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Abstract

This paper uses the staggered adoption of the Sarbanes-Oxley Act of 2002 for a difference-in-difference identification of the impact of corporate governance on hedging. In a large panel of listed US firms, we focus on two indexes of the legally required governance reforms, but also a wide index of governance quality. We find that the substantial improvements in governance standards robustly lead to less foreign exchange exposure and more foreign exchange derivatives hedging, and that the economic magnitude of the effect is large. Also, the adoption of mandatory governance measures is a stronger predictor of hedging than voluntary improvements. Dynamic panel GMM estimates confirm a significant positive relationship between governance quality and hedging.

Key words: hedging, foreign exchange exposure, Sarbanes-Oxley Act, corporate governance, board monitoring, staggered introduction

JEL codes: F31, F23, G34

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1. Introduction

The effect of good corporate governance on corporate hedging policies is ambiguous, both in theory and according to empirical studies. This paper attempts to make headway in studying the impact of corporate governance on foreign exchange risk management by using a large-scale natural experiment, the staggered adoption of the Sarbanes-Oxley (SOX) Act of 2002 and its sweeping governance changes on US listed companies. Applying a comprehensive metric of governance quality as well as subindexes that allow us to focus on governance changes induced by the legal reform, we find that improvements in governance robustly lead to less foreign exchange risk and more foreign exchange derivatives hedging, and that the level of adoption of required governance reforms is a stronger predictor of hedging than voluntary governance improvements.

The ambiguity of the governance-hedging relationship is due to two popular but conflicting theory views. On one hand, theory suggests that reducing financial risks and expected costs of financial distress via hedging is in shareholders' interest (Smith and Stulz, 1985; Froot, Scharfstein and Stein, 1993; Myers, 1977; Leland, 1998). In this view, managers tend to hedge too little due to agency problems, and firms reduce corporate risk when exposed to more stringent governance rules. There is substantial empirical evidence to support this view, showing that managers hedge more when faced with better incentives and monitoring (Borokhovich, Brunarski, Parrino, 2004; Géczy et al., 2007; Allayannis, Lel, Miller, 2012; Lel 2012; Bartram, 2015; Knopf, Nam and Thornton, 2002; Graham and Rogers, 2002).

On closer inspection, however, things are more complex. In a starkly contrasting theory view, agency theories can also lead to the opposite prediction: when managers are imperfectly diversified or overly risk-averse and choose hedging policies to suit their own interests, they may 'overhedge' in the absence of oversight looking out for shareholders' interests. Stronger governance will then lead to less hedging (Stulz 1984; Smith and Stulz, 1985). There is again a body of evidence in support of this view (Tufano 1996; Huang, Peyer and Segal, 2013).

While the literature on the relationship between governance quality and corporate hedging is substantial, there has been almost no empirical work trying to use large-scale governance

reforms for the purposes of identification of the relationship between governance and hedging. The 2002 Sarbanes-Oxley Act, arguably the most sweeping reform of governance mandates worldwide in the past 30 years, presents a particular opportunity in this respect. To the best of our knowledge, our paper is the first to use comprehensive measures of the governance changes induced by the SOX mandates to undertake a difference-in-difference study of the impact on corporate hedging.¹

In this paper, we ask whether the mandated transition to better governance in the SOX reform – with its differential and staggered impact on companies depending on their pre-reform governance – is associated with more intensive management of foreign exchange risk. Using a balanced panel of 507 US non-financial firms over the period 2000 to 2007, we deploy a dual approach for the measurement of corporate hedging, by considering the exposure to foreign exchange rate movements as well as the use of FX derivatives. Foreign exchange exposure is appealing as it reflects all of the different instruments of corporate risk management, including financial and operational hedges, whereas derivatives constitute only a small portion of firms' foreign exchange hedging. Foreign exchange exposure, however, is a black box: the observer is never quite sure whether an observed change in risk is the outcome of intentional risk management or due to different causes. Our derivatives use measure is meant to overcome this limitation and to verify that any change in corporate risk is a deliberate policy. Our paper is one of the first to adopt this dual measurement.²

¹ We are aware of only one other study that uses a limited set of SOX-related governance changes to examine their effect on risk management practices. Huang, Peyer and Segal (2013) limit their investigation to board independence required by NYSE and NASDAQ and find weak evidence that companies required to increase the number of independent directors reduce their hedging. Their evidence is stronger for 'high agency problem' firms, defined as those with above-median CEO equity ownership, which the authors interpret as evidence in favour of board independence reducing overhedging. Our paper uses comprehensive measures of the SOX-induced governance changes, it looks at actual policy adoptions rather than pre-reform distance to the new rules, and it comes to different conclusions.

² Foreign exchange exposure is a well-established risk management measure in the international finance literature (e.g., Jorion, 1990; Dominguez and Tesar, 2006). It is attractive because it encompasses all effects of firms' foreign exchange hedging of which derivatives constitute only a small part. Other foreign exchange risk management tools include exchange rate pass-through, the use of foreign currency debt, and various operational hedging techniques, including international operations that enhance firms' operational flexibility and their capacity to manage exposures (see Section 2.2 for a literature review). Thus, foreign exchange exposure is a more comprehensive proxy of hedging activity than derivatives use, but it does not allow to distinguish between intentional risk management, unintended side-effects, or circumstances outside of corporate policies. Therefore, considering the use of derivatives as a second metric ensures that the observer captures intentional risk management choices. To the best of our knowledge, the only prior paper to use these dual measures to corporate hedging is Hutson and Laing (2014).

We use a comprehensive index of 41 measures describing the quality of corporate governance, *GOV41*. We find that foreign exchange exposure was smaller and the use of foreign exchange derivatives was greater for firms that adopted a better quality governance, as measured by a higher *GOV41* index. This finding is consistent with the notion that a weak governance environment is associated with insufficient attention to risk management – rather than ‘overhedging’ by managers acting in their own interests – and that better governance is linked to a greater likelihood that the firm manages foreign exchange risk with derivatives.

To tighten our identification, we decompose the wide *GOV41* index into two different subindexes, with the goal of extracting a measure of exogenously triggered governance reforms: first, we consider the ten governance attributes that were rendered obligatory with the SOX reform, with a mandate to adopt them by 2004 at the latest (*REG10*). Second, we add ten other governance attributes to the ten mandatory *REG10* attributes that were so intimately linked to the Sarbanes-Oxley Act that their simultaneous adoption was highly likely; thus, we obtain an index of 20 governance measures, *MANDATE-INDUCED*, that allows a representative view of the actual governance quality while maintaining a tight connection to the exogenous change in the law. There is a trade-off between a narrow measure that contains only mandated changes and a broader measure that better captures the governance reality, and our use of the two subindexes *REG10* and *MANDATE-INDUCED* attempts to address this trade-off. Our key findings hold up well for our two subindexes reflecting the exogenous law change: the results remain highly significant for the restricted indexes *MANDATE-INDUCED* and *REG10*. We also find that the two subindexes have a stronger impact on hedging than their complements aggregating voluntary governance rules, the subsets among the 41 governance attributes that are not mandated by or linked to SOX. We find that the mandated changes wash out the effect of the voluntary complements when both are included simultaneously. These results are robust for both risk management metrics, FX exposure and FX derivatives use.

The economic magnitude on hedging of the governance changes investigated in our study is substantial: according to our coefficient estimates, the median increase in *GOV41* attributes that we observe in our sample between 2002 and 2007 leads to a 17.1% decrease in foreign

exchange exposure and a 14.8% increase in the probability of derivatives use, and the median increase in *MANDATE-INDUCED (REG10)* to a 14.9% (15.4%) decrease in foreign exchange exposure to a 8.0% (2.6%) increase in the probability of derivatives use amongst our sample firms.

In further analysis and extensions, we create additional subindexes, the index *BOARD* based on 17 non-mandated board-related practices relating to the board of directors, and *COMPENSATION*, comprising 7 ‘good governance’ attributes regarding executive compensation and stock ownership. We find that both are significant but *BOARD* is associated with a stronger foreign exchange risk-reduction effect than *COMPENSATION*, suggesting that the role of boards is critical to improving foreign exchange risk management. Also, we use a time-trend analysis in which we interact our governance indexes with year dummies 2002-2006, deploying all seven indexes introduced so far, *GOV41*, the subindexes *REG10* and *MANDATE-INDUCED*, their complements *GOV31* and *VOLUNTARY*, as well as *BOARD* and *COMPENSATION*. We find that the fixed effect of each of our seven indexes remains highly significant both on FX exposure and on the use of FX derivatives. Further, we find that the governance reforms have a lasting and even increasing impact on FX risk management, with a non-monotonic magnifying effect in the immediate years after the SOX reform: the strength of the governance-hedging relation is stronger in the initial years after SOX and then reverses back over time to the trend line. There is a subtle but clear difference between the use of derivatives and FX exposure: the stronger sensitivity effect of the use of FX derivatives is immediate, concentrated in 2002 and thus before most of the SOX governance mandates were adopted, perhaps happening under the attention bias of corporate decision makers to the corporate fraud scandals of the time. By contrast, the stronger sensitivity to FX exposure follows the time trend of the adoption of the governance mandates for the entire 2002-2004 legal adoption period, decays much more slowly and exhibits a persistent effect throughout 2007.

In final robustness tests, we re-estimate the exposure regressions using a dynamic panel generalized method of moments (GMM) estimator (Arellano and Bond, 1991). The dynamic panel GMM approach has the potential to mitigate the endogeneity concerns that are rife in corporate governance research (Wintoki, Linck and Netter, 2012) and allows for the

possibility of a dynamic relation between explanatory and dependent variables. Using dynamic panel GMM, we find that six of our seven governance indexes remain negative and highly significant, with *REG10* as the only exception.

The remainder of the paper is structured as follows. The next section briefly discusses the prior literature and hypotheses. Section 3 describes our data and methodology. Section 4 presents summary statistics and univariate findings, and section 5 discusses our multivariate analysis. Section 6 provides concluding comments.

2. Literature Review

2.1 *Hedging and corporate governance*

Corporate finance theory generally holds that hedging strategies reduce the volatility of future cash flows and hence will help to mitigate underinvestment, increase debt capacity, and reduce financial distress costs (Smith and Stulz, 1985; Myers, 1977; Froot, Scharfstein and Stein, 1993; Leland, 1998). Thus, there is broad consensus that the management of financial risks should be value-enhancing. There is also ample empirical evidence that hedging improves firm value (Allayannis and Weston, 2001; Carter, Rogers and Simkins, 2006; MacKay and Moeller, 2007; Disatnik, Duchin and Schmidt, 2014; Campello et al., 2011; Bartram, Brown and Conrad, 2011).

The modern corporation, however, is run by managers, and the impact of improved corporate governance on risk management depends on its effect on managerial decisions. This paper focuses on the relationship between hedging and corporate governance which can be understood as the set of rules and arrangements that address agency problems and ensure that corporate decision making is aligned with the interest of shareholders (and other relevant stakeholders).³ Thus, we limit our discussion to agency theories that explain how managers would in the presence of weak governance relative to the efficient hedging policy.

In one view, managers hedge too little compared with the value-maximizing strategy. There is a variety of reasons why they will do so: managers could be short-termists and have

³ For this discussion, we consider that firm and shareholder value maximization coincide, that is we adopt an ex ante perspective where all ex post value transfers between equity, debt and other securities are anticipated.

career concerns while the benefits of hedging accrue in the long term; managers's compensation may award them with a disproportionate stake in the upside, or they may be overconfident or be inattentive. When managers are inclined to hedge too little relative to shareholders' interests, then better governance is associated with a greater use of derivatives for hedging purposes. There is substantial evidence in support of this view, looking at a variety of governance mechanisms specifically. Borokhovich et al. (2004) report a positive relation between the monitoring of outside directors and the firm's use of interest rate derivatives, and Lel (2012) finds that firms with strong corporate governance use derivatives to reduce risk and maximise firm value whereas those with weak governance use derivatives selectively to satisfy managerial self-interest. Allayannis, Lel and Miller (2012) show that hedging creates more value in firms with strong internal governance (such as those with a large outside blockholder) as well as better external governance. In firms with good governance, managers are less likely to use financial derivatives for speculative purposes (Géczy et al., 2007; Bartram, 2015). Hutson and Stevenson (2010) find, using a large international data set, that firms in countries with weak shareholder and creditor protection have higher exposure than firms in countries with a strong governance environment.

