Corporate Hedging and Speculation with Derivatives

Söhnke M. Bartram[*]

Abstract

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[*] Professor of Finance, Warwick Business School, Department of Finance, Coventry CV4 7AL, United Kingdom, Phone: +44 (24) 7657 4168, Fax: +1 (425) 952 10 70, Email: <s.m.bartram@wbs.ac.uk>, Internet: <http://go.warwick.ac.uk/sbartram/>.

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Abstract

Against the backdrop of the role of derivatives in the recent financial crisis, this paper investigates the effect of derivatives usage on the risk and exposure of nonfinancial firms around the world and presents evidence that they use derivatives for hedging purposes. There is no evidence of corporate speculation with derivatives for firms in individual countries or for different types of derivatives, except for marginally higher net commodity price exposure of firms using commodity price derivatives. Firms use derivatives for hedging purposes independent of access to derivatives or country-level corporate governance. While there are no differences in risk between firms in countries with strong and weak shareholder rights, the reduction in risk is larger for firms in countries where creditor rights are weak or where derivatives are readily available. Consequently, policy makers could facilitate corporate hedging activities by pursuing strategies that encourage the development of local-currency derivatives markets. Given the similarity in the use and effect of derivatives across countries, internationally harmonized regulation of derivatives markets may be adequate.

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1 Motivation

Today, most large nonfinancial corporations use financial derivatives. While derivatives can be effective and efficient tools for corporate hedging, they are equally well suited for speculative purposes, possibly even under the guise of hedging. In surveys, firms surprisingly admit to speculative uses of derivatives. For example, 50% of 1,161 global firms indicate that the firm's market view is important for their use of derivatives (Bodnar, Graham, Harvey and Marston, 2014), close to 50% of 229 firms from 36 countries indicate that they take active positions at least some of the time (Lins, Servaes and Tamayo, 2011), and two out of three U.S. firms alter the size or the timing of a hedge depending on their market view on exchange rates or interest rates (Bodnar, Hayt and Marston, 1998). Given low currency volatility, many firms that used to hedge their currency exposure currently opt to live with the risk based on the assumption that rates will move within a limited range (Economist 2014), illustrating that firms take views on direction and volatility of exchange rates.

For various stakeholders, it is important to know for what purpose nonfinancial firms employ derivatives and what the consequences are, as corporate derivatives usage may decrease (in the case of hedging) or increase (in the case of speculation) the risk characteristics of a company's stock and consequently affect its value. Regulators also concern themselves with the potential role of derivatives in accounting scandals as well as broader issues of market stability, not least because of the role that the use of derivatives by financial institutions played in the recent financial crisis. The investor Warren Buffett is even often cited as condemning derivatives as "financial weapons of mass destruction." At the same time, it is important to understand the effect that reduced availability and higher costs of derivatives as a consequence of new regulation of OTC derivatives is likely going to have on the behavior of end-users (ISDA, 2015).

Despite its potential importance, only a few studies investigate the effect of derivatives usage on firm risk and exposures. These studies have almost exclusively looked at U.S. firms, and their conclusions are mixed. Hentschel and Kothari (2001) find few, if any, differences in risk between derivatives users and non-users in the United States, while Guay (1999) finds a slight reduction in the risk of U.S. firms that initiate the use of derivatives, and Nguyen and Faff (2010) find a reduction in risk only for moderate derivatives users in Australia. The results of Allayannis and Ofek (2001) are also consistent with the use of derivatives for hedging, and Bartram, Brown and Conrad (2011) find global evidence that firms hedge downside risk. However, Chernenko and Faulkender (2011) and

Faulkender (2005) identify evidence of speculation (market timing) in firms' interest rate risk management practices, and Géczy, Minton, and Schrand (2007) find that frequent speculators have significantly *lower* return volatility than non-speculators and sometimes speculators.[1]

Since the consequences of derivatives use on firm risk are potentially important to a variety of stakeholders of the firm, and amid the limited and mixed existing evidence, this paper provides new, comprehensive evidence on the question of whether firms in different parts of the world are reducing or taking risks with derivatives. The analysis is based on a sample of 6,896 nonfinancial firms from 47 countries, using a unique dataset of global derivatives usage. In particular, we investigate the systematic impact of the use of exchange rate (FX), interest rate (IR) and commodity price (CP) derivatives on the risk characteristics of nonfinancial firms. Our main measures of financial risk and exposures are the standard deviation of stock returns (scaled by the standard deviation of the returns of the local market index), as well as stock price exposure to market, exchange rate, interest rate and commodity price risk. If firms are using derivative financial instruments for hedging purposes, derivatives users may exhibit lower or similar levels of risk by these measures (see e.g. Hentschel and Kothari, 2001; Allayannis and Ofek, 2001).[2] In contrast, speculative uses of derivatives would be consistent with higher risk, e.g. higher stock return volatility, for derivatives users.

Studying the use of derivatives on an international scale is important, because U.S. nonfinancial firms account for only a minority of global derivatives transactions. Moreover, the global coverage of firms has three main advantages for studying the use and effects of derivatives. First, it increases the statistical power of tests compared to previous studies due to a larger sample size and more cross-sectional variation. Second, the international sample allows studying different countries side by side in a consistent, coherent and fully comparable way. Since previous research has focused on few individual countries (mostly the United States) and has used different data sources, sample definitions, methodologies, model specifications, variable measurements, etc., the comparability of results across different studies is limited. Especially from a policy perspective, it is important to understand how general the motivations for and effects of derivatives usage are. To illustrate, in 2015, around 40% of end-users

[1] Koski and Pontiff (1999) show that mutual funds that use derivatives have similar risk exposure and return performance to non-users, while Chen (2011) finds that hedge funds that use derivatives exhibit on average lower fund risks (e.g., market risk, downside risk, and event risk).

[2] Hedging (speculation) is defined as a policy that reduces (increases) firm value exposure to a market risk factor. An unintended increase in firm risk associated with hedging using derivatives should bias against finding a negative relation between derivatives and risk (Nguyen and Faff, 2010).

of derivatives are concerned about the scope of cross-border derivatives regulation (ISDA, 2015). Third, the international sample allows studying the role of country characteristics. Cross-country variation in the effect of derivatives on risk characteristics is likely related to country-specific factors such as country risk, the strength of country-level corporate governance and access to derivatives markets. Country characteristics are new, important determinants of corporate derivatives usage. Previous research has not been able to investigate these dimensions, even though they are potentially very interesting and relevant since they can be influenced by policy.

The study adds to the existing literature along several dimensions. First, it studies a sample of firms from a large number of countries, while previous work has focused on firms in the United States. Importantly, most of the results are clear and strong, compared to weaker and more mixed findings across previous research. Moreover, the limited analysis of derivatives usage internationally allows to effectively conduct out-of-sample tests of prior results where they exist. We provide, for the first time, evidence for a number of different non-U.S. countries based on systematically and consistently collected data. In contrast to prior work, we consider a wide range of firm-level and country-level measures of risk and exposure, derivatives for different types of underlyings, as well as net and gross exposures for firms in the largest countries outside the United States. These countries are more important with regard to derivatives usage, both in terms of turnover as well as the propensity of firms to employ these instruments, and given institutional differences across countries, the effect of derivatives usage on firm risk and exposure might vary from country to country.

The results show, for the first time, that the motives for the use of derivatives are surprisingly homogenous across countries when taking a comparable approach. Studying country samples side by side, we show that the effect of derivatives on firm risk is also similar. Thus, in contrast to mixed evidence across prior studies, the results yield a clear bottom line, which is important for policy design. At the same time, the strong results for the pooled sample demonstrate the importance of sample size. Moreover, the study is the first to demonstrate how country-level governance and access to derivatives moderates the effect of derivatives on firm risk and exposures. These results are entirely new, but important since they inform the current policy debate regarding the regulation of derivatives markets. Moreover, influential policy makers have recently suggested that access to derivatives can enhance macroeconomic development.

The results strongly suggest that nonfinancial firms use derivatives to reduce risk. Users of derivatives are more exposed to exchange rate risk and interest rate risk before the potential effects of

hedging are considered (gross or pre-hedging exposure). They are also more likely to belong to commodity-based industries that are exposed to commodity price risk. However, derivatives users show stock return volatilities that are 21% lower than volatilities of non-users. By the same token, firms that use derivatives also have significantly lower market betas as well as lower or similar levels of net (or post-hedging) foreign exchange rate, interest rate and commodity price exposures. These findings are consistent with hedging motives for corporate derivatives use, but not with corporate speculation with derivatives. The results persist after controlling for other factors that prior studies have identified as determinants of firm risk (e.g., size, profitability, etc.), the level of gross exposure (e.g. foreign sales), as well as country risk as measured by exchange rate and interest rate volatility, political risk and trade dependency.

Firms with international business (i.e. that have foreign sales, foreign income or foreign assets) exhibit significantly lower foreign exchange rate exposure of their stock returns if they use currency derivatives. While the motivation to use currency derivatives is less clear *a priori* for firms without foreign business, there is no difference between the currency exposure of derivatives users and non-users, and thus also no evidence of firms speculating with FX derivatives. These results differ in important ways from existing evidence in the literature, which has focused on the use of derivatives by U.S. firms *with* foreign business. In contrast, the focus of our analysis here is on firms that have no international business activities, which raises the interesting question of why they are using currency derivatives to start with. We also investigate potential endogeneity problems between the use of derivatives and measures of firm risk. While the use of derivatives is affected (among other things) by the risk and exposure of a firm, the finding of a negative impact of derivatives use on the risk and exposures of firms that use derivatives is robust to estimation techniques such as instrumental variables and simultaneous equations. The results are also exist when using a treatment effects model to account for a potential self-selection bias.

Overall, there is no evidence of corporate speculation with derivatives for different types of derivative instruments, since derivatives users always have lower or similar levels of risk and exposure, except for a marginally higher net commodity price exposure among firms using commodity price derivatives, which is consistent with commodity price risk being closely related to the operating business and thus the competitive advantage of nonfinancial firms. The results are also present in subsamples of individual countries. In fact, there are notably few differences across countries in the determinants of derivatives usage as well as in the effect of derivatives use on measures of firm risk, which is

important in the context of current regulatory efforts (e.g. with regard to the regulation/clearing of OTC Derivatives markets), entailing that harmonized policy and regulation across countries may be adequate. In contrast, the majority of end-users of derivatives believe that market fragmentation along geographic lines as a result of the regulatory framework being put into place in key jurisdictions is likely going to have a negative impact on their ability to manage risk (ISDA, 2015). While these results may appear plausible and intuitive, they are by no means obvious, given the role of derivatives in the recent financial crisis, the indication of speculation in surveys, and the mixed and controversial existing empirical evidence from academic research of U.S. firms.

