Exhibit 27

CORPORATE GOVERNANCE AND EQUITY PRICES

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Shareholder rights vary across firms. Using the incidence of 24 governance rules, we construct a "Governance Index" to proxy for the level of shareholder rights at about 1500 large firms during the 1990s. An investment strategy that bought firms in the lowest decile of the index (strongest rights) and sold firms in the highest decile of the index (weakest rights) would have earned abnormal returns of 8.5 percent per year during the sample period. We find that firms with stronger shareholder rights had higher firm value, higher profits, higher sales growth, lower capital expenditures, and made fewer corporate acquisitions.

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I. Introduction

Corporations are republics. The ultimate authority rests with voters (shareholders). These voters elect representatives (directors) who delegate most decisions to bureaucrats (managers). As in any republic, the actual power-sharing relationship depends upon the specific rules of governance. One extreme, which tilts toward a democracy, reserves little power for management and allows shareholders to quickly and easily replace directors. The other extreme, which tilts toward a dictatorship, reserves extensive power for management and places strong restrictions on shareholders' ability to replace directors. Presumably, shareholders accept restrictions of their rights in hopes of maximizing their wealth, but little is known about the ideal balance of power. From a theoretical perspective, there is no obvious answer. In this paper, we ask an empirical question -- is there a relationship between shareholder rights and corporate performance?

Twenty years ago, large corporations had little reason to restrict shareholder rights. Proxy fights and hostile takeovers were rare, and investor activism was in its infancy. By rule, most firms were shareholder democracies, but in practice management had much more of a free hand than they do today. The rise of the junk bond market in the 1980s disturbed this equilibrium by enabling hostile-takeover offers for even the largest public firms. In response, many firms added takeover defenses and other restrictions of shareholder rights. Among the most popular were those that stagger the terms of directors, provide severance packages for managers, and limit shareholders' ability to meet or act. During the same time period, many states passed antitakeover laws giving firms further defenses against hostile bids. By 1990, there was considerable variation across firms in the strength of shareholder rights. The takeover market subsided in the early 1990s, but this variation remained in place throughout the decade.

Most research on the wealth impact of takeover defenses uses event-study methodology, where firms' stock returns are analyzed following the announcement of a new defense.[1] Such studies face the difficulty that new defenses may be driven by contemporaneous conditions at the firm, i.e., adoption of a defense may both change the governance structure and provide a signal of managers' private information about impending takeover bids. Event studies of changes in state takeover laws are mostly immune from this problem, but it is difficult to identify a single date for an event that is preceded by legislative negotiation and followed by judicial uncertainty. For these and other reasons, some authors argue that event-study methodology cannot identify the impact of governance provisions.[2]

We avoid these difficulties by taking a long-horizon approach. We combine a large set of governance provisions into an index which proxies for the strength of shareholder rights, and then study the empirical relationship between this index and corporate performance. Our analysis should be thought of as a "long-run event study": we have democracies and dictatorships, the rules stayed mostly the same for a decade -- how did each type do? Our main results are to demonstrate that, in the 1990s, democracies earned significantly higher returns, were valued higher, and had better operating performance. Our analysis is not a test of market efficiency. Because theory provides no clear prediction, there is no reason that investors in 1990 should have foreseen the outcome of this novel experiment. Also, because this "experiment" did not use random assignment, we cannot make strong claims about causality, but we do explore the implications and assess the supportive evidence for several causal hypotheses.[3]

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[1] Surveys of this literature can be found in Bhagat and Romano [2001], Bittlingmayer [2000], Comment and Schwert [1995], and Karpoff and Malatesta [1989].

[2] See Coates [2000] for a detailed review of these arguments.

[3] Other papers that analyze relationships between governance and either firm value or performance have generally focused on board composition, executive compensation, or insider ownership [Baysinger and Butler 1985, Bhagat and Black 1998, Core, Holthausen, and Larcker 1999, Hermalin and Weisbach 1991, Morck, Shleifer, and Vishny 1988, Yermack 1996]. See Shleifer and Vishny [1997] for a survey.

Our data are derived from publications of the Investor Responsibility Research Center. These publications provide 24 distinct corporate-governance provisions for approximately 1,500 firms since 1990.[4] In Section II, we describe these provisions and data sources in more detail. We divide the rules into five thematic groups and then construct a "Governance Index" as a proxy for the balance of power between shareholders and managers. Our index construction is straightforward: for every firm, we add one point for every provision that reduces shareholder rights. This reduction of rights is obvious in most cases; the few ambiguous cases are discussed. Firms in the highest decile of the index are placed in the "Dictatorship Portfolio" and are referred to as having the "highest management power" or the "weakest shareholder rights"; firms in the lowest decile of the index are placed in the "Democracy Portfolio" and are described as having the "lowest management power" or the "strongest shareholder rights".

In Section III, we document the main empirical relationships between governance and corporate performance. Using performance-attribution time-series regressions from September 1990 to December 1999, we find that the Democracy Portfolio outperformed the Dictatorship Portfolio by a statistically significant 8.5 percent per year. These return differences induced large changes in firm value over the sample period. By 1999, a one-point difference in the index was negatively associated with an 11.4 percentage-point difference in Tobin's *Q*. After partially controlling for differences in market expectations by using the book-to-market ratio, we also find evidence that firms with weak shareholder rights were less profitable and had lower sales growth than other firms in their industry.

[4] These 24 provisions include 22 firm-level provisions and six state laws (four of the laws are analogous to four of the firm-level provisions). For the remainder of the paper, we refer interchangeably to corporate governance "laws", "rules", and "provisions". We also refer interchangeably to "shareholders" and "investors" and refer to "management" as comprising both managers and directors.

The correlation of the Governance Index with returns, firm value, and operating performance could be explained in several ways. Section IV sets out three hypotheses to explain the results. Hypothesis I is that weak shareholder rights caused additional agency costs. If the market underestimated these additional costs, then a firm's stock returns and operating performance would have been worse than expected, and the firm's value at the beginning of the period would have been too high. Hypothesis II is that managers in the 1980s predicted poor performance in the 1990s, but investors did not. In this case, the managers could have put governance provisions in place to protect their jobs. While the provisions might have real protective power, they would not have caused the poor performance. Hypothesis III is that governance provisions did not cause poor performance (and need not have any protective power) but rather were correlated with other characteristics that were associated with abnormal returns in the 1990s. While we cannot identify any instrument or natural experiment to cleanly distinguish among these hypotheses, we do assess some supportive evidence for each one in Section V. For Hypothesis I, we find some evidence of higher agency costs in a positive relationship between the index and both capital expenditures and acquisition activity. In support of Hypothesis III, we find several observable characteristics that can explain up to one-third of the performance differences. We find no evidence in support of Hypothesis II. Section VI concludes the paper.

II. Data

A. Corporate-Governance Provisions

Our main data source is the Investor Responsibility Research Center (IRRC), which publishes detailed listings of corporate-governance provisions for individual firms in *Corporate Takeover Defenses* [Rosenbaum 1990, 1993, 1995, and 1998]. These data are derived from a variety of public sources including corporate bylaws and charters, proxy statements, annual reports, as well as 10-K and 10-Q documents filed with the SEC. The IRRC's universe is drawn from the Standard & Poor's (S&P) 500 as well as the annual lists of the largest corporations in the publications of *Fortune*, *Forbes,* and *Businessweek*. The IRRC's sample expanded by several hundred firms in 1998 through additions of some smaller firms and firms with high institutional-ownership levels. Our analysis uses all firms in the IRRC universe except those with dual-class common stock (less than 10 percent of the total).[5] The IRRC universe covers most of the value-weighted market: even in 1990, the IRRC tracked more than 93 percent of the total capitalization of the combined New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and Nasdaq markets.

The IRRC tracks 22 charter provisions, bylaw provisions, and other firm-level rules plus coverage under six state takeover laws; duplication between firm-level provisions and state laws yields 24 unique provisions. Table I lists all of these provisions and Appendix A discusses each one in detail. We divide them into five groups: tactics for delaying hostile bidders (*Delay*); voting rights (*Voting*); director/officer protection (*Protection*); other takeover defenses (*Other*); and state laws (*State*).

[5] We omit firms with dual-class common stock because the wide variety of voting and ownership differences across these firms makes it difficult to compare their governance structures with those of single-class firms.

The *Delay* group includes four provisions designed to slow down a hostile bidder. For takeover battles that require a proxy fight to either replace a board or dismantle a takeover defense, these provisions are the most crucial. Indeed, some legal scholars argue that the dynamics of modern takeover battles have rendered all other defenses superfluous [Daines and Klausner 2001, Coates 2000]. The *Voting* group contains six provisions, all related to shareholders' rights in elections or charter/bylaw amendments. The *Protection* group contains six provisions designed to insure officers and directors against job-related liability or to compensate them following a termination. The *Other* group includes the six remaining firm-level provisions.

These provisions tend to cluster within firms. Out of (22 * 21)/2 = 231 total pairwise correlations for the 22 firm-level provisions, 169 are positive, and 111 of these positive correlations are significant.[6] In contrast, only nine of the 62 negative correlations are significant. This clustering suggests that firms may differ significantly in the balance of power between investors and management.

The IRRC firm-level data do not include provisions that apply automatically under state law. Thus, we supplement this data with state-level data on takeover laws as given by Pinnell [2000], another IRRC publication. From this publication, we code the presence of six types of so-called "second-generation" state takeover laws and place them in the *State* group.[7] Few states

[6] Unless otherwise noted, all statements about statistical significance refer to significance at the five-percent level.

[7] These laws are classified as "second-generation" in the literature to distinguish them from the "first-generation" laws passed by many states in the 60s and 70s and held to be unconstitutional in 1982. See Comment and Schwert [1995] and Bittlingmayer [2000] for a discussion of the evolution and legal status of state takeover laws and firm-specific takeover defenses. The constitutionality of almost all of the second-generation laws and the firm-specific takeover defenses was clearly established by 1990. All of the state takeover laws cover firms incorporated in their home state. A few states have laws that also cover firms incorporated outside of the state that have significant business within the state. The rules for "significant" vary from case to case, but usually cover only a few very large firms. We do not attempt to code for this out-of-state coverage.

have more than three of these laws, and only Pennsylvania has all six.[8] Some of these laws are analogues of firm-level provisions given in other groups. We discuss these analogues in Section II.B.

The IRRC dataset is not an exhaustive listing of all provisions. Although firms can review their listing and point out mistakes before publication, the IRRC does not update every company in each new edition of the book, so some changes may be missed. Also the charter and bylaws are not available for all companies and thus the IRRC must infer some provisions from proxy statements and other filings. Overall, the IRRC intends its listings as a starting point for institutional investors to review governance provisions. Thus, these listings are a noisy measure of a firm's governance provisions, but there is no reason to suspect any systematic bias. Also, all of our analysis uses data available at time t to forecast performance at time $t+1$ and beyond, so there is no possibility of look-ahead bias induced by our statistical procedures.

To build the dataset, we coded the data from the individual firm profiles in the IRRC books. For each firm, we recorded the identifying information (ticker symbol, state of incorporation) and the presence of each provision. Although many of the provisions can be made stronger or weaker (e.g., supermajority thresholds can vary between 51 and 100 percent), we made no strength distinctions and coded all provisions as simply "present" or "not present". This methodology sacrifices precision for the simplicity necessary to build an index.

For most of the analysis of this paper, we match the IRRC data to the Center for Research in Security Prices (CRSP) and, where necessary, to Standard and Poor's Compustat database. CSRP matching was done by ticker symbol and was supplemented by handchecking names, exchanges, and states of incorporation. These procedures enable us to match 100 percent of the

[8] The statistics of Table I reflect exactly the frequency of coverage under the default law in each state. A small minority of firms elect to "opt-out" of some laws and "opt-in" to others. We code these options separately and use them in the creation of our index.

IRRC sample to CRSP, with about 90 percent of these matches having complete annual data in Compustat.

B. The Governance Index

The index construction is straightforward: for every firm, we add one point for every provision that restricts shareholder rights (increases managerial power). This power distinction is straightforward in most cases, as is discussed below. While this simple index does not accurately reflect the relative impacts of different provisions, it has the advantage of being transparent and easily reproducible. The index does not require any judgments about the efficacy or wealth effects of any of these provisions; we only consider the impact on the balance of power.

For example, consider Classified Boards, a provision that staggers the terms and elections of directors and hence can be used to slow down a hostile takeover. If management uses this power judiciously, it could possibly lead to an increase in overall shareholder wealth; if management uses this power to maintain private benefits of control, then this provision would decrease shareholder wealth. In either case, it is clear that Classified Boards increase the power of managers and weaken the control rights of large shareholders, which is all that matters for constructing the index.

Most of the provisions can be viewed in a similar way. Almost every provision gives management a tool to resist different types of shareholder activism, such as calling special meetings, changing the firm's charter or bylaws, suing the directors, or just replacing them all at once. There are two exceptions: Secret Ballots and Cumulative Voting. A Secret Ballot, also called "confidential voting" by some firms, designates a third-party to count proxy votes and

prevents management from observing how specific shareholders vote. Cumulative Voting allows shareholders to concentrate their directors' votes so that a large minority holder can ensure some board representation. (See Appendix A for fuller descriptions.) These two provisions are usually proposed by shareholders and opposed by management.[9] In contrast, none of the other provisions enjoy consistent shareholder support or management opposition; in fact, many of these provisions receive significant numbers of shareholder proposals for their repeal [Ishii 2000]. Also, both Cumulative Voting and Secret Ballots tend to be negatively correlated with the presence of other firm-level provisions (19 negative out of 21 for Cumulative Voting; 11 out of 21 for Secret Ballot). Thus, we consider the presence of Secret Ballots and Cumulative Voting to be *increases* in shareholder rights. For each one, we add one point to the Governance Index when firms do *not* have it. For all other provisions, we add one point when firms do have it.[10]

Thus, the Governance Index ("*G*") is just the sum of one point for the existence (or absence) of each provision. We also construct subindices for each of the five categories: *Delay, Protection, Voting, Other,* and *State*. Recall that there are 28 total provisions listed in the five categories, of which 24 are unique. For the state laws with a firm-level analogue, we add one point to the index if the firm is covered under the firm-level provision, the state law, or both.[11] For example, a firm that has an Antigreenmail provision and is also covered by the

[9] In the case of Secret Ballots, shareholder fiduciaries argue that it enables voting without threat of retribution, such as the loss of investment-banking business by brokerage-house fiduciaries. See Gillan and Bethel [2001] and McGurn [1989].

[10] Only two other provisions – Antigreenmail and Golden Parachutes – seem at all ambiguous. Since both are positively correlated with the vast majority of other firm-level provisions and can logically be viewed as takeover defenses, we code them like other defenses and add one point to the index for each. See their respective entries in Appendix A for a discussion.

[11] Firms usually have the option to opt out of state law coverage. Also, a few state laws require firms to opt in to be covered. The firms that exercise these options are listed in the IRRC data. When we constructed the *State* subindex, we ignored these options and used the default state coverage. When we constructed the *G* index, we included the options and used actual coverage.

Antigreenmail state law would get one point added to both its *State* subindex and its *Other* subindex, but only one point (not two) would be added to its overall *G* index. Thus, *G* has a possible range from 1 to 24 and is not just the sum of the five subindices.

Table II gives summary statistics for *G* and the subindices in 1990, 1993, 1995, and 1998. Table II also shows the frequency of *G* by year, broken up into groups beginning with $G \leq 5$, then each value of *G* from *G* 6 through *G* 13, and finishing with $G \geq 14$. These ten "deciles" are similar but not identical in size, with relative sizes that are fairly stable from 1990 to 1995. In the remainder of the paper, we pay special attention to the two extreme portfolios: the "Dictatorship Portfolio" of the firms with the weakest shareholder rights ($G \geq 14$), and the "Democracy Portfolio" of the firms with the strongest shareholder rights ($G \leq 5$). These portfolios are updated at the same frequency as *G*.

Most of the changes in the distribution of *G* come from changes in the sample due to mergers, bankruptcies, and additions of new firms by the IRRC. In 1998, the sample size increased by about 25 percent, and these new firms tilted toward lower values of *G*. At the firm level, *G* is relatively stable. For individual firms, the mean (absolute) change in *G* between publication dates (1990, 1993, 1995, 1998) is 0.60, and the median (absolute) change between publication dates is zero.[12]

Table III shows the correlations between pairs of subindices. The *Delay*, *Protection*, *Voting*, and *Other* subindices all have positive and significant pairwise correlations with each other. *State*, however, has negative correlations with *Delay*, *Protection*, and *Voting*. It could be that firms view some of the state laws as substitutes for the firm-level provisions, but then it

[12] The IRRC gives dates for some of the provision changes – where available, this data suggests that the majority of the provisions were adopted in the 1980s. Danielson and Karpoff [1998] perform a detailed study on a similar set of provisions and demonstrate a rapid pace of change between 1984 and 1989.

would be surprising that *Other*, which contains three provisions that are direct substitutes for state laws, is the only subindex that is positively correlated with *State*. Overall, it appears that coverage under state laws is not highly correlated with the adoption of firm-level provisions. This fact has implications for the analysis of causality, as is discussed in Section IV.

Table IV lists the ten largest firms (by market capitalization) in the Democracy and Dictatorship Portfolios in 1990 and gives the value of *G* for these firms in 1990 and 1998. Of the ten largest firms in the Democracy Portfolio in 1990, six of them are still in the Democracy Portfolio in 1998, three have dropped out of the portfolio and have $G = 6$, and one (Berkshire Hathaway) disappeared from the sample.[13] The Dictatorship Portfolio has a bit more activity, with only two of the top ten firms remaining in the portfolio, four firms dropping out with $G = 13$, and three firms leaving the sample though mergers or the addition of another class of stock.[14] Thus, 40 percent (eight out of 20) of the largest firms in the extreme portfolios in 1990 were also in these portfolios in 1998. This is roughly comparable to the full set of firms: among all firms in the Democracy and Dictatorship Portfolios in 1990, 31 percent were still in the same portfolios in 1998.

There is no obvious industry concentration among these top firms; the whole portfolios are similarly dispersed. Classifying firms into 48 industries as in Fama and French [1997], the portfolios appear to be broadly similar to each other in all years, with a mix of old-economy and new-economy industries.[15] Each portfolio has an important technology component. "Computers" is the largest industry by market value in the Democracy Portfolio in 1990, with

[13] Berkshire Hathaway disappeared because it added a second class of stock before 1998. Firms with multiple classes of common stock are not included in our analysis.

[14] NCR disappeared after a merger. It reappeared in the sample in 1998 as a spin-out, but since it received a new permanent number from CRSP, we treat the new NCR as a different company.

[15] The industry names are from Fama and French [1997], but use a slightly updated version of the SIC classification of these industries that is given on Ken French's website (June 2001). In Sections III and V, we use both this updated classification and the corresponding industry returns (also from the French website).

22.4 percent of the portfolio, falling to third place with 12.3 percent of the value in 1998. "Communications" does not make the top five in market value for the Dictatorship Portfolio in 1990, but rises to first place with 25.3 percent of the portfolio in 1998.

III. Governance: Empirical Relationships

A. Summary Statistics

Table V gives summary statistics and correlations for *G* (and subindices) with a set of firm characteristics as of September 1990: book-to-market ratio, firm size, share price, monthly trading volume, Tobin's *Q,* dividend yield, S&P 500 inclusion, past five-year stock return, past five-year sales growth, and percentage of institutional ownership. The first four of these characteristics are in logs. The construction of each characteristic is described in Appendix B. The first column of Table V gives the correlation of each of these characteristics with *G*, the next two columns give the mean value in the Democracy and Dictatorship Portfolios, and the final column gives the difference between these means. These results are descriptive and are intended to provide some background for the analyses in the following sections.

The strongest relation is between *G* and S&P 500 inclusion. The correlation between these variables is positive and significant -- about half of the Dictatorship Portfolio is drawn from S&P 500 firms compared to 15 percent of the Democracy Portfolio. Given this finding, it is not surprising that *G* is also positively correlated with size, share price, trading volume, and institutional ownership. S&P firms tend to have relatively high levels of all of these characteristics. In addition, the correlation of *G* with five-year sales growth is negative and significant, suggesting that high-*G* firms had relatively lower sales growth over the second half of the 1980s, the period when many of the provisions were first adopted.

Correlations at other times in the sample period (not shown in the table) are similar. Overall, it appears that firms with weaker shareholder rights tend to be large S&P firms with relatively high share prices, institutional ownership and trading volume, relatively poor sales growth, and poor stock-market performance. The 1990s were a time of rising activism by institutional investors and more attention to governance provisions; thus, we might expect to see some reduction in the institutional ownership of high-*G* firms. In untabulated tests, we find no evidence of such a reduction, with both pairwise correlations and multivariate analysis suggesting no robust relationship between *G* and changes in institutional ownership.

B. Governance and Returns

If corporate governance matters for firm performance *and* this relationship is fully incorporated by the market, then a stock price should quickly adjust to any relevant change in the firm's governance. This is the logic behind the use of event studies to analyze the impact of takeover defenses. If such a reaction occurs, then expected returns on the stock would be unaffected beyond the event window. If, however, governance matters but is not incorporated immediately into stock prices, then realized returns on the stock would differ systematically from equivalent securities.

In this section, we examine the relationship between *G* and subsequent returns. An investment of $1 in the (value-weighted) Dictatorship Portfolio on September 1, 1990, when our data begin, would have grown to $3.39 by December 31, 1999. In contrast, a $1 investment in the Democracy Portfolio would have grown to $7.07 over the same period. This is equivalent to annualized returns of 14.0 percent for the Dictatorship Portfolio and 23.3 percent for the Democracy Portfolio, a difference of more than nine percent per year.

What can explain this disparity? One possible explanation is that the performance differences are driven by differences in the riskiness or "style" of the two portfolios. Researchers have identified several equity characteristics that explain differences in realized returns. In addition to differences in exposure to the market factor ("beta"), a firm's market capitalization (or "size"), book-to-market ratio (or other "value" characteristics), and immediate past returns ("momentum") have all been shown to significantly forecast future returns.[16] If the Dictatorship Portfolio differs significantly from the Democracy Portfolio in these characteristics, then style differences may explain at least part of the difference in annualized raw returns.

Several methods have been developed to account for these style differences in a system of performance attribution. We employ one method here and use another in Section V. The four-factor model of Carhart [1997] is estimated by:

$$(1) \qquad R_t \quad \alpha \quad + \beta_1 * RMRF_t + \beta_2 * SMB_t + \beta_3 * HML_t + \beta_4 * Momentum_t + \varepsilon_t$$

where R_t is the excess return to some asset in month t, $RMRF_t$ is the month t value-weighted market return minus the risk-free rate, and the terms SMB_t (small minus big), HML_t (high minus low), and $Momentum_t$ are the month t returns on zero-investment factor-mimicking portfolios designed to capture size, book-to-market, and momentum effects, respectively.[17] Although there is ongoing debate about whether these factors are proxies for risk, we take no position on this issue and simply view the four-factor model as a method of performance attribution. Thus, we

[16] See Basu [1977] (price-to-earnings ratio), Banz [1981] (size), Fama and French [1993] (size and book-to-market), Lakonishok, Shleifer and Vishny [1994] (several value measures), and Jegadeesh and Titman [1993] (momentum).

[17] This model extends the Fama-French [1993] three-factor model with the addition of a momentum factor. For details on the construction of the factors, see Fama and French [1993] and Carhart [1997]. We are grateful to Ken French for providing the factor returns for *SMB* and *HML*. *Momentum* returns were calculated by the authors using the procedures of Carhart [1997].

interpret the estimated intercept coefficient, "alpha", as the abnormal return in excess of what could have been achieved by passive investments in the factors.

The first row of Table VI shows the results of estimating (1) where the dependent variable, R_t, is the monthly return difference between the Democracy and Dictatorship Portfolios. Thus, the alpha in this estimation is the abnormal return on a zero-investment strategy that buys the Democracy Portfolio and sells short the Dictatorship Portfolio. For this specification, the alpha is 71 basis points (bp) per month, or about 8.5 percent per year. This point estimate is statistically significant at the one-percent level. Thus, very little of the difference in raw returns can be attributed to style differences in the two portfolios.

The remaining rows of Table VI summarize the results of estimating (1) for all ten "deciles" of G, including the extreme deciles comprising the Democracy ($G \leq 5$) and Dictatorship ($G \geq 14$) Portfolios. As the table shows, the significant performance difference between the Democracy and Dictatorship Portfolios is driven both by overperformance (for the Democracy Portfolio) and underperformance (by the Dictatorship Portfolio). The Democracy Portfolio earns a positive and significant alpha of 29 bp per month, while the Dictatorship Portfolio earns a negative and significant alpha of 42 bp per month.

The results also show that alpha decreases as G increases. The Democracy Portfolio earns the highest alpha of all the deciles, and the next two highest alphas, 24 and 22 bp, are earned by the third (G 7) and second (G 6) deciles, respectively. The Dictatorship Portfolio earns the lowest alpha, and the second lowest alpha is earned by the eighth (G 12) decile. Furthermore, the four lowest G deciles earn positive alphas, while the three highest G deciles earn negative alphas. More formally, a Spearman rank-correlation test of the null hypothesis of

no correlation between *G*-decile rankings and alpha rankings yields a test statistic of 0.842, and is rejected at the one-percent level.

Table VII reports several variations of the abnormal-return results. In each variation, we estimate the performance-attribution regression in equation (1) on the return difference between the Democracy and Dictatorship Portfolios, while changing some aspect of the portfolio construction or return calculation. We perform all of these tests using both value-weighted (VW) and equal-weighted (EW) portfolios. These tests allow us to estimate the fraction of the benchmark abnormal returns that can be attributed to industry composition, choice of cutoffs for the extreme portfolios, new provisions during the decade, legal variation across states, and different time periods.

The first row of Table VII replicates the baseline portfolio construction used above. The remaining rows of the table summarize tests using industry-adjusted returns (Row 2), two alternative constructions of the extreme portfolios (Rows 3 and 4), fixed portfolios built with 1990 levels of *G* (Row 5), a subsample that includes only Delaware firms (Row 6), and subsamples split between the first half and the second half of the sample period (Rows 7 and 8). Details of each of these constructions are given in the table note. The main themes of these results are, first, that the VW returns (Democracy minus Dictatorship) are economically large in all cases and, second, the EW abnormal returns are usually about two-thirds of the VW abnormal returns. Most of the return differential can be attributed to within-state variation already in place in 1990, and this return differential is apparent in both halves of the sample period.

Overall, we find significant evidence that the Democracy Portfolio outperformed the Dictatorship Portfolio in the 1990s. We also find some evidence of a monotonic relationship between *G* and returns. It would be useful to know which subindices and provisions drive these

results. We address this issue in depth within the broader analysis of causality and omitted-variable bias in Section V, so we defer a detailed analysis until then.

C. Governance and the Value of the Firm

It is well established that state and national laws of corporate governance affect firm value. La Porta et al. [2001] show that firm value is positively associated with the rights of minority shareholders. Daines [2001] finds that firms incorporated in Delaware have higher valuations than other U.S. firms. In this section, we study whether variation in firm-specific governance is associated with differences in firm value. More importantly, we analyze whether there was a change in the governance/value relationship during the 1990s. Since there is evidence of differential stock returns as a function of *G*, we would expect to find relative "mispricing" between 1990 and 1999 as a function of *G*.

Our valuation measure is Tobin's *Q*, which has been used for this purpose in corporate-governance studies since the work of Demsetz and Lehn [1985] and Morck, Shleifer, and Vishny [1988]. We follow Kaplan and Zingales' [1997] method for the computation of *Q* (details are listed in Appendix B) and also compute the median *Q* in each year in each of the 48 industries classified by Fama and French [1997]. We then regress

$$(2) \qquad Q'_{it} = a_t + b_t X_{it} + c_t W_{it} + e_{it},$$

where Q'_{it} is industry-adjusted *Q* (firm *Q* minus industry-median *Q*), X_{it} is a vector of governance variables (*G*, its components, or inclusion in one of the extreme portfolios) and W_{it} is a vector of firm characteristics. As elements of *W*, we follow Shin and Stulz [2000] and include

the log of the book value of assets and the log of firm age as of December of year t.[18] Daines [2001] found that Q is different for Delaware and non-Delaware firms, so we also include a Delaware dummy in W. Morck and Yang [2001] show that S&P 500 inclusion has a positive impact on Q, and that this impact increased during the 1990s; thus, we also include a dummy variable for S&P 500 inclusion in W.

Using a variant of the methods of Fama and MacBeth [1973], we estimate annual cross-sections of (2) with statistical significance assessed within each year (by cross-sectional standard errors) and across all years (with the time-series standard error of the mean coefficient). This method of assessing statistical significance deserves some explanation. In particular, one logical alternative would be a pooled setup with firm fixed effects and time-varying coefficients. We rejected this alternative mainly because there are few changes over time in the Governance Index, and the inclusion of fixed effects would force identification of the G coefficient from only these changes. In effect, our chosen method imposes a structure on the fixed effects: they must be a linear function of G or its components.

Table VIII summarizes the results. The first column gives the results with G as the key regressor. Each row gives the coefficients and standard errors for a different year of the sample; the last row gives the average coefficient and time-series standard error of these coefficients. The coefficients on G are negative in every year and significantly negative in nine of the ten years. The largest absolute value point estimate occurs in 1999, and the second largest is in 1998. The point estimate in 1999 is economically large; a one-point increase in G, equivalent to adding a single governance provision, is associated with an 11.4 percentage point lower value for

[18] Unlike Shin and Stulz [2000], we do not trim the sample of observations that have extreme independent variables. Results with a trimmed sample are nearly identical and are available from the authors.

Q. If we assume that the point estimates in 1990 and 1999 are independent, then the difference between these two estimates (11.4 – 2.2 = 9.2) is statistically significant.

In the second column of Table VIII, we restrict the sample to include only firms in the Democracy and Dictatorship Portfolios. We then estimate (2) using a dummy variable for the Democracy Portfolio. The results are consistent with the previous regressions on *G*. The point estimate for 1999 is the largest in the decade, implying that firms in the Democracy Portfolio have a *Q* that is 56 percentage points higher, other things being equal, than do firms in the Dictatorship Portfolio. This compares to an estimated difference of 19 percentage points in 1990. While the difference in coefficients between 1990 and 1999 is not statistically significant, it is similar to the total EW difference in abnormal returns estimated in Table VII.[19] There is no real pattern for the rest of the decade, however, and large standard errors toward the end of the sample period prevent any strong inference across years.

The final columns of Table VIII give results using the five governance subindices: *Delay, Voting, Protection, Other,* and *State*. The table shows that all subindices except *Voting* have average coefficients that are negative and significant (assuming independence across years). Over the full sample period, *Delay* and *Protection* have the most consistent impact, while the largest absolute coefficients are for *Voting* at the end of the sample period. The subindices are highly collinear, however, and the resulting large standard errors and covariances make it difficult to draw strong conclusions. For example, even in 1999 we cannot reject the null hypothesis that the coefficient on *Voting* is equal to the coefficient on *Delay*.

[19] Table VII, first row, second column, shows an alpha of 45 bp per month for the EW difference between the Democracy and Dictatorship portfolios. Over 112 months this produces a difference of approximately 50 percent, as compared to the 56 – 19 = 37 percent difference estimated for the *Q* regressions. We use the EW alpha as a comparison because the *Q* regressions are also equal-weighted.

Overall, the results for returns and prices tell a consistent story. Firms with the weakest shareholder rights (high values of *G*) significantly underperformed firms with the strongest shareholder rights (low values of *G*) during the 1990s. Over the course of the 1990s, these differences have been at least partially reflected in prices. While high-*G* firms already sold at a significant discount in 1990, this discount became much larger by 1999.

D. Governance and Operating Performance

Table IX shows the results of annual regressions for three operational measures on *G* (or a Democracy dummy). The three operational measures are the net profit margin (income divided by sales), the return on equity (income divided by book equity), and one-year sales growth. All of these measures are industry-adjusted by subtracting the median for this measure in the corresponding Fama-French [1997] industry. This adjustment uses all available Compustat firms. To reduce the influence of large outliers – a common occurrence for all of these measures -- we estimate median (least-absolute-deviation) regressions in each case. While our sample does not include a natural experiment to identify *G* as the cause of operational differences, we attempt to control for "expected" cross-sectional differences by using the log book-to-market ratio (*BM*) as an additional explanatory variable.