In the contrasting view, however, managers, when left to their own devices, decide to 'overhedge' relative to shareholders' interest. The leading explanation is that they are underdiversified and hence overly risk averse (Stulz 1984; Smith and Stulz, 1985), but excessive managerial risk aversion could have other roots. Stronger governance will align managers actions with shareholders' interest and, thus, should lead to less hedging. Again there is a considerable body of evidence in support of this view (Tufano, 1996; Knopf, Nam and Thornton, 2002; Graham and Rogers, 2002; Kumar and Rabinovitch, 2013; Huang, Peyer and Segal, 2013).

It is of course also possible that corporate hedging policies are already close to the efficient choices, either because agency problems are of minor relevance for risk management practices, or because the existing governance framework already leads to approximately

efficient decisions. In this case, standard microeconomic theory would predict that changes in governance rules have no impact on hedging policies.⁴

Regarding the measurement of foreign exchange exposure and corporate hedging policies, there is an important literature showing that the management of foreign exchange exposure is complex as it involves not only a range of financial hedges (forwards, options, swaps, and foreign currency debt) but also operational hedging decisions that alter the firm's real operations to reduce foreign exchange exposure (see Aretz and Bartram, 2010; Bartram and Bodnar, 2007; and Muller and Verschoor, 2006, for reviews). Operational hedges through the internationalization of operations are viewed as beneficial as they are associated with currency diversification, lead to currency matching of foreign exchange revenues with costs (Bodnar and Marston, 2002) and enhance operational flexibility when operations and suppliers are spread out in various parts of the world, creating options for firms to manage risks, and to take advantage of international opportunities as they arise (Allen and Pantzalis, 1996; Mello, Parsons and Triantis, 1995; Buckley and Casson, 1998; Kogut and Kulatilaka, 1994; Pantzalis, Simkins and Laux, 2001; Carter, Pantzalis and Simkins, 2003). It is against the backdrop of this literature that we choose our dual measure of hedging policies: the foreign exchange exposure measure that encompasses all financial and operational hedges, as well as the derivative use variable that validates the intentional character of any observed changes in foreign currency risk.

2.2 *The Sarbanes-Oxley Act and its impact*

The Sarbanes-Oxley Act (SOX) of 2002 was an unprecedented policy overhaul in the US in reaction to a wave of fraud and accounting scandals in the early 2000s, the most emblematic ones engulfing Enron and WorldCom. The legislation included a number of stringent provisions, including on board composition, board oversight and compensation, intended to safeguard investors and to mitigate governance problems. The main thrust of the Sarbanes-Oxley Act (SOX) mandates and associated revisions to NYSE and NASDAQ listing rules was to better align the incentives of corporate insiders with shareholders' interests by strengthening internal corporate governance mechanisms. A salient feature of

⁴ Another theoretical possibility is that changes in the governance set-up push firm away from efficient hedging levels. We briefly discuss this possibility in Section 2.3.

the Sarbanes-Oxley Act that was that it gave companies until November 2004 to comply with the mandatory policy changes. We exploit this element for the purposes of our identification strategy.

The literature on the effects of the SOX legislation mostly asks whether the better governance had a measurable performance impact. The answer seems to be predominantly positive: On balance, the literature concludes that the SOX mandates have been value-enhancing (e.g., Iliev, 2010; Dicks, 2012; Coates and Srinivasan, 2014). Chhaochharia and Grinstein (2007) study the announcement effects of the SOX reform and find that firms that were less compliant with the SOX mandates earned positive abnormal returns, and that the effect was concentrated in large firms. Aggarwal, Schloetzer and Williamson (2016) (ASW) ask whether the corporate governance mandates resulted in higher value for firms that had not been in compliance with the mandates before SOX. ASW gather data on 41 ‘good’ governance attributes, and we follow their index as our comprehensive measure of the adoption of governance reforms (*GOV41*). They identify ten governance attributes that were made obligatory with the SOX Act that we use (the *REG10* index below) in addition to our wider measure *MANDATE-INDUCED*. ASW find that firms that had not adopted most of the mandated attributes pre-SOX experienced an increase in firm value after complying with the regulations, they document a substantial increase in the adoption of the 31 non-mandated governance practices, and show that this voluntary improvement in “governance culture” was associated with enhanced firm value.

2.3 Summary of hypotheses

The empirical investigation in this paper takes the theoretical and empirical controversy laid out in Section 2.1 as its starting point to understand how corporate governance reform affects managerial decisions on risk management. Following the literature, we assume that corporate governance reform will strengthen the alignment of managerial decisions with shareholders’ interest. We summarize this literature discussion in three hypotheses:

Underhedging hypothesis: When companies hedge too little prior to corporate governance reform compared with the firm optimum, improved corporate governance will lead to reduced foreign exchange exposure and to more hedging, as measured by derivatives use.

Overhedging hypothesis: When companies overhedge prior to corporate governance reform, improved governance will lead to more foreign exchange exposure and less hedging, as measured by derivatives use.

Efficient hedging hypothesis: When companies hedge approximately efficiently prior to reform, corporate governance should have no significant impact on exposure and hedging.

From the perspective of relevant corporate finance theory, these three hypotheses are the leading contenders to explain the relationship between governance and hedging.

Using the natural experiment of the SOX Act of 2002, we gather new evidence that contributes to arbiters between these hypotheses. Of course, identifying a causal relationship between governance reform and corporate hedging still leaves the door open for alternative interpretations, for example the possibility that the SOX reform did not contribute to a better alignment of managerial actions and shareholders' interest. It is conceivable, for example, that managers hedge approximately efficiently (over overhedge), and that stricter governance rules distort risk management towards excessive hedging. This possibility, however, would imply that stricter governance destroys shareholder value, contradicting the bulk of empirical evidence, especially the evidence on the value effects of the Sarbanes-Oxley reform that we survey in Section 2.2. However, we cannot dismiss this possibility outright. Thus, while our paper adds evidence helping to empirically discriminate between the leading agency theories on the governance-hedging nexus of *efficient* governance reforms, it cannot distinguish between efficient and inefficient governance reforms, or contribute to the discussion on the efficiency of the Sarbanes-Oxley Act.

3. Data and methodology

3.1 *Data and measures of corporate hedging*

In our data gathering, we start with the Russell 1000 firms that were listed for the period 2000-2007. We remove financial firms and REITs (which have unique governance

structures), leaving us with 786 remaining firms.⁵ Financial information – including stock price and financial statement data – is from Compustat and Datastream, and the governance data are drawn from RiskMetrics (formerly ISS). To gather data on foreign exchange derivatives use, we search 10-K filings for mentions of hedging activity using derivative instruments.⁶ Matching with the governance and control variables sourced from Compustat, Datastream and Riskmetrics yields a final sample of 507 firms.

We use dual measures of corporate hedging policies. First, we estimate each firm’s annual *Foreign exchange exposure*, following the methodology and use by Jorion (1990), Dominguez and Tesar (2006), Hutson and Stevenson (2010), and others. We adopt this measure because of its popularity in the literature and the fact that it should encompass all unhedged exposure effects of FX movements. We use Jorion’s (1990) two-factor model that is estimated as follows:

$$r_t^i = \alpha_0^i + \alpha_1^i R_t + \alpha_2^i s_t + e_t^i \quad (1)$$

where r_t^i is the log difference return on stock i , and R_t is the return on the benchmark stock index in time period t . s_t is the log difference in the exchange rate over the same period, and e_t^i is a random error term. To estimate equation (1), we use the firm’s closing stock price, the S&P 500 index, and the USD nominal trade weighted index (an increase in the index implies an appreciating US dollar relative to its trading partners’ currencies). We use weekly data to estimate exposure coefficients for each firm i for each year.

We transform the exposure coefficients α_2^i by taking their absolute value and then taking their square root. The former is necessary because foreign exchange exposure can be negative or positive, and we need an absolute rather than directional measure of exposure. We then take the square root because taking absolute values imposes truncation bias, which

⁵ We remove firms with two-digit SIC codes from 60 to 67 inclusive. This category includes depository and non-depository institutions, security and commodity brokers insurance carriers, insurance agents, brokers and services, real estate, holding and other investment offices.

⁶ Item 7A in the 10-K report details the firm’s “Quantitative and Qualitative Disclosures About Market Risk”. For example, the following excerpt is from pp. 40-41 of the 2007 10-K report for Abbott Laboratories. “Abbott enters into foreign currency forward exchange contracts to manage its exposure to foreign currency denominated intercompany loans and trade payables and third-party trade payables and receivables.....”.

results in non-normal error terms (Dominguez and Tesar, 2006; Hutson and Stevenson, 2010). This leaves the error term normally distributed.

As our second corporate hedging variable, we define the dummy *Derivatives use*, which takes a value of one if a firm hedges using foreign currency derivatives and zero otherwise.⁷ Its use is meant to verify that changes in foreign exchange exposure are the consequence of deliberate hedging choices.⁸

3.2 Corporate governance measures

We follow ASW and gather data on 41 ‘good’ corporate governance practices from Institutional Shareholder services (ISS).⁹ Among these 41 governance attributes, ASW identify 10 that are mandated by the SOX regulations and are included in the related revisions to NYSE and NASDAQ listing standards (*REGIO* subindex). They are:

1. The Board must consist of majority independent directors.
2. Non-management directors must have executive sessions without management.
3. Nominating Committee must have only independent directors.
4. Compensation Committee must have only independent directors.
5. Audit Committee must have only independent directors and a minimum of three members.
6. Firms must adopt corporate governance guidelines.
7. Performance of the Board is reviewed regularly.
8. Board approved succession plan is in place for CEO.
9. Stock-incentive plans adopted with shareholder approval.
10. Consulting fee paid to auditors is less than audit fee paid to auditors.

⁷ We create the Derivative use dummy variable from a manual extraction of the annual reports between 2000 to 2007 for the full sample of firms. Thus, Derivative use can vary annually based on the annual reports.

⁸ We do not use firm fixed effects because they essentially remove all cross-sectional variation, and we expect cross-sectional variation in governance quality to be an important driver of our findings. See also Hermalin and Weisbach (1991), Zhou (2001), Adams, Almeida and Ferreira (2005), Coles, Daniel and Naveen (2008).

⁹ Detailed definitions of each of the 41 attributes, and the breakdown in the subindexes *REGIO* and *MANDATE-INDUCED*, are contained in the Appendix. As discussed in ASW, complete one-to-one mapping between the ISS governance criteria and the SOX-related governance mandates is not possible. For instance, the ISS definition of independent director is more stringent than that mandated by regulation. Also, SOX regulations require only that firms adopt the provisions; ISS requires that they also be published.

We create *REG10* using these 10 governance attributes, following ASW; one point is added for each attribute. Firms had until their first annual meeting or no later than 15th November 2004 to adopt these corporate governance regulations.¹⁰ We use the remaining 31 governance attributes to create the *GOV31* index.

We then identify ten more governance attributes that, while not expressly made obligatory by the SOX Act, are so intimately tied to at least one of the governance attributes in *REG10* that the adoption of the obligatory SOX mandates most likely leads to the simultaneous adoption of these attributes as well. Indeed, their correlations with the *REG10* measures are very high. We call the ensuing index *MANDATE-INDUCED*: it includes the 10 original mandates of *REG10* as well as the 10 closely related attributes.¹¹ We define the *VOLUNTARY* index as the complement of *MANDATE-INDUCED*, i.e. as the 21 remaining variables of *GOV41*. A correlation analysis of adoption (not reported in Tables but the correlation matrix in Table 5 gives a good impression) shows that *MANDATE-INDUCED* is a well chosen index, with the 10 additional components being highly correlated with the components of *REG10*, and substantially less correlated with the components of *VOLUNTARY*.

We introduce additional subindexes to measure the specific role of heightened board oversight and control of executive compensation. *GOV31* consists of three sub-categories relating to (1) board (17 practices), (2) compensation and ownership (7 practises) (3) anti-takeover (6 practises), and (4) audit (1 practice). We create sub-indexes for the first two of these sub-categories – which we call *BOARD* and *COMPENSATION*.¹² These definitions provide us with 7 indexes in total, *GOV41* and 6 subindexes.

We also use the variable *AFFECTED* introduced by ASW that measures the initial distance (in 2002) between a firm's governance standards and the 41 governance attributes in

¹⁰ Non-accelerated filers and foreign private issuers were to comply with the section 404 requirements for their first fiscal year ending on or after July 15, 2005.

