

Corporate Governance and Firm Value: The Impact of the 2002 Governance Rules

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ABSTRACT

The 2001 to 2002 corporate scandals led to the Sarbanes–Oxley Act and to various amendments to the U.S. stock exchanges' regulations. We find that the announcement of these rules has a significant effect on firm value. Firms that are less compliant with the provisions of the rules earn positive abnormal returns compared to firms that are more compliant. We also find variation in the response across firm size. Large firms that are less compliant earn positive abnormal returns but small firms that are less compliant earn negative abnormal returns, suggesting that some provisions are detrimental to small firms.

THE HIGH-PROFILE CORPORATE FAILURES IN THE UNITED STATES over the 2001–2002 period have led to the Sarbanes–Oxley Act of 2002 (SOX) and to various amendments to the stock exchanges' regulations. These rules include different provisions whose purpose is to ensure alignment of incentives of corporate insiders with those of investors, and to reduce the likelihood of corporate misconduct and fraud. For example, SOX imposes higher penalties on officers who are charged with forging documents and requires more timely disclosure of equity transactions by corporate insiders. It also requires independence of audit committees, certification of financial statements by the chief executive officer and the chief financial officer, procedures to evaluate the effectiveness of the firms' internal controls and increased oversight over audit firms. The exchange regulations require a majority of independent directors on corporate boards and independence of the board committees that choose new directors and compensate managers.

Proponents of the rules argue that such rules are necessary because the corporate scandals indicate that existing monitoring mechanisms in U.S. public corporations should be improved.

Yet, it is not clear whether the provisions of the rules indeed lead to more effective monitoring and to higher corporate value. To the extent that these provisions are only cosmetic in nature, they might not have any material effect on firm value. But even if the provisions have an effect, it is not clear whether all firms should benefit from them. Optimal governance structure depends both on a firm's monitoring needs and the costs and benefits of different monitoring mechanisms. To the extent that these costs and benefits vary across firms and

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over time, optimal governance structure should also vary. Thus, imposing one structure on all firms might be suboptimal at least to some firms.¹

Scholars and practitioners have raised the concern that some provisions of the rules do not benefit small firms. In particular, Holmstrom and Kaplan (2003), among others, have argued that relative to their size, small firms bear higher costs of complying with the internal control requirements of the SOX. In addition, smaller firms might find it hard to attract qualified independent directors to their boards, and thus are more likely to bear higher costs of complying with the director independence requirements.

In this article, we study the announcement effect of the new governance rules on firm value. We ask whether the rules have any significant effect on firm value, and whether there is a difference in the announcement effect across small and large firms.

To test the effect of the rules on firm value, we construct portfolios of firms based on the degree to which they are compliant with the rules. We then compare the returns of these portfolios during the rule announcement period. If the relative effect of the rules on the less compliant firms is positive, then, holding all else constant, the portfolio of the less compliant firms should outperform the portfolio of the more compliant firms. If, on the other hand, the relative effect is negative, then, holding all else constant, a portfolio of firms that are less compliant should underperform a portfolio of firms that are more compliant.

The rules consist of many provisions, each of which has a different effect on firms. We construct five different portfolios to capture the effect of the following main provisions: insider trading provisions, financial reporting provisions, related party transaction provisions, internal control provisions, and board and committee independence provisions. For each of these provisions, we construct a portfolio of firms that are less compliant with that provision and we test whether that portfolio outperforms or underperforms during the announcement period a benchmark portfolio of firms that are more compliant with that provision. For the insider trading provisions, the less compliant portfolio consists of firms whose insiders sold shares in the past just before a negative shock to the stock price, and therefore are more likely to be perceived by the market as timing the market. For the financial reporting provisions, the less compliant portfolio consists of firms that restated their financial statements in the past; for the related party transaction provisions, the less compliant portfolio consists of firms that engage in related party transactions. For the internal control provisions, the less compliant portfolio consists of firms that replaced their auditors in the past, and for the director independence provisions, the less compliant portfolio consists of firms that do not comply with the director independence requirements.

¹ For empirical evidence regarding the variation of governance mechanisms across firms and over time see for example, Hermalin and Weisbach (1988, 1998), Cremers and Nair (2005), Gillan, Hartzel, and Starks (2003), and Lehn, Patro, and Zhao (2004). See also Romano (2005), who argues that the corporate governance provisions of the SOX legislation should be stripped of their mandatory force and rendered optional, so that firms can decide whether they want to adopt them.

In general, we find that during the announcement period, portfolios of firms that are less compliant with the rules earn positive abnormal returns compared to portfolios of firms that are more compliant. Firms that restated their financial statements, firms whose insiders are perceived as timing the market, firms that have related party transactions, and firms that did not comply with the board independence provisions outperform their peers during the announcement year. The magnitude of the abnormal return is in the order of 6%–20%. We perform several robustness tests to determine whether our results are driven by events not related to the rules or by some unobserved firm characteristics. Our results are robust to all these tests.

Since the internal control and the director independence provisions are the ones that are likely to affect small firms and large firms differently, we analyze large and small firms separately for these provisions. We find that, for these provisions, the positive abnormal return obtains only in large firms; small firms that are less compliant with these provisions do not outperform small firms that are more compliant with them. In fact, we find some evidence for negative abnormal returns. For example, a portfolio of small firms with less board independence underperforms a matching portfolio of small firms with more board independence by about 12% during the announcement year. The results suggest that these provisions of the rules might impose suboptimal structure or excessive costs on small firms.

Our methodology identifies relative, rather than absolute, benefits of the provisions on firm value. To the extent that some provisions of the rules impose costs or benefits on all firms, these costs and benefits are not captured in our analysis. However, we note that certain provisions, such as the board independence provision or the related party transactions provision, are not likely to impose costs on firms that are already complying with them—and therefore the relative benefits and costs are more likely to coincide with the absolute benefits and costs to these firms.

This article contributes to the line of research that examines the relation between corporate governance and firm value (e.g., Yermack (1996), Gompers, Ishii, and Metrick (2003), Cremers and Nair (2005), Bebchuk, Cohen, and Ferrel (2004)). Many of these studies find that certain governance structures are associated with better performance and higher firm value. However, it is sometimes hard to interpret the results in these studies since governance structure is a variable chosen by firms, in part because of their monitoring needs. Controlling for this endogenous relation often requires additional assumptions on the potential effect of firm characteristics on governance structure and firm value, which can lead to estimation bias and reduced statistical power. The new governance rules offer a unique laboratory to test the effect of governance structure on firm value since the rules can be considered an outside intervention to the governance structure of firms.

This research also contributes to the literature that studies the desirability of governance rules on corporations. Dahya, McConnell, and Travlos (2002) study the effect of the Cadbury committee recommendations on the relation between

corporate performance and managerial turnover in the United Kingdom. They find that firms adopting the recommendations have larger sensitivity of CEO turnover to performance. Greenstone, Oyer, and Vissing-Jørgensen (2005) study the effect of the 1964 Over the Counter disclosure rules on firm value and find an overall positive effect. Gomes, Gorton, and Madureira (2007) study the effect of the Fair Disclosure regulation on firms' cost of capital and find that the rules result in reduced cost of capital in large firms but increased cost of capital in small firms.

More closely related to our work are the studies of Li, Pincus, and Rego (2006), Jain and Rezaee (2006), and Zhang (2005), who all look at the announcement effect of the SOX on firm value. Unlike our study, the approach in these studies is to identify key dates associated with changes in the likelihood that the law would be passed and examine the abnormal market and firm-level reactions around those dates. Li, Pincus, and Rego (2006) and Jain and Rezaee (2006) find a total positive effect of SOX on firm value, while Zhang (2005) finds a total negative effect of SOX on firm value. The results differ across the studies likely because each identifies different key dates associated with the rules, and each has a different interpretation as to whether the information release on these key dates increased or decreased the likelihood that the law would be passed. Our study tries to overcome this identification problem by considering a large event window that captures any information spillover and belief updates by the market during the legislation-making process. We are also better able to control for market-wide shocks not associated with the rules by focusing on differences in returns between portfolios of firms that are less compliant with the rules and matching portfolios of firms that are more compliant with the rules. Finally, we also explore variations in the announcement effect across firm size.

The rest of the article proceeds as follows. Section I summarizes the new rules' background and provisions. Section II describes the methodology, and Section III presents the data and variables. Section IV provides the results, Section V discusses robustness checks, and Section VI concludes.

I. Background and Provisions

The new governance rules of 2002 came after a series of corporate scandals involving accounting irregularities and share price manipulation. The most notorious of these scandals is perhaps the collapse of the energy company Enron.² On November 8, 2001, Enron filed restated financial results with the Securities and Exchange Commission (SEC). The restatement came after several weeks of SEC investigations, which revealed several accounting irregularities and showed that the company was more heavily indebted than its earlier statements indicated. On December 2, 2001, Enron filed for bankruptcy protection. The SEC identified accounting irregularities and corporate misconduct in a number of other firms, including Tyco and Worldcom, several months later.

² For an analysis of the Enron collapse, see, for example, Healy and Palepu (2003).

Between December 2001 and April 2002, the Senate Committee on Banking, Housing, and Urban Affairs and the House Committee on Financial Services held numerous hearings about the collapse of Enron and related accounting and investor protection issues. These hearings and the corporate scandals that followed Enron led to the passage of the SOX. The Senate and the House reached consensus on the act on July 24 and voted almost unanimously for the act on July 25, 2002. President George W. Bush signed the bill into law on July 30, 2002.

