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Sarbanes-Oxley: changes in risk premium and return volatility

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Abstract

Purpose – The purpose of this paper is to examine if the enactment of Sarbanes-Oxley (SOX) resulted in lower risk premium and return volatility in the US stock markets. The paper examines the two components of excess return (total risk premium) separately: the amount of volatility (risk) and the unit price of risk (risk premium).

Design/methodology/approach – The authors use a Component Generalized Autoregressive Conditional Heteroskedasticity approach to estimate the permanent and transitory component of share price volatility. The authors then use the predicted volatility to measure the unit price of risk and its changes due to the enactment of the SOX Act.

Findings – The results regarding excess returns indicate that the implementation of SOX had a positive effect on the market. A positive effect means a steady decrease in required excess rates of returns due to the implementation of SOX. The years leading up to the implementation of SOX are characterized by significant sources of uncertainty. Around the implementation of SOX, the authors observe a long-term reduction in return volatility (risk), and a temporary reduction in the unit price of risk. Subsequent to the implementation, investors gained confidence in the effectiveness of internal controls over the financial reporting process, which helped in reducing the information risk and, therefore, the risk premium.

Research limitations/implications – The authors find that total risk premium decreased over extended periods. The authors conclude that the enactment of SOX helped in reducing the uncertainty in the US capital market resulting in a reduction of total risk premiums and hence the cost of capital.

Practical implications – The results have implications for policy makers, investors and researchers in general and those in the US markets in particular. The results are important because it allows policy makers and regulators to improve on how they design and implement accounting, market and finance regulations and reforms.

Social implications – The study shows how financial markets react to regulations and the authors also provide information on investors' reaction as firms adjust to changing regulations. The results of the study allows regulators to potentially use a more refined or targeted approach when introducing new regulations. It also allows investors to make informed investment decisions as they relate to risk premium requirements, which in turn may allow investors to allocate capital more efficiently.

Originality/value – There are many studies concerning the enactment of SOX but few, if any, existing studies examine the original intent of SOX: to calm the US equity markets and restore market confidence from a return volatility perspective. The results have implications for policy makers, investors and researchers in general and those in the US markets in particular. The results are important because it allows policy makers and regulators to improve on how they design and implement accounting, market and finance regulations and reforms.

Keywords Sarbanes-Oxley, Internal control, Return volatility, Risk premium

Paper type Research paper

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1. Introduction

During the last decade, a number of US firms were involved in fraudulent financial reporting and eventually filed for bankruptcy. Names like Enron and WorldCom became household names because investors lost billions of dollars and thousands of employees lost their jobs (Bhamornsiri *et al.*, 2009). To restore confidence in the financial markets, improve transparency (Dey, 2010) and reduce the selective disclosure of material information by companies (Eleswarapu *et al.*, 2004), the House of Representatives and Congress passed two bills, which together became known as the Sarbanes-Oxley (SOX) bill. Sections 302 and 404 of SOX require firms to report and their auditors to express an opinion on the effectiveness of firms' internal controls with respect to financial reporting. As a result, investors may view SOX 302 and 404 reports as additional information and assurances compared to prior reports. Since internal control is an important factor underlying the reliability of financial statements, information concerning these should signal higher information reliability. This should result in a reduction in information risk and hence risk premiums should decrease. In other words, the internal control information and relevant auditors' assurance should affect investors' assessment of market and firms specific risk premiums and return volatilities.

The SOX Act, in particular its Sections 302 and 404, has generated considerable controversy since its introduction, with most of the discussion focussing on costs rather than benefits. According to Hammersley *et al.* (2008), large firms spend an average of $5.9 million to comply with the internal control reporting requirements. Several reports show that the occurrence of deficiencies in internal control is confined to a small group of firms (Ashbaugh-Skaife *et al.*, 2007; Ge and McVay, 2005; Krishnan *et al.*, 2009). Given the substantial costs that have been documented in the brief period since the act's implementation, it is important to examine its benefits (Krishnan *et al.*, 2009). The *Wall Street Journal* reports that 59 percent of investors believe that SOX help secure their investments (Burns, 2004). However, it remains an empirical question whether the act has helped improve the information environment for investors. Recent studies examine the value relevance of Section 302 and 404 disclosures of material weaknesses, but focus on the market's reaction material weakness disclosure. For instance, Beneish *et al.* (2007) examine stock price responses to disclosures of material internal control weakness and document a significant negative reaction to Section 302 but not to Section 404. Likewise, De Franco *et al.* (2005) and Hammersley *et al.* (2007) document significant negative reactions to disclosures of Section 302 material weaknesses. In addition, De Franco *et al.* (2005) show that negative returns are driven by the net selling of small investors. Iliev (2009) find that SOX compliance reduced the market value of smaller firms. Recent studies (Hostak *et al.*, 2013; Doidge *et al.*, 2010) find no evidence that firms delist as a result of SOX.

Adding to this line of research, we examine the effects of SOX on the general population of firms in the US market. Focussing on the behavior of the risk premium in the US stock market around the enactment of the SOX Act of 2002, we find that both risk premiums and unit price of risk decrease as a result of the enactment suggesting a positive effect of investor perceptions on market risk premiums. Specifically, we find that total risk premium, as reflected by the risk adjusted excess return, decreased over extended periods of time. The unit price of risk is less volatile around the enactment of SOX and has no long-term persistence. The volatility of returns, as measured by the standard deviation of index returns, showed the same decreasing trend as the total risk premiums. In conclusion, our results indicate that the enactment of SOX help reduce market uncertainty, which in turn, reduces the total risk premiums and hence the cost of capital.

We contribute to the extant literature in at least two ways. First, unlike the studies discussed above that focus on the market price reaction to material weakness disclosures, we focus on the changes in the risk premium and return volatility of the market around the enactment of SOX. Second, we conduct a time-series study using a Component Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model to investigate the market effect of implementing SOX, allowing us to capture the transitory and permanent component of volatility. We then use our results to calculate a time varying unit price of risk.

The rest of this paper is organized as follows. We discuss the literature and develop our research questions in the next section. Our model is presented in section three. We then discuss our sample selection procedures in Section 4, followed by a detailed discussion of the results in section five. Section six summarizes the results.