¹¹ The Appendix provides the full list of the 20 governance attributes contained in *MANDATE-INDUCED*.

¹² As two out of the three audit attributes are mandated (and are therefore in *REG10*), we do not examine the audit sub-category. We also do not examine the anti-takeover sub-category because there was essentially no change during the sample period in our sample firms' adoption of these attributes. The median number of adopted anti-takeover attributes is 2 (out of 6) throughout our sample period.

GOV41; thus, *AFFECTED* does not take account of actual adoptions, but only their putative need for reform, as measured by distance. However, as our data show, the depth and pace of adoption of both mandated and voluntary governance changes vary widely, even among firms with similar initial needs for reform. ASW (as well as Huang, Peyer and Segal, 2013) use only this measure of initial distance. Our study takes the complementary view that actual implementations are probably a more reliable and precise measure of firms' current governance situation than their putative need *AFFECTED* dummy for the sake of comparison. Thus, we deploy in total 8 governance metrics, ASW's *AFFECTED* variable on the initial 2002 distance to high-quality governance, and the seven measures of actual adoptions of new governance practices laid out above.

As the ISS database provides consistent data on these attributes only from 2002 onwards, our governance indexes start in 2002; we follow ASW in using the 2002 data also for the two previous years. In order to readily compare our results using the different indexes, we express all indexes as percentages. For example, if firms had adopted all 41 governance attributes of the *GOV41* index, the firm scores 100 percent on this particular index.

3.3 Firm characteristics and control variables

It is essential to control for a wide set of firm characteristics that may influence the governance-risk management relationship. We use several firm characteristics that have been commonly used in prior exchange rate exposure studies as control variables: firm size as measured by total assets (*Assets*), market-to-book value of equity (*MTB*), the quick ratio (*Quick*), R&D expense as a proportion of sales (*R&D*), the debt-to-assets ratio (*D/A*). These data are annual. We control for industry using two-digit SIC codes. In the exposure regressions, we also control for the use of derivatives using *Derivatives use* dummy.

In particular, we need to include measures of firms' exposure to international markets and to exchange rate risk. Importantly, we always include a measure of foreign sales as a proportion of total sales (*Foreign sales*). Unfortunately, limitations in reporting make it impossible to break down foreign sales by country or region, and hence to refine the foreign exchange exposure estimate by geographies and currencies. In addition, we control for the international diversification of a firm's operations and the extent of its operational hedging

by using the multinationality classification system of Aggarwal, Berrill, Hutson and Kearney (2011) (*ABHK*). The *ABHK* classification system divides the world into six regions based on the inhabited continents: Africa, Asia, Europe, North America (including Central America), South America, and Oceania (Australia, New Zealand and the Pacific islands). A firm with activities entirely within its home country is defined as domestic (*D*), and a firm activities in the region in which it is headquartered (beyond its own country) is referred to as regional (*R*). If a firm has activities in more than one region (but not fully global) it is defined as trans-regional (*T*), and this category is further subdivided into *T2* (two regions), *T3* (three regions), *T4* (four regions) and *T5* (five regions). A ‘global’ (*G*) firm has activities in all six regions. A firm is considered by *ABHK* to have a presence in a particular region if it has at least one activity there. The ‘activity’ we use is subsidiaries. Data on subsidiary location were hand-collected for each year from the Directory of Corporate Affiliates via Lexis Nexis. Subsidiaries data is the best available measure of international reach, as the Directory of Corporate Affiliates provides the address of each firm’s subsidiaries.¹³ The *ABHK* classification scheme is operationalised by assigning a value of 1 to domestic (*D*) firms, 2 to regional (*R*) firms, 3, 4, 5 and 6 to *T2*, *T3*, *T4* and *T5* firms respectively, and 7 to global (*G*) firms. As there may be a nonlinear relation between multinationality and derivatives use as well as between multinationality and foreign exchange exposure (Hutson and Laing, 2014), we include squared *ABHK* terms in all regressions.

The effectiveness of corporate governance reform may also depend on CEO characteristics and incentives. To address this possibility, we use several variables measuring CEO characteristics and CEO incentives, namely CEO tenure, the equity and option holdings of the CEO, and CEO duality (the chairman and CEO positions held by the same person) that we obtain from the ExecuComp database (variables used in robustness tests reported in an Internet Appendix).

3.4 Identification

¹³ This is in contrast to annual report data on firms’ foreign sales and assets. *SFAS 131* gives firms considerable latitude when reporting data on geographic business segments. Each firm reports their foreign activity differently, and at various levels of granularity. Some firms are quite specific on the countries in which they operate, and others are more vague.

A powerful feature of our data is that the actual adoption of the governance mandates contained in the Sarbanes-Oxley Act of 2002 is staggered, and so for two reasons: first, the SOX Act of 2002 left companies with a choice during a two-year transition period, until November 2004. Second, a substantial number of companies had not adopted all required measures by the November 2004 deadline but did so in subsequent years, thus allowing to observe staggered adoptions during a longer time window; as one would expect, the adoption of voluntary governance attributes is slower than that of the mandated ones (see Table 1.)

We use this staggered adoption of the mandatory changes in governance attributes as the backdrop for our difference-in-difference identification in our balanced panel analysis for the 2000-2007 period. In each regression using a specific governance index as independent variable of interest, we focus on the actual adoption and approval of governance attributes.¹⁴ That is, each change in component i in year t of the governance index puts the firms with the recorded change in component i in year t in the treated sample, whereas firms with no change in component i in year t are in the control sample for that component and year.

We first consider the wide *GOV41* index, and then consider the two parallel subindexes of law-induced governance changes, *REG10* limited to the obligatory measures prescribed in the SOX legislation, and *MANDATE-INDUCED* containing an additional 10 attributes. In addition, we use ASW's *AFFECTED* variable capturing the initial distance between a firm's governance standards and the 41 attributes of *GOV41* but ignoring actual adoptions.

4. Summary statistics and univariate analysis

Table 1 presents the mean, median and standard deviation by year (2002-2007) for the comprehensive governance index *GOV41*, as well two breakdowns of the 41 governance measures in *GOV41*: the first breakdown by *MANDATE-INDUCED* (20 measures in tight association with the SOX-mandated changes) vs. *VOLUNTARY* (the remaining 21 measures), the second by *REG10* (the 10 SOX-mandated measures) vs. *GOV31* (31 measures). Table 1 also shows for each variable the median values of these indexes for

¹⁴ Our indexes are in contrast to Aggarwal, Schloetzer, and Williamson (2015) and Huang, Peyer and Segal (2013) who ignore actual adoptions and focus only on the initial distance to the newly required governance framework. We also use ASW's *AFFECTED* dummy for the sake of comparison.

small and large firms, defined as those with less than and greater than the median overall median asset value of \$1,374.2 million. Column (7) presents the percentage change in each index's value between 2002 to 2007, and in column (8) we present results for *t*-tests for difference in means and Wilcoxon rank sum *z*-statistics for difference in medians for the governance indexes between 2002 and 2007. Column (9) displays the Wilcoxon rank sum *z*-statistic for the difference in medians for small versus large firms.

There was a significant rise in all of those indexes over time as the firms worked towards compliance with the mandates. *GOV41*, *MANDATE-INDUCED*, and *REG10* doubled in the number of adoptions, both in means and medians. *REG10* shows the strongest increase in means, an increase of 140 percent from 3.4 in 2002 to 8.1 in 2007, and medians increase threefold. *GOV31* has the smallest increase, by only 70% (mean) to 80% (median). All increases between 2002 and 2007 are highly significant (*p*-values < 0.01). Interestingly, the bulk of the increase in levels in *REG10* is accomplished by 2005 (in line with the legal deadline of 2004 imposed by the SOX Act), and the same pattern is true for *MANDATE-INDUCED*. By contrast, the adoption of various measures in the *VOLUNTARY* subindex were slower and continued until 2007. These panel inspections of means and medians provide additional insights that our breakdowns are meaningful. Looking at the median values of Large vs Small firms, there does not appear to be a clear difference in the adoption of *GOV41* or any of the breakdown variables, in either direction. Looking at the evolution in means (not reported in tables), we find that large firms had significantly greater compliance with the mandates (*MANDATE-INDUCED* and *REG10*) than small firms, and large firms had also adopted more of the non-mandated attributes (*VOLUNTARY* and *GOV31*). This difference might be expected given the evidence on the costs of compliance for small firms (Linck, Netter and Yang, 2008, and Iliev, 2010). We also find, confirming ASW in this regard, that the mean differences in compliance between large and small firms – as well as the adoption of non-mandated governance attributes – persist after 2004.

Table 2 presents summary information on the firms' use of foreign currency derivatives over the period 2000-2007. For each of our first five indexes, we break down the use of derivatives by firms below and above the median of the index, respectively. In Panel A, we consider first the comprehensive *GOV41* index, before breaking it down by *MANDATE-*

INDUCED and *VOLUNTARY*; Panel B shows the breakdown by *REG10* vs. *GOV 31*. It is clear from Panel A that firms with strong compliance with governance mandates – as proxied by above-median index values for *GOV41*, *MANDATE-INDUCED*, and *REG10* – have significantly higher financial derivative use. In all cases, the usage difference between firms above and below the governance index in question is strongly significant for the three indexes, and this is particularly strong – highly significant in almost all years with – for the two indexes built around mandated governance changes *REG 10* and *MANDATE-INDUCED*. By contrast, the difference in usage is the opposite for the two governance indexes containing only voluntary adoptions, providing a strong case that the distinction between *MANDATE-INDUCED* vs. *VOLUNTARY* and *REG10* vs. *GOV31* is economically meaningful. Interestingly, the derivatives use counter seems to be slightly decreasing for firms with below median adoption rates, but increases for the above-median adoption.

In Panel C we report the overall proportion of firms using derivatives, this time broken down by Small v. Large firms. Consistent with the risk management literature, we find that small firms are significantly less likely to use currency derivatives than large firms (Bodnar and Wong, 2003; Chow, Lee and Solt, 1997; Dominguez and Tesar, 2006; Hutson and Stevenson, 2010).

We recall that there are several weaknesses associated with the derivatives use metric. The first – that firms may speculate rather than hedge with derivatives – we have addressed via careful searches of firms' 10-Ks (as described in Section 3). The second and most salient is that the dummy provides no indication of the extent of firms' derivative hedging activities. If a firm had improved its derivative hedging activities by, for example, ceasing to selectively or partially hedge foreign currency transactions, this would not show up in the data. Thus, while the average use of foreign exchange derivatives changes little over time over the key 2002 to 2007 period (from 0.40 to 0.42), this does not necessarily imply that the managers of our sample firms fail to improve their derivatives hedging programs during the period.

Table 3 presents summary statistics on the sample firms' median absolute exposure for each year; that is, the absolute value of α^i_2 estimated via equation (1). We also present, for the full

sample, the proportion of the exposure coefficients found to be significant at the 5 percent level or better. The structure of Table 3 replicates that of Table 2. In Panel A and Panel B, where we distinguish according to high and low values of the first five indexes, we find that median levels of foreign exchange exposure are generally lower for firms with stronger governance. But while this difference is strong for *MANDATE-INDUCED*, it is substantially weaker for *VOLUNTARY*, whereas no such difference is discernible for the breakdown between *REG10* and *GOV31*. This difference is significant (at standard levels) for *REG10*, however, in only two of the years. For *GOV31*, better-governed firms have significantly lower exposure in 4 of the 8 years. Panel C presents median exposures for small and large firms. The exposure of small firms exceeds that of large firms, and so in every year of the observation period, as expected based on earlier literature (Chow et al., 1997; Bodnar and Wong, 2003; Dominguez and Tesar, 2006).

In Table 4, we present median values for the control variables, for the three indexes *GOV41*, *MANDATE-INDUCED*, and *VOLUNTARY*. As anticipated, firms with above-median adoption of governance attributes are larger and have a higher valuation (*M/B* ratios) than below-median firms. However, no clear pattern exists regarding leverage (variable *D/A*) and the ABHK multinationality measures. Low-governance index firms also have significantly higher R&D expense ratios and quick ratios than high-governance firms. We find similar differences for the other indexes (not reported in tables).