The odd-numbered columns give the results when *G* is the key regressor. We find that the average coefficient on *G* is negative and significant for both the net-profit-margin and sales-growth regressions, and is negative but not significant for the return-on-equity regressions. The even-numbered columns give the results for the subsample of firms from the extreme deciles, with a dummy variable for the Democracy Portfolio as the key regressor. For all three operating measures, the average coefficient on this dummy variable was positive but insignificant. Thus,

these results are consistent with the evidence for the full sample but not significant on their own. In untabulated results, we also regressed these same measures on the five subindices. The results show no clear pattern of differential influence for any particular subindex, with most coefficients having the same sign as *G*. Overall, we find some significant evidence that more democratic firms have better operating performance and no evidence that they do not.

IV. Governance: Three Hypotheses

Section III established an empirical relationship of *G* with returns, firm value, and operating performance. Since firms did not adopt governance provisions randomly, this evidence does not itself imply a causal role by governance provisions. Indeed, there are several plausible explanations for our results:

Hypothesis I) Governance provisions cause higher agency costs. These higher costs were underestimated by investors in 1990.

Hypothesis II) Governance provisions do not cause higher agency costs, but rather were put in place by 1980s managers who forecasted poor performance for their firms in the 1990s.

Hypothesis III) Governance provisions do not cause higher agency costs, but their presence is correlated with other characteristics that earned abnormal returns in the 1990s.

Most explanations of the Section III results can be fit within these three hypotheses. Under Hypothesis I, a reduction in shareholder rights causes an unexpectedly large increase in agency costs through some combination of inefficient investment, reduced operational efficiency, or self-dealing. If shareholders find it difficult or costly to replace managers, then managers may be more willing and able to extract private benefits. This is the standard justification for takeover threats as the strongest form of managerial discipline [Jensen 1986]. For Hypothesis I to be correct, these additional agency costs must have been underestimated in 1990.

Under Hypothesis II, governance does not affect performance, but there must be a perception that governance provisions are protective for management. In this case, the stock in these companies would have been relatively overvalued in 1990, even though objective measures (e.g., *Q* regressions) would suggest that it was undervalued relative to observable characteristics. When the poor operating performance occurs, the market is surprised but the managers are not. The protective provisions then supply a shield, real or imagined, for managerial jobs and compensation.

Under Hypothesis III, all of the results in the previous section would be driven by omitted-variable bias. Since governance provisions were certainly not adopted randomly, it is plausible that differences in industry, S&P 500 inclusion, institutional ownership, or other firm characteristics could be correlated both with *G* and with abnormal returns. Under this hypothesis, governance provisions could be completely innocuous, with no influence either on managerial power or on agency costs.

Ideally, we would distinguish among these three hypotheses by using random variation in some characteristic that was causal for *G*. Unfortunately, we have not been able to identify such

an instrument. One candidate would be the subset of state laws, with the *State* subindex as a proxy. Though in some states these laws were passed at the urging of large corporations, it seems reasonable to assume that their passage was exogenous to most firms. But the *State* subindex has three flaws as an instrument. First, firms can choose to reincorporate into different states; enough firms have done so that exposure to state laws is not truly exogenous [Subramanian 2001]. Second, many firms have opted out of the protections of some of the most stringent of these laws, so that a firm's state of incorporation is only a noisy measure for its actual legal exposure. Third, as shown in Table III, the *State* subindex is not positively or consistently correlated with the other components of *G*. Other potential instruments have different problems. For example, if takeover protections were adopted during industry-specific takeover waves, then we might be able to use industry as an instrument for *G*. Unfortunately, this would render it impossible to distinguish between *G* or industry as the cause of poor returns in the 1990s.

In Section V, our tests consist of a search for evidence supportive of each hypothesis, while acknowledging the impossibility of a perfect test to distinguish among them. First, if Hypothesis I is correct, then we should observe some "unexpected" differences in agency costs across firms. We discuss several previous studies on this topic and look for such differences in our sample by analyzing capital expenditure and acquisition behavior. Second, for Hypothesis II, we analyze insider-trading activity as a function of *G*. If governance provisions were put in place by prescient managers, these same managers might be net sellers of the stock in their firms. Finally, for Hypothesis III, we test whether a large set of observable firm characteristics can explain the empirical relationship between returns and *G*.

V. Governance: Tests

In this section we examine the evidence for each of the hypotheses described in Section IV. Section V.A covers Hypothesis I, Section V.B covers Hypothesis II, and Section V.C covers Hypothesis III. Section V.D summarizes and discusses the evidence.

A. Evidence on Hypothesis I

Increased agency costs at high-*G* firms can directly affect firm performance in several ways. In the specific case of state takeover laws, where causality is easier to establish, researchers have found evidence of increased agency costs through a variety of mechanisms. Borokhovich, Brunarski and Parrino [1997] show that compensation rises for CEOs of firms adopting takeover defenses. Bertrand and Mullainathan [1999a, 1999b, and 2000] find a similar result for CEOs and other employees in firms newly covered by state takeover laws. They also find that these laws cause a decrease in plant-level efficiency, measured either by total factor productivity or return on capital. Garvey and Hanka [1999] show that state takeover laws led to changes in leverage consistent with increased corporate slack. These studies provide the cleanest evidence in support of Hypothesis I, but, of course, do not make use of the full variation embodied in the *G* index. We supplement these findings by examining the empirical relationship of *G* with two other possible sources of agency costs: capital expenditure and acquisition behavior.

A substantial literature, dating back at least to Baumol [1959], Marris [1964], and Williamson [1964], holds that managers may undertake inefficient projects in order to extract private benefits. This problem is particularly severe when managers are entrenched and can resist hostile takeovers [Jensen and Ruback 1983, Shleifer and Vishny 1989]. Under this view, if

capital expenditure increases following the adoption of new takeover defenses, this increase would be a net negative for firm value.[20]

To examine the empirical relationship between capital expenditure and governance, we estimate annual median regressions for capital expenditure (CAPEX), scaled by either sales or assets, and net of the industry median. To control for the different investment opportunities available at value and growth firms, we include the log book-to-market ratio (BM) as a control variable in all specifications. Table X summarizes the results, with BM coefficients omitted. Columns (1) and (3) give results for the full sample, with *G* as the key regressor; columns (2) and (4) give results for the sample restricted to firms in the Democracy and Dictatorship Portfolios, with a Democracy dummy as the key regressor. The average coefficient on *G* is positive and significant in both sets of regressions. Consistent with these results, we find that the average coefficient on the Democracy dummy is negative and significant in both sets of regressions. We conclude that, other things equal, high-*G* firms have higher CAPEX than do low-*G* firms.

Another outlet for capital expenditure is for firms to acquire other firms. Some of the strongest evidence for the importance of agency costs comes from the negative returns to acquirer stocks after a bid is announced. Considerable evidence shows that these negative returns are correlated with other agency problems, including low managerial ownership [Lewellen, Loderer, and Rosenfeld 1985], high free-cash flow [Lang, Stulz, and Walkling 1991], and diversifying transactions [Morck, Shleifer, and Vishny 1990]. In addition to negative announcement returns, there is also long-run evidence of negative abnormal performance by

[20] For an alternative view, see Stein [1988 and 1989]. Empirical evidence on this issue is given by Daines and Klausner [2001], Johnson and Rao [1997], Meulbroek et al. [1990], Pugh, Page, and Jahera [1992], and Titman, Wei, and Xie [2001].

acquirer firms [Loughran and Vijh 1997, Rao and Vermaelen 1998].[21] Taken together, these studies suggest acquisitions as another pathway through which governance affects performance.

To analyze the relation between acquisition activity and *G*, we use the SDC database to identify all transactions in which a sample firm acted as either the acquirer or the seller during the sample period. From January 1991 through December 1999, there are 12,694 acquisitions made by sample firms; SDC gives the acquisition price for just under half of these. For each firm, we count the number of acquisitions ("Acquisition Count"). We also calculate the sum of the price of all acquisitions in each calendar year and divide this sum by the firm's average market capitalization for the first day and last day of the year ("Acquisition Ratio").

Table XI summarizes the results of annual regressions for both Acquisition Count and the Acquisition Ratio in year *t* on *G* (or a Democracy dummy), the log of size, the log of the book-to-market ratio, and 48 industry dummies, all measured at year-end *t-1*. Coefficients on all control variables are omitted from the table. Since many firms make no acquisitions in a year, the dependent variables are effectively left-censored at zero. To account for this censoring, we estimate Poisson regressions for Acquisition Count and Tobit regressions for the Acquisition Ratio. Columns (1) and (3) give results for the full sample, with *G* as the key regressor; columns (2) and (4) give results for the sample restricted to firms in the Democracy and Dictatorship portfolios, with a Democracy dummy as the key regressor. For both sets of regressions, the coefficients on *G* are positive in every year, and the average coefficient on *G* is positive and significant. Consistent with this result, the average coefficient on the Democracy dummy is negative for both sets of regressions and is significant for Acquisition Count.

[21] Mitchell and Stafford [2000] have challenged the magnitude of this long-run evidence, but still allow for some underperformance for acquisitions financed by stock. A related debate on whether diversifying acquisitions destroy value has grown too large to survey here. The seminal works are Lang and Stulz [1994] and Berger and Ofek [1995]. Recent work is summarized in Holmstrom and Kaplan [2001] and Stein [2001].

One interpretation of these results is that high-*G* firms engaged in an unexpectedly large amount of inefficient investment during the 1990s. This interpretation is consistent with contemporaneous unexpected differences in profitability, stock returns, and firm value. This inefficient investment does not necessarily mean that firms are attempting to maximize their size in a form of empire building. Indeed, empire building would be inconsistent with the negative relationship between sales growth and *G* found in Table IX. Instead, managers may be attempting to stave off "empire collapse" with high expenditure and acquisition activity. In that case, the results of this section are consistent with the evidence of Table IX.

B. Evidence on Hypothesis II

It is well established that insider trading can forecast returns. Firms whose shares have been intensively sold (bought) by insiders tend to underperform (overperform) benchmarks in subsequent periods.[22] If some 1980s insiders forecasted poor performance for their firms, we might expect them to have looked for ways to keep the shareholders from firing them, either through voting or takeovers. In this case, weak shareholder rights would be a symptom of insiders' superior information, but would not necessarily be the cause of the poor performance in the subsequent decade.

To study this possibility, we use data collected by Thomson Financial from the required SEC insider-trading filings. For each firm in our sample, we sum all (split-adjusted) open-market transactions for all insiders in each year, with purchases entering positively and sales entering negatively. We then normalize this sum by shares outstanding at the beginning of the year to arrive at a "Net Purchases" measure for each firm in each year. If insiders put new

[22] See Seyhun [1998] for a comprehensive review of this literature and a discussion of SEC rules, filing requirements, and available data.

provisions in place when they forecast poor performance, then we would expect Net Purchases to be negatively correlated with *G*.

We employ two regression specifications. First, we estimate OLS regressions of Net Purchases on *G* (or a Democracy dummy), BM, and log of size. For some firm-years, the Net Purchase measure is dominated by one large transaction. While large transactions might have information content, they might also reflect liquidity or rebalancing needs. In an OLS regression, firms with large outliers will dominate. Thus, we also estimate ordered logit regressions on the same OLS regressors, in which the dependent variable is equal to one if Net Purchases is positive, zero if Net Purchases is zero, and negative one if Net Purchases is negative.

Table XII summarizes the results of these regressions. Columns (1) and (3) give results for the full sample, with *G* as the key regressor; columns (2) and (4) give results for the sample restricted to firms in the Democracy and Dictatorship Portfolios with a Democracy dummy as the key regressor. Coefficients on all control variables are omitted from the table. We find no significant relationships between governance and insider trading. Two of four sets of regressions have positive average coefficients, two have negative average coefficients, and none of these average coefficients are significant. In untabulated results, we also estimated median regressions, replicated all of the above results using all transactions (the main difference is the inclusion of option-exercise transactions), and estimated long-horizon regressions using all years of data for each firm. In none of these cases did we find a robust relationship between governance and insider trading. Overall, we find no support for Hypothesis II in the insider-trading data.

C. Evidence on Hypothesis III

What other factors might be driving the return difference between the Democracy and Dictatorship portfolios? We saw in Table II that G is correlated with several firm characteristics, including S&P 500 membership, institutional ownership, trading volume, and past sales growth. If returns to stocks with these characteristics differed in the 1990s in a way not captured by the model in equation (1), then a type of omitted variable bias may drive the abnormal-return results. In this section, we explore this possibility using a cross-sectional regression approach. In addition to providing evidence on Hypothesis III, this method also supplements the analysis of Section III.B by allowing a separate regressor for each component of G.

For each month in the sample period, September 1990 to December 1999, we estimate

$$r_{it} = a_t + b_t X_{it} + c_t Z_{it} + e_{it}, \tag{3}$$

where, for firm i in month t, r_{it} are the returns (either raw or industry-adjusted), X_{it} is a vector of governance variables (either G, its components, or inclusion in one of the extreme portfolios), and Z_{it} is a vector of firm characteristics. As elements of Z, we include the full set of regressors used by Brennan, Chordia, and Subrahmanyam [1998], plus five-year sales growth, S&P 500 inclusion, and institutional ownership.[23] Variable definitions are given in Appendix B.

We estimate (3) separately for each month and then calculate the mean and time-series standard deviation of the 112 monthly estimates of the coefficients. Table XIII summarizes the results. The first two columns give the results, raw and industry-adjusted, for the full sample of firms in each month with G as the key independent variable. In both regressions, the average

[23] All of these additional variables are correlated with G (see Table III) and, in prior studies, with either firm value or abnormal returns. See Lakonishok, Shleifer, and Vishny [1994] (sales growth), Gompers and Metrick [2001] (institutional ownership), and Morck and Yang [2001] (Q).

coefficient on *G* is negative but not significant. The point estimates are not small. For example, the point estimate for the coefficient on *G* in column 3 implies a lower return of approximately four bp per month (48 bp per year) for each additional point of *G*, but it would require estimates nearly twice as large before statistical significance would be reached.

The next two columns give the results when the sample is restricted to stocks in either the Democracy ($G \leq 5$) or Dictatorship ($G \geq 14$) portfolios. In the first column, the dependent variable is the raw monthly return for each stock. In the second column, the dependent variable is the industry-adjusted return for each stock, where industry adjustments are relative to the Fama and French [1997] 48 industries. The key independent variable in these regressions is the Democracy dummy, set equal to one if the stock is in the Democracy Portfolio and zero if the stock is in the Dictatorship Portfolio. For both the raw and industry-adjusted returns, the coefficient on this dummy variable is positive and significant at the one-percent level. The average point estimate can be interpreted as a monthly abnormal return. These point estimates, 76 bp per month raw and 63 bp per month industry-adjusted, are similar to those found in the factor models, and provide a further robustness check to the benchmark result. Here, industry adjustments explain about one-sixth of the raw result. In the factor-model results of Table VII, the industry adjustment explained about one-third of the raw result.

Columns (5) and (6) of Table XIII give the results for the full sample of firms when the five subindices are used as the components of *X*. In principle, these regressions could help us distinguish between Hypotheses I and III. If governance provisions cause poor performance, then we might expect certain provisions to play a stronger role. In the absence of such a finding, we should wonder if the results are driven by some other characteristic. For example, some legal scholars argue that the *Delay* provisions are the only defenses with deterrent value [Coates 2000,

Daines and Klausner 2001]. If managers also believe this, then the *Delay* subindex should also be the most important driver of the results.

Unfortunately, large standard errors, due in part to the substantial multicollinearity between the regressors, makes it difficult to construct a powerful test. None of the subindex coefficients are statistically significant in either specification, but many of the point estimates are economically large. In the end, we cannot precisely measure the relative importance of *Delay* or any other subindex. This is similar to the problem that occurred in the *Q* regressions of Table VIII. For example, in both Tables VIII and XIII, the coefficients on *Voting* suggest potentially enormous economic significance, but large standard errors prevent any meaningful statistical inference.

In untabulated tests, we also included all 28 provisions from Table I as separate regressors in (3). Regressing raw returns on these 28 provisions plus the same controls as in Table XIII, we find that 16 of the coefficients are negative, and only one (Unequal Voting) is significant. (With this many regressors, we would expect one to appear "significant" just by chance.) Results for industry-adjusted returns are similar. These results highlight and magnify the lack of power in the subindex regressions. Indeed, many of the point estimates imply return effects above 20 basis points per month (2.4 percent per year), but are still far from being statistically significant. This result also suggests that the Democracy-minus-Dictatorship return differences are not driven by the presence or absence of any one provision.

D. Discussion

The evidence in sections V.A, V.B, and V.C must be interpreted with caution. Since this is an experiment without random assignment, no analysis of causality can be conclusive. The

main problem is the possibility that some unobserved characteristic is correlated with *G* and is also the main cause of abnormal returns. This type of omitted-variable bias could be something prosaic, such as imperfect industry adjustments or model misspecification, or something more difficult to quantify, such as a partially unobservable or immeasurable "corporate culture". Under the latter explanation, management behavior would be constrained by cultural norms within the firm, and democracy and dictatorship would be a persistent feature of a corporate culture; *G* would be a symptom, but not a cause, of this culture. In this case, all the results of the paper could be explained if investors mispriced culture in 1990, just as they appear to have mispriced its proxy, *G*. The policy impact of reducing *G* would be nonexistent unless it affected the culture of managerial power that was the true driver of poor performance.

In addition to the three hypotheses considered above, other explanations fall into the general class of "Type I" error. For example, one could argue that investors in 1990 had rational expectations about the expected costs and benefits of takeover defenses, where the expected costs are more severe agency problems and the expected benefits are higher takeover premia. Then, when the hostile takeover market largely evaporated in the early 1990s – perhaps because of macroeconomic conditions unrelated to takeover defenses – Dictatorship firms were left with the costs but none of the benefits of their defenses. Over the subsequent decade, the expected takeover premia eroded as investors gradually learned about the weak takeover market. Simple calculations suggest that this explanation cannot be that important. Suppose that in 1990 the expected takeover probability for Dictatorship firms was 30 percent, and the expected takeover premium conditional on takeover was also 30 percent. Further suppose that both of these numbers were zero for Democracy firms. Then, the unconditional expected takeover premium

for Dictatorship firms would have been only nine percent, which is approximately the relative underperformance of these firms for only a single year.

In sum, we find some evidence in support of Hypothesis I and no evidence in support of Hypothesis II. For Hypothesis III, we find that industry classification can explain somewhere between one-sixth and one-third of the benchmark abnormal returns, but we do not find any other observable characteristic that explains the remaining abnormal return. The subindex regressions, which might be helpful in distinguishing between Hypotheses I and III, are not powerful enough for strong inference. We conclude that the remaining performance differences, which are economically large, were either directly caused by governance provisions (Hypothesis I), or were related to unobservable or difficult-to-measure characteristics correlated with governance provisions (Hypothesis III).

What do these hypotheses imply about abnormal returns in the future? None suggests any obvious pattern for the relationship between *G* and returns. Under Hypothesis I, if we interpret our test as a long-run event study, then there is no reason to expect any relationship once the market has fully priced the underlying "event" of corporate governance. The fact that this price adjustment is taking such a long time does not seem so surprising in light of the lengthy intervals necessary for much more tangible information to be incorporated into prices.[24] Thus, to the extent that end-of-sample price adjustment is incomplete, complete, or has overreacted, the future relationship between *G* and returns could be negative, zero, or positive. Under Hypothesis II, there is a similar dependence on whether past insider information has been fully incorporated into prices. Under Hypothesis III, future return differences would be driven the relevant omitted characteristic; clearly, this hypothesis yields no clear prediction.

[24] For example, there is evidence that earnings surprises [Bernard and Thomas 1989], dividend omissions [Michaely, Thaler, and Womack 1995], and stock repurchases [Ikenberry, Lakonishok, and Vermaelen 1995] have long-term drift following the event, and all seem to be relatively simp le events compared to changes in governance structure.

VI. Conclusion

The power-sharing relationship between investors and managers is defined by the rules of corporate governance. Beginning in the late 1980s, there is significant and stable variation in these rules across different firms. Using 24 distinct corporate-governance provisions for a sample of about 1,500 firms per year during the 1990s, we build a Governance Index, denoted as *G*, as a proxy for the balance of power between managers and shareholders in each firm. We then analyze the empirical relationship of this index with corporate performance.

We find that corporate governance is strongly correlated with stock returns during the 1990s. An investment strategy that purchased shares in the lowest-*G* firms ("Democracy" firms with strong shareholder rights), and sold shares in the the highest-*G* firms ("Dictatorship" firms with weak shareholder rights), earned abnormal returns of 8.5 percent per year. At the beginning of the sample, there is already a significant relationship between valuation and governance: each one-point increase in *G* is associated with a decrease in Tobin's *Q* of 2.2 percentage points. By the end of the decade, this difference has increased significantly, with a one-point increase in *G* associated with a decrease in Tobin's *Q* of 11.4 percentage points. The results for both stock returns and firm value are economically large and are robust to many controls and other firm characteristics.

We consider several explanations for the results, but the data do not allow strong conclusions about causality. There is some evidence, both in our sample and from other authors, that weak shareholder rights caused poor performance in the 1990s. It is also possible that the results are driven by some unobservable firm characteristic. These multiple causal explanations have starkly different policy implications and stand as a challenge for future research. The

empirical evidence of this paper establishes the high stakes of this challenge. If an 11.4 percentage point difference in firm value were even partially "caused" by each additional governance provision, then the long-run benefits of eliminating multiple provisions would be enormous.

Appendix A – Corporate-Governance Provisions

This appendix describes the provisions listed in Table I and used as components of the Governance Index. The shorthand title of each provision, as used in the text of the paper, is given in bold. These descriptions are given in alphabetical order and are similar to Rosenbaum [1998]. For a few provisions, we discuss their impact on shareholder rights or the logic behind their categorization in Table I.

Antigreenmail – Greenmail refers to a transaction between a large shareholder and a company in which the shareholder agrees to sell his stock back to the company, usually at a premium, in exchange for the promise not to seek control of the company for a specified period of time. Antigreenmail provisions prevent such arrangements unless the same repurchase offer is made to all shareholders or approved by a shareholder vote. Such provisions are thought to discourage accumulation of large blocks of stock because one source of exit for the stake is closed, but the net effect on shareholder wealth is unclear [Shleifer and Vishny 1986, Eckbo 1990]. Five states have specific **Antigreenmail laws**, and two other states have "recapture of profits" laws, which enable firms to recapture raiders' profits earned in the secondary market. We consider recapture of profits laws to be a version of Antigreenmail laws (albeit a stronger one). The presence of firm-level Antigreenmail provisions is positively correlated with 18 out of the other 21 firm-level provisions, is significantly positive in eight of these cases, and is not significantly negative for any of them. Furthermore, states with Antigreenmail laws tend to pass them in conjunction with laws more clearly designed to prevent takeovers [Pinnell 2000]. Since it seems likely that most firms and states perceive Antigreenmail as a takeover "defense", we treat Antigreenmail like the other defenses and code it as a decrease in shareholder rights.

Blank Check preferred stock is stock over which the board of directors has broad authority to determine voting, dividend, conversion, and other rights. While it can be used to enable a company to meet changing financial needs, its most important use is to implement poison pills or to prevent takeover by placing this stock with friendly investors. Because of this role, blank check preferred stock is a crucial part of a "delay" strategy. Companies that have this type of preferred stock but require shareholder approval before it can be used as a takeover defense are *not* coded as having this provision in our data.

Business Combination laws impose a moratorium on certain kinds of transactions (e.g., asset sales, mergers) between a large shareholder and the firm, unless the transaction is approved by the Board of Directors. Depending on the State, this moratorium ranges between two and five years after the shareholder's stake passes a prespecified (minority) threshold. These laws were in place in 25 states in 1990 and two more by 1998. It is the only state takeover law in Delaware, the state of incorporation for about half of our sample.

Bylaw and **Charter** amendment limitations limit shareholders' ability to amend the governing documents of the corporation. This might take the form of a supermajority vote requirement for charter or bylaw amendments, total elimination of the ability of shareholders to amend the bylaws, or the ability of directors (beyond the provisions of state law) to amend the bylaws without shareholder approval.

Control-share **Cash-out laws** enable shareholders to sell their stakes to a "controlling" shareholder at a price based on the highest price of recently acquired shares. This works something like fair-price provisions (see below) extended to nontakeover situations. These laws were in place in three states by 1990 with no additions during the decade.

A **Classified Board** (or "staggered" board) is one in which the directors are placed into different classes and serve overlapping terms. Since only part of the board can be replaced each year, an outsider who gains control of a corporation may have to wait a few years before being able to gain control of the board. This slow replacement makes a classified board a crucial component of the *Delay* group of provisions, and one of the few provisions that clearly retains some deterrent value in modern takeover battles [Daines and Klausner 2001].

Compensation Plans with changes-in-control provisions allow participants in incentive bonus plans to cash out options or accelerate the payout of bonuses should there be a change in control. The details may be a written part of the compensation agreement, or discretion may be given to the compensation committee.

Director indemnification **Contracts** are contracts between the company and particular officers and directors indemnifying them from certain legal expenses and judgments resulting from lawsuits pertaining to their conduct. Some firms have both "Indemnification" in their bylaws or charter and these additional indemnification "Contracts".

Control-share Acquisition laws (see Supermajority, below).

Cumulative Voting allows a shareholder to allocate his total votes in any manner desired, where the total number of votes is the product of the number of shares owned and the number of directors to be elected. By allowing them to concentrate their votes, this practice helps minority shareholders to elect directors. Cumulative Voting and Secret Ballot (see below) are the only two provisions whose presence is coded as an *increase* in shareholder rights, with an additional point to the Governance Index if the provision is absent.

Directors' Duties provisions allow directors to consider constituencies other than shareholders when considering a merger. These constituencies may include, for example,

employees, host communities, or suppliers. This provision provides boards of directors with a legal basis for rejecting a takeover that would have been beneficial to shareholders. 31 states have **Directors' Duties laws** allowing similar expansions of constituencies, but in only two of these states (Indiana and Pennsylvania) are the laws explicit that the claims of shareholders should not be held above those of other stakeholders [Pinnell 2000]. We treat firms in these two states as though they had an expanded directors' duty provision unless the firm has explicitly opted out of coverage under the law.

Fair-Price provisions limit the range of prices a bidder can pay in two-tier offers. They typically require a bidder to pay to all shareholders the highest price paid to any during a specified period of time before the commencement of a tender offer, and do not apply if the deal is approved by the board of directors or a supermajority of the target's shareholders. The goal of this provision is to prevent pressure on the target's shareholders to tender their shares in the front end of a two-tiered tender offer, and they have the result of making such an acquisition more expensive. Also, 25 states had **Fair-Price laws** in place in 1990, and two more states passed such laws in 1991. The laws work similarly to the firm-level provisions.

Golden Parachutes are severance agreements that provide cash and non-cash compensation to senior executives upon an event such as termination, demotion, or resignation following a change in control. They do not require shareholder approval. While such payments would appear to deter takeovers by increasing their costs, one could argue that these parachutes also ease the passage of mergers through contractual compensation to the managers of the target company [Lambert and Larcker 1985]. While the net impact on managerial entrenchment and shareholder wealth is ambiguous, the more important effect is the clear decrease in shareholder rights. In this case, the "right" is the ability of a controlling shareholder to fire management

without incurring an additional cost. Golden Parachutes are highly correlated with all the other takeover defenses. Out of 21 pairwise correlations with the other firm-level provisions, 15 are positive, 10 of these positive correlations are significant, and only one of the negative correlations is significant. Thus, we treat Golden Parachutes as a restriction of shareholder rights.

Director **Indemnification** uses the bylaws, charter, or both to indemnify officers and directors from certain legal expenses and judgments resulting from lawsuits pertaining to their conduct. Some firms have both this "Indemnification" in their bylaws or charter and additional indemnification "Contracts". The cost of such protection can be used as a market measure of the quality of corporate governance [Core 1997 and 2000].

Limitations on director **Liability** are charter amendments that limit directors' personal liability to the extent allowed by state law. They often eliminate personal liability for breaches of the duty of care, but not for breaches of the duty of loyalty or for acts of intentional misconduct or knowing violation of the law.

Pension Parachutes prevent an acquirer from using surplus cash in the pension fund of the target to finance an acquisition. Surplus funds are required to remain the property of the pension fund and to be used for plan participants' benefits.

Poison Pills provide their holders with special rights in the case of a triggering event such as a hostile takeover bid. If a deal is approved by the board of directors, the poison pill can be revoked, but if the deal is not approved and the bidder proceeds, the pill is triggered. Typical poison pills give the holders of the target's stock other than the bidder the right to purchase stock in the target or the bidder's company at a steep discount, making the target unattractive or diluting the acquirer's voting power. Poison pills are a crucial component of the "delay" strategy

at the core of modern defensive tactics. Nevertheless, we do not include poison pills in the *Delay* group of provisions, but include it in the *Other* group because the pill itself can be passed on less than one-day's notice, so it need not be in place for the other *Delay* provisions to be effective. The other provisions in this group require a shareholder vote, so they cannot be passed on short notice. See Coates [2000] and Daines and Klausner [2001] for a discussion of this point.

Under a **Secret Ballot** (also called confidential voting), either an independent third party or employees sworn to secrecy are used to count proxy votes, and the management usually agrees not to look at individual proxy cards. This can help eliminate potential conflicts of interest for fiduciaries voting shares on behalf of others, and can reduce pressure by management on shareholder-employees or shareholder-partners. Cumulative Voting (see above) and Secret Ballots are the only two provisions whose presence is coded as an *increase* in shareholder rights, with an additional point to the Governance Index if the provision is absent.

Executive **Severance** agreements assure high-level executives of their positions or some compensation and are not contingent upon a change in control (unlike Golden or Silver parachutes).

Silver Parachutes are similar to Golden Parachutes in that they provide severance payments upon a change in corporate control, but differ in that a large number of a firm's employees are eligible for these benefits. Since Silver Parachutes do not protect the key decision makers in a merger, we classified them in the *Other* group rather than in the *Protection* group.

Special Meeting limitations either increase the level of shareholder support required to call a special meeting beyond that specified by state law or eliminate the ability to call one entirely. Such provisions add extra time to proxy fights, since bidders must wait until the regularly scheduled annual meeting to replace board members or dismantle takeover defenses.

This delay is especially potent when combined with limitations on actions by written consent (see below).

Supermajority requirements for approval of mergers are charter provisions that establish voting requirements for mergers or other business combinations that are higher than the threshold requirements of state law. They are typically 66.7, 75, or 85 percent, and often exceed attendance at the annual meeting. In practice, these provisions are similar to **Control-Share Acquisition laws**. These laws require a majority of disinterested shareholders to vote on whether a newly qualifying large shareholder has voting rights. They were in place in 25 states by September 1990 and one additional state in 1991.

Unequal Voting rights limit the voting rights of some shareholders and expand those of others. Under time-phased voting, shareholders who have held the stock for a given period of time are given more votes per share than recent purchasers. Another variety is the substantial-shareholder provision, which limits the voting power of shareholders who have exceeded a certain threshold of ownership.

Limitations on action by **Written Consent** can take the form of the establishment of majority thresholds beyond the level of state law, the requirement of unanimous consent, or the elimination of the right to take action by written consent. Such requirements add extra time to many proxy fights, since bidders must wait until the regularly scheduled annual meeting to replace board members or dismantle takeover defenses. This delay is especially potent when combined with limitations for calling special meetings (see above).

Appendix B – Definitions for the Regression Variables

This list includes all variables used as regressors or for summary statistics in Tables V and XIII. All components are drawn from the CRSP monthly files and all variables are in natural logs unless explicitly noted otherwise. Variables are listed in alphabetical order.

BM - The ratio of book value of common equity (previous fiscal year) to market value of common equity (end of previous calendar year). Book value of common equity is the sum of book common equity (Compustat item 60) and deferred taxes (Compustat item 74). This variable, and all other variables that use Compustat data, are recalculated each July and held constant through the following June.

5-Year Return – The compounded return from month t-61 to month t-2.

IO – Shares held by institutions divided by total shares outstanding (not in logs). Institutional holdings are from SEC Form 13F quarterly filings, as provided by Thomson Financial. We use the most recent quarter as of the end of month t-1, with shares outstanding (from CRSP) measured on the same date.

NADVOL - The dollar volume of trading in month t-2 for stocks that trade on the Nasdaq. Approximated as stock price at the end of month t-2 multiplied by share volume in month t-2. For New York Stock Exchange (NYSE) and American Stock Exchange (AMEX) stocks, NADVOL equals zero.

NASDUM - A dummy variable equal to one if the firm traded on the Nasdaq Stock Market at the beginning of month t and zero otherwise.

