or average captures the middle of the distribution, while the variance captures the tendency of observations to differ from the mean. A larger variance means a greater spread in the distribution. The variance of a given sample of observations is the average of the squared deviations of the sample values from the sample mean.

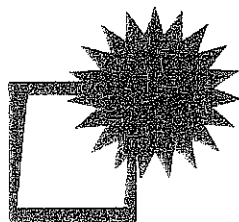
4. This is a consequence of the Gauss-Markov theorem; see, for example, Newbold (1984, Chapter 12).

5. This discussion assumes the use of daily returns, both for simplicity and because studies commonly use daily returns. One can, however, measure event periods in terms of other return intervals, such as weekly [see, for example, Patel (1976)] or monthly [see, for example, Schipper and Thompson (1983)].

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Event Studies in Economics and Finance

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1. Introduction

ECONOMISTS are frequently asked to measure the effects of an economic event on the value of firms. On the surface this seems like a difficult task, but a measure can be constructed easily using an event study. Using financial market data, an event study measures the impact of a specific event on the value of a firm. The usefulness of such a study comes from the fact that, given rationality in the marketplace, the effects of an event will be reflected immediately in security prices. Thus a measure of the event's economic impact can be constructed using security prices observed over a relatively short time period. In contrast, direct productivity related measures may require many months or even years of observation.

The event study has many applications. In accounting and finance research, event studies have been applied to a variety of firm specific and economy wide events. Some examples include mergers and acquisitions, earnings announcements, issues of new debt or equity, and announcements of macroeconomic variables such as the trade

deficit.¹ However, applications in other fields are also abundant. For example, event studies are used in the field of law and economics to measure the impact on the value of a firm of a change in the regulatory environment (see G. William Schwert 1981) and in legal liability cases event studies are used to assess damages (see Mark Mitchell and Jeffry Netter 1994). In the majority of applications, the focus is the effect of an event on the price of a particular class of securities of the firm, most often common equity. In this paper the methodology is discussed in terms of applications that use common equity. However, event studies can be applied using debt securities with little modification.

Event studies have a long history. Perhaps the first published study is James Dolley (1933). In this work, he examines the price effects of stock splits, studying nominal price changes at the time of the split. Using a sample of 95 splits from 1921 to 1931, he finds that the price in-

¹ The first three examples will be discussed later in the paper. Grant McQueen and Vance Roley (1993) provide an illustration of the fourth using macroeconomic news announcements.

creased in 57 of the cases and the price declined in only 26 instances. Over the decades from the early 1930s until the late 1960s the level of sophistication of event studies increased. John H. Myers and Archie Bakay (1948), C. Austin Barker (1956, 1957, 1958), and John Ashley (1962) are examples of studies during this time period. The improvements included removing general stock market price movements and separating out confounding events. In the late 1960s seminal studies by Ray Ball and Philip Brown (1968) and Eugene Fama et al. (1969) introduced the methodology that is essentially the same as that which is in use today. Ball and Brown considered the information content of earnings, and Fama et al. studied the effects of stock splits after removing the effects of simultaneous dividend increases.

In the years since these pioneering studies, a number of modifications have been developed. These modifications relate to complications arising from violations of the statistical assumptions used in the early work and relate to adjustments in the design to accommodate more specific hypotheses. Useful papers which deal with the practical importance of many of the complications and adjustments are the work by Stephen Brown and Jerold Warner published in 1980 and 1985. The 1980 paper considers implementation issues for data sampled at a monthly interval and the 1985 paper deals with issues for daily data.

In this paper, event study methods are reviewed and summarized. The paper begins with discussion of one possible procedure for conducting an event study in Section 2. Section 3 sets up a sample event study which will be used to illustrate the methodology. Central to an event study is the measurement of an abnormal stock return. Section 4 details the first step—measuring the normal performance—and Section 5 follows

with the necessary tools for calculating an abnormal return, making statistical inferences about these returns, and aggregating over many event observations. The null hypothesis that the event has no impact on the distribution of returns is maintained in Sections 4 and 5. Section 6 discusses modifying this null hypothesis to focus only on the mean of the return distribution. Section 7 presents analysis of the power of an event study. Section 8 presents nonparametric approaches to event studies which eliminate the need for parametric structure. In some cases theory provides hypotheses concerning the relation between the magnitude of the event abnormal return and firm characteristics. Section 9 presents a cross-sectional regression approach that is useful to investigate such hypotheses. Section 10 considers some further issues relating event study design and the paper closes with the concluding discussion in Section 11.

2. Procedure for an Event Study

At the outset it is useful to briefly discuss the structure of an event study. This will provide a basis for the discussion of details later. While there is no unique structure, there is a general flow of analysis. This flow is discussed in this section.

The initial task of conducting an event study is to define the event of interest and identify the period over which the security prices of the firms involved in this event will be examined—the event window. For example, if one is looking at the information content of an earnings with daily data, the event will be the earnings announcement and the event window will include the one day of the announcement. It is customary to define the event window to be larger than the specific period of interest. This permits examination of periods surrounding the

event. In practice, the period of interest is often expanded to multiple days, including at least the day of the announcement and the day after the announcement. This captures the price effects of announcements which occur after the stock market closes on the announcement day. The periods prior to and after the event may also be of interest. For example, in the earnings announcement case, the market may acquire information about the earnings prior to the actual announcement and one can investigate this possibility by examining pre-event returns.

After identifying the event, it is necessary to determine the selection criteria for the inclusion of a given firm in the study. The criteria may involve restrictions imposed by data availability such as listing on the New York Stock Exchange or the American Stock Exchange or may involve restrictions such as membership in a specific industry. At this stage it is useful to summarize some sample characteristics (e.g., firm market capitalization, industry representation, distribution of events through time) and note any potential biases which may have been introduced through the sample selection.

Appraisal of the event's impact requires a measure of the abnormal return. The abnormal return is the actual ex post return of the security over the event window minus the normal return of the firm over the event window. The normal return is defined as the expected return without conditioning on the event taking place. For firm i and event date τ the abnormal return is

$$AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_\tau) \quad (1)$$

where $AR_{i\tau}$, $R_{i\tau}$, and $E(R_{i\tau}|X_\tau)$ are the abnormal, actual, and normal returns respectively for time period τ . X_τ is the conditioning information for the normal return model. There are two common

choices for modeling the normal return—the *constant mean return model* where X_τ is a constant, and the *market model* where X_τ is the market return. The constant mean return model, as the name implies, assumes that the mean return of a given security is constant through time. The market model assumes a stable linear relation between the market return and the security return.

Given the selection of a normal performance model, the estimation window needs to be defined. The most common choice, when feasible, is using the period prior to the event window for the estimation window. For example, in an event study using daily data and the market model, the market model parameters could be estimated over the 120 days prior to the event. Generally the event period itself is not included in the estimation period to prevent the event from influencing the normal performance model parameter estimates.

With the parameter estimates for the normal performance model, the abnormal returns can be calculated. Next comes the design of the testing framework for the abnormal returns. Important considerations are defining the null hypothesis and determining the techniques for aggregating the individual firm abnormal returns.

The presentation of the empirical results follows the formulation of the econometric design. In addition to presenting the basic empirical results, the presentation of diagnostics can be fruitful. Occasionally, especially in studies with a limited number of event observations, the empirical results can be heavily influenced by one or two firms. Knowledge of this is important for gauging the importance of the results.

Ideally the empirical results will lead to insights relating to understanding the sources and causes of the effects (or lack

of effects) of the event under study. Additional analysis may be included to distinguish between competing explanations. Concluding comments complete the study.

3. *An Example of an Event Study*

The Financial Accounting Standards Board (FASB) and the Securities Exchange Commission strive to set reporting regulations so that financial statements and related information releases are informative about the value of the firm. In setting standards, the information content of the financial disclosures is of interest. Event studies provide an ideal tool for examining the information content of the disclosures.

In this section the description of an example selected to illustrate event study methodology is presented. One particular type of disclosure—quarterly earnings announcements—is considered. The objective is to investigate the information content of these announcements. In other words, the goal is to see if the release of accounting information provides information to the marketplace. If so there should be a correlation between the observed change of the market value of the company and the information.

The example will focus on the quarterly earnings announcements for the 30 firms in the Dow Jones Industrial Index over the five-year period from January 1989 to December 1993. These announcements correspond to the quarterly earnings for the last quarter of 1988 through the third quarter of 1993. The five years of data for 30 firms provide a total sample of 600 announcements. For each firm and quarter, three pieces of information are compiled: the date of the announcement, the actual earnings, and a measure of the expected earnings. The source of the date of the announcement

is Datastream, and the source of the actual earnings is Compustat.

If earnings announcements convey information to investors, one would expect the announcement impact on the market's valuation of the firm's equity to depend on the magnitude of the unexpected component of the announcement. Thus a measure of the deviation of the actual announced earnings from the market's prior expectation is required. For constructing such a measure, the mean quarterly earnings forecast reported by the Institutional Brokers Estimate System (I/B/E/S) is used to proxy for the market's expectation of earnings. I/B/E/S compiles forecasts from analysts for a large number of companies and reports summary statistics each month. The mean forecast is taken from the last month of the quarter. For example, the mean third quarter forecast from September 1990 is used as the measure of expected earnings for the third quarter of 1990.