Table 5 presents the correlation matrix for the full set of variables used in the multivariate analysis. The tabulation provides validation of our two decompositions of the 41 governance attributes in the *GOV41* index. Unsurprisingly, *GOV41* is strongly correlated with all the six subindexes that are constructed from its components. However, whereas the obligatory measures in *REG10* are almost perfectly correlated with *MANDATE-INDUCED* ($\rho=0.91$), the correlation is only half as strong with *VOLUNTARY*; the pattern is similar for *GOV31*. While our indexes of mandated and mandate-induced actual adoptions (*REG 10* and *MANDATE-INDUCED*) or significantly correlated with the *AFFECTED* dummy of pre-reform distance to the mandates, these correlations are an order of magnitude weaker than those with *GOV41*. our Table 5 also shows that our As expected, there is a strong and significant positive correlation between firm size as measured by total assets and the seven

governance indexes we use. FX exposure is strongly negatively correlated with all seven indexes, with the lowest correlation for *REG10*. The use of derivatives is significantly positively correlated with all index variables except for *VOLUNTARY*. Table 5 reveals little to be concerned about regarding multicollinearity, with the possible exception of R&D and the quick ratio, which have a Spearman rank correlation of 0.55. However, all variables have a Variance Inflation Factor (VIF) of less than two.

5. Multivariate analysis

5.1 Panel analysis of the time variations in governance quality

Table 6 presents the findings for our first main set of panel logistic regressions, with foreign exchange exposure, or more precisely the square root of the absolute exposure coefficient ($\sqrt{|\alpha_2^i|}$, with α_2^i estimated according to equation (1)) being used as the dependent variable. In column (1) we examine the effect of the comprehensive *GOV41* index. We find that governance quality, as measured by these broad dimensions of governance practices, are strongly correlated with foreign exchange exposure, significant at the 1%-level. This is the first central result of the paper.

For the control variables, we find that larger firms are more likely to use derivatives, and that firms with a higher market value relative to book are less likely to use derivatives. As expected, firms with a greater proportion of sales abroad are more likely to hedge with foreign exchange derivatives. We also find the expected inverse U-shaped relation between derivatives use and the extent of multinationality.¹⁵

We further address concerns governance and hedging could be jointly driven by unobservable determinants by focusing on subindexes that represents the exogenously imposed governance mandates. Therefore, in columns (2) and (3) we decompose *GOV41* into the *MANDATE-INDUCED* index of 20 attributes, and the *VOLUNTARY* index for the remaining 21 attributes. When using *MANDATE-INDUCED* as the governance index, we find that the variables of interest remain strongly significant at the 1%-level (column (2)).

¹⁵ We lose about 15% of observations because of missing values for the ABHK variable. When we repeat all our analyses using the number of foreign subsidiaries as the proxy for the extent of operational hedging (rather than ABHK), our findings are essentially unchanged.

By contrast, the complementary *VOLUNTARY* index measuring non-mandated improvements in governance is not significant (column (3)). When we include both the *MANDATE-INDUCED* and the *VOLUNTARY* subindex in the same regression, a rather telling result emerges: the *MANDATORY* subindex remains highly significant at the 1%-level with a practically unchanged coefficient, whereas the *VOLUNTARY* subindex remains insignificant and further decreases in value (column (4)). The second partition of the comprehensive governance measures in the legally mandated governance subindex *REG10* and the voluntary complement *GOV31* provides comparable results: both the *REG10* index and its voluntary complement *GOV31* are significant at the 5%-level (columns (5) and (6)). But when we include both *REG10* and *GOV31* in the same regression, we find again that only *REG10* is significant ($p = 0.09$) whereas *GOV31* becomes insignificant. *BOARD* and *COMPENSATION* also show a significant impact on the derivatives use, albeit at weaker level, and ASW's *AFFECTED* dummy also shows significance ($p = 0.023$).

Table 7 shows the impact on the second hedging measure, derivatives use, presented in exactly the same format as in Table 6. In column (1), we find that the broad measure of governance quality *GOV41* is strongly correlated with derivatives use, significant at the 1%-level, complementing our first main result above. When using *MANDATE-INDUCED* and *VOLUNTARY* instead, the variables of interest remain strongly significant (regressions (2) and (3)). When we include both the *MANDATE-INDUCED* and the *VOLUNTARY* subindex in the same regression (4), the same clear-cut result that we had seen for foreign exchange exposure obtains: only the mandatory component is highly significant, whereas the voluntary component no longer is. The second breakdown of the comprehensive governance measures in the legally mandated governance subindex *REG10* and the voluntary complement *GOV31* provides the same result: we find that the significance of *REG10* is much stronger in the joint regression (7). *BOARD* and *COMPENSATION* are also significant, whereas ASW's variable *AFFECTED* no longer is.

In conclusion of our baseline regression results, we find that the mandated governance changes measured by *MANDATE-INDUCED* and *REG10* significantly reduce foreign exchange exposure and symmetrically increase the use of foreign exchange derivatives. In addition, there is a clear differential impact of mandated and voluntary governance changes

on hedging, with mandated changes producing stronger and robust effects. These are two of the key findings of the paper, in particular the significant impact of governance reform when we restrict the observation to exogenous variations in governance quality.

5.2 Extensions

Table 8 contains our first set of extensions, where we repeat the main analysis both for small and for large firms (firms below and above median by asset size, respectively). Panel A looks at derivatives use, Panel B at foreign exchange exposure. Small firms tend to be more exposed to exchange rate movements than large, and an important explanation for this is that small firms are less likely to hedge because of the high fixed costs associated with implementing effective hedging programs (Bodnar, Hayt and Marston 1996, 1998; Bodnar et al., 1995; Géczy, Minton and Schrand, 1997; Nance, Smith and Smithson, 1993; Allayannis and Ofek, 2001). For small firms, therefore, better governance may not have as strong an effect on risk management as it has for large firms. Our findings show that the significance of the comprehensive *GOV41* measure for small and large firms alike are confirmed, albeit with weaker significance especially when it come to derivatives use. But when we look at the subindexes, we find that large firms seem to be reacting more clearly to *MANDATE-INDUCED* government measures, whereas small firms react more to the measures in the *VOLUNTARY* subindex. We find the same pattern when looking at the decomposition into the *REG10* and *GOV31* subindexes. These results are consistent with the views that small firms face higher hedging costs. It is, however, somewhat surprising that small firms' hedging and risk management appears to be more affected by a voluntary change in governance practices than by a legally mandated change, and that the opposite is true for large firms. The results seem to confirm, though, that our earlier results in Tables 6 and 7 that show a clearly distinct reaction to *MANDATE-INDUCED* (*REG10*) and *VOLUNTARY* (*GOV31*) are not driven by small firms.

In the second extension, we add a time trend variable¹⁶ in which we interact each of our seven governance indexes with year dummies 2002 to 2006 (Table 9). Panel A of Table 9

¹⁶ This approach is informed by Aggarwal, Schloetzer and Williamson (2016), who define firms affected by the mandates as those that had adhered to 3 or fewer of the *REG10* attributes in 2001. Because of the

regresses the FX exposure variable, whereas Panel B considers the derivatives use. The first term in each column has no time interaction and therefore indicates the time-invariant effect of the governance index, whereas the following terms capture the year-specific sensitivity of the governance index.

In Panel A of Table 9, where we consider the impact on foreign exchange exposure, the time-invariant effect is highly significant in all case except for the *COMPENSATION* index. The year-specific effects show a strong additional impact that slowly rises to about double the time-invariant impact two years after the adoption of the law before falling back again. As can be seen in all columns of Panel A, the strongest foreign exchange risk-reduction effect of the mandates occurs around the 2004 – the year of the mandates’ deadline – before the interaction term coefficients decline in an absolute sense. Thus, overall there appears to emerge a hump-shaped reaction of FX exposure to the governance measures; it seems that the impact of better governance on overall FX exposure is persistent but takes more time to deploy, and hence is increasing over a number of years.

In Panel B of Table 9, where derivatives use is the dependent variable, we find a different time pattern. As in Panel A, we uncover a highly significant impact of the time-invariant component for each of the seven governance indexes ($p < 0.01$ in all cases except for the *COMPENSATION* index where $p = 0.011$). The time-variant patterns, however, exhibit a much more shortlived nature. We find a stronger effect of the governance index on derivatives use only in 2002, the year of adoption of the Sarbanes-Oxley Act in which the novelty of the reform and the awareness of recent corporate fraud cases were strong, and a quick reversal to the normal sensitivity in all subsequent years. Thus, we find a heightened sensitivity that is very temporary in nature, consistent perhaps with initial attention-induced overshooting.

Another extension that we investigate is the possibility that the effectiveness of corporate governance reform depends on CEO characteristics. To address this possibility, we include four variables of CEO characteristics and CEO incentives (CEO tenure, CEO equity, CEO options, and CEO duality) in the regressionset-up of Tables 6 and 7. The results show that

inherently arbitrary nature of selecting the cutoff, we instead interact the indexes *REG10* and *GOV31* with year dummies.

our results are not altered when these CEO variables are included (the tests and correlations are reported in an Internet Appendix).

5.3 Additional Endogeneity Tests

In this section, we re-estimate our exposure regressions using a dynamic panel generalized method of moments (GMM) estimator (Arellano and Bond, 1991). Table 10 displays our results for the effects of the seven indexes on foreign exchange exposure. We find strong and highly significant results for all governance indexes except for *REGIO*; the six other indexes remain highly significant.¹⁷ Given the advantages of the dynamic panel GMM approach over standard panel regressions, these are reassuring results that indicate that a rise in the adoption of governance attributes leads to better risk management in US firms, albeit with weaker result than in our original estimation equation. Also, the effect seems to hold by and large when we focus on exogenous, law-induced subindexes of governance changes. We redo the same regressions with derivatives use as the dependent variable and find no significant effect (not reported in tables). Overall, these findings confirm our conclusion that the implementation of the SOX mandates and related listing rules contributed to substantially lower foreign exchange risk for US firms.

As an aside, we find a much stronger relation between *BOARD* and exposure than *COMPENSATION* and exposure. This suggests that the monitoring role of the board may be more critical in ensuring best practice risk management than compensation-related attributes designed to align managers' with shareholders' interests. Alternatively, it may be the case that the effects of executive compensation would be better proxied by more direct measures of compensation contracts and their changes over time, as in Géczy et al. (1997), Gay and Nam (1998), Kumar and Rabinovich (2013) and Bakke et al. (2016).

6. Conclusion

Following the corporate governance scandals of the early 2000s, the strong regulatory response in the form of the 2002 Sarbanes-Oxley Act was accompanied by a wave of investor sentiment demanding better governance standards in listed firms that led to

¹⁷ Dynamic panel GMM cannot be applied to the *AFFECTED* dummy since it is time-invariant.

stringent regulation, providing a hitherto little explored opportunity to strengthen the identification of the governance-hedging relation. In this paper, we use this exogenous shock to investigate the effect of corporate governance quality on firms' risk management relating to foreign exchange risk. Using a sample of 507 US firms over the period 2000-2007, we examine the relation between indexes of 'good governance' attributes and the sample firms' use of currency derivatives for hedging purposes, and their exposure to exchange rate movements. We use a comprehensive variable of 41 governance practices (*GOV41*), we find a strong and robust risk-reduction effect of better governance, consistent with the hypothesis that firms tend to hedge too little on average when managerial discretion is not checked by effective governance mechanisms.

To address concerns about the endogeneity of the link between governance rules and hedging policies, we focus on governance changes mandated or induced by the Sarbanes-Oxley Act of 2002 (SOX). We propose two measures of panel variation in governance standards that are directly driven by the mandatory improvements in governance imposed by the Sarbanes-Oxley Act: we use an index of governance attributes that were directly made mandatory by the Sarbanes-Oxley Act of 2002, with a two year transition period to execute the mandatory changes (*REG10*), and a somewhat larger index of measures that, beyond the 10 included in *REG10*, also include 10 measures that are usually adopted in tandem with the mandatory changes (*MANDATE-INDUCED*). We contrast these indexes with their complements of voluntary governance practices (*GOV31* and *MANDATE-INDUCED*). For both index splits, we find robust and highly significant results, and find that the subindexes based on mandated governance changes have a stronger impact than the indexes comprising voluntary governance improvements. As further test to allay endogeneity concerns, we employ dynamic panel GMM and find strong confirmation for our result on foreign exchange exposure. Overall, our findings suggest that the exogenous SOX reform in governance norms resulted in companies strengthening their foreign exchange risk management practices, thus shedding new light on still ambiguous body of work on the relationship between good governance and managers' hedging of financial risks.