NYDVOL - The dollar volume of trading in month t-2 for stocks that trade on the NYSE or AMEX. Approximated as stock price at the end of month t-2 multiplied by share volume in month t-2. For Nasdaq stocks, NYDVOL equals zero.

PRICE - Price at the end of month t-2.

Q - The market value of assets divided by the book value of assets (Compustat item 6), where the market value of assets is computed as book value of assets plus the market value of common stock less the sum of the book value of common stock (Compustat item 60) and balance sheet deferred taxes (Compustat item 74). All book values for fiscal year t (from Compustat) are combined with the market value of common equity at the calendar end of year t.

RET2-3 - Compounded gross returns for months t-3 and t-2.

RET4-6 - Compounded gross returns for months t-6 through t-4.

RET7-12 - Compounded gross returns for months t-12 through t-7.

SGROWTH - The growth in sales (Compustat item 12) over the previous five fiscal years (not in logs).

SIZE - Market capitalization in millions of dollars at the end of month t-2.

SP500 - membership in the S&P 500 as of the end of month t-1. Value is equal to one if the firm is in the index, and zero otherwise. Data is from CRSP S&P 500 constituent file.

VOLUME - The dollar volume of trading in month t-2 = NADVOL + NYDVOL.

YLD - The ratio of dividends in the previous fiscal year (Compustat item 21) to market capitalization measured at calendar year end (not in logs).

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TABLE I
Governance Provisions

This table presents the percentage of firms with each provision between 1990 and 1998. The data are drawn from the IRRC Corporate Takeover Defenses publications [Rosenbaum 1990, 1993, 1995, and 1998] and are supplemented by data on state takeover legislation coded from Pinnell [2000]. See Appendix A for detailed information on each of these provisions. The sample consists of all firms in the IRRC research universe except those with dual class stock.

	Percentage of firms with governance provisions in			
	1990	1993	1995	1998
Delay				
Blank Check	76.4	80.0	85.7	87.9
Classified Board	59.0	60.4	61.7	59.4
Special Meeting	24.5	29.9	31.9	34.5
Written Consent	24.4	29.2	32.0	33.1
Protection				
Compensation Plans	44.7	65.8	72.5	62.4
Contracts	16.4	15.2	12.7	11.7
Golden Parachutes	53.1	55.5	55.1	56.6
Indemnification	40.9	39.6	38.7	24.4
Liability	72.3	69.1	65.6	46.8
Severance	13.4	5.5	10.3	11.7
Voting				
Bylaws	14.4	16.1	16.0	18.1
Charter	3.2	3.4	3.1	3.0
Cumulative Voting	18.5	16.5	14.9	12.2
Secret Ballot	2.9	9.5	12.2	9.4
Supermajority	38.8	39.6	38.5	34.1
Unequal Voting	2.4	2.0	1.9	1.9
Other				
Antigreenmail	6.1	6.9	6.4	5.6
Directors' Duties	6.5	7.4	7.2	6.7
Fair Price	33.5	35.2	33.6	27.8
Pension Parachutes	3.9	5.2	3.9	2.2
Poison Pill	53.9	57.4	56.6	55.3
Silver Parachutes	4.1	4.8	3.5	2.3
State				
Antigreenmail Law	17.2	17.6	17.0	14.1
Business Combination Law	84.3	88.5	88.9	89.9
Cash-Out Law	4.2	3.9	3.9	3.5
Directors' Duties Law	5.2	5.0	5.0	4.4
Fair Price Law	35.7	36.9	35.9	31.6
Control Share Acquisition Law	29.6	29.9	29.4	26.4
Number of Firms	1357	1343	1373	1708

TABLE II
The Governance Index

This table provides summary statistics on the distribution of *G*, the Governance Index, and the subindices (*Delay, Protection, Voting, Other,* and *State*) over time. *G* and the subindices are calculated from the provisions listed in Table I as described in Section II**.** Appendix A gives detailed information on each provision. We divide the sample into ten portfolios based on the level of *G* and list the number of firms in each portfolio. The Democracy Portfolio is composed of all firms where $G \leq 5$, and the Dictatorship Portfolio contains all firms where $G \geq 14$.

	1990	1993	1995	1998
Governance Index				
Minimum	2	2	2	2
Mean	9.0	9.3	9.4	8.9
Median	9	9	9	9
Mode	10	9	9	10
Maximum	17	17	17	18
Standard Deviation	2.9	2.8	2.8	2.8
Number of Firms				
$G \leq 5$ (Democracy Portfolio)	158	139	120	215
G 6	119	88	108	169
G 7	158	140	127	186
G 8	165	139	152	201
G 9	160	183	183	197
G 10	175	170	178	221
G 11	149	168	166	194
G 12	104	123	142	136
G 13	84	100	110	106
$G \geq 14$ (Dictatorship Portfolio)	85	93	87	83
Total	1357	1343	1373	1708
Subindex Means				
Delay	1.8	2.0	2.1	2.1
Protection	2.4	2.5	2.5	2.1
Voting	2.2	2.1	2.1	2.2
Other	1.1	1.2	1.1	1.0
State	1.8	1.8	1.8	1.7

TABLE III
Correlations between the Subindices

This table presents pairwise correlations between the subindices, *Delay, Protection, Voting, Other,* and *State* in 1990. The calculation of the subindices is described in Section II. The elements of each subindex are given in Table I and described in detail in Appendix A. Significance at the five-percent and one-percent levels is indicated by * and ** respectively.

	Delay	*Protection*	*Voting*	*Other*
Protection	0.22**			
Voting	0.33**	0.10**		
Other	0.43**	0.27**	0.19**	
State	-0.08**	-0.04	-0.07*	0.05

TABLE IV
The Largest Firms in the Extreme Portfolios

This table presents the firms with the largest market capitalizations at the end of 1990 of all companies within the Democracy Portfolio ($G \leq 5$) and the Dictatorship Portfolio ($G \geq 14$). The calculation of G is described in Section II. The companies are listed in descending order of market capitalization.

1990 Democracy Portfolio			
	State of Incorporation	1990 Governance Index	1998 Governance Index
IBM	New York	5	6
Wal-Mart	Delaware	5	5
Du Pont de Nemours	Delaware	5	5
Pepsico	North Carolina	4	3
American International Group	Delaware	5	5
Southern Company	Delaware	5	5
Hewlett Packard	California	5	6
Berkshire Hathaway	Delaware	3	–
Commonwealth Edison	Illinois	4	6
Texas Utilities	Texas	2	4

1990 Dictatorship Portfolio			
	State of Incorporation	1990 Governance Index	1998 Governance Index
GTE	New York	14	13
Waste Management	Delaware	15	13
General Re	Delaware	14	16
Limited Inc	Delaware	14	14
NCR	Maryland	14	–
K Mart	Michigan	14	10
United Telecommunications	Kansas	14	–
Time Warner	Delaware	14	13
Rorer	Pennsylvania	16	–
Woolworth	New York	14	13

TABLE V
Summary Statistics

This table gives descriptive statistics for the relationship of *G* with several financial and accounting measures in September 1990. The first column gives the correlations for each of these variables with the Governance Index, *G*. The second and third columns give means for these same variables within the Democracy Portfolio ($G \leq 5$) and the Dictatorship Portfolio ($G \geq 14$) in 1990. The final column gives the difference of the two means with its standard error in parentheses. The calculation of *G* is described in Section II, and definitions of each variable are given in Appendix B. Significance at the five-percent and one-percent levels is indicated by * and ** respectively.

	Correlation with *G*	Mean, Democracy Portfolio	Mean, Dictatorship Portfolio	Difference
BM	0.02	-0.66	-0.54	-0.12
				(0.10)
SIZE	0.15**	12.86	13.46	-0.60**
				(0.21)
PRICE	0.16**	2.74	3.14	-0.40**
				(0.12)
VOLUME	0.19**	16.34	17.29	-0.95**
				(0.24)
Q	-0.04	1.77	1.47	0.30*
				(0.14)
YLD	0.03	4.20%	7.20%	-3.00%
				(4.34)
SP500	0.23**	0.15	0.49	-0.34**
				(0.06)
5-Year Return	-0.01	90.53%	85.41%	5.12%
				(20.74)
SGROWTH	-0.08**	62.74%	44.78%	17.96%
				(9.83)
IO	0.14**	25.89%	34.44%	-8.55%*
				(3.36)

TABLE VI

Performance-Attribution Regressions for Decile Portfolios

We estimate four-factor regressions (equation (1) from the text) of value-weighted monthly returns for portfolios of firms sorted by *G*. The calculation of *G* is described in Section II. The first row contains the results when we use the portfolio that buys the Democracy Portfolio ($G \leq 5$) and sells short the Dictatorship Portfolio ($G \geq 14$). The portfolios are reset in September 1990, July 1993, July 1995, and February 1998, which are the months after new data on *G* became available. The explanatory variables are *RMRF*, *SMB*, *HML*, and *Momentum*. These variables are the returns to zero-investment portfolios designed to capture market, size, book-to-market, and momentum effects, respectively. (Consult Fama and French [1993] and Carhart [1997] on the construction of these factors.) The sample period is from September 1990 through December 1999. Standard errors are reported in parentheses and significance at the five-percent and one-percent levels is indicated by * and ** respectively.

	α	*RMRF*	*SMB*	*HML*	*Momentum*
Democracy-Dictatorship	**0.71** **(0.26)**	**-0.04** **(0.07)**	**-0.22*** **(0.09)**	**-0.55**** **(0.10)**	**-0.01** **(0.07)**
$G \leq 5$ (Democracy)	0.29* (0.13)	0.98** (0.04)	-0.24** (0.05)	-0.21** (0.05)	-0.05 (0.03)
G 6	0.22 (0.18)	0.99** (0.05)	-0.18** (0.06)	0.05 (0.07)	-0.08 (0.04)
G 7	0.24 (0.19)	1.05** (0.05)	-0.10 (0.07)	-0.14 (0.08)	0.15** (0.05)
G 8	0.08 (0.14)	1.02** (0.04)	-0.04 (0.05)	-0.08 (0.06)	0.01 (0.04)
G 9	-0.02 (0.12)	0.97** (0.03)	-0.20** (0.04)	0.14** (0.05)	-0.01 (0.03)
G 10	0.03 (0.11)	0.95** (0.03)	-0.17** (0.04)	-0.00 (0.04)	-0.08** (0.03)
G 11	0.18 (0.16)	0.99** (0.05)	-0.14* (0.05)	-0.06 (0.06)	-0.01 (0.04)
G 12	-0.25 (0.14)	1.00** (0.04)	-0.11* (0.05)	0.16** (0.06)	0.02 (0.04)
G 13	-0.01 (0.14)	1.03** (0.04)	-0.21** (0.05)	0.14* (0.06)	-0.08* (0.04)
$G \geq 14$ (Dictatorship)	-0.42* (0.19)	1.03** (0.05)	-0.02 (0.06)	0.34** (0.07)	-0.05 (0.05)

TABLE VII

Performance-Attribution Regressions under Alternative Portfolio Constructions

This table presents the alphas from four-factor regressions for variations on the Democracy ($G \leq 5$) minus Dictatorship ($G \geq 14$) Portfolio. The calculation of G is described in Section II. The portfolios are reset in September 1990, July 1993, July 1995, and February 1998, which are the months after new data on G became available. The sample period is September 1990 to December 1999. The first row uses the unadjusted difference between the monthly returns to the Democracy and Dictatorship Portfolios. The second row contains the results using industry-adjusted returns, with industry adjustments done relative to the 48 industries of Fama and French [1997]. The third and fourth rows use alternative definitions of the Democracy and Dictatorship Portfolios. In the third row, firms are sorted on G and the two portfolios contain the smallest set of firms with extreme values of G such that each has at least 10 percent of the sample. This implies cutoff values of G for the Democracy Portfolio of 5, 5, 6, and 5 for September 1990, July 1993, July 1995, and February 1998, respectively. The cutoffs for the Dictatorship Portfolio are always 13. In the fourth row, the two portfolios contain the largest set of firms such that each has no more than 10 percent of the sample. The cutoff values of G for the Democracy Portfolio are 4, 4, 5, and 4 for September 1990, July 1993, July 1995, and February 1998, respectively, and they are always 14 for the Dictatorship Portfolio. In the fifth row, portfolio returns are calculated maintaining the 1990 portfolios for the entire sample period. As long as they are listed in CRSP, we neither delete nor add firms to these portfolios regardless of subsequent changes in G or changes in the IRRC sample in later editions. The sixth row shows the results of restricting the sample to firms incorporated in Delaware. In the seventh and eighth rows, the sample period is divided in half at April 30, 1995, and separate regressions are estimated for the first half and second half of the period (56 months each). The explanatory variables are *RMRF*, *SMB*, *HML*, *Momentum*, and a constant. These variables are the returns to zero-investment portfolios designed to capture market, size, book-to-market, and momentum effects, respectively. (Consult Fama and French [1993] and Carhart [1997] on the construction of these factors.) All coefficients except for the alpha are omitted in this table. Standard errors are reported in parentheses and significance at the five-percent and one-percent levels is indicated by * and ** respectively.

		α, Value-Weighted	α, Equal-Weighted
(1)	Democracy-Dictatorship	0.71**	0.45*
		(0.26)	(0.22)
(2)	Industry-Adjusted	0.47*	0.30
		(0.22)	(0.19)
(3)	Big Portfolios	0.47*	0.39*
		(0.21)	(0.19)
(4)	Small Portfolios	0.78*	0.45
		(0.33)	(0.25)
(5)	1990 Portfolio	0.53*	0.33
		(0.24)	(0.22)
(6)	Delaware Portfolio	0.63	0.42
		(0.34)	(0.26)
(7)	Early Half	0.45	0.58*
		(0.23)	(0.28)
(8)	Late Half	0.75	0.04
		(0.40)	(0.27)

TABLE VIII
***Q* Regressions**

The first column of this table presents the coefficients on *G*, the Governance Index, from regressions of industry-adjusted Tobin's *Q* on *G* and control variables. The second column restricts the sample to firms in the Democracy ($G \leq 5$) and Dictatorship ($G \geq 14$) portfolios and includes as regressors a dummy variable for the Democracy Portfolio and the controls. The third through seventh columns show the coefficients on each subindex from regressions where the explanatory variables are the subindices *Delay*, *Protection*, *Voting*, *Other*, and *State*, and the controls. We include as controls a dummy variable for incorporation in Delaware, the log of assets in the current fiscal year, the log of firm age measured in months as of December of each year, and a dummy variable for inclusion in the S&P 500 as of the end of the previous year. The coefficients on the controls and the constant are omitted from the table. The calculation of *G* and the subindices is described in Section II. *Q* is the ratio of the market value of assets to the book value of assets: the market value is calculated as the sum of the book value of assets and the market value of common stock less the book value of common stock and deferred taxes. The market value of equity is measured at the end of the current calendar year, and the accounting variables are measured in the current fiscal year. Industry adjustments are made by subtracting the industry median, where medians are calculated by matching the four-digit SIC codes from December of each year to the 48 industries designated by Fama and French [1997]. The coefficients and standard errors from each annual cross-sectional regression are reported in each row, and the time-series averages and time-series standard errors are given in the last row. * and ** indicate significance at the five-percent and one-percent levels respectively.

	(1) *G*	(2) *Democracy Portfolio*	(3) *Delay*	(4) *Protection*	(5) *Voting*	(6) *Other*	(7) *State*
1990	-0.022**	0.186	-0.015	-0.035	0.015	-0.031	-0.004
	(0.008)	(0.127)	(0.022)	(0.018)	(0.030)	(0.026)	(0.020)
1991	-0.040**	0.302*	-0.033	-0.048	-0.012	-0.059	0.003
	(0.012)	(0.143)	(0.034)	(0.028)	(0.047)	(0.040)	(0.031)
1992	-0.036**	0.340*	-0.041	-0.039	0.021	-0.054	-0.011
	(0.010)	(0.151)	(0.027)	(0.023)	(0.038)	(0.032)	(0.025)
1993	-0.042**	0.485*	-0.023	-0.055*	0.009	-0.060	-0.062*
	(0.011)	(0.204)	(0.029)	(0.026)	(0.038)	(0.035)	(0.027)
1994	-0.031**	0.335*	-0.032	-0.012	-0.032	-0.029	-0.047*
	(0.009)	(0.161)	(0.023)	(0.020)	(0.031)	(0.028)	(0.022)
1995	-0.039**	0.435*	-0.046	-0.062*	-0.086*	0.023	-0.022
	(0.011)	(0.217)	(0.030)	(0.027)	(0.041)	(0.036)	(0.028)
1996	-0.025*	0.299	-0.029	-0.030	-0.078	0.018	-0.024
	(0.011)	(0.195)	(0.031)	(0.028)	(0.041)	(0.037)	(0.028)
1997	-0.016	0.210	-0.017	-0.007	-0.055	-0.001	-0.017
	(0.013)	(0.196)	(0.035)	(0.032)	(0.047)	(0.042)	(0.032)
1998	-0.065**	0.203	-0.023	-0.096*	-0.132	-0.058	0.012
	(0.020)	(0.404)	(0.052)	(0.049)	(0.070)	(0.066)	(0.052)
1999	-0.114**	0.564	-0.067	-0.171*	-0.294**	-0.006	-0.033
	(0.027)	(0.602)	(0.071)	(0.067)	(0.098)	(0.090)	(0.073)
Mean	-0.043**	0.336**	-0.033**	-0.056**	-0.065	-0.025*	-0.020*
	(0.009)	(0.040)	(0.005)	(0.015)	(0.030)	(0.010)	(0.007)

TABLE IX
Operating Performance

The first, third, and fifth columns of this table give the results of annual median (least absolute deviation) regressions for net profit margin, return on equity, and sales growth on the Governance Index, *G,* measured in the previous year, and the book-to-market ratio, *BM.* The second, fourth, and sixth columns restrict the sample to firms in the Democracy ($G \leq 5$) and Dictatorship ($G \geq 14$) portfolios and include as regressors a dummy variable for the Democracy Portfolio and *BM.* The coefficients on *BM* and the constant are omitted from the table. The calculation of *G* is described in Section II. Net profit margin is the ratio of income before extraordinary items available for common equity to sales; return on equity is the ratio of income before extraordinary items available for common equity to the sum of the book value of common equity and deferred taxes; *BM* is the log of the ratio of book value (the sum of book common equity and deferred taxes) in the previous fiscal year to size at the close of the previous calendar year. Each dependent variable is net of the industry median, which is calculated by matching the four-digit SIC codes of all firms in the CRSP-Compustat merged database in December of each year to the 48 industries designated by Fama and French [1997]. The coefficients and standard errors from each annual cross-sectional regression are reported in each row, and the time-series averages and time-series standard errors are given in the last row. Significance at the five-percent and one-percent levels is indicated by * and ** respectively. All coefficients and standard errors are multiplied by 1000.

	(1)	(2)	(3)	(4)	(5)	(6)
	Net Profit Margin		Return on Equity		Sales Growth	
	G	*Democracy Portfolio*	*G*	*Democracy Portfolio*	*G*	*Democracy Portfolio*
1991	-0.70	10.61	-1.19*	13.54	-2.30	-3.52
	(0.39)	(7.12)	(0.60)	(11.30)	(1.38)	(17.83)
1992	-0.52	9.45	0.42	2.54	-1.43	0.10
	(0.58)	(10.43)	(0.61)	(9.21)	(1.06)	(11.52)
1993	-0.76	7.77	-0.34	2.51	-3.35**	18.55
	(0.48)	(9.98)	(0.79)	(10.98)	(1.17)	(17.71)
1994	-0.83	10.94	-1.07	2.69	-2.71*	12.58
	(0.48)	(6.59)	(0.61)	(10.36)	(1.10)	(22.81)
1995	-0.72	7.56	-1.39	14.77	-0.89	7.91
	(0.67)	(8.30)	(0.75)	(9.88)	(1.70)	(19.67)
1996	-0.43	-2.17	0.90	-2.30	-2.44	14.84
	(0.40)	(7.22)	(0.65)	(12.09)	(1.39)	(19.36)
1997	0.21	-9.61	0.66	-17.54	0.01	-4.28
	(0.55)	(9.99)	(0.81)	(9.83)	(1.64)	(26.61)
1998	-0.73	-3.99	-1.28	13.62	-1.45	-15.65
	(0.63)	(7.15)	(1.01)	(15.10)	(1.50)	(23.36)
1999	-1.27*	4.59	0.93	-15.53	-0.52	15.38
	(0.58)	(11.58)	(0.85)	(10.38)	(1.92)	(26.10)
Mean	-0.64**	3.91	-0.26	1.59	-1.68**	5.10
	(0.13)	(2.46)	(0.33)	(3.98)	(0.37)	(3.84)

TABLE X
Capital Expenditure

The first and third columns of this table present the results of annual median (least absolute deviation) regressions of CAPEX/Assets and CAPEX/Sales on the Governance Index, *G*, measured in the previous year, and *BM*. The second and fourth columns restrict the sample to firms in the Democracy ($G \leq 5$) and Dictatorship ($G \geq 14$) portfolios and include as regressors a dummy variable for the Democracy Portfolio and *BM*. The coefficients on *BM* and the constant are omitted from the table. The calculation of *G* is described in Section II. CAPEX is capital expenditures, and *BM* is the log of the ratio of book value (the sum of book common equity and deferred taxes) in the previous fiscal year to size at the close of the previous calendar year. Both dependent variables are net of the industry median, which is calculated by matching the four-digit SIC codes of all firms in the CRSP-Compustat merged database in December of each year to the 48 industries designated by Fama and French [1997]. The coefficients and standard errors from each annual cross-sectional regression are reported in each row, and the time-series averages and time-series standard errors are given in the last row. Significance at the five-percent and one-percent levels is indicated by * and ** respectively. All coefficients and standard errors are multiplied by 1000.

	(1)	(2)	(3)	(4)
	CAPEX/Assets		CAPEX/Sales	
	G	*Democracy Portfolio*	*G*	*Democracy Portfolio*
1991	1.32**	-13.02**	0.70*	-9.28
	(0.27)	(4.28)	(0.32)	(4.96)
1992	0.42	-7.03	0.54	-7.23
	(0.35)	(4.86)	(0.35)	(6.01)
1993	0.81*	-6.06	0.09	-1.68
	(0.37)	(4.48)	(0.34)	(4.98)
1994	0.51	-7.84	-0.07	-4.82
	(0.32)	(5.21)	(0.37)	(4.76)
1995	0.35	-3.40	0.32	-9.80
	(0.39)	(6.83)	(0.39)	(5.90)
1996	0.75	-6.90	0.31	-3.26
	(0.39)	(5.55)	(0.33)	(6.36)
1997	0.74*	-4.23	0.70	-8.05
	(0.34)	(3.50)	(0.40)	(5.71)
1998	0.80*	-10.57	0.37	-6.43
	(0.37)	(6.75)	(0.35)	(5.63)
1999	-0.15	3.12	-0.32	3.49
	(0.39)	(4.20)	(0.38)	(5.52)
Mean	0.62**	-6.21**	0.30*	-5.23**
	(0.13)	(1.53)	(0.11)	(1.41)

TABLE XI
Acquisitions

The first column of this table presents annual Tobit regressions of the *Acquisition Ratio* on the Governance Index, *G,* measured in the previous year, *SIZE*, *BM*, and industry dummy variables. The third column presents annual Poisson regressions of *Acquisition Count* on the same explanatory variables. In the second and fourth columns, we restrict the sample to firms in the Democracy ($G \leq 5$) and Dictatorship ($G \geq 14$) portfolios, and we include as a regressor a dummy variable that equals 1 when the firm is in the Democracy Portfolio and 0 otherwise. The coefficients on *SIZE*, *BM*, and the industry dummy variables are omitted from the table. The calculation of *G* is described in Section II. *Acquisition Ratio* is defined as the sum of the value of all corporate acquisitions during a calendar year scaled by the average of market value at the beginning and end of the year. *Acquisition Count* is defined as the number of acquisitions during a calendar year. The data on acquisitions are from the SDC database. *SIZE* is the log of market capitalization at the end of the previous calendar year in millions of dollars, and *BM* is the log of the ratio of book value (the sum of book common equity and deferred taxes) in the previous fiscal year to size at the close of the previous calendar year. Industry dummy variables are created by matching the four-digit SIC codes of all firms in the CRSP-Compustat merged database in December of each year to the 48 industries designated by Fama and French [1997]. The coefficients and standard errors from each annual cross-sectional regression are reported in each row, and the time-series averages and time-series standard errors are given in the last row. Significance at the five-percent and one-percent levels is indicated by * and ** respectively. All coefficients and standard errors are multiplied by 100.

	(1)	(2)	(3)	(4)
	Acquisition Count (Poisson Regressions)		*Acquisition Ratio (Tobit Regressions)*	
	G	*Democracy Portfolio*	*G*	*Democracy Portfolio*
1991	1.58 (1.46)	-50.81 (26.12)	0.51 (0.47)	0.14 (5.03)
1992	1.64 (1.44)	-31.39 (24.61)	0.10 (0.50)	7.91 (6.42)
1993	1.75 (1.42)	-47.67 24.51	0.70 (0.56)	-6.31 (6.85)
1994	4.09** (1.27)	-13.10 (21.02)	0.75 (0.48)	1.82 (4.14)
1995	2.57* (1.15)	-60.92** (17.85)	0.41 (0.44)	-2.95 (4.42)
1996	2.69* (1.14)	-66.06** (20.48)	1.33* (0.60)	-24.22** (9.41)
1997	2.34* (1.12)	-63.81** (19.03)	0.99* (0.51)	-9.24 (6.78)
1998	2.42* (1.09)	-52.03** (17.67)	1.47 (0.76)	-11.11 (8.51)
1999	0.52 (1.01)	-47.64** (17.27)	0.84 (0.74)	-20.87* (9.68)
Mean	2.18** (0.33)	-48.16** (5.60)	0.79** (0.14)	-7.21 (3.49)

TABLE XII
Insider Trading

The first and third columns of this table present annual OLS and ordered logit regressions of *Net Insider Purchases* on *G* measured in the previous year, *SIZE*, *BM*, and a constant. In the second and fourth columns, we restrict the sample to firms in the Democracy ($G \leq 5$) and Dictatorship ($G \geq 14$) portfolios and we include as a regressor a dummy variable that equals 1 when the firm is in the Democracy Portfolio and 0 otherwise. The coefficients on *SIZE*, *BM*, and the constant are omitted from the table. The calculation of *G* is described in Section II. *Net Insider Purchases* is the sum of split-adjusted open market purchases less split-adjusted open market sales during a year scaled by shares outstanding at the end of the previous calendar year. The ordered logit regressions use a dependent variable that equals 1 if *Net Insider Purchases* is positive, 0 if it is zero, and -1 if it is negative. The data on insider sales is from the Thomson database. *SIZE* is the log of market capitalization in millions of dollars measured at the end of the previous calendar year, and *BM* is the log of the ratio of book value (the sum of book common equity and deferred taxes) in the previous fiscal year to size at the close of the previous calendar year. The coefficients and standard errors from each annual cross-sectional regression are reported in each row, and the time-series averages and time-series standard errors are given in the last row. Significance at the five-percent and one-percent levels is indicated by * and ** respectively. All coefficients and standard errors are multiplied by 1000.

	(1)	(2)	(3)	(4)
	OLS		Ordered Logit	
	G	*Democracy Portfolio*	*G*	*Democracy Portfolio*
1991	0.07*	-0.14	-8.85	-345.18
	(0.04)	(0.53)	(21.34)	(295.15)
1992	0.10	-1.47	-66.92**	499.93
	(0.07)	(1.50)	(21.70)	(310.53)
1993	0.10	-0.23	-32.40	797.17*
	(0.07)	0.51	(21.41)	(326.87)
1994	0.07	-0.61	-28.09	323.07
	(0.04)	(1.23)	(20.58)	(290.11)
1995	0.04	-0.17	-4.66	-153.33
	(0.02)	(0.20)	(22.00)	(308.90)
1996	0.15	-0.62	12.01	-93.95
	(0.14)	(1.05)	(21.67)	(321.18)
1997	-0.01	0.89	-46.08	781.42*
	(0.10)	(0.66)	(24.33)	(369.78)
1998	-0.12	2.41	-1.88	146.49
	(0.20)	(3.17)	(24.31)	(342.22)
1999	0.36	-1.36	4.41	-117.36
	(0.48)	(2.91)	(21.09)	(323.85)
Mean	0.09	-0.15	-19.16	204.25
	(0.04)	(0.40)	(8.66)	(140.02)

TABLE XIII
Fama-MacBeth Return Regressions

This table presents the average coefficients and time-series standard errors for 112 cross-sectional regressions for each month from September 1990 to December 1999. The dependent variable is the stock return for month *t*. The results are presented using both raw and industry-adjusted returns, with industry adjustments done using the 48 industries of Fama and French [1997]. The first and second columns include all firms with data for all right-hand side variables and use *G*, the Governance Index, as an independent variable. In the third and fourth columns, the sample is restricted to firms in either the Democracy ($G \leq 5$) or Dictatorship ($G \geq 14$) portfolios, and we use the independent variable, *Democracy Portfolio*, a dummy variable that equals 1 when the firm is in the Democracy Portfolio and 0 otherwise. In the fifth and sixth columns, we again include all firms with data for each explanatory variable and use the subindices, *Delay*, *Protection*, *Voting*, *Other*, and *State* as regressors. The calculation of *G* and the subindices is described in Section II. Definitions for all other explanatory variables are provided in Appendix B. All regressions are estimated with weighted least squares where all variables are weighted by market value at the end of month *t-1*. Significance at the five-percent and one-percent levels is indicated by * and ** respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	Industry-Adjusted	Raw	Industry-Adjusted	Raw	Industry-Adjusted
G	-0.04	-0.02				
	(0.04)	(0.03)				
Democracy Portfolio			0.76*	0.63*		
			(0.32)	(0.26)		
Delay					-0.03	0.02
					(0.10)	(0.07)
Protection					-0.07	-0.01
					(0.08)	(0.06)
Voting					-0.08	-0.08
					(0.13)	(0.10)
Other					0.01	-0.04
					(0.08)	(0.07)
State					0.02	-0.04
					(0.08)	(0.06)
NASDUM	-0.83	-0.42	-8.23	-10.36	-2.60	-0.29
	(6.94)	(5.26)	(6.45)	(5.94)	(6.39)	(4.98)
SP500	-0.19	-0.20	-0.42	-0.21	-0.19	-0.24
	(0.49)	(0.42)	(0.49)	(0.41)	(0.45)	(0.40)
BM	0.04	0.14	0.06	0.11	0.06	0.15
	(0.19)	(0.12)	(0.38)	(0.29)	(0.20)	(0.11)
SIZE	0.17	0.22	0.47	0.02	0.19	0.24
	(0.27)	(0.16)	(0.38)	(0.32)	(0.27)	(0.17)
PRICE	0.26	0.20	0.28	0.44	0.20	0.16
	(0.26)	(0.20)	(0.31)	(0.31)	(0.28)	(0.22)
IO	0.61	0.10	0.78	-0.16	0.59	0.14
	(0.47)	(0.33)	(0.67)	(0.60)	(0.44)	(0.33)
NYDVOL	-0.11	-0.21	-0.49	-0.03	-0.13	-0.21
	(0.29)	(0.18)	(0.36)	(0.31)	(0.28)	(0.18)
NADVOL	0.01	-0.13	-0.09	0.48	0.06	-0.15
	(0.43)	(0.29)	(0.41)	(0.39)	(0.43)	(0.29)
YLD	10.85	10.94	15.74	9.23	6.21	8.76
	(10.54)	(7.25)	(14.62)	(11.56)	(11.63)	(7.70)
RET2-3	-0.48	-0.93	-2.04	-1.82	-0.57	-1.03
	(1.40)	(1.04)	(2.33)	(1.73)	(1.43)	(1.07)
RET4-6	-0.68	-0.48	-2.21	-1.12	-0.58	-0.55
	(1.33)	(0.92)	(1.89)	(1.36)	(1.33)	(0.93)
RET7-12	2.42*	0.89	0.12	-1.67	2.69**	1.06
	(1.00)	(0.65)	(1.35)	(1.03)	(0.99)	(0.65)
SGROWTH	-0.00	0.03	0.75	0.27	-0.01	0.02
	(0.26)	(0.18)	(0.47)	(0.40)	(0.25)	(0.18)
Constant	-0.53	-0.18	1.17	-1.86	0.03	-0.16
	(2.55)	(1.71)	(3.43)	(2.99)	(2.39)	(1.69)

Exhibit 28

The Loss Causation Requirement for Rule 10b-5 Causes of Action: The Implications of *Dura Pharmaceuticals, Inc. v. Broudo*

*By Allen Ferrell and Atanu Saha**

In order to have recoverable damages in a Rule 10b-5 action, plaintiffs must establish loss causation, i.e., that the actionable misconduct was the cause of economic losses to the plaintiffs. The requirement of loss causation has come to the fore as a result of the U.S. Supreme Court's landmark decision in Dura Pharmaceuticals, Inc. v. Broudo. *We address in this Article a number of loss causation issues in light of* Dura, *including the proper use of event studies to establish recoverable damages, the requirement that there be a corrective disclosure, what types of disclosure should count as a corrective disclosure, post-corrective disclosure stock price movements, the distinction between the class period and the damage period, collateral damage caused by a corrective disclosure, and forward-casting estimates of recoverable damages.*

I. Introduction: The Requirement of Loss Causation

In a Rule 10b-5 cause of action, plaintiffs have the burden of pleading and proving that the actionable misconduct, such as a reckless or intentional material misrepresentation upon which they relied, was responsible causally for damaging their shares. The requirement of establishing so-called "loss causation" has long been part of the common law.[1] It was at the very start of the development of Rule 10b-5 jurisprudence in *Schlick v. Penn-Dixie Cement Corp.* that a federal circuit court first mentioned the requirement of "loss causation" in a Rule 10b-5 action.[2] The requirement of loss causation for Rule 10b-5 causes of action was

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1. *See* Pasley v. Freeman, (1789) 100 Eng. Rep. 450, 457 (K.B.) (finding that if "no injury is occasioned by the lie, it is not actionable"); *see also* Dura Pharms., Inc. v. Broudo, 544 U.S. 336, 344 (2005) (discussing how "loss causation" is a requirement in common law deceit and misrepresentation actions).