Corporate governance has some clear implications for risk management decisions and the use of derivatives for hedging and speculation. In particular, stronger shareholder rights should better align the interests of managers and shareholders and prevent managers' speculation with derivatives that is not in the interest of shareholders. Similarly, strong creditor rights should reduce risk shifting by speculating with derivatives. Moreover, easier access to derivatives might induce more speculative behavior. Utilizing our international sample, we find that the effect of derivatives usage on firm risk is negative independent of country-level corporate governance or access to derivatives. While the extent of risk reduction is not affected by shareholder rights, derivatives users in countries with weak creditor rights have significantly larger reductions in risk. These findings are consistent with lenders requiring firms to commit to an effective risk management policy when granting a loan in countries where creditor rights are weak.

Finally, the reduction in risk is larger for firms in countries where derivatives are readily available, which is also in line with hedging motives for derivatives use. The finding that supply-side constraints are an important determinant of derivatives use is particularly relevant given recent policy debates surrounding financial risk and derivatives use (Stulz, 2004). The results for country-level measures of corporate governance complement recent findings by Géczy, Minton, and Schrand (2007) that U.S. nonfinancial firms with weaker firm-level corporate governance are more likely to indicate, in the Wharton survey of derivatives usage, that they take a view with derivatives, while these firms also have more extensive and sophisticated internal controls and monitoring mechanisms specifically related to derivatives activities. At the same time, the existing literature has shown that country-level governance is much more important generally (Doidge, Karolyi and Stulz, 2007) and with regard to derivatives usage in particular (Allayannis, Lel and Miller, 2012).

Overall, this study provides new and comprehensive evidence regarding the effect of derivatives usage by nonfinancial firms around the world on firm risk. Our results suggest that users of derivatives haver lower risk and often lower exposure to financial risks. The low relevance of speculative aspects of hedging may explain why firms are willing to admit in questionnaires that they occasionally take positions with derivatives or adjust the size and timing of their derivatives position depending on their market view. While the lack of evidence of widespread gambling with derivatives by nonfinancial corporations is reassuring, the finding that corporate governance and access to financial derivatives affect the extent of risk reduction bears important implications, since these dimensions can be affected by policy decisions. Derivatives are very important financial tools for end-users such as nonfinancial firms, as they allow them to manage their risks effectively, especially using tailored derivatives in the OTC market; as a result, these derivatives can enable such firms to grow more and to create more jobs (Stulz, 2009).

The remainder of the paper is organized as follows: Section 2 develops the hypotheses as well as describes the methodology and data. The empirical results are presented in Section 3, while Section 4 presents alternative specifications and robustness checks. Finally, Section 5 concludes.

2 Hypotheses, Methodology and Data

2.1 Risk Taking and Determinants of Derivatives Usage

Nonfinancial firms face a range of risks in the course of their business activities, such as changes in production technology, shifts in consumer demand, increases in raw material prices, the resignation of key executives, a fire in the warehouse, etc. While many of these risks can be hedged and thus transferred to other market participants, in the extreme this would turn the firm into a Treasury bond yielding the risk-free rate. However, investors can already buy Treasury bonds in the market, and they invest in the equities of nonfinancial firms because they seek higher returns for higher risk. In order for firms to determine which risks they should take (and which not), they need to understand their competitive advantage, which results from comparative advantages in terms of technology, efficiency and effectiveness of production, cost structures, etc. Firms should consider taking those risks where they have a comparative advantage in accordance with their risk management policy, capital structure and general financial health (Stulz, 1996).

Nonfinancial firms typically have a competitive advantage with regards to taking risks on the real side of their business. For example, they might have an edge at manufacturing particular goods, predicting trends in technology or consumer demand, or developing or adapting to new raw materials

and production inputs. Their competitive advantage allows them to take these operating risks better than other firms, thus creating value for shareholders. In contrast, nonfinancial firms typically do not have a competitive advantage at predicting pure financial risks such as exchange rates or interest rates. As a result, it is economically sensible for nonfinancial firms to hedge their exposure to financial risks, if the cash flow variability arising from these risks could entail costs for the firm. To this end, the decision by many multinationals to currently no longer hedge FX risk reflects them taking a view on the volatility and direction of exchange rates, assuming that rates will remain in a limited range given that exchange rate volatility has plunged to its lowest levels in two decades with uniform near-zero interest rates since the recent financial crisis (Economist, 2014). Since hedging means to eliminate an exposure, selective or partial hedging (which reduces exposures but does not eliminate all of them) also amounts to speculation, because an exposure is retained based on a particular view about the underlying risk. Whether nonfinancial firms should hedge commodity price risk is less clear cut and will depend on how closely it is related to the core business of the firm and whether it extends to the competitive advantage of the firm or not. To illustrate, gold mining firms will have detailed insights into the factors determining the price of gold, and as a result some firms retain the gold price risk, while others use derivatives to hedge (part of) it.

In principle, corporate hedging by nonfinancial corporations can increase shareholder value due to capital market imperfections. For example, corporate hedging can increase shareholder value by lowering the likelihood of bankruptcy and thus the expected cost of financial distress (Smith and Stulz, 1985; Stulz, 1996). A lower probability of financial distress will also increase the optimal debt-equity ratio and therefore the associated tax shield of debt (Myers, 1984, 1993; Leland, 1998). In addition, if firms face a convex tax schedule, lower volatility of taxable income will result in lower expected tax payments (Smith and Stulz, 1985).

Hedging at the firm level can also increase firm value by aligning corporate investment and financing policies (Froot, Scharfstein and Stein, 1993). Capital market imperfections cause the marginal cost of external financing to be increasing – for debt as well as for equity capital. When raising external capital is costly, e.g., because of transaction costs or conflicts of interest between shareholders and debtholders, firms may underinvest. Consequently, a shortage of internal funds for investment projects results in either a higher cost of capital or foregone profitable investment opportunities. Corporate risk management, however, can help coordinate investment and financing policies and thus

harmonize the need for and availability of funds and avoid underinvestment and asset substitution problems.

Finally, managers tend to have highly undiversified financial positions that are closely tied to their employer. As a result, risk-averse managers might be inclined to reduce the firm's risk characteristics to levels conflicting with shareholder value maximization or, alternatively, to demand higher compensation for being exposed to high business risk (Mayers and Smith 1990; Stulz 1990, 1984). Hedging at the firm level can mitigate these conflicts of interest by linking management compensation appropriately to the stock price of the firm (Han, 1996; Campbell and Kracaw, 1987; Smith and Stulz, 1985). Firms will be more likely to hedge if they are closely held or have multiple share classes, but not if they have a stock option plan.

These theories of corporate derivatives usage can be tested by regressing derivatives usage on firm characteristics in a probit model. The empirical hypotheses that have been derived in the literature from these theories are that firms with higher distress costs (e.g. higher leverage, lower coverage, lower quick ratio, lower size, lower profitability), with tax incentives to hedge (e.g. tax credits), more financial constraints (e.g. no dividend), more severe underinvestment problems (e.g. higher market/book, higher leverage), with management incentives to hedge (e.g. multiple share classes, no stock options), and with underlying gross exposure (e.g. foreign sales) are more likely to use derivatives.[3] Thus:

Hypothesis 1: Firms with higher distress costs, with tax incentives to hedge, more financial constraints, more severe underinvestment problems, with management incentives to hedge, and with underlying gross exposure are more likely to hedge with derivatives.

However, an important underlying assumption of such tests is that firms indeed use derivatives for hedging purposes, not for speculation. In case there are no real costs associated with a firm bearing foreign exchange, interest rate and commodity price risk, nonfinancial firms do not necessarily need to devote resources to reducing these risks if shareholders can eliminate them by holding diversified portfolios (Stulz, 1996). In particular, if companies have diversified shareholders and negative realizations of financial risks cannot cause a situation that affects their operations or interferes with their ability to carry out their strategic plan (e.g. because the financial exposures are limited and the firms have a significant equity base), a reasonable case could be made that firms should avoid hedging (Stulz,

[3] See Aretz and Bartram (2010) for a review of this literature and the empirical evidence.

2013). In contrast, firms have strong reasons to hedge if they are closely held by owners who have a substantial fraction of their wealth in the firms' equity and if losses due to financial risks could cause a difficult financial situation, force the firms to cancel planned investments, or require them to issue more equity. Nevertheless, unless they have private information, nonfinancial firms should not create or increase corporate exposure to financial risks with derivatives, since market efficiency would suggest that corporate treasurers are unlikely to consistently make money by taking financial positions. Even in the case of specialized information, companies are more likely to hedge selectively than to take purely speculative derivatives positions (Stulz, 1996). As a result, to the extent that nonfinancial firms use derivatives, they should mostly employ them to reduce risk and financial exposures, but not to create positions with speculative motives.[4]

While speculation with derivatives at the firm level may destroy firm value if it increases the expected costs of market imperfections, there are incentives for managers acting in the interest of shareholders to increase the riskiness of the firm in order to realize a wealth transfer from bondholders to shareholders (Jensen and Meckling, 1976; Myers, 1977). Management compensation schemes, in particular stock options, may also reduce managerial risk aversion and create monetary incentives for managers to take gambles at the firm level, and managers with inferior management skill can use corporate speculation with derivatives to increase the noise associated with firm performance in order to hide their true ability (Breeden and Viswanathan, 1998). Whether firms use derivatives for hedging or speculation can be tested empirically, as detailed in the next section.

2.2 Risk Measures and Derivatives Use

The risk taking behavior of derivatives users can be studied by relating their use of derivatives to firm risk and exposures, in order to assess whether derivatives users have higher or lower risk and exposure compared to similar firms not using derivatives. To this end, three different categories of risk/exposure are employed. First, firms may differ with regard to their gross or pre-hedging exposure. For instance, measures of gross exposure with regard to foreign exchange rate risk include foreign sales (relative to total sales), foreign income (relative to total income), and foreign assets (relative to total assets). In addition to these individual proxies of foreign exchange rate exposure, we follow the literature and create a variable *Gross-FX-Exposure* that is one if firms have non-zero values for any of these

[4] See Rossi (2013) with regards to empirical classifications of hedgers, selective hedgers and speculators. Lin, Pantzalis and Park (2017) provide evidence consistent with the notion that prudent use of financial derivatives improves firms' information environment.

characteristics (and zero otherwise), in order to capture exposure from either source. Foreign debt may create an exposure as well, but it could also work as a hedge. Leverage, coverage or the quick ratio may be proxies for gross interest rate exposure.[5] With regard to commodity price exposure, the variable *Gross-CP-Exposure* is assigned the value one for firms in the utilities, oil, mining, steel, and chemicals industries (and zero otherwise).[6] If firms are using derivatives primarily for hedging purposes, they should be observed to use derivatives if they have high measures of gross exposure.

Hypothesis 2: Derivatives users have higher gross exposure than non-users.