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Table 1 Corporate governance index values over time

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2002	2003	2004	2005	2006	2007	% change 2002 - 2007	T-test /rank sum test	Rank sum test, small vs large
GOV41									
Mean	13.05	18.91	20.74	24.45	24.25	25.81	98	54.56***	18.32***
Median	13.00	19.00	21.00	25.00	25.00	26.00	100	28.27***	
Standard deviation	4.01	3.58	3.55	3.86	3.79	3.76			
Small firm median	14.00	20.00	22.00	26.00	26.00	27.00			
Large firm median	13.00	17.00	19.50	23.00	23.00	24.00			
MANDATE-INDUCED									
Mean	7.53	10.21	11.76	14.77	14.47	14.63	94	45.29***	19.70***
Median	8.00	10.00	12.00	15.00	15.00	15.00	88	26.64***	
Standard deviation	2.74	2.39	2.41	2.78	2.51	2.46			
Small firm median	8.00	11.00	13.00	16.00	16.00	16.00			
Large firm median	7.00	9.00	11.00	14.00	14.00	14.00			
VOLUNTARY									
Mean	5.52	8.70	8.98	9.68	9.79	11.18	103	45.66***	12.50***
Median	6.00	9.00	9.00	10.00	10.00	11.00	83	27.77***	
Standard deviation	1.98	2.11	2.01	2.08	2.16	2.14			
Small firm median	6.00	9.00	9.00	10.00	10.00	11.00			
Large firm median	5.00	8.00	8.50	9.00	9.00	10.00			
REG10									
Mean	3.38	4.38	4.77	7.79	8.07	8.12	140	52.80***	12.57 ***
Median	3.00	5.00	5.00	8.00	9.00	9.00	200	27.02***	
Standard deviation	1.51	1.54	1.56	1.71	1.53	1.43			
Small firm median	3.00	4.00	4.00	8.00	8.00	8.00			
Large firm median	4.00	5.00	5.00	9.00	9.00	9.00			
GOV31									
Mean	10.34	14.54	15.97	16.65	16.18	17.69	71	47.35***	15.96***
Median	10.00	15.00	16.00	17.00	16.00	18.00	80	27.26***	
Standard deviation	1.92	3.02	2.80	2.95	2.98	3.03			
Small firm median	10.00	13.00	15.00	16.00	15.00	16.00			
Large firm median	11.00	15.50	17.00	18.00	17.00	18.00			
BOARD									
Mean	0.28	0.46	0.53	0.53	0.49	0.56	99	46.69***	12.54***
Median	0.29	0.47	0.53	0.53	0.47	0.53	80	27.91***	
Standard deviation	0.09	0.11	0.10	0.11	0.11	0.10			
Small firm median	0.29	0.41	0.53	0.53	0.47	0.53			
Large firm median	0.29	0.47	0.53	0.53	0.53	0.59			
COMPENSATION									
Mean	0.42	0.51	0.56	0.63	0.64	0.68	63	23.19***	24.47***
Median	0.43	0.43	0.57	0.57	0.57	0.71	67	19.63***	
Standard deviation	0.17	0.17	0.18	0.18	0.19	0.21			
Small firm median	0.43	0.43	0.43	0.57	0.57	0.57			
Large firm median	0.43	0.57	0.57	0.71	0.71	0.86			

Notes: In this table, we present the mean, median and standard deviation for the *REG10*, *GOV31*, *BOARD* and *COMPENSATION* governance indexes respectively for each year 2002-2007. Column (7) shows the percentage change in the governance indexes to 2007 from 2002. Column (8) presents the t-statistic and Wilcoxon rank sum z-statistic for the test of difference between mean and median values of the governance indexes in 2007 relative to 2002. Column (9) displays the Wilcoxon rank sum z-statistic for the test of overall difference in medians between small and large firms. Small (large) firms are classified as having total assets less than or equal to (greater than) the overall median value of \$1,374.2 million. *** denotes significance at the 1% level. The governance variables are defined in the Appendix.

Table 2 Proportion of derivative usage by governance over time

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Year	Low GOV41	High GOV41	Z-statistic	Low MANDATE-INDUCED	High MANDATE-INDUCED	Z-statistic	Low VOLUNTARY	High VOLUNTARY	Z-statistic	
2000	0.3	0.38	-0.78	0.29	0.45	-1.99**	0.31	0.24	0.71	
2001	0.35	0.48	-1.17	0.34	0.55	-2.62***	0.36	0.32	0.39	
2002	0.39	0.57	-1.66*	0.38	0.61	-2.70***	0.4	0.4	-0.02	
2003	0.29	0.41	-3.04***	0.29	0.44	-3.34***	0.32	0.36	-1.09	
2004	0.28	0.44	-3.86***	0.29	0.45	-3.75***	0.34	0.42	-1.77*	
2005	0.12	0.43	-4.66***	0.2	0.42	-3.47***	0.31	0.44	-2.87***	
2006	0.27	0.42	-2.33**	0.31	0.41	-1.63	0.34	0.43	-2.06**	
2007	0.22	0.43	-2.48**	0.25	0.44	-2.81***	0.32	0.43	-1.57	
Panel B	Low REG10	High REG10	Z-statistic	LOW GOV31	High GOV31	Z-statistic	Low BOARD	High BOARD	Z-statistic	
2000	0.29	0.49	-2.73***	0.31	0.15	1.19	0.304	0.304	0.00	
2001	0.34	0.58	-3.20***	0.36	0.23	0.96	0.352	0.393	-0.60	
2002	0.38	0.55	-2.51***	0.41	0.31	1.31	0.396	0.411	-0.21	
2003	0.32	0.46	-2.57***	0.25	0.43	-4.47***	0.214	0.383	-3.63***	
2004	0.35	0.46	-2.37**	0.28	0.43	-3.48***	0.268	0.395	-1.60	
2005	0.21	0.44	-4.64***	0.27	0.43	-3.34***	0.170	0.415	-3.28***	
2006	0.3	0.42	-1.86*	0.29	0.44	-3.31***	0.310	0.416	-1.85*	
2007	0.26	0.44	-2.63***	0.29	0.45	-2.73***	0.211	0.427	-1.88*	
Panel C	Low COMPENSATION	High COMPENSATION	Z-statistic	AFFECTED	NON-AFFECTED	Z-statistic	All Firms	Small Firms	Large Firms	Z-statistic
2000	0.29	0.54	-3.37***	0.24	0.38	3.62***	0.3	0.2	0.44	-6.16***
2001	0.34	0.59	-3.18***	0.31	0.41	2.52**	0.36	0.25	0.48	-5.60***
2002	0.38	0.61	-2.88***	0.35	0.46	2.71***	0.4	0.28	0.54	-6.16***
2003	0.29	0.53	-4.83***	0.28	0.41	3.11***	0.34	0.26	0.42	-4.00***
2004	0.30	0.56	-5.80***	0.33	0.45	2.94***	0.39	0.27	0.5	-5.65***
2005	0.29	0.54	-5.75***	0.33	0.47	3.22***	0.39	0.29	0.48	-4.52***
2006	0.29	0.53	-5.73***	0.34	0.47	2.97***	0.4	0.29	0.49	-4.78***
2007	0.32	0.51	-4.56***	0.38	0.47	2.25**	0.42	0.3	0.51	-4.95***

Notes: Table 2, Panels A, B and C presents the proportion of derivatives usage for firms in high and low governance groups. Low and high *GOV41*, *MANDATE-INDUCED*, *VOLUNTARY*, *REG10*, *GOV31*, *BOARD* and *COMPENSATION* groups are defined as having values less than or equal to (greater than) the overall median index values of 19, 11, 8, 5 and 15, respectively. *AFFECTED* (*NON-AFFECTED*) is a binary variable, which is assigned a value of 1 (0) if firms complied with three or fewer (greater than four) of the *REG10* governance mandates that were revised in the NASDAQ and NYSE listing standards in the year 2002. Panel C also presents the proportion of derivatives usage for the full sample, small firms and large firms. Small (large firms) are classified as having total assets less than or equal to (greater than) the overall median asset value of \$1,374.2 million for the full period 2000 to 2007. The Wilcoxon rank sum z-statistic presents the significance tests for the difference in median values. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively. The governance variables are defined in the Appendix.

Table 3 Median absolute foreign exchange rate exposure

Panel A	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Year	Low GOV41	High GOV41	Z-statistic	Low MANDATE-INDUCED	High MANDATE-INDUCED	Z-statistic	Low VOLUNTARY	High VOLUNTARY	Z-statistic		
2000	1.35	1.497	0.8	1.4	1.179	2.10**	1.398	1.055	1.06		
2001	1.478	1.227	0.54	1.497	1.217	1.24	1.457	1.605	0.54		
2002	1.107	0.612	1.94*	1.109	0.625	2.35**	1.101	0.709	0.87		
2003	0.837	0.713	2.59***	0.847	0.678	2.11**	0.81	0.782	1.49		
2004	0.828	0.637	3.37***	0.741	0.67	2.37**	0.758	0.67	1.95*		
2005	1.118	0.702	2.34**	1.058	0.7	2.52**	0.832	0.7	1.92*		
2006	0.767	0.893	-0.36	0.864	0.893	-0.6	0.853	0.905	-0.25		
2007	1.248	0.985	1.85*	1.226	0.978	2.15**	1.293	0.985	1.34		
Panel B	Low REG10	High REG10	Z-statistic	Low GOV31	High GOV31	Z-statistic	Low BOARD	High BOARD	Z-statistic		
2000	1.396	1.294	0.95	1.343	2.161	-1.3	1.400	1.239	0.949		
2001	1.488	1.223	1.13	1.457	1.637	-0.31	1.474	1.333	1.44		
2002	1.106	0.747	1.97**	1.085	1.068	0.93	1.105	0.917	1.471		
2003	0.834	0.651	1.29	0.819	0.749	2.26**	0.771	0.804	0.379		
2004	0.715	0.675	1.32	0.806	0.654	2.67***	0.684	0.697	1.022		
2005	0.937	0.693	2.66***	1.029	0.685	2.25***	1.242	0.701	2.992***		
2006	1.048	0.891	0.24	0.905	0.891	0.27	1.135	0.874	2.142**		
2007	1.248	0.978	1.86*	1.405	0.952	2.85***	1.195	1.009	0.83		
Panel C	Low COMPENSATION	High COMPENSATION	Z-statistic	AFFECTED	NON-AFFECTED	Z-statistic	All Firms	Proportion significant	Small Firms	Large firms	Z-statistic
2000	1.396	1.261	1.918	1.467	1.296	-1.56	1.394	0.05	1.678	1.211	3.18***
2001	1.499	1.173	1.59	1.629	1.346	-2.18**	1.458	0.07	1.668	1.225	3.39***
2002	1.125	0.642	2.75***	1.062	1.127	-0.07	1.085	0.08	1.201	0.992	2.64***
2003	0.862	0.589	3.34***	0.847	0.738	-1.54	0.803	0.09	0.966	0.688	3.29***
2004	0.725	0.603	2.22**	0.765	0.591	-2.90***	0.694	0.1	0.789	0.624	3.29***
2005	0.791	0.700	1.12	0.784	0.659	-2.26**	0.72	0.07	0.922	0.659	3.03***
2006	1.017	0.833	2.69***	0.987	0.792	-2.70***	0.891	0.1	1.008	0.801	3.08***
2007	1.125	0.939	2.20**	1.105	0.884	-2.58***	1.017	0.11	1.305	0.896	4.73***

Notes: Panels A, B and C of this table presents the median absolute foreign exchange rate exposure coefficients (α i2) as estimated in equation [1] for firms in high and low governance groups. Low and high *GOV41*, *MANDATE-INDUCED*, *VOLUNTARY*, *REG10*, *GOV31*, *BOARD* and *COMPENSATION* groups are defined as having values less than or equal to (greater than) the overall median index values of 19, 11, 8, 5 and 15, respectively. *AFFECTED* (*NON-AFFECTED*) is a binary variable, which is assigned a value of 1 (0) if firms complied with three or fewer (greater than four) of the *REG10* governance mandates that were revised in the NASDAQ and NYSE listing standards in the year 2002.

Panel C also presents the overall median exposure coefficients for the full sample and the proportion of the firms with significant exposure (at the 5 percent level or better) We also present median absolute exposure for small versus large firms. Small (large) firms are defined as having total assets less (greater) than the overall median value of \$1,374.2 million for the period 2000 to 2007. The Wilcoxon rank sum z-statistic presents the significance tests for the difference in median values. ***, ** and * indicate significance at the 1, 5 and 10 percent levels respectively. The governance variables are defined in the Appendix.