The act has 11 sections. These sections include new requirements on accounting firms, financial analysts, corporate officers, and corporate directors. The main provisions of the SOX are as follows:

1. Section I: Establishment of the Public Corporation Accounting Oversight Board. Among its tasks are to register public accounting firms, to establish standards related to the preparation of audit reports, and to oversee public accounting firms.
2. Section II: Restrictions on public accounting firms. Accounting firms should not provide any nonauditing services contemporaneously with auditing services and coordinating and reviewing auditing partners should rotate every 5 years.
3. Section III: Corporate responsibility. This section includes provisions such as independence of audit committee members (subsection 301), executive certification of financial reports (subsection 302), and forfeiture of certain bonuses to executives upon financial restatements (subsection 304).
4. Section IV: Enhanced financial disclosure and internal controls. The main provisions in this section require enhanced disclosure of firms' relationships with unconsolidated entities (subsection 401), prohibition of personal loans to executives (subsection 402), disclosure of managerial assessment of internal controls (subsection 404), code of ethics for senior financial officers (subsection 406), and disclosure of whether the audit committee has a financial expert (subsection 407).³
5. Sections VIII, IX, and XI: Increased penalties for corporate fraud.

The numerous cases of accounting irregularities and corporate misconduct also led to changes to the stock exchanges' regulations. On February 13, 2002, in the midst of the Senate and House investigation of Enron, the SEC called for the major stock exchanges to review their governance requirements. On June 6, 2002, the New York Stock Exchange (NYSE) announced the governance proposal recommended by its board committee. NYSE's board approved the proposal on August 1, 2002, and submitted it to the SEC for approval on August 16 of that year. The main provisions of the final NYSE proposal are:

³ Section 404 is potentially the most costly of these provisions. In order to assess their internal controls, CEOs need to establish mechanisms that assess the quality of the internal controls across all levels in the organization, detect potential risks in the internal control procedures and implementations, and establish ways to eliminate these risks.

1. All firms must have a majority of independent directors.
2. Independent directors must comply with an elaborate definition of independent directors.
3. The compensation committee, nominating committee, and audit committee shall consist of independent directors.
4. All audit committee members should be financially literate. In addition, at least one member of the audit committee is required to have accounting or related financial management expertise.
5. In addition to its regular sessions, the board should hold additional sessions without management.

The National Association of Securities Dealers Automated Quotation System (NASDAQ) followed a similar process. On April 12, 2002, NASDAQ announced that its executive committee approved a first round of governance change proposals. NASDAQ's board of directors approved these proposals on May 22, 2002. On July 24, 2002, NASDAQ's board approved a second round of proposals that closely follow those of the NYSE.⁴ NASDAQ submitted its second-round proposals to the SEC in October 2002. After a few minor changes, the SEC approved the NYSE and NASDAQ proposals in November 2003.

Figure 1 summarizes the events leading up to the SOX legislation and exchange regulations. This timeline suggests that the new governance rules took months to develop and pass. Hence, market expectations with respect to the rules could have gone in different directions before the rules were signed. It is also clear from the timeline of events that the initial catalyst for this legislative process is the Enron scandal. Accordingly, we choose an event window between November 2001 and October 2002 to capture the entire effect of the events related to the legislation on corporate value.

II. Methodology

Our goal is to assess whether the governance rules have an effect on firm value. Toward that end, we compare the announcement period returns of firms that are less compliant with the rules to those of firms that are more compliant with the rules, controlling for other firm attributes that are likely to affect returns. If the rules have a positive effect on the less compliant firms compared to the more compliant firms, then, holding all else constant, the portfolio of the less compliant firms should outperform the portfolio of the more compliant firms.

In analyzing aggregate abnormal returns associated with rule announcement, we face a clustering problem: Since all firms under consideration are affected by the same event, the covariance among their abnormal returns differs from zero, and thus a simple event study test in which the abnormal returns of

⁴ NASDAQ relaxes some of the NYSE provisions to better fit smaller firms. The main difference is that (1) it allows the compensation and nomination decisions to be made by a majority of independent directors without a formal committee, and (2) in special circumstances it permits one nonindependent board member to participate in these decisions.

individual stocks are aggregated (or regressed against explanatory variables) will be biased and will lead to wrong inferences. To mitigate the clustering problem, Schwert (1981) and Campbell, Lo, and MacKinlay (1997) recommend using a portfolio approach whereby firms under consideration are grouped into portfolios and the return of each portfolio is compared against a benchmark. We adopt their approach in this paper, using two different methodologies to form our benchmark portfolios. Both methodologies are reminiscent of Greenstone, Oyer, and Vissing-Jørgensen (2005), who test the announcement effect of disclosure rules in U.S. companies across different portfolios of firms.

Our first benchmark is based on the four-factor model. Let A denote a portfolio of firms that are less compliant with the rules, and R_{At} denote its return on date t . We run the following regression over the daily portfolio returns between November 2001 and October 2002:

$$R_{At} - R_{ft} = \alpha_A + \beta_{1A}(R_{mt} - R_{ft}) + \beta_{2A}SMB_t + \beta_{3A}HML_t + \beta_{4A}MOM_t + \varepsilon_t, \quad (1)$$

where R_{ft} is the risk-free rate. The first factor, $R_{mt} - R_{ft}$, controls for the excess return that is correlated with the market excess return. The second and third factors, SMB_t and HML_t , are based on Fama and French (1993) and represent the differences in returns between portfolios of small and large firms (SMB) and the differences in returns between portfolios of high and low book-to-market ratios (HML), respectively.⁵ The momentum factor, MOM_t , follows from Carhart (1997).

The parameter α_A in equation (1) measures the excess return of portfolio A relative to the four factors. Since we consider daily returns, α_A represents the average excess daily return. Thus, if the relative effect of the rules is positive, then the abnormal return of portfolio A should be positive and significant. (To give an idea of the economic significance of these coefficients, we also report the average annualized excess return, which we obtain by multiplying the α parameter by 252 trading days.) In the regression analysis we consider both equal-weight portfolios and value-weight portfolios.⁶

Our second benchmark is based on matched sample methodology (e.g., Barber and Lyon (1997), and Barber, Lyon, and Tsai (1999)). We match firms that are less compliant with the rules with firms that are more compliant with the rules based on industry, market capitalization, and market-to-book (in some of our tests we also match based on past performance and leverage). We define the market-to-book ratio as the market value of the firms' equity plus the book value of the firms' assets minus the book value of the firms' equity, all divided by the book value of the firms' assets. The industry matching is based on Fama and French's 17-industry classification. We require that the market capitalization of the matched firm be within $\pm 30\%$ of the market capitalization of the firm

⁵ Our source for these daily factors is Kenneth French's web site, <http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/>. To mitigate any potential non-synchronous trading biases, we also used weekly returns. All of our results stay the same when we consider weekly returns.

⁶ To reduce the effect of outliers, we winsorize the value-weight returns at 1%.

that is less compliant with the rules, and of the firms within this range we select the firm with the closest market-to-book ratio.⁷

Let R_{iA}^M denote the event period buy-and-hold return of firm i which is less compliant with the rules, and let R_{iNA}^M denote the buy-and-hold return of its matched firm, where the matched firm is more compliant with the rules. Define $R_g^M = \frac{1}{N} \sum_{i=1}^N R_{ig}^M$ to be the buy-and-hold return of the portfolio of firms that have a score $g = \{A, NA\}$, and define $\hat{\Delta} = R_A^M - R_{NA}^M$ to be the difference in returns between portfolios A and NA . Since, by assumption, the matching portfolios should have similar risk characteristics, we should expect $E(\Delta) = 0$. We can therefore form the t -statistics $\hat{\Delta}/\hat{\sigma}_\Delta$, where $\hat{\sigma}_\Delta^2$ is the return volatility of a portfolio that is long A and short NA , measured over the three months before the event period.

One of the drawbacks of the above hypothesis test is that it is based on asymptotic theory, which can be misleading when the sample size is small. The bootstrap methodology can help improve the accuracy of such a test, (e.g., Mackinnon (2002)). We therefore use this methodology in our analysis. We first generate the empirical distribution of the t -statistics. For each firm that is less compliant with the rule, we randomly select (with replacement) a more compliant firm that is in the same industry and in the same quintile in terms of the matched characteristics (our matching quintiles are based on the Compustat population). After matching all firms in our sample, we calculate $\hat{\Delta}$, $\hat{\sigma}_\Delta^2$, and the t -statistic $\hat{\Delta}/\hat{\sigma}_\Delta$. We repeat the entire process 1,000 times until we have 1,000 observations of the t -statistic. We then compare the t -statistic from our original test to the distribution of t -statistic from the empirical distribution, and reject the hypothesis that the t -statistic is not positive at the α significance level if the fraction of t -statistics observations above the t -statistic under consideration is lower than α .

III. Data Description and Variables

We measure the extent to which the rules affect firm value by comparing portfolios of firms along five different provisions: insider trading provisions, financial reporting provisions, related party transaction provisions, internal control provisions, and director independence provisions.

In this section, we describe the variables we use to measure the compliance with each of the above provisions and we discuss our source of data for each variable. The financial data for all tests come from the Center for Research in Security Prices (CRSP) database and the Compustat database.⁸

⁷To ensure that our selection methodology does not lead to biased samples, we test for differences in market capitalization and market-to-book between the two samples in each of our tests. We conduct both a rank test and a t -test. We do not detect any significant differences across our samples.

⁸We exclude from our samples penny stocks (stocks that are traded at a price of less than \$1). These stocks very often have low liquidity and limited attention from investors, and their price is less likely to fully reflect market information.