2. Literature review and research questions

The disclosure literature has documented a significant link between increased disclosure and market microstructures arguing that firms' disclosure level have negative effects on asymmetric information risk among market participants and among firms and their investors (Lev, 1988; Leuz and Verrecchia, 2000). The reduction of information risk is critical to investors because information risk increases total trading costs, as discussed by Lev (1988). In the finance and accounting literature, there are a number of theoretical and empirical studies dealing with what effects of public news and accounting disclosure may have on information risk. Theoretical models concerning information flow usually suggest that public disclosures decrease the information risk (e.g. Verrecchia, 1982; Diamond, 1985). More recent theoretical models show how the anticipation or release of earnings news affect the information flows in the market (e.g. McNichols and Trueman, 1994; Demski and Feltham, 1994). Generally, these models show that prior to earnings announcements, the number of informed traders can increase because short-term investors may seek private information in anticipation of earnings announcements with the goal of earning abnormal short-term profits. As a result, the anticipation of earnings announcement can temporarily increase the asymmetric information.

Empirical studies in the literature have examined both the immediate and long-term effect on information risk surrounding earnings announcements and other disclosure events. Consistent with recent theoretical models (e.g. McNichols and Trueman, 1994), studies concerning immediate effects usually focus on dealers' concern about asymmetric information risk and report a temporary increase in bid-ask spreads prior to, on the day, and subsequent to earnings announcements (e.g. Yohn, 1998; Callahan *et al.*, 1997). In contrast, other empirical studies in the literature have investigated the long-term effect of disclosure on asymmetric information risk in the market. Using bid-ask spread as a proxy for asymmetric information, Hagerman and Healy (1992) document a decrease in spreads subsequent to SEC insider trading disclosures. Raman and Tripathy (1993) find that the disclosure of reserve-based present value information reduces information risk for firms in the extractive petroleum industry, which is consistent with Boone (1998). Using a time-series research design, Greenstein and Sami (1994) find that firms, which initially implemented SEC disclosure requirement of segment data, experienced a decrease in their spreads, and that the magnitude of the decrease in bid-ask spreads was positively associated with the number of segments. Consistent with the perception that IAS and US GAAP have higher disclosure quality than German GAAP, Leuz and Verrecchia (2000) document lower relative spreads, higher trading volume and price volatility for firms using either IAS or US GAAP compared to firms, which used local GAAP. Establishing a link between disclosure and asymmetric information is further enhanced by using analyst disclosure ratings, such as Healy *et al.* (1999) and Heflin *et al.* (2008). Overall, these findings provide evidence for the theoretical models in Verrecchia (1982) and Diamond (1985) indicating that increased disclosure could decrease the information risk in the market. Our study is in line with these studies as we investigate the effects of disclosure on information risk in the market. However, our study differs as we examine whether the enactment of SOX resulted in lower risk premium and return volatility. In particular, we examine the two components of excess return (total risk premium) separately: the amount of volatility (risk) and the unit price of risk (risk premium) using a Component GARCH model to estimate the permanent and temporary unit price of risk and its changes due to the enactment of SOX Act on US stocks.

As discussed previously, SOX marks the first time that management is required to report, and the auditors to express an opinion, on internal controls in annual reports to all investors. To the extent that SOX makes previously undisclosed valuable information available to the public, asymmetric information as reflected in the risk premium and return volatility should decrease. In other words, SOX provides investors timely and equal access to information regarding firms' internal controls as it relates to financial reporting and this, in turn, helps investors assess firm risk. It also helps investors evaluate firms' future earnings prospects. Based on our discussion and review of the literature, we examine the following research questions, both of which are based on managements' self-assessment of internal controls and the auditors' opinion of internal controls:

H1. The risk premium is expected decrease following the enactment of SOX disclosure requirements.

H2. The return volatility is expected to decrease following the enactment of SOX disclosure requirements.

3. Model specification

In a capital market, a risk premium is defined as compensation for taking market risk, which is a demand from a risk averse investor. Its relationship with market risk could be described by the following stochastic return process (Merton, 1980; Breeden, 1979):

$$\frac{dM_t}{M_t} = \mu dt + \sigma_t dz(t) \tag{1}$$

where M is the price of a market portfolio, μ is the expected instantaneous return of a market portfolio, σ is the standards deviation, and $z(t)$ is a standard Wiener process. To further interpret the conditional equation, the following inter-temporal equilibrium model is used in the literature to describe the link between the excess return and the market's variance (Merton, 1980; Breeden, 1979):

$$\alpha_t - R_t = \lambda \sigma_t{}^2 \tag{2}$$

Here, the excess return, i.e. the difference between market return (α_t) and the risk-free interest rate (R_t), is shown directly related to the variance of the market portfolio (δ_t^2).

Such a relation can be estimated empirically with excess returns and the conditional volatility of the market. For a typical investor with a constant risk aversion function, λ from Equation (2) should be equal to the constant and positive. That is, the expected risk premium under capital market equilibrium conditions should be proportional to the conditional market risk and the risk premium ratio should be positive.

In an efficient capital market, risk (volatility) of stock prices and returns are used by investors in determining their expected excess stock returns. The link between the expected excess stock returns and volatility can be estimated using the following equation:

$$r_t = \alpha_t - R_t = \lambda_0 + \lambda_1 h_t + \varepsilon_t \tag{3}$$

where the excess return is a function of return volatility (h_t). If $\lambda_0 = 0$ and $\lambda_1 > 0$ in Equation (3) then Equation (2) is verified. As current return volatility could be a function of the actual size of the previous time period's volatility, the variance is often related to the squares of the previous volatility. A GARCH model can be used to simultaneously estimate the relation between stock returns and volatility (see Eagle *et al.*, 1987):

$$r_t = \alpha_t - R_t = \lambda h_t + \varepsilon_t \tag{4a}$$

$$h_t = \beta_0 + \beta_1 {\varepsilon_{t-1}}^2 + \beta_2 h_{t-1} \tag{4b}$$

$$E(\varepsilon_t) = 0, Var(\varepsilon_t) = h_t. \tag{4c}$$

In Equation (4a), λ is the risk premium, or the unit price of risk as it is called in Jochum (1998), while h is volatility of the market, the return volatility term used in the current paper. In Equation (4b), return volatility h_t is a function of previous volatility ($h_{t\text{-}1}$) and the usual error term in the previous time period ($\varepsilon_{t\text{-}1}$). Equation (4c) shows the error term is assumed to be normal distributed with zero mean and time varying variance (h_t). To make the equations valid, all βs are restricted to be positive, and their sum is <1. Equation (4a) also assumes that λ, the risk premium, remains constant.