Table 4 Medians for control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
			GOV41			MANDATE-INDUCED					VOLUNTARY		
	All firms	Low	High	(3) – (2)	Z-statistic	Low	High	(7) – (6)	Z-statistic	Low	High	(11) – (10)	Z-statistic
Assets (\$ millions)	1,374.20	890.48	2225.08	1334.60	-16.60***	838.64	2407.33	1568.69	-18.71***	1023.19	2078.04	1054.84	-12.37***
R&D	0.05	0.06	0.04	-0.02	3.74***	0.06	0.04	-0.01	3.78***	0.05	0.04	0.00	0.86
Quick ratio	1.41	1.51	1.32	-0.20	5.82***	1.54	1.29	-0.24	7.75***	1.44	1.38	-0.05	1.77**
MTBV	1.74	1.69	1.81	0.12	-2.91***	1.71	1.80	0.09	-2.00**	1.69	1.82	0.13	-3.68***
D/A	0.21	0.21	0.21	0.00	-0.02	0.21	0.22	0.01	-1.33	0.22	0.21	-0.01	1.34
Foreign sales	16.69	13.09	21.79	8.70	-6.52***	11.81	23.82	12.01	-8.12***	15.09	18.73	3.64	-3.73***
ABHK	4	4.00	4.00	0.00	1.29	4.00	4.00	0.00	-1.46	4.00	4.00	0.00	5.03***

Notes: This table reports the median values for the control variables for the all firms and high/low governance groups. Low and high *GOV41*, *MANDATE-INDUCED* and *VOLUNTARY*, groups are defined as having values less than or equal to (greater than) the overall median index values of 19, 11, and 8 respectively. The ‘z-statistic’ reports the results of a Wilcoxon rank sum test of the difference in medians. **denotes significance at the 5% level, and *** at the 1% level. The control variables are defined in the Appendix.

Table 5 Spearman rank correlation matrix

	1	2	3	4	5	6	8	9	10	11	12	13	14	15	16
1 ABSOLUTE α_i2															
2 ASSETS	-0.20*														
3 R&D	0.15*	-0.32*													
4 QUICK RATIO	0.16*	-0.50*	0.57*												
5 MTBV	-0.03	-0.04	0.28*	0.19*											
6 D/A	-0.05	0.39*	-0.27*	-0.43*	-0.27*										
8 FOREIGN SALES	-0.04	0.23*	0.19*	0.00	-0.02	0.05									
9 ABHK	-0.15*	0.48*	-0.04	-0.31*	0.00	0.16*	0.49*								
10 DERIVATIVES USE	-0.09*	0.27*	-0.03	-0.25*	-0.04	0.09*	0.45*	0.47*							
11 GOV41	-0.12*	0.30*	-0.06†	-0.14*	0.13*	0.07†	0.11*	0.17*	0.12*						
12 MANDATE-INDUCED	-0.11*	0.31*	-0.06†	-0.17*	0.11*	0.06†	0.12*	0.21*	0.14*	0.92*					
13 VOLUNTARY	-0.08*	0.19*	-0.04	-0.06†	0.14*	0.04	0.05	0.05	0.06†	0.81*	0.52*				
14 REG10	-0.07†	0.27*	-0.11*	-0.17*	0.05	0.06†	0.07†	0.17*	0.11*	0.83*	0.91*	0.45*			
15 BOARD	-0.11*	0.20*	-0.03	-0.09*	0.14*	0.03	0.10*	0.08*	0.08*	0.79*	0.64*	0.77*	0.46*		
16 COMPENSATION	-0.13*	0.33*	-0.04	-0.18*	0.10*	0.07†	0.18*	0.27*	0.23*	0.65*	0.63*	0.48*	0.47*	0.37*	
17 AFFECTED	0.14*	-0.40*	0.05	0.24*	-0.07†	-0.13*	-0.13*	-0.28*	-0.19*	-0.18*	-0.21*	-0.08*	-0.16*	-0.11*	-0.29*

Notes: This table presents the Spearman rank correlation matrix. The absolute foreign exchange exposure estimates α_i2 , are estimated via Eq.(1). Detailed information on the variables can be found in the appendix. † denotes significance at 5%, and * denotes significance at the 1% level. The governance and control variables are defined in the Appendix.

Table 6 Multivariate analysis: foreign exchange rate exposure

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
AT	-0.019*** (0.005)	-0.019*** (0.004)	-0.022*** (0.001)	-0.018*** (0.005)	-0.021*** (0.001)	-0.020*** (0.003)	-0.019*** (0.005)	-0.021*** (0.001)	-0.020*** (0.002)	-0.022*** (0.001)
R&D	0.078 (0.138)	0.078 (0.136)	0.074 (0.157)	0.078 (0.135)	0.076 (0.149)	0.076 (0.144)	0.078 (0.138)	0.075 (0.149)	0.075 (0.149)	0.073 (0.156)
QUICK	0.096*** (0.000)	0.094*** (0.000)	0.099*** (0.000)	0.094*** (0.000)	0.095*** (0.000)	0.098*** (0.000)	0.095*** (0.000)	0.098*** (0.000)	0.096*** (0.000)	0.095*** (0.000)
MTBV	0.073*** (0.001)	0.073*** (0.001)	0.071*** (0.002)	0.073*** (0.001)	0.070*** (0.002)	0.072*** (0.001)	0.073*** (0.001)	0.072*** (0.001)	0.071*** (0.002)	0.071*** (0.001)
DA	0.158*** (0.003)	0.158*** (0.003)	0.165*** (0.002)	0.157*** (0.003)	0.161*** (0.002)	0.161*** (0.002)	0.158*** (0.003)	0.161*** (0.002)	0.161*** (0.002)	0.160*** (0.003)
FOREIGN SALES	0.001 (0.148)	0.001 (0.158)	0.001 (0.140)	0.001 (0.156)	0.001 (0.165)	0.001 (0.137)	0.001 (0.156)	0.001 (0.124)	0.001 (0.156)	0.001 (0.133)
ABHK	0.037* (0.086)	0.038* (0.078)	0.038* (0.083)	0.038* (0.080)	0.038* (0.082)	0.038* (0.083)	0.037* (0.086)	0.037* (0.089)	0.039* (0.072)	0.038* (0.080)
ABHK ²	-0.005** (0.042)	-0.005** (0.040)	-0.005** (0.039)	-0.005** (0.041)	-0.005** (0.043)	-0.005** (0.039)	-0.005** (0.043)	-0.005** (0.041)	-0.005** (0.037)	-0.005** (0.045)
DERIVATIVE USE	-0.028 (0.206)	-0.028 (0.190)	-0.030 (0.171)	-0.028 (0.198)	-0.031 (0.158)	-0.028 (0.203)	-0.028 (0.197)	-0.029 (0.189)	-0.028 (0.191)	-0.032 (0.140)
GOV41	-0.260*** (0.009)									
MANDATE-INDUCED		-0.204*** (0.004)		-0.197*** (0.007)						
VOLUNTARY			-0.101 (0.259)	-0.034 (0.711)						
REG10					-0.123** (0.027)		-0.098* (0.090)			
GOV31						-0.202** (0.033)	-0.154 (0.117)			
BOARD								-0.154* (0.070)		
COMPENSATION									-0.103** (0.040)	
AFFECTED										0.042** (0.023)
Constant	1.291*** (0.000)	1.287*** (0.000)	1.257*** (0.000)	1.291*** (0.000)	1.266*** (0.000)	1.279*** (0.000)	1.290*** (0.000)	1.272*** (0.000)	1.260*** (0.000)	1.209*** (0.000)
Observations	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374
Adjusted R ²	0.129	0.130	0.128	0.129	0.129	0.129	0.129	0.128	0.128	0.129

Notes: This table presents the results for the fixed effects panel regression analysis where the dependent variable is foreign exchange exposure, operationalized as the square root of the absolute exposure coefficient $\sqrt{|\alpha_2|}$, with α_2 estimated in equation [1]. Year and industry dummy variables are included in the analysis. P-values are located in the parenthesis below the coefficients. ***, ** and * indicates significance at the 1, 5 and 10 percent level respectively. The governance and control variables are defined in the Appendix.

Table 7 Multivariate analysis: derivatives usage

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
AT	0.268*** (0.007)	0.278*** (0.005)	0.295*** (0.003)	0.268*** (0.007)	0.298*** (0.003)	0.281*** (0.005)	0.270*** (0.007)	0.302*** (0.002)	0.290*** (0.004)	0.322*** (0.001)
R&D	-1.321 (0.251)	-1.291 (0.258)	-1.311 (0.259)	-1.320 (0.251)	-1.276 (0.263)	-1.312 (0.256)	-1.315 (0.251)	-1.279 (0.269)	-1.293 (0.258)	-1.258 (0.275)
QUICK	-0.651*** (0.003)	-0.627*** (0.005)	-0.671*** (0.002)	-0.649*** (0.003)	-0.621*** (0.005)	-0.663*** (0.003)	-0.641*** (0.004)	-0.661*** (0.003)	-0.633*** (0.004)	-0.639*** (0.004)
MTBV	-0.552** (0.013)	-0.532** (0.016)	-0.529** (0.016)	-0.552** (0.013)	-0.532** (0.016)	-0.528** (0.016)	-0.556** (0.012)	-0.514** (0.019)	-0.514** (0.019)	-0.486** (0.027)
DA	-0.680 (0.261)	-0.679 (0.263)	-0.673 (0.263)	-0.680 (0.261)	-0.702 (0.250)	-0.661 (0.270)	-0.691 (0.256)	-0.647 (0.280)	-0.674 (0.263)	-0.663 (0.270)
FOREIGN SALES	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)	0.038*** (0.000)
ABHK	1.186*** (0.000)	1.188*** (0.000)	1.182*** (0.000)	1.186*** (0.000)	1.195*** (0.000)	1.180*** (0.000)	1.190*** (0.000)	1.170*** (0.000)	1.190*** (0.000)	1.183*** (0.000)
ABHK ²	-0.078** (0.028)	-0.078** (0.029)	-0.077** (0.030)	-0.078** (0.028)	-0.079** (0.027)	-0.077** (0.030)	-0.079** (0.028)	-0.076** (0.033)	-0.079** (0.027)	-0.077** (0.031)
GOV41	3.055*** (0.002)									
MANDATE-INDUCED		1.920*** (0.006)		1.547** (0.037)						
VOLUNTARY			2.212** (0.020)	1.475 (0.149)						
REG10					1.387*** (0.008)		1.102** (0.044)			
GOV31						2.383** (0.013)	1.818* (0.071)			
BOARD								1.636** (0.040)		
COMPENSATION									0.986* (0.053)	
AFFECTED DUMMY										-0.074 (0.824)
Constant	-9.164*** (0.000)	-9.041*** (0.000)	-8.935*** (0.000)	-9.163*** (0.000)	-8.956*** (0.000)	-9.000*** (0.000)	-9.170*** (0.000)	-8.863*** (0.000)	-8.782*** (0.000)	-8.578*** (0.000)
Observations	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374

Notes: This table presents the results for the random effects panel logit model. The dependent variable is the derivative usage binary variable. Year and industry dummy variables are included in the analysis. P-values are located in the parenthesis below the coefficients. ***, ** and * indicates significance at the 1, 5 and 10 percent level respectively. The governance and control variables are defined in the Appendix.