Second, firms in different countries face different levels of macroeconomic or country risk. To illustrate, firms operate in a more risky environment if incorporated in a country that is characterized by high volatility of interest rates (*IR-Country*) and exchange rates (*FX-Country*). A high ratio of (the natural logarithm of) exports and imports relative to the Gross Domestic Product (*LogEXIM/GDP*) indicates a stronger dependence of a country on international trade and thus vulnerability to exchange rate risk. In contrast, larger economies (as measured by the logarithm of GDP) may provide a more stable operating environment. Aggregate measures of country risk are the International Country Risk indices that provide inverse rankings of countries' financial risk (*ICR-Financial*), economic risk (*ICR-Economic*), political risk (*ICR-Political*), and overall country risk (*ICR-Composite*). It is expected that more firms use derivatives in countries with high risk if hedging is the motivation for the use of these instruments.

Hypothesis 3: Derivatives users have higher macroeconomic or country risk than non-users.

Third, a firm's net (or post-hedging) risk and exposure is the result of the characteristics of its assets and liabilities, but also includes the effects of off-balance sheet transactions such as derivatives. While the different components and their interactions are difficult to decompose, the assumption of efficient capital markets suggests that net risk and exposures can be estimated empirically using a company's stock price as an aggregate measure of all relevant information. Consequently, different corporate risk/exposure measures are constructed from stock returns during the observation year. In particular, the ratio of a firm's stock return standard deviation to the standard deviation of the returns

[5] Coverage might not be a very clean measure of gross exposure. We use the three-year average of coverage since any effects of interest rate derivatives on this variable should smooth out over the cycle. The exact nature of the exposure of firms to interest rate risk depends on whether their debt is fixed or floating rate.

[6] The commodity price exposure of firms depends on whether they have cost or revenue exposure, long-term contracts, commodity-price-linked debt, etc. Commodity-price-sensitive industries are identified based on input-output tables.

of the local market index (*Std.Dev.*) is a measure of the net risk of the firm.[7] We standardize firm volatility using local market volatility to avoid a potential bias from a spurious correlation between derivatives use and market volatility. The sensitivity of the firm's stock return to the local market return, as well as measures of exchange rate risk, interest rate risk and commodity price risk, is estimated using the model

$$R_{jt} = \alpha_j + \beta_j R_{Mt} + \chi_j R_{FXt} + \delta_j R_{IRt} + \varepsilon_j R_{CPt} + \phi_{jt}, \quad (1)$$

where R_{jt} is the stock return of firm *j*, R_{Mt} is the return on the local stock market index, R_{FXt} is the return of the exchange rate index, R_{IRt} is the percentage change in the short-term interest rate variable, and R_{CPt} is the percentage change in the commodity price index (see the data section for details on these variables).[8] The estimated coefficients from this model provide our primary measures of net exposures to financial risks. Specifically, market exposure is measured by $\hat{\beta}_j$ (*Beta*), net foreign exchange rate exposure is measured by $\hat{\chi}_j$ (*Net-FX-Exposure*), net interest rate exposure is measured by $\hat{\delta}_j$ (*Net-IR- Exposure*), and net commodity price exposure is measured by $\hat{\varepsilon}_j$ (*Net-CP- Exposure*). Corporate use of derivatives for hedging purposes would be consistent with lower or similar total risk and measures of post-hedging exposures as estimated in the regression framework. Since stock return volatility is a summary measure of the different financial risks, the effects are expected to be stronger compared to the net exposures, which may also suffer from measurement error.[9] In contrast to return volatility as a measure of total risk, the net exposures only capture the part of total risk related to market, currency, interest rate and commodity price fluctuations.

Hypothesis 4: Derivatives users have lower or similar net risk and exposure than non-users.

To summarize, the empirical predictions are that, consistent with firms using derivatives for hedging purposes, users of derivatives have higher firm-level gross exposure to exchange rate, interest rate and commodity price risk, are located in countries with higher country risk, and have lower or similar levels of net risk and exposure. However, two caveats are in order. First, as mentioned earlier,

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[7] Alternative measures of total risk are earnings/cash flow volatility (see Beneda, 2013; Bartram, Brown and Conrad, 2011).

[8] In robustness tests, we also examine the sensitivity to long-term interest rates.

[9] The literature has provided ample evidence that net exposures to currency risk, interest rate risk and commodity price risk are hard to estimate with a lot of precision (but also documented that they are still economically meaningful). Results using weekly data are overall similar.

some nonfinancial firms might have a comparative advantage with regard to managing commodity price risk and thus might not hedge it. Consequently, while it would still seem more likely that firms use commodity price derivatives for partial/selective hedging rather than taking new positions (Goldstein, Li and Yang, 2014), it is less clear whether this results in lower risk and exposures compared to non-users of CP derivatives. Second, if firms are far away from financial distress and other capital market imperfections do not cause real costs, firms might opt not to hedge financial risks even if they have no private information. However, it is not clear that such behavior, if present during the sample period, would bias this analysis in a particular way.

Additional firm characteristics, as suggested by the prior literature and economic intuition, are included in the multivariate analysis as important control variables.[10] In particular, firm risk is expected to be negatively related to industrial diversification (number of industry segments) and firm size (natural logarithm of total assets or alternatively the sum of equity market capitalization, total debt, and preferred stock). In contrast, firms with more growth options, as measured by the book-to-market ratio, research and development expenses (relative to sales) and capital expenditures (relative to total sales) are expected to exhibit higher risk. Beyond these firm characteristics, factors at the country level might have an effect on the relation between derivatives usage and firm risk, which is explored in the next section.

2.3 Corporate Governance and Derivatives Market Access

The broad coverage of countries by our sample provides several benefits. First, the large number of companies compared to prior studies provides statistical power. Second, the limited analysis of derivatives usage internationally allows us to effectively conduct out-of-sample tests of prior results. Third, influential policy makers have suggested that access to derivatives can enhance macroeconomic development. For example, the former U.S. Federal Reserve Board Chairman Alan Greenspan remarked in a speech "*The further development of derivatives markets, particularly in smaller economies where idiosyncratic risk may be more difficult to hedge, will likely facilitate greater cross-border flows and a more productive distribution of global savings.*"[11] Thus, it is important to determine which country-specific factors, if any, moderate the extent

[10] To illustrate, Hentschel and Kothari (2001) use firm size, leverage and the market-to-book ratio as control variables in regressions of the stock return volatility of U.S. firms on derivatives usage.

[11] Comments made at the Banque de France International Symposium on Monetary Policy, Economic Cycle, and Financial Dynamics, Paris, France, March 7, 2003.

to which firms use derivatives for hedging or speculation, especially if these factors can be influenced by policy.

To this end, Allayannis, Lel and Miller (2012) and Lel (2012) suggest that corporate governance may be important for the motivations of firms with ADRs to use currency derivatives in order to increase their firm value. Stronger investor protection entails lower agency costs, and shareholders can, for instance, easily replace managers as a result of weak firm performance. We focus our analysis on measures of the strength of country-level governance, since country characteristics explain much more of the variance in governance ratings than observable firm characteristics (Doidge, Karolyi and Stulz, 2007). Moreover, they have been shown to matter most for the effect of derivatives use on firm value, because weak firm-level corporate governance can be mitigated by strong country-level governance (Allayannis et al., 2012).

Consequently, it could be argued that firms that operate in an environment with strong shareholder rights are less likely to use derivatives for speculative purposes due to well-protected rights of minority shareholders and effective monitoring (La Porta et al., 1998). If nonfinancial firms have no competitive advantage at predicting exchange rates and interest rates, it will typically be in the interest of shareholders to hedge these risks in the presence of capital market imperfections. However, managers have incentives to use the firm's resources to pursue their own interests as opposed to maximizing shareholder value. To illustrate, managers might use derivatives to avoid being replaced due to negative effects of financial risks on firm performance (Breeden and Viswanathan, 1996), to gamble for resurrection, or to insure their personal wealth. Executive compensation schemes with nonlinear payoffs might incentivize managers to take higher levels of risk, and managers with inferior ability have incentives to increase the noise associated with firm performance in order to hide their true skills (Breeden and Viswanathan, 1998; DeMarzo and Duffie, 1995). As a result, managers may use their discretion to employ derivatives for speculative purposes such as bets on both the direction and future volatility of the underlying asset, possibly even under the guise of hedging. Nevertheless, strong investor protection rights entail more effective monitoring, which should reduce these agency costs and the private benefits consumed by managers (La Porta et al., 2000, 2002).[12]

[12] This hypothesis is in the same spirit to hypotheses on role of shareholder protection for the effect of corporate derivatives usage or cash holdings on firm value (Allayannis et al., 2012; Pinkowitz et al., 2006; Kalcheva and Lins, 2007).

Thus, the empirical prediction is that firms in countries with strong shareholder rights will reduce risk more, compared to otherwise similar firms in countries with weak shareholder rights. Note though that, even in countries with strong shareholder rights, managers acting in the best interests of shareholders may have an incentive not to hedge if hedging primarily benefits bondholders at the expense of shareholders. Our proxy for the strength of shareholder rights is the Anti-Self-Dealing Index (from Djankov, La Porta, Lopez-de-Silanes and Shleifer, 2008).

Hypothesis 5: Firms in countries with strong shareholder rights reduce risk more, compared to otherwise similar firms in countries with weak shareholder rights.

Second, consistent with La Porta et al. (1998), one might also expect firms to use derivatives for hedging rather than speculation in the presence of strong creditor rights where the legal system is more efficient and contracts can be enforced (Berkowitz, Pistor and Richard, 2001). Creditors are concerned about the risk of the firm and losses, e.g. due to unexpected changes in exchange rates, interest rates or commodity prices, that lead to a wealth transfer to shareholders and may cause the firm to default on its interest and capital repayment obligations. Therefore, they have a preference for a risk management policy that reduces risk, i.e. hedging, and firms will use derivatives to reduce risk more in countries where creditors can more easily exercise their powers against management (La Porta et al., 2000).

In fact it could be argued that strong bondholder rights could lead to overly conservative/costly risk management, while strong shareholder rights would lead, on the margin, to less and closer to optimal degrees of hedging. Moreover, bankruptcy costs are expected to be large in countries with strong creditor rights (Smith and Stulz, 1985). As a result, the empirical prediction is that firms in countries with strong creditor rights reduce risk more than similar firms in countries with weak creditor rights. Alternatively, lenders in countries with weak creditor rights might require firms to credibly commit to an effective risk management policy before providing funds. To this end, we examine the relation between derivatives use and firm risk/exposure, conditional on the strength of Creditor Rights (from La Porta et al., 1998).[13]

Hypothesis 6: Firms in countries with strong creditor rights reduce risk more than similar firms in countries with weak creditor rights.

[13] Results using the creditor rights index by Djankov, McLiesh and Shleifer (2007) are similar.