To facilitate the examination of the impact of the earnings announcement on the value of the firm's equity, it is essential to posit the relation between the information release and the change in value of the equity. In this example the task is straightforward. If the earnings disclosures have information content, higher than expected earnings should be associated with increases in value of the equity and lower than expected earnings with decreases. To capture this association, each announcement is assigned to one of three categories: good news, no news, or bad news. Each announcement is categorized using the deviation of the actual earnings from the expected earnings. If the actual exceeds expected by more than 2.5 percent the announcement is designated as good news, and if the actual is more than 2.5 percent less than expected the announcement is designated as bad news. Those announce-

ments where the actual earnings is in the 5 percent range centered about the expected earnings are designated as no news. Of the 600 announcements, 189 are good news, 173 are no news, and the remaining 238 are bad news.

With the announcements categorized, the next step is to specify the parameters of the empirical design to analyze the equity return, i.e., the percent change in value of the equity. It is necessary to specify a length of observation interval, an event window, and an estimation window. For this example the interval is set to one day, thus daily stock returns are used. A 41-day event window is employed, comprised of 20 pre-event days, the event day, and 20 post-event days. For each announcement the 250 trading day period prior to the event window is used as the estimation window. After presenting the methodology of an event study, this example will be drawn upon to illustrate the execution of a study.

4. Models for Measuring Normal Performance

A number of approaches are available to calculate the normal return of a given security. The approaches can be loosely grouped into two categories—statistical and economic. Models in the first category follow from statistical assumptions concerning the behavior of asset returns and do not depend on any economic arguments. In contrast, models in the second category rely on assumptions concerning investors' behavior and are not based solely on statistical assumptions. It should, however, be noted that to use economic models in practice it is necessary to add statistical assumptions. Thus the potential advantage of economic models is not the absence of statistical assumptions, but the opportunity to calculate more precise measures of the normal return using economic restrictions.

For the statistical models, the assumption that asset returns are jointly multivariate normal and independently and identically distributed through time is imposed. This distributional assumption is sufficient for the constant mean return model and the market model to be correctly specified. While this assumption is strong, in practice it generally does not lead to problems because the assumption is empirically reasonable and inferences using the normal return models tend to be robust to deviations from the assumption. Also one can easily modify the statistical framework so that the analysis of the abnormal returns is autocorrelation and heteroskedasticity consistent by using a generalized method-of-moments approach.

A. Constant Mean Return Model

Let μ_i be the mean return for asset i . Then the constant mean return model is

$$R_{it} = \mu_i + \zeta_{it} \quad (2)$$

$$E(\zeta_{it}) = 0 \quad \text{var}(\zeta_{it}) = \sigma_{\zeta_i}^2,$$

where R_{it} is the period- t return on security i and ζ_{it} is the time period t disturbance term for security i with an expectation of zero and variance $\sigma_{\zeta_i}^2$.

Although the constant mean return model is perhaps the simplest model, Brown and Warner (1980, 1985) find it often yields results similar to those of more sophisticated models. This lack of sensitivity to the model can be attributed to the fact that the variance of the abnormal return is frequently not reduced much by choosing a more sophisticated model. When using daily data the model is typically applied to nominal returns. With monthly data the model can be applied to real returns or excess returns (the return in excess of the nominal risk free return generally measured using the U.S. Treasury Bill with one month to maturity) as well as nominal returns.

B. Market Model

The market model is a statistical model which relates the return of any given security to the return of the market portfolio. The model's linear specification follows from the assumed joint normality of asset returns. For any security i the market model is

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (3)$$

$$E(\varepsilon_{it}) = 0 \quad \text{var}(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$$

where R_{it} and R_{mt} are the period- t returns on security i and the market portfolio, respectively, and ε_{it} is the zero mean disturbance term. α_i , β_i , and $\sigma_{\varepsilon_i}^2$ are the parameters of the market model. In applications a broad based stock index is used for the market portfolio, with the S&P 500 Index, the CRSP Value Weighted Index, and the CRSP Equal Weighted Index being popular choices.

The market model represents a potential improvement over the constant mean return model. By removing the portion of the return that is related to variation in the market's return, the variance of the abnormal return is reduced. This in turn can lead to increased ability to detect event effects. The benefit from using the market model will depend upon the R^2 of the market model regression. The higher the R^2 the greater is the variance reduction of the abnormal return, and the larger is the gain.

C. Other Statistical Models

A number of other statistical models have been proposed for modeling the normal return. A general type of statistical model is the *factor model*. Factor models are motivated by the benefits of reducing the variance of the abnormal return by explaining more of the variation in the normal return. Typically the factors are portfolios of traded securities.

The market model is an example of a one factor model. Other multifactor models include industry indexes in addition to the market. William Sharpe (1970) and Sharpe, Gordon Alexander, and Jeffery Bailey (1995, p. 303) provide discussion of index models with factors based on industry classification. Another variant of a factor model is a procedure which calculates the abnormal return by taking the difference between the actual return and a portfolio of firms of similar size, where size is measured by market value of equity. In this approach typically ten size groups are considered and the loading on the size portfolios is restricted to unity. This procedure implicitly assumes that expected return is directly related to market value of equity.

Generally, the gains from employing multifactor models for event studies are limited. The reason for the limited gains is the empirical fact that the marginal explanatory power of additional factors the market factor is small, and hence, there is little reduction in the variance of the abnormal return. The variance reduction will typically be greatest in cases where the sample firms have a common characteristic, for example they are all members of one industry or they are all firms concentrated in one market capitalization group. In these cases the use of a multifactor model warrants consideration.

The use of other models is dictated by data availability. An example of a normal performance return model implemented in situations with limited data is the market-adjusted return model. For some events it is not feasible to have a pre-event estimation period for the normal model parameters, and a market-adjusted abnormal return is used. The market-adjusted return model can be viewed as a restricted market model with α_i constrained to be zero and β_i constrained to be one. Because the model coefficients

are prespecified, an estimation period is not required to obtain parameter estimates. An example of when such a model is used is in studies of the under pricing of initial public offerings. Jay Ritter (1991) presents such an example. A general recommendation is to only use such restricted models if necessary, and if necessary, consider the possibility of biases arising from the imposition of the restrictions.

D. *Economic Models*

Economic models can be cast as restrictions on the statistical models to provide more constrained normal return models. Two common economic models which provide restrictions are the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). The CAPM due to Sharpe (1964) and John Lintner (1965) is an equilibrium theory where the expected return of a given asset is determined by its covariance with the market portfolio. The APT due to Stephen Ross (1976) is an asset pricing theory where the expected return of a given asset is a linear combination of multiple risk factors.

The use of the Capital Asset Pricing Model is common in event studies of the 1970s. However, deviations from the CAPM have been discovered, implying that the validity of the restrictions imposed by the CAPM on the market model is questionable.² This has introduced the possibility that the results of the studies may be sensitive to the specific CAPM restrictions. Because this potential for sensitivity can be avoided at little cost by using the market model, the use of the CAPM has almost ceased.

Similarly, other studies have employed multifactor normal performance models

motivated by the Arbitrage Pricing Theory. A general finding is that with the APT the most important factor behaves like a market factor and additional factors add relatively little explanatory power. Thus the gains from using an APT motivated model versus the market model are small. See Stephen Brown and Mark Weinstein (1985) for further discussion. The main potential gain from using a model based on the arbitrage pricing theory is to eliminate the biases introduced by using the CAPM. However, because the statistically motivated models also eliminate these biases, for event studies such models dominate.

5. *Measuring and Analyzing Abnormal Returns*

In this section the problem of measuring and analyzing abnormal returns is considered. The framework is developed using the market model as the normal performance return model. The analysis is virtually identical for the constant mean return model.

Some notation is first defined to facilitate the measurement and analysis of abnormal returns. Returns will be indexed in event time using τ . Defining $\tau = 0$ as the event date, $\tau = T_1 + 1$ to $\tau = T_2$ represents the event window, and $\tau = T_0 + 1$ to $\tau = T_1$ constitutes the estimation window. Let $L_1 = T_1 - T_0$ and $L_2 = T_2 - T_1$ be the length of the estimation window and the event window respectively. Even if the event being considered is an announcement on given date it is typical to set the event window length to be larger than one. This facilitates the use of abnormal returns around the event day in the analysis. When applicable, the post-event window will be from $\tau = T_2 + 1$ to $\tau = T_3$ and of length $L_3 = T_3 - T_2$. The timing sequence is illustrated with a time line in Figure 1.

² Eugene Fama and Kenneth French (1996) provide discussion of these anomalies.

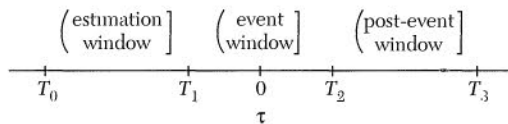


Figure 1. Time line for an event study.

It is typical for the estimation window and the event window not to overlap. This design provides estimators for the parameters of the normal return model which are not influenced by the returns around the event. Including the event window in the estimation of the normal model parameters could lead to the event returns having a large influence on the normal return measure. In this situation both the normal returns and the abnormal returns would capture the event impact. This would be problematic because the methodology is built around the assumption that the event impact is captured by the abnormal returns. On occasion, the post event window data is included with the estimation window data to estimate the normal return model. The goal of this approach is to increase the robustness of the normal market return measure to gradual changes in its parameters. In Section 6 expanding the null hypothesis to accommodate changes in the risk of a firm around the event is considered. In this case an estimation framework which uses the event window returns will be required.