Table 8 Multivariate analysis: foreign exchange exposure and derivatives use by firm size

Panel A: Foreign exchange exposure (dependent variable)	(1) Large Firms	(2) Small Firms	(3) Large Firms	(4) Small Firms	(5) Large Firms	(6) Small Firms	(7) Large Firms	(8) Small Firms	(9) Large Firms	(10) Small Firms	(11) Large Firms	(12) Small Firms
AT	0.005 (0.623)	-0.065*** (0.005)	0.004 (0.643)	-0.067*** (0.005)	0.001 (0.914)	-0.068*** (0.003)	0.004 (0.669)	-0.068*** (0.004)	0.003 (0.729)	-0.066*** (0.004)	0.003 (0.727)	-0.069*** (0.002)
R&D		0.060 (0.271)		0.057 (0.286)		0.058 (0.282)		0.056 (0.295)		0.059 (0.272)		0.056 (0.295)
QUICK	0.102*** (0.001)	0.085*** (0.000)	0.095*** (0.003)	0.085*** (0.000)	0.104*** (0.001)	0.086*** (0.000)	0.098*** (0.002)	0.085*** (0.000)	0.104*** (0.001)	0.086*** (0.000)	0.101*** (0.001)	0.083*** (0.001)
MTBV	0.052* (0.077)	0.087** (0.010)	0.052* (0.073)	0.085** (0.012)	0.049* (0.094)	0.086** (0.011)	0.050* (0.087)	0.083** (0.014)	0.051* (0.083)	0.088*** (0.010)	0.049* (0.091)	0.087** (0.011)
DA	0.175** (0.028)	0.191** (0.010)	0.166** (0.036)	0.192*** (0.010)	0.194** (0.015)	0.196*** (0.008)	0.173** (0.027)	0.194*** (0.009)	0.184** (0.021)	0.193*** (0.009)	0.178** (0.025)	0.192*** (0.010)
FOREIGN SALES	0.001 (0.279)	0.000 (0.498)	0.001 (0.289)	0.000 (0.505)	0.001 (0.279)	0.000 (0.492)	0.001 (0.305)	0.000 (0.512)	0.001 (0.274)	0.000 (0.482)	0.001 (0.259)	0.000 (0.480)
ABHK	0.044 (0.131)	0.035 (0.309)	0.047 (0.109)	0.034 (0.327)	0.047 (0.105)	0.037 (0.283)	0.046 (0.110)	0.033 (0.332)	0.045 (0.125)	0.037 (0.284)	0.048* (0.098)	0.030 (0.379)
ABHK ²	-0.006* (0.086)	-0.004 (0.319)	-0.006* (0.074)	-0.004 (0.347)	-0.006* (0.067)	-0.005 (0.285)	-0.006* (0.074)	-0.004 (0.354)	-0.006* (0.081)	-0.005 (0.286)	-0.006* (0.070)	-0.004 (0.414)
DERIVATIVE USE	-0.045 (0.100)	0.003 (0.939)	-0.044 (0.107)	-0.001 (0.976)	-0.048* (0.082)	0.005 (0.891)	-0.046* (0.096)	-0.002 (0.946)	-0.046* (0.092)	0.005 (0.882)	-0.047* (0.084)	-0.003 (0.932)
GOV41	-0.195 (0.146)	-0.251* (0.094)										
MANDATE-INDUCED			-0.246*** (0.008)	-0.084 (0.441)								
VOLUNTARY					0.075 (0.531)	-0.290** (0.032)						
REG10							-0.166** (0.025)	-0.031 (0.723)				
GOV31									-0.080 (0.531)	-0.279* (0.050)		
AFFECTED											0.042* (0.070)	0.042 (0.161)
Constant	1.039*** (0.000)	1.578*** (0.000)	1.078*** (0.000)	1.548*** (0.000)	0.972*** (0.000)	1.595*** (0.000)	1.040*** (0.000)	1.540*** (0.000)	1.006*** (0.000)	1.590*** (0.000)	0.956*** (0.000)	1.514*** (0.000)
Observations	1,864	1,510	1,864	1,510	1,864	1,510	1,864	1,510	1,864	1,510	1,864	1,510
Adjusted R ²	0.110	0.117	0.113	0.116	0.110	0.118	0.112	0.116	0.110	0.117	0.111	0.117

Panel B: Derivatives use (dependent variable)	(1) Large Firms	(2) Small Firms	(3) Large Firms	(4) Small Firms	(5) Large Firms	(6) Small Firms	(7) Large Firms	(8) Small Firms	(9) Large Firms	(10) Small Firms	(11) Large Firms	(12) Small Firms
AT	0.063 (0.627)	0.472 (0.153)	0.073 (0.574)	0.489 (0.140)	0.079 (0.543)	0.510 (0.119)	0.076 (0.562)	0.532 (0.108)	0.075 (0.567)	0.471 (0.151)	0.088 (0.498)	0.555* (0.089)
R&D		-1.503 (0.297)		-1.454 (0.312)		-1.508 (0.302)		-1.426 (0.324)		-1.504 (0.298)		-1.393 (0.336)
QUICK	-0.483 (0.150)	-0.841*** (0.008)	-0.457 (0.174)	-0.812** (0.011)	-0.501 (0.135)	-0.877*** (0.006)	-0.463 (0.169)	-0.798** (0.013)	-0.493 (0.141)	-0.866*** (0.007)	-0.483 (0.150)	-0.816** (0.010)
MTBV	-0.332 (0.246)	-0.860** (0.020)	-0.327 (0.253)	-0.802** (0.028)	-0.318 (0.265)	-0.858** (0.020)	-0.330 (0.252)	-0.786** (0.032)	-0.321 (0.261)	-0.843** (0.021)	-0.309 (0.280)	-0.728** (0.044)
DA	-1.018 (0.229)	-0.760 (0.432)	-1.054 (0.215)	-0.710 (0.462)	-1.059 (0.209)	-0.782 (0.418)	-1.093 (0.200)	-0.729 (0.452)	-1.036 (0.219)	-0.730 (0.447)	-1.086 (0.200)	-0.678 (0.481)
FOREIGN SALES	0.044*** (0.000)	0.034*** (0.000)	0.044*** (0.000)	0.033*** (0.000)	0.044*** (0.000)	0.034*** (0.000)	0.044*** (0.000)	0.034*** (0.000)	0.044*** (0.000)	0.033*** (0.000)	0.044*** (0.000)	0.034*** (0.000)
ABHK	0.861** (0.013)	1.522** (0.011)	0.851** (0.014)	1.573*** (0.009)	0.838** (0.016)	1.525** (0.010)	0.833** (0.016)	1.638*** (0.006)	0.850** (0.014)	1.490** (0.012)	0.822** (0.018)	1.634*** (0.006)
ABHK ²	-0.060 (0.135)	-0.062 (0.388)	-0.059 (0.141)	-0.067 (0.351)	-0.057 (0.155)	-0.063 (0.377)	-0.057 (0.155)	-0.075 (0.299)	-0.058 (0.145)	-0.058 (0.416)	-0.055 (0.166)	-0.074 (0.302)
GOV41	2.265* (0.084)	3.771** (0.022)										
MANDATE-INDUCED			1.593* (0.072)	1.897 (0.118)								
VOLUNTARY					0.960 (0.440)	4.072** (0.012)						
REG10							1.203* (0.072)	1.225 (0.182)				
GOV31									1.418 (0.267)	3.631** (0.025)		
AFFECTED											-0.127 (0.722)	-0.004 (0.995)
Constant	-5.957*** (0.000)	-14.046*** (0.000)	-5.942*** (0.000)	-13.832*** (0.000)	-5.507*** (0.000)	-14.186*** (0.000)	-5.720*** (0.000)	-14.007*** (0.000)	-5.707*** (0.000)	-13.882*** (0.000)	-5.245*** (0.001)	-13.751*** (0.000)
Observations	1,864	1,510	1,864	1,510	1,864	1,510	1,864	1,510	1,864	1,510	1,864	1,510

Notes: A presents the results for the fixed effects panel regression analysis where the dependent variable is foreign exchange exposure, operationalised as the square root of the absolute exposure coefficient $\sqrt{|\alpha'_2|}$, with α_2 , estimated in equation [1]. Panel B of this table presents the results for the random effects panel logit regression analysis where *DERIVATIVES USE* is the dependent variable. Panel Small (large) firms are defined as having total assets less (greater) than the overall median value of \$1,374.2 million for the period 2000 to 2007. Year and industry dummy variables are included in the analysis. P-values are located in the parenthesis below the coefficients. ***, ** and * indicates significance at the 1, 5 and 10 percent level respectively. Variables are defined in the Appendix.

Table 9 Time trend analysis

Panel A: Foreign exchange exposure (dependent variable)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AT	-0.013** (0.043)	-0.015** (0.025)	-0.019*** (0.004)	-0.019*** (0.004)	-0.015** (0.020)	-0.019*** (0.003)	-0.018*** (0.007)
R&D	0.086 (0.101)	0.086 (0.102)	0.079 (0.125)	0.081 (0.128)	0.084 (0.106)	0.082 (0.109)	0.079 (0.130)
QUICK	0.091*** (0.000)	0.086*** (0.000)	0.098*** (0.000)	0.085*** (0.000)	0.096*** (0.000)	0.094*** (0.000)	0.089*** (0.000)
MTBV	0.082*** (0.000)	0.083*** (0.000)	0.081*** (0.000)	0.079*** (0.001)	0.083*** (0.000)	0.084*** (0.000)	0.080*** (0.000)
DA	0.154*** (0.004)	0.156*** (0.003)	0.170*** (0.001)	0.166*** (0.002)	0.162*** (0.002)	0.159*** (0.003)	0.173*** (0.001)
FOREIGN SALES	0.000 (0.268)	0.000 (0.342)	0.000 (0.299)	0.000 (0.478)	0.001 (0.258)	0.001 (0.206)	0.000 (0.470)
ABHK	0.049** (0.024)	0.056** (0.010)	0.054** (0.014)	0.060*** (0.006)	0.053** (0.015)	0.053** (0.016)	0.071*** (0.001)
ABHK ⁻²	-0.006** (0.015)	-0.007*** (0.008)	-0.007*** (0.008)	-0.007*** (0.005)	-0.007*** (0.008)	-0.007*** (0.008)	-0.008*** (0.002)
DERIVATIVE USE	-0.023 (0.283)	-0.026 (0.231)	-0.026 (0.237)	-0.033 (0.138)	-0.022 (0.305)	-0.024 (0.279)	-0.026 (0.241)
GOV41	-0.368*** (0.000)						
GOV41*2002	-0.358*** (0.000)						
GOV41*2003	-0.562*** (0.000)						
GOV41*2004	-0.585*** (0.000)						
GOV41*2005	-0.338*** (0.000)						
GOV41*2006	-0.223*** (0.000)						
MANDATE-INDUCED		-0.255*** (0.000)					
MANDATE-INDUCED *02		-0.271*** (0.001)					
MANDATE-INDUCED *03		-0.505*** (0.000)					
MANDATE-INDUCED *04		-0.494*** (0.000)					
MANDATE-INDUCED *05		-0.261*** (0.000)					
MANDATE-INDUCED *06		-0.183*** (0.000)					
VOLUNTARY			-0.198** (0.013)				
VOLUNTARY *02			-0.288** (0.019)				
VOLUNTARY *03			-0.584*** (0.000)				
VOLUNTARY *04			-0.682*** (0.000)				
VOLUNTARY *05			-0.487***				

VOLUNTARY *06			(0.000)					
			-0.311***					
			(0.000)					
REG10								
REG10*2002								
REG10*2003								
REG10*2004								
REG10*2005								
REG10*2006								
GOV31								
GOV31*2002								
GOV31*2003								
GOV31*2004								
GOV31*2005								
GOV31*2006								
BOARD								
BOARD *2002								
BOARD *2003								
BOARD *2004								
BOARD *2005								
BOARD *2006								
COMPENSATION								
COMPENSATION *2002								
COMPENSATION *2003								
COMPENSATION *2004								
COMPENSATION *2005								
COMPENSATION *2006								
Constant	1.228***	1.191***	1.151***	1.134***	1.193***	1.184***	1.063***	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
Observations	3,374	3,374	3,374	3,374	3,374	3,374	3,374	
Adjusted R ²	0.120	0.118	0.112	0.109	0.117	0.115	0.107	