A. Insider Trading and Financial Reporting

One of the main aims of the SOX legislation is to limit corporate fraud, especially fraud associated with manipulation of financial statements and insider trading. Toward that end, SOX imposes increased penalties on corporate executives charged with manipulation of financial statements and fraudulent insider trading. It also requires forfeiture of certain bonuses and profits upon financial restatements.

We expect that if the new rules are effective, then firms that are perceived as fraudulent with respect to insider trading and financial reporting should increase in value compared to firms that are perceived as less fraudulent.

We conjecture that the market perceives firms whose corporate insiders sold shares just before a large drop in their stock price as among those firms whose insiders are more likely to have used their inside information at the shareholders' expense. We begin by considering all firms whose insiders sold shares between January 2001 and March 2001, where information about insider selling activity comes from Thomson Financial's Insider Filings database. Of this initial sample we retain firms that, between April 2001 and October 2001, experienced a large drop in price relative to the market (the bottom third of all sample firms that experienced a drop in price). We then generate two groups of firms. The first group consists of firms whose CEOs sold shares, and the second group consists of firms whose corporate insiders (directors or officers) sold shares. This procedure yields 72 firms in the CEO sample and 124 firms in the insider sample.

Similarly, we conjecture that the market perceives firms that had to restate their financial statements in the past as among those firms that are likely to benefit from the rules. This prediction follows from the accounting literature, which finds that firms that restate their financial statements are perceived by the market as having lower earnings quality and management credibility. For example, Dechow, Hutton, and Sloan (1996) and Palmrose, Richardson, and Scholz (2004) find that the market reaction to restatement announcements reflects not only the market's updated expectations about future cash flows, but also its revised expectations with respect to earnings quality and management credibility. Consistent with these findings, Hribar and Jenkins (2004) find that firms' cost of capital increases after restatements, and Anderson and Yohn (2002) find that the bid-ask spread of firms increases after financial restatements.⁹

⁹ Another approach is to group firms into portfolios according to how likely they are to manipulate their earnings, and to look at their returns during the announcement period. A number of studies in the accounting literature compare the characteristics of firms that had accounting problems to those of other firms and find differences in accounting variables, market variables, and governance variables (e.g., Dechow, Sloan, and Sweeney (1996), Beasley (1996), Summers and Sweeney (1998), Beneish (1999), Richardson, Tuna, and Wu (2002)). These variables can then be used to forecast the likelihood of a firm being associated with accounting problems or earnings manipulation. In our study, we look at firms that have accounting problems rather than at firms for which we estimate accounting problems to mitigate potential biases and reduced statistical power associated with such estimates.

We obtain data on firms that restated their financial statements from the Government Accountability Office (GAO). At the request of Senator Sarbanes, in October 2002 GAO published its investigation with respect to financial restatements. Using online searches of periodicals and news reports, the GAO identified 919 cases of financial restatements by 842 firms between January 1997 and June 2002. From this list, we retain firms that issued accounting restatements prior to November 2001 and for which information is available on Compustat and CRSP. A total of 312 firms are in our final sample.

B. Related Party Transactions

Related party transactions are transactions between the company and its insiders or affiliates. For instance, transactions such as buying certain goods or services from insiders, selling goods to insiders, or extending loans to executives all fall under the category of related party transactions.¹⁰

One criticism of these transactions is that they can be a way for corporate insiders to expropriate value from shareholders. For instance, in the case of Tyco and Adelphia, loans to executives were given at significant discounts to market rates, effectively transferring value from shareholders to executives. The lucrative terms of these loans were not properly disclosed to the shareholders. Moreover, in some cases these loans would also be collateralized by the firm's shares, and firms would often not require repayment of the loan if the stock price fell below a certain level (Bebchuk and Fried (2003)).

We expect the new rules to affect the degree to which related party transactions arise. First, the general provisions that deal with corporate fraud should cause insiders to be cautious about striking a deal with the company that might conflict with their duty to the shareholders. Further, SOX explicitly bans firms from extending loans to executives (Sec. 402), and requires enhanced disclosure of general contractual arrangements, which might include related party transactions (Sec. 401).

If the rules have a positive effect on firms that engaged in related party transactions, then holding all else constant, firms that had engaged in related party transactions in the past should benefit more from the rules than firms that had not engaged in related party transactions. We construct our related party transaction sample by selecting a random sample of 263 firms from the

¹⁰ For a detailed discussion of related party transactions, see, for example, Gordon, Henry, and Palia (2004). The Financial Accounting Standard Board (FASB) defines related party transactions as transactions between companies and their management, board members, affiliates, owners, or family members of these groups (FASB Statement No. 57). FASB requires the disclosure of material related party transactions in the financial statements. The SEC requires the disclosure of the following relationships or transactions: (a) transactions over \$60,000 between the company and affiliated persons such as board members, executives, principal owners, or the families of any of these groups; (b) ownership or management relationships between directors and any entity with which the company has a business relationship such as sales to, purchases from, loans to, or borrowings from; (c) transactions with promoters; and (d) corporate loans to the management of the company.

S&P 1500 index and determining whether these firms were involved in related party transactions in the years 2000 and 2001. For each firm, we read the proxy statements and the 10-K statements in the years 2000 and 2001 to identify disclosure of related party transactions. We find 138 disclosed related party transactions in 95 firms.

C. Board and Committee Independence

The new rules include several requirements related to board and committee independence. For example, the NYSE requires boards to have a majority of independent directors, an independent audit committee, an independent nominating committee, and an independent compensation committee, and other exchanges have adopted similar requirements. The SOX requires all public firms to have an independent audit committee.

We define firms that are more compliant with the director independence requirements as those that have at least three of the four above independence requirements, and we define firms that are least compliant as those that have only one or none of these requirements in place.

We obtain board structure information from the Investor Responsibility Research Center (IRRC), which provides governance information on firms that belong to the S&P 500, MidCap 400, and SmallCap 600 indexes. We exclude foreign issuers and firms in which there is one controlling shareholder, because the requirements of these firms differ from those of other U.S. issuers. We obtain financial information on the firms from the Compustat and CRSP databases. After merging these databases with the IRRC database, we have data for 1,101 firms.

D. Internal Controls

The rules require firms to enhance their internal controls. Among other provisions, firms must have procedures in place to evaluate their internal auditing (SOX 404) and management has to certify the accuracy of the financial statements (SOX 302). Our measure of whether a firm is perceived as having less effective internal controls is whether the firm replaced its external auditors in the past, since the choice to change auditors is often perceived as a way to shop for more favorable auditors' opinion. Indeed, the SEC raised concern that an auditor change might involve "the search for an auditor willing to support a proposed accounting treatment designed to help a company achieve its reporting objectives even though that treatment might frustrate reliable reporting" (Securities and Exchange Commission (1988)). Consistent with this concern, previous research suggests that, on average, auditor switches are considered bad news (e.g., Fried and Schiff (1981), Shu (2000)), and auditors switch firms when the client faces increased litigation risk (e.g., DeFond and Subramanyan (1998), Shu (2000)).

We obtain data on auditor changes from the Auditor Track database of Strafford Publications Inc., which gathers this information from the SEC filings

of U.S. public corporations. Our sample consists of all firms in the Strafford database that replaced their auditors between January 2001 and September 2001 and have information in the Compustat database. A total of 87 firms are in our final sample.

IV. Results

A. Insider Trading and Financial Reporting

Table I reports the results of the analysis of the group of firms whose insiders sold shares prior to a price drop. Panel A shows that the average dollar value of shares sold by CEOs in our sample between January 2001 and March 2001 is \$20.1 million, and the median is \$11.4 million. Insiders as a whole sold on average \$30.5 million worth of shares and a median of \$10.3 million worth of shares. The actual net amount from these sales to the CEO and the insiders is somewhat smaller because some of these sales were associated with redemptions of options. The mean drop in the price (net of market) between April 2001 and October 2001 in the CEO and insider samples is 27.7% and 27.8%, respectively, and the median drop is 18.6%, and 18.8%, respectively.

Table I, Panel A, also shows the financial characteristics of the firms in the insider trading group at the end of fiscal year 2001. The average market capitalization of the firms is \$10.4 billion in the CEO sample and \$11.9 billion in the insider sample. The medians are \$2.9 billion and \$2.6 billion, respectively. In comparison, the average market capitalization of all firms that belong to the S&P 1500 composite index is around \$9 billion, and the median market capitalization is around \$2 billion. Thus, compared to the S&P 1500 index, these two samples consist of relatively large firms. The average market-to-book ratio is 2.26 in the CEO sample and 2.24 in the insider sample, whereas the average market-to-book is around 1.95 in the S&P 1500 index. Therefore, the firms in our sample have higher growth opportunities or are valued higher than the average firm in the S&P 1500 index.

Panel B shows the sample portfolios' abnormal returns over the period November 2001 to October 2002. The α coefficient of the sample of firms whose CEO sold shares is 0.0009 in the equal-weight portfolio and 0.0010 in the value-weight portfolio. These coefficients are significant at the 5% level. We can convert these coefficients into average annualized abnormal returns by multiplying them by 252 trading days. The average annualized abnormal returns become 23% and 25%, respectively. We obtain similar results in the sample of firms whose insiders sold shares.