A. Estimation of the Market Model

Under general conditions ordinary least squares (OLS) is a consistent estimation procedure for the market model parameters. Further, given the assumptions of Section 4, OLS is efficient. For the i^{th} firm in event time, the OLS estimators of the market model parameters for an estimation window of observations are

$$\hat{\beta}_i = \frac{\sum_{\tau=T_0+1}^{T_1} (R_{i\tau} - \hat{\mu}_i)(R_{m\tau} - \hat{\mu}_m)}{\sum_{\tau=T_0+1}^{T_1} (R_{m\tau} - \hat{\mu}_m)^2} \quad (4)$$

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i \hat{\mu}_m \quad (5)$$

$$\hat{\sigma}_{\epsilon_i}^2 = \frac{1}{L_1 - 2} \sum_{\tau=T_0+1}^{T_1} (R_{i\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m\tau})^2 \quad (6)$$

where

$$\hat{\mu}_i = \frac{1}{L_1} \sum_{\tau=T_0+1}^{T_1} R_{i\tau}$$

and
$$\hat{\mu}_m = \frac{1}{L_1} \sum_{\tau=T_0+1}^{T_1} R_{m\tau}.$$

$R_{i\tau}$ and $R_{m\tau}$ are the return in event period τ for security i and the market respectively. The use of the OLS estimators to measure abnormal returns and to develop their statistical properties is addressed next. First, the properties of a given security are presented followed by consideration of the properties of abnormal returns aggregated across securities.

B. Statistical Properties of Abnormal Returns

Given the market model parameter estimates, one can measure and analyze the abnormal returns. Let $AR_{i\tau}$, $\tau = T_1 + 1, \dots, T_2$, be the sample of L_2 abnormal returns for firm i in the event window. Using the market model to measure the normal return, the sample abnormal return is

$$AR_{i\tau} = R_{i\tau} - \hat{\alpha}_i - \hat{\beta}_i R_{m\tau}. \quad (7)$$

The abnormal return is the disturbance term of the market model calculated on an out of sample basis. Under the null hypothesis, conditional on the event win-

dow market returns, the abnormal returns will be jointly normally distributed with a zero conditional mean and conditional variance $\sigma^2(AR_{it})$ where

$$\sigma^2(AR_{it}) = \sigma_{\varepsilon_i}^2 + \frac{1}{L_1} \left[1 + \frac{(R_{m\tau} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2} \right]. \quad (8)$$

From (8), the conditional variance has two components. One component is the disturbance variance $\sigma_{\varepsilon_i}^2$ from (3) and a second component is additional variance due to the sampling error in α_i and β_i . This sampling error, which is common for all the event window observations, also leads to serial correlation of the abnormal returns despite the fact that the true disturbances are independent through time. As the length of the estimation window L_1 becomes large, the second term approaches zero as the sampling error of the parameters vanishes. The variance of the abnormal return will be $\sigma_{\varepsilon_i}^2$ and the abnormal return observations will become independent through time. In practice, the estimation window can usually be chosen to be large enough to make it reasonable to assume that the contribution of the second component to the variance of the abnormal return is zero.

Under the null hypothesis, H_0 , that the event has no impact on the behavior of returns (mean or variance) the distributional properties of the abnormal returns can be used to draw inferences over any period within the event window. Under H_0 the distribution of the sample abnormal return of a given observation in the event window is

$$AR_{it} \sim N(0, \sigma^2(AR_{it})). \quad (9)$$

Next (9) is built upon to consider the aggregation of the abnormal returns.

C. Aggregation of Abnormal Returns

The abnormal return observations must be aggregated in order to draw

overall inferences for the event of interest. The aggregation is along two dimensions—through time and across securities. We will first consider aggregation through time for an individual security and then will consider aggregation both across securities and through time. The concept of a cumulative abnormal return is necessary to accommodate a multiple period event window. Define $CAR_i(\tau_1, \tau_2)$ as the sample cumulative abnormal return (CAR) from τ_1 to τ_2 where $T_1 < \tau_1 \leq \tau_2 \leq T_2$. The CAR from τ_1 to τ_2 is the sum of the included abnormal returns,

$$CAR_i(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} AR_{it}. \quad (10)$$

Asymptotically (as L_1 increases) the variance of CAR_i is

$$\sigma_i^2(\tau_1, \tau_2) = (\tau_2 - \tau_1 + 1) \sigma_{\varepsilon_i}^2. \quad (11)$$

This large sample estimator of the variance can be used for reasonable values of L_1 . However, for small values of L_1 the variance of the cumulative abnormal return should be adjusted for the effects of the estimation error in the normal model parameters. This adjustment involves the second term of (8) and a further related adjustment for the serial covariance of the abnormal return.

The distribution of the cumulative abnormal return under H_0 is

$$CAR_i(\tau_1, \tau_2) \sim N(0, \sigma_i^2(\tau_1, \tau_2)). \quad (12)$$

Given the null distributions of the abnormal return and the cumulative abnormal return, tests of the null hypothesis can be conducted.

However, tests with one event observation are not likely to be useful so it is necessary to aggregate. The abnormal return observations must be aggregated for the event window and across observations of the event. For this aggregation,

TABLE 1

Event Day	Market Model					
	Good News		No News		Bad News	
	AR	CAR	AR	CAR	AR	CAR
-20	.093	.093	.080	.080	-.107	-.107
-19	-.177	-.084	.018	.098	-.180	-.286
-18	.088	.004	.012	.110	.029	-.258
-17	.024	.029	-.151	-.041	-.079	-.337
-16	-.018	.011	-.019	-.060	-.010	-.346
-15	-.040	-.029	.013	-.047	-.054	-.401
-14	.038	.008	.040	-.007	-.021	-.421
-13	.056	.064	-.057	-.065	.007	-.414
-12	.065	.129	.146	.081	-.090	-.504
-11	.069	.199	-.020	.061	-.088	-.592
-10	.028	.227	.025	.087	-.092	-.683
-9	.155	.382	.115	.202	-.040	-.724
-8	.057	.438	.070	.272	.072	-.652
-7	-.010	.428	-.106	.166	-.026	-.677
-6	.104	.532	.026	.192	-.013	-.690
-5	.085	.616	-.085	.107	.164	-.527
-4	.099	.715	.040	.147	-.139	-.666
-3	.117	.832	.036	.183	.098	-.568
-2	.006	.838	.226	.409	-.112	-.680
-1	.164	1.001	-.168	.241	-.180	-.860
0	.965	1.966	-.091	.150	-.679	-1.539
1	.251	2.217	-.008	.142	-.204	-1.743
2	-.014	2.203	.007	.148	.072	-1.672
3	-.164	2.039	.042	.190	.083	-1.589
4	-.014	2.024	.000	.190	.106	-1.483
5	.135	2.160	-.038	.152	.194	-1.289
6	-.052	2.107	-.302	-.150	.076	-1.213
7	.060	2.167	-.199	-.349	.120	-1.093
8	.155	2.323	-.108	-.457	-.041	-1.134
9	-.008	2.315	-.146	-.603	-.069	-1.203
10	.164	2.479	.082	-.521	.130	-1.073
11	-.081	2.398	.040	-.481	-.009	-1.082
12	-.058	2.341	.246	-.235	-.038	-1.119
13	-.165	2.176	.014	-.222	.071	-1.048
14	-.081	2.095	-.091	-.312	.019	-1.029
15	-.007	2.088	-.001	-.314	-.043	-1.072
16	.065	2.153	-.020	-.334	-.086	-1.159
17	.081	2.234	.017	-.317	-.050	-1.208
18	.172	2.406	.054	-.263	.066	-1.142
19	-.043	2.363	.119	-.144	-.088	-1.230
20	.013	2.377	.094	-.050	-.028	-1.258

TABLE 1 (Cont.)

Constant Mean Return Model					
Good News		No News		Bad News	
AR	CAR	AR	CAR	AR	CAR
.105	.105	.019	.019	-.077	-.077
-.235	-.129	-.048	-.029	-.142	-.219
.069	-.060	-.086	-.115	-.043	-.262
-.026	-.086	-.140	-.255	-.057	-.319
-.086	-.172	.039	-.216	-.075	-.394
-.183	-.355	.099	-.117	-.037	-.431
-.020	-.375	-.150	-.266	-.101	-.532
-.025	-.399	-.191	-.458	-.069	-.601
.101	-.298	.133	-.325	-.106	-.707
.126	-.172	.006	-.319	-.169	-.876
.134	-.038	.103	-.216	-.009	-.885
.210	.172	.022	-.194	.011	-.874
.106	.278	.163	-.031	.135	-.738
-.002	.277	.009	-.022	-.027	-.765
.011	.288	-.029	-.051	.030	-.735
.061	.349	-.068	-.120	.320	-.415
.031	.379	.089	-.031	-.205	-.620
.067	.447	.013	-.018	.085	-.536
.010	.456	.311	.294	-.256	-.791
.198	.654	-.170	.124	-.227	-1.018
1.034	1.688	-.164	-.040	-.643	-1.661
.357	2.045	-.170	-.210	-.212	-1.873
-.013	2.033	.054	-.156	.078	-1.795
.088	1.944	-.121	-.277	.146	-1.648
.041	1.985	.023	-.253	.149	-1.499
.248	2.233	-.003	-.256	.286	-1.214
-.035	2.198	-.319	-.575	.070	-1.143
.017	2.215	-.112	-.687	.102	-1.041
.112	2.326	-.187	-.874	.056	-.986
-.052	2.274	-.057	-.931	-.071	-1.056
.147	2.421	.203	-.728	.267	-.789
-.013	2.407	.045	-.683	.006	-.783
-.054	2.354	.299	-.384	.017	-.766
-.246	2.107	-.067	-.451	.114	-.652
-.011	2.096	-.024	-.475	.089	-.564
-.027	2.068	-.059	-.534	-.022	-.585
.103	2.171	-.046	-.580	-.084	-.670
.066	2.237	-.098	-.677	-.054	-.724
.110	2.347	.021	-.656	-.071	-.795
-.055	2.292	.088	-.568	.026	-.769
.019	2.311	.013	-.554	-.115	-.884

Abnormal returns for an event study of the information content of earnings announcements. The sample consists of a total of 600 quarterly announcements for the 30 companies in the Dow Jones Industrial Index for the five year period January 1989 to December 1993. Two models are considered for the normal returns, the market model using the CRSP value-weighted index and the constant return model. The announcements are categorized into three groups, good news, no news, and bad news. AR is the sample average abnormal return for the specified day in event time and CAR is the sample average cumulative abnormal return for day -20 to the specified day. Event time is days relative to the announcement date.

it is assumed that there is not any clustering. That is, there is not any overlap in the event windows of the included securities. The absence of any overlap and the maintained distributional assumptions imply that the abnormal returns and the cumulative abnormal returns will be independent across securities. Later inferences with clustering will be discussed.