In our paper, we loosen the assumption of constant risk premium by applying the conditional standard deviation into the GARCH mean equation, thus, allowing an estimate of a time varying risk premium. We further apply a Component GARCH model proposed by Engle and Lee (1999) that allows the conditional volatility to be separated into its two components, permanent and transitory. The permanent component, also known as the long-run trend, is affected by economic fundaments factors, while the transitory component, also known as short-run trends, is affected by market sentiments (Li *et al.*, 2012; Pramor and Tamirisa, 2006). The conditional variance, permanent and transitory components are as follows:

$$\begin{aligned}{\sigma_t}^2 = {} & (1-\alpha-\beta)(1-\rho)\omega + (\alpha+\phi)\varepsilon_{t-1}^2 - (\alpha\rho + (\alpha+\beta)\phi)\varepsilon_{t-2}^2 + (\beta-\phi)\sigma_{t-1}^2 \\ & -(\beta\rho - (\alpha+\beta)\phi)\sigma_{t-2}^2\end{aligned} \tag{5}$$

$${\sigma_t}^2 - m_t = \alpha\left(\varepsilon_{t-1}^2 - m_{t-1}\right) + \beta\left(\sigma_{t-1}^2 - m_{t-1}\right) \tag{5a}$$

$$mt = \omega + P(m_{t-1} - \omega) + \phi\left(\varepsilon_{t-1}^2 - \sigma_{t-1}^2\right) \tag{5b}$$

where the conditional variance is measured in Equation (5). The Component GARCH model allows the mean reversion to vary across time differing from the typical GARCH (1,1) model, which has a constant mean across time (Li *et al.*, 2012; Engle and Lee, 1999). Thus, the mean reversion is measured by Equation (5a) with levels of m_t; therefore Equation (5b) measures the permanent component. The transitory component is the difference between the conditional variance and the permanent component stated in Equation (5a). We then estimate our Component GARCH-in-mean model with the above conditional standard deviation from Equation (5). Our mean equation is stated as follows:

$$r_t = \alpha_0 + \beta_1 \, Risk\ Per + \beta_2 Risk\ Per_{t-1} + \beta_3 r_{t-1} + \beta_4 \sigma_t + \varepsilon_t \quad (6)$$

where r_t is the excess return of the index, $RiskPer_t$ is equal to the market risk premium of the US market at time t, $RiskPer_{t\text{-}1}$ is equal to the lag market risk premium of the US market, $r_{t\text{-}1}$ is the lagged value of the excess return of the index, and σ_t is the conditional standard deviation estimated by the following Equation (5).

In Equations (5) and (6) we capture components of volatility in our indices. Next, we estimate our time vary risk premium in the following model:

$$Volatility_t = \beta_0 + \beta_1 Volatility_{t-1} + \beta_2 ExRet_{t-1} + \varepsilon_t \quad (7)$$

We use a GARCH-in-mean model to control for heteroskedasticity in the squared error terms. The dependent variable is the predicted component of volatility from Equation (5), (5a), and (5b) of our indices to explain the impact SOX have on the risk and return of the US market. We include a lagged variable of the dependent variable in the model. The $ExRet_{t\text{-}1}$ is the lagged excess return of the indices. The GARCH models are estimated using the Maximum Log Likelihood Method, which we evaluate using *F*-statistic.

4. Sample selection

Using the DATASTREAM database, we collect daily return information for the S&P 500 for the period of 1998-2010. We exclude small firms, which may have low trading volume and therefore, significant volatility in their stock prices for reasons unrelated to the topic of study. To investigate whether the excess returns are caused by spillover effects of other indices, we also collect data on American Depository Receipts (ADRs) for foreign indices, including Germany ADRs, UK ADRs, Japan ADRs, Hong Kong ADRs, China ADRs and BNY Mellon ADRs indices[1]. We use ADR indices instead of the actual indices because we are interested in the impact of SOX, which only affects firms traded on US exchanges. Furthermore, SOX directly affected firms that had internal control weaknesses. Thus, to further test the effect of SOX on the US market risk and return we construct a weighted average portfolio of firms, which received an internal control weakness report during the sample period. After controlling for outliers, our sample includes 3,119 observations available for each index in our descriptive statistics tests. Recall that the purpose of our study is to analyze risk and return behavior in and around the time of enactment of SOX in 2002. We calculate the daily return of the indices to standardize our analysis across indices. We then calculate the excess return in a similar fashion to Zhang (2007) who obtained excess return data for the US Market. We create a global index and compute the daily return of the global index[2]. We then take the difference between the US market indices returns (S&P 500 and the internal control weakness index) and the global market index to compute the excess return due to the US market. This allows us to capture the risk and return behavior of the US market due to the implication of SOX. For the ADR indices we use a similar method, but rather than using the computed global index, we use each country's respective indices[3]. We then take the difference between the ADR returns and the country index returns to obtain excess return gained from the US market. We calculate the daily volatility (standard deviation) from the Component GARCH model of each index observation. Our study includes two periods of recession: 2001 and 2008. We argue that the recession in 2001 is more of a dot-com bust largely affecting high-technology firms, which tends to be small and illiquid. Also, we use indices rather than individual stock performances. Therefore, our results are robust since we use a sample of large firms.

Table I shows descriptive statistics for the excess returns of all indices. The mean/median excess returns are mixed during the sample period during 1998-2010. The results suggest that indices are impacted differently by the US market. The excess return for the S&P 500 has a negative excess return over the sample period, while the internal control weakness index has a general uptrend. The standard deviation varies significantly across the various exchanges during the period. *t*-Test indicates that the mean excess return in all markets is not statistically different from zero, except for Canadian ADR index.

5. Empirical results

In this section, we present the empirical results of our study. Table II shows the excess return correlation among the various markets. In Panel A, the S&P 500 excess return shows positive and significant correlations with BNY Mellon ADR, S&P ADR, UK ADR, and the internal weakness index at time T (the same day correlation). On the other hand, Asia ADR, and Japan ADR are negatively significant at time T. The correlation coefficients between S&P 500 at time $T-1$ and the other indices are all positively significant except for the Canadian ADR index. As six out of the eight indices show statistical significance at time T and seven out of eight show statistical significance at time $T+2$, it indicates that the ADR indices (internal control weakness) are closely related to the S&P 500 and the US markets. In Panel B, the correlations of the S&P 500 at time $T+1$ and $T+2$ are generally stronger with Asia ADR, Germany ADR and the internal weakness index but less persistent and disappear at time $T+3$, $T+4$ and $T+5$. The only index that is correlated with the S&P 500 after $T+2$ is the Japan ADR index, which is negatively significant at time $T+5$. We conclude that the risk premium in one market affects risk premiums in other markets. Our conclusion is specific with respect to foreign stocks being traded in the US Specifically related to our study, we support the argument that the volatility of the S&P 500 has a significant and persistent effect on volatilities in other markets. Our results also support the argument that other markets affect the S&P 500 but the persistence is very short. We conclude that any changes in the risk premium and return volatility are more likely the result from the domestic events rather than from the influences of other markets.