Panel B: Derivatives use (dependent variable)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AT	0.276*** (0.005)	0.284*** (0.004)	0.296*** (0.003)	0.301*** (0.002)	0.284*** (0.004)	0.306*** (0.002)	0.304*** (0.002)
R&D	-1.312 (0.258)	-1.290 (0.263)	-1.316 (0.261)	-1.270 (0.269)	-1.315 (0.259)	-1.282 (0.271)	-1.289 (0.260)
QUICK	-0.616*** (0.005)	-0.599*** (0.007)	-0.630*** (0.004)	-0.589*** (0.008)	-0.628*** (0.004)	-0.626*** (0.004)	-0.599*** (0.006)
MTBV	-0.585*** (0.007)	-0.589*** (0.007)	-0.591*** (0.007)	-0.598*** (0.006)	-0.586*** (0.007)	-0.589*** (0.007)	-0.604*** (0.005)
DA	-0.584 (0.327)	-0.631 (0.292)	-0.609 (0.306)	-0.669 (0.266)	-0.606 (0.308)	-0.617 (0.298)	-0.728 (0.223)
FOREIGN SALES	0.038*** (0.000)	0.039*** (0.000)	0.039*** (0.000)	0.039*** (0.000)	0.039*** (0.000)	0.039*** (0.000)	0.040*** (0.000)
ABHK	1.181*** (0.000)	1.173*** (0.000)	1.165*** (0.000)	1.170*** (0.000)	1.164*** (0.000)	1.147*** (0.000)	1.142*** (0.000)
ABHK ²	-0.077** (0.030)	-0.076** (0.032)	-0.075** (0.034)	-0.076** (0.032)	-0.075** (0.034)	-0.073** (0.039)	-0.074** (0.037)
GOV41	2.101*** (0.000)						
GOV41*2002	1.983*** (0.002)						
GOV41*2003	-0.629 (0.135)						
GOV41*2004	-0.017 (0.967)						
GOV41*2005	-0.216 (0.548)						
GOV41*2006	-0.309 (0.386)						
MANDATE-INDUCED		1.658*** (0.001)					
MANDATE-INDUCED *02		1.542*** (0.003)					
MANDATE-INDUCED *03		-0.408 (0.272)					
MANDATE-INDUCED *04		0.006 (0.987)					
MANDATE-INDUCED *05		-0.256 (0.392)					
MANDATE-INDUCED *06		-0.323 (0.278)					
VOLUNTARY			1.961*** (0.002)				
VOLUNTARY *02			2.146*** (0.005)				
VOLUNTARY *03			-0.941** (0.048)				
VOLUNTARY *04			-0.038 (0.935)				
VOLUNTARY *05			0.008 (0.985)				
VOLUNTARY *06			-0.131 (0.760)				
REG10				1.137***			

REG10*2002									
REG10*2003									
REG10*2004									
REG10*2005									
REG10*2006									
GOV31									
GOV31*2002									
GOV31*2003									
GOV31*2004									
GOV31*2005									
GOV31*2006									
BOARD									
BOARD *2002									
BOARD *2003									
BOARD *2004									
BOARD *2005									
BOARD *2006									
COMPENSATION									
COMPENSATION *2002									
COMPENSATION *2003									
COMPENSATION *2004									
COMPENSATION *2005									
COMPENSATION *2006									
Constant	-8.631***	-8.617***	-8.505***	-8.459***	-8.611***	-8.496***	-8.410***		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
Observations	3,374	3,374	3,374	3,374	3,374	3,374	3,374		

Notes: Panel A of this table presents the results for the fixed effects panel regression analysis where the dependent variable is foreign exchange exposure, operationalised as the square root of the absolute exposure coefficient $\sqrt{|a_2|}$, with a_2 estimated in equation [1]. Panel B presents the findings of panel random effects logit regression analysis in which the dependent variable is the *DERIVATIVES USE* binary variable. We include the time trend interaction terms, whereby the *GOV41*, *MANDATE-INDUCED*, *VOLUNTARY*, *REG10* and *GOV31*, *BOARD* and *COMPENSATION* indexes are interacted with year dummies. Industry dummies are included in the analysis. P-values are in parenthesis below the coefficients. ***, ** and * indicates significance at the 1, 5 and 10 percent level respectively. The governance and control variables are defined in the Appendix.

Table 10 Dynamic panel GMM

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
AT	0.161*** (0.004)	0.139** (0.012)	0.118** (0.025)	0.048 (0.415)	0.161*** (0.002)	0.131*** (0.007)	0.078 (0.145)
R&D	0.277*** (0.000)	0.280*** (0.000)	0.268*** (0.000)	0.267*** (0.000)	0.270*** (0.000)	0.270*** (0.000)	0.268*** (0.000)
QUICK	0.011 (0.861)	0.015 (0.809)	0.024 (0.697)	0.038 (0.550)	0.014 (0.817)	0.021 (0.726)	0.034 (0.586)
MTBV	0.104 (0.138)	0.098 (0.166)	0.089 (0.204)	0.063 (0.374)	0.117* (0.090)	0.114* (0.099)	0.072 (0.310)
DA	-0.064 (0.773)	-0.060 (0.787)	-0.031 (0.889)	-0.002 (0.994)	-0.066 (0.759)	-0.060 (0.781)	-0.006 (0.980)
FOREIGN SALES	-0.002 (0.359)	-0.002 (0.284)	-0.002 (0.273)	-0.003 (0.127)	-0.001 (0.500)	-0.001 (0.445)	-0.002 (0.180)
ABHK	0.083 (0.301)	0.088 (0.272)	0.077 (0.349)	0.086 (0.305)	0.068 (0.392)	0.071 (0.375)	0.082 (0.324)
ABHK^2	-0.011 (0.253)	-0.012 (0.228)	-0.011 (0.280)	-0.012 (0.237)	-0.010 (0.321)	-0.010 (0.300)	-0.011 (0.260)
DERIVATIVES USE	-0.054 (0.196)	-0.053 (0.212)	-0.058 (0.173)	-0.056 (0.194)	-0.058 (0.168)	-0.057 (0.172)	-0.057 (0.188)
GOV41	-0.624*** (0.000)						
MANDATE-INDUCED		-0.420*** (0.000)					
VOLUNTARY			-0.540*** (0.000)				
REG10				-0.049 (0.479)			
GOV31					-0.904*** (0.000)		
BOARD						-0.736*** (0.000)	
COMPENSATION							-0.239** (0.020)
Constant	-0.122 (0.776)	-0.029 (0.947)	0.122 (0.767)	0.443 (0.335)	0.022 (0.956)	0.152 (0.701)	0.321 (0.446)
Observations	2,537	2,537	2,537	2,537	2,537	2,537	2,537

Notes: This table presents the results for the dynamic panel GMM analysis. The dependent variable is the square root of the absolute exposure coefficient $\sqrt{|\alpha_2|}$, with α_2 estimated in equation [1]. P-values are in parenthesis below the coefficients. ***, ** and * indicates significance at the 1, 5 and 10 percent level respectively. The governance and control variables are defined in the Appendix.

Appendix: Variables used in the panel analysis

Dependent variables

Derivative Use

The binary variable takes a value of one if the firm uses foreign currency derivatives and zero otherwise. The data were collected from item 7a “quantitative and qualitative disclosures about market risk” in the firm’s annual 10-K report filed with the SEC.

$\sqrt{|\alpha_2^i|}$ *Square root of the absolute exposure coefficient*

We take the absolute value of the foreign exchange exposure response coefficient α_2^i estimated via equation [1], and then, to avoid truncation bias, we take its square root.

Governance variables

Aggarwal, Schloetzer and Williamson’s (2016) 41 ‘good’ governance attributes. Aggarwal, Schloetzer and Williamson (2016) identify the following 41 firm-level ‘good’ governance practices, under four categories; those relating to *board*, *audit*, *anti-takeover provisions*, and *compensation and ownership*. * denotes the *REG10* index attributes was mandated in revised stock exchange listing standards. † denotes the *MANDATE-INDUCED* index attributes.

Board

1. All directors attended 75% of board meetings or had a valid excuse
2. CEO serves on the boards of two or fewer public companies
3. Board is controlled by more than 50% independent outside directors * †
4. Board size is at greater than five but less than sixteen †
5. CEO is not listed as having a related-party transaction
6. Compensation committee composed solely of independent outsiders *†
7. Chairman and CEO positions are separated, or there is a lead director
8. Nominating committee composed solely of independent outsiders *†
9. Governance committee exists and met in the past year †
10. Shareholders vote on directors selected to fill vacancies
11. Governance guidelines are publicly disclosed *†
12. Annually elected board (no staggered board) †
13. Policy exists on outside directorships (four or fewer boards is the limit) †

14. Shareholders have cumulative voting rights
15. Shareholder approval is required to increase/decrease board size
16. Majority vote requirement to amend charter/bylaws (not supermajority)
17. Board has the express authority to hire its own advisers†
18. Performance of the board is reviewed regularly *†
19. Board-approved succession plan in place for the CEO *†
20. Outside directors meet without CEO and disclose number of times met *†
21. Directors are required to submit resignation upon a change in job
22. Board cannot amend bylaws without shareholder approval or can do so under limited circumstances
23. Does not ignore shareholder proposal
24. Qualifies for proxy contest defenses combination points

Audit committee

25. Consulting fees paid to auditors are less than audit fees paid to auditors *†
26. Audit committee composed solely of independent outsiders *†
27. Auditors ratified at most recent annual meeting †

Anti-Takeover provisions

28. Single class, common
29. Majority vote requirement to approve mergers (not supermajority)
30. Shareholders may call special meetings
31. Shareholders may act by written consent
32. Company either has no poison pill or a pill that is shareholder approved.
33. Company is not authorized to issue blank check preferred stock

Compensation and ownership

34. Directors are subject to stock ownership requirements†
 35. Officers are subject to stock ownership guidelines†
 36. No interlocks among compensation committee members†
 37. Directors receive all or a portion of their fees in stock†
 38. All stock-incentive plans adopted with shareholder approval *†
 39. Options grants align with company performance and reasonable burn rate
 40. Officers' and directors' stock ownership is at least 1% but not over 30% of total shares outstanding
 41. Repricing prohibited
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GOV41 is a composite index of the 41 attributes in the table above. A value of one is assigned if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

MANDATE-INDUCED is a composite index of the 20 attributes denoted by the † symbol in the table above. These 20 attributes include the 10 mandatory attributes in *REG10* plus 10 more that are so closely associated with the legal requirements in *REG10* that a joint introduction is likely, as the very high correlation with *REG10* shows. A value of one is assigned to each attribute if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

VOLUNTARY is a composite index of the 41 attributes in the table above minus the 20 attributes that comprise the *MANDATE-INDUCED* index (as denoted by the † symbol) in the table above. A value of one is assigned to each attribute if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

REG10 is a composite index of ten attributes that were mandated in the revised stock exchange listing standards denoted by the asterisk * in the table above. A value of one is assigned to each attribute if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

GOV31 is a composite index of the 41 attributes in the table above minus the 10 attributes that comprise *REG10* (as denoted by the asterisk *). A value of one is assigned if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

BOARD is a composite index of the attributes numbered 1-24 in the table above minus the attributes that are included in *REG10* (as denoted by the asterisk *). A value of one is assigned if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

COMPENSATION is a composite index of the attributes numbered 34-41 in the table above minus the attributes included in *REG10* (as denoted by the asterisk *). A value of one is assigned if the firm meets minimally acceptable guidelines on that attribute, and zero otherwise. The index is expressed as a percentage.

AFFECTED DUMMY is a binary variable, which is assigned a value of 1 if firms complied with three or fewer of the *REG10* governance mandates that were revised in the NASDAQ and NYSE listing standards in the year 2002, 0 otherwise.

Control variables

Foreign sales

Foreign sales is the International Sales / Net Sales or Revenues * 100.

D/A

Debt-to-assets ratio is long-term total debt divided by total assets.

MTBV

Market-to-book value ratio is defined as the market value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity.

Quick

Quick ratio (also referred to as the liquidity ratio) is defined as (Cash & Equivalents + Receivables (Net)) / Current Liabilities-Total.

R&D

R&D expense is research and development expenses / net sales or revenues * 100.

Assets

Total assets is the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.

Industry

Using the two-digit standard industry classification codes we create industry dummies that take the value of 1 if the firm is in an industry category and 0 otherwise. We removed financial, insurance and real estate firms that which had two digit codes in the range 60 to 67.

Multinationality: the ABHK Scheme

The ABHK multinationality classification system divides the world into six regions based on the inhabited continents: Africa, Asia, Europe, North America (including Central America), South America, and Oceania (Australia, New Zealand and the Pacific islands). A firm is considered to have a presence in a particular region if it has at least one subsidiary there. The ABHK scheme index ranges in value from one to seven. A firm with activities entirely within the United States is defined as domestic (*D*) and is assigned a value of one in the index. A firm activities in the region of North and Central America is classified as regional (*R*), and is assigned a value of two in the index. If a firm has activities in two regions (*T2*), it is assigned a value of three, three regions (*T3*) is assigned a value of four, four regions (*T4*) is assigned a value of five and five regions (*T5*) is assigned a value of six. A firm is classified as 'global' (*G*) if it has activities in all six regions and is assigned a value of seven in the index. The data were collected from the Directory of Corporate Affiliates via Lexis Nexis.

Number of foreign subsidiaries

Number of foreign subsidiaries is the total number of the firm's foreign subsidiaries. The data on subsidiary location were collected from the Directory of Corporate Affiliates via Lexis Nexis.