2. 507 F.2d 374, 380–82 (1974), *cert denied*, 421 U.S. 976 (1975).

codified in the Private Securities Litigation Reform Act of 1995, which requires plaintiffs to "prov[e] that the act or omission of the defendant alleged to violate [section 10(b)] caused the loss for which the plaintiff seeks to recover damages."[3] The requirement of loss causation has become increasingly emphasized by federal circuit courts, especially in light of the U.S. Supreme Court's recent landmark decision on loss causation in *Dura Pharmaceuticals, Inc. v. Broudo*.[4] Perhaps the most notable decision in this regard is the U.S. Court of Appeals for the Fifth Circuit's recent opinion in *Oscar Private Equity Investments v. Allegiance Telecom, Inc.*[5] The court held that loss causation must be established before class-wide reliance can be presumed under a fraud-on-the-market theory *at the class certification stage*.[6]

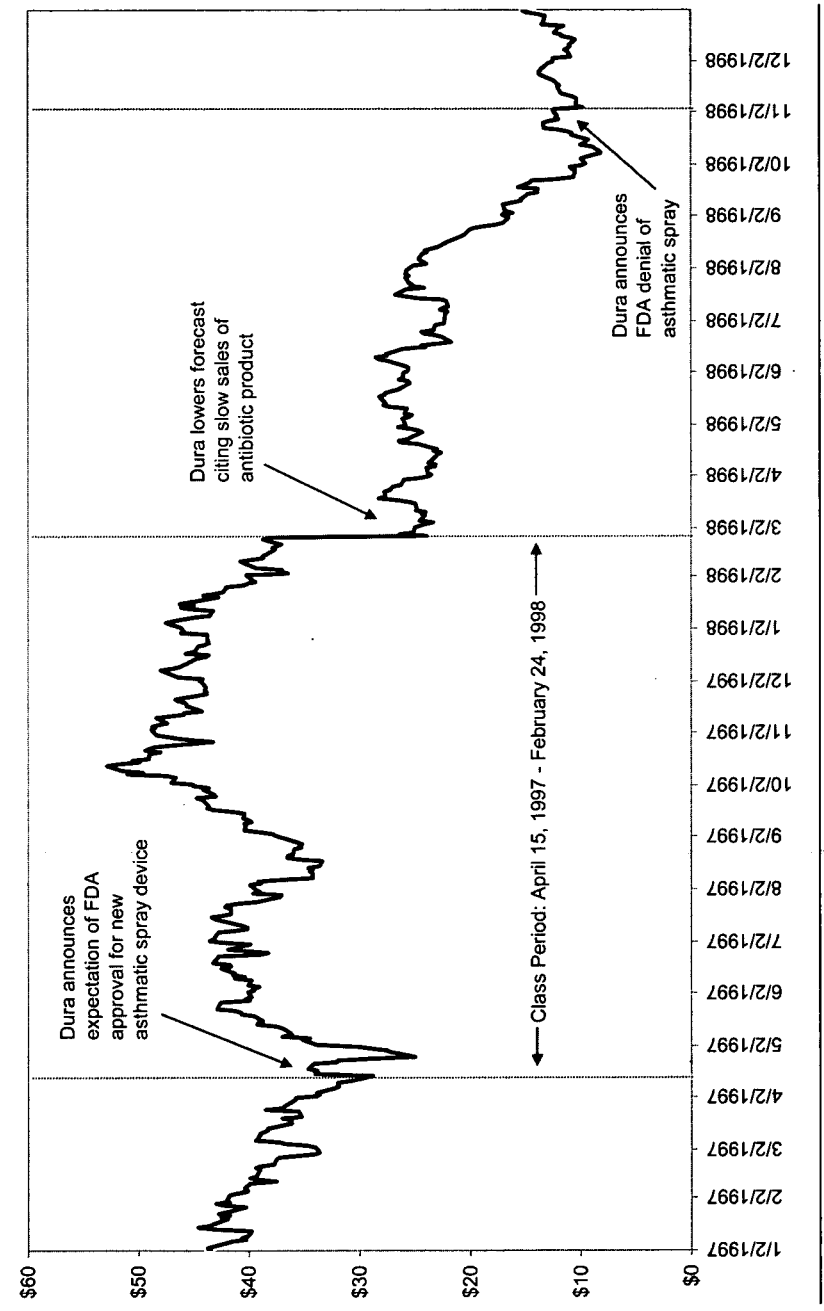
The Supreme Court's decision in *Dura* provided some much-needed clarification on what constitutes "loss causation." In that case, the defendant Dura Pharmaceuticals was alleged to have stated falsely on April 15, 1997 that it was likely to receive U.S. Food and Drug Administration ("FDA") approval of an asthmatic spray device.[7] On February 24, 1998, Dura Pharmaceuticals lowered its earnings forecast citing slow drug sales.[8] Finally, on November 4, 1998, Dura Pharmaceuticals announced the FDA's denial of its asthmatic spray device.[9] Plaintiffs sued Dura Pharmaceuticals under Rule 10b-5 with the class period running from April 15, 1997—the date of the alleged misrepresentation concerning the likelihood of approval—to February 24, 1998—the date of the lowered forecast being disseminated to the market.[10] Dura's stock price over that time period is summarized in Figure 1.[11]

There are two aspects of the Court's analysis of plaintiffs' Rule 10b-5 action that are particularly noteworthy. First, the Court held that even if Dura Pharmaceuticals' stock price was artificially inflated as a result of a fraudulent statement concerning the expectation of FDA approval of Dura's asthmatic inhaler, that was nevertheless insufficient to establish loss causation.[12] In so doing, the Court rejected the position of the U.S. Court of Appeals for the Ninth Circuit that merely pleading price inflation was sufficient to state a claim under Rule 10b-5.[13] Second, and equally important, the Court explained that the mere fact that Dura Pharmaceuticals' shareholders who purchased after Dura had made the purportedly false statement

3. *See* Private Securities Litigation Reform Act of 1995, Pub. L. No. 104-67, § 101(b), 109 Stat. 737, 747 (codified at 15 U.S.C. § 78u-4(b)(4) (2000)) [hereinafter "PSLRA"]; *see also* PSLRA, § 105, 109 Stat. at 757 (codified at 15 U.S.C. § 77l(b) (2000)) (stating that loss causation means the "depreciation in value of the subject security" caused by the misrepresentation); PSLRA, § 101(b), 109 Stat. at 748–49 (codified at 15 U.S.C. § 78u-4(e) (2000)) (limiting Rule 10b-5 recovery based on stock price movements following disclosure of "the misstatement or omission that is the basis for the action").
4. 544 U.S. 336.
5. 487 F.3d 261 (5th Cir. 2007).
6. *Id.* at 268–69.
7. *See* Respondents' Brief at 1a, Dura Pharms., Inc. v. Broudo, 544 U.S. 336 (2005) (No. 03-932).
8. *Id.* at 4.
9. *See id.* at 1a.
10. *Dura Pharms., Inc.*, 544 U.S. at 339.
11. *See* Respondents' Brief at 1a, Dura Pharms., Inc. v. Broudo, 544 U.S. 336 (2005) (No. 03-932).
12. *Dura Pharms., Inc.*, 544 U.S. at 342–46.
13. *See id.* at 342–47.

Figure 1

Dura Pharmaceutical Share Prices: 1997–1998



to the market, and hence arguably purchased at an inflated price, suffered a decline in the value of their stock between the time of purchase and the time of sale was likewise insufficient to establish loss causation.[14] That conclusion was based on the observation that any number of factors could have caused shareholders' economic losses besides revelation of the misrepresentation (a so-called "corrective disclosure"), such as changing industry or market conditions.[15]

In short, the Supreme Court in *Dura* emphasized that the actionable misconduct must *cause* economic losses to shareholders who purchased shares at an inflated price. The method to calculate the portion (if any) of shareholders' losses attributable to the inflation caused by actionable misconduct raises a number of important issues. We begin by first outlining the basic analytical framework used in thinking about loss causation (as well as the related issue of materiality)—the event study—and then discuss several practically important damage issues that frequently come up in Rule 10b-5 securities litigation: the requirement that there be a "corrective disclosure"; what exactly constitutes a "corrective disclosure"; post-"corrective disclosure" stock market price movements; the allocation of inflation to different shares; collateral damage caused by revelation of the actionable misconduct; and back-casting versus forward-casting estimates of damages.

II. Analytical Framework for Event Study Analysis

Event study analysis is a ubiquitous tool in assessing claims of loss causation as well as the "materiality" of misstatements or fraudulently omitted information.[16] An event study is a regression analysis that measures the effect of an event, such as a firm's earnings announcement, on a firm's stock price.[17] In such an analysis, one must, of course, control for factors other than the event that may also simultaneously affect the stock price.[18]

A typical econometric model for measuring the effect of an alleged misrepresentation or a corrective disclosure on stock price is:

$$r_t = \ln\left(\frac{p_t}{p_{t-1}}\right) = \beta_0 + \beta_1 M_t + \beta_2 I_t + \sum_{i=1}^{k} \alpha_i D_i + \varepsilon_t$$

where r is the daily return (i.e., logarithmic percent change) of the stock price, M is the return on a market index, such as the S&P 500 Index or the Dow Jones Index, I is the return on an industry index (e.g., S&P Telecom Index), and the t subscript denotes the t^{th} day. $D_1 \ldots D_k$ are k day-dummy variables—that is, they are binary

14. *Id.* at 342–46.
15. *Id.* at 343.
16. *See, e.g.*, Jonathan R. Macey, Geoffrey P. Miller, Mark L. Mitchell & Jeffrey M. Netter, *Lessons from Financial Economics: Materiality, Reliance, and Extending the Reach of* Basic v. Levinson, 77 Va. L. Rev. 1017, 1028–42 (1991).
17. *See generally* John Y. Campbell, Andrew W. Lo & A. Craig MacKinlay, The Econometrics of Financial Markets 149–80 (1997).
18. Macey et al., *supra* note 16, at 1032, 1036–37.

variables, each taking the value of one for the day at issue and a value of zero for all other days.[19] These days may be the days of the alleged misrepresentations or days of the corrective disclosures.

The estimated coefficient of the *i*-th day dummy, $\hat{\alpha}_i$, is a measure of the market and industry-adjusted return, in short the "abnormal return" on the *i*-th day.[20] The t-statistics for $\hat{\alpha}_i$ provide statistical evidence on whether the price move on the *i*-th day, after controlling for market and industry factors, is explained by random chance or by firm-specific news. A sufficiently large value of the t-statistics (generally greater than 1.96 in absolute value for a 95% level of confidence) allows the investigator to conclude that the estimated abnormal return on the *i*-th day cannot be explained by chance alone and is therefore attributable to firm-specific news.[21] Thus, this analytical framework has obvious implications for both loss causation and materiality.

There are a number of important generic issues that must be considered in undertaking a rigorous event study analysis: proper choice of an industry index; the length of the "event-window"; the possible "trickling" out to the market of the fact that there had been a misrepresentation; and confounding events.

1. Proper Choice of an Industry Index

In selecting an appropriate industry index, it is important to pay particular attention to which firms are truly "comparable" in terms of their line of business and hence should be included in the industry index. The magnitude and the statistical significance of the $\hat{\alpha}_i$-s (i.e., the size and significance of the abnormal returns) can be highly sensitive to the choice of the industry comparables. The information source for the selection of firms to be used as industry comparables can include the firm's own financial filings (10-K, 10-Q), equity analysts' reports, and the constituents of widely-used industry indexes, such as the Dow Jones Internet Index or the S&P Telecom Index.

2. The Length of the "Event Window"

The $D_1 \ldots D_k$ can be single-day dummy variables, or two-day or three-day or even five-day dummy variables. It often makes sense to use multiple-day dummy variables because of possible "overreaction" in the market to a corrective disclosure. There is a substantial finance literature documenting that, in some circumstances, there appears to be market "overreaction" to certain disclosures and that it might take the market some time to "digest" fully and accurately the implications of a correc-

19. *See, e.g.*, Nihat Aktas, Eric de Bodt, Jean-Gabriel Cousin, *Event Studies with a Contaminated Estimation Period*, 13 J. Corp. Fin. 129–45 (2007).

20. This framework is analytically equivalent to estimating the model $r_t = \ln\left(\frac{p_t}{p_{t-1}}\right) = \beta_0 + \beta_1 M_t + \beta_2 I_t + \varepsilon_t$ using all of the observations except the k-dummied days and the forecast for these k days.

21. *See* Campbell et al., *supra* note 17, at 166.

tive disclosure, such as an accounting restatement.[22] The market may correct for the "overreaction' over the course of several days, which would suggest the need to dummy out not only the day of the corrective disclosure but one or two days post-corrective disclosure as well. Alternatively, there can be "leakage" of news about the disclosure before the actual official corrective disclosure, suggesting, in some cases, the need to dummy the day or days prior to the actual corrective disclosure.

3. Post-Disclosure "Trickle" Effect

Corrective disclosures can occur over a protracted period of time, i.e., the truth gradually "trickles" out into the market. As a result, while a single day's abnormal return may not be significant, the cumulative effect on the firm's stock over the entire corrective disclosure period may be. To examine such a hypothesis, one can test the significance of $\hat{\alpha}_1 + \ldots + \hat{\alpha}_m$, assuming the disclosure period spans m days.

4. Confounding Events

On a corrective disclosure day, there may be a disclosure event as well as firm-specific news unrelated to the alleged fraud. In that case, the estimated abnormal return on that day $\hat{\alpha}_i$, measures the combined effect of the disclosure and the unrelated firm-specific news. This confounding effect problem is exacerbated when using multi-day event windows as the longer the event window the more likely it is that confounding events occurred. Potential ways of dealing with this problem include (a) deletion of confounded days from the event study; and (b) the use of intra-day data.

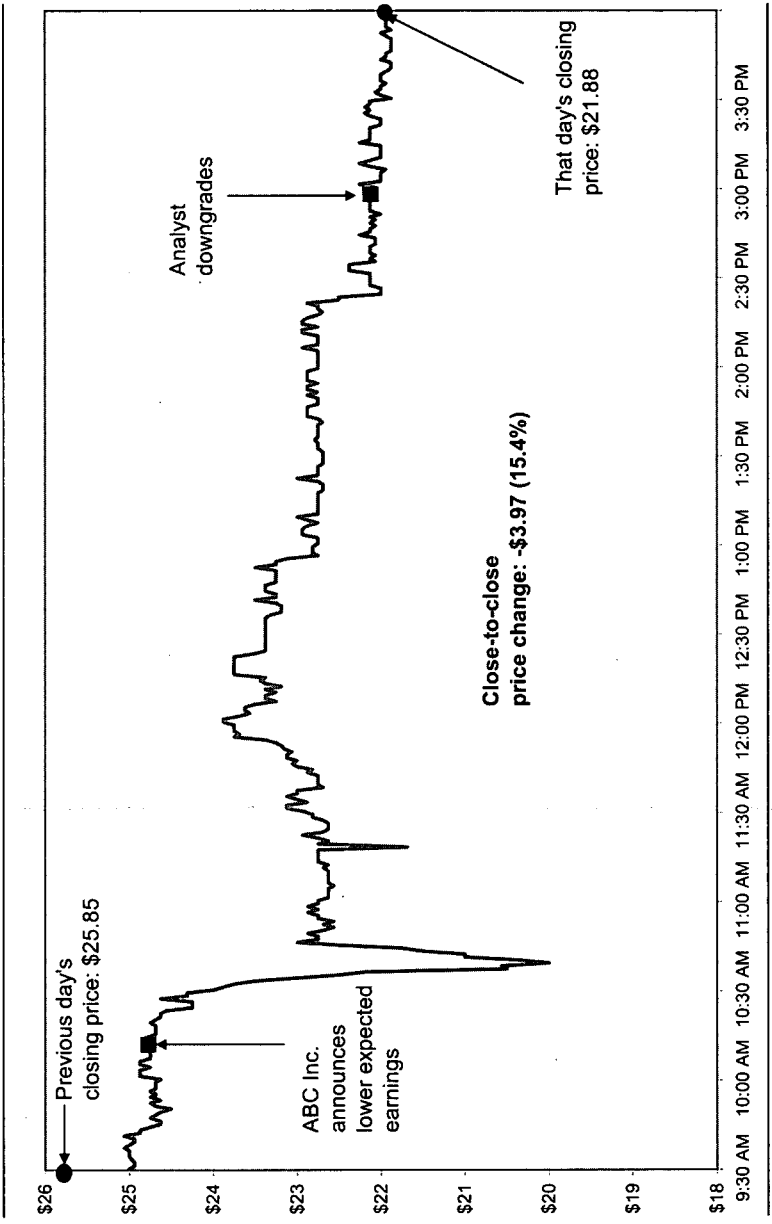
Deletion of confounded days from the event study, while sometimes necessary, incurs the cost of removing potentially relevant information. The use of intra-day data can sometimes avoid this problem. In Figure 2 we illustrate the usage of intra-day data to disentangle the effects of two confounding events. The hypothetical data used in this figure is very similar to the actual NYSE TAQ data of a publicly traded firm; we call the firm ABC. Suppose in this litigation, the plaintiffs' class alleged that an investment bank's analyst artificially propped up the share prices of ABC by providing overly optimistic ratings and target prices. Also suppose the plaintiffs alleged that disclosure occurred over a series of days in which the analyst lowered the ratings of ABC. The share price movement on such a "disclosure" day, during which the analyst downgraded his recommendation of ABC, is depicted in Figure 2.

In this example, ABC's prices moved down by 15.4%, falling from the previous day's close of $25.85 to $21.88 on that day. Event study analysis, based on close-to-close price change, shows that day's price drop to be statistically significant.

22. *See generally, i.e.*, Georgina Benou & Nivine Richie, *The Reversal of Large Stock Price Declines: The Case of Large Firms*, 27 J. Econ. & Fin. 19 (2003); Navin Chopra, Josef Lakonishok & Jay R. Ritter, *Measuring Abnormal Performance: Do Stocks Overreact?*, 31 J. Fin. Econ. 235 (1992); Marc Bremer & Richard J. Sweeney, *The Reversal of Large Stock-Price Decreases*, 46 J. Fin. 747 (1991).

Figure 2

Intra-Day Share Prices of ABC Inc.



Thus, based purely on daily price change one may erroneously conclude that the analyst's downgrade had a statistically significant negative impact on ABC's share price.

However, examination of the intra-day data leads to a wholly different conclusion. As shown in Figure 2, the analyst did not downgrade ABC until 3:00 PM that day. At 10:15 AM on the very same day, ABC announced that it expected next quarter's and year's earnings to be lower. As is clear from the figure, the price reaction to that negative earnings news was sharp and immediate. By the time the analyst downgraded the stock later that afternoon, more than 14% of the total 15.4% price drop had already occurred. After the analyst's downgrade, ABC's prices moved by a statistically insignificant negative 1% for the rest of the trading day.

In this example, while the day's return is statistically significant, examination of the intra-day data allows one to disentangle the confounding effects of the two events, and conclude that the effect of the corrective disclosure was not significant. In contrast to the overreaction effect, consideration of confounding events emphasizes the advantage of using a shorter event window when possible. Thus, damages experts need to be judicious in choosing the length of the event window. In the end this decision may well turn on a balancing act between capturing the full-impact of the disclosure (allowing for the correction for overreaction) and avoiding the contamination of confounding events.

III. When Does a Corrective Disclosure Occur?

1. The Requirement that There Be a Corrective Disclosure

The *Dura* court explained that the plaintiffs' failure to identify a fall in stock price "after the truth became known" to the market indicated a lack of loss causation.[23] The "truth" the Court is referring to is the revelation to the market of the actionable misconduct that forms the basis for the Rule 10b-5 cause of action.[24] For example, if an investor, who purchases at an inflated price because of a misrepresentation, "sells the shares quickly before the relevant truth begins to leak out, the misrepresentation will not have led to any loss."[25] The Court noted that a price decline does not result in recoverable damages if the decline is due to changes in "economic circumstances, changed investor expectations, new industry-specific or firm-specific facts, conditions, or other events . . . ."[26] Some federal circuit courts have rightfully emphasized this language in *Dura* indicating the need for a corrective disclosure as a prerequisite to establishing loss causation.[27]

23. *See* Dura Pharms., Inc. v. Broudo, 544 U.S. 336, 347 (2005).
24. *See id.*
25. *See id.* at 342.
26. *Id.* at 343.
27. *See, e.g.*, Glaser v. Enzo Biochem, Inc., 464 F.3d 474, 479 (4th Cir. 2006) ("It is only after the fraudulent conduct is disclosed to the investing public, followed by a drop in the value of the stock, that the hypothetical investor has suffered a "loss" that is actionable after the Supreme Court's decision in *Dura*.").

Some commentators, plaintiffs' damage experts, and courts have argued that despite this language in *Dura,* in-and-out traders—investors who purchase and sell after the misrepresentation but *prior* to any "corrective disclosure" or the "truth" of the earlier misrepresentation becoming known—should still be able to recover damages in some circumstances.[28] The basis for their conclusion is often what is called the "market forces operating on the fraud" theory.[29] They believe that in-and-out traders can prove loss causation in certain circumstances.

Consider the following situation. Suppose a widget manufacturer fraudulently states that it has spare capacity to build additional widgets so as to meet the market's demand for widgets in the event that demand for widgets increases. The stock price of the manufacturer increases, say from $80 to $100, as the market places a certain positive value on having spare capacity for producing widgets. Immediately after the fraudulent statement, an investor purchases shares in the widget manufacturer at $100. Subsequent to the purchase, the European Union imposes a tariff on widgets which substantially reduces the market's demand for widgets and thereby decreases the value of having spare capacity. As a result, the value of the investor's shares drops from $100 to $90 (in other words, the value of having spare capacity drops from $20 to $10). After the imposition of the tariff, the investor sells her shares. At no time does the market learn that the widget manufacturer's statement about having spare capacity is false. Did the fraudulent statement cause economic losses to the investor? More specifically, can the investor recover the amount of the disinflation—the difference between inflation at the time of purchase and inflation at the time of sale—which, in this example, is $10 ($20–$10)?

Employing the "market forces operating on the fraud" theory, some commentators would argue that this investor did suffer recoverable damages. The investor had to pay an inflated price for the shares initially as a result of the combined effect of the false statement concerning spare capacity and the market's value on having spare capacity at the time of purchase, and had to sell the shares at a less inflated price as a result of the European Union's tariff lowering the market's value on having spare capacity at the time of sale.[30]

28. *See, e.g.*, Madge S. Thorsen, Richard A. Kaplan & Scott Hakala, *Recovering the Economics of Loss Causation*, 6 J. Bus. & Sec. L. 93, 105–06 (2006) (finding that the theory is "rooted in thirty-year old legal precedent [and] sound economic theory" but recognizing that "it is controversial after *Dura*"). The several district courts that have considered whether in-and-out traders can show loss causation have been divided on the issue. *Compare In re* Bally Total Fitness Sec. Litig., No. 04C3530, 2005 WL 627960, at *5–6 (N.D. Ill. Mar. 15, 2005) (refusing to appoint as lead plaintiff an in-and-out trader who would need "to use considerable resources to establish" loss causation); Arduini/Messini P'ship v. Nat. Med. Fin. Servs. Corp., 74 F. Supp. 2d 353, 360–61 (S.D.N.Y. 1999) (holding that in-and-out traders cannot establish loss causation), *with* Montoya v. Mamma.com Inc., No. 05 Civ. 2313(HB), 2005 WL 1278097, at *2–3 (S.D.N.Y. May 31, 2005) (appointing a group that included in-and-out traders as lead plaintiff); *In re* Bearingpoint, Inc. Sec. Litig., 232 F.R.D. 534, 544 (E.D. Va. 2006) ("Moreover, it is also conceivable that the inflationary effect of a misrepresentation might well diminish over time, even without a corrective disclosure, and thus in-and-out traders in this circumstance would be able to prove loss causation.").

29. *See, e.g.*, Wool v. Tandem Computers Inc., 818 F.2d 1433, 1436–38 (9th Cir. 1986).

30. *See* Thorsen, Kaplan & Hakala, *supra* note 28, at 105–06.

Several observations based on *Dura* in assessing this argument are in order. First, the "market forces operating on the fraud" theory ignores the language in *Dura* about the need for the truth concerning the misrepresentation to become known in order for there to be loss causation. Under the theory, there are recoverable damages even if the market never learns (as in the example), directly or indirectly, of the actionable misconduct that forms the basis for Rule 10b-5 liability. Second, the theory severely limits the language in *Dura* about how there is no loss causation in a situation in which an investor sells his or her shares after purchase but before disclosure of the truth. If one accepts the "market forces operating on the fraud" theory, then that language in *Dura* must be confined to the highly unusual situation of instantaneous purchases and sales. If any time elapses between the purchase and sale then, according to the "market forces operating on the fraud" theory, recoverable damages might well exist. Third, such an approach ignores the discussion in *Dura* about how price declines from market and industry changes do not give rise to recoverable damages. According to the "market forces operating on the fraud" theory, market and industry changes, such as a change in the value placed by the market on spare capacity, can quite readily give rise to recoverable damages even in the absence of a corrective disclosure concerning the actionable misconduct.

Putting *Dura* aside, what about the economics of the situation described in the hypothetical? Has not such an investor suffered a loss, in an economic sense, from the fraudulent statement? The answer turns on whether one looks at the situation ex post or ex ante. Ex ante the investor is as likely to be the beneficiary of changes in the market's valuation placed on spare capacity as it is that the investor will incur losses as a result of a change. In the hypothetical, the investor would have gained if the market placed a greater value on having spare capacity (for whatever reason) between the time of purchase and sale. Indeed, an investor might have purchased the stock betting that this would happen. It is unclear why the securities laws should provide a put option for investors (i.e., bailing investors out when their bets turn out poorly) who speculate on changes in general market conditions when, as in the hypothetical, there has not even been a corrective disclosure to establish the necessary link between economic loss and the actionable misconduct.

2. What Constitutes a "Corrective Disclosure"?

Consider another hypothetical. A company misstates its financial statements and subsequently issues a downward revision of its earnings projection. Many months after the dissemination of the lowered earnings projection the company discloses the need to restate its financials. When did a "corrective disclosure" occur? Did the "truth" about the financial misstatements become "known" at the time of the downward earnings projection or at the time of the disclosure of the need to restate? To raise the stakes, further suppose that there was a statistically significant negative abnormal stock return associated with the downward earnings projection but there was none associated with the disclosure of the need to restate the financials. Indeed, this hypothetical is not so different from the fact

situation in *Dura* itself in which the class period ended on the day Dura Pharmaceuticals released lower than forecasted revenues and lower earnings per share estimates—a day on which Dura's stock price fell approximately 47%.[31] In contrast, Dura Pharmaceuticals' price moved only modestly on the day that the FDA denied approval of the asthmatic spray device.[32]

The U.S. Court of Appeals for the Fifth Circuit in *Greenberg v. Crossroads Systems, Inc.*[33] addressed this issue most directly. The Fifth Circuit held that there was no loss causation in such a situation given that the earnings projection did "not report any concern that [the company's earlier earnings statements] may be incorrect."[34] But what about other circuits which have not squarely addressed when downward earnings projections can constitute the moment at which the "truth" about the earlier financial misstatements became, at least partially, revealed? What is the proper application of the loss causation requirement and *Dura* to this issue?

The issue of when negative stock price reactions to downward earnings projections can form the basis for establishing loss causation is often quite important both in its own right as well as for raising the general issue of whether a disclosure constitutes a "corrective disclosure" with respect to earlier misstatements when the disclosure does not directly indicate that the earlier statements were in fact false. One common claim is that a disclosure should be deemed a "corrective disclosure" when that disclosure reveals the "true financial condition" of the company that was being concealed by the earlier misstatement.[35] According to this approach, the "fact that no wrongdoing or error has been identified is unimportant . . . the company's true performance [ ] has entered the market and the market will react to that."[36]

The "true financial condition" theory, like the "market forces operating on the fraud" theory, is problematic. Any negative firm news, such as a downward earnings projection, can contain important information as to the true value of the firm and in that sense a downward-adjusted earnings projection can reveal the "true financial condition" of the firm. However, without a concrete reason to link the negative stock market reaction associated with the earnings projection (or whatever the negative news happens to be) to the removal of the inflation in the stock price caused by the actionable misconduct, such as a misstatement of the financials, loss causation is lacking. In the downward-adjusted earnings projection hypothetical, for example, there is the possibility that if the timing of the intent to restate and the timing of the downward-adjusted earnings projection had been switched, we would have observed exactly the same stock price reactions (significant negative stock market reaction to the earnings projection and none to the intent to restate). This would suggest that the market's reaction to the earnings

31. *See* Respondents' Brief at 1a, Dura Pharms., Inc. v. Broudo, 544 U.S. 336 (2005) (No. 03-932).
32. *See id.*
33. 364 F.3d 657 (5th Cir. 2004).
34. *Id.* at 668.
35. *See* Thorsen, Kaplan & Hakala, *supra* note 28, at 102–03.
36. *See id.*

projection was negative not because of the removal of inflation caused by the misrepresentation, but because of the implications of the earnings projection for the firm's future cash flows irrespective of the earlier misrepresentation.

It is worth emphasizing that if the downward-adjusted earnings projection had in fact indicated a concern with the veracity of the earlier stated financials, then there would have been a concrete reason to connect the negative market reaction associated with the downward-adjusted earnings projection to the removal of inflation caused by the misstated financials. Alternatively, if market analysts had called into question the earlier financials as a result of the earnings projection, then there likewise would have been a concrete reason to connect the negative stock market reaction to the removal of inflation caused by the misstated financials.[37] Without the requirement of establishing such a concrete connection, the "true financial condition" theory removes much of the disciplining effect of the loss causation requirement. One could merely label the firm disclosure associated with the largest negative abnormal stock return reaction as the "corrective disclosure," as such disclosure reveals the "true financial condition" of the company, and thereby generate the largest possible securities damage estimates.[38] It is interesting to note that the "market forces operating on the fraud" theory ensures that negative market changes are ready candidates for establishing loss causation, while the "true financial condition" theory ensures that disclosures of negative firm news are likewise ready candidates.

The "true financial condition" theory sometimes arises in the context of the Second Circuit's "zone of risk" test for loss causation. In *Lentell v. Merrill Lynch & Co. Inc.*, the Second Circuit explained that the loss causation question is whether "the loss was within the zone of risk *concealed* by the misrepresentations and omissions, ..."[39] If one characterizes the "zone of risk" that was concealed by a misrepresentation or omission, say a misstatement of the firm's financials, as the risk of investing in the company, then losses resulting from almost any subsequent negative news about the firm, such as a downward-adjusted earnings projection, can be said to be "caused" by the misrepresentation or omission under the "zone of risk" test. This characterization of the "zone of risk" is in reality just another version of the 'true financial condition" theory of loss causation and therefore likewise also effectively vitiates the loss causation requirement.