Figure 1 shows excess return distributions for the S&P 500, Asia ADRs, Japan ADRs, S&P ADRs, UK ADRs, and the internal control weakness index, the indices that are correlated the most[4]. Not surprisingly, it shows similar change pattern for these indices over time with more change in volatility before the enactment of SOX and after the 2008 financial crisis. In Table III, we present the descriptive statistics of excess returns before and after the enactment of SOX. Panel A shows excess returns for the

Table I.
Descriptive statistics of excess returns across markets

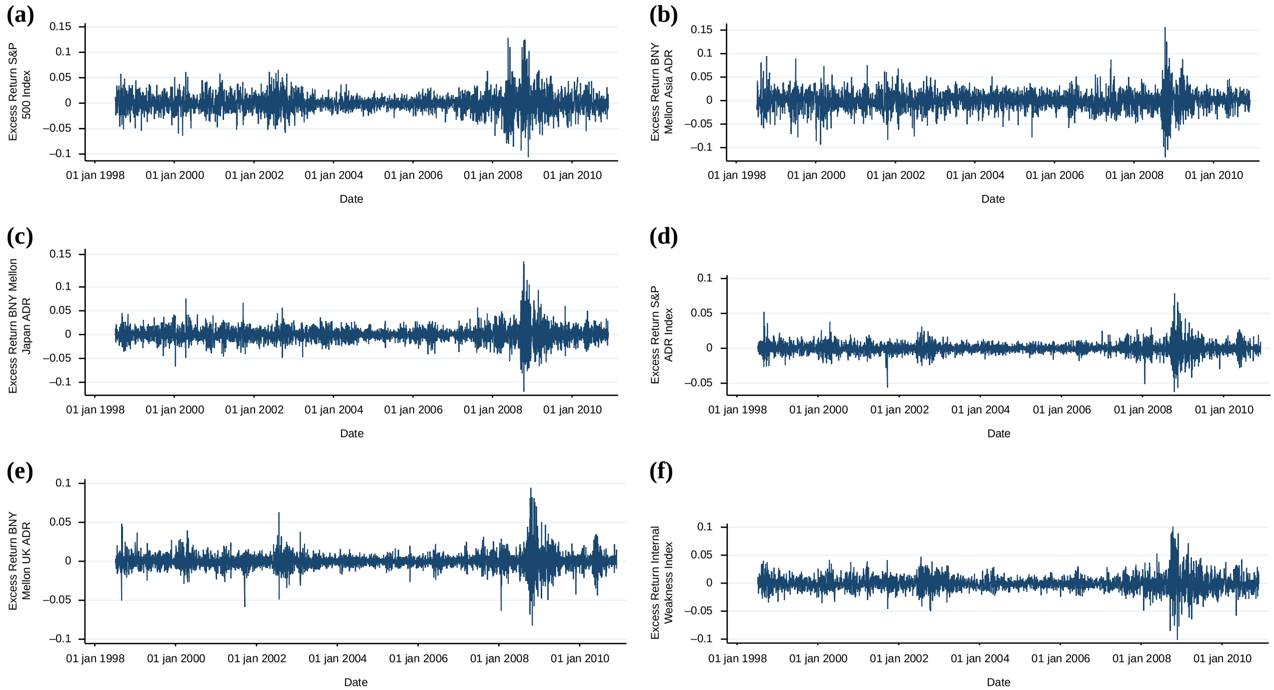
	S&P 500 index	BNY Mellon ADR	Canadian ADR	German ADR	Japan ADR	S&P ADR	Asia ADR	UK ADR	Internal weakness index
Mean	−0.00005	−0.00010	0.00030	−0.00003	−0.00003	−0.00008	−0.00026	0.00001	0.00007
SD	0.01905	0.00918	0.00938	0.01515	0.01675	0.00887	0.02040	0.01088	0.01430
Minimum	−0.10624	−0.06165	−0.07453	−0.11379	−0.11973	−0.06275	−0.12085	−0.08247	−0.10143
Percentile 25	−0.01035	−0.00460	−0.00428	−0.00693	−0.00865	−0.00440	−0.01121	−0.00489	−0.00753
Median	−0.00014	−0.00007	0.00010	−0.00022	−0.00007	−0.00003	0.00024	0.00010	−0.00046
Percentile 75	0.00914	0.00431	0.00474	0.00645	0.00820	0.00404	0.01134	0.00502	0.00706
Maximum	0.12822	0.08182	0.10442	0.22816	0.15376	0.07881	0.15644	0.09456	0.10094
t-stat	−0.14	−0.71	−0.60	1.77*	−0.10	−0.08	−0.51	0.07	0.28

Notes: $n = 3{,}119$. Table I shows descriptive statistics for all indices used in this study: S&P 500, Asia ADR, BNY Mellon ADR index, Canadian ADR, German ADR, Japan ADR, S&P ADR, UK ADR and Internal weakness index. We report the mean, median, standard deviation (volatility), minimum and maximum values, as well as percentiles. *t*-Statistics is to test whether the mean is significantly different from zero. *,**,***Significant at the 10, 5 and 1 percent level, respectively (two tails)

Table II. Pearson correlation coefficients of excess returns from different markets