The individual securities' abnormal returns can be aggregated using $AR_{i\tau}$ from (7) for each event period, $\tau = T_1 + 1, \dots, T_2$. Given N events, the sample aggregated abnormal returns for period τ is

$$\overline{AR}_\tau = \frac{1}{N} \sum_{i=1}^N AR_{i\tau} \quad (13)$$

and for large L_1 , its variance is

$$\text{var}(\overline{AR}_\tau) = \frac{1}{N^2} \sum_{i=1}^N \sigma_{\varepsilon_i}^2. \quad (14)$$

Using these estimates, the abnormal returns for any event period can be analyzed.

The average abnormal returns can then be aggregated over the event window using the same approach as that used to calculate the cumulative abnormal return for each security i . For any interval in the event window

$$\overline{CAR}(\tau_1, \tau_2) = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_\tau. \quad (15)$$

$$\text{var}(\overline{CAR}(\tau_1, \tau_2)) = \sum_{\tau=\tau_1}^{\tau_2} \text{var}(\overline{AR}_\tau). \quad (16)$$

Observe that equivalently one can form the CAR's security by security and then aggregate through time,

$$\overline{CAR}(\tau_1, \tau_2) = \frac{1}{N} \sum_{i=1}^N CAR_i(\tau_1, \tau_2) \quad (17)$$

$$\text{var}(\overline{CAR}(\tau_1, \tau_2)) = \frac{1}{N^2} \sum_{i=1}^N \sigma_i^2(\tau_1, \tau_2). \quad (18)$$

For the variance estimators the assumption that the event windows of the N securities do not overlap is used to set the covariance terms to zero. Inferences about the cumulative abnormal returns can be drawn using

$$\overline{CAR}(\tau_1, \tau_2) \sim N[0, \text{var}(\overline{CAR}(\tau_1, \tau_2))] \quad (19)$$

to test the null hypothesis that the abnormal returns are zero. In practice, because $\sigma_{\varepsilon_i}^2$ is unknown, an estimator must be used to calculate the variance of the abnormal returns as in (14). The usual sample variance measure of $\sigma_{\varepsilon_i}^2$ from the market model regression in the estimation window is an appropriate choice. Using this to calculate $\text{var}(\overline{AR}_\tau)$ in (14), H_0 can be tested using

$$\theta_1 = \frac{\overline{CAR}(\tau_1, \tau_2)}{\text{var}(\overline{CAR}(\tau_1, \tau_2))^{1/2}} \sim N(0, 1). \quad (20)$$

This distributional result is asymptotic with respect to the number of securities N and the length of estimation window L_1 .

Modifications to the basic approach presented above are possible. One common modification is to standardize each abnormal return using an estimator of its standard deviation. For certain alternatives, such standardization can lead to more powerful tests. James Patell (1976) presents tests based on standardization and Brown and Warner (1980, 1985) provide comparisons with the basic approach.

D. CAR's for the Earnings Announcement Example

The information content of earnings example previously described illustrates the use of sample abnormal residuals and sample cumulative abnormal returns. Table 1 presents the abnormal returns av-

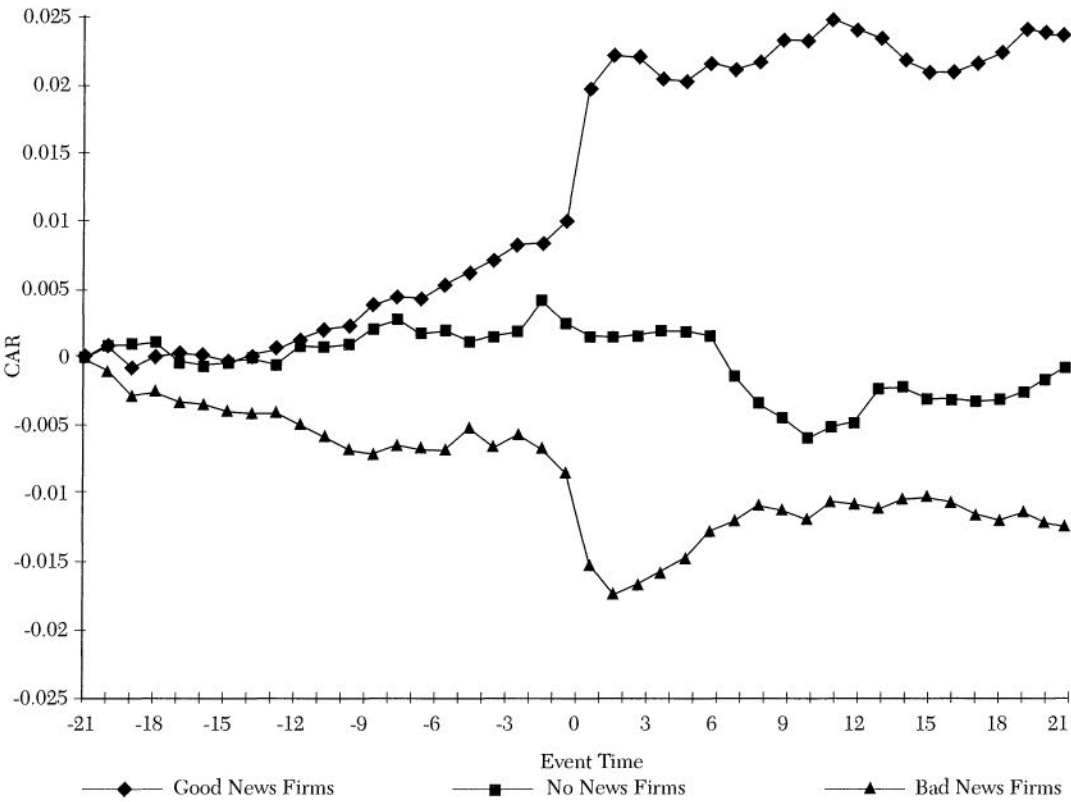


Figure 2a. Plot of cumulative abnormal return for earning announcements from event day -20 to event day 20. The abnormal return is calculated using the market model as the normal return measure.

eraged across the 600 event observations (30 firms, 20 announcements per firm) as well as the aggregated cumulative abnormal return for each of the three earnings news categories. Two normal return models are considered; the market model and for comparison, the constant mean return model. Plots of the cumulative abnormal returns are also included, with the CAR's from the market model in Figure 2a and the CAR's from the constant mean return model in Figure 2b.

The results of this example are largely consistent with the existing literature on the information content of earnings. The evidence strongly supports the hypothesis that earnings announcements do in-

deed convey information useful for the valuation of firms. Focusing on the announcement day (day 0) the sample average abnormal return for the good news firm using the market model is 0.965 percent. Given the standard error of the one day good news average abnormal return is 0.104 percent, the value of θ_1 is 9.28 and the null hypothesis that the event has no impact is strongly rejected. The story is the same for the bad news firms. The event day sample abnormal return is -0.679 percent, with a standard error of 0.098 percent, leading to θ_1 equal to -6.93 and again strong evidence against the null hypothesis. As would be expected, the abnormal return of the no news firms is small at -0.091 percent and

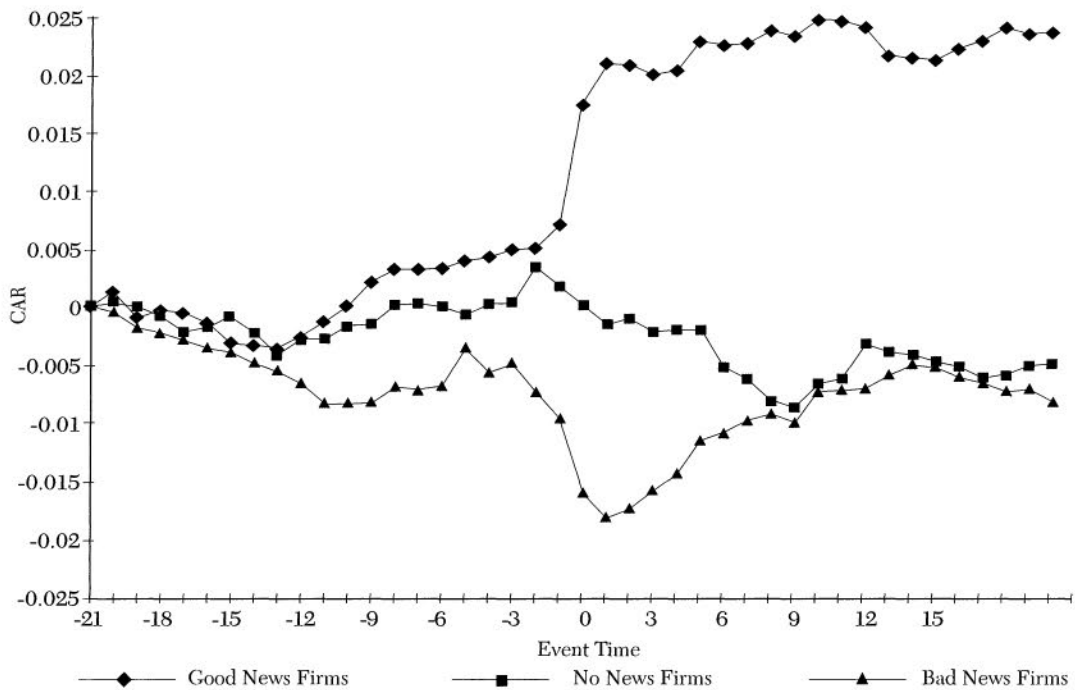


Figure 2b. Plot of cumulative abnormal return for earning announcements from event day -20 to event day 20. The abnormal return is calculated using the constant mean return model as the normal return

with a standard error of 0.098 percent is less than one standard error from zero. There is some evidence of the announcement effect on day one. The average abnormal return is 0.251 percent and -0.204 percent for the good news and the bad news firms respectively. Both these values are more than two standard errors from zero. The source of these day one effects is likely to be that some of the earnings announcements are made on event day zero after the close of the stock market. In these cases, the effects will be captured in the return on day one.