Third, firms located in economies with more developed and liquid derivatives markets have better access to derivatives that can affect the likelihood and purpose of firms using these instruments. If it is difficult to take positions in derivatives, firms might not go through the trouble to do so unless they have a serious hedging need, and to the extent that they have the objective to speculate, they might seek gambles elsewhere. In contrast, easy access to derivatives may facilitate engaging in derivatives transactions for purposes other than hedging because the costs of entering transactions (or more generally, markets) are lower and therefore less likely to require extraordinary actions on the part of managers. Thus, the empirical prediction would be that firms in countries with easier access to derivatives markets reduce risk less than firms in countries with difficult market access. On the other hand, easier access to derivatives markets entails that firms are able to set up hedging strategies more efficiently and at a lower cost, which may lead to risk reduction. As a proxy for access to derivatives markets we use the Derivatives Market Rank, which quantifies the size of the local-currency derivatives market relative to the size of the economy (from Bartram, Brown and Fehle, 2009).

Hypothesis 7: Firms in countries with easier access to derivatives markets reduce risk less than firms in countries with difficult market access.

To summarize, the empirical predictions are that firms in countries with strong shareholder rights, strong creditor rights and more difficult access to derivatives reduce risk more than otherwise similar firms (with likely weaker results for commodity price exposures). Thus, corporate governance and derivatives market access are dimensions by which the use of derivatives may vary across countries, even if firms in all countries were using derivatives for hedging purposes, i.e. firms may vary in the degree to which they reduce risk (i.e. hedge or selectively hedge), or in the extreme increase risk, with derivatives.

2.4 Sample and Data Sources

The markets for over-the-counter instruments and exchange-traded derivative financial instruments on foreign exchange rates, interest rates and commodity prices have exhibited exponential growth over the past 30 years (see Figure 1). As a result, notional amounts outstanding for OTC derivatives exceeded $650 trillion in 2013, with interest rate derivatives accounting for about 85% of the total (Table 1). Along with increased use, regulation for the disclosure of derivatives has developed, requiring firms in many countries to include information about their derivatives positions in their annual reports. In particular, firms in the United States, the United Kingdom, Australia, Canada and New Zealand, as well as firms complying with International Accounting Standards (IAS), are required to

disclose information on their derivatives positions; many other firms do so voluntarily.[14] The resulting availability of data makes the empirical analysis of the use of derivatives by nonfinancial firms in different countries possible.

The sample in this study comprises 6,896 nonfinancial firms from 47 countries including the United States. It consists of all firms that have accounting data for either the year 2000 or 2001 on the Thomson Analytics database, that have an annual report in English for the same year on the Global Reports database, that are not part of the financial sector (banking, insurance, etc.), and that have at least 36 non-missing daily stock returns on Datastream during the year of the annual report.[15] The 47 countries represent 99% of global market capitalization in 2000 and 2001, and the firms in the sample account for 60.6% of overall global market capitalization or 76.8% of global market capitalization of nonfinancial firms.[16] Firms are classified as users or non-users of derivatives based on a search of their annual reports for information about the use of derivatives. In addition to the systematically and consistently collected categorical data on derivatives (*Derivatives*), information on the underlying (i.e., foreign exchange, interest rates, or commodity price) is collected (*FX-Derivatives*, *IR-Derivatives*, *CP-Derivatives*). Given the difficulty of data collection for a large international sample and of determining the correct size and sign of derivatives positions generally (due to different underlyings, maturities, long/short positions etc.), we only use categorical data on derivatives usage throughout the paper. Dichotomous variables for the use of foreign currency debt (to capture money market hedges) (*Foreign Debt*) and stock options (*Stock Options*) are created in the same fashion, since this information is not readily available elsewhere. Compared to questionnaires, archival data might be more reliable since they are sourced from audited financial statements, and the analysis of stock market data should reflect all sources of exposure and hedging.

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[14] For example, the following are recent standards (and effective dates) adopted by so-called G4+1 countries and the International Accounting Standards Board (IASB) as part of the movement toward common reporting standards: United States, FAS 133 (effective June 15, 1999); United Kingdom, FRS 13 (effective March 23, 1999); Australia, AAS 33 (effective January 1, 2000); Canada, AcSB Handbook Section 3860 (Financial Instruments – Disclosure and Presentation, effective January 1, 1996); New Zealand, FRS-31 (effective December 31, 1993); IASB, IAS 32 (March 1995, modified March 1998 to reflect issuance of IAS 39, effective January 1, 2001).

[15] Global Reports (www.global-reports.com) is an online information provider of public company documents in full-color, portable document format (PDF). While we do not impose a liquidity filter, we find similar results when excluding stocks with less than 30% non-zero returns. See Crosby (2014) with regards to optimal hedging of variance derivatives.

[16] Since the data cover two years, these values are calculated as the sum of each firm's percentage of global market capitalization for the year it appears.

All capital market data (i.e. the firms' stock return indices, stock market return indices, interest rates, exchange rate indices and commodity price indices) are from Datastream. These data are provided at the daily frequency. For each firm, we calculate stock returns in local currency, local currency returns of the corresponding Datastream value-weighted national stock market index, the percentage change in the Bank of England currency index (in local currency relative to the basket of foreign currencies), the percentage change in the Eurocurrency interest rate, the percentage change in the yield of the Datastream benchmark bond, and the percentage change in the Goldman Sachs Commodity Index. All time-series are limited to the year of the firm's annual report.

Accounting data originate from the Thomson Analytics database.[17] Outliers are eliminated by winzorizing observations in the top and bottom one percentile as well as those exceeding more than five standard deviations from the median. This filter eliminates some apparent data errors where the magnitudes suggest data units are not properly reported (e.g., thousands instead of millions). Systematic differences across countries and industries are controlled for by country, industry and year fixed effects in the regressions (where possible), or by regressing accounting variables on country, industry and year indicator variables and analyzing the residuals from this regression. In order to avoid the results being influenced by the effect of the economic cycle, we use three-year averages of variables where this impact seems most relevant (e.g. coverage, foreign income). The definitions of all variables are presented in Table A-1 in the Appendix.

3 Empirical Results

3.1 Derivatives Use and Risk Measures

Summary statistics on the use of derivatives by the sample firms is presented in Table A-2. Panel A shows aggregate statistics by country. Across all countries, 60.5% of the firms in the sample use at least one type of derivative. FX derivatives are the most common (45.5%), followed by interest rate derivatives (33.1%) and commodity price derivatives (9.8%). While there is variation across countries, the statistics show that derivatives usage is very common across geographic areas, and more the rule than the exception. Derivatives usage is more frequent in developed countries compared to non-OECD countries, as well as slightly more popular in non-U.S. countries compared to the United

[17] Data are commonly reported in millions of U.S. dollars. Many of the variables we examine are ratios and are therefore largely comparable across countries and years. However, we also include an indicator variable for the year (2000 or 2001) in our multivariate analysis and have undertaken robustness checks for all parts of the analysis to make sure that our results are not driven by the year we examine.

States. Panel B shows statistics on derivatives usage by industry, and also distinguishes between different types of instruments. More than three-quarters of the firms use derivatives in the industries Machinery, Fabr. Products, Automobiles, Utilities, Tobacco Products, Aircraft, and Defense. Across different types of underlyings, the heaviest users of FX products are firms in Machinery, Automobiles, Aircraft and Tobacco Products. In contrast, interest rate derivatives are most frequently used in the industries Aircraft, Utilities and Tobacco Products. The use of commodity price derivatives is more limited and concentrated among firms in Utilities, Precious Metals and Oil.

In order to study the relation between the risk characteristics of the sample firms and their use of derivatives, we conduct nonparametric Wilcoxon tests. Table 2 reports the *p*-values of these tests together with the means, medians and standard deviations of firm characteristics for derivatives users and non-users. While the results in Table 2 only refer to general derivatives use, the tests are also conducted for foreign exchange rate derivatives, interest rate derivatives and commodity price derivatives, and differences are mentioned where appropriate. Table 2 shows some initial evidence that firms use derivatives in line with hedging considerations. In particular, users of derivatives have significantly more *Gross-FX-Exposure*, i.e. firms using derivatives are more exposed to exchange rate risk before considering hedging (i.e., pre-hedging or gross exposure). In fact all three dimensions of foreign business, i.e. foreign sales, income and assets, are larger for derivatives users. This is what one would expect to see if firms were using derivatives for hedging purposes. The liabilities of derivatives users are also significantly more exposed to exchange rate risk, since they are more likely to have foreign currency debt. Moreover, derivatives users have significantly higher leverage, and they are more likely to belong to commodity-based industries. Overall, the results suggest that firms are more likely to use derivatives if they have higher gross exposure, which is in line with hypothesis 2, and the results are robust to the type of underlying risk (exchange rate risk, interest rate risk or commodity price risk).

In addition to the business and financial risk of the firm, risks outside the company, such as country risk, may impact a firm's propensity to use derivatives for hedging or speculative purposes. To this end, the univariate evidence for hypothsis 3 in Table 2 is mixed. The results suggest that firms in countries with higher foreign exchange rate risk and higher financial risk use derivatives more frequently, which is consistent with hedging motives. On the other hand, there is also evidence that more firms use derivatives in countries with low interest rate risk, lower trade, lower aggregate country risk (economic risk or political risk) and larger GDP.

The fact that asset, liability, and country risk are not independent suggests looking at more comprehensive risk and exposure measures based on firms' stock returns, as well as employing a multivariate analysis (presented subsequently). Stock prices represent an aggregate measure of asset and liability risk and should also incorporate the effects of financial risk management. If derivatives are used for hedging purposes, derivatives users might show lower or similar post-hedging (net) risk compared to otherwise similar non-users. Table 2 reports that derivatives users exhibit significantly lower absolute levels of net risk and exposure. This is true for all measures (*Std.Dev.*, *Beta*, *Net-FX-Exposure*, *Net-IR-Exposure*, and *Net-CP-Exposure*). The magnitudes of the differences are substantial. For example, the median Std.Dev. is 20.8% lower for derivatives users than for non-users, while median market betas are 13.4% smaller. Similar differences exist for *Net-FX-Exposure*, *Net-IR-Exposure*, and *Net-CP-Exposure*. This evidence is suggestive of firms using derivative instruments for hedging purposes and thus exhibiting lower measures of net financial risk, in support of hypothesis 4.

Similar results are obtained for most of the firm-specific variables after each variable has been adjusted for country and industry fixed-effects, except that derivatives users now have slightly higher average (but not median) market betas. Overall, these univariate results suggest that nonfinancial firms use derivatives in line with hedging motives. Given the relatively modest leverage ratios of the sample firms, the incremental benefits accruing from the additional risk of derivatives speculation may be small, since the equity position as an option on the assets of the firm is relatively deep in the money (Hentschel and Kothari, 2001).

3.2 Determinants of Derivatives Use

An important caveat to the results in Table 2 is that derivatives users also differ by other firm characteristics that have been related to lower financial risk in other studies. As outlined in Section 2.1, various theories suggest that firms may be able to enhance shareholder value by hedging at the firm level in the presence of capital market imperfections. They can be tested using corporate derivatives usage as an indicator for corporate hedging and relating it as a dependent variable in a probit regression to various firm characteristics. Table 3 shows results from such regressions for the full sample, as well as the six countries with the most observations (the United States, the United Kingdom, Japan, Germany, Canada, and Australia) and all other countries, based on general derivatives use.