	Asia ADR (T)	BNY Mellon ADR (T)	Canadian ADR (T)	German ADR (T)	Japan ADR (T)	S&P ADR (T)	UK ADR (T)	Internal weakness index (T)
Panel A. Excess return correlation at time T through time T-5								
S&P 500 (T)	−0.4005*	0.0850*	−0.0338	−0.0096	−0.2055*	0.0982*	0.1137*	0.8160*
	0.000	0.000	0.059	0.591	0.000	0.000	0.000	0.000
S&P 500 (T-1)	0.0528*	0.1682*	0.0221	0.0680*	0.2635*	0.1636*	0.1150*	0.0604*
	0.003	0.000	0.217	0.000	0.000	0.000	0.000	0.001
S&P 500 (T-2)	0.0073	0.0065	0.0244	0.0266	0.0166	0.0054	0.005	−0.0336
	0.6855	0.7147	0.1725	0.1378	0.3538	0.7652	0.7821	0.0607
S&P 500 (T-3)	−0.03	−0.0413*	−0.0014	−0.0177	−0.0371*	−0.0414*	−0.0685*	0.0078
	0.0939	0.0211	0.9366	0.323	0.0384	0.0209	0.0001	0.6651
S&P 500 (T-4)	0.0155	0.0298	0.02	0.0075	−0.0046	0.03	0.032	0.0156
	0.3886	0.0964	0.2653	0.6773	0.7959	0.0946	0.0743	0.3852
S&P 500 (T-5)	0.0413*	−0.0028	0.0531*	0.0223	0.0447*	−0.0043	−0.0019	−0.0372*
	0.0211	0.8773	0.003	0.2144	0.0125	0.8125	0.9137	0.0377
Panel B. Excess return correlation at time T+1 through time T+5								
S&P 500 (T+1)	−0.1313*	−0.1919*	−0.0223	−0.1578*	−0.1594*	−0.1993*	−0.1944*	0.0508*
	0.000	0.000	0.214	0.000	0.000	0.000	0.000	0.005
S&P 500 (T+2)	0.0458*	0.0277	0.0551*	0.0564*	0.022	0.0277	0.0292	−0.0448*
	0.0106	0.1217	0.0021	0.0016	0.2201	0.1226	0.1034	0.0124
S&P 500 (T+3)	−0.0305	0.0013	0.0215	−0.0037	0.0109	0.0003	−0.0027	0.0264
	0.089	0.9414	0.2301	0.8353	0.5427	0.9882	0.8792	0.1405
S&P 500 (T+4)	0.0024	0.0255	0.0024	−0.0012	0.0345	0.0241	0.0057	0.0265
	0.8913	0.1552	0.8921	0.9485	0.0541	0.1789	0.749	0.1393
S&P 500 (T+5)	−0.0042	−0.0287	−0.031	−0.0065	−0.0374*	−0.0268	−0.0237	−0.0197
	0.1096	0.0837	0.7182	0.0368	0.1347	0.186	0.272	0.0377

Notes: $n = 2{,}599$. Table II displays Pearson correlation of excess returns between the S&P 500 and the Asia ADR, BNY mellon ADR index, Canadian ADR, German ADR, Japan ADR, S&P ADR, UK ADR and Internal weakness index. Panel A shows the correlations for T, T-1, T-2, T-3, T-4, and T-5, representing days: 0, −1 to day − 5, respectively. Panel B shows the correlations for T+1, T+2, T+3, T+4 and T+5 representing day 1 to day 5, respectively. The excess return is defined as the actual index return less the respective risk free rate. *,**,***Significant at the 10, 5 and 1 percent level, respectively



Notes: Figure 1 shows excess return distributions for the S&P 500, Asia ADRs, Japan ADRs, S&P ADRs, UK ADRs, and the internal control weakness index, the indices that are correlated the most. Excess return is calculated as the actual return less the global index to capture excess return due to the US market. (a) Excess return distribution of the S&P 500 index for the period 1998-2010; (b) excess return distribution of the Asia ADRs index for the period 1998-2010; (c) excess return distribution of the Japan ADRs index for the period 1998-2010; (d) excess return distribution of the S&P ADRs index for the period 1998-2010; (e) excess return distribution of the UK ADRs index for the period 1998-2010; (f) excess return distribution of the Internal Weakness index for the period 1998-2010

Figure 1.
Excess returns of the S&P 500, Asia ADRs, Japan ADRs, S&P ADRs, UK ADRs, and internal control weakness indices

Table III. Excess returns during the two sub-periods

	S&P 500 index	BNY Mellon ADR	Canadian ADR	German ADR	Japan ADR	S&P ADR	Asia ADR	UK ADR	Internal weakness index
Panel A. Excess return during (1998-2002)									
Mean	0.0003	−0.0004	0.0001	0.0002	0.0003	0.0002	0.0001	0.0001	0.0003
SD	0.0176	0.0216	0.0084	0.0130	0.0197	0.0144	0.0082	0.0093	0.0121
Minimum	−0.0639	−0.0936	−0.0599	−0.0498	−0.1138	−0.0668	−0.0561	−0.0588	−0.0460
Percentile 25	−0.0113	−0.0129	−0.0048	−0.0065	−0.0095	−0.0085	−0.0048	−0.0054	−0.0072
Median	−0.0001	−0.0004	0.0002	0.0001	−0.0005	0.0000	0.0000	0.0003	0.0001
Percentile 75	0.0113	0.0126	0.0050	0.0066	0.0098	0.0079	0.0048	0.0055	0.0080
Maximum	0.0613	0.0946	0.0534	0.1044	0.2282	0.0755	0.0523	0.0484	0.0415
Panel B. Excess return during (2002-2010)									
Mean	−0.0002	−0.0002	−0.0002	0.0003	−0.0002	−0.0001	−0.0001	0.0000	0.0000
SD	0.0196	0.0199	0.0095	0.0075	0.0130	0.0176	0.0091	0.0114	0.0151
Minimum	−0.1062	−0.1208	−0.0617	−0.0745	−0.1091	−0.1197	−0.0628	−0.0825	−0.1014
Percentile 25	−0.0100	−0.0106	−0.0045	−0.0036	−0.0060	−0.0087	−0.0042	−0.0047	−0.0076
Median	−0.0002	0.0007	−0.0002	0.0001	−0.0001	−0.0001	−0.0001	0.0000	−0.0006
Percentile 75	0.0084	0.0108	0.0040	0.0041	0.0057	0.0083	0.0037	0.0049	0.0066
Maximum	0.1282	0.1564	0.0818	0.0444	0.1159	0.1538	0.0788	0.0946	0.1009

Notes: Table III presents the descriptive statistics of excess returns before and after the enactment of SOX. Panel A shows excess returns for the 4-year period leading up to the enactment of SOX. Panel B shows post-implementation recess returns for the period 2002-2010. The Japanese interest rate was effectively zero during this point in time four-year period leading up to the enactment of SOX. Prior to the event date, the mean excess return of the S&P 500 is slightly positive whereas the median return is slightly negative. The lowest excess return of the S&P index is −6.39 percent and the maximum excess return is 6.13 percent with a standard deviation of 1.76 percent. The BNY Mellon ADR and Japan ADR indices show the highest dispersion. In analyzing the post-implementation returns for the period 2002-2010 in Panel B, we find that the mean excess returns of the S&P 500 are slightly negative and the same for the median excess returns. The lowest excess return of the S&P index is −0.1062 percent and the maximum excess return is −0.0002 percent with a standard deviation of 0.0196 percent. Again, the BNY Mellon ADR and Japan ADR indices show the highest dispersion in the post-SOX period, although they are slightly smaller than in the pre-SOX period.