Panel C reports the abnormal returns of the matched sample methodology. We match firms based on market-to-book, size, industry, and past performance, using bootstrap analysis to generate the empirical distribution of the returns. We include the match based on past performance because, by construction, firms in the sample have had negative abnormal returns, and thus their returns during the announcement period may be driven by momentum. The results suggest that the portfolio of firms in which the CEO sold shares earned 13.9%

Table I
Insider Trading

The table shows abnormal returns of firms that are less compliant with the insider trading rules. The sample consists of firms whose insiders sold shares between January 2001 and March 2001, and whose stock had the worst negative return compared to the market between April 2001 and September 2001 (bottom third of firms with negative returns in the sample). Market-to-book is the market value of equity plus the book value of assets minus the book value of equity, all divided by the book value of assets. Abnormal returns are calculated over the period November 2001 and October 2002. In Panel C, the matching is based on market capitalization, market-to-book ratio, past performance, and industry. Industry match is based on Fama and French 17 industries classification. For a description of the bootstrap methodology, see the text. ** and *** indicate significance at the 5% and 1% levels, respectively.

Panel A: Summary Statistics									
	N	Shares Sold (\$ millions)		Return (Relative to Market)		Market Cap (\$ billions)		Market-to-Book	
		Mean	Median	Mean (%)	Median (%)	Mean	Median	Mean	Median
CEO redemption of shares followed by a large price decline	72	20.1	11.4	-27.7	-18.6	10.4	2.9	2.26	1.79
Insiders' redemption of shares followed by a large price decline	124	30.5	10.3	-27.8	-18.8	11.9	2.6	2.24	1.70

Panel B: Abnormal Returns: Four-Factor Returns						
Sample	N	Four-Factor Equal-Weighted			Four-Factor Value-Weighted	
		α	α Annualized (%)		α	α Annualized (%)
CEO redemption of shares followed by a large decrease in stock price	72	0.0009** (0.0004)	23		0.0010** (0.0005)	25
Insiders' redemption of shares followed by a large decrease in stock price	124	0.0008** (0.0004)	20		0.0008** (0.0004)	20

Panel C: Abnormal Returns: Matched Sample Methodology (Equal-Weight Portfolio)					
Sample	B&H Return (%)	Matched Sample Return (%)	Difference (%)	t-Statistics	p-Value Bootstrap
CEO redemption of shares followed by a large decrease in stock price	-11.0	-24.9	13.9	1.38	0.049**
Insiders' redemption of shares followed by a large decrease in stock price	-15.5	-26.7	11.2	1.41	0.001***

above the matched portfolio return during the announcement year. The portfolio of firms in which the insiders sold shares earned 11.2% above the matched portfolio return. The bootstrap analysis shows that these abnormal returns are significant at the 5% level or better. Thus, the bootstrap results corroborate the results of the four-factor model.

Table II shows the abnormal returns of the group of firms that filed financial restatements between January 1997 and November 2001. Table II, Panel A, gives the financial characteristics of the sample of firms. The average market capitalization is \$2.65 billion, but the median is only \$0.12 billion. This discrepancy suggests that the sample is skewed by several large firms. The average market-to-book ratio is 1.85, which is slightly lower than the average of 1.95 for the S&P 1500 index.

Table II, Panel B, shows the abnormal returns of the sample portfolio over the announcement period. The α coefficient is 0.0005 in both the equal-weight and the value-weight portfolios. These coefficients are significant at the 5% level. We convert these coefficients into average annual abnormal returns by multiplying them by 252 trading days. The average annual abnormal returns become 13% and 12%, respectively.

Panel B also shows the abnormal returns of the matched sample methodology. We match firms based on market-to-book, leverage, and industry, again using bootstrap analysis to generate the empirical distribution of the returns. Here we choose to match based on market-to-book and leverage because prior literature suggests that among firm's financial variables, these variables tend to strongly distinguish restating firms from others. (e.g., Richardson, Tuna, and Wu (2002)).

The results suggest that the portfolio of firms in which the CEO sold shares earned 8.5% above the matched portfolio return during the announcement year. The bootstrap analysis shows that this abnormal return is significant at the 5% level. Thus, the bootstrap results corroborate the results of the four-factor model.

B. Related Party Transactions

Table III summarizes the related party transactions results. Table III, Panel A, shows that related party transactions appear across large-, medium-, and small-size firms, and that Purchase and Loans are the most frequent types of related party transactions among our sample firms. Our definition of the different types of related party transactions follows that of Gordon, Henry, and Palia (2004). "Sales" comprises sales of company assets or goods to a related party such as the management or the board. "Purchase" comprises company purchases of goods from a related party such as a corporate executive, board member or party related to a board member. "Direct" comprises director-provided services to the company. "Loans" comprises company loans to management or directors.

Table III, Panel B, shows that the average market capitalization of firms that engage in related party transactions is \$6.6 billion at the end of fiscal

Table II
Financial Restatements

The table shows abnormal returns in a sample of firms that restate their financial statements between the years 1997 and 2001. Abnormal returns are calculated over the period November 2001 and October 2002. In Panel B, the matching is based on market-to-book ratio, leverage, and industry. Industry match is based on Fama and French 17 industry classification. For a description of the bootstrap methodology, see the text. ** indicates significance at the 5% level.

Panel A: Summary Statistics									
N	Market Cap (\$ billions)		Sales (\$ billions)		Market-to-Book				
	Mean	Median	Mean	Median	Mean	Median	Mean	Median	
312	2.65	0.12	3.02	0.37	1.85	1.32			

Panel B: Abnormal Returns									
N	Four-Factor Equal-Weight		Four-Factor Value-Weight		Matched Sample Equal-Weight				
	α	Annualized	α	Annualized	B&H Return	Matched Sample Return	Difference	t-Statistics	p-Value Bootstrap
312	0.0005** (0.0002)	13%	0.0005** (0.0002)	12%	-0.7%	-9.5%	8.5%	1.159	0.019**

Table III
Related Party Transactions

The table shows abnormal returns of firms whose insiders engage in related party transactions. The sample consists of 263 firms, randomly picked from the S&P 1500 index. Information on related party transactions comes from the 2000 and 2001 proxy statements and 10-K statements. We follow the classification of Gordon, Henry, and Palia (2004) and divide related party transactions into four categories. "Sales" comprises sales of company assets or goods to a related party such as the management or the board. "Purchase" comprises company purchase of goods from a related party such as a corporate executive, board member or party related to a board member. "Direct" comprises director-provided services to the company. Finally, "loans" comprises company loans to management or directors. In Panel B, market-to-book is the market value of equity plus the book value of assets minus the book value of equity, all divided by the book value of assets. Panel C shows the abnormal returns of portfolios of those firms between November 2001 and October 2002. For a description of the bootstrap methodology, see the text. * and ** indicate significance at the 10% and 5% levels, respectively.

Panel A: Frequency of Related Party Transactions (RPT)							
Type	Sample Size	Number of Firms Reporting RPT	Number of RPT	Sales	Purchase	Direct	Loans
All	263	95	138	22	58	21	37
S&P 500	84	33	53	7	27	8	11
MidCap	94	31	44	11	13	6	14
SmallCap	85	31	41	4	18	7	12

Panel B: Financial Characteristics of RPT Firms						
N	Market Cap (\$billion)		Sales (\$billion)		Market-to-Book	
	Mean	Median	Mean	Median	Mean	Median
95	6.6	1.6	4.7	1.3	1.98	1.59

Panel C: Abnormal Returns						
N	Four-Factor Equal-Weight		Four-Factor Value-Weight		B&H Return (Equal-Weight)	p-Value Bootstrap (Equal-Weight)
	α	α Annualized	α	α Annualized		
95	0.0004* (0.0002)	9%	0.0006** (0.0002)	15%	3.9%	0.019**

year 2001, and the average market-to-book ratio is 1.98. In comparison, for the same period, the average market capitalization of the S&P 1500 firms is \$8.3 billion, and the average market-to-book is 1.95. Thus, on average, firms that engage in related party transactions are smaller than and have similar growth opportunities and performance as the average S&P 1500 firms.

Table III, Panel C, reports the abnormal returns of the firms that engage in related party transactions. The α coefficient of the equal-weight portfolio between November 2001 and October 2002 is 0.0004. This coefficient is equivalent to a 9% average abnormal return over the period. The α coefficient of the

value-weight portfolio over the same period is 0.0006, which is equivalent to a 15% abnormal return over the period. The α coefficient of the equal-weight portfolio is significant at the 10% level, and the α coefficient of the value-weight portfolio is significant at the 5% level. We also report the results of the bootstrap analysis. We randomly select 95 firms out of the 263 firms and calculate their portfolio return and t -statistics. We repeat this procedure 1,000 times to obtain the empirical distribution of the t -statistics, and then we compare the t -statistics obtained from the buy-and-hold return of our original sample of related party transactions to the empirical distribution. The bootstrap analysis suggests a significantly positive abnormal return at the 5% level to the firms that engage in related party transactions.

C. Director Independence

We define group L as the group of firms that need to make the most changes to their board structure. These firms either have none of the board and committee independence provisions in place at the end of fiscal year 2000, or their policies are only consistent with one of them. Group H is the group of firms whose pre-rules independence policies are most consistent with the rules' requirements, with either all or all but one of these requirements in place at the end of fiscal year 2000. Group M is the group of firms that do not belong to H or L. Table IV, Panel A, shows that 237 firms in our sample belong to group L, 254 firms belong to group M, and 610 firms belong to group H. Thus, the majority of firms in our sample comply with all or most of the board independence requirements.

Panel B presents differences in financial characteristics across the three groups. We do not detect any strong trend in market capitalization, sales, or market-to-book across the different groups, although group L tends to have slightly larger average market-to-book and slightly lower average sales than the other groups. The average sales are \$4.6 billion in group L, compared with \$7.6 billion in group M and \$5.4 billion in group H. The average market-to-book ratio is 2.07 in group L compared with 1.88 in group M and 1.93 in group H.