For all countries (first column), sufficient data are available for 6,220 firms. The financial distress and tax hypotheses are supported by the positive coefficients for leverage and the income tax credit variable, as well as the negative coefficient for the quick ratio. However, the positive coefficients

for size and profit margin are contrary to predictions. The full sample also provides mixed support for the underinvestment theory. Contrary to the prediction, the coefficient for the market-to-book ratio is negative, yet the coefficient for the interaction between market-to-book and leverage is positive. There also exists mixed support for the managerial incentives hypothesis – both the presence of stock options and multiple share classes are positively related to derivatives use. It is possible that these results might both support the managerial incentives hypothesis if managers on average hold very in-the-money options and are thus using derivatives to preserve the value of their equity-like positions.

We include several variables in the analysis as controls. For example, we condition our analysis on the unobserved levels of exposure. For IR exposure, leverage is our proxy (and is already included in the analysis). To identify firms more likely to use derivatives because of significant currency exposure, we include our FX exposure variable, which is, as predicted, positively related to derivatives use. We include a foreign debt variable separately, because it may be an FX hedging tool that is a complement to derivatives, a source of exposure (e.g., for firms in developing countries), or an FX hedging tool that substitutes for derivatives (e.g., for U.S. firms). The first two explanations suggest a positive relation between foreign debt and derivatives use, and the last suggests a negative relation. The estimated positive coefficient is consistent with foreign debt either acting as a complement to derivatives or creating an FX exposure on average.

An important contribution of this study is to compare derivatives use across many countries using consistent and fully comparable data. The remaining columns in Table 3 show that the results discussed above differ very little across countries. In fact, for all but two cases where a variable is significant for the full sample, the sign of significant coefficients for individual countries is the same (the quick ratio in Australia has a positive coefficient and MB*Leverage has a negative sign in Japan). Overall, these results are important since they indicate that factors determining derivatives usage are surprisingly common across different countries. We also note the apparent increase in statistical power gained from examining firms across many countries. Coefficients that are of the same sign in most subsamples but only statistically significant in a few countries are statistically significant in the full sample.

The fact that the results are strong and consistent suggests that none of the examined primary theories in hypothesis 1 is unequivocally supported by the data. Consequently, it may be that other motivations that are not well motivated by existing risk management theory and that are difficult to

examine empirically provide a better explanation of the results, such as earnings management, competitive factors in firms' industries, and speculation (Mello, Parsons and Triantis, 1995; Brown, 2001; Core, Guay and Kothari, 2002). In the rest of the paper, we investigate the possibility of corporate speculation with derivatives as one such alternative explanation. Alternatively, it may simply be that derivatives are financial tools that firms integrate into their financial operations once they obtain a certain level of sophistication.

3.3 Hedging and Speculation with Derivatives

In order to investigate to what extent firms use derivatives for speculation, we follow the literature on U.S. firms (see e.g. Hentschel and Kothari, 2001) and estimate regressions that relate corporate risk and absolute values of exposure measures as alternative dependent variables to derivatives use while controlling for the level of gross exposure and other firm characteristics. In particular, the regressions use *Gross-FX-Exposure*, *Leverage* and industry fixed effects to capture gross exposure to currency, interest rate and commodity price risk. The regressions further control for a set of country risk variables selected from a range of available proxies (such as the ICR composite index and its subindices, country-level measures of interest rate and exchange rate risk, etc.) covering different aspects of country risk. Specifically, the (natural logarithm of the) ratio of exports and imports to GDP is used as a proxy for country-level exchange rate risk, the standard deviation of the short-term interest rate is used as a proxy for interest rate risk, and the ICR index is used to capture political risk.[18] These variables model country risk characteristics more explicitly and control for differences in the environment that firms are operating in (without suggesting that firms will or can hedge these dimensions). The Newey-West (1987) procedure is used to correct the standard errors for autocorrelation and heteroscedasticity.

Table 4 shows detailed results using general derivatives in Panel A, while Panel B is based on the same regression specifications but with FX, IR and CP derivatives, respectively, and displays only the coefficient on the derivatives variable. The results corroborate the prior univariate finding that derivatives users have significantly lower stock return volatility than non-users, consistent with hypothesis 4. In particular, the OLS coefficient of general derivatives use in Panel A is large (-0.112) and

[18] ICR Political is a commonly used proxy for country risk. The literature suggests that country risk could increase systematic risk and decreases the rewards of risk taking at the firm level, so that firms take fewer diversifiable risks in riskier countries. Alternatively, country risk could lead to more firm-specific shocks that firms cannot mitigate, thereby increasing idiosyncratic risk. Empirical evidence suggests that firms in countries with more political risk have more systematic risk, while the relation between political risk and idiosyncratic risk is ambiguous (Bartram, Brown and Stulz, 2012).

highly significant (p-value < 0.01). Several of the control variables are also significant and of the predicted sign. Firms have higher stock return standard deviations if they are small, have foreign debt, few industry segments and do not pay dividends, while gross FX exposure, leverage, and the book-to-market ratio are insignificant.[19]

Beyond total risk as measured by stock return volatility, it is interesting to examine the effect of derivatives on some of the underlying risk factors. Given that the regression only measures selected risk exposures, their effects do not necessarily have to align with the effect on overall volatility. With regards to systematic market risk, firms that use derivatives also have significantly lower market betas. Betas are lower by -0.072 (p-value < 0.01). Firms have systematically higher market betas if they are large, have high book-to-market ratios, have low leverage, and do not pay dividends. The relations between derivatives use and *Net-FX-Exposure*, *Net-IR-Exposure* and *Net-CP-Exposure* are also negative, and significant for exposures to currency and commodity price risk. Several control variables are important, such as international trade for foreign exchange rate exposure and interest rate risk for interest rate exposure, while the firm-level measures of these gross exposures (*Gross-FX-Exposure*, *Leverage*) are not significant. The coefficients of the aggregate measure of country political risk suggest that higher country risk is associated with higher market and currency exposures, but lower interest rate exposure. The economic magnitude of these effects is relatively small.

A potential concern of this analysis the possible endogeneity of derivatives use.[20] In particular, the observed measures of firm risk may not only be a function of derivatives use, but they may also determine the decision of a firm to use derivatives at the same time. Hentschel and Kothari (2001) discuss the inherent difficulty of controlling for endogeneity issues for derivatives usage, but argue that a net negative bias in the estimates of the coefficients on derivatives is unlikely, and the results of their instrumental variables approach are similar to their main results. Guay (1999) controls for endogeneity by analyzing U.S. firms that initiate the use of derivatives and find a slight reduction in the risk. Bartram, Brown and Conrad (2011) provide evidence from propensity score matching showing that the risk effects of derivatives are not very sensitive to potential endogeneity and omitted variable problems.

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[19] The negative sign on firm size is also consistent with prior evidence by Christie (1982) and Hentschel and Kothari (2001); the latter find a statistically significant but economically small *positive* relation between the size of a firm's derivatives position and stock return volatility.

[20] See also Chen (2011), Chen and King (2014).

In order to mitigate potential concerns about derivatives usage and firm risk being endogenously determined and driven by similar variables, Table 4 also reports results from an instrumental variables approach. We instrument the use of derivatives with variables that are likely to affect derivatives use but not firm risk. Following the literature, our instruments include a variable indicating the percent of firms in the same country and industry that use derivatives (Allayannis, Lel and Miller, 2012) and a dummy indicating income tax credits e.g. due to tax loss carry forwards (Chen and King, 2014). We expect positive correlations between these variables and derivatives usage and find confirming evidence since all of these variables are positively associated with the decision to use derivatives. We validate our instruments via several specification tests. As reported in the table, we can reject the hypotheses of underidentification and weak identification (Stock and Yogo), confirming that our instruments are strongly related to the endogenous variable of derivatives use. The Sargan overidentification tests have *p*-values between 0.31 and 0.80, and therefore fail to reject the null hypotheses that the instruments are valid instruments, i.e., uncorrelated with the error term, and that the excluded instruments are correctly excluded from the estimated second-stage regressions. The results from the instrumental variables regressions confirm that derivatives use is negatively associated with firm risk and exposure with the exception of commodity price exposure, which has a negative but insignificant coefficient.

We also estimate a treatment effects model in order to address potential concerns that firms that use derivatives may self-select. The treatment effects methodology models the decision to use derivatives using variables that have previously been shown to be important, such as size, leverage, profitability, dividends (see Table 3), and controls for the associated selection effect in the second stage. Similar to the main results, estimations that control for self-selection show a negative and significant relation between derivatives usage and firm risk and exposure.[21]

Panel B of Table 4 provides additional insights into the relations between financial risk and exposure measures and the types of derivatives that firms use. Analyzing derivatives with different underlyings is interesting given the differences in motivations of nonfinancial firms to use them. Nonfinancial firms typically do not have a competitive advantage at predicting currencies and interest rates and thus should hedge these financial exposures. In contrast, commodity prices are potentially closely

[21] For further robustness tests regarding endogeneity see Section 4.

related to the operating business of nonfinancial firms, suggesting that firms might have sound economic rationales to take or retain commodity prices exposures. Moreover, evidence of derivatives speculation from questionnaires pertains generally to currency and interest rate derivatives, and there is academic (Chernenko and Faulkender, 2011; Faulkender, 2005) and anecdotal (Economist, 2014) evidence of speculation with FX and IR derivatives. At the same time, identifying the use of derivatives on particular underlyings is more difficult.

Consistent with the hedging hypothesis 4, FX-Derivatives have the largest negative effect on *Net-FX-Exposure* though there is also a significant negative effect on *Beta* and *Net-CP-Exposure*. IR-Derivatives use is significantly negatively related to *Std.Dev.*, *Beta*, *Net-FX-Exposure* and *Net-CP-Exposure*. The effect on *Net-IR-Exposure* is insignificant, providing no evidence of speculation with interest rate derivatives. Finally, CP-Derivatives use leads to lower *Std.Dev.* and *Beta* despite being associated with significantly higher *Net-CP-Exposure*. This might be due to the fact that commodity price risk is likely related to the competitive advantage of the firms using CP-Derivatives and thus part of the risk that these firms want to take. Nevertheless, these higher CP exposures may be too small to result in higher total risk for derivatives users, *ceteris paribus*.

Panel B of Table 4 also show results for the instrumental variables model. All coefficients on all types of derivatives have negative coefficients, and they are significant for total risk, beta and *Net-FX-Exposure* and *Net-IR-Exposure*. While the derivatives coefficients are negative for *Net-CP-Exposure* as well, they are not statistically different from zero. Thus, even after controlling for endogeneity with instrumental variables there is no evidence of corporate speculation with derivatives. The panel also reports results from the treatment effects model. Here, the relation between FX and IR derivatives and firm risk and exposure is significantly negative for all measures. In contrast, while the relation of CP derivatives with *Std.Dev., Net-FX-Exposure* and *Net-IR-Exposure* is insignificant, it is significantly negative for beta, but significantly positive for *Net-CP-Exposure*. Thus, results that control for self-selection confirm the prior results of firms using derivatives to reduce risk and exposures, except for commodity price risk which is closely related to the competitive advantage of non-financial firms and thus may be economically sensible for them to bear.