As discussed earlier, we use a Component GARCH model to estimate the conditional variance. The Component GARCH model allows us to determine short- and long-term conditional excess return volatilities of the S&P 500 index. The purpose of our study is to analyze the US market behavior at and around the time of SOX enactment in 2002. Therefore, we only provide Component GARCH results for the S&P 500, S&P ADRs and the internal control weakness indices. The dependent variable is one of these indices and the results are provided in Table IV. Furthermore, Figure 2 show the graphs of the conditional volatility, which is also referred to as the risk amount, and its permanent and transitory components for the S&P 500, S&P ADRs and the internal control weakness indices, respectively. Examining the conditional volatility (risk amount) of all three indices shows that it decreased in the post-SOX period. Right after the implementation of SOX, volatility temporarily increases but then steadily decreases until 2008 when other uncertainties in the US market appeared. The permanent component (long-run risk amount) shows a similar story with an overall decrease in volatility of the indices around the enactment of SOX followed by an increase for about half a year further followed by a steady decreases. The S&P 500 and S&P ADR indices' transitory component decreases steadily right after the implantation of SOX. On the other hand, the transitory component (short-run risk amount) for the internal weakness index shows more volatility and takes a long time to decrease post-SOX implementation. In addition, the volatility does not decrease as much as the S&P 500 and S&P ADR indices. Overall, the results from the Component GARCH model suggest that SOX had a positive impact on the US market showing a decrease in both the permanent and transitory volatility components. The increase in volatility (risk amount) around the event date of SOX could be reflecting the uncertainty about the enactment of SOX but decreases significantly after the passing of the regulation. Over the long-term, volatility decreased suggesting that the uncertainty diminishes over time.

We next turn our focus toward obtaining the unit price of risk. In Table V, Panel A, we show the results from Equation (7), which models the volatility from the Component GARCH in-the-mean models with volatility conditional on its past volatility and lagged excess return. The difference between the conditional volatility and the predicted volatility provide us a daily error term over the 12-year period. In essence, we predict the S&P 500 based on its past historical information along with its lagged excess return, which allow us to estimate the error term. We use the error term to calculate the time-varying risk premium coefficient (unit price of risk). The risk premium coefficient is calculated using return in the volatility less the error term, the sum of which is divided by the lagged excess return.

Table IV.
Empirical results on the conditional volatility and its transitory and permanent components estimated under component GARCH

	S&P 500 index	S&P ADR index	Internal control weakness index
ω	0.000275	0.000042	0.000092
	0.045	0.001	0.318
P	0.995066	0.992109	0.993016
	0.000	0.000	0.286
ϕ	0.066995	0.048251	0.052393
	0.000	0.000	0.000
α	−0.051985	0.083684	0.026629
	0.002	0.132	0.000
β	−0.494504	0.75756	0.857473
	0.037	0.000	0.000
Log Likelihood	9059.213	12012.79	10481.85

Notes: Table IV provides Component GARCH results for the S&P 500, S&P ADRs and the internal control weakness indices. The conditional variance, permanent and transitory components are as follows:

$$\sigma_t^{\,2} = (1-\alpha-\beta)(1-\rho)\omega+(\alpha+\phi)\varepsilon_{t-1}^2-(\alpha\rho+(\alpha+\beta)\phi)\varepsilon_{t-2}^2+(\beta-\phi)\sigma_{t-1}^2-(\beta\rho-(\alpha+\beta)\phi)\sigma_{t-2}^2 \quad (5)$$

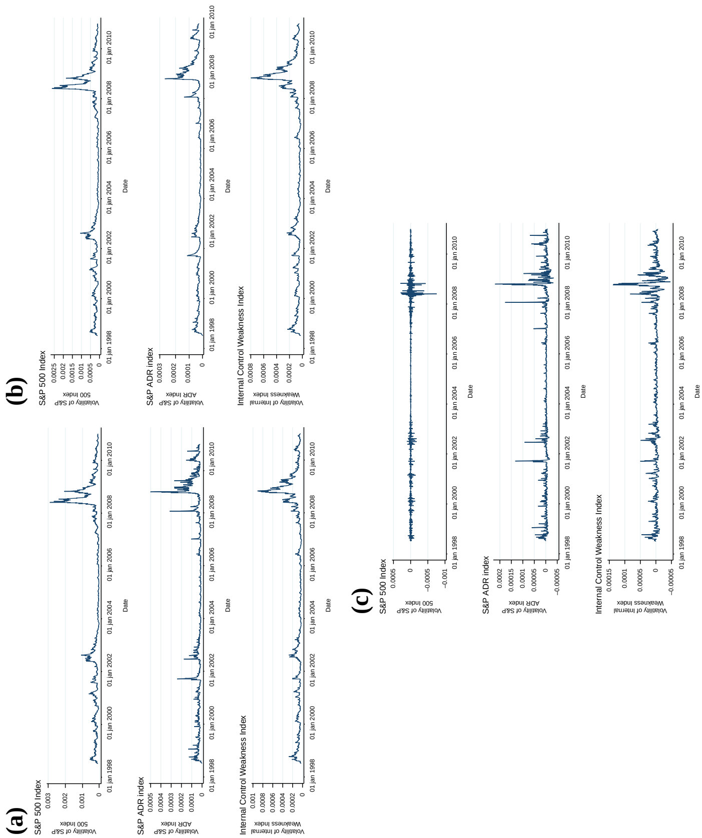
$$\sigma_t^{\,2}-m_t = \alpha\left(\varepsilon_{t-1}^2-m_{t-1}\right)+\beta\left(\sigma_{t-1}^2-m_{t-1}\right) \quad (5a)$$

$$mt = \omega+P(m_{t-1}-\omega)+\phi\left(\varepsilon_{t-1}^2-\sigma_{t-1}^2\right) \quad (5b)$$

where the conditional variance is measured in Equation (5). The Component GARCH model allows the mean reversion to vary across time differing from the typical GARCH (1,1) model, which has a constant mean across time (Li *et al.*, 2012; Engle and Lee, 1999). Thus, the mean reversion is measured by Equation (5a) with levels of m_t; therefore Equation (5b) measures the permanent component. The transitory component is the difference between the conditional variance and the permanent component stated in Equation (5a)