A proper interpretation of the Second Circuit's "zone of risk" test for loss causation, consistent with *Dura*, is to require that there be a corrective disclosure in the sense that new information reaches the market that unveils earlier actionable

37. In *In re Daou Systems, Inc. Securities Litigation*, 411 F.3d 1006, 1025–26 (9th Cir. 2005), *cert. denied sub nom.* Dacu Systems, Inc. v. Sparling, 546 U.S. 1172 (2006), an analyst questioned the veracity of earlier statements by a firm, including its earlier financials, based on a quarterly earnings report that did not meet expectations.

38. As the district court explained in *In re Motorola Securities Litigation*,---F. Supp. 2d---, No. 03 C 287, 2007 WL 487738, at *34 (N.D. Ill. Feb. 8, 2007), the standard for determining when a disclosure constitutes a corrective disclosure "cannot be so lax that every announcement of negative news becomes a potential 'corrective disclosure.'"

39. 396 F.3d 161, 173 (2d Cir.) (emphasis in original), *cert. denied*, 546 U.S. 935 (2005).

misconduct. In the absence of such a corrective disclosure, the negative firm news, and the associated losses, should not be considered within the "zone of risk" concealed by the actionable misconduct. The reason for this is simple. Without imposing a requirement that there be a corrective disclosure in defining the "zone of risk," one runs the risk that the loss causation requirement would have been deemed satisfied even if there would have been the same negative price market reaction to the negative news without the conduct that ran afoul of Rule 10b-5. And it is the earlier misconduct, it must be remembered, that forms the basis for liability in the first place.

3. Post-Corrective Disclosure Stock Price Movements

Class membership in a securities class action suit often covers purchasers of stock between the date of the alleged misrepresentation (or the date of the first alleged misrepresentation) and the date of the "corrective disclosure" on which the market learns the truth about the misrepresentation (or the earliest date by which the full truth about the fraud is revealed).[40] Operationally, the "corrective disclosure" date identified by plaintiffs' counsel is often a date on which there is a large stock drop purportedly because of the market learning the truth about the earlier fraud.[41]

An important issue that often arises in estimating securities damages concerns stock price movements in the period immediately following the corrective disclosure date identified by the plaintiffs. In a number of circumstances, the stock price of the firm recovers, at least partially, in the immediate post-corrective disclosure period.[42] The question post-corrective disclosure stock price movements raise is what impact, if any, do these movements have on damages per share calculations in light of the Supreme Court's decision in *Dura*? It is important to emphasize that this issue is analytically distinct from the "cap" on damages contained in section 21D of the Securities Exchange Act of 1934, which limits damages to the average trading price of the security in the 90-day period following the corrective disclosure.[43] The issue here is not what the applicable "cap" on damages is, but rather what are in fact the damages.

If the stock price reaction in the days, weeks, and months following a corrective disclosure is a result of the market inferring additional information about the implications of a misrepresentation for the firm's valuation, then these stock price movements occurring after the corrective disclosure date identified by the plaintiffs should analytically be additional corrective disclosures. That is, the full truth

40. *See, e.g.*, Consolidated Amended Securities Class Action Complaint at 2, *In re* Royal Ahold N.V. Sec. & ERISA Litig., Civil No. 1:03-MD-01539 (D. Md. Feb. 18, 2004); Amended Class Action Complaint at 23, Ohio Pub. Employees Ret. Sys. v. Freddie Mac, Civil No. C2-03-711 (S.D. Ohio Jan. 15, 2004).

41. *See, e.g., id.*

42. *See, e.g., id. See also infra* Figure 3 for an illustration of Ahold share prices.

43. *See* Section 21D of the Securities Exchange Act of 1934, ch. 404, § 21D, 48 Stat. 881 (codified as amended at 15 U.S.C. § 78u-4(e) (2000)), as added by PSLRA, *supra* note 3, § 101(b), 109 Stat. at 748–49.

concerning the misrepresentation was revealed to the market on a series of dates. This can have important implications for securities damages.

Suppose, for instance, the market believes that an accounting restatement is indicative of deeper, as of yet undisclosed, problems at a firm. Then the market's reaction to a firm's restatement of its financials will reflect the expected negative effects of those undisclosed problems (perhaps, for instance, expected further accounting restatements) in addition to any negative implications for firm value of the initially misrepresented numbers. If no such problems are disclosed, then as time passes the market might view those hidden problems as less and less likely, resulting in positive stock price changes in the period following the disclosure of the financial restatement. In other words, the non-disclosure of additional problems itself can constitute new information to the market (no news is good news) that should be considered in evaluating the total harm caused by the initially misrepresented financials. Since nondisclosure of further bad news can itself constitute important positive information about the implications of misstated financials on firm value, the dissemination to the market of the full implications of the misrepresentation for firm value does not necessarily occur solely on the date of the disclosure of the true financials.

On a similar note, the disclosure of the misrepresentation can be partial. For example, suppose a firm simply announces that it will restate its prior years' financials without quantifying the extent of the restatement. Often a firm's share price falls, in many cases quite sharply, merely in response to the announcement of a restatement. Typically, the class action plaintiffs end the class period on the day of the announcement of the intent to restate. That is, they argue that the share price on the day of the announcement reflects the "fair value" of the stock and should be used in calculating damages. However, in this example, the restatement announcement, although "corrective," is by no means a full disclosure. In the subsequent weeks and months the firm may provide further details about the extent of the restatement and full disclosure occurs only after the firm finalizes its restatement. Of course, whether the stock price reaction is negative or positive in response to the additional disclosures depends on the market's prior expectation of the probability and type of likely disclosures by the firm.

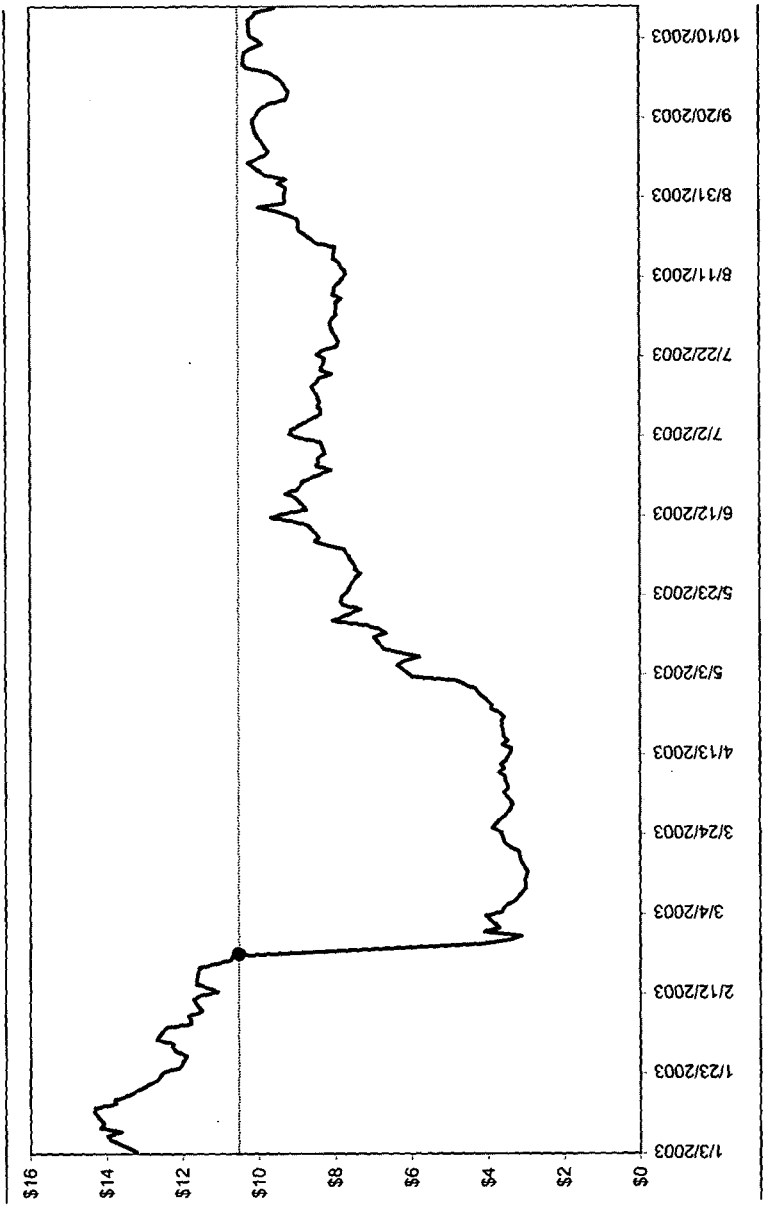
In this context, the Ahold Securities litigation is illustrative. On February 24, 2003, Ahold announced that it would restate its financials for the period 2000–2002. In response to that news, Ahold share prices[44] fell by 61 percent—dropping from $10.69, the previous day's closing price, to $4.16 on the day of the announcement.[45] In the ensuing Ahold securities litigation, the plaintiffs filed a complaint with the class period ending on February 24, 2003—the day of the restatement announcement.[46]

44. Ahold is traded as an ADR in the U.S. equity market.

45. We believe that the large price impact reflects, in part, the market's "overreaction" to news about financial restatements in the post-Enron environment.

46. *See* Consolidated Amended Securities Class Action Complaint at 2, *In re* Royal Ahold N.V. Sec. & ERISA Litig., Civil No. 1:03-MD-01539 (D. Md. Feb. 18, 2004).

Figure 3
Share Prices of Ahold: January through October 2003



However, as is evident from Figure 3, Ahold share prices continued to rebound as the company provided more news about the extent of the restatement in the subsequent months: on August 8, 2003, it announced that the net income restatement amount for the years 1998 through 2002 would be $880 million; on July 1, it further revised the restatement estimate to $1.2 billion; finally, on October 17, 2003, the company filed the restated financials with the U.S. Securities and Exchange Commission ("SEC") on a Form 20-F.[47] On that day, Ahold shares closed at $9.56, only 11% or $1.13 lower than the price prior to the first restatement announcement.[48] Here the critical question is what is the impact of the curative disclosures? From the plaintiffs' point of view the impact is $6.53, which is the 61% drop on February 24, 2003. However, if one recognizes that the time frame of the corrective disclosures spans the entire period between February 24, 2003 through October 17, 2003, and that full disclosure did not take place until the latter date, then the corrective disclosure impact[49] is only $1.13, the difference between the price on February 21, 2003 (the day before the first disclosure) and on October 17, 2003. Needless to say, the difference in the quantification of the impact of the curative disclosures has nontrivial implications for class-wide damages.

IV. Allocation of Inflation to Different Shares

An important distinction to bear in mind in allocating the artificial inflation in stock price to shares purchased at different points in time within the class period is the difference between the class period and the damage period. This is a distinction that is frequently overlooked despite its often important implications for the measure of damages. The distinction is best conveyed through the use of an example.

Suppose that a pharmaceutical company called Dura II truthfully announces that it expects that the FDA will soon grant approval to its new asthmatic spray device. Dura II learns several years later, however, that the FDA, after conducting an extensive examination of the device, is in fact unlikely to approve. When the firm learns of that fact it withholds the information but months later does announce the FDA's actual denial of the asthmatic spray device. Upon the announcement of the denial, Dura II's share price drops substantially. Plaintiffs' counsel, in such a situation, would typically extend the class period from the time of the negative announcement back to the day on which the firm had announced the prospects of likely approval. But, in the absence of a crystal ball, the firm could not have known on that day what it later learned. So despite the losses, perhaps considerable, for those shareholders who purchased upon the firm's announcement of likely approval, damages should exist only for those shareholders who purchased in the time period between when the firm had a legal duty to disclose

47. *See id.* at 113–57. The Ahold ADR price data used in Figure 3 is from Bloomberg LP.

48. *See id.*

49. Here, in the interest of simplicity, we are discussing the "raw" price difference without accounting for market or industry factors.

the FDA's likely denial (and hence arguably engaged in actionable misconduct because it did not promptly disclose) and the announcement of the denial.

Drawing a distinction between the class period and the damage period is faithful to *Dura's* emphasis on focusing on whether actionable misconduct, such as a misrepresentation or a fraudulent nondisclosure, caused economic harm to shareholders. In the pharmaceutical company hypothetical, the economic loss suffered by shareholders who purchased upon the initial positive announcement was not caused by the actionable misconduct, which is the fraudulent nondisclosure of the FDA's likely denial. The actionable misconduct therefore cannot be said to have caused the loss suffered by shareholders who purchased upon the initial positive announcement which, after all, occurred earlier in time. Put slightly differently, there was no inflation in the pharmaceutical's stock price at the time of the positive announcement as the firm at that point had not engaged in fraudulent conduct that would have given rise to Rule 10b-5 liability. To allow the investors who purchased at that point to recover their economic losses would "effectively convert Rule 10b-5 into a scheme of investor's insurance."[50]

Another important aspect of allocating the inflation, as proxied by the market's reaction to the corrective disclosure, to shares purchased at different times is the issue of apportionment of the harm resulting from multiple misrepresentations. Suppose that there is a substantial stock price drop in response to a firm announcing it will restate its financials for the prior years. Assume also the price drop can be attributed to the market removing the inflation in stock price because of a series of misrepresentations (i.e., prior years' financials) that had previously occurred. It is analytically obvious that one cannot use the entire price drop on the announcement day to measure inflation in stock price throughout the damage period because the price drop is the cumulative effect of the disclosure of a series of prior misrepresentations. To do so would result in a gross overestimation of damages. The critical challenge then becomes apportioning the cumulative inflation (as represented by the stock price drop in this example) to shares purchased in different periods. Indeed, this problem is sufficiently serious that it suggests, in some circumstances, that damages experts should not use the stock price drop in reaction to a restatement announcement covering multiple years to approximate the price inflation during the damage period, but should "forward-cast" when feasible. We revisit this issue in greater detail in Part VI.

V. Collateral Damage

Dividing misrepresentations, such as accounting misstatements, into two categories is helpful in thinking about which types of representations can legally give rise to recoverable damages. In the first category are misstatements that have direct implications for the current and future cash flows of a firm or the rate at which

50. Dura Pharms., Inc. v. Broudo, 544 U.S. 336, 345 (2005) (internal quotation marks omitted) (quoting with approval Basic Inc. v. Levinson, 485 U.S. 224, 252 (1988) (White, J., concurring) (internal quotation marks and citation omitted)).

those cash flows will be discounted. For instance, if a firm overstates its cash-flow generating assets on its balance sheet, that might artificially inflate expectations about the *future* cash flows of the business. Given that share prices, in an efficient market, are the discounted cash flows of the firm,[51] that overstatement would inflate the price of the stock all else being equal. There is, however, a second category of misstatements: those that do not have any bearing on the future cash flows of the firm or the discount rate that should apply to those cash flows when calculating the cash flows' present value. One possible example of such a misstatement might be an accounting statement by a firm that falsely states that the firm has $100 more in cash than it really does while falsely understating, in the same statement, the firm's corporate holdings of U.S. treasury bonds by an equivalent amount, $100.

There are three different doctrinal categories under which to analyze the second type of misstatement: loss causation, reliance, and materiality. The reasoning, whatever doctrinal category is employed, consistently points to a lack of recoverable damages. Consider, first, whether there is loss causation. Section 21D of the Securities Exchange Act of 1934 requires that the "act or omission of the defendant alleged to violate [section 10(b)] caused the loss for which the plaintiff seeks to recover damages."[52] This provision clearly indicates that the actionable Rule 10b-5 misconduct, i.e., the misstatement of corporate holdings, must cause the economic loss alleged by plaintiffs. Or as the U.S. Court of Appeals for the Seventh Circuit put it, "[t]o plead loss causation, the plaintiff must allege that it was the very facts about which the defendant lied which caused its injuries."[53] Given the fact that the overstatement of cash reserves exactly equals the understatement of U.S. treasury bonds (a highly liquid asset), it is difficult to argue that the misstatement or the revelation of the truth had any implications for the future cash flows of the firm or the applicable discount rate.

We can also analyze the issue, not in loss causation terms, but in terms of whether one can use the fraud-on-the-market theory to establish "reliance" (another necessary element for a Rule 10b-5 cause of action) on the misstatement. That was the approach adopted by the U.S. Court of Appeals for the Fifth Circuit. In *Greenberg v Crossroads Systems, Inc.*, the Fifth Circuit explained that "plaintiffs cannot trigger the presumption of reliance by simply offering evidence of any decrease in price following the release of negative information. Such evidence does not raise an inference that the stock's price was actually affected by an earlier release of positive information."[54] The question in the cash reserve example is whether there is any reason to believe that the misstatement constituted "positive information" that increased the firm's stock price above what it otherwise would have been if the correct holdings had been provided to the market. To posit such

51. *See* Maurice E. Stucke, *Behavioral Economists at the Gate: Antitrust in the Twenty-First Century*, 38 Loy. U. Chi. L.J. 513, 534 (2007).

52. *See* Section 21D of the Securities Exchange Act of 1934, ch. 404, § 21D, 48 Stat. 881 (codified as amended at 15 U.S.C. § 78u-4(b)(4) (2000)), as added by PSLRA, *supra* note 3, § 101(b), 109 Stat. at 747.

53. Caremark, Inc. v. Coram Healthcare Corp., 113 F.3d 645, 648 (7th Cir. 1997).

54. 364 F.3d 657, 665 (5th Cir. 2004).

a reason one would have to explain, as was the case when considering loss causation, how knowing the truth would have affected the market's expectation of the firm's future cash flows or the appropriate discount rate.

Finally, the same conclusion can be reached using instead the language of "materiality" (yet another necessary element for a Rule 10b-5 cause of action). Some circuits, such as the U.S. Court of Appeals for the Third Circuit in *Oran v. Stafford*,[55] have taken the position that in the context of an efficient market, if a misstatement does not artificially inflate the price of a stock, then the statement is not "material." Again, in the absence of a reason to believe that the misstatement impacted the market's expectations of the firm's cash flows or the applicable discount rate, the misstatement is necessarily immaterial as it would not have affected the stock price as an initial matter.

But suppose that the stock price dropped in reaction to a corrective disclosure that a firm had been misstating its holdings in the past. And further suppose that, using an event study, one concludes that the association of the negative stock reaction with the disclosure announcement is statistically significant. Does the mere fact of a price reaction to a disclosure announcement indicate that the misstatement (in the example, the misstatement concerning the corporate holdings) somehow affected expectations about cash flows and discount rates and is therefore in fact in the first category of statements which can give rise to recoverable damages? Such a conclusion would be premature.

It is possible to account for a negative price reaction associated with the corrective disclosure without assuming that the misstatement artificially inflated the stock price. The corrective disclosure can create negative stock price reactions because of what we will label "collateral damage." The presence of "collateral damage" is entirely consistent with the misstatement not inflating the price of the stock at the time the misstatement was made. By way of illustration we will consider two types of "collateral damage," both of which might well occur as a result of the disclosure of an accounting restatement necessitated by the misstatement of corporate holdings: reassessment of the quality of a firm's management or internal controls; and possible disruptive legal action.

a. Reassessment of a Firm's Management or Internal Controls

An example of collateral damage would be investors revaluing a firm not as a result of the information contained in the corrective disclosure contradicting the (false) representation made earlier, but rather as a result of a reassessment (perhaps only temporary) of how well the firm is run. Upon the announcement of the need for an accounting restatement, investors might infer that the quality of the firm's management and internal controls are lower than they had previously believed and revalue the firm downward accordingly. For example, investors might infer that the firm's internal controls are less rigorous than they had previously believed given the fact that false statements somehow made it into the firm's ac-

55. 226 F.3d 275, 282 (3d Cir. 2000).

counting statements. Such an inference could result, for example, in a reduction in firm value if investors placed some importance on the quality of the firm's internal controls in generating future cash flows.

However, this explanation for the stock price decline associated with a corrective disclosure is consistent with the original misstatement not artificially increasing the stock price (and hence the misstatement not causing economic losses á la *Caremark* or not creating reliance by inflating stock prices á la *Crossroads* or not being material by inflating prices á la *Oran*). If the original fraudulent accounting statement only contained information, albeit false, about corporate holdings then there was no statement, let alone a misstatement, about the quality of the firm's management or its internal controls. And it is only the actionable fraudulent statement that gives rise to potential Rule 10b-5 liability, i.e., the misstatement of corporate holdings, and only if that statement caused the stock price to be artificially inflated. There is no general duty to disclose, for instance, that the management of a firm or the quality of the firm's internal controls are not the same as those expected by the market. The U.S. Supreme Court succinctly captured this point when it flatly stated, "Silence, absent a duty to disclose, is not misleading under Rule 10b-5."[56]

The critical point is that the economic losses suffered by investors must be traceable to whatever misconduct is actionable under the federal securities laws, and not merely to the dissemination of information unrelated to the fraud. This later category includes information relating to conduct that might be actionable under other laws, such as state corporate law. The Court in *Broudo v. Dura Pharmaceuticals, Inc.* explained that loss causation only exists if a "plaintiff prove[s] that the defendant's *misrepresentation (or other fraudulent conduct)* proximately caused the plaintiff's economic loss."[57] Indeed, the U.S. Court of Appeals for the Seventh Circuit, going one step beyond that, recently emphasized that plaintiffs must show that each actionable misrepresentation individually has a "causal connection" with plaintiffs' losses.[58] As has been long established, it is simply not actionable misconduct under the federal securities laws for a firm to be poorly run nor does the fact that a firm's internal controls are weaker than those expected by the market give rise to a cause of action. The U.S. Supreme Court made this clear in *Santa Fe Industries, Inc. v. Green* when it explained that "Congress by 10(b) did not seek to regulate transactions which constitute no more than internal corporate mismanagement."[59] On a similar note, the U.S. Supreme Court in *Chiarella v. United States*[60] reversed a conviction under Rule 10b-5 in a case in which the jury instructions tracked the text of Rule 10b-5 but did not mention that nondisclosure is only actionable when there is a duty to disclose.

56. Basic Inc. v. Levinson, 485 U.S. 224, 239 n.17 (1988).

57. Dura Pharms., Inc. v. Broudo, 544 U.S. 336, 346 (2005) (emphasis added).

58. Tricontinental Indus., Ltd. v. PricewaterhouseCoopers, LLP, 475 F.3d 824, 843 (7th Cir. 2007) (internal quotation marks omitted), *cert. denied*,---S. Ct.---, No. 06-1670, 2007 WL 2819761 (U.S. Oct. 1, 2007).

59. 430 U.S. 462, 479 (1977) (internal quotation marks omitted) (quoting with approval Superintendent of Ins. v. Bankers Life & Cas. Co., 404 U.S. 6, 12 (1971)).

60. 445 U.S. 222, 236 (1980).

Nor is it obvious that such information about a firm's managerial quality or its internal controls would have reached the market earlier but for the misrepresentation. In other words, in the "but for" world, the hypothetical world in which the corporate holdings misstatement had not been made, it is not at all clear (or perhaps even plausible) that the firm would have disclosed to the market that its internal controls or the quality of its management was lower than the market's expectation. As a result, one could not plausibly claim that price declines resulting from investors' reassessment of managerial quality or the firm's internal controls were caused by the market learning the truth about the content of the misrepresentation concerning corporate holdings (returning to the earlier example) which is the purported basis for Rule 10b-5 liability in the first place.

In this context of "collateral damage," the facts surrounding the Freddie Mac securities litigation provide useful insights. The class action lawsuit against Freddie Mac followed the company's announcement in January 2003 that it would restate its earnings for four prior years. However, unlike the vast majority of Rule 10b-5 matters, here Freddie Mac had announced it would restate its earnings upward! Subsequently, on June 9, 2003, it announced that its top three officers would be replaced. On that day, Freddie Mac's share prices fell by 16%—from a previous close of $59.87 to $50.26—a $9.61 drop. However, over the subsequent weeks Freddie Mac continued to provide further information about its restatement, announcing, for example, on June 25 that the upward restatement could be as high as $4.5 billion. On November 21, 2003, Freddie Mac finally filed its restated financials with the SEC, and not unexpectedly, the share prices went up in response to the news. The share price movement for Freddie Mac over this relevant period is depicted in Figure 4. In the class action complaint, the plaintiffs chose to end the class period on June 9, 2003, the day of the announcement of the top officers being replaced.[61]

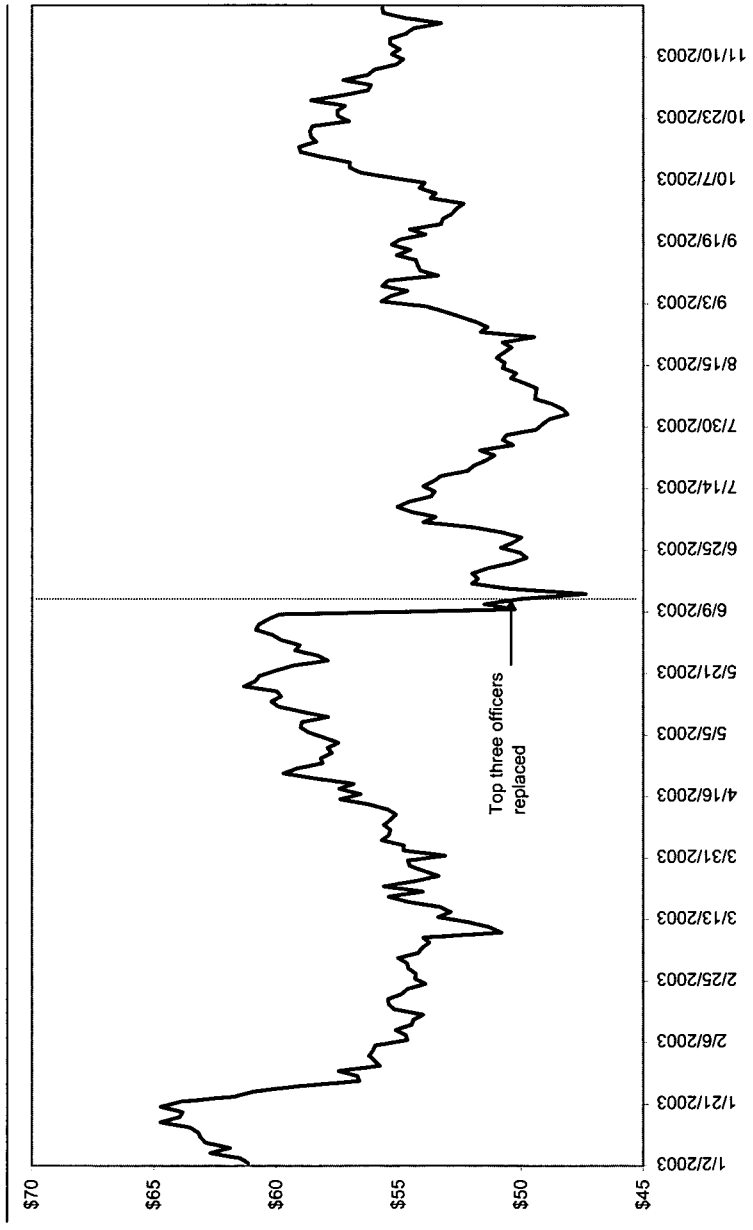
The Freddie Mac securities litigation exemplifies a case in which collateral damages associated with the replacement of management had no bearing on the misstatement of the company's prior years' financial results. Likewise, there was not a direct link between the misstatement and an adverse impact on share prices. It is unclear how revision of prior years' earnings *upward* could have harmed the firm's value and its then-current share prices. Moreover, while the replacement of the top officers was associated with a price drop, it is equally unclear why that drop should lead to any recoverable damages based on Rule 10b-5 claims.

b. Disruptive Legal Action

Revisiting the corporate holdings misstatement example, suppose that the stock price decline was due to investors predicting that the company was likely to be subject to disruptive lawsuits, state attorneys general actions, and SEC en-

61. See Amended Class Action Complaint at 23, 157, Ohio Pub. Employees Ret. Sys. v. Freddie Mac, Civil No. C2-03-711 (S.D. Ohio Jan. 15, 2004). The Freddie Mac stock price data used in Figure 4 is from Bloomberg LP.

Figure 4
Freddie Mac Share Prices: January through November 2003



forcement proceedings as a *result* of the accounting restatement. In particular, if investors valued the retention of the executives who were responsible for the misstatement, then expected legal action could well have the effect of these executives losing their jobs and thereby hurting the value of the firm. A company's stock price could decline for this reason even if investors placed absolutely no lower value on the firm as a result of the information contained in the accounting restatement. As the Supreme Court explained in *Dura*, price changes "may reflect, not the earlier misrepresentation, but changed economic circumstances, changed investor expectations, new industry-specific or firm-specific facts, conditions or other events...."[62] The price decline in this situation would be due to new "firm-specific facts" as opposed to firm revaluation resulting from the market learning the truth about corporate holdings which was the subject of the earlier fraudulent representation.

VI. Confirmatory Statements and Forward-Casting Estimates of Damages

In estimating per-share damages, plaintiffs' experts typically adopt a "back-casting" approach.[63] That is, they use the price decline as a result of the curative disclosure to measure the inflation during the class period.[64] In particular, they begin with the share prices at the end of the class period (which presumably reflect the fair market value of the security) and proceed backward in time to the beginning of the class period in constructing the but-for share price line.[65] The difference between the actual price and the 'back-casted' but-for price is purported to provide a measure of per-share damages on a given day within the class period.

This 'back-casting' approach can suffer from some problems. As we discussed earlier, market overreaction, post-corrective disclosure price movement, collateral damage, and apportionment issues can render it difficult to estimate with any degree of reliability the inflation during the damage period using the price drop associated with the disclosure.

A potential avenue for avoiding these problems is to use a "forward-casting" approach in creating the but-for price line. In forward-casting, one estimates the inflation in stock price associated with the misrepresentation announcement as opposed to inferring the extent of the inflation from the price decline associated with the curative disclosure. The doctrines of loss causation, reliance, and materiality, after all, all point to the inflation in stock price (and its subsequent removal via a corrective disclosure) as the potential harm to shareholders associated with a misrepresentation.

62. Dura Pharms., Inc. v. Broudo, 544 U.S. 336, 343 (2005).

63. *See* John Finnerty & George Pushner, *An Improved Two-Trader Model for Measuring Damages in Securities Fraud Class Actions*, 8 Stan. J.L. Bus. & Fin. 213, 220 (2003) (discussing the "basic plaintiff-style approach" before critiquing it).

64. *See id.*

65. *See id.*

The application of the forward-casting approach is straightforward when the false information, which the market believes is true, was unanticipated by the market. In such an event, the stock price reaction (net of market, industry and other confounding effects) associated with the initial dissemination of the misrepresentation would represent the inflation in stock price which potentially harms shareholders by artificially inflating the purchase price.

A number of misrepresentations, however, are motivated by the firm's desire to meet market expectations, such as a desire to meet the market's expectations of earnings. These so-called "confirmatory statements" pose some challenging issues in terms of estimating securities damages. As the U.S. Court of Appeals for the Fifth Circuit noted, "[C]onfirmatory information has already been digested by the market and will not cause a change in stock price."[66] It is still possible, nevertheless, to use a forward-casting approach even in a "confirmatory statement" situation.

Suppose, for instance, that a firm overstates its earnings in order to meet the market's earnings expectations and there is, accordingly, no market reaction to the misrepresentation. In this case, the forward-casting approach would entail estimating what the market reaction would have been had the restated lower earnings been known on the misstated earnings announcement days. This estimation can be undertaken through an event study using the firm's prior earnings announcement days and quantifying the relationship between price response and earnings surprises or changes.[67] This relationship could then be used to estimate the but-for stock returns in the earnings announcement days using the firm's restated earnings. These but-for returns when substituted for the actual returns on the earnings announcement days would generate the forward-casted but-for price line. The difference between the actual and the but-for price line would be a direct measure of the inflation caused by the overstated earnings. Our experience suggests that, typically, the back-casted and the forward-casted approaches yield substantially different but-for price lines, and hence vastly dissimilar estimates of damages.

VII. Conclusion

The Supreme Court's decision in *Dura* raises a host of important issues concerning the contours of the loss causation requirement for Rule 10b-5 actions. These important issues include the proper application of event study analysis, the requirement that there be a corrective disclosure, what constitutes a corrective disclosure, the proper treatment of post-corrective disclosure stock price movements, the allocation of inflation to different shares, the treatment of collateral damage from a corrective disclosure, and the use of forward-casted damage estimates. The proper resolution of these issues plays a critical role in ensuring that the loss causation requirement, a requirement emphasized by the Court's opinion in *Dura*, plays its important role in preventing Rule 10-b5 damages from becoming a costly insurance scheme for investors.