In order to better understand the use of derivatives internationally, we also conduct the analysis individually for the six countries with the most observations (as well as all other countries together) and run regressions for each subsample for each of the five risk/exposure measures we examine as alternative dependent variable. For brevity, Table 5 only displays the coefficient and *p*-value of the

derivatives variable. As would be expected with few observations, the statistical significance of the results is lower but the vast majority of estimated coefficients for the derivatives use variable are negative, and importantly, they are always negative when significant. There are a number of cases where the coefficients are insignificant, indicating that there is no difference in risk or exposure between users and non-users of derivatives. However, there are no instances where derivatives use is associated with significantly higher measures of financial risk or exposure, i.e. there is no evidence of speculation with derivatives anywhere in the world, which is in line with hypothesis 4. Thus, the results show a remarkable consistency in the effect of derivatives use on risk and exposure of firms across countries. While prior evidence has either been for U.S. samples or aggregate global samples, Table 5 provides both new evidence for U.S. firms in the light of conflicting evidence of previous studies, as well as first international evidence for a range of individual countries. The by-country results also show that the full sample results in Table 4 are not just driven by the large fraction of U.S. firms in the sample, but exist in similar fashion in other countries.

On the whole, these findings provide further support for the hypothesis that nonfinancial firms use financial derivatives for hedging purposes even after controlling for gross exposure at the firm and country level and other firm characteristics. Because financial risk management is likely a decision based on the level of gross exposure, it would *a priori* not be surprising to find derivatives users having higher net exposures. However, there is no evidence of higher net exposures, apart from marginally higher net commodity price exposure for firms using commodity price derivatives. Overall, the evidence alleviates concerns that firms might use financial derivatives to increase levels of total risk or exposures to financial risks.

While there have historically been a number of cases of huge derivatives losses (Procter & Gamble, Gibson Greeting Cards, Metallgesellschaft, etc.) and prominent investors such as Warren Buffett have characterized derivatives as dangerous financial instruments, our broad sample evidence documents robustly that nonfinancial firms around the globe are using financial derivatives on the whole quite sensibly.[22] Even in the recent financial crisis, instances of problems of nonfinancial firms

[22] While Warren Buffett referred to derivatives as "financial weapons of mass destruction" in Berkshire Hathaway's 2002 annual report, this remark is according to Robert Merton taken out of context and misinterpreted, since Buffett "uses derivatives all the time" (Redmond and Nozawa, 2016). The same news article reports that according to regulatory filings Berkshire Hatahway had wound down its last credit derivative contract in July 2016, but still has some positions equity index derivatives.

with derivatives have been rare.[23] The uniformity across countries suggests that harmonized policy and regulation of derivatives markets, currently with a focus on OTC derivatives, might be adequate.

3.4 Internationalization, Currency Exposure and Derivatives Use

One of the most important financial exposures that firms face in the context of their international business activities is with regards to currency risk. In a seminal study of the exchange rate exposure phenomenon, Jorion (1990) investigates the effect of exchange rate risk on the return of 287 U.S. multinational firms based on a market model augmented with a multilateral exchange rate index. Despite these firms being selected due to significant international activities, the study finds that only 15 firms or 5.2% of the sample have a significant exchange rate exposure at the 5% significance level – only a little more than by pure chance. Subsequently, many studies have similarly documented that the empirical research on nonfinancial firms typically produces fewer significant exposure estimates than researchers expect, independent of the sample studied and the methodology used, which has been referred to as the "exposure puzzle" (Bartram and Bodnar, 2007).

Currency exposures tend to be small across firms because either they have small gross exposures to start with (e.g. purely domestic companies that are not facing indirect competitive exposures) or they have large gross exposures but reduce these via hedging. In particular, firms use a combination of different hedging channels such as currency derivatives, foreign currency debt, operational hedging, and pass-through (Bartram, Brown and Minton, 2012; Clark and Judge, 2009; Allayannis, Ihrig and Weston, 2001), and the resulting net currency exposures are small. Given the inherent level of noise in both exchange rate changes and stock returns, these smaller exposures tend to be less likely to be statistically significant. However, the literature has also documented that these exposures are nevertheless still meaningful and can for instance be used to predict stock returns (Bartram and Bodnar, 2012).

In order to investigate how the internationalization of firms relates to their currency exposures and their use of currency derivatives, we identify firms with international business as those that have non-zero foreign sales, foreign income or foreign assets. These are firms that have underlying gross currency exposures and thus good reasons to use derivatives for hedging purposes. In contrast, the effect of currency risk on firms that have no foreign business (zero foreign sales, income or assets) is

[23] See, for instance, Zeidan and Rodrigues (2013).

less obvious, and the use of currency derivatives by these firms could be driven by speculative motives. Still, even firms without foreign business activities may be exposed to currency risk via various indirect channels, such as import competition.

We investigate the effect of currency derivatives on the absolute value of the net FX exposure of firms (estimated from stock return regressions as before) in Table 6 by regressing stock return exposures to exchange rate risk on currency derivatives and control variables. We show results for regressions of firms with and without foreign business as proxied by different measures (sales, income, assets). The results show that "multinational firms" use currency derivatives to significantly reduce the currency exposure of their stock returns. The coefficients are negative and statistically significant for all three samples of firms with international business, and the size of the coefficients is large. Do "domestic firms" that have no international business, however, use derivatives to take bets on currencies? The three regressions for firms without foreign sales, income or assets suggest otherwise. All three coefficients are insignificant and thus statistically not different from zero, indicating that there is no difference between the currency risk exposure of domestic firms that use derivatives and those that do not. Thus, focusing on the important and well understood dimension of currency exposure, our broad sample analysis again supports the hedging hypothesis 4 and shows no evidence of firms using derivatives for speculative purposes. Nevertheless, the relation between derivatives usage and firm risk and exposures could be moderated by country characteristics, which is investigated in the next section.

3.5 Corporate Governance and Derivatives Market Access

Corporate governance and the ease with which derivatives are available may influence whether and to what extent nonfinancial corporations employ derivatives for hedging or speculative purposes. While the general importance of corporate governance has been shown in La Porta et al. (1998), we investigate it here in a risk management context. In order to examine how country characteristics moderate the use of derivatives, we divide the sample into subsamples. The effect of shareholder rights (at the country level) on the relation between derivatives use and risk is explored in Table 7. Specifically, we estimate regressions separately for firms in countries with weak and strong shareholder rights, and then test for differences between the coefficients on the derivatives use variable. The regressions employ alternative measures of firm risk and exposure as dependent variables as well as derivatives usage and control variables as independent variables. While the *p*-values (in brackets) in the table refer to the significance level of the individual regression coefficients, the stars indicate the significance level

of differences in the coefficients on the derivatives variable across equations. While misaligned interests between managers and shareholders might entail sub-optimal, non-value-increasing risk management activities, strong shareholder rights should reduce these agency costs and lead to the use of derivatives that is more in the interests of shareholders.

The results suggest that firms use derivatives for hedging purposes in both countries with weak and strong shareholder rights. To wit, the coefficient on the derivatives variable is negative in all regressions with significant coefficients. However, contrary to hypothesis 5, the strength of shareholder rights has no effect on the extent to which firms reduce total risk. At the same time, there are some significant differences across the subsamples with regards to some of the underlying exposures. In particular, in support of hypothesis 5, firms in countries with stronger shareholder rights show significantly larger reductions in market risk. The coefficient on the derivatives variable is -0.09 and -0.15 for firms in countries with weak and strong shareholder rights, respectively, which is not only a statistically significant but also an economically meaningful difference. In addition, firms in countries with strong shareholder rights have larger reductions in foreign exchange rate exposure, while the differences with regard to interest rate and commodity price exposures are small. Overall, these results further confirm that firms do not use derivatives in order to increase their risk and exposure (hypothesis 4). While the strength of shareholder rights has no effect on the extent of reduction of overall firm risk, the reduction in exposures tends to be smaller if shareholder rights are weak, which provides some support to hypothesis 5 and which is consistent with small speculative components of hedging (e.g., 'selective' hedging as discussed by Stulz (1996)).

The strength of creditor rights may also impact the relation between the use of derivatives and corporate risk and exposure measures, which is explored in Table 8. Stronger bondholder rights should mitigate the potential agency costs of debt and align the use of derivatives with the interests of creditors. The coefficient on derivatives usage is negative in all subsamples, i.e. for firms in countries with either strong or weak creditor rights. Contrary to predictions (hypothesis 6), the reduction in stock return volatility is significantly larger (-0.20) in countries where creditor rights are weak compared to countries where creditor rights are strong (-0.04). This finding is consistent with anecdotal evidence of lenders in countries with weak creditor rights requiring firms to commit to an effective risk management policy when granting a loan. In line with this explanation, the fraction of firms using interest rate derivatives generally and interest rate swaps in particular is higher in countries with weak creditor rights. The effect on market betas (-0.13 vs. -0.10) and interest rate exposures (-0.01 vs. 0.00) are also

larger for weak creditor rights, but the differences are statistically and/or economically insignificant. In contrast, though in line with predictions (hypothesis 6), reductions in FX and CP exposures are actually larger in countries with strong creditor rights.

Easy access to derivatives may also facilitate or induce speculative uses of derivatives by nonfinancial corporations. In particular, firms located in economies with more developed and liquid derivatives markets may speculate more because they have greater access to derivatives. Alternatively, easier access to derivatives might induce more hedging. Consequently, the relation between derivatives use and corporate risk measures is analyzed separately for firms with easy or difficult access to derivatives. The results are presented in Table 9. The coefficient of the derivatives variable is negative for most subsamples with easy and difficult access to derivatives markets (and thus provides further support for hypothesis 4). Importantly, reductions in total risk are significantly larger for firms in countries where large derivatives markets provide easy access compared to countries with more difficult access (-0.16 vs. 0.02), which allows rejecting hypothesis 7. Thus, the availability of derivatives appears to facilitate the hedging efforts of companies. With regards to the underlying individual financial exposures, however, the picture is more mixed. Reductions in interest rate risk are small but larger in countries with easy access. In contrast, for exposure to market risk and exchange rate risk, reductions are smaller in countries with easy access.

Overall, these results further confirm the use of derivatives by nonfinancial firms for hedging purposes. In none of the subsamples across country characteristics is derivatives usage associated with significantly higher risk or exposure measures. In contrast, the effect is statistically significant and negative in most subsamples, or otherwise not different from zero. Reductions in risk (and often exposures) are larger for firms in countries weak creditor rights and easier access to derivatives. These findings are important given that these country dimensions can be affected by policy.