Table V, Panel A, shows the results from the GARCH models' mean equations using the S&P 500, the S&P ADRs and the internal control weakness indices conditional volatility. Discussing the S&P 500 index, the lagged return volatility ($Volatility_{\,t-1}$) has a coefficient of .9877, indicating that for every unit increase of the risk (return volatility) in the previous period, current return volatility tends to increase by 98.77 percent. The result is statistically significant at the $p < 0.0001$ level. The lagged excess return ($ExRet_{\,t-1}$) has a positive coefficient of 0.000134 showing that for every unit increase in excess return volatility in the previous period, the return volatility tends to increase by 0.0134 percent. The result is statistically significant at a 0.05 level. The intercept coefficient is statistically significant at $p < 0.01$ level. We evaluate the overall model using a statistically significant ($p < 0.0001$) *F*-value. The other indices results are interpreted the same. Table V, Panel B and C, show the GARCH-in-mean model measuring the permanent and transitory component of each index. The results are interpreted the same as in Table V, Panel A.

Figure 3 plots the risk premium coefficient (unit price of risk). Panels A, B, and C show the graphs of the risk premium for the conditional volatility and its permanent and transitory components. In Panel A, the conditional volatility unit price of risk shows a decreasing trend in the six-month period leading up to the implementation of SOX. In and around the pre- and post-event date, the graph displays a higher volatility, especially in the post-implementation period. The unit price of risk then begins to



Notes: Figure 2 show the graphs of the conditional volatility, which is also referred to as the risk amount, and its permanent and transitory components for the S&P 500, S&P ADRs and the internal control weakness indices, respectively. (a) Conditional volatility (risk amount) estimated under component GARCH; (b) permanent component of conditional volatility estimated under component GARCH; (c) transitory component of conditional volatility estimated under component GARCH

Figure 2.
The Graphs of the conditional volatility (Risk Amount) and its permanent and transitory components for the S&P 500, S&P ADRs and the internal control weakness indices

Variable	S&P 500 index	S&P ADR index	Internal control weakness index
Panel A: time vary risk premium (unit price of risk) of conditional volatility (total risk amount) estmated under GARCH			
Interception	0.0000014	0.0000015	0.0000007
	0.007	0	0.057
$Volatility_{t-1}$	0.987736***	0.963985***	0.994962***
	0	0	0
$ExRet_{t-1}$	0.000134**	−0.000032	0.000013
	0.0127	0.7221	0.6533
LOG-Likelihood	28648.93	31685.68	31715.93
F-statistic	17723.93***	4819.508***	23956.94***
Prob(*F*-statistic)	0	0	0
Panel B: time varying risk premium (unit price of risk) of permanent component estmated under GARCH			
Interception	0.00000122	−0.00000028	0.00000024
	0.0223	0.2811	0.45
$Volatility_{t-1}$	0.996557***	1.019727***	0.99921***
	0	0	0
$ExRet_{t-1}$	−0.00011100	−0.00003980	0.00000235
	0.0194	0.3081	0.9133
Log likelihood	29579.85	34831.82	33014.43
F-statistic	36851.11***	23011.39***	48517.83***
Prob(*F*-statistic)	0	0	0
Panel C: Time varying risk premium (unit price of risk) of transitory component estmated under GARCH			
Interception	0.00000005	0.00000007	0.00000013
	0.823	0.54	0.1437
$Volatility_{t-1}$	−0.555532***	0.865246***	0.899868***
	0	0	0
$ExRet_{t-1}$	8.16E-05**	−4.11E-05	2.36E-05
	0.0274	0.5915	0.0456
Log likelihood	30378.83	33165.38	33165.38
F-statistic	244.1693***	1389.969***	1389.969***
Prob(*F*-statistic)	0	0	0

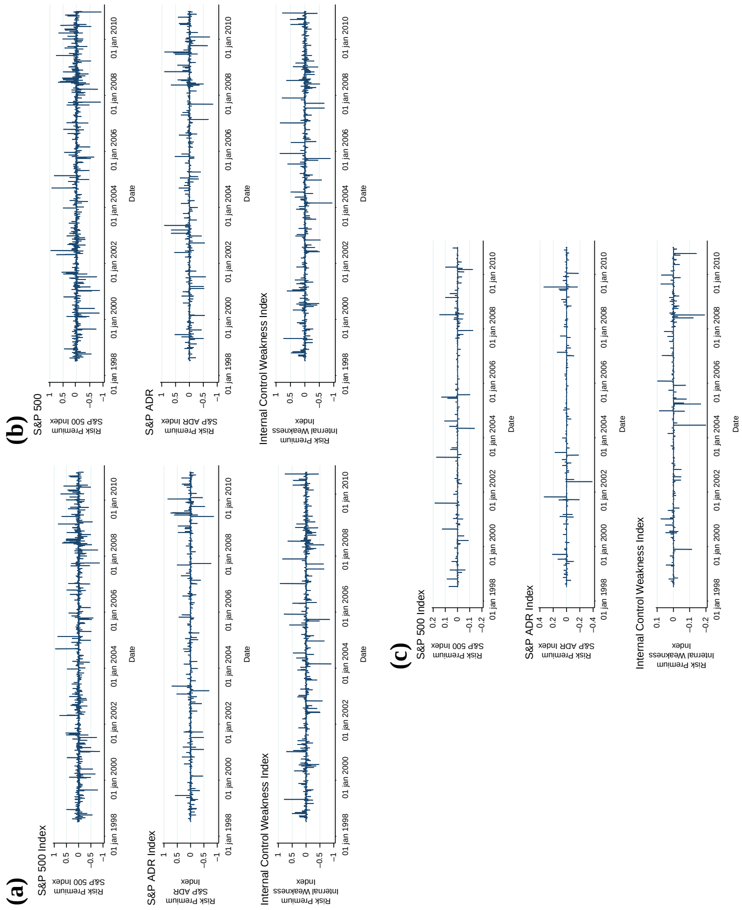
Notes: Table V shows the results from equation (7), which models the volatility and its permanent and transitory components) with volatility conditional on its past volatility and lagged excess return:

$$Volatility_t = \beta_0 + \beta_1 Volatility_{t-1} + \beta_2 ExRet_{t-1} + \varepsilon_t \quad (7)$$