66. Greenberg v. Crossroad Sys., Inc., 364 F.3d 657, 665–66 (5th Cir. 2004).

67. While this estimation can be undertaken using only the 'clean' period (i.e., the period preceding the misstatement) as long as market believed in the stated earnings, there is no reason necessarily to exclude the class period from this estimation.

Exhibit 29

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

SECURITIES AND EXCHANGE COMMISSION, Plaintiff, v. RIPPLE LABS INC., BRADLEY GARLINGHOUSE, and CHRISTIAN A. LARSEN, Defendants.	20-cv-10832 (AT)

Expert Report of Prof. Carol Osler

I. Background and Qualifications

1. I am the Martin and Ahuva Gross Professor of Financial Markets and Institutions at Brandeis University. My Curriculum Vitae is included as Exhibit A to this report.

2. I have earned an MA and Ph.D. in Economics, with specialization in International Finance, from Princeton University. That was preceded by a BA in Economics from Swarthmore College. At Brandeis I usually teach about 125 master's students and supervise one or two Ph.D. theses each year. Prior to teaching at Brandeis, I taught at Dartmouth's Amos Tuck School of Business, Northwestern University's Kellogg School of Management, Columbia University's Economics Department and, separately, its School for International and Public Affairs. I have also taught a Ph.D. course at the Norwegian Business School (BI).

3. At Tuck and Kellogg I taught an MBA course entitled "International Capital Markets," in which foreign exchange ("FX") markets naturally occupied some weeks. At Brandeis I teach a master's-level course on financial markets. At its inception the course was called "Foreign Exchange," and it was entirely dedicated to exchange rates and currency trading. Over the years I added substantial material on equity, bond, and commodity markets, so the course title was changed to "Trading and Exchanges."

4. My research primarily focuses on currency markets and exchange rates, about which I have published roughly twenty papers. All but two of these appeared in A-rated journals, according to the well-regarded Australian Business Deans Council ("ABDC") ranking. Five of my research articles were published by the ABDC's highest quality (A*) journals including the *Journal of Finance*, the *Journal of Financial and Quantitative Analysis*, and the *Review of Finance*.

5. I have been retained by Kellogg, Hansen, Todd, Figel & Frederick, PLLC, counsel to Defendant Ripple Labs Inc. ("Ripple"), to offer my expert opinions in this case. I am being compensated at the rate of $600 per hour for my work on this matter. My compensation is not dependent upon the outcome of this case, and all of the opinions I express in this report are my own. The materials I have relied on and considered in forming my opinions are cited throughout this report.

II. Expert Assignment and Opinions

6. I have been asked to offer an expert opinion on the following questions

Q1. From an economic perspective, does the digital asset XRP function as a "currency"?

Q2. Does Ripple's On-Demand Liquidity product ("ODL") present an economically sound option for making cross-border and cross currency payments? Why or why not?

7. For reasons described in greater detail below, my opinions on these questions are as follows:

Q1. XRP fits the economic definition of a "currency" because it has the functions and attributes commonly assigned to currencies by experts.

- Functions: XRP serves as a medium of exchange, means of payment, unit of account, and store of value.
- Attributes: XRP is durable, portable, divisible, uniform, acceptable, in limited supply, and inexpensive to store.

Q2. ODL, which operates using the open-source XRP Ledger system and leverages the digital asset XRP as a bridge currency, presents an economically sound option for making cross-border and cross-currency payments.

- Compared to the dominant traditional payments platforms, ODL provides less costly, faster, and more transparent payments.
- Compared to the dominant cryptocurrency ledger systems, the XRP Ledger is faster, less costly, equally transparent, more scalable, and less resource-intensive.
- The XRP Ledger, which ODL leverages, not only realizes the advantages of digital technologies but advances them by implementing original solutions to well-known challenges in computer science.
- XRP is a logical part of its eponymous Ledger system. It embodies a centuries-old solution for limiting the unmanageably extreme multiplicity of connections among currencies.
- The dominant payment platforms have not fully incorporated the potential advantages of digital technologies. Furthermore, the modernization process is proceeding slowly in part because the dominant payment processors have both the incentives and the power to maintain high costs.
- Ripple faces specific, well-known challenges as a start-up. The dominant firms in its industry benefit from "network externalities" that create barriers to entry.
- Ripple follows a strategy known as "disruptive innovation" in promoting its ODL system. According to economists, this strategy is appropriate for a firm, like Ripple, which has technological advantages but financial disadvantages relative to the dominant firms.

III. Opinion on Question 1: XRP has the functions and attributes commonly assigned to currencies by experts

8. To ascertain whether XRP has the economic characteristics of a currency, one must first identify the nature of a currency.[1] It is commonly assumed that all currencies are state-sponsored, in part because the currencies in use for exchanging goods and services have been state-sponsored for roughly two centuries. However, state sponsorship is neither necessary nor sufficient for legitimate currencies. Currencies came into use as early 40,000 years ago,[2] far before the emergence of states.[3] Early currencies included natural objects that are independent of any government by definition, such as feathers, ivory, jade, cows, and shells. Early currencies also included objects that were made by humans without government guidance or control, such as beads, drums, gongs, knives, spades, vodka, wampum, and zappozats (decorated axes).[4] As recently as WWII a man-made currency with no government endorsement – cigarettes – circulated as currency in a prisoner-of-war camp.[5]

9. Economists and economic anthropologists have identified four standard functions of a currency and a number of attributes that promote a currency's success. This section reviews these functions and attributes and concludes that XRP demonstrates them all.

10. Evidence gathered by economic anthropologists indicates that the first function for currencies was means of payment in circumstances dictated by social norms. Two common examples provided are (i) bride payments and other gift exchanges and (ii) debt repayments, such as compensation to a crime victim.[6]

11. Economists typically highlight that currencies have long served the function of medium of exchange, meaning they enabled efficient exchanges of goods and services. Under a barter

[1] Note: The terms currency and money are used interchangeably in this document. This is consistent with today's common practice as manifested in phrases such as a "currency crisis" and "currency markets" (synonymous with FX markets).

[2] Kusimba, Chapurukha (19 June 2017). When – and why – did people first start using money? *The Conversation*. https://theconversation.com/when-and-why-did-people-first-start-using-money-78887.

[3] Spencer, Charles S. (2010). Territorial expansion and primary state formation. *Proceedings of the National Academy of Sciences of the United States of America* (PNAS) 107(16): 7119, 7126. https://doi.org/10.1073/pnas.1002470107

[4] Davids, Glyn (2002). *A history of money from ancient times to the present day, 3rd ed.* (Cardiff: University of Wales Press).

[5] Radford, R.A. (1945). The economic organisation of a POW camp. *Economica* 12(48): 189-201.

[6] Kusimba (2008), *op. cit.*

system, which is considered the main alternative, any exchange requires a hard-to-find "double-coincidence of wants." To illustrate: the farmer with excess eggs who needs an ox must find someone willing to part with an ox in exchange for eggs. With currencies the farmer can acquire the ox in two steps: first, sell eggs for money; second, purchase the ox with money. The eggs can be sold to anyone who is willing to pay money; the ox can be purchased from anyone willing to sell an ox for money. Because currencies eliminate the need for a double-coincidence of wants, the number of feasible routes to converting eggs into an ox is vastly multiplied.

12. Economists also highlight two additional functions of a currency: unit of account and store of value.[7] A unit of account is a measure of value. To disentangle this concept from a medium of exchange, it helps to recognize the following: British pounds and shillings had no physical form until they were first minted around 1500.[8] Instead, pounds and shillings existed as concepts, and were used to measure castle inventories and the like, as early as the eighth century C.E. During the eight centuries from the 700s to the 1500s, the main medium of exchange in Britain was the silver penny (worth 1/12 shilling), and other coins of relatively small value such as the groat (worth four pence), first issued in 1361. A store of value is an asset that will still be valuable in the future.

13. XRP serves all four of the functions of a currency just discussed. Means of payment: Every transaction on the XRP Ledger, including transactions through Ripple's ODL product, described in Section IV, costs a fraction of an XRP. That is, XRP is used to pay for the service of liquidity. In addition to that payment for use of the XRP Ledger itself, XRP can be used to pay for physical goods through online platforms including Bitcoin Superstore and Shopify and travel through Travala.[9] Medium of exchange: One function of XRP is to serve as a medium of exchange between two other currencies and currently serves that function for the client firms using Ripple's ODL. Unit of account: XRP is used to value other things available to exchange.

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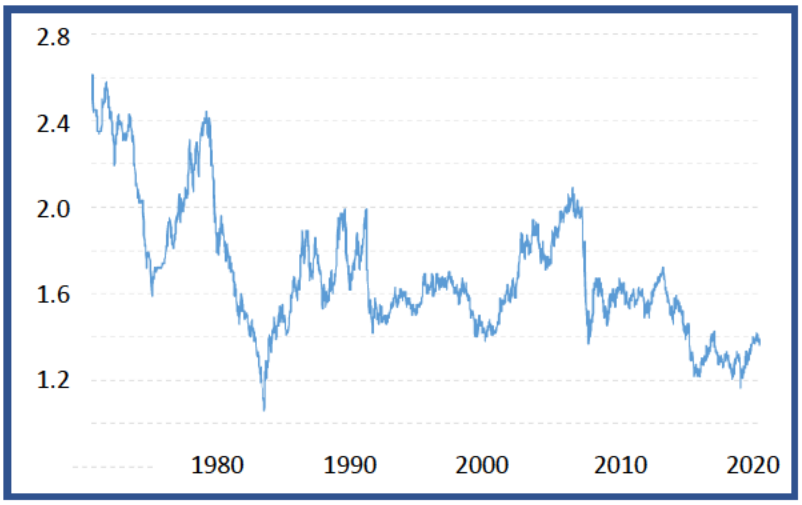
[7] Federal Reserve Bank of St. Louis. Functions of money. *The Economic Lowdown Podcast Series.* https://www.stlouisfed.org/education/economic-lowdown-podcast-series/episode-9-functions-of-money. Virtually any standard economics textbook will list the same three functions of money. *See, e.g.*, Mankiw, N. Gregory (2008). *Principles of Economics* 5th ed., (Southwestern Cengage Learning, Ohio): p. 642.

[8] Lowther, Ed (14 February 2014). A short history of the pound. *BBC News*. https://www.bbc.com/news/uk-politics-26169070.

[9] https://www.xrparcade.com/xrpecosystem/.

14. The final function commonly ascribed to currencies, store of value, benefits from a more extended discussion. Specifically, volatility does not necessarily negate the ability to serve as a store of value. This is illustrated in Figure 1 by the exchange rate between the U.K. pound and the US dollar, which has ranged from $1.1/£ and $2.5/£ since the early 1970s. Prior to the early 1970s this exchange rate was generally fixed, as were virtually all exchange rates worldwide. Importantly, the shift from fixed to fluctuating exchange rates had no bearing on whether the US dollar and the UK pound were still considered currencies. By this same logic, the existence of day-to-day fluctuations in XRP exchange rates does not change the nature of XRP as a currency.

Figure 1: Exchange rate between U.K. pound and U.S. dollar (as dollars per pound)[10]



15. A wide range of prices between a currency, on the one hand, and goods and services, on the other, is also irrelevant to the nature of that currency. At the time of writing there is substantial uncertainty about US inflation, or equivalently there is concern about the US dollar's future value in terms of goods and services. No one questions, however, whether the US dollar is a currency. Likewise, the rate at which Venezuelan bolivar loses value in terms of goods and services has been extremely difficult to predict in recent years. In 2018, for example, that currency lost 88% of its value in February, 1% in September, and 85% in December. This has no influence on whether the bolivar is a currency.

16. The Federal Reserve, the world's dominant central bank for the past century, identifies six attributes that enhance the use value of a currency: durability, portability, divisibility, uniformity,

[10] Source: https://www.macrotrends.net/2549/pound-dollar-exchange-rate-historical-chart.

acceptability, and limited supply.[11] Other economists often include low storage costs on this list.[12] An ideal currency would have all these attributes, but no single attribute is individually necessary and many objects have succeeded as currencies with only a few. Cows were a very early form of money in societies from Egypt[13] to Ireland[14] and remain "the preferred form of currency" in South Sudan even today.[15] However, cows are not portable, divisible, or uniform, their durability is limited, and they are costly to store. For many centuries boulders have served as currency on the Micronesian island of Yap, though they are extraordinarily difficult to transport and divide.[16]

17. Cowrie shells, depicted in Figure 2, were a highly successful currency across Africa, Asia, Australia, Oceana, and parts of Europe from the 13th century BCE to the early 20th century.[17] They were once so widely used in China that the symbol for cowrie shell can be found within many Chinese words involved with money.[18] Cowrie shells succeeded as a currency because they have the helpful attributes identified by economists. Durability: Cowrie shells can last for centuries and are not attractive to pests. They do not tarnish. Portability: Cowrie shells are small and light. In China they were strung into groups of 20; in Bengal they were carried in baskets of roughly 12,000.[19] Divisibility: The length of an individual cowrie shell ranges from a quarter inch to six inches and they are valued proportionately. Uniformity: As can be seen in Figure 2, cowries of a given species are remarkably consistent in shape.[20] Acceptability: Cowrie shells were accepted by common consent across much of the globe. Low storage costs: Beyond a

[11] Federal Reserve Bank of St. Louis, *op. cit*.

[12] Bagus, Philipp (2009). The quality of money. *The Quarterly Journal of Austrian Economics* 12(4): 22-45.

[13] Federal Reserve Bank of Atlanta. The story of money: 02 – Cows as a form of money. https://www.atlantafed.org/about/tours/story-of-money/02-common-products-as-money/cows-as-money.aspx.

[14] Carmody, Isolde (22 July 2012). Cows as currency. *StoryArcheology.com*. https://storyarchaeology.com/cows-as-currency/.

[15] Warner, Gregory (15 November 2017). Understanding South Sudan's cow currency is key to understanding the country's war. *NPR.* https://www.npr.org/2017/11/15/564443821/understanding-south-sudans-cow-currency-is-key-to-understanding-the-countrys-war.

[16] Fitzpatrick, Scott M. and Stephen McKeon (2020), Banking on Stone Money: Ancient Antecedents to Bitcoin. *Economic Anthropology* 7: 7-21.

[17] https://www.istockphoto.com/photo/white-cowrie-shells-gm952073298-259929937.

[18] Van Damme, Ingrid. Cowries. *Citéco: Cité de l'Économie*. https://www.citeco.fr/en/cowries-. Accessed October 3, 2021.

[19] Van Damme, *op. cit*.

[20] Van Damme, *op. cit*.

secure bit of space, cowrie shells cost nothing to store. Limited supply: Cowrie shells "occur rarely in nature"[21] and are challenging to harvest.

Figure 2: Cowrie shells

18. XRP has all of the attributes that economists agree to be valuable in a currency. Durability: Units of XRP do not rot, hold no appeal to animals, and do not tarnish. Portability: Units of XRP are effectively portable insofar as they can be accessed anywhere one finds an internet connection. Divisibility: Units of XRP are divisible because, like Bitcoin, they can be traded in decimal fractions. Uniformity: Unlike a shell, a bead, or a silver coin that must be stamped by a craftsperson and will naturally vary slightly, units of XRP are identical by construction. Each XRP comprises precisely 1 million drops, the smallest sub-unit.[22] Acceptability: XRP can be traded on myriad exchanges around the world. Low storage costs: XRP is stored in "wallets," which effectively "cost" 10 XRP (to satisfy a reserve requirement) for on-Ledger electronic repositories[23] and can be stored in hardware wallets that cost roughly the same range as a medium-quality physical wallet: $50 to $200.[24] Wallet security is high because transaction ledgers are maintained on many independent servers around the world and updated frequently. This means that the underlying record of XRP ownership is robust to physical or electronic disasters. Limited supply: The long-term supply of XRP is limited to the 100 billion already in existence. No additional units of XRP can be created without changing the XRP Ledger itself.

[21] Kusimba, *op. cit*.

[22] https://xrpl.org/xrp html.

[23] https://xrpl.org/reserves.html.

[24] Martindale, Jon (19 July 2021). The Best Crypto Wallets for Storing Bitcoin, Ethereum, Dogecoin and More. *Forbes*. https://www forbes.com/sites/forbes-personal-shopper/2021/07/19/best-crypto-wallet/.

18. To summarize: Experts on money have identified four major functions of a currency and a long list of attributes that foster a currency's success. XRP fulfills all these functions and has all these attributes. Consequently, XRP fully qualifies as a currency in the economic sense.

IV. Opinion on Q2: Ripple's ODL product provides an economically sound option for making cross-border and cross currency payments

A. Cross-border payments

19. Ripple's ultimate goal is to become a major hub for cross-currency payments, as it has publicly stated. As early as 2013, when the firm was quite young, Chris Larsen – a Ripple co-founder, then-CEO, and now Executive Chairman – stated that the firm's goal was "money without borders," a system in which "buyers and sellers [could] transfer money between each other more directly."[25]

20. Ripple continues to publicize its goals with respect to payments processing. To illustrate, the first item listed upon a Google search for "Ripple" is sponsored by Ripple itself and has this lead line: "Learn More About Ripple - Faster Cross-Border Payments." Next in the search results is Ripple's homepage, which states: "Ripple: Global Payment Solutions - Instant Processing." As illustrated in later paragraphs, Ripple sends this message at conferences, in the self-produced videos on its website, and in interviews by senior executives.

21. Ripple has stated that its main business strategy in the short-to-medium term is remittance payments. Worldwide remittance flows were small and largely ignored by economists and policymakers until the early 1990s, when workers began moving across borders en masse to support their families at home. By 2020, 170 million expatriate workers around the world[26] were formally remitting $540 billion to low- and middle-income economies.[27] For perspective, this is more than three times total foreign aid from all official donors, $161 billion, in that same year.[28]

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[25] Larsen presentation at the May 2013 "Finovate" conference: https://www.youtube.com/watch?app=desktop&v=t06YEtQjVvU.

[26] Guthrie, Jonathan (17 August 2021). Lex in depth – remittance fintechs herald a payments revolution. *Financial Times of London.* https://www.ft.com/content/1f11b38b-54d6-451c-ba4b-48843efa329d.

[27] World Bank (12 May 2021). Defying predictions, Remittance flows remain strong during COVID-19 crisis. https://www.worldbank.org/en/news/press-release/2021/05/12/defying-predictions-remittance-flows-remain-strong-during-covid-19-crisis.

[28] OECD (13 April 2021). COVID-19 spending helped to lift foreign aid to an all-time high in 2020 but more effort needed. https://www.oecd.org/newsroom/covid-19-spending-helped-to-lift-foreign-aid-to-an-all-time-high-in-2020-

22. A brief review of the process for a formal remittance transfer provides helpful context. A sender brings funds to a remittance service provider ("RSP") in the sender's country. This RSP, RSP ***S***, sends the funds to RSP ***R*** in the recipient's country. Finally, RSP ***R*** makes the funds available to the ultimate recipient, typically a member of the sender's family. Ripple's ODL product facilitates, and can offer faster settlements and lower costs for, transfers among RSPs, which can but need not be related institutions. A Western Union office in Hong Kong could send funds to a Western Union office in the Philippines or, alternatively, Citibank's Hong Kong subsidiary could send funds to the Bank of the Philippine Islands.

23. The outright cost of a remittance transfer is naturally higher if the source and/or recipient use physical cash (bills and coins). If the sender arrives with cash then RSP ***S*** must first convert it to digital form; if the recipient needs cash then RSP ***R*** must convert the digital funds received to cash. Dealing with cash is expensive in terms of employee time, space, and security. The additional cost of cash transfers is about 1.7% of the amount transferred, a figure that ranges across regions from 1.4% to 2.7%.[29]

24. Remittances can be sent via formal or informal channels. The four formal channels are: banks; money transfer operators such as Western Union; mobile operators such as MoneyGram; and post offices. Informal channels include foot, bus, or boat.[30] The magnitude of informal remittance flows is unknown: estimates vary from 50% to 250% of formal flows.[31] The choice between formal and informal channels is strongly influenced by the cost of remittances.[32] The total value of remittances, however, is determined primarily by family needs and resources. This means that if Ripple succeeds at bringing lower remittance costs for banks and money transfer organizations, the total flow of remittances through those channels could greatly exceed current levels.

25. One might naturally assume that, in our digital age, cross-border transactions are speedy and efficient. Indeed, debit cards have long been able to complete domestic payments within

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but-more-effort-needed htm.

[29] World Bank (2021), *op. cit.*

[30] Cronje, Jan (10 May 2017). High bank charges force immigrants to send money home "hand-to-hand." *Ground Up*. https://www.groundup.org.za/article/high-bank-charges-force-immigrants-send-money-home-hand-hand/.

[31] Freund, Caroline and Nikola Spatafora (2008). Remittances, transaction costs, and informality. *Journal of Development Economics* 86: 346-366.

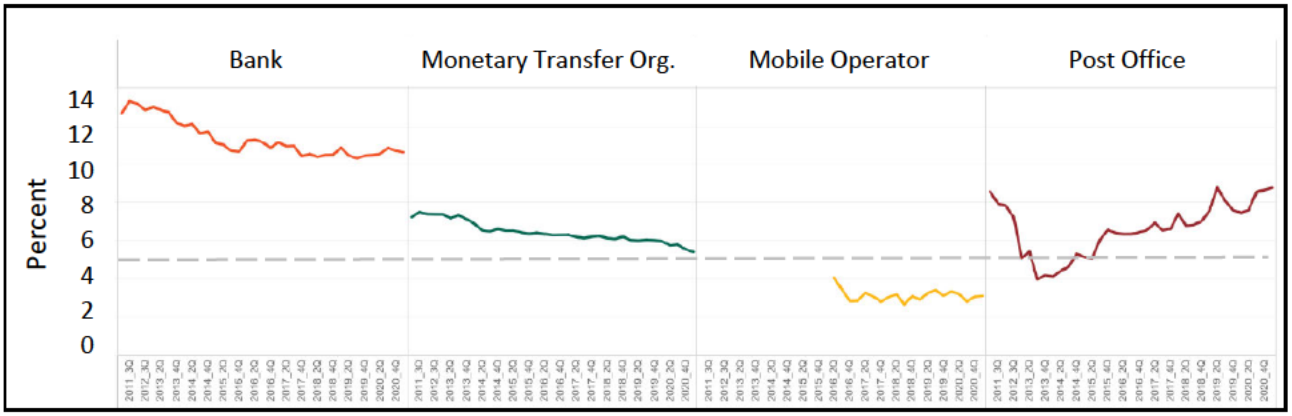
[32] Cronje (2017), *op. cit*.

minutes and at low cost. However, in the third decade of the 21st century, cross-border payments are still processed using mid-20th-century payment technologies. In consequence, remittance processing is slow, opaque, and costly. Slow: Most remittances arrive after one to 10 business days. The average speed is so slow that the World Bank considers delays of five days or less to be reasonably fast.[33] Opaque: During a standard funds transfer, neither sender nor receiver knows the status of the transfer.

26. Costly: The World Bank regularly estimates the total cost of formal remittance transfers: estimates for such costs from 2011 to the present are shown in Figure 3. In 2020, the worldwide average total cost to remit $200 by formal channels was estimated to be 6.7%.[34] (This figure includes costs to both sender and receiver. Note that it does not include the interest foregone during the delays just discussed, which is earned instead by the remittance service providers.) In that same year banks and other remittance service providers claimed at least $35 billion of the remittance money sent via formal channels to low- and middle-income countries.[35] For perspective, that represented over 20% of total official foreign aid from donors worldwide.

Figure 3: Average cost to remit $200[36]

Each figure begins in 2011:4Q and ends in 2020:4Q; dashed line represents 5% target level



[33] In selecting "smart" choices among remittance providers, the World Bank accepts any delay of five days or less. World Bank (March 2021). *Remittance prices worldwide quarterly*. https://remittanceprices.worldbank.org/sites/default/files/rpw_main_report_and_annex_q121_final.pdf.

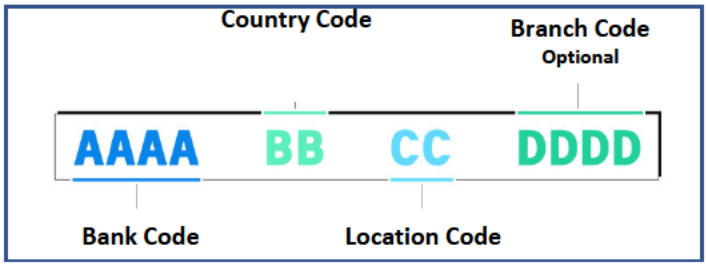
[34] *Ibid*.

[35] Arnold, Tom (12 May 2021). Remittances to developing nations resilient in 2020-World Bank. *Reuters*. https://www.reuters.com/article/health-coronavirus-remittances-int/remittances-to-developing-nations-resilient-in-2020-world-bank-idUSKBN2CT22L.

[36] *Ibid*.

27. Banks are the most expensive type of remittance service provider, as shown in Figure 3. The average cost to remit $200 via a bank was most recently estimated at 10.7%, well above the average cost across all formal remittance service providers of 6.7%.[37] The high cost of remittances via banks can be traced, in part, to their reliance on the global communications network run by SWIFT, the Society for Worldwide Interbank Financial Telecommunication. Relative to the Telex machines that preceded it, SWIFT greatly improved payment speeds and accuracy for cross-border payments in the 1970s. They did so by assigning unique identifying codes to each bank, as shown in Figure 4. The SWIFT network now includes over 10,000 banks and processes over 40 million transaction messages per day.[38]

Figure 4: SWIFT bank identification system[39]



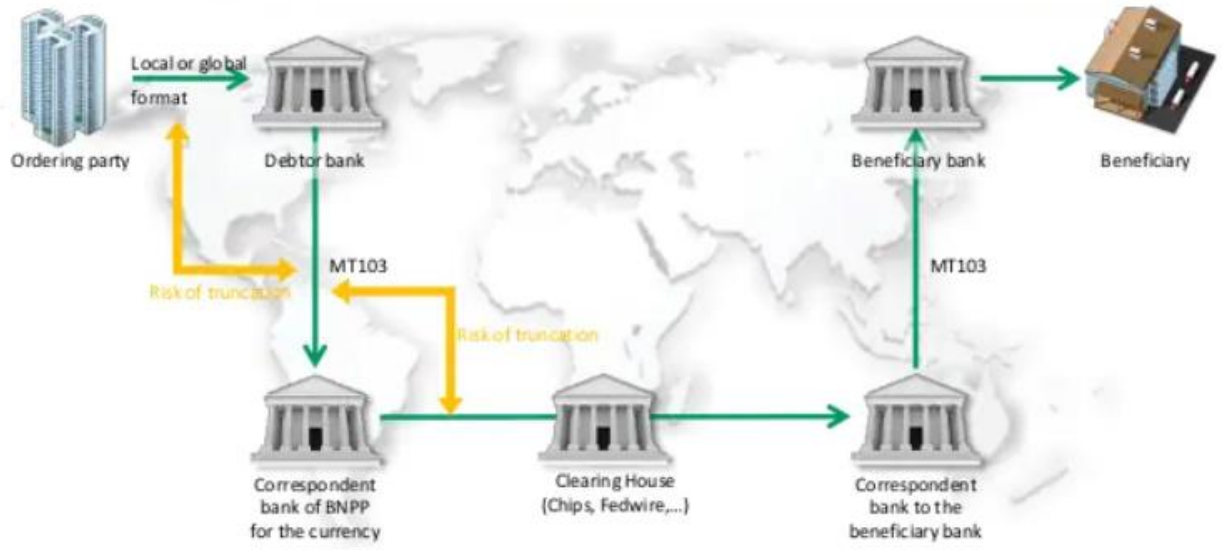
28. SWIFT only recently began to incorporate digital solutions to communication challenges. In consequence, by today's standards most cross-border remittance payments among banks are especially slow, opaque, and costly. To get from one bank to another the funds must pass through a chain of correspondent banks, as shown in Figure 5. Each bank in the chain imposes additional delays, raises the remittance cost, and increases the risk of error or misconduct.

[37] Source: World Bank (March 2021). *Remittance prices worldwide quarterly:* p. 14. https://remittanceprices.worldbank.org/sites/default/files/rpw_main_report_and_annex_q121_final.pdf.

[38] SWIFT website accessed October 3, 2021. https://www.swift.com/about-us/discover-swift/fin-traffic-figures.

[39] Sullivan, Tom (12 August 2021). What is SWIFT and what is its future? *Plaid.com.* https://plaid.com/resources/banking/what-is-swift/.

Figure 5: Correspondent chain for international payment[40]



29. In 2015 SWIFT introduced a new system known as the Global Payments Initiative ("GPI"), which is faster and substantially more transparent.[41] However, GPI remains slow relative to Ripple's ODL system because transfers through GPI still involve chains of correspondent banks.[42] GPI also remains costly because each bank in the chain must still be paid. Perhaps unsurprisingly, membership in the GPI system remains relatively limited. As of August 2021, SWIFT reported 785 member banking groups in the GPI system, less than 10% of the banks in the traditional SWIFT network.[43]

30. Ripple sees SWIFT as one of the firms it intends to challenge and has gone out of its way to publicize this message. In a November 2018 interview with Bloomberg, the current CEO, Brad Garlinghouse, stated: "What we're doing and executing on a day-by-day basis is, in fact, taking over SWIFT."[44]

[40] Yang, Eric, and Wim Grosemans (28 November 2016). An Introduction to SWIFT GPI. https://www.slideshare net/BNPPCMCC/an-introduction-to-swift-gpi.

[41] SWIFT website. https://www.swift.com/our-solutions/swift-gpi.

[42] Westerhaus, Christian (2017). SWIFT gpi: Time for action. *Deutsche Bank Global Transaction Banking.* https://corporates.db.com/files/documents/SWIFT-gpi-Time-for-action.pdf.

[43] Sullivan, Tom (12 August, 2021). What is SWIFT and what is its future? A guide to the Society for Worldwide Interbank Financial Telecommunication (SWIFT). *Plaid.com*. https://plaid.com/resources/banking/what-is-swift/.

[44] Lam, Eric, and Haslinda Amin (13 November 2018). Ripple is aiming to overtake Swift banking network, CEO says. *Bloomberg Quint.* https://www.bloombergquint.com/technology/ripple-is-destined-to-overtake-swift-banking-network-ceo-says.

31. Ripple's goal of reducing remittance costs has long been recognized among global leaders. According to the World Bank in 2015, "Remittances contribute to sustaining the welfare of about 700 million people globally and they often represent the only source of income to provide food, healthcare, housing, and education to migrants' families."[45] Remittances can be especially important at times of crises, where a crisis could be anything from a family health emergency to major national catastrophes such as India's early-2021 COVID surge and Haiti's earthquake in August of 2021. According to Michal Rutkowski, Global Director of World Bank's Social Protection and Jobs Global Practice, "As COVID-19 still devastates families around the world, remittances continue to provide a critical lifeline for the poor and vulnerable."[46]

32. Remittance flows also promote financial development[47] and financial inclusion. "Remittances [are] … often a critical first point of entry into the regulated financial market for conventionally unbanked segments of the population."[48] Remittance transfers provide "migrants and their families … the opportunity to progressively access a more sophisticated set of financial products, such as savings, microcredit and insurances."[49]

33. In 2009, the G8 committed to reducing the cost of migrants' remittances from 10% to 5% in five years, the so-called "5x5 target."[50] In 2011, the full G20 committed to the 5x5 target at Cannes, anticipating that it would "contribut[e] to release an additional 15 billion USD per year for recipient families."[51] Though the 5% target was not reached by 2014, the G20, meeting in Brisbane that year, recommitted itself to reducing remittance costs to 5%, though they no longer

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[45] World Bank Group, Finance and Markets Global Practice (October 2015). Report on the G20 survey on de-risking in the remittance market. https://documents1.worldbank.org/curated/en/679881467993185572/pdf/101071-WP-PUBLIC-GPFI-DWG-Remittances-De-risking-Report-2015-Final-2.pdf.

[46] World Bank (12 May 2021). Defying predictions, remittance flows remain strong during COVID-19 crisis. https://www.worldbank.org/en/news/press-release/2021/05/12/defying-predictions-remittance-flows-remain-strong-during-covid-19-crisis.

[47] Giuliano, Paola, and Marta Ruiz-Arranz (2009). Remittances, financial development, and growth. *Journal of Development Economics* 90: 144-152.

[48] Global Partnership for Financial Inclusion (November 2018). 2018 Update to Leaders on Progress Towards the G20 Remittance Target. https://www.gpfi.org/sites/gpfi/files/documents/2018%20Update%20to%20Leaders%20on%20Progress%20Towards%20the%20G20%20Remittance%20Target.pdf.