Table IV, Panel C, shows that the α coefficient of portfolio L is statistically significant at the 1% level both for the equal-weight and the value-weight portfolios. The coefficient is also economically significant. The equal-weight portfolio has an α of 0.0006, and the value-weight portfolio has a coefficient of 0.0008. We can again convert these coefficients into average annual abnormal returns by multiplying them by 252 trading days. The average annual abnormal returns are 15% and 20%, respectively.

The results are also similar when we consider the abnormal return of a portfolio that is long portfolio L and short portfolio H. Such a portfolio has an α value of 0.0002 in the equal-weight portfolio and 0.0006 in the value-weight portfolio. The coefficient is significant at the 5% level in the value-weight portfolio but it is not significant in the equal weight portfolio. These coefficients are equivalent to annual abnormal returns of 4% and 14%, respectively.

Table IV
Director Independence

The table shows the announcement effect of governance rules on different groups of firms, based on their compliance with the board independence provisions. Board information corresponds to firms that belong to the S&P 500, MidCap 400, and Small Cap 600 indexes and comes from IRRC. The board score is based on the sum of four indicator variables: Existence of a majority of independent directors, existence of an independent audit committee, existence of an independent nominating committee, and existence of an independent compensation committee. Score L corresponds to a sum of one or zero, score M corresponds to a sum of two, and score H corresponds to a sum of three or four. In Panel B, market-to-book is the market value of equity plus the book value of assets minus the book value of equity, all divided by the book value of assets. In Panel C, the matching is based on market capitalization, market-to-book ratio, and industry in fiscal year 2001. Industry match is based on Fama and French 17 industries classification. For a description of the bootstrap methodology, see the text. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Board Score						
Score	N	% of Firms in Group	% with Majority of Independent Directors on Board	% with Independent Nominating Committee	% with Independent Audit Committee	% with Independent Compensation Committee
L	237	18	32	0	14	11
M	254	19	88	7	64	41
H	610	46	100	48	98	92

Panel B: Financial Characteristics							
Score	N	Market Cap (\$billions)		Sales (\$billions)		Market-to-Book	
		Mean	Median	Mean	Median	Mean	Median
L	255	9.4	1.9	4.6	1.3	2.07	1.63
M	280	9.9	1.6	7.6	1.5	1.88	1.45
H	663	8.0	1.9	5.4	1.7	1.93	1.39

Panel C: Abnormal Returns: Four-Factor Model				
	Four-Factor Equal-Weight		Four-Factor Value-Weight	
	α	α (Annualized) (%)	α	α (Annualized) (%)
L-H	0.0002 (0.0001)	4	0.0006** (0.0002)	14
Portfolio L	0.0006*** (0.0001)	15	0.0008*** (0.0002)	20
Portfolio M	0.0002 (0.0001)	4	0.0001 (0.0001)	2
Portfolio H	0.0004** (0.0001)	9	0.0002 (0.0002)	6

Panel D: Abnormal Returns-Matched Sample Methodology (Equal-Weight Portfolios)				
	N	B&H Return (%)	t-Statistics	p-Value Bootstrap
Portfolio L	237	5.6		
Portfolio H	237	-0.4		
Difference		6.0	1.15	0.043**

We do not find a significant α coefficient for portfolio M in either the value-weight or the equal-weight portfolios and for portfolio H in the value-weight portfolio. This evidence is consistent with the hypothesis that only the firms that are most affected by the rules should realize abnormal returns. However, we do find that the α coefficient of the equal-weight portfolio H is positive and significant at the 5% level. This evidence is not consistent with the above hypothesis, which might suggest that we are capturing some heterogeneity in responses across different firm sizes. We explore this possibility in Subsection E.

Table IV, Panel D, reports the results of the matched sample methodology. For every firm that belongs to portfolio L, we match a firm that belongs to portfolio H by market capitalization, market-to-book, and industry and calculate the buy-and-hold returns for each of the matching portfolios during the event period. The difference between the returns is 6%. The bootstrap test shows that the difference is significant at the 5% level.¹¹

D. Internal Control

Table V shows the results of the analysis of the group of firms that replaced their auditors between January 2001 and September 2001. Table V, Panel A, shows that the average market capitalization of these firms is \$1.334 billion and the median market capitalization of these firms is \$0.191 billion, suggesting that firms that switch auditors tend to be small. The large discrepancy between the average market capitalization and the median market capitalization suggests that while most firms in the sample are very small, several large firms skew the distribution. Similar results obtain when we compare average and median sales. The mean market-to-book ratio in these firms is 1.94 and the median is 1.09.

Table V, Panel B, shows the abnormal returns of firms that switch auditors. The α coefficient of the equal-weight portfolio is 0.0004, and the α coefficient of the value-weight portfolio is 0.0011. By multiplying these coefficients by 252, these coefficients are equivalent to annual abnormal returns of 10% and 28%, respectively. However, only the α coefficient of the value weight portfolio is statistically significant. The fact that the value-weight portfolio has a larger α than the equal-weight portfolio might suggest that larger firms tend to have a larger abnormal return than smaller firms. We explore this possibility in the next subsection.

Table V, Panel B, also shows the results of the matched sample methodology. We match firms based on size, market-to-book, and industry. The difference in returns between firms in our sample and the matched firms is only -0.16% , suggesting that our sample does not outperform the matched sample. The bootstrap analysis also shows no significant abnormal returns.

¹¹ In the bootstrap methodology in this section, we randomly assign portfolios L and H across firms in the sample (based on size, market-to-book, and industry) and calculate difference in returns and the t -stat between these portfolios. We repeat these random assignments 1,000 times to obtain the empirical distribution of t -statistics between randomly assigned portfolios. We then compare the t -statistic distribution to the one we originally obtained.

Table V
Internal Controls

The table shows abnormal returns for firms that are less compliant with the internal controls requirements. The sample consists of a group of firms whose auditors were replaced between January 2001 and September 2001. The data are from the Auditor Track database of Stafford Publications Inc. Panel B shows the abnormal returns of portfolios of those firms between November 2001 and October 2002. In Panel B, the matching is based on market capitalization, market-to-book ratio, past performance, and industry in fiscal year 2001. Past performance is the buy-and-hold return between June 2001 and November 2001. Industry match is based on Fama and French 17 industries classification. For a description of the bootstrap methodology, see the text. ** indicates significance at the 5% level.

Panel A: Summary Statistics						
N	Market Cap (\$billions)		Sales (\$billions)		Market-to-Book	
	Mean	Median	Mean	Median	Mean	Median
87	1.334	0.191	0.777	0.176	1.94	1.09

Panel B: Tests of Abnormal Return						
N	Four-Factor Equal-Weight		Four-Factor Value-Weight		Matched Sample Equal-Weight	
	α (Annualized)	α	α (Annualized)	α	B&H Return	Matched Sample Return
87	0.0004 (0.0003)	10%	0.0011** (0.0005)	28%	-0.01%	0.14%
					Difference	<i>t</i> -Statistic
					-0.16%	-0.01
						<i>p</i> -Value Bootstrap
						0.51

E. Heterogeneity in Response across Firm Sizes

Several studies suggest that the rules are more likely to benefit large firms than small firms. In particular, Holmstrom and Kaplan (2003), among others, argue that because of the high fixed costs of complying with the rules, small firms are less likely to benefit from the rules. In addition, small firms are likely to incur higher costs of finding qualified independent directors to their boards, and thus are likely to bear higher costs of complying with the director independence requirements.

According to these arguments, imposing a common set of internal controls and board independence requirements on all firms is likely to have a different effect across firm size. We therefore test separately the response to these two aspects of the rules across large and small firms.

Table VI shows the analysis of firms that have replaced their auditors. We separate our original sample of 87 firms into two groups of about similar size, based on market capitalization. Panel A shows that the group of large firms consists of 44 firms, with an average (median) market capitalization of \$2.584 billion (\$0.746 billion). The group of small firms consists of 43 firms, with an average (median) market capitalization of \$0.055 billion (\$0.043 billion). Note that the large firms have an average (median) market-to-book ratio of 2.42 (1.52), whereas the small firms have an average (median) market-to-book ratio of 1.439 (1.048). Thus, the group of large firms seems to have more growth opportunities.

Table VI, Panel B, shows the tests of abnormal returns across large and small firms. The α coefficient of the equal-weight portfolio of large firms is 0.0001 and the coefficient of the value-weight portfolio is 0.0011. As before, we convert these returns into average annual abnormal returns by multiplying them by 252 trading days. The average annual coefficients are 3% and 28%, respectively. The α coefficient of the value-weight portfolio is statistically significant. The matched sample methodology shows that large firms that replace their auditors have higher buy-and-hold returns than their matched sample, but the difference is not statistically significant.

In small firms, the α coefficients of both the equal-weight and the value-weight portfolios are not significantly different from zero. The matched sample methodology shows that small firms that replace their auditors have slightly lower buy-and-hold returns than their matched sample, but again, the difference is not statistically significant.

Overall, the results suggest that small firms that replace their auditors do not exhibit abnormal returns upon the announcement of the rules. Large firms, however, exhibit a positive abnormal return in the value-weight portfolio and a positive but not statistically significant abnormal return in the equal-weight portfolio. This result is consistent with the hypothesis that only the large firms in this sample benefited from this provision.