The conclusions using the abnormal returns from the constant return model are consistent with those from the market model. However, there is some loss of precision using the constant return model, as the variance of the average abnormal return increases for all three

categories. When measuring abnormal returns with the constant mean return model the standard errors increase from 0.104 percent to 0.130 percent for good news firms, from 0.098 percent to 0.124 percent for no news firms, and from 0.098 percent to 0.131 percent for bad news firms. These increases are to be expected when considering a sample of large firms such as those in the Dow Index because these stocks tend to have an important market component whose variability is eliminated using the market model.

The CAR plots show that to some extent the market gradually learns about the forthcoming announcement. The average CAR of the good news firms gradually drifts up in days -20 to -1 and the average CAR of the bad news firms gradually drifts down over this period. In the days after the an-

nouncement the CAR is relatively stable as would be expected, although there does tend to be a slight (but statistically insignificant) increase with the bad news firms in days two through eight.

E. *Inferences with Clustering*

The analysis aggregating abnormal returns has assumed that the event windows of the included securities do not overlap in calendar time. This assumption allows us to calculate the variance of the aggregated sample cumulative abnormal returns without concern about the covariances across securities because they are zero. However, when the event windows do overlap and the covariances between the abnormal returns will not be zero, the distributional results presented for the aggregated abnormal returns are no longer applicable. Victor Bernard (1987) discusses some of the problems related to clustering.

Clustering can be accommodated in two ways. The abnormal returns can be aggregated into a portfolio dated using event time and the security level analysis of Section 5 can be applied to the portfolio. This approach will allow for cross correlation of the abnormal returns.

A second method to handle clustering is to analyze the abnormal returns without aggregation. One can consider testing the null hypothesis of the event having no impact using unaggregated security by security data. This approach is applied most commonly when there is total clustering, that is, there is an event on the same day for a number of firms. The basic approach is an application of a multivariate regression model with dummy variables for the event date. This approach is developed in the papers of Katherine Schipper and Rex Thompson (1983, 1985) and Daniel Collins and Warren Dent (1984). The advantage of the approach is that, unlike the portfolio

approach, an alternative hypothesis where some of the firms have positive abnormal returns and some of the firms have negative abnormal returns can be accommodated. However, in general the approach has two drawbacks—frequently the test statistic will have poor finite sample properties except in special cases and often the test will have little power against economically reasonable alternatives. The multivariate framework and its analysis is similar to the analysis of multivariate tests of asset pricing models. MacKinlay (1987) provides analysis in that context.

6. *Modifying the Null Hypothesis*

Thus far the focus has been on a single null hypothesis—that the given event has no impact on the behavior of the returns. With this null hypothesis either a mean effect or a variance effect will represent a violation. However, in some applications one may be interested in testing for a mean effect. In these cases, it is necessary to expand the null hypothesis to allow for changing (usually increasing) variances. To allow for changing variance as part of the null hypothesis, it is necessary to eliminate the reliance on the past returns to estimate the variance of the aggregated cumulative abnormal returns. This is accomplished by using the cross section of cumulative abnormal returns to form an estimator of the variance for testing the null hypothesis. Ekkehart Boehmer, Jim Musumeci, and Annette Poulsen (1991) discuss methodology to accommodate changing variance.

The cross sectional approach to estimating the variance can be applied to the average cumulative abnormal return ($\bar{CAR}(\tau_1, \tau_2)$). Using the cross-section to form an estimator of the variance gives

$$\begin{aligned} \text{var}(\overline{CAR}(\tau_1, \tau_2)) \\ = \frac{1}{N^2} \sum_{i=1}^N (CAR_i(\tau_1, \tau_2) \\ - \overline{CAR}(\tau_1, \tau_2))^2. \quad (21) \end{aligned}$$

For this estimator of the variance to be consistent, the abnormal returns need to be uncorrelated in the cross-section. An absence of clustering is sufficient for this requirement. Note that cross-sectional homoskedasticity is not required. Given this variance estimator, the null hypothesis that the cumulative abnormal returns are zero can then be tested using the usual theory.

One may also be interested in the question of the impact of an event on the risk of a firm. The relevant measure of risk must be defined before this question can be addressed. One choice as a risk measure is the market model beta which is consistent with the Capital Asset Pricing Model being appropriate. Given this choice, the market model can be formulated to allow the beta to change over the event window and the stability of the risk can be examined. Edward Kane and Haluk Unal (1988) present an application of this idea.

7. Analysis of Power

An important consideration when setting up an event study is the ability to detect the presence of a non-zero abnormal return. The inability to distinguish between the null hypothesis and economically interesting alternatives would suggest the need for modification of the design. In this section the question of the likelihood of rejecting the null hypothesis for a specified level of abnormal return associated with an event is addressed. Formally, the power of the test is evaluated.

Consider a two-sided test of the null hypothesis using the cumulative abnormal return based statistic θ_1 from (20). It is assumed that the abnormal returns are uncorrelated across securities; thus

the variance of \overline{CAR} is $1/N^2 \sum_{i=1}^N \sigma_i^2(\tau_1, \tau_2)$

and N is the sample size. Because the null distribution of θ_1 is standard normal, for a two sided test of size α , the null hypothesis will be rejected if θ_1 is in the critical region, that is,

$$\theta_1 < c\left(\frac{\alpha}{2}\right) \text{ or } \theta_1 > c\left(1 - \frac{\alpha}{2}\right)$$

where $c(x) = \Phi^{-1}(x)$. $\Phi(\cdot)$ is the standard normal cumulative distribution function (CDF).

Given the specification of the alternative hypothesis H_A and the distribution of θ_1 for this alternative, the power of a test of size α can be tabulated using the power function,

$$\begin{aligned} P(\alpha, H_A) = & pr\left(\theta_1 < c\left(\frac{\alpha}{2}\right) \mid H_A\right) \\ & + pr\left(\theta_1 > c\left(1 - \frac{\alpha}{2}\right) \mid H_A\right). \quad (22) \end{aligned}$$

The distribution of θ_1 under the alternative hypothesis considered below will be normal. The mean will be equal to the true cumulative abnormal return divided by the standard deviation of \overline{CAR} and the variance will be equal to one.

To tabulate the power one must posit economically plausible scenarios. The alternative hypotheses considered are four levels of abnormal returns, 0.5 percent, 1.0 percent, 1.5 percent, and 2.0 percent and two levels of the average variance for the cumulative abnormal return of a given security over the event period, 0.0004 and 0.0016. The

TABLE 2

Sample Size	Abnormal Return				Abnormal Return			
	.005	.010	.015	.020	.005	.010	.015	.020
	$\sigma = 0.02$				$\sigma = 0.04$			
1	0.06	0.08	0.12	0.17	0.05	0.06	0.07	0.08
2	0.06	0.11	0.19	0.29	0.05	0.06	0.08	0.11
3	0.07	0.14	0.25	0.41	0.06	0.07	0.10	0.14
4	0.08	0.17	0.32	0.52	0.06	0.08	0.12	0.17
5	0.09	0.20	0.39	0.61	0.06	0.09	0.13	0.20
6	0.09	0.23	0.45	0.69	0.06	0.09	0.15	0.23
7	0.10	0.26	0.51	0.75	0.06	0.10	0.17	0.26
8	0.11	0.29	0.56	0.81	0.06	0.11	0.19	0.29
9	0.12	0.32	0.61	0.85	0.07	0.12	0.20	0.32
10	0.12	0.35	0.66	0.89	0.07	0.12	0.22	0.35
11	0.13	0.38	0.70	0.91	0.07	0.13	0.24	0.38
12	0.14	0.41	0.74	0.93	0.07	0.14	0.25	0.41
13	0.15	0.44	0.77	0.95	0.07	0.15	0.27	0.44
14	0.15	0.46	0.80	0.96	0.08	0.15	0.29	0.46
15	0.16	0.49	0.83	0.97	0.08	0.16	0.31	0.49
16	0.17	0.52	0.85	0.98	0.08	0.17	0.32	0.52
17	0.18	0.54	0.87	0.98	0.08	0.18	0.34	0.54
18	0.19	0.56	0.89	0.99	0.08	0.19	0.36	0.56
19	0.19	0.59	0.90	0.99	0.08	0.19	0.37	0.59
20	0.20	0.61	0.92	0.99	0.09	0.20	0.39	0.61
25	0.24	0.71	0.96	1.00	0.10	0.24	0.47	0.71
30	0.28	0.78	0.98	1.00	0.11	0.28	0.54	0.78
35	0.32	0.84	0.99	1.00	0.11	0.32	0.60	0.84
40	0.35	0.89	1.00	1.00	0.12	0.35	0.66	0.89
45	0.39	0.92	1.00	1.00	0.13	0.39	0.71	0.92
50	0.42	0.94	1.00	1.00	0.14	0.42	0.76	0.94
60	0.49	0.97	1.00	1.00	0.16	0.49	0.83	0.97
70	0.55	0.99	1.00	1.00	0.18	0.55	0.88	0.99
80	0.61	0.99	1.00	1.00	0.20	0.61	0.92	0.99
90	0.66	1.00	1.00	1.00	0.22	0.66	0.94	1.00
100	0.71	1.00	1.00	1.00	0.24	0.71	0.96	1.00
120	0.78	1.00	1.00	1.00	0.28	0.78	0.98	1.00
140	0.84	1.00	1.00	1.00	0.32	0.84	0.99	1.00
160	0.89	1.00	1.00	1.00	0.35	0.89	1.00	1.00
180	0.92	1.00	1.00	1.00	0.39	0.92	1.00	1.00
200	0.94	1.00	1.00	1.00	0.42	0.94	1.00	1.00