[49] World Bank Group (October 2015), *op. cit.*

[50] Beck, Thorsten, and María Soledad Martínez Pería (2009). What explains the high cost of remittances: An examination across 119 country corridors. *World Bank Policy Research Working Paper* 5072. https://documents1.worldbank.org/curated/en/730331468338938197/pdf/WPS5072.pdf.

[51] G20 (4 November 2011). Cannes Summit Final Declaration – Building Our Common Future: Renewed Collective Action for the Benefit of All. http://www.g20.utoronto.ca/2011/2011-cannes-declaration-111104-en html.

set a target date.[52] The United Nations' Sustainable Development Goals, adopted in 2015, have a more ambitious target: average remittance cost should fall to 3% by 2030, with costs below 5% in every remittance corridor.[53]

34. Global progress towards these goals has been disappointingly slow across all four formal channels, as is visible in Figure 3. At banks, which in 2011 charged on average 13% to remit $200, costs fell to around 10.5% by 2015, and then ceased declining altogether.

35. Progress on reducing costs has not been any more impressive at other formal remittance service providers. The cost of remitting $200 through a post office was near 9% in 2011 and rapidly achieved the 5% target, which might seem logical because Post Offices are under greater government control than private firms. However, the cost of remitting through a post office then began rising, in direct conflict with governments' stated aspirations, and has continued rising to its current level near 8%. The cost at money transfer operators was not far above the 5% target in 2011 and declined gradually but consistently and has essentially reached the target. The cost at mobile operators is not known for 2011 but was well below the target when data began in 2016 and has remained low.

36. The potential for a company like Ripple to compete effectively with SWIFT is a function not only of the high costs, slow speeds, and low transparency of SWIFT payments but also SWIFT's two interlocking obstacles to progress. First, a multitude of banks would earn less income from any payment system that does not require funds to flow through chains of correspondent banks. Second, SWIFT is owned and controlled by its member banks.

37. The extent to which these forces can delay a firm's adoption of new technology, even while undermining the firm's long-run viability, is clear from the New York Stock Exchange's ("NYSE") long-delayed adoption of electronic trading. For most of the 20th century the NYSE dominated US stock issuance and trading with a system that relied on "specialists" on the floor of the exchange. Crucially, those specialists also owned the exchange. During the late 1980s and 1990s, electronic trading systems were developed that proved highly attractive to traders. Stock exchanges around the world began switching to all-electronic trading in the 1990s: the Toronto

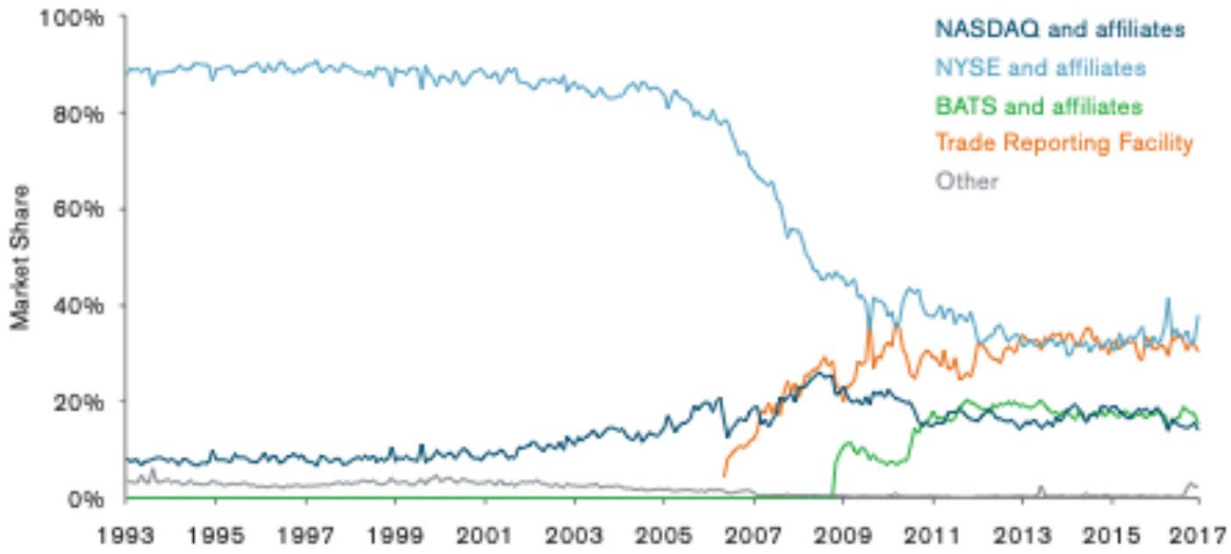
[52] G20 Leaders' Communiqué, Brisbane Summit, 15-16 November 2014. https://www.mofa.go.jp/files/000059841.pdf.

[53] UN Department of Economic and Social Affairs. The 17 goals. (Goal 10c.) https://sdgs.un.org/goals.

Stock Exchange, for example, closed its trading floor and implemented an electronic trading platform in 1997. Closer to home, new electronic exchanges emerged in the U.S. and began siphoning NYSE's market share.

38. The NYSE's specialists had become obsolete, in essence. However, they were still profitable and reluctant to adopt a trading system in which they would have little role, much like the banks that participate in remittances today. The specialists resisted any move towards electronic trading, which compromised the exchange's long-run success. From 2001 through 2007 the NYSE's market share collapsed from roughly 87% to roughly 50%, as shown in Figure 6. The NYSE eventually solved this conundrum by going public, which meant the specialists could monetize their seats. The damage done through delay proved lasting, however: the once-dominant exchange's market share continued to decline through 2012, and subsequently stabilized at roughly 35%.

Figure 6: Market shares among U.S. stock exchanges[54]

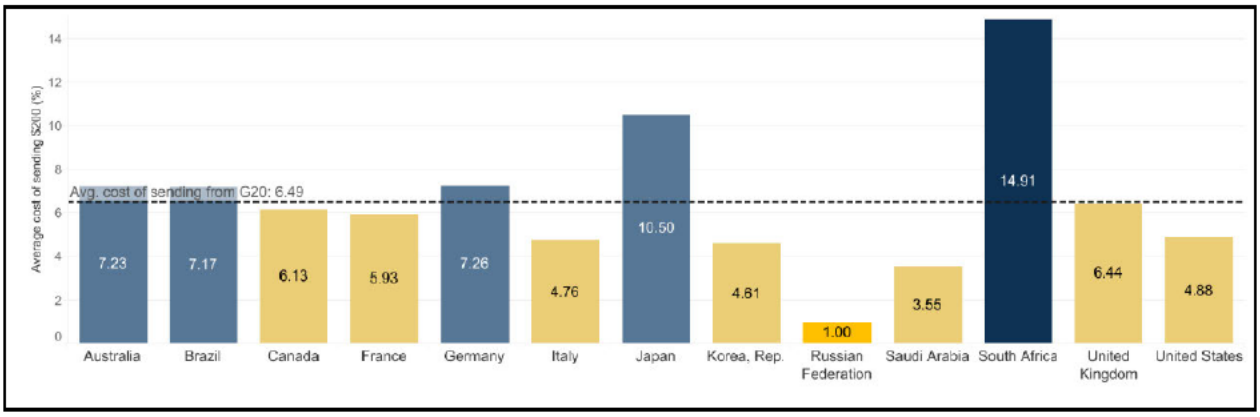


39. Despite the world's slow progress in reducing remittance costs, there have been pockets of success. Digital transfer systems clearly have an advantage in lowering costs. Figure 3 shows that it is least costly to remit $200 via mobile operators, which are digital by design. Confirmation that remittance costs can be reduced dramatically comes from Russia, whose 1%

[54] Moolji, Amyn, and Briand Smith (October 2017). A financial system that creates economic opportunities: Capital markets. *U.S. Department of the Treasury*: p. 53. https://www.treasury.gov/press-center/press-releases/Documents/A-Financial-System-Capital-Markets-FINAL-FINAL.pdf

average total cost to remit $200 is far below the average total cost in other G20 countries, as shown in Figure 7 (as a reminder, the total cost combines costs to sender and receiver).

Figure 7: Average total cost of remittances, 13 of the G20 countries[55]



40. Ripple is not the only firm to recognize the potential for profits from using a blockchain platform for remittance processing, though it was among the first. Other start-ups pursuing this market segment include Currency Cloud[56] and Earthport[57] (now owned by Visa).[58]

41. Ripple has achieved significant progress towards its goals of becoming a significant competitor among remittance service providers. By 2015 many of the world's biggest banks had joined Ripple's Global Payments Steering Group as founding members. The group's intent is "to use Ripple's technology to slash the time and cost of settlement while enabling new types of high-volume, low-value global transactions."[59] ("Settlement" refers to the actual process of moving funds.) Original members include Bank of America Merrill Lynch, Japan's MUFG Bank (formed via mergers of five commercial banks during 1996-2002), Standard Chartered Bank, Westpac, and Banco Santander.

42. Though only commercially available since 2019, I understand that ODL has customers in locations as diverse as the near-east, Latin America, and Asia's Pacific Rim. It has achieved the

[55] Source: World Bank (March 2021), *op. cit.*, p. 12.

[56] https://www.currencycloud.com/global-payments-for-fintech-platforms.

[57] https://www.thepower50.com/profiles/earthport/

[58] PYMNTS (15 May 2019). Why Visa brought Earthport into its orbit. https://www.pymnts.com/visa/2019/earthport-acquisition-cross-border-payments/.

[59] Finextra.com (28 September 2016). Ripple rudely gatecrashes Sibos party. https://www.finextra.com/newsarticle/29512/ripple-rudely-gatecrashes-sibos-party.

greatest growth in the latter region, which is economically logical because payments systems there have been more advanced than in the "advanced economies" for over a decade. Among Ripple's clients or ODL partners is Tranglo in Malaysia,[60] Coins.ph in the Philippines, at least two remittance service providers in South Korea (Sentbe and CoinOne), and SBI Remit in Japan.[61] SBI, one of Japan's largest banks, is a natural partner for Ripple because it is young and tech-savvy and growing rapidly; it did not even exist before 1999.

43. Ripple's long-run strategic goals extend well beyond remittances. The firm's ambition is to modernize international payments. In the firm's own words, its goal is "[e]nabling the world to move value like it moves information today."[62] This goal encompasses the payments associated with international trade in goods and services. In 2020 these were worth $17.6 trillion, over thirty times the value of remittance flows, and the bulk of these payments were necessarily facilitated by the SWIFT system of the banks.[63] Payment for international trade has been identified by multiple firms as a potentially lucrative market for innovative protocols. IBM has developed its own blockchain and embedded it in the trade finance network We.trade.[64] Other challengers to SWIFT's dominance in payments for international trade are government sponsored, including Instex (EU),[65] CIPS (China),[66] and SPFS (Russia).[67]

44. Ripple's ODL service is designed to provide a cost-effective and efficient alternative to the cross-border payments market. As explained below, ODL provides fast, secure, transparent, and low-cost cross-border and cross-currency payments. Customers licensing ODL from Ripple use XRP to make cross-border and cross-currency payments "in as little as three seconds," which allows them to eliminate pre-funding of destination accounts, reduce operations costs, and unlock capital.[68] In my opinion, for the reasons explained below, the ODL system is superior to

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[60] Tranglo (9 April 2021). Tranglo levels up with Ripple to power cross-border payments in Southeast Asia. https://tranglo.com/blog/tranglo-levels-up-with-ripple-to-power-cross-border-payments-in-southeast-asia/.

[61] Ripple (25 February 2020). Ripple on full-scale to tap into South Korean market. https://ripple.com/ripple-press/ripple-on-full-scale-to-tap-into-south-korean-market/.

[62] https://ripple.com/company.

[63] Statista. Trends in global export value of trade in goods from 1950 to 2020. https://www.statista.com/statistics/264682/worldwide-export-volume-in-the-trade-since-1950/.

[64] IBM. What are smart contracts on blockchain? https://www.ibm.com/topics/smart-contracts.

[65] https://instex-europe.com/about-us/.

[66] https://www.cips.com.cn/cipsen/7052/7057/index.html.

[67] http://www.cbr ru/eng/psystem/fin_msg_transfer_system/.

[68] https://ripple.com/ripplenet/on-demand-liquidity/.

existing cross-border payment systems and therefore a viable competitor. Relative to current payment systems with fiat money, ODL is faster, more transparent, and less costly. Relative to the dominant cryptocurrency ledger systems, the XRP Ledger is faster, less costly, equally transparent, and less resource-intensive.

B. Innovative technology

45. ODL, at its core, leverages the XRP Ledger, a blockchain ledger system for recording and verifying transactions. Complete records of all transactions – "ledgers" – are simultaneously maintained on many computers, typically located worldwide. As transactions arrive, they are verified individually or in a group ("block") by these same computers.

46. The decentralized nature of a blockchain reflects the commitment among the founders of Bitcoin and other cryptocurrencies to avoiding central control. Even so, like any monetary system, these systems must be trusted to succeed. Fiat currency systems are trusted in part because they have state sponsorship. In addition, residents learn through experience that their local monetary institutions can be trusted: commercial banks, savings banks, and the central bank successfully collaborate to provide accurate and timely payments. A decentralized currency system must generate trust as well, and a common approach for new cryptocurrencies is to implement and publicize a technology that assures fast and accurate payments.[69]

47. For blockchain ledgers, a major requirement for trust is a solution to the "double-spend" problem:

> Decentralized cryptocurrency networks need to make sure that nobody spends the same money twice without a central authority like Visa or PayPal in the middle. To accomplish this, networks use something called a "consensus mechanism," which is a system that allows all the computers in a crypto network to agree about which transactions are legitimate.[70]

48. Computers can be taken over by corrupt parties, and falsely label invalid transactions as valid. A consensus mechanism identifies when the signals from a set of computers can be

[69] Andrews, Edmund L. (24 September 2013). Chris Larsen: Money without borders. *Insights by Stanford Graduate School of Business*. https://www.gsb.stanford.edu/insights/chris-larsen-money-without-borders.

[70] Coinbase. What is "proof of work" or "proof of stake"? Accessed October 3, 2021. https://www.coinbase.com/tr/learn/crypto-basics/what-is-proof-of-work-or-proof-of-stake.

trusted. This represents a version of the "Byzantine Generals Problem" in computer science: How can one verify information from multiple sources, without knowing which are trustworthy?

49. Bitcoin pioneered the most common solution to the Byzantine Generals Problem among cryptocurrencies in a protocol known as "proof-of-work." In essence, computers seeking to verify a given block of transactions are given a processing challenge that almost invariably requires a lot of time and computing power. The first computer to solve the challenge is rewarded with a small number of Bitcoins, potentially worth hundreds of thousands of dollars at current prices. The challenge, known as "mining," involves putting numbers chosen largely at random through a special mathematical function until a sufficiently small outcome is generated.[71]

50. Proof-of-work transaction verification, though reliable and transparent, is slow and expensive by digital standards and resource-intensive by any standard. Slow: The average time to verify a Bitcoin transaction is generally about ten minutes, as shown in Figure 8. The time occasionally rises when transaction volumes are high, as happened when the price fell dramatically in May of 2021. Ten minutes is certainly speedy relative to the days or weeks required for traditional currency conversion channels. However, time is now measured in microseconds in financial markets, which makes even ten minutes an extremely long time. If each microsecond were a full second, a "ten-minute delay" would be 57 years. Expensive: As shown in Figure 9, Bitcoin transaction fees over approximately the past year have been at least $2 and can range up to $60 per transaction. As discussed below in paragraphs 51-54, this is many multiples of the cost per transaction on the XRP Ledger, and a major contributor is the cost of computing resources (electricity and dedicated mining computers).

[71] For details, *see* Foley, Maxwell (12 September 2019). How Bitcoin works: Hashing. *Certick*. https://medium.com/certik/how-bitcoin-works-hashing-e897157f7940.

Figure 8: Bitcoin Average Confirmation Time[72]

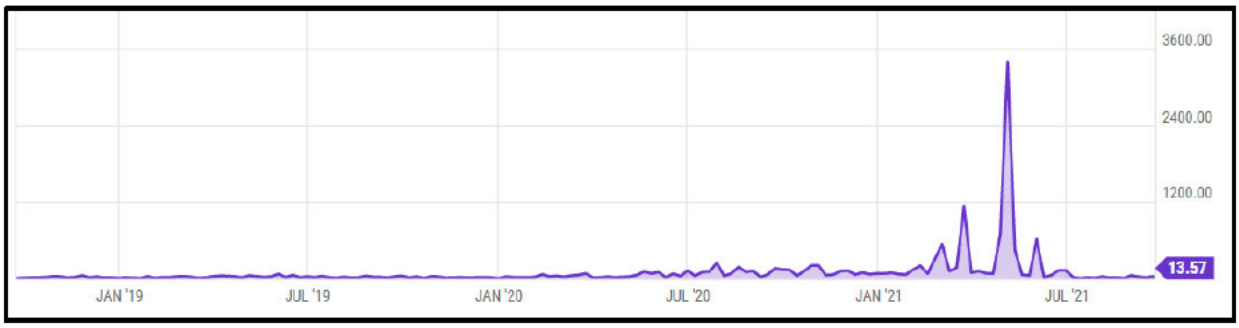
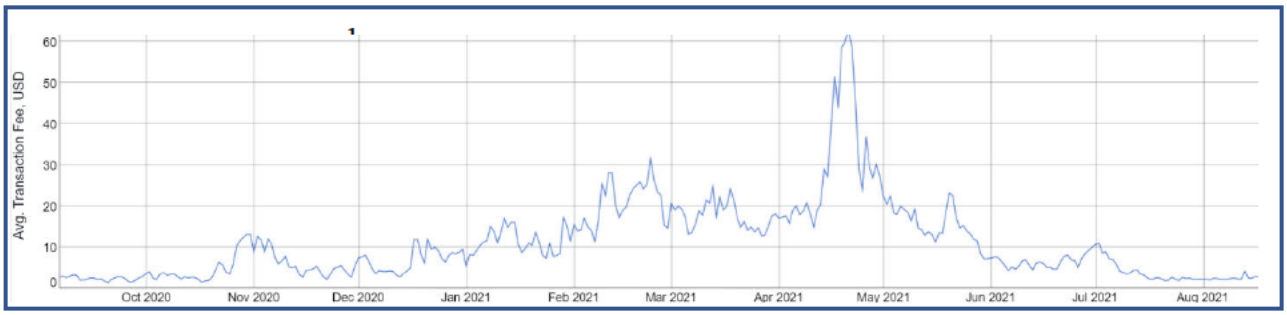


Figure 9: Average transaction fees for Bitcoin over 12 months[73]



51. Resource intensive: It would be natural to assume that Bitcoin's 10- to 60-minute average verification time – and the amount of resources required to verify Bitcoin transactions using proof-of-work – would decline as computers become more powerful. This is not the case, however. It *is* true that every advance in computer sophistication provides the first miners to exploit it with an advantage over their peers. However, that first-mover advantage is fleeting because other miners quickly upgrade their computers. It is estimated that computers dedicated to Bitcoin mining are used for only 1.3 years, on average – and because they are tailored to that purpose they cannot be used for others. In consequence, Bitcoin miners collectively generate as much physical electronic waste (e-waste) as the Netherlands, and little of it is recycled.[74]

52. Rising computer speeds also do not reduce the energy-intensity of Bitcoin mining. To ensure that just 2,016 new bitcoin are put in circulation every two weeks, the ledger system is

[72] Source: https://ycharts.com/indicators/bitcoin_average_confirmation_time.

[73] Source: https://bitinfocharts.com/comparison/bitcoin-transactionfees.html#1y. Accessed September 7, 2021.

[74] BBC News (September 2020). Bitcoin mining producing tonnes of waste. https://www.bbc.com/news/technology-58572385.

programmed to track the average time required to verify a block and, whenever that time declines, to increase the difficulty of verification.[75] By 2018 verifying a single Bitcoin transaction required 80,000 times the electricity as a single Visa credit card transaction.[76] In 2019 the Bitcoin blockchain system alone consumed approximately as much energy, and generated as many carbon emissions, as the economies of Jordan or Sri Lanka.[77]

53. The XRP Ledger does not use proof-of-work verification. Instead, it relies on a "consensus protocol." The consensus mechanism in the XRP Ledger is faster, less costly, and less energy-intensive than proof-of-work because its solution to the Byzantine Generals Problem is based on voting. Each computer in the XRP Ledger specifies a set of other network computers whose votes it will consider. A transaction is verified if it is confirmed by a sufficient share of computers in that set. The critical share is determined mathematically to guarantee accuracy even if some members of the set are corrupt.

54. The performance of XRP Ledger is striking. Speed: The XRP Ledger's verification protocol requires just a few seconds, less than 1% of the 10 minutes required by proof-of-work.[78] Cost: The cost to transact on the XRP Ledger is well below the cost of a Bitcoin transaction. The cost for any XRP Ledger transaction is fixed at 0.00001 XRP; at the current USD-XRP exchange rate this is worth about $0.00001 (1/1000th of a cent). A Bitcoin transaction fee of $10 (which appears to be a bit below the average of the past year, according to Figure 9) would be roughly 1 million times the cost of an XRP transaction.[79] For perspective, a tall oak tree is roughly one million times the height of half a grain of sand. Resource intensity: The voting protocol on the XRP Ledger requires less than 0.002% of the computing power required by proof-of-work.[80] There is no gain to be anticipated from applying greater computing power.

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[75] Rosenfeld, Meni (2016). How many zeros should I require for proof-of-work and how should this change through the years? https://www.quora.com/How-many-zeros-should-I-require-for-proof-of-work-and-how-should-this-change-through-the-years.

[76] Popper, Nathaniel (21 January 2018). There is nothing virtual about Bitcoin's energy appetite. *New York Times.* https://www.nytimes.com/2018/01/21/technology/bitcoin-mining-energy-consumption html?searchResultPosition=1.

[77] Smith, Alexander (13 May 2021). Factbox: How big is Bitcoin's carbon footprint? *Reuters*. https://www.reuters.com/technology/how-big-is-bitcoins-carbon-footprint-2021-05-13/.

[78] https://xrpl.org/xrp-ledger-overview html.

[79] https://bitinfocharts.com/comparison/bitcoin-transactionfees.html#1y.

[80] Schwartz, David (8 July 2020). The Environmental Impact: Cryptocurrency Mining vs. Consensus. https://ripple.com/insights/the-environmental-impact-cryptocurrency-mining-vs-consensus/.

55. A further advantage of the XRP Ledger relative to the Bitcoin proof-of-work ledger is **scalability**, meaning the ability to handle a high number of transactions per period. On average just 4.6 transactions per second can be processed on the Bitcoin ledger, a limit that is essentially programmed into the ledger. The goal of the limit is important: protecting the system against the possibility that someone with ill intent might spam the system by sending a massive number of transactions through the system at once, slowing the system down, and effectively crowd out other transactions. Ether can handle 30 transactions per second.[81] The XRP Ledger has had far greater capacity for years – it could handle 500 transactions per second in 2015.[82] By now it can readily process 1,500 transactions per second.[83]

56. Given the high cost of proof-of-work verification, Ether and a few other crypto-currency platforms are shifting to a newer solution to the Byzantine Generals Problem. In this "proof-of-stake" system, transaction verifiers must set aside or "stake" a substantial quantity of the platform's native currency (*e.g.*, Ether on the Ethereum platform). A greater stake brings higher odds of being included as a verifying party and, crucially, the amount of native currency received in compensation when that happens. To further enhance security, verifiers lose part of their stake if a bad transaction is verified.[84] Proof-of-stake has lower transaction costs than proof-of-work and imposes lower costs on the environment. Nonetheless, a proof-of-stake transaction will be more costly than a transaction over the XRP Ledger because the former requires substantial resources to be set aside (and be paid in case of a false verification) that could otherwise be earning income.

C. XRP is a logical solution to well-known challenges in cross-currency conversion

57. From an economic perspective, the features of XRP and the XRP Ledger are well suited to the ODL product. Any cross-border transaction processing network, including today's foreign exchange ("FX") market, faces a major challenge from the multiplicity of currencies. The United

[81]Conway, Luke (1 September 2021). What is Ethereum 2.0? *The Street*. https://www.thestreet.com/crypto/ethereum/ethereum-2-upgrade-what-you-need-to-know.

[82] Travis, Mark (2 October 2017). Ripple: The most (demonstrably) scalable blockchain. *High Scalability*. http://highscalability.com/blog/2017/10/2/ripple-the-most-demonstrably-scalable-blockchain.html.

[83] Bhalla, Anshika. Top cryptocurrencies with their high transaction speeds. *The Blockchain Council*. https://www.blockchain-council.org/cryptocurrency/top-cryptocurrencies-with-their-high-transaction-speeds/.

[84] Coinbase, *op. cit.*

Nations lists 195 sovereign countries in the world, with 154 "operational" currencies.[85] Suppose that every unique national currency could be converted directly to every other one: Omani rial could be converted directly to Cambodian riel, Colombian pesos could be converted directly to Ugandan shillings. There would be 11,628 unique exchange rates, each of which would be changing frequently during every day. To ensure they offer appropriate exchange rates when a client reaches out to trade, dealing banks would have to actively monitor each exchange rate, which would require massive and expensive staffing. Trading rooms would hire hundreds of new dealers, each of them requiring significant salaries plus bonuses, and each bank's electronic trading staff would likewise expand to generate and stream up-to-the-microsecond values for each exchange rate. There would be commensurate increases in back-office staff – those involved in settlement, risk, and compliance.

58. The extreme multiplicity of country pairs and exchange rates has been a challenge to the FX market for roughly two centuries. Throughout that period a single solution has been consistently adopted: a vehicle (or bridge) currency. Suppose V is the vehicle currency. Conversion of, say, Colombian pesos to Ugandan shillings involves two transactions: (1) a purchase of V with pesos; (2) a sale of V for shillings.[86] Though it involves two transactions rather than one, this system of indirect currency conversion proves to be less costly than having 11,000+ directly-traded currency pairs. In addition to the labor savings, when trading is concentrated in a relatively small number of currency pairs the liquidity of each traded pair increases sufficiently to reduce total transaction costs.

59. The world's first vehicle currency was the pound sterling, which acquired that role in the 19th century when the UK dominated world trade and finance. After WWI the vehicle-currency function began shifting to the US dollar. By the end of WWII, when the Bretton Woods system of fixed exchange rates was adopted, the US dominated world trade and finance so the dollar became the only vehicle currency. The euro, created in 1999, has become a vehicle currency for a few fiat currencies from countries adjacent to the European Monetary Zone (*e.g.*, the

[85] United Nations. UN Operational Rates of Exchange. https://treasury.un.org/operationalrates/OperationalRates.php.

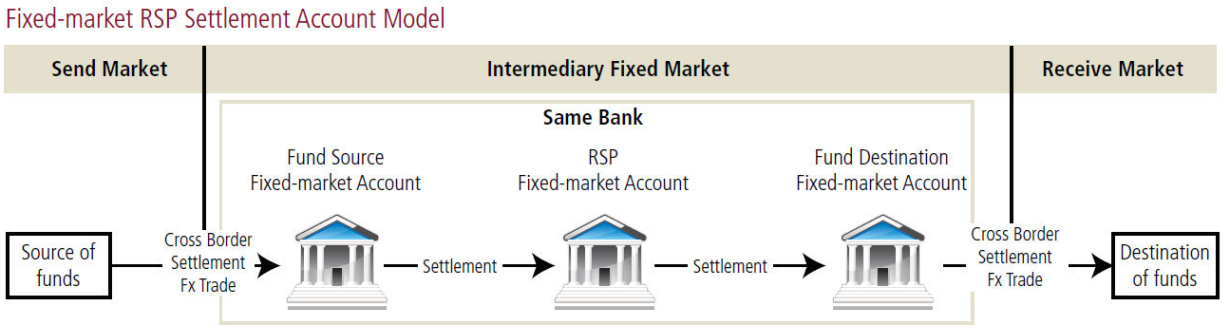
[86] Vehicle currencies have long been a subject of research in economics. Notable contributions from the past 40 years include: Magee, Stephen P., and Ramesh K. Rao (1980). Vehicle and nonvehicle currencies in international trade. *American Economic Review* 70(2): 368-373.

Devereux, Michael B., and Shouyong Shi (2013). Vehicle Currency. *International Economic Review* 54(1): 97-133.

Norwegian krone). China seeks to develop this function for its currency, known as the yuan or the renminbi.

60. A vehicle-currency system has also proved valuable for digital transactions. Some mobile remittance service providers adopt a "fixed-market [remittance service provider] settlement accounts model," depicted in Figure 10, which is, in essence, a vehicle-currency system. The sender's currency, whatever it may be, is traded into the currency of a specific "intermediary" market. This amount is then converted by local banks into the receiver's currency and moved to the destination country. The "intermediary" currency is effectively a vehicle currency.

Figure 10: Using a vehicle currency to process remittances[87]



61. The XRP Ledger can be used to facilitate payments across not just fiat currencies, but also cryptocurrencies. As of August, 2021 there were 5,840 cryptocurrencies in existence.[88] To provide direct convertibility for all pairs of fiat and crypto currencies would involve tracking and verifying exchange rates across 17,955,028 unique currency pairs. A vehicle currency system reduces that figure by 99.97%.

62. So far, this section has discussed the logic behind using a vehicle currency to streamline currency conversions. Ripple also had to decide on a specific currency to perform that function. Critically, today's fiat currencies could be immediately ruled out because FX transactions in fiat currencies currently take days to settle. In the wholesale FX markets settlement requires two

[87] Daly, Neil (May 2010). International remittance service providers. *GSMA Mobile Money Transfer*: p. 7. https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/03/gsmaremittanceserviceproviderwhitepaper182.pdf.

[88] Source: Statista. Number of cryptocurrencies worldwide from 2013 to August 2021. https://www.statista.com/statistics/863917/number-crypto-coins-tokens/. Accessed August 24, 2021.

business days[89] during which each counterparty contacts the other, verifies trade specifics, and exchanges information about bank accounts and the like. This makes fiat currencies unsuitable for payments that are designed to process in real time, meaning settlement happens within minutes of the initial trade (the initial agreement to exchange certain assets at a certain price). In contrast, the XRP Ledger is designed to achieve real-time settlement, and XRP is the native currency of the XRP Ledger.

63. The most efficient cryptocurrency on any decentralized platform is one that is carefully designed to fulfill that platform's intended purpose. The software behind Bitcoin and the vast majority of other cryptocurrencies is not designed to facilitate efficient payments from a holder of one fiat currency to the holder of another fiat currency. That, however, is precisely the purpose of the XRP Ledger, and XRP is the specially-designed or "native" currency of the XRP Ledger. XRP therefore maximizes the efficiency of the XRP Ledger which, in turn, minimizes the cost of Ledger transactions.

64. To summarize: the XRP Ledger relies on a vehicle currency to reduce the number of active currency pairs to a manageable level, the same solution adopted for two centuries in the FX market. ODL is intended to achieve settlement in real time and therefore cannot rely on a fiat currency as vehicle currency, because fiat currencies require two days to settle. ODL therefore relies on the XRP Ledger's native currency, XRP, to serve as vehicle currency.

D. Disruptive innovation

65. The competitive viability of ODL leveraging the XRP Ledger is supported by Ripple's choice of global strategy. Economic theory suggests that a firm with superior technology but fewer resources than the currently-dominant firms will wisely adopt the strategy known as "disruptive innovation." The relevance of this strategy is immediately apparent from this description by the economists who first outlined this strategy:

> "Disruption" describes a process whereby a smaller company with fewer resources is able to successfully challenge established incumbent businesses. Specifically, as incumbents focus on improving their products and services for their most demanding (and usually most profitable) customers, they exceed the needs of some segments and

[89] There is one exception to this two-day rule: just one business day is required to settle trades between the US and Canadian dollars.

> ignore the needs of others. Entrants that prove disruptive begin by successfully targeting those overlooked segments, gaining a foothold by delivering more-suitable functionality—frequently at a lower price. Incumbents, chasing higher profitability in more-demanding segments, tend not to respond vigorously. Entrants then move upmarket, delivering the performance that incumbents' mainstream customers require, while preserving the advantages that drove their early success. When mainstream customers start adopting the entrants' offerings in volume, disruption has occurred.[90]

66. Amazon provides a classic example of disruptive innovation. Amazon began as a small online bookseller. Its technology proved so successful that it quickly gathered market share from many brick-and-mortar book retailers, including large chain book sellers. Amazon used that experience to refine its systems for marketing, inventory management, payment, and shipment, and then went on to disrupt retail markets in many other products. By now almost anything tangible and reasonably portable can be purchased through Amazon, including groceries, streamed movies, and furniture.