We repeat the analysis across firm size in the samples that differ in board and committee independence. Table VII shows the abnormal returns across large, medium, and small firms. Table VII, Panel A, shows the

Table VI
Internal Controls by Firm Size

The table shows abnormal returns for large and small firms with worse internal controls. The sample consists of a group of firms whose auditors were replaced between January 2001 and September 2001. The data are from the Auditor Track database of Stafford Publications Inc. Panel B shows the abnormal returns of portfolios of those firms between November 2001 and October 2002. In Panel B, the matching is based on market capitalization, market-to-book ratio, past performance, and industry in fiscal year 2001. Past performance is the buy-and-hold return between June 2001 and November 2001. Industry match is based on Fama and French 17 industries classification. For a description of the bootstrap methodology, see the text. ** indicates significance at the 5% level.

Panel A: Summary Statistics									
N	Size	Market Cap (\$billions)		Sales (\$billions)		Market-to-Book		Mean	Median
		Mean	Median	Mean	Median	Mean	Median		
44	Large	2.584	0.746	0.144	0.577	2.420	1.520		
43	Small	0.550	0.434	0.963	0.049	1.439	1.048		

Panel B: Tests of Abnormal Return										
N	Size	Four-Factor Equal-Weight		Four-Factor Value-Weight		Matched Sample Equal-Weight		Difference (%)	p-Value Bootstrap	
		α	α	α	α	B&H Return (%)	Matched Sample Return (%)			t-Statistics
44	Large	0.0001 (0.0003)	3	0.0011** (0.0004)	28	1.7	-0.1	1.8	0.17	0.35
43	Small	0.0006 (0.0005)	15	0.0005 (0.0005)	12	0.3	4.5	-4.2	-0.28	0.76

Table VII
Director Independence by Firm Size

The table shows the announcement effect of governance rules on different groups of firms, based on their board characteristics and their size. Board information corresponds to firms that belong to the S&P 500, MidCap 400, and Small Cap 600 indexes and comes from IRRC. The board score is based on the sum of four indicator variables: existence of a majority of independent directors, existence of an independent audit committee, existence of an independent nominating committee, and existence of an independent compensation committee. Score L corresponds to a sum of one or zero, Score M corresponds to a sum of two, and Score H corresponds to a sum of three or four. In Panel B, market-to-book is the market value of equity plus the book value of assets minus the book value of equity, all divided by the book value of assets. In Panel C, the matching is based on market capitalization, market-to-book ratio, and industry in fiscal year 2001. Industry match is based on Fama and French 17 industries classification. For a description of the bootstrap methodology, see the text. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Board Characteristics								
Size	Score	<i>N</i>	% of Firms in Group	% with Majority of Independent Directors on Board	% with Independent Nominating Committee	% with Independent Audit Committee	% with Independent Compensation Committee	
Large	L	72	17	40	0	14	7	
	H	246	59	100	64	98	90	
Medium	L	68	23	23	0	14	12	
	H	178	59	100	42	97	93	
Small	L	97	25	33	0	15	12	
	H	186	48	99	32	99	95	

Panel B: Financial Characteristics								
Size	Score	<i>N</i>	Market Cap (\$billions)		Sales (\$billions)		Market-to-book	
			Mean	Median	Mean	Median	Mean	Median
Large	L	72	25.833	8.515	11.641	4.536	2.28	1.83
	H	246	17.326	7.673	10.793	6.464	2.16	1.54
Medium	L	68	2.804	2.451	1.979	1.462	2.24	1.67
	H	178	2.025	1.669	2.236	1.439	2.04	1.39
Small	L	97	0.671	0.534	0.742	0.539	1.79	1.39
	H	186	0.594	0.430	0.891	0.550	1.52	1.29

Panel C: Abnormal Returns: Four-Factor Model					
Size	Portfolio	Four-Factor Equal-Weight		Four-Factor Value-Weight	
		α	α (Annualized) (%)	α	α (Annualized) (%)
Large	Portfolio L	0.0009*** (0.0002)	22	0.0009*** (0.0003)	21
	Portfolio H	0.0002 (0.0002)	5	0.0000 (0.0002)	0

(continued)

Table VII—Continued

Panel C: Abnormal Returns: Four-Factor Model					
Size	Portfolio	Four-Factor Equal-Weight		Four-Factor Value-Weight	
		α	α (Annualized) (%)	α	α (Annualized) (%)
Medium	Portfolio L	0.0009*** (0.0003)	23	0.0009*** (0.0003)	23
	Portfolio H	0.0003 (0.0002)	7	0.0004 (0.0003)	9
Small	Portfolio L	0.0001 (0.0002)	3	-0.0001 (0.0002)	-3
	Portfolio H	0.0008*** (0.0002)	20	0.0005** (0.0002)	12
Large	Port. L-Port. H	0.0007*** (0.0002)	16	0.0006*** (0.0002)	16
Medium	Port. L-Port. H	0.0006*** (0.0002)	16	0.0005* (0.0003)	13
Small	Port. L-Port. H	-0.0007*** (0.0002)	-17	-0.0006** (0.0003)	-15

Panel D: Abnormal Returns: Matched Sample Methodology (Equal-Weight Portfolio)					
Size		<i>N</i>	Return (%)	<i>t</i> -Statistics	<i>p</i> -Value Bootstrap
Large	Portfolio L	72	5.3		
	Portfolio H	72	-12.8		
	Difference		18.2	3.01	0.001***
Medium	Portfolio L	68	11.1		
	Portfolio H	68	-2.9		
	Difference		14.1	2.11	0.001***
Small	Portfolio L	97	2.1		
	Portfolio H	97	14.3		
	Difference		-12.2	-1.54	0.001***

distribution of firms in portfolios L and H for each of the size groups. As before, group L is the group of firms that comply with either one or with none of the board and committee independence requirements, and group H is the group of firms that comply with at least three out of the four independence requirements. The table shows that a higher percentage of large firms belongs to group H than do small firms, with as much as 59% of the large firms belonging to group H, compared to 48% of the small firms. However, the difference is not statistically significant. Table VII, Panel A, also shows the rate of compliance with each of the board characteristics for each of the size groups. We observe a similar pattern across all sizes.

Table VII, Panel B, reports firm financial characteristics by the three size groups. In each of the groups, firms that belong to group L tend to have slightly

larger market capitalization than firms that belong to group H. They also have slightly larger market-to-book ratio.

Table VII, Panel C, shows the abnormal returns of the portfolios across the different size groups. In large and medium firms, portfolio L has a significantly and positive α coefficient of 0.0009 both in the equal-weight portfolio and in the value-weight portfolio. By multiplying this coefficient by 252, we get an average annualized abnormal return of 21%–23%. In contrast, in small firms, portfolio L does not exhibit any significant return. In fact, portfolio H exhibits significantly positive returns.

We observe a similar pattern when we measure the returns of an investment strategy that is long portfolio L and short portfolio H. The abnormal return associated with this strategy over the period November 2001 to October 2002 is positive and significant in the medium and large firms, but it is negative and significant (at the 1% level) in the small firms.

Table VII, Panel D, shows the results of the matched sample methodology. Again, for each firm that belongs to portfolio L, we match it to a firm that belongs to portfolio H and that belongs to the same size quintile, the same market-to-book quintile, and the same industry. We find that the difference between the buy-and-hold returns of portfolios L and H is 18.2% among the large firms and 14.1% among the medium-size firms. The bootstrap analysis suggests that these returns are statistically significant at the 1% level. In contrast, we find that in small firms, the difference between portfolio L and portfolio H is –12.2%, statistically significant in the bootstrap analysis at the 1% level.

We use different matching techniques to verify the robustness of our results. In particular we use a finer partition of industries (the Fama-French 48 industries); we match firms based on past performance, size, and market-to-book; and we match only the firms that have all the independence requirements in place with firms that have none of the independence requirements in place. The results we obtain using these different matching strategies are similar to those above.

Overall, the results in Table VII suggest that in large and medium firms the announcement of the rules is associated with higher returns to portfolios that are less compliant with the rules. In small firms, the announcement of the rules is associated with lower returns to such portfolios.

V. Robustness Tests

A. Abnormal Returns Outside the Event Window

One potential reason for the correlation between abnormal returns and rule-related characteristics is that these characteristics are a proxy for some fundamental risk characteristics not related to the ruling event. To determine whether this is the case, we repeat the analysis in Section IV separately for the periods before and after the event window. If there is a fundamental difference in risk characteristics across portfolios, then the portfolios in Section IV should exhibit a similar pattern in abnormal returns during those periods.

We study the returns of the portfolios during the period between January 2001 and October 2001 and between November 2002 and July 2003. (For the insider trading portfolio and the restatement portfolio we only study the later period, because, by construction, these portfolios would have abnormal returns in the period before the event window.)

We find no abnormal returns in any of the portfolios we consider in Section IV. That is, the insider trading, the restatement, the internal control, the related transaction, and the board independence portfolios exhibit no abnormal returns during these above periods. This result suggests that the abnormal returns we find in the previous section are not due to fundamental differences in risk characteristics but are specific to the events that occurred between November 2001 and October 2002.

B. Controlling for Other Financial and Governance Characteristics

One concern with our analysis is that the results may be driven by some firm characteristics not captured by industry, size, and market-to-book matching. We therefore include several tests to verify that indeed our results are not driven by other characteristics. We first test whether there are differences between the sample portfolios and matching portfolios in the following financial characteristics: institutional holdings, outside financing, leverage, book assets, and sales. We run both a *t*-test and a Wilcoxon test, and do not detect any significant difference in these characteristics between sample portfolios and matched portfolios. Second, we test whether there are differences in board and CEO holdings across firms. Since we have data on board and CEO holdings only for firms in the IRRC database, we perform the test only on our board sample.¹²

We find a significant difference in board and CEO holdings between firms that belong to portfolio L (less compliance with the independence requirements) and firms that belong to portfolio H (more compliance with the independence requirements). CEOs and boards of firms that belong to portfolio L have significantly larger holdings than CEOs and boards of firms that belong to portfolio H. It is therefore possible that our results are driven by these differences in governance characteristics.