Power of event study methodology for test of the null hypothesis that the abnormal return is zero. The power is reported for a two-sided test using θ_1 with a size of 5 percent. The sample size is the number of event observations included the study and σ is the square root of the average variance of the abnormal return across firms.

sample size, that is the number of securities for which the event occurs, is varied from one to 200. The power for a test with a size of 5 percent is documented. With $\alpha = 0.05$, the critical val-

ues calculated using $c(\alpha/2)$ and $c(1 - \alpha/2)$ are -1.96 and 1.96 respectively. Of course, in applications, the power of the test should be considered when selecting the size.

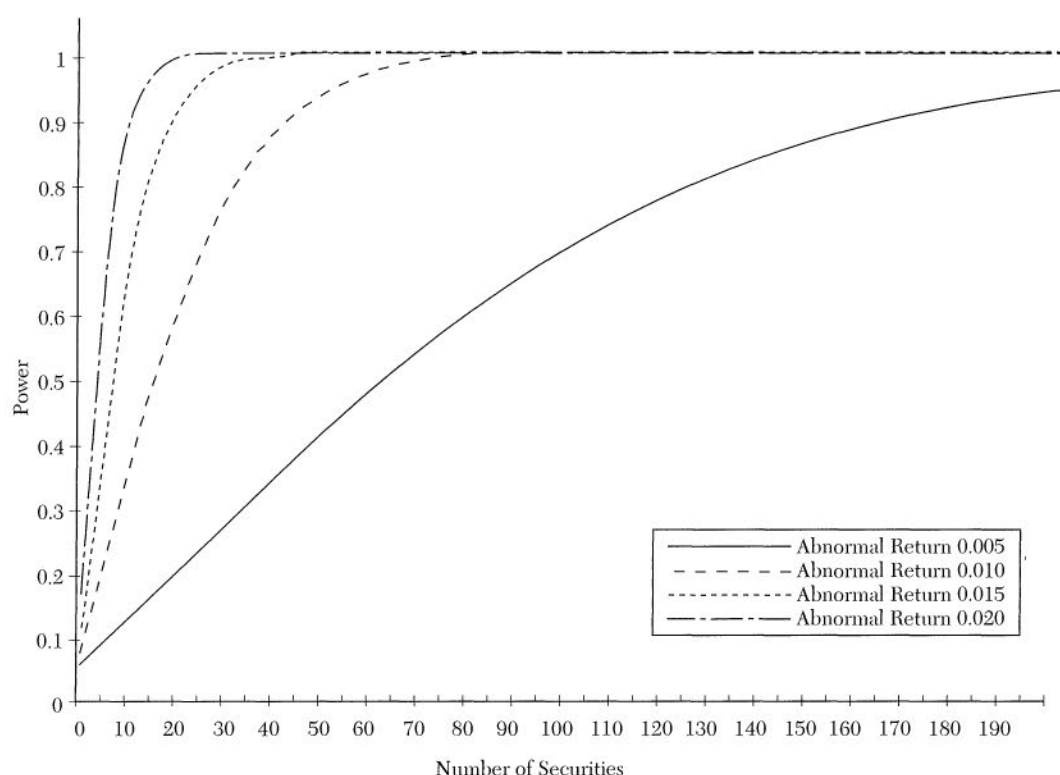


Figure 3a. Power of event study test statistic θ_1 to reject the null hypothesis that the abnormal return is zero, when the square root of the average variance of the abnormal return across firms is 2 percent.

The power results are presented in Table 2, and are plotted in Figures 3a and 3b. The results in the left panel of Table 2 and Figure 3a are for the case where the average variance is 0.0004. This corresponds to a cumulative abnormal return standard deviation of 2 percent and is an appropriate value for an event which does not lead to increased variance and can be examined using a one-day event window. In terms of having high power this is the best case scenario. The results illustrate that when the abnormal return is only 0.5 percent the power can be low. For example with a sample size of 20 the power of a 5 percent test is only 0.20. One needs a sample of over 60 firms before the power reaches 0.50. However, for a given sample size, increases in power

are substantial when the abnormal return is larger. For example, when the abnormal return is 2.0 percent the power of a 5 percent test with 20 firms is almost 1.00 with a value of 0.99. The general results for a variance of 0.0004 is that when the abnormal return is larger than 1 percent the power is quite high even for small sample sizes. When the abnormal return is small a larger sample size is necessary to achieve high power.

In the right panel of Table 2 and in Figure 3b the power results are presented for the case where the average variance of the cumulative abnormal return is 0.0016. This case corresponds roughly to either a multi-day event window or to a one-day event window with the event leading to increased variance

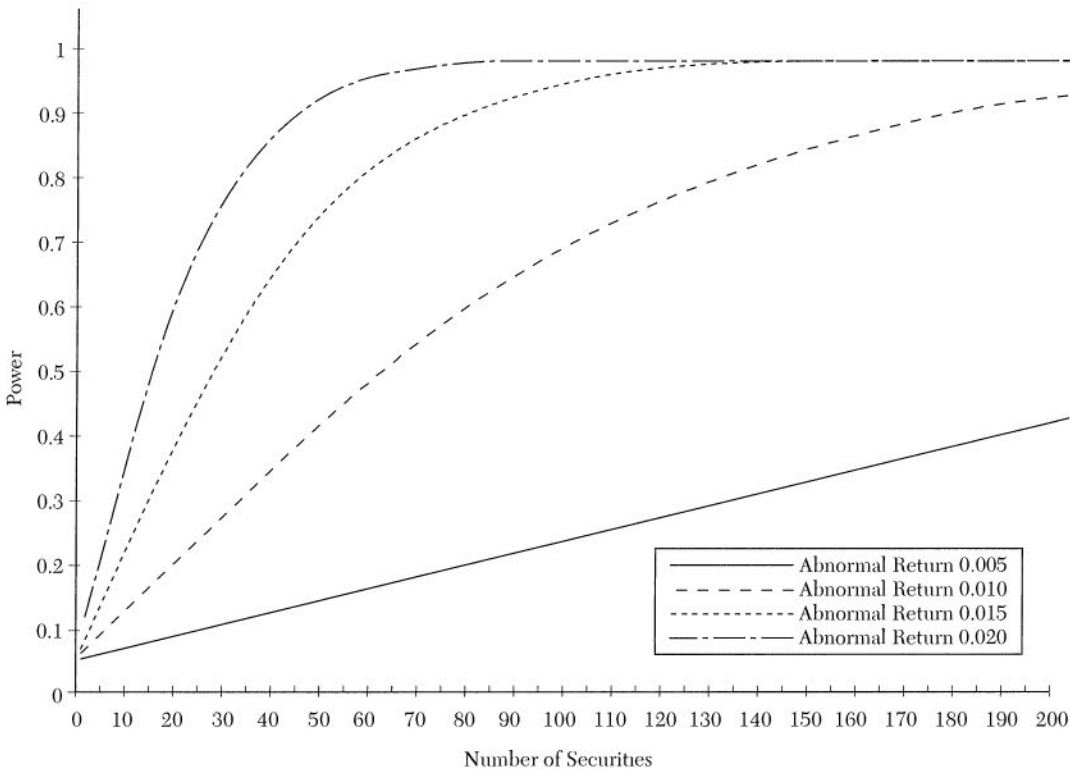


Figure 3b. Power of event study test statistic θ_1 to reject the null hypothesis that the abnormal return is zero, when the square root of the average variance of the abnormal return across firms is 4 percent.

which is accommodated as part of the null hypothesis. When the average variance of the CAR is increased from 0.0004 to 0.0016 there is a dramatic power decline for a 5 percent test. When the CAR is 0.5 percent the power is only 0.09 with 20 firms and is only 0.42 with a sample of 200 firms. This magnitude of abnormal return is difficult to detect with the larger variance. In contrast, when the CAR is as large as 1.5 percent or 2.0 percent the 5 percent test is still has reasonable power. For example, when the abnormal return is 1.5 percent and there is a sample size of 30 the power is 0.54. Generally if the abnormal return is large one will have little difficulty rejecting the null hypothesis of no abnormal return.