67. Like Amazon when it started, Ripple fulfills the economic conditions that make disruptive innovation an appropriate strategy. It has a product that provides improved functionality at faster speeds and lower costs than incumbent products. As a start-up it has far fewer resources than incumbents such as SWIFT or Western Union.

68. Ripple's actions conform to the disruptive innovation strategy. The firm has focused on remittances, which is not a core business for most banks, and has avoided challenging the dominant payments systems head-on. It has collaborated with big banks on prototype digital payment systems rather than compete directly with SWIFT. Likewise, Ripple has intentionally avoided any direct challenge to the dominant money transfer operator, Western Union, as stated explicitly by David Schwartz, Ripple's Chief Technology Officer, in 2016.[91]

69. Gaining market share with a disruptive product that must ultimately create a network to thrive is extremely challenging. The reason is that the network of a dominant firm creates an almost insurmountable "barrier to entry" for challengers. SWIFT, with its network of over 10,000 banks worldwide, provides an apt illustration of a phenomenon known in economics as

[90] Christensen, Clayton, Michael E. Raynor, and Rory McDonald (December 2015). What is disruptive innovation? *Harvard Business Review*: 44–53. https://hbr.org/2015/12/what-is-disruptive-innovation.

[91] Ripple Live: Ask me anything with David Schwartz (21 December 2017). https://www.youtube.com/watch?v=NNuu7NIJAN4.

"network externalities." SWIFT's network gives it an advantage (or "positive externality") as the firm seeks new member banks. Any non-member bank can be confident that a SWIFT membership will make it easy and profitable to send funds to banks in a myriad of locations.

70. Economists would say that a dominant firm with an established network is "highly defensible" because it is extremely difficult to challenge them, even for a firm with far better products.[92] The challenger needs a network to attract clients, but without clients there is no network. Further, the dominant firm can set up additional roadblocks by giving second-class treatment to network members that collaborate with a challenger.

71. Some of Ripple's key strategic moves to date seem directly aimed at finding a route past the barricades associated with network externalities. Its 2019 commitment of up to $50 million to seed a partnership with Moneygram was likely intended to seed or jumpstart the necessary network. With this agreement in hand, Ripple could make a stronger case with other potential partners. For example, Ripple's choice to focus on one region, Asia's Pacific Rim, can be seen as leveraging that seed to create a strong network in one region. Many of the clients that Ripple has gained in this region are relatively small and focus on a narrow set of remittance "corridors." Coins.ph is focused on Philippine clients and, one infers, remittances into the Philippines; Siam Commercial Bank focuses on clients in Thailand; SBI Remit in Japan is focused on remittances from Japan. Such clients would benefit from ODL in their remittance corridors but do not need it to be available in all others. The network Ripple is creating in the Pacific Rim includes ties to countries in other regions including Latin America, and Africa. In theory those ties could next be leveraged to reinforce its still-limited links to one or more of those other regions. There is no rush, however. According to experts on the disruptive innovation strategy, "a headlong rush to fast growth is often unnecessary and can even backfire…"[93]

72. I understand that the SEC has argued that ODL is unprofitable or earns Ripple only *de minimis* revenue.[94] Assuming that is true, it provides no information on the firm's ability to compete as a payments service provider using ODL. Put differently, ODL can be (and in my opinion is) a viable option for making cross-border payments even if it is not currently profitable.

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[92] Haiglu, Andrei, and Simon Rothman (April 2016). Disruptive innovation: Network effects aren't enough. *Harvard Business Review:* 65-71. https://hbr.org/2016/04/network-effects-arent-enough.

[93] *Ibid.,* p. 65.

[94] Amended Complaint, ¶ 374.

Young technology-driven firms that must build networks often take many years to reach profitability. Airbnb, established in 2008, did not become profitable until 2020 and then returned to losses in 2021.[95] Uber, founded in 2009, is not yet profitable.[96] Pinterest, also established in 2009, may have finally reached profitability in 2021.[97] However, the viability of a start-up is not evaluated according to its profitability: Airbnb is currently worth $105 billion, Uber is worth $89 billion, and Pinterest is worth $34 billion. Indeed, profitability eluded over 80% of the firms that launched initial public offerings during the first three quarters of 2018.[98]

73. Profitable or not, Ripple is certainly getting noticed as a market disruptor. In 2020 CNBC listed Ripple as 28th on its list of the top 50 "Disruptor" firms, citing specifically the ODL service and XRP.[99]

74. To summarize this section, Ripple is a start-up with an innovative platform for cross-currency payments, ODL, that makes transfers more rapidly, at lower cost, and with greater transparency than existing platforms. The firm hews closely to the economically-logical strategy for firms in this situation, disruptive innovation. It faces massive barriers to entry, however, because it is attempting to disrupt an industry in which network externalities are substantial. Consistent with the principle of disruptive innovation, Ripple has so far avoided direct challenges to the dominant players by focusing on relatively small or new segments of the payments industry. The firm has always been clear, however, that its ultimate goal is to remake the $2 trillion business of payments processing.

[95] https://finance.yahoo.com/quote/ABNB/. Market capitalization as of 1 October 2021.

[96] https://finance.yahoo.com/quote/UBER/. Market capitalization as of 1 October 2021.

[97] https://finance.yahoo.com/quote/PINS?p=PINS&.tsrc=fin-srch. Market capitalization as of 1 October 2021.

[98] Cremades, Alejandro (4 December 2018). Profit vs growth: How to select the right strategy for your business. *Forbes*. https://www forbes.com/sites/alejandrocremades/2018/12/04/profit-vs-growth-how-to-select-the-right-strategy-for-your-business/?sh=54b023a1410e.

[99] CNBC.com Staff (16 June 2020). *Disruptor 50 2020*. https://www.cnbc.com/2020/06/16/ripple-disruptor-50 html.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on October 4, 2021

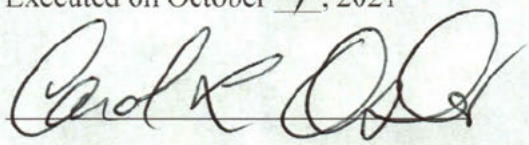

Exhibit A

Carol Osler, Ph.D.
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BIO

Carol Osler, Ph.D. is the Martin and Ahuva Gross Professor of Financial Markets and Institutions at the International Business School of Brandeis University. Dr. Osler's research focuses on exchange rates and foreign exchange trading. She has also recently published research on workplace bullying. Dr. Osler's courses cover behavioral finance, financial market structure and the trading process, and applied macroeconomic analysis. Dr. Osler's legal consulting engagements have the foreign exchange, bond, and precious-metals markets.

Dr. Osler served as research economist at the Federal Reserve Bank of New York and has also taught at the Norwegian School of Business (BI), the Amos Tuck School of Business at Dartmouth College, the Kellogg School of Management at Northwestern University, Columbia University, and the Massachusetts Correctional Institution at Concord.

EDUCATION

Ph.D., Economics: Princeton University
M.A., Economics: Princeton University
BA: Swarthmore College

PROFESSIONAL EXPERIENCE

ACADEMIC ENGAGEMENTS

PRESENT:	Martin and Ahuva Gross Professor of Financial Markets and Institutions, Brandeis International Business School, Brandeis University
2019	Taught basic finance to prisoners at MCI Concord, MA.
2002-2013	Associate Professor of Finance and Economics, Brandeis International Business School
1991-2002	Federal Reserve Bank of New York. Capital Markets Division of Research and Market Analysis Group. Senior Economist
1994	Visiting Economist, Foreign Exchange Trading Desk, Federal Reserve Bank of New York
1993-1996	Columbia University, Adjunct Assistant Professor of Economics.
1990-1991	Kellogg School of Management, Visiting Assistant Professor of Finance.
1988	NBER Ford Foundation Fellow
1985-1991	Assistant Professor, Amos Tuck School of Business Administration, Dartmouth College.

EXPERT RETENTIONS

2019-PRESENT *Joseph S. Mancinelli et al. v. Bank of America et al.*, Ontario Superior Court of Justice (SSA Bonds)

2018-PRESENT *Julius di Filippo and David Caron v. Bank of Nova Scotia et al.,* Ontario Superior Court of Justice (Silver)

2017-PRESENT *Julius di Filippo and David Caron v. Bank of Nova Scotia et al.,* Ontario Superior Court of Justice (Gold)

2017-PRESENT Maurice Blackburn Pty Ltd., Melbourne, Australia. Economic consultant on FX antitrust suit (FX).

2018 *Axiom Investment Advisors, LLC, v. Deutsche Bank AG*. US Southern District of New York.

2018 *James Contant, et al., v. Bank of America Corporation, et al.,* US District Court, Southern District of New York (Indirect FX)

2016-PRESENT *Chris Staines v. Royal Bank of Canada et al., Defendants*, Ontario Superior Court of Justice (FX)

2018 *Axiom Investment Advisors, L.L.C. v. Deutsche Bank AG*, US District Court, Southern District of New York (FX: Last look)

2015-2016 U.S. Department of Justice action on price-fixing conspiracy in FX markets

2014 Lovell Stewart Halebian Jacobson L.L.P. Preliminary work towards class-action complaint on price-fixing conspiracy in FX markets

2011-2012 Consultant for Charles River Associates in their support of State Street Bank in *People of the State of California v. State Street et al.,* Superior Court of the State of California County of Sacramento.

ADMINISTRATION

2021-2022: Chair, Brandeis Faculty Senate

2019 – 2021: Member, Faculty Senate and Faculty Senate Council, Brandeis University

2020 – 2021: Library Advisory Committee

2019: Co-facilitator, Course Design Workshop, Brandeis Center for Teaching and Learning

2016 – 2020: Co-Chair, Dignity at Work Task Force of the Faculty Senate, Brandeis University

2015: Chair, Provost Search Committee, Brandeis University

2010 – 2018: Chair, University Budget Committee, Standing Committee of Brandeis University.

2009 – 2012: Member, Faculty Senate Council, Brandeis University

2008 – 2015: Program Director, Master of Arts in International Economics and Finance, Brandeis International Business School

2007-2008: Acting Program Director, Ph.D. Program, Brandeis International Business School

Chair and member of numerous search committees including those for presidential direct reports and other senior administrators. Member and chair of committees on undergraduate mental health, tenure and promotion committees, contract review committees, etc.

RESEARCH

PUBLICATIONS

Workplace Bullying: Nature, Consequences, and Recommended Policies. *Journal of Organizational Psychology* 21(2).

Price Discovery in Two-tier Markets, joint with Geir H. Bjønnes and Dagfinn Rime (2021). *International Journal of Finance and Economics* 26(2): 3109-3133.

The Market Microstructure Approach to Foreign Exchange: Looking Back and Looking Forward, joint with Michael King and Dagfinn Rime (2013). *Journal of International Money and Finance* 38 (November): 95-119.

The Microstructure of Currency Markets: Market Microstructure in Emerging and Developed Markets (2013), with Xuhang Wang. Chapter 5 in: Ed. Kent Baker and Halil Kiymaz, Eds. (John Wiley, Inc.: New York and London).

Currency Market Microstructure and the Profitability of Currency Trading (2012). *Annual Review of Financial Economics* 4: 469-495.

Noise Trading and Illusory Correlations in US Equity Markets, joint with Jennifer Bender and David Simon (2012). *Review of Finance* 17(2): 625-652.

Survival of Overconfidence in Currency Markets, joint with Thomas Oberlechner (2012). *Journal of Financial and Quantitative Analysis* 47(1): 92-113.

Foreign Exchange Market Structure, Players, and Evolution (2012), with Michael King and Dagfinn Rime. In: James, J., Marsh, I., Sarno, L. (Eds), *Handbook of Exchange Rates*. (Wiley and Sons: New York and London).

Price Discovery in Currency Markets, joint with Alexander Mende and Lukas Menkhoff (2011). *Journal of International Money and Finance* 30 (8): 1696-1718.

Extreme Returns: The Case of Currencies, joint with Tanseli Savaser (2011). *Journal of Banking and Finance* **35**: 2868-2880

Limit-Order Submission Strategies under Asymmetric Information. Joint with Lukas Menkhoff and Maik Schmeling (2010). *Journal of Banking and Finance* 34(11): 2665-2677.

Foreign Exchange Microstructure: A Survey (2009). *Encyclopedia of Complexity and System Science,* Robert A. Meyers, Ed (Springer: New York).

The Exchange Rate in a Behavioral Finance Framework (2007). Book Review: *Journal of International Economics* 72: 265-270.

Macro Lessons from Microstructure (2006). *International Journal of Finance and Economic*s 11: 55-80.

Stop-Loss Orders and Price Cascades in Currency Markets (2005). *Journal of International Money and Finance* 24: 219-241.

Currency Orders and Exchange-Rate Dynamics: Explaining the Success of Technical Analysis (2003). *Journal of Finance* 58: 1791-1819.

The Changing Landscape of the Financial Services Industry: What Lies Ahead? (2000). *Economic Policy Review* 6 no. 4: 39-54. www.ny.frb.org/rmaghome/econ_pol/900lown.pdf

Support for Resistance: Technical Analysis and Intraday Exchange Rates (2000). *Economic Policy Review* 6, no. 2: 53-67. http://www.newyorkfed.org/research/epr/00v06n2/0007osle.html

Rapidly Rising Corporate Debt: Are Firms Now Vulnerable to an Economic Slowdown? (2000). *Current Issues in Economics and Finance* 6, no. 7: 1-6.

Rational Speculators and Exchange Rate Volatility with John Carlson (2000). *European Economic Review* 44: 231-253.

Methodical Madness: Technical Analysis and the Irrationality of Exchange-Rate Forecasts, with Kevin Chang (1999). *Economic Journal* 109: 636-661.

Second District House Prices: Why So Weak in the 1990s? joint with Matthew Higgins and Anjeli Sridhar (1999). Federal Reserve Bank of New York *Current Issues in Economics and Finance* 5(January).

Short-Term Speculators and the Puzzling Behavior of Exchange Rates (1998). *Journal of International Economics* 43(1): 37-58.

Is More Always Better? Head-and-Shoulders and Filter Rules in Foreign Exchange Markets, joint with P.W. Kevin Chang (1998). In: E. Acar and S. Satchell, eds., *Advanced Trading Strategies and Tactics.* (Irwin-Probus: London).

Asset Market Hangovers and Economic Growth: U.S. Housing Markets, joint with Matthew Higgins (1998). In: *The Role of Asset Prices in the Formulation of Monetary Policy*, BIS Conference Papers Vol. 5 (Bank for International Settlements, Basle).

Asset Market Hangovers and Economic Growth: The OECD During 1984-1993, join with Matthew Higgins (1997). *Oxford Review of Economic Policy* 13(3): 110-34.

Charting : Chaos Theory in Disguise? joint with William Clyde (1997). *Journal of Futures Markets* 17(August): 489-514.

Exchange Rate Dynamics and Speculators' Horizons (1995). *Journal of International Money and Finance* 14: 695-719.

The Credit Slowdown Abroad, joint with S. Hickok (1994). In: *Studies on Causes and Consequences of the 1989-92 Credit Slowdown* (Federal Reserve Bank of New York): 429-73.

High Real Interest Rates and Investment in the 1990s (1994). Federal Reserve Bank of New York *Quarterly Review* 19(1): 38-44.

Interest Rate Term Premiums and the Failure of Uncovered Interest Rate Parity (1992). *Journal of International Financial Markets, Institutions and Money* 2(2): 1-26.

Factor Prices Under Integrated Markets for Risky Capital, (1991). *European Economic Review* 35: 1311-40.

Explaining the Absence of International Factor-Price Convergence (1991). *Journal of International Money and Finance* 10: 89-107.

Optimal Growth Under Uncertainty (1991). *Economic Letters* 36: 31-35.

OTHER PUBLICATIONS

Greece Illustrates the Importance of Staying Within Economic Limits (2015). *European Politics and Policy* (London School of Economics) September 1. http://blogs.lse.ac.uk/europpblog/2015/09/01/greece-illustrates-the-importance-of-staying-within-economic-limits/

Reading Between the Lines of Greece's Bailout: Debt Relief is Inevitable – Just Not Yet (2015). *The Conversation*. July 20. http://theconversation.com/reading-between-the-lines-of-greeces-bailout-debt-relief-is-inevitable-just-not-yet-44744

The Fix Is In (2014). *The Conversation*. November 13. http://theconversation.com/the-fix-is-in-how-banks-allegedly-rigged-the-us-5-3-trillion-foreign-exchange-market-33828.

WORKING PAPERS

Shrouding and the Forex Trades of Global Custody Banks. (with Tanseli Savaser). https://ideas.repec.org/p/brd/wpaper/118.html. Resubmitted to the *Journal of Banking and Finance.*

Price Discrimination in OTC Markets. (with Geir Bjønnes and Neophytos Kathitziotis). January, 2017.

Dealer Trading at the Fix (with Alasdair Turnbull). September 2020.

Private Non-fundamental Information and Adverse-Selection in Cryptocurrencies, November 2019, joint with Shuran Zhang.

Information Content of Marketable Limit Orders, November 2019, joint with Shuran Zhang.

Short-Run Exchange-Rate Dynamics: Theory and Evidence, with J. A. Carlson and C. Dahl.

WORK IN PROGRESS

Explaining the Intraday Behavior of Spreads in the Foreign Exchange Interbank Market, joint with David Simon and Shuran Zhang

OTHER ACADEMIC ENGAGEMENTS

THESIS ADVISING

Current Ph.D.
Neophitos Kathitziotis (Hamburg Univ.)
Karen Smith

Completed Masters Theses
Olzas Kuramazov
Damir Ćosić

Completed Ph.D., Chair
Shuran Zhang
Ly Tran
Rawley Heimer
David Simon
Rimma Yusim Sherman
Vitaliy Vandrovych
Prasandjeet (Vinay) Nundlall
Tanseli Savaser
Jennifer Chu Bender

Completed Ph.D., Committee
Henok Tewolde
Siri Valseth (Norwegian Schl.Mgmt.)
Kjell Jorgenson (Norwegian Schl.Mgmt.)
Tyler Hull Gotham George
Ritti Bumiputra
Eskandar (Sandro) Tooma
Xia Meng
Ma Gang
Heidi Zhao

TEACHING

Courses taught since 2002

- Human Psychology and Financial Decision Making (Brandeis, undergraduates)
- Behavioral Finance and Economics (Brandeis - master's students)
- Applied International Macroeconomics (Brandeis - master's students)
- Trading and Exchanges (Brandeis - master's students)
- Central Banking (Brandeis - master's students)
- Investments (Brandeis - master's-level)
- International Finance (Brandeis - Ph.D. students)
- Financial Market Microstructure (Norwegian School of Management - Ph.D. students)
- Basic Finance (Massachusetts Correctional Institution, Concord)

Past teaching expertise

- Macroeconomics (Amos Tuck School of Business, Dartmouth)
- Bank Management (Amos Tuck School of Business, Dartmouth)
- International Capital Markets (Amos Tuck School of Business, Dartmouth; Kellogg Graduate School of Management, Northwesterm)
- Monetary Theory (Columbia University, undergraduates)
- International Finance (Columbia University, undergraduates and SIPA)

FELLOWSHIPS AND AWARDS

Brandeis University International Business School Teaching Award, 2018.

Martin and Ahuva Gross Chaired Professorship in Financial Markets and Institutions.

Brandeis Teaching Innovation Grant, 2015

Market Technicians Association, Inc., Recognition Award for the Teaching of Technical Analysis in Academia.

Brandeis University International Business School Teaching Award, 2008.

First Prize, Academic Papers Competition, Investors' Forum, December, 1996, for Rational Speculators and Exchange Rate Volatility (with John Carlson).

Faculty Research Fellow, National Bureau of Economic Research, 1987-1991.

Ford Foundation Scholar, National Bureau of Economic Research, Fall 1988.

REFEREE

Ad hoc referee: *Journal of Economic Literature, NSF, Review of Financial Studies, Journal of Finance, Journal of Financial Markets, Journal of Financial and Quantitative Analysis, Journal of Financial Markets, International Economic Review, Journal of Money, Credit, and Banking, European Economic Review, Economic Bulletin, Journal of International Economics, Journal of Development Economics, Journal of Financial Management, IMF Staff Papers, Science, Review of Economics and Statistics, Journal of International Money and Finance, Journal of Economic Behavior and Organizations, European Journal of Finance, Journal of Empirical Finance, Canadian Journal of Economics, Journal of Financial Services Research, Journal of Economics and Business, Journal of Macroeconomics, Journal of Futures Markets, Quarterly Review of Economics and Finance, Applied Operations Research, Quantitative Finance.*

SEMINARS AND CONFERENCE PRESENTATIONS

Discussant: Locked-in at home: Female Analysts' Attention at Work During the COVID-19 Pandemic. Mengqiao Du. Northern Finance Association Annual Meeteings, September 2021.

Presenter: Workplace Bullying in Economics: Nature, Consequences, and Recommended Policies, Southern Economic Association Annual Meetings, 2020.

Presenter: Dealer Trading at the Fix. December, 2019. 3rd Sydney Banking and Stability Conference, Sydney, Australia. Also: discussant.

Presenter: Dealer Trading at the Fix. October, 2018. FMA Meetings, San Diego, CA. Also: discussant.

Presenter: Dealer Trading at the Fix. June 12, 2018. Infiniti Conference on International Finance, Poznan, Poland. Also: discussant.

Presenter: Dealer Trading at the Fix. December 15, 2017. Second annual Conference on High Frequency Exchange Rate Dynamics: Econophysics and Econometric Analysis Based on the EBS data sets. Tokyo, Japan.

Presenter: Dealer Trading at the Fix. December 21, 2017. Eurofidai Conference, Paris, France.

Discussant, Did the Reform Fix the London Fix problem? By Takatoshi Ito and Masahiro Yamada. March, 2017: International Conference on High Frequency Exchange Rate Dynamics: Econophysics and Econometric Analysis Based on the EBS data sets. Tokyo, Japan

Discussant: Puzzles in the Tokyo Fixing in the Forex Market: Order Imbalances and Bank Pricing? By Takatoshi Ito. March 2017: International Conference on High Frequency Exchange Rate Dynamics: Econophysics and Econometric Analysis Based on the EBS data sets. Tokyo, Japan

Presenter: Dealer Trading at the Fix. December 2016: 6th Workshop on Financial Determinants of Foreign Exchange Rates, Cass Business School, London.

Presenter: Bank Reserve Management After the Global Financial Crisis, IBS Brown Bag, December 2016.

Presenter: Price Discrimination in OTC Markets. November 2016, Wilfried Laurier University, Ontario, Canada.

Presenter: Dealer Trading at the Fix. October 2016: Financial Management Association Annual Meetings, Las Vegas.

Presenter: Dealer Trading at the Fix. October 2016. OECD, Paris.

Presenter: Dealer Trading at the Fix September 2016: 12th Annual Central Bank Workshop on the Microstructure of Financial Markets, Banque de France, Paris.

Presenter: Dealer Trading at the Fix. September 2016: Portsmouth-Fordham Conference on Banking and Finance, University of Portsmouth, UK.

Presenter: Dealer Trading at the Fix. September 2016: Cass Business School, London.

Presenter: Price Discrimination in OTC Markets. September 2016, CFM (Hedge Fund) Paris.

Presenter: Dealer Trading at the Fix. September 2016: University of Essex Business School, Colchester, England.

Discussant: June 2016: Illiquidity in the stock and FX markets: an investigation of their cross-market dynamics by Chiara Banti. Women in Microstructure conference, Park City, UT

Presenter: Price Discrimination in OTC Markets. April 2016: Eastern Finance Association meetings, Baltimore, MD.

Discussant: Libor's Poker. By Jiakai Chen. April 2016: Eastern Finance Association meetings, Baltimore, MD.

Presenter: Depth and Information in the Foreign Exchange Limit Order Book: A Nonlinear Approach (with Ly Tran). June 2015, Women in Microstructure Conference.

Discussant: Forex Trading and the WMR Fix, by Martin D.D. Evans. NYU-Stern Annual Microstructure Meetings, May 2015.

Discussant: Understanding FX Liquidity, Karnaukh, Ranaldo, Soöerlind, 10th Annual Central Bank Workshop on the Microstructure of Financial Markets, Rome, Italy, October 2014.

Presenter: Asymmetric Information and the Foreign Exchange Trades of Global Custody Banks, Joint with

Tanseli Savaser and Thang Tan Nguyen. Midwest Finance Association Annual Meeting, New Orleans, February 23, 2012.

Discussant: Mink, Mark, Procyclical Bank Risk-Taking and the Lender of Last Resort, DNB Working Paper No. 301 (July 2011). Midwest Finance Association Annual Meeting, New Orleans, February 23, 2012.

Presenter: Noise Trading and Illusory Correlations in U.S. Equity Markets, joint with Jennifer Bender and David Simon. Behavioral Finance Working Group Conference, Cass Business School, London. (presented, due to time conflict, by David Simon) April 7, 2011.

Discussant: Market Reaction to Second-Hand News: Attention Grabbing or Information Dissemination? Cervellati, Enrico Maria, Riccardo Ferretti, and Pierpaolo Pattitoni (presented by David Simon). April 7, 2011.

Presenter: Extreme Returns: The Case of Currencies, joint with Tanseli Savaser. Boston QWAFAFEW, July 2010.

Presenter: Hedge Funds and the Origins of Private Information in Foreign Exchange Markets, French Finance Association Meetings, Paris, December 16, 2009.

Presenter: Uninformed Momentum Traders, Ali Emre Konokoglu, Discussion, French Finance Association Meetings, Paris, December 16, 2009.

Presenter: Technical Analysis of Equity Indexes, Warwick Business School, University of Warwick, U.K. December 2, 2009.

Presenter: Technical Analysis of Equity Indexes, AFATE, Paris, December 16, 2009.

Presenter: Technical Analysis of Equity Indexes, Society of Technical Analysts, London, November 10, 2009.

Presenter: Overconfidence in Currency Markets, Cass Business School, London, November 4, 2009.

Presenter: Exchange-Rate Effect of Multi-Currency Arbitrage, Harald Hau, Discussion, Sixth Annual Central Bank Workshop on the Microstructure of Financial Markets, Zurich, Switzerland, October 8, 2009.

Presenter: Hedge Funds and the Origins of Private Information in Foreign Exchange Markets, Bank for International Settlements, Basel, October 7, 2009.

Presenter: Extreme Returns Without News: The Case of Currencies, Financial Economics Research Center Conference on Microstructure, September 23, 2009.

Discussant, Crash Risk in Currency Markets, Romain Ranciere, Xavier Gabaix, Adrien Verdelhan, Emmanuel Farhi, Discussant, Western Finance Association Meetings, San Diego, June 17-20, 2009.

Presenter: Hedge Funds and the Origins of Private Information in Foreign Exchange Markets, Third Annual Microstructure Workshop, Emerging Markets Group, Cass Business School, London, May 1, 2009.

Panelist, Causes and Consequences of the Financial Crisis, Jean Beer Center for Ethics, Philosophy Department, Georgia State University, Atlanta, GA, March 18, 2009.

Presenter: Extreme Returns Without News: The Case of Currencies, State Street Advanced Research Center, March 11, 2009.

Presenter: Extreme Returns Without News: The Case of Currencies, International Federation of Technical Analysts, Paris, November 6-8, 2008.

Presenter: Extreme Returns Without News: The Case of Currencies, Midwest Finance Association meetings, Dallas, Texas, October 2008.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, Infiniti Conference, Dublin, Ireland, June 2008.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, Seminar at UNH Durham, October 2007.

Presenter: Asymmetric Information in the Interbank Foreign Exchange Market, Joint with Geir Bjønnes and Dagfinn Rime, *Third Annual Conference on Market Microstructure*, Budapest, Hungary, September 15, 2007.

Presenter: Extreme Returns: The Case of Currencies, joint with Tanseli Savaser. *Third Annual Conference on Market Microstructure*, Budapest, Hungary, September 15, 2007

Presenter: Price Discovery in Currency Markets, Seminar Presentation at the NBER Conference on Microstructure, May 11, 2007.

Presenter: Price Discovery in Currency Markets, Seminar Presentation at Acadian Asset Management, April 4, 2007.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, Seminar at Williams College, April 2, 2007.

Presenter: Price Discovery in Currency Markets, Seminar presentation at Rutgers University, November 28, 2006.

Presenter: Price Discovery in Currency Markets, Seminar at State Street Global Research Advanced Research Center, December 2007.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, seminar presentation at Hannover University, Hannover, Germany, November 15, 2006.

Presenter: Price Discovery in Currency Markets, seminar presentation at the University of Copenhagen, Copenhagen, Denmark, November 13, 2006.

Presenter: Price Discovery in Currency Markets, Bank of Canada/Norges Bank Conference on the Microstructure of Equity and Foreign Exchange Markets, Ottawa, Canada. October 20-21, 2006.

Presenter: Price Discovery in Currency Markets, Seminar presentation at the Federal Reserve Bank of St. Louis, October 4, 2005.

Presenter: Price Discovery in Currency Markets, Hong Kong Institute for Monetary Research Conference on financial Markets and the Macroeconomy. Hong Kong, July 13-14, 2006.

Presenter: Price Discovery in Currency Markets, MMF/ESRC/WFRI Workshop on the Micro Structure of FX markets and Fixed Income. Warwick University Business School, Wednesday 28th June 2006.

Presenter: Macro Lessons from Microstructure, Seminar presentation at University of North Carolina, April 1, 2006.

Presenter: Macro Lessons from Microstructure, Seminar presentation at the Bank of Canada, April 12, 2006.

Presenter: Macro Lessons from Microstructure, Seminar presentation at University of Virginia, March 1, 2006.

Presenter: Getting Tenure, CSWEP Annual Mentoring Conference, Boston, MA, January 10, 2006.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, American Economic Association Annual Meetings, Boston, MA January 8, 2006.

Presenter: Macro Lessons from Microstructure, Econometric Society Annual Meetings, Boston, MA, January 7, 2006.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, Norges Bank Conference on Equity and Foreign Exchange Microstructure, Oslo, Norway: September 7-8, 2005.

Presenter: Asymmetric Information and Currency Spreads, Bank of Canada/University of British Columbia Workshop on International Financial Markets, University of British Columbia: August 23-24, 2005.

Presenter: Asymmetric Information and Currency Spreads, Summer School and Workshop on Market Microstructure, Aix-en-Provence: July 4-8, 2005.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, Seminar presentation at the Federal Reserve Bank of Boston: May 2005.

Presenter: Stop-Loss Orders and Price Cascades in Currency Markets, Eighth International Conference on International Macroeconomics and Finance, University of Crete, Greece: May 26-28, 2004.

Presenter: Short-Run Exchange-Rate Dynamics: Theory and Evidence, Seminar at Federal Reserve Bank of Boston May 2004.

Presenter: Extreme Exchange-Rate Returns Without News: A Microstructural Approach, A series of seminars and private presentations to the clients of the Royal Bank of Scotland in London and New York. Fall 2003 and summer 2004.

Presenter: Identifying Noise Traders: The Head-and-Shoulders Pattern in U.S. Equities. 4th Empirical Finance Conference, Financial Markets Group, London School of Economics: April 30, 2003.

Presenter: Stop-Loss Orders and Price Cascades in Currency Markets, Currency Market Microstructure Conference, Stockholm Institute of Finance, Stockholm: April 12, 2003.

Presenter: Identifying Noise Traders: The Head-and-Shoulders Pattern in U.S. Equities. Conference on Computational Finance, New York, NY, January 1999.

Presenter: Identifying Noise Traders: The Head-and-Shoulders Pattern in U.S. Equities. Financial Management Association Annual Meetings, New York City, October 1998.

Presenter: Identifying Noise Traders: The Head-and-Shoulders Pattern in U.S. Equities. Conference on Forecasting Financial Markets sponsored by Imperial College, London, and Banque National de Paris. London, May 27-29, 1998.

Presenter: Identifying Noise Traders: The Head-and-Shoulders Pattern in U.S. Equities. French Finance Association Annual Meetings, Grenoble, France, June 23-25 1997.

Presenter: Head-and-Shoulders: Not Just a Flaky Pattern, System Committee on International Economics Meetings, Kansas City, 1995.

Presenter: Head-and-Shoulders: Not Just a Flaky Pattern, Financial Management Association Annual Meetings, New York City, October 1995.

Presenter: Head-and-Shoulders: Not Just a Flaky Pattern, Conference on Forecasting Financial Markets, London, April 1995.

Presenter: Head-and-Shoulders: Not Just a Flaky Pattern, Eastern Economic Association Meetings, New York, NY, March 1995.

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