To explore this issue further, we test whether director independence is associated with abnormal returns after controlling for board holdings. Table VIII,

¹² Another concern is that of correlation in compliance across different provisions. While we cannot completely rule out this possibility, we run additional tests in which we ensure that the population of compliant firms complies with all the provisions (i.e., none of the matching firms belongs to the portfolios that restated their earnings, that engaged in insider trading, or that replaced their auditors), and that the portfolio of non-compliant firms is non-compliant only with the provision in question. The overlap in non-compliance across provisions is as follows: Among the 312 firms that restated their earnings, only 2 firms replaced their auditors, and none of them had a CEO who sold shares before a drop in the stock price. Among the 95 firms that replaced their auditors, only 2 had a CEO who sold shares before a drop in the stock price. Running the tests with the above restrictions does not change any of our results. We did not control for board compliance and related party transactions compliance because the data for these provisions is limited only to a subset of firms and the overlap with the other non-compliance samples is very small.

Table VIII

Abnormal Returns: Controlling for Other Governance Characteristics

The table shows buy-and-hold returns over the event window November 2001 to October 2002, for firms that have a high board score and a low board score after controlling for equity stake by board members and the Governance Index of Gompers et al. (2003). Board information comes from IRRC. The board score is the sum of four indicator variables: existence of a majority of independent directors, existence of an independent audit committee, existence of an independent nominating committee, and existence of an independent compensation committee. A high-score portfolio has firms that have a score of three or four. A low-score portfolio has firms that have a score of one or zero. The numbers in square brackets are the number of firms in each portfolio. In Panel B, for each of the size groups, firms are first divided into Democracy firms (Governance Index of 5 or below) and Dictatorship firms (Governance Index of 15 or above). Within each group, the returns of firms with a high score are compared to the returns of firms with a low board score. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Controlling for Board Holdings					
	Mean Ownership	Low Score	High Score	Difference (Low – High)	Wilcoxon Test
Large					
High equity stake	8.6%	–1.6%	–3.1%	1.5%	(0.06)
		[50]	[93]		
Low equity stake	0.4%	6.3%	–11.3%	17.6%	(2.56)**
		[20]	[141]		
Medium					
High equity stake	14.5%	5.8%	0.1%	5.7%	(0.29)
		[50]	[72]		
Low equity stake	1.0%	19.1%	–9.6%	28.7%	(2.68)***
		[16]	[96]		
Small					
High equity stake	20%	–0.2%	6.9%	–7.1%	(–0.69)
		[67]	[63]		
Low equity stake	2%	–2.5%	19.5%	–22.0%	(–1.36)
		[26]	[116]		
Panel B: Controlling for Gompers, Ishii, and Metrick (2003) Score					
	Director Independence		Difference (Low – High)	Wilcoxon Test	
	Low Score	High Score			
Large					
GIM score democracy	–1.1%	–10.8%	10%	1.07	
	[32]	[61]			
GIM score dictatorship	6.4%	–3.3%	10%	1.21	
	[17]	[69]			
Medium					
GIM score democracy	11.0%	–6.2%	17.2%	1.69*	
	[29]	[64]			
GIM score dictatorship	14.7%	4.3%	10.5%	0.72	
	[13]	[45]			
Small					
GIM score democracy	–0.2%	25.0%	–25.2%	–1.93**	
	[54]	[62]			
GIM score dictatorship	12.9%	3.3%	9.6%	1.11	
	[9]	[30]			

Panel A, shows the abnormal returns after controlling for the total equity stake of directors. We divide each size group into two equal groups based on the equity stake of the directors in the firm. We then compare the returns to firms in group H to group L within each equity-stake group. The results in Panel A show that when the equity stake is high, there is no difference between firms with high director independence and low director independence. However, when directors' equity stake is low, firms with low director independence earn higher returns than firms with high director independence. As before, the results are significant only in large and medium firms. This result indicates that board and committee independence add value after controlling for other governance characteristics. It also indicates that board and committee independence matter only when board holdings are low, and only in large firms.

Since the above analysis indicates that controlling for other governance characteristics seems to be important, we conduct another robustness check. We repeat the above analysis, but this time we replace insiders' equity stake with the governance score of Gompers, Ishii, and Metrick (2003) (GIM score). The GIM score ranks the firm according to 24 different governance characteristics that capture firms' vulnerability to takeover attempts and the ability of shareholders (vs. corporate insiders) to affect corporate decisions. Gompers et al. define firms with high shareholders' rights and more takeover vulnerability as "Democracy" firms (score of 5 or below), and firms with low shareholder rights and less takeover vulnerability as "Dictatorship" firms (score of 13 or above).

Panel B shows that firms with less director independence earn higher returns than firms with more director independence in large firms and medium firms, regardless of whether they are Dictatorship firms or Democracy firms. The difference is between 10% and 17.2% across the different portfolios. However the result is generally not significant. (The difference is statistically significant at the 10% level only in medium Democracy firms). One potential reason for the lack of significance is the relatively small number of firms in each portfolio. The fact that the effect is similar across Democracy firms and Dictatorship firms might suggest that the governance measure captured by the GIM score does not substitute for board and committee independence in large firms.

Interestingly, firms with less director independence earn significantly lower returns than firms with higher director independence in small Democracy firms. The return of the less compliant firms is 25% lower than the return of their matched firms. This result is consistent with our previous findings, that the rules do not improve value in small firms. It also suggests that the requirement of board and committee independence has a worse impact on small firms when the firm is already disciplined by the takeover market.

As a whole, the results in Table VIII suggest that the requirement of board and committee independence has a positive impact on firms after controlling for other governance characteristics, but only in large and medium firms. The requirement has a negative impact in smaller firms.

Anecdotal evidence suggests that the direct costs of complying with the internal control requirements are substantial for small firms.¹³ However, the cost of attracting independent directors in small firms might not be high enough to explain the -12% abnormal returns that we find between small firms that are consistent with the board independence requirements and small firms that are not. Therefore, there could be other reasons for the large negative abnormal returns.

One possibility is that director independence in small firms has other costs besides the direct search costs. For example, Adams and Ferreira (2006) argue that board independence might have adverse effect on the willingness of a CEO to share information with the board. Almazan and Suarez (2003) show that weak boards are a form of commitment not to replace managers *ex post* in order to elicit managerial effort *ex ante*. It is possible that these potential costs of having independent boards are higher in small firms than in large firms. Another possibility is that the market views the corporate scandals of 2000 and 2001 as chiefly a large-firm problem, applauding the oversight regulations in large firms more so than in small firms.

A full analysis of the costs and benefits of independent directors across firm size is beyond the scope of this study, and we leave it for future research. Nevertheless, we wish to point to several studies that do find that a less independent board might be a part of an optimal governance structure in small firms (e.g., Chhaochharia and Grinstein (2007), Lehn, Patro, and Zhao (2004)).

C. Association of Abnormal Return with Rule Announcements

So far in the analysis we use a large event window to ensure that the announcement of the rules comes as a full surprise to the market, with investors not having already formed their own expectations about the rules before they are announced. The drawback of any analysis of this kind is that it might capture other events during the period that cause a similar effect on prices. While we cannot rule out completely this possibility, we wish to establish a direct relation between the announcement of the rules and stock returns.

In this section, we run a test to establish such association. We run an event study similar to the one above, but this time using an event window of one day around rule-related announcements to see whether announcements related to the rules are associated with any price effect. If the rules have an effect on firm value, then we should observe an effect around release of information related to the rule. We do not make inferences about the direction of this effect because it is likely that the market forms expectations about the rule before the event day, and the direction of the effect is likely to depend on these unobservable

¹³ *The Wall Street Journal* (February 10, 2004) reports a study by Financial Executives International, estimating that first-year direct costs of implementing stricter control systems to comply with the new rules amount to about 1% of revenues in small firms. These costs decrease to about 0.1% of revenues in large firms.

expectations. However, a significant effect of any kind would establish a direct relation between the announcement of the rule and corporate value.

Standard event study methodology is not appropriate for rule announcements, since the announcement events are not independent across firms, and the errors from the estimation of the expected returns are correlated with one another (Schwert (1981)). Moreover, there is often more than one regulation announcement to consider. To overcome this issue, Schipper and Thompson (1983, 1985) propose a methodology that takes into account the correlation in errors across firms and the possibility for several announcements. They use this methodology to test the effect of merger-related regulations on acquiring firms. Our test is based on their methodology.

Within each of the three size groups, we select all firms from the director independent portfolio with a score of zero. This selection yields $J = 28$ large firms, $J = 35$ medium-size, and $J = 36$ small firms. For each of these groups we then estimate the following regression, using a panel of J firms $\times T = 237$ days (November 2001 to October 2002):

$$r_j - r_o = \alpha_j + \beta_j(r_m - r_o) + \delta_k \mu_{jk} + \varepsilon_j,$$

where $r_j - r_o$ = the $T \times 1$ time-series vector of excess returns to firm j ; $(r_m - r_o)$ = the $T \times 1$ time-series vector of excess returns to the market portfolio; r_m = the $T \times 1$ time-series vector of realized returns to the market portfolio proxy (here, we use the value-weight CRSP index); r_o = the $T \times 1$ time-series vector of realized returns to a 1-month treasury bill; α_j = an intercept coefficient; β_j = the β of the stock; δ_k = the $K \times 1$ vector of event parameters multiplying the regulatory announcement variables (these variables represent the shift in the mean excess return associated with the K regulatory-related announcements); μ_{jk} = a $T \times K$ matrix of regulatory change variables, with one column for each regulatory change considered (each column contains ones and zeroes to identify time periods with no regulatory-related announcements (zeros) and time periods with regulatory-related announcements (ones)); ε_j = a $T \times 1$ vector of error terms assumed to be serially independent of the excess return to the market and the regulatory change variables, and identically distributed normally.