In the preceding analysis the power is

considered analytically for the given distributional assumptions. If the distributional assumptions are inappropriate then the results may differ. However, Brown and Warner (1985) consider this possible difference and find that the analytical computations and the empirical power are very close.

It is difficult to make general conclusions concerning the adequacy of the ability of event study methodology to detect non-zero abnormal returns. When conducting an event study it is best to evaluate the power given the parameters and objectives of the study. If the power seems sufficient then one can proceed, otherwise one should search for ways of increasing the power. This can be done by increasing the sample size, shortening the event window, or by

developing more specific predictions to test.

8. Nonparametric Tests

The methods discussed to this point are parametric in nature, in that specific assumptions have been made about the distribution of abnormal returns. Alternative approaches are available which are nonparametric in nature. These approaches are free of specific assumptions concerning the distribution of returns. Common nonparametric tests for event studies are the sign test and the rank test. These tests are discussed next.

The sign test, which is based on the sign of the abnormal return, requires that the abnormal returns (or more generally cumulative abnormal returns) are independent across securities and that the expected proportion of positive abnormal returns under the null hypothesis is 0.5. The basis of the test is that, under the null hypothesis, it is equally probable that the CAR will be positive or negative. If, for example, the null hypothesis is that there is a positive abnormal return associated with a given event, the null hypothesis is $H_0: p \leq 0.5$ and the alternative is $H_A: p > 0.5$ where $p = \text{pr}[CAR_i \geq 0.0]$. To calculate the test statistic we need the number of cases where the abnormal return is positive, N^+ , and the total number of cases, N . Letting θ_2 be the test statistic,

$$\theta_2 = \left[\frac{N^+}{N} - 0.5 \right] \frac{\sqrt{N}}{0.5} \sim N(0,1). \quad (23)$$

This distributional result is asymptotic. For a test of size $(1 - \alpha)$, H_0 is rejected if $\theta_2 > \Phi^{-1}(\alpha)$.

A weakness of the sign test is that it may not be well specified if the distribution of abnormal returns is skewed as can be the case with daily data. In response to this possible shortcoming,

Charles Corrado (1989) proposes a non-parametric rank test for abnormal performance in event studies. A brief description of his test of no abnormal return for event day zero follows. The framework can be easily altered for more general tests.

Drawing on notation previously introduced, consider a sample of L_2 abnormal returns for each of N securities. To implement the rank test, for each security it is necessary to rank the abnormal returns from one to L_2 . Define $K_{i\tau}$ as the rank of the abnormal return of security i for event time period τ . Recall, τ ranges from $T_1 + 1$ to T_2 and $\tau = 0$ is the event day. The rank test uses the fact that the expected rank of the event day is $(L_2 + 1)/2$ under the null hypothesis. The test statistic for the null hypothesis of no abnormal return on event day zero is

$$\theta_3 = \frac{1}{N} \sum_{i=1}^N \left(K_{i0} - \frac{L_2 + 1}{2} \right) / s(K) \quad (24)$$

where

$$s(K) = \sqrt{\frac{1}{L_2} \sum_{\tau=T_1+1}^{T_2} \left(\frac{1}{N} \sum_{i=1}^N \left(K_{i\tau} - \frac{L_2 + 1}{2} \right) \right)^2}. \quad (25)$$

Tests of the null hypothesis can be implemented using the result that the asymptotic null distribution of θ_3 is standard normal. Corrado (1989) includes further discussion of details of this test.

Typically, these nonparametric tests are not used in isolation but in conjunction with the parametric counterparts. Inclusion of the nonparametric tests provides a check of the robustness of conclusions based on parametric tests. Such a check can be worthwhile as illustrated by the work of Cynthia Campbell and Charles Wasley (1993). They find that for NASDAQ stocks daily returns the nonparametric rank test provides more reliable inferences than do the standard parametric tests.

9. Cross-Sectional Models

Theoretical insights can result from examining the association between the magnitude of the abnormal return and characteristics specific to the event observation. Often such an exercise can be helpful when multiple hypotheses exist for the source of the abnormal return. A cross-sectional regression model is an appropriate tool to investigate this association. The basic approach is to run a cross-sectional regression of the abnormal returns on the characteristics of interest.

Given a sample of N abnormal return observations and M characteristics, the regression model is:

$$AR_j = \delta_0 + \delta_1 x_{1j} + \cdots + \delta_M x_{Mj} + \eta_j \quad (26)$$

$$E(\eta_j) = 0 \quad (27)$$

where AR_j is the j^{th} abnormal return observation, $x_{mj}, m = 1, \dots, M$, are M characteristics for the j^{th} observation and η_j is the zero mean disturbance term that is uncorrelated with the x 's. $\delta_m, m = 0, \dots, M$ are the regression coefficients. The regression model can be estimated using OLS. Assuming the η_j 's are cross-sectionally uncorrelated and homoskedastic, inferences can be conducted using the usual OLS standard errors. Alternatively, without assuming homoskedasticity, heteroskedasticity-consistent t -statistics using standard errors can be derived using the approach of Halbert White (1980). The use of heteroskedasticity-consistent standard errors is advisable because there is no reason to expect the residuals of (26) to be homoskedastic.

Paul Asquith and David Mullins (1986) provide an example of this cross-sectional approach. The two day cumulative abnormal return for the announcement of an equity offering is regressed on the size of the offering as a percentage of the value of the total equity of the firm and on the cumulative abnormal re-

turn in the eleven months prior to the announcement month. They find that the magnitude of the (negative) abnormal return associated with the announcement of equity offerings is related to both these variables. Larger pre-event cumulative abnormal returns are associated with less negative abnormal returns and larger offerings are associated with more negative abnormal returns. These findings are consistent with theoretical predictions which they discuss.

Issues concerning the interpretation of the results can arise with the cross-sectional regression approach. In many situations, the event window abnormal return will be related to firm characteristics not only through the valuation effects of the event but also through a relation between the firm characteristics and the extent to which the event is anticipated. This can happen when investors rationally use the firm characteristics to forecast the likelihood of the event occurring. In these cases, a linear relation between the valuation effect of the event and the firm characteristic can be hidden. Paul Malatesta and Thompson (1985) and William Lanen and Thompson (1988) provide examples of this situation.

Technically, with the relation between the firm characteristics and the degree of anticipation of the event introduces a selection bias. The assumption that the regression residual is uncorrelated with the regressors breaks down and the OLS estimators are inconsistent. Consistent estimators can be derived by explicitly incorporating the selection bias. Sankarshan Acharya (1988) and B. Espen Eckbo, Vojislav Maksimovic, and Joseph Williams (1990) provide examples of this approach. N. R. Prabhala (1995) provides a good discussion of this problem and the possible solutions. He argues that, despite an incorrect specification, under weak conditions, the OLS ap-

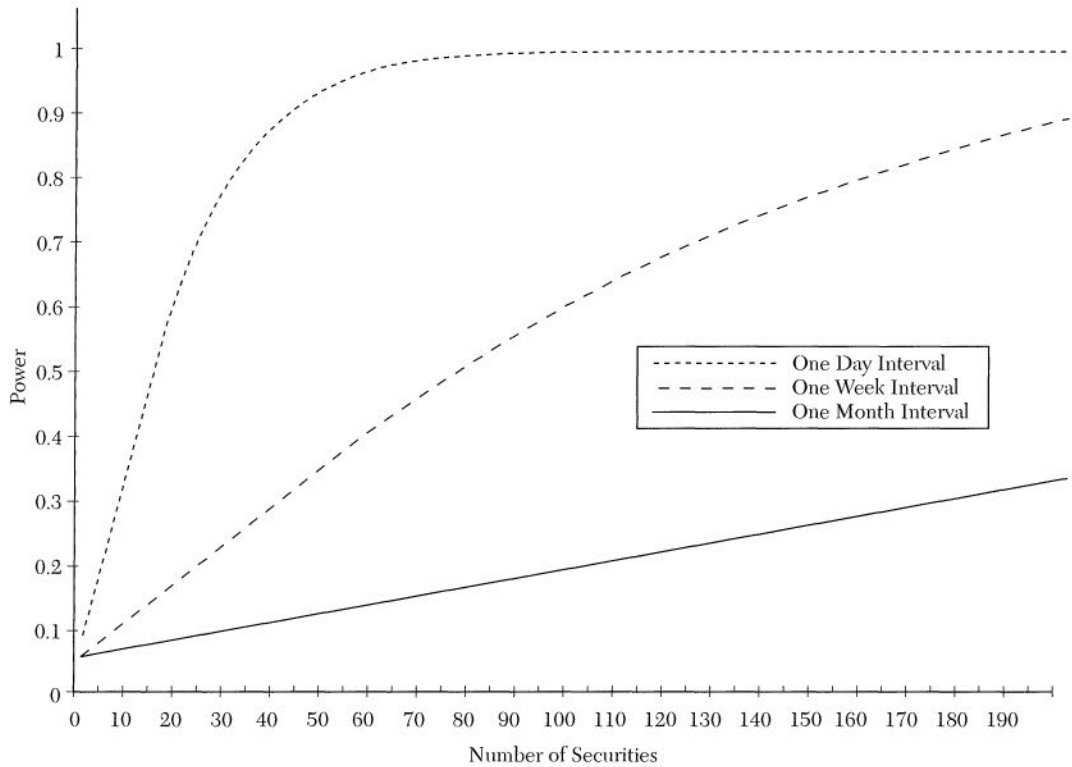


Figure 4. Power of event study test statistic θ_1 to reject the null hypothesis that the abnormal return is zero, for different sampling intervals, when the square root of the average variance of the abnormal return across firms is 4 percent for the daily interval. Size of test is 5 percent.

proach can be used for inferences and that the t -statistics can be interpreted as lower bounds on the true significance level of the estimates.