4 Robustness Tests

We examine a variety of alternative specifications and undertake additional tests to check the robustness of the empirical findings. Disclosure of derivatives use is not a regulatory requirement for all firms in the sample, which could lead to a potential bias if the derivatives variables capture the reporting of derivatives use rather than derivatives use *per se*. In order to address this issue, the sample is limited to firms in countries with well-regarded accounting practices (the so-called 'G4+1' group consisting of the U.S., the U.K., Canada, Australia, and New Zealand) and firms reporting according to

IAS. For the resulting sample of 4,644 firms, disclosure of derivatives is mandatory. Table 10 documents that the results for this subsample are very similar to the findings for the whole sample. Most importantly, the relation of derivatives use with firm risk and exposure is very robust to the reporting requirement and, if anything, is slightly stronger.

Another potential concern is that additional risk factors identified by the asset pricing literature might be correlated with the financial risks we examine. For example, if the Fama-French (1993) or momentum (Carhart, 1997) factors are correlated with currency, interest rates or commodity price fluctuations, then our analysis might be commenting on these factor loadings for individual firms instead of the financial risks we seek to analyze. To examine this possibility, we augment Equation (1) by the return on the world market index and standard factors to capture size, value and momentum effects. Utilizing the net risk measures from this estimation results in consistently negative values for the derivatives variables for exposures to currency, interest rate and commodity price risk, though they are on average slightly smaller in magnitude than those reported in Table 4. The coefficient on the local market beta is smaller (-0.023) and only marginally significant, while the coefficients on the additional risk exposures are all negative and significant for size and value factors.

The robustness of the results is also investigated by employing alternative variables or regressors that reduce the sample size. Consistent with monetary incentives to reduce managerial risk aversion, stock options are positively associated with stock return volatility as well as financial exposures. In particular, coefficients for the stock option variable are positive and statistically significant for all of the risk and exposure measures. The coefficients of the derivatives variables remain negative and significant in all alternative specifications. In addition, the percentage of closely held shares of a firm (*Closely Held Pct*) is significantly negatively related to stock return volatility and market betas, which is consistent with effective monitoring leading to lower risk.[24]

Finally, we also estimate a simultaneous equations model that considers the interactions beween firm risk/exposure and the likelihood of a firm to use derivatives, following Graham and Rogers (2002), Bartram, Brown and Fehle (2009) and Gay, Lin and Smith (2011). The results in Panel A of Table 11 show that derivatives usage is still negative and significant for all measures of firm risk and exposure (in line with hypothesis 4). In addition, most of the significant coefficients for other

[24] Supanvanij and Strauss (2010) find that hedging by U.S. firms is negatively related to exercisable options compensation.

variables have the same sign as reported in Table 4. Panel B of Table 11 shows the coefficients and marginal effects of a logit model for derivatives use. The specification follows the risk management literature (e.g. Géczy, Minton and Schrand, 1997), but given the use of endogenous variables, tries to limit the overlap of independent variables with the risk regressions in Panel A. The results indicate that measures of firm risk are also a significant determinant of the use of derivatives, with firms that exhibit high net exposures being less likely to use derivatives. The coefficients and significance levels of the other determinants of derivatives use are overall consistent with those in the prior literature.

We also perform all analyses in the paper using three-year (or, alternatively, five-year) averages of the accounting data, whenever data for several years is available, or using lagged regressors as alternative ways of addressing endogeneity concerns (Chen and King, 2014; Chen 2011). The tenor of all previous results remains unchanged. Moreover, users of derivatives have generally lower levels of risk and exposure after the introduction of the Euro in 1999, as an exogenous shock, compared to non-users (except for commodity price risk).

5 Conclusion

In the wake of recent efforts to regulate derivatives markets, many end-users are concerned about their ability to effectively use derivatives due to more limited access and higher costs. An interesting and important question is what the likely effect of the new regulation will be on corporate risk, since derivatives are very versatile financial instruments that can be used equally well for hedging as well as speculation. While surveys of corporate derivatives' usage indicate that many corporations use derivatives at least occasionally in order to take positions depending on their market view, most of the academic risk management literature assumes a hedging motive for corporate derivatives use. To illustrate, a significant literature has tested various theories of how hedging at the firm level can increase shareholder value in the presence of capital market imperfections using the use of derivatives by firms to classify these firms as hedgers. To this end, this paper analyzes the relation between the use of financial derivatives at the firm level and various corporate risk measures to assess whether the use of derivatives by nonfinancial firms is indeed consistent with hedging, or whether firms use these instruments with speculative motives. For regulators, policy makers, shareholders and other corporate stakeholders alike, it is important to be aware of the risk management practices of nonfinancial firms and the concomitant effects on firm risk and value.

For a sample comprising 6,896 firms from 47 countries, this paper documents that firms use derivatives to reduce risk. There is no evidence of corporate speculation with derivatives for firms in

individual countries or for different types of derivatives, except for marginally higher net commodity price exposure of firms using commodity price derivatives. These results are consistent across different countries and robust to controlling for the level of gross exposure and differences in country risk, such as exchange rate or interest rate volatility, political risk and trade dependency. Firms use derivatives for hedging purposes independent of country-level corporate governance or access to derivatives. At the same time, derivatives users in countries with strong creditor rights have lower reductions of their stock return volatility, while the reduction in risk is larger in countries with easier access to derivatives.

This is consistent with the assertions of some policy makers that derivatives could be important in limiting the severity of economic downturns in developing economies with typically less liquid derivatives markets. Consequently, it is likely that financial policy makers could facilitate corporate hedging activities by pursuing strategies that encourage the development of local-currency derivatives markets. Our results suggest that nonfinancial firms overall employ derivatives with the motive and effect of risk reduction, despite the fact that – according to questionnaires – they occasionally take positions with derivatives or adjust the size and timing of their derivatives position depending on their market view. These speculative aspects of derivatives use appear minor overall, relative to the dominant effect of reducing corporate exposures to financial risks.

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Figure 1: Notional Amounts Outstanding Over Time

The figure shows the notional amounts outstanding (in trillions of USD) by year of exchange rate, interest rate and commodity price derivatives, separately for OTC and exchange-traded derivatives. The data is from the Bank for International Settlements.

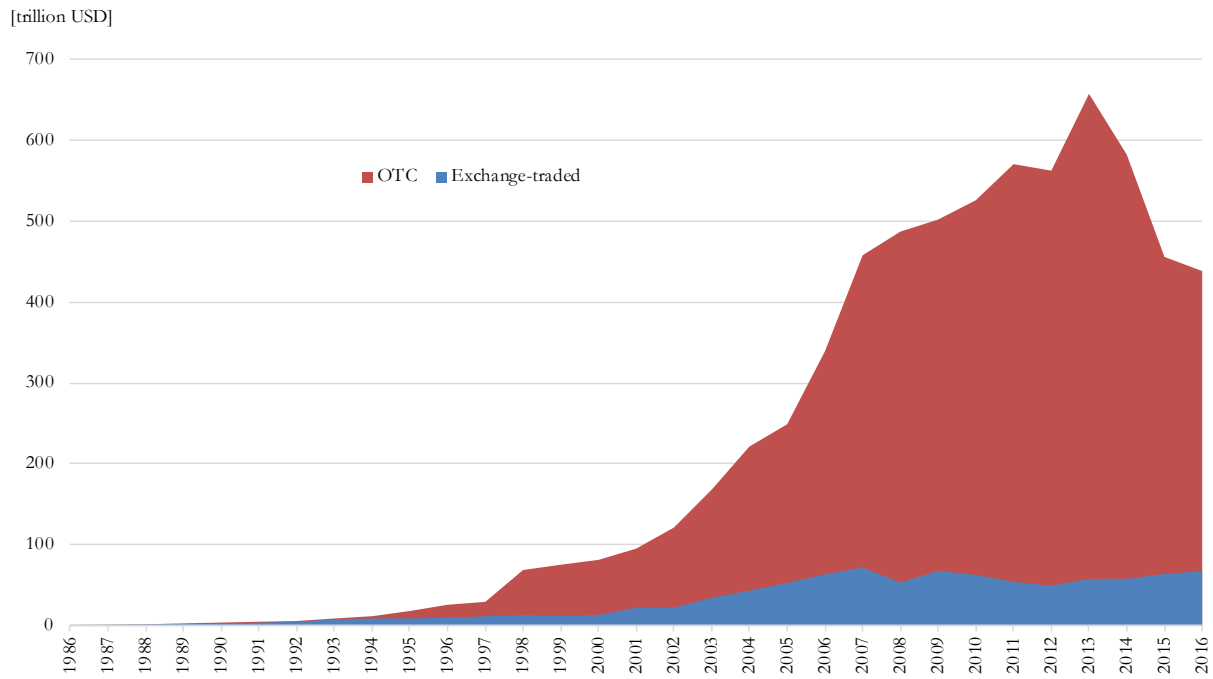

Table 1: Derivatives' Risk Categories and Instruments

The table shows the notional amounts outstanding (in trillions of USD as of 31 December 2016) by underlying and instrument. The data is from the Bank for International Settlements.

Risk Category	Instrument	Notional Amount Oustanding (trillion of USD)
Interest Rate Contracts	Interest rate swaps	275.2
	Forward rate agreements	60.7
	Options	32.2
	Other	0.3
	All OTC	**368.4**
	Options	51.0
	Futures	32.9
	All Exchange-Traded	**83.9**
	All Interest Rate Contracts	**452.3**
Foreign Exchange Contracts	Forwards and swaps	37.2
	Currency swaps	20.9
	Options	10.5
	Other	0.0
	All OTC	**68.6**
	Futures	0.2
	Options	0.1
	All Exchange-Traded	**0.4**
	All Exchange Rate Contracts	**69.0**
Commodity Price Contracts	Forwards and Swaps	1.0
	Options	0.4
	All Commodity Price Contracts	**1.3**
Equity-linked Contracts	Options	3.6
	Forwards and Swaps	2.5
	All Equity-Linked Contracts	**6.1**
Credit Default Swaps	Single-name Instruments	5.6
	Multi-name Instruments	4.3
	All CDS contracts	**9.9**

Table 2: Derivatives Use and Risk Measures

The table shows the number of observations (N), mean, median and standard deviation (Std.Dev.) of different risk characteristics for derivatives users and derivatives non-users. The last column presents *p*-values of Wilcoxon rank sum tests between derivatives users and non-users. All variables are defined in Table A-1 in the appendix.