A full description of the estimation method of Schipper and Thompson (1983) appears in the Appendix. We identify from Figure 1 six important announcement dates that are related to the rulings. The dates are 2/13/2002, 4/12/2002, 5/22/2002, 6/6/2002, 7/24/2002, and 8/1/2002.

Table IX shows that there is a significant announcement effect across all size groups on July 24, 2002—the day Congress announces a consensus regarding SOX and the date the NASDAQ board approves the NASDAQ governance proposal. There is also a significant effect in large and small firms on August 1st, 2002, the day the NYSE board approves the NYSE proposals. Mid-sized firms observe a significant announcement effect on May 22nd, 2002, the date the NASDAQ approves the first round of governance recommendations. These results establish a direct relation between the rules and firm value.

Table IX
Abnormal Returns on Specific Ruling Dates

The table shows the χ^2 coefficients of the tests of abnormal returns around different rule-related event dates between December 2001 and November 2002. The methodology for forming the tests closely follows Schipper and Thompson (1983), and is described in the Appendix. The tables report the results for a random sample of large, medium, and small firms with a governance score of zero. The event dates are taken from Figure 1. *** indicates significance at the 1% level.

Size	Event Date	<i>N</i>	χ^2 Value
Large	02/13/02	28	21.12
	04/12/02	28	31.53
	05/22/02	28	22.35
	06/06/02	28	20.49
	07/24/02	28	115.76***
	08/01/02	28	153.77***
Medium	02/13/02	35	22.07
	04/12/02	35	21.56
	05/22/02	35	20.60
	06/06/02	35	40.09
	07/24/02	35	109.28***
	08/01/02	35	40.26
Small	02/13/02	36	37.82
	04/12/02	36	42.92
	05/22/02	36	40.30
	06/06/02	36	20.94
	07/24/02	36	103.76***
	08/01/02	36	101.12***

D. The Effect of the Worsening Corporate Scandals on Firm Value

Another way to establish the connection between corporate value and the governance structure imposed by the rules is to analyze the effect of the worsening of the corporate scandals, before the market realizes their legislation effect on firm value.¹⁴ If the rules enhance firm value, then the worsening of the corporate scandals should have a larger negative effect on firms that are less compliant with the rules.

We choose the periods 10/10/2001 to 12/1/2001 and 10/10/2001 to 10/20/2001 as the periods in which the corporate scandals worsened.¹⁵ Table X shows the difference between the returns of our portfolios and matched portfolios for each of the rule provisions. The results show that, in general, the portfolios of firms that were affected the most by the rules observed lower returns than their

¹⁴ We thank the referee for pointing out this test.

¹⁵ On October 16, 2001, Enron filed its third-quarter earnings, reporting more than a billion dollars in losses, of which more than half were related to structured finance arrangements. The SEC began its inquiry the following day. The inquiry became a formal investigation on October 30, 2001.

Table X
Abnormal Returns at the Worsening of the Corporate Scandals

The table reports buy-and-hold as well as matched-sample returns of the related party transactions, board independence, and auditor changes samples around dates indicating worsening of the corporate scandals. The returns of firms in Panel A and C are matched against similar firms, based on size, market-to-book, and industry. The returns of firms in Panel B are based on size and industry. * and ** indicate significance at the 10% and 5% levels, respectively.

Panel A: Financial Restatements					
Event Window	B&H Return (%)	Return (Matched) (%)	Difference (%)	<i>t</i> -Statistics	
10/10/2001–12/1/2001	19.5	18.2	1.3	0.502	
10/10/2001–10/20/2001	4.1	4.4	-0.3	-0.237	
Panel B: Related Party Transactions					
Event Window	B&H Return (%)	Return (Matched) (%)	Difference (%)	<i>t</i> -Statistics	
10/10/2001–12/1/2001	15.9	16.4	-0.5	-0.164	
10/10/2001–10/20/2001	4.6	4.2	0.5	0.325	
Panel C: Internal Controls					
Event Window	Sample	Return (%)	Return (Matched) (%)	Difference (%)	<i>t</i> -Statistics
10/10/2001–12/1/2001	Whole	16.9	18.0	-1.1	-0.258
	Small	19.0	19.7	-0.8	-0.130
	Large	14.8	16.2	-1.3	-0.331
10/10/2001–10/20/2001	Whole	4.9	5.8	-0.9	-0.545
	Small	5.9	7.3	-1.5	-0.539
	Large	3.9	4.2	-0.3	-0.142
Panel D: Director Independence					
Event Window	Size	Return (H) (%)	Return (L) (%)	Difference (%)	<i>t</i> -Statistics
10/10/2001–12/1/2001	Small	16.7	12.7	-4.0	1.66*
	Medium	14.8	11.0	-3.8	0.82
	Large	19.7	11.4	-8.3	2.24**
10/10/2001–10/20/2001	Small	-2.9	-4.9	-2.0	2.08**
	Medium	0.1	-1.3	-1.4	0.77
	Large	2.3	-1.1	-3.4	2.29**

matched portfolios. The effect is statistically significant in firms with less director independence. This result suggests that the market changed its expectations about firms after the scandals, perceiving such firms as in worse condition, and that the provisions we measure capture governance characteristics that needed to be improved.

VI. Conclusion

We find a positive abnormal return in firms that are less compliant with the rules. The magnitude of this return suggests that the corporate governance rules had an economically significant impact on firm value, and that firms that were less compliant with the rules realize a greater value improvement compared to firms that are more compliant with the rules. We find some evidence that the rules associated with board independence and internal controls do not enhance the value of small firms, since small firms that are less compliant with the board independence provisions and small firms that are less compliant with the internal control provisions exhibit lower returns compared to other firms.

In general, our results capture only relative costs and benefits between firms that are more compliant and firms that are less compliant with the rules. We therefore cannot identify rule-related costs that are equally borne by all firms, such as extra filing costs and auditing costs. However, we note that certain provisions, such as the board independence provision and the related party transactions provision, are not likely to impose costs on firms that are already complying with them, and therefore the relative benefits and costs are more likely to coincide with the absolute benefits and costs for these provisions.

Our study also does not capture potential benefits of the rules on other constituencies besides shareholders, such as employees and creditors. To the extent that these benefits are substantial, they will increase the positive overall effect of the rules on the society.

We see two avenues for future research. First, our analysis captures investors' perceptions in relation to the rules, but does not look at actual improvements in shareholder wealth in the long run. It is important to see whether the rules actually enhance firm performance. Second, our analysis suggests that, compared to their size, small firms suffer larger costs from implementing the rules than large firms. Analyzing these costs and studying their effect on a firm's financial and nonfinancial strategies is an important topic for future research.

VII. Appendix: Schipper and Thompson (1983) Estimation Methodology

For each of the firms in our sample we use 237 (T) daily observations. The system of equations for the firms is given by:

$$R = X\Gamma + E$$

where

$$R = \begin{bmatrix} r_1 - r_0 \\ \vdots \\ r_J - r_0 \end{bmatrix}, \quad X = \begin{bmatrix} \bar{X} & & & \bar{X} \\ & \ddots & & \\ & & \bar{X} & \\ & & & \ddots \\ \bar{X} & & & \bar{X} \end{bmatrix} \quad \bar{X} = [1 \quad r_m - r_0 \quad \delta_k],$$

$$E = \begin{bmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_J \end{bmatrix}, \quad \Gamma = \begin{bmatrix} \alpha_1 \\ \beta_1 \\ \mu_{1K} \\ \vdots \\ \alpha_J \\ \beta_J \\ \mu_{JK} \end{bmatrix}.$$

In the above system, the contemporaneous residual covariance matrix is $\Sigma_{J \times J}$ and therefore the covariance matrix of E is $\Sigma \otimes I$. The estimation procedure we use is that of seemingly unrelated regressions. When $\Sigma_{J \times J}$ is known, the generalized least squares estimate of Γ is maximum likelihood and best unbiased. When $\Sigma_{J \times J}$ is replaced by the ordinary least squares residual covariance matrix, the joint GLS estimate of Γ is consistent and asymptotically efficient.

Here, since we have identical explanatory variables, the OLS estimates provide identical parameter estimates to GLS. We test that for a particular regulatory announcement, all of the individual μ_{jk} parameters across the sample of firms are equal to zero. That is,

$$H_0 : \mu_{jk} = 0 \quad \forall j.$$

The quadratic form used to test the null hypothesis is formulated as

$$(a - A\hat{\Gamma})'[A(X'(\Sigma^{-1} \otimes I)X)^{-1}A']^{-1}(a - A\hat{\Gamma}),$$

where A is a matrix of J rows, such that each of the rows contains a single one multiplying an individual $\hat{\mu}_{jk}$ and zeroes multiplying the rest of $\hat{\Gamma}$.

Under the null hypothesis, the test statistic is distributed as a $\chi^2(q)$, where q is the number of constraints being tested. There are J degrees of freedom, one for each coefficient tested. Note that the covariance matrix must be inverted to calculate the test statistic. Inversion is possible as long as the number of time-series observations exceeds the number of firms (or else the inverted covariance matrix follows a Wishart distribution that has undesirable properties).

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