10. Other Issues

A number of further issues often arise when conducting an event study. These issues include the role of the sampling interval, event date uncertainty, robustness, and some additional biases.

A. Role of Sampling Interval

Stock return data is available at different sampling intervals, with daily and monthly intervals being the most common. Given the availability of various intervals, the question of the gains of using

more frequent sampling arises. To address this question one needs to consider the power gains from shorter intervals. A comparison of daily versus monthly data is provided in Figure 4. The power of the test of no event effect is plotted against the alternative of an abnormal return of one percent for 1 to 200 securities. As one would expect given the analysis of Section 7, the decrease in power going from a daily interval to a monthly interval is severe. For example, with 50 securities the power for a 5 percent test using daily data is 0.94, whereas the power using weekly and monthly data is only 0.35 and 0.12 respectively. The clear message is that there is a substantial payoff in terms of increased power from reducing the sampling inter-

val. Dale Morse (1984) presents detailed analysis of the choice of daily versus monthly data and draws the same conclusion.

A sampling interval of one day is not the shortest interval possible. With the increased availability of transaction data, recent studies have used observation intervals of duration shorter than one day. However, the net benefit of intervals less than one day is unclear as some complications are introduced. Discussion of using transaction data for event studies is included in the work of Michael Barclay and Robert Litzenberger (1988).

B. *Inferences with Event-Date Uncertainty*

Thus far it is assumed that the event date can be identified with certainty. However, in some studies it may be difficult to identify the exact date. A common example is when collecting event dates from financial publications such as the *Wall Street Journal*. When the event announcement appears in the paper one can not be certain if the market was informed prior to the close of the market the prior trading day. If this is the case then the prior day is the event day, if not then the current day is the event day. The usual method of handling this problem is to expand the event window to two days—day 0 and day +1. While there is a cost to expanding the event window, the results in Section 6 indicated that the power properties of two day event windows are still good suggesting that the costs are worth bearing rather than to take the risk of missing the event.

Clifford Ball and Walter Torous (1988) have investigated the issue. They develop a maximum likelihood estimation procedure which accommodates event date uncertainty and examine results of their explicit procedure versus the informal procedure of expanding the event window. The results indicates that the

informal procedure works well and there is little to gain from the more elaborate estimation framework.

C. *Robustness*

The statistical analysis of Sections 4, 5, and 6 is based on assumption that returns are jointly normal and temporally independently and identically distributed. In this section, discussion of the robustness of the results to departures from this assumption is presented. The normality assumption is important for the exact finite sample results to hold. Without assuming normality, all results would be asymptotic. However, this is generally not a problem for event studies because for the test statistics, convergence to the asymptotic distributions is rather quick. Brown and Warner (1985) provide discussion of this issue.

D. *Other Possible Biases*

A number of possible biases can arise in the context of conducting an event study. Nonsynchronous trading can introduce a bias. The nontrading or nonsynchronous trading effect arises when prices, are taken to be recorded at time intervals of one length when in fact they are recorded at time intervals of other possibly irregular lengths. For example, the daily prices of securities usually employed in event studies are generally “closing” prices, prices at which the last transaction in each of those securities occurred during the trading day. These closing prices generally do not occur at the same time each day, but by calling them “daily” prices, one is implicitly and incorrectly assuming that they are equally spaced at 24-hour intervals. This nontrading effect induces biases in the moments and co-moments of returns.

The influence of the nontrading effect on the variances and covariances of individual stocks and portfolios naturally feeds into a bias for the market model

beta. Myron Scholes and Williams (1977) present a consistent estimator of beta in the presence of nontrading based on the assumption that the true return process is uncorrelated through time. They also present some empirical evidence which shows the nontrading-adjusted beta estimates of thinly traded securities to be approximately 10 to 20 percent larger than the unadjusted estimates. However, for actively traded securities, the adjustments are generally small and unimportant.

Prem Jain (1986) considers the influence of thin trading on the distribution of the abnormal returns from the market model with the beta estimated using the Scholes-Williams approach. When comparing the distribution of these abnormal returns to the distribution of the abnormal returns using the usual OLS betas finds that the differences are minimal. This suggests that in general the adjustments for thin trading are not important.

The methodology used to compute the cumulative abnormal returns can induce an upward bias. The bias arises from the observation by observation rebalancing to equal weights implicit in the calculation of the aggregate cumulative abnormal return combined with the use of transaction prices which can represent both the bid and the offer side of the market. Marshall Blume and Robert Stambaugh (1983) analyze this bias and show that it can be important for studies using low market capitalization firms which have, in percentage terms, wide bid offer spreads. In these cases the bias can be eliminated by considering cumulative abnormal returns which represent buy and hold strategies.

11. *Concluding Discussion*

In closing, examples of event study successes and limitations are presented. Perhaps the most successful applications

have been in the area of corporate finance. Event studies dominate the empirical research in this area. Important examples include the wealth effects of mergers and acquisitions and the price effects of financing decisions by firms. Studies of these events typically focus on the abnormal return around the date of first announcement.

In the 1960s there was a paucity of empirical evidence on the wealth effects of mergers and acquisitions. For example, Henry Manne (1965) discusses the various arguments for and against mergers. At that time the debate centered on the extent to which mergers should be regulated in order to foster competition in the product markets. Manne argued that mergers represent a natural outcome in an efficiently operating market for corporate control and consequently provide protection for shareholders. He downplayed the importance of the argument that mergers reduce competition. At the conclusion of his article Manne suggested that the two competing hypotheses for mergers could be separated by studying the price effects of the involved corporations. He hypothesized that, if mergers created market power, one would observe price increases for both the target and acquirer. In contrast, if the merger represented the acquiring corporation paying for control of the target, one would observe a price increase for the target only and not for the acquirer. However, Manne concludes, in reference to the price effects of mergers, that "no data are presently available on this subject."

Since that time an enormous body of empirical evidence on mergers and acquisitions has developed which is dominated by the use of event studies. The general result is that, given a successful takeover, the abnormal returns of the targets are large and positive and the abnormal returns of the acquirer are close

to zero. Gregg Jarrell and Poulsen (1989) document that the average abnormal return for target shareholders exceeds 20 percent for a sample of 663 successful takeovers from 1960 to 1985. In contrast the abnormal returns for acquirers is close to zero. For the same sample, Jarrell and Poulsen find an average abnormal return of 1.14 percent for acquirers. In the 1980s they find the average abnormal return is negative at -1.10 percent. Eckbo (1983) explicitly addresses the role of increased market power in explaining merger related abnormal returns. He separates mergers of competing firms from other mergers and finds no evidence that the wealth effects for competing firms are different. Further, he finds no evidence that rivals of firms merging horizontally experience negative abnormal returns. From this he concludes that reduced competition in the product market is not an important explanation for merger gains. This leaves competition for corporate control a more likely explanation. Much additional empirical work in the area of mergers and acquisitions has been conducted. Michael Jensen and Richard Ruback (1983) and Jarrell, James Brickley, and Netter (1988) provide detailed surveys of this work.

A number of robust results have been developed from event studies of financing decisions by corporations. When a corporation announces that it will raise capital in external markets there is, on average, a negative abnormal return. The magnitude of the abnormal return depends on the source of external financing. Asquith and Mullins (1986) find for a sample of 266 firms announcing an equity issue in the period 1963 to 1981 the two day average abnormal return is -2.7 percent and on a sample of 80 firms for the period 1972 to 1982 Wayne Mikkelsen and Megan Partch (1986) find the two day average abnormal return is

-3.56 percent. In contrast, when firms decide to use straight debt financing, the average abnormal return is closer to zero. Mikkelsen and Partch (1986) find the average abnormal return for debt issues to be -0.23 percent for a sample of 171 issues. Findings such as these provide the fuel for the development of new theories. For example, in this case, the findings motivate the pecking order theory of capital structure developed by Stewart Myers and Nicholas Majluf (1984).

A major success related to those in the corporate finance area is the implicit acceptance of event study methodology by the U.S. Supreme Court for determining materiality in insider trading cases and for determining appropriate disgorgement amounts in cases of fraud. This implicit acceptance in the 1988 *Basic, Incorporated v. Levinson* case and its importance for securities law is discussed in Mitchell and Netter (1994).

There have also been less successful applications. An important characteristic of a successful event study is the ability to identify precisely the date of the event. In cases where the event date is difficult to identify or the event date is partially anticipated, studies have been less useful. For example, the wealth effects of regulatory changes for affected entities can be difficult to detect using event study methodology. The problem is that regulatory changes are often debated in the political arena over time and any accompanying wealth effects generally will gradually be incorporated into the value of a corporation as the probability of the change being adopted increases.

Larry Dann and Christopher James (1982) discuss this issue in the context of the impact of deposit interest rate ceilings for thrift institutions. In their study of changes in rate ceilings, they decide not to consider a change in 1973 because it was due to legislative action. Schipper

and Thompson (1983, 1985) also encounter this problem in a study of merger related regulations. They attempt to circumvent the problem of regulatory changes being anticipated by identifying dates when the probability of a regulatory change being passed changes. However, they find largely insignificant results leaving open the possibility the of absence of distinct event dates as the explanation of the lack of wealth effects.

Much has been learned from the body of research based on the use of event study methodology. In a general context, event studies have shown that, as would be expected in a rational marketplace, prices do respond to new information. As one moves forward, it is expected that event studies will continue to be a valuable and widely used tool in economics and finance.

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