We use a GARCH-in-mean model to control for heteroskedasticity in the squared error terms. The dependent variable is the predicted component of volatility from Equation (5), (5a), and (5b) of our indices to explain the impact SOX have on the risk and return of the US market. We include a lagged variable of the dependent variable in the model. The $ExRet_{t\text{-}1}$ is the lagged excess return of the indices. The GARCH models are estimated using the Maximum Log Likelihood Method, which we evaluate using *F*-statistic. *,**,***Significant at the 10, 5 and 1 percent level, respectively

Table V.
Time vary risk premium estimated under GARCH

decline six months after the implementation of SOX. Using a 12-year event horizon, the unit price of risk increases after the initial six-month period and it becomes more substantial farther away from the event date. This suggests that the effect of implementing SOX on the unit price of risk is observable over a two-year period. Market participants expect and therefore incorporate the effect of SOX subsequent to the two-year window. It also indicates that over a longer time period, the unit price of risk is determined by other factors. Thus, the decrease in unit price of risk does not



Notes: Figure 3 plots the risk premium coefficient (unit price of risk). (a)-(c) show the graphs of the risk premium for the conditional volatility and its permanent and transitory components, respectively. (a) Time-varying Risk Premium (unit Price of Risk) of conditional volatility (total risk amount); (b) time-varying risk premium (unit price of risk) of permanent component; (c) time-varying risk premium (unit price of risk) of transitory component

Figure 3.
The graphs of risk premium coefficient (unit price of risk) for the conditional volatility and its permanent and transitory components

show long-term persistence but a semi-persistent and transient nature as reflected by the time-varying coefficients of return volatility. As time progresses the market incorporates the implementation of regulations into the regular market noise and turns its focus to other information that affects the unit price of risk. The results are present in the conditional volatility of all three indices.

In panel B and C, the results for the risk premium of the permanent and transitory components are similar to that of the conditional volatility unit price of risk, showing a decrease six months prior to the implementation of SOX followed by an increase for about six months. This is then followed by a steady decrease. We find that this is the case for both the S&P 500 and S&P ADR indices. The internal control weakness index shows a decline in unit price of risk six month prior to the event date but this is then followed by an increase in the unit price of risk. Unlike the S&P 500 and S&P ADR, the internal control weakness index does not show a decline in the unit price of risk. The transitory unit price of risk shows a similar pattern similar with a decrease in the unit price of risk leading up to the enactment of SOX, followed by an increase. This is then followed by a decrease in unit price of risk. Overall, our results suggest that investors do not know if the implementation of SOX will have the desired effect and thus demand higher returns. As the enactment date draws nearer, uncertainty increases as investors speculate on the potential outcome. Investors might also focus on the possibility that auditors may not be ready to provide assurances that specific firms' internal control mechanisms are functioning properly. Subsequent to the enactment, the uncertainty decreases over time as firms reveal their progress of implementing and embracing SOX. Audit firms attest that firms' internal control systems are functioning properly. Thus, we observe a decreasing trend for return volatility (risk amount) in Panel B. As market participants focus on other events that may affect risk premiums, the initial decrease disappears into regular market noise as market participants focus on other events that may affect risk premiums. We conclude that decreases in unit price of risk as reflected by the time-varying coefficient on return volatility are transitory at best.

6. Conclusion

The SOX Act requires the management of public firms to assess the effectiveness of internal controls over financial reporting and auditors to express an opinion on the effectiveness of such controls. We examine whether the enactment of SOX reduces risk premium (unit price of risk), return volatility (risk amount), and thus total risk premium (excess return) in the US stock market. We examine the two components of total risk premium separately: the amount of risk (volatility) and the unit price of risk. A component GARCH approach is used to estimate the permanent and transitory component of volatility. We use the predicted volatility to estimate the unit price of risk and its changes due to the enactment of SOX Act.

Using a component GARCH model and observations of S&P 500 index, we estimate predicted values of return volatility and errors between the actual and predicted values, which in turn, generates the unit price of risk across time. Our results regarding excess returns indicate that the implementation of SOX had a positive effect on the market. A positive effect means a steady decrease in required excess rates of returns due to the implementation of SOX. The years leading up to the implementation of SOX are characterized by significant sources of uncertainty, which we argue are largely driven by financial reporting uncertainty. Around the implementation of SOX, we observe a long-term reduction in return volatility (risk), and a temporary reduction in the unit price of risk. This is expected as SOX was designed to counteract uncertainty regarding the reliability of firms' financial information. Subsequent to the implementation, investors gained confidence in the effectiveness of internal controls over the financial reporting process, which helped in reducing the information risk and, therefore, the risk premium.

To summarize, total risk premium decreased over an extended period of time. Its two components showed that the risk amount has been significantly reduced over the long window while the unit price of risk was temporarily reduced around the implementation of SOX. Our results thus indicate that the enactment of SOX helped reduce the information risk in the US capital market, which in turn, largely reduced the excess returns demanded by investors and the cost of capital paid by public firms.

The implications of our study are clear. Well-designed and implemented accounting and financial rules and regulations affect financial markets and investors. Investors became confident in the financial markets, which was the intended outcome of SOX. Regulators and policy makers can improve regulatory performance by taking steps to reduce uncertainty around the implementation date since our study shows that there was considerable uncertainty during this time. In addition, our study indirectly argues that future regulatory performance may improve if a targeted approach is used and that future regulations should use an approach that targets more than one variable, i.e. returns and volatilities.

Notes

1. The BNY Mellon ADR index tracks all ADRs on the New York Stock Exchange (NYSE), NYSE AMEX, and NASDAQ.
2. The global index is a weight portfolio created with the following indices DAX (Germany), FTSE (UK), NIKKEI (Japan), HANG SENG (Hong Kong), SHANGHAI (China), and S&P/TSX (Canada).
3. For the BNY Mellon ADR index we use the global index to calculate excess return.
4. The BNY Mellon ADRs, Canadian ADRs and German ADRs are all below 0.09 percent correlation or statistically significant at time *T*, thus we do not include them.

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