	Derivatives Users				Derivatives Non-Users				Wilcoxon
Variable	N	Mean	Median	Std.Dev.	N	Mean	Median	Std.Dev.	*p*-value
Gross Exposure									
Gross-FX-Exposure	4,172	0.621	1.000	0.490	2,724	0.395	0.000	0.490	0.000
Foreign Debt	4,172	0.882	1.000	0.320	2,724	0.725	1.000	0.450	0.000
Leverage	4,092	0.297	0.254	0.240	2,644	0.189	0.081	0.240	0.000
Gross-CP-Exposure	4,172	0.157	0.000	0.360	2,724	0.082	0.000	0.270	0.000
Country Risk									
IR-Country	4,166	1.099	0.844	0.590	2,718	1.151	0.844	0.580	0.000
FX-Country	4,166	0.042	0.049	0.020	2,718	0.038	0.033	0.020	0.000
LogEXIM/GDP	4,169	3.802	4.024	0.780	2,722	4.152	4.130	0.940	0.000
ICR-Composite	4,169	83.28	84.25	4.000	2,723	82.28	84.25	4.370	0.000
ICR-Financial	4,169	38.46	37.00	3.750	2,723	38.91	37.00	3.460	0.000
ICR-Economic	4,169	42.19	42.00	2.130	2,723	42.15	42.00	2.040	0.000
ICR-Political	4,169	85.92	90.00	7.370	2,723	83.50	88.00	8.970	0.000
LogGDP	4,171	28.01	27.98	1.680	2,724	27.60	27.89	1.740	0.000
Net Risk/Exposure									
Std.Dev.	4,172	2.377	2.136	1.060	2,724	2.846	2.697	1.260	0.000
Beta	4,042	0.679	0.532	0.570	2,620	0.734	0.614	0.590	0.000
Net-FX-Exposure	4,042	0.569	0.384	0.580	2,620	0.786	0.561	0.720	0.000
Net-IR-Exposure	4,042	0.078	0.044	0.100	2,620	0.099	0.052	0.120	0.000
Net-CP-Exposure	4,042	0.120	0.083	0.120	2,620	0.141	0.106	0.130	0.000

Table 3: Determinants of Derivatives Use

The table reports regression marginal effects and their significance levels from probit regressions of the relationship between the likelihood of general derivatives use, proxies of incentives for derivatives use, proxies of exposure, and control variables. Marginal effects are calculated as the change in the probability of using derivatives that comes from a change in the exogenous variable of interest from (mean - 0.5 Std.Dev.) to (mean + 0.5 Std.Dev.), where all other variables are evaluated at the mean. Below the coefficients, information about the goodness of fit and the number of observations are reported. R-Square is the generalized coefficient of determination proposed by Cox and Snell (1989, pp. 208 -209). ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively. All regressions use country, industry and year fixed effects. All variables are defined in Table A-1 in the appendix.

	All Countries	United States	United Kingdom	Canada	Japan	Germany	Australia	All Other
Leverage	0.047 ***	0.073 ***	0.038	0.079 **	0.158 ***	0.088 ***	0.041	0.019
Coverage (3y)	-0.010	-0.005	-0.033 *	0.018	0.046	0.027	-0.059 **	-0.032 **
Quick Ratio	-0.026 ***	-0.050 ***	-0.014	0.101 *	-0.085 **	-0.003	0.041 **	0.006
Logsize	0.131 ***	0.123 ***	0.141 ***	0.073 **	0.215 ***	0.151 ***	0.062 ***	0.144 ***
Dividend	0.055 ***	0.069 ***	0.116 ***	0.063	0.008	0.041	0.055 **	0.057 ***
GrossProfitMargin (3y)	0.017 **	0.004	-0.003	-0.022	0.076	0.059 **	0.067 ***	0.006
Income Tax Credit	0.031 ***	0.034 ***	0.017	0.162	-0.018	0.015	-0.010	0.029 *
Market-to-Book	-0.034 ***	-0.018	-0.042 **	-0.020	-0.041	-0.080 *	-0.027	-0.033 **
Market-to-Book*Leverage	0.025 ***	0.035 **	0.081 **	0.008	-0.125 *	0.054	0.076 *	0.018
Multiple Share Classes	0.036 ***	0.034 ***	0.024	0.000	0.018	0.020	0.255	0.075 ***
Stock Options	0.030 ***	0.144 ***	0.008	-0.004	0.018	0.007	-0.017	0.015
Gross-FX-Exposure	0.039 ***	0.071 ***	0.058 ***	0.041	0.089 **	-0.004	-0.002	0.037 ***
Foreign Debt	0.055 ***	0.031 ***	0.115 ***	0.170 ***	0.143 ***	0.047	0.093 ***	0.118 ***
Intercept	-0.468 ***	-1.083 ***	-0.902 *	-0.978 **	-1.303 ***	-0.028	-0.446	-1.095 ***
R-Square	0.165	0.214	0.263	0.205	0.326	0.212	0.261	0.157
Observations	6,220	1,934	814	363	287	431	244	2,147

Table 4: Regressions of Corporate Risk Measures on Derivatives Use

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of corporate risk measures on derivatives use and control variables. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. Panel A shows full results for general derivatives use. Panel B shows results for regressions with foreign exchange rate, interest rate and commodity price derivatives. For brevity the panel displays only the coefficient on the derivatives variable. Std.Dev. is the standardized standard deviation of local currency stock returns. Beta, Net-FX-Exposure, Net-IR-Exposure and Net-CP-Exposure are the coefficients of regressions of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. All regressions include industry and year fixed effects. Standard errors are corrected with the Newey-West (1987) method. The table also reports results and test statistics from an instrumental variables approach and a treatment effects model. All variables are defined in Table A-1 in the appendix.

Panel A: General Derivatives

	Total Risk		Exposures							
	Std.Dev.		Beta		Net-FX-Exposure		Net-IR-Exposure		Net-CP-Exposure	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
OLS Estimates										
Derivatives	-0.112	[0.00]	-0.072	[0.00]	-0.072	[0.00]	-0.001	[0.66]	-0.010	[0.00]
Gross-FX-Exposure	0.021	[0.43]	0.013	[0.32]	0.024	[0.18]	-0.009	[0.00]	0.001	[0.72]
Foreign Debt	0.098	[0.00]	0.010	[0.53]	-0.009	[0.72]	0.001	[0.80]	0.002	[0.60]
Leverage	0.001	[0.99]	-0.419	[0.00]	0.018	[0.65]	-0.007	[0.23]	0.000	[0.98]
Logsize	-0.094	[0.00]	0.114	[0.00]	-0.006	[0.34]	-0.003	[0.00]	-0.002	[0.04]
NumIndSeg	-0.012	[0.07]	-0.001	[0.81]	-0.012	[0.01]	-0.002	[0.00]	-0.001	[0.22]
Book-to-Market	-0.017	[0.42]	0.028	[0.00]	0.010	[0.48]	0.002	[0.25]	-0.001	[0.70]
Dividend	-0.906	[0.00]	-0.356	[0.00]	-0.274	[0.00]	-0.038	[0.00]	-0.049	[0.00]
LogEXIM/GDP	-0.137	[0.00]	-0.037	[0.00]	0.053	[0.00]	-0.007	[0.00]	-0.004	[0.03]
IR-Country	-0.108	[0.00]	-0.032	[0.01]	0.250	[0.00]	0.021	[0.00]	0.021	[0.00]
ICR-Political	0.004	[0.02]	-0.012	[0.00]	-0.008	[0.00]	0.001	[0.00]	0.000	[0.15]
Intercept	4.219	[0.00]	1.759	[0.00]	1.106	[0.00]	0.026	[0.16]	0.137	[0.00]
Adjusted R^2	0.41		0.40		0.15		0.24		0.17	
Observations	6,703		6,497		6,497		6,497		6,497	
Instrumental Variables Model										
Derivatives	-0.483	[0.00]	-0.437	[0.00]	-0.327	[0.00]	-0.038	[0.00]	-0.002	[0.85]
Underidentification test (LM statistic) ($\chi 2$)	1,118	[0.00]	974	[0.00]	974	[0.00]	974	[0.00]	974	[0.00]
Weak identification test (Stock and Yogo) (*F*-test)	669	[0.00]	572	[0.00]	572	[0.00]	572	[0.00]	572	[0.00]
Overidentification test (Sargan statistic) ($\chi 2$)	0.07	[0.79]	1.04	[0.31]	0.53	[0.47]	0.07	[0.80]	0.15	[0.70]
Treatment Effects Model										
Derivatives	-0.614	[0.00]	-0.409	[0.00]	-0.898	[0.00]	-0.056	[0.00]	-0.096	[0.00]
Wald test: all coefficients = 0 (χ^2)	5,177	[0.00]	4,741	[0.00]	2,000	[0.00]	2,874	[0.00]	2,257	[0.00]
Heckman's λ	0.319	[0.00]	0.211	[0.00]	0.522	[0.00]	0.034	[0.00]	0.054	[0.00]

(contined)

Table 4: Regressions of Corporate Risk Measures on Derivatives Use (continued)

Panel B: Currency, Interest Rate and Commodity Price Derivatives

	Total Risk		Exposures							
	Std.Dev.		Beta		Net-FX-Exposure		Net-IR-Exposure		Net-CP-Exposure	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
OLS Estimates										
FX-Derivatives	0.001	[0.97]	-0.032	[0.02]	-0.085	[0.00]	-0.002	[0.57]	-0.007	[0.03]
IR-Derivatives	-0.135	[0.00]	-0.116	[0.00]	-0.030	[0.09]	-0.003	[0.23]	-0.010	[0.00]
CP-Derivatives	-0.070	[0.06]	-0.069	[0.00]	-0.015	[0.56]	0.003	[0.45]	0.011	[0.07]
Instrumental Variables Model										
FX-Derivatives	-0.571	[0.00]	-0.524	[0.00]	-0.398	[0.00]	-0.045	[0.00]	-0.002	[0.88]
IR-Derivatives	-1.425	[0.00]	-1.269	[0.00]	-0.965	[0.00]	-0.110	[0.00]	-0.004	[0.88]
CP-Derivatives	-2.132	[0.00]	-1.922	[0.00]	-1.307	[0.00]	-0.154	[0.00]	-0.014	[0.74]
Treatment Effects Model										
FX-Derivatives	-0.130	[0.09]	-0.343	[0.00]	-0.919	[0.00]	-0.058	[0.00]	-0.089	[0.00]
IR-Derivatives	-0.151	[0.08]	-0.502	[0.00]	-0.394	[0.00]	-0.029	[0.00]	-0.057	[0.00]
CP-Derivatives	0.092	[0.44]	-0.157	[0.01]	0.043	[0.61]	-0.001	[0.95]	0.109	[0.00]

Table 5: Regressions of Corporate Risk Measures on Derivatives Use By Country

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of corporate risk measures on derivatives use and control variables. It also reports the number of observations by type of risk measure. Regressions are run separately by country. Alternative dependent variables are the standardized standard deviation of local currency stock returns, as well as the coefficients of regressions of stock returns on market index returns (Beta), exchange rate changes (Net-FX-Exposure), short-term interest rate changes (Net-IR-Exposure) and commodity price changes (Net-CP-Exposure). Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. The independent variables are the same as in Table 4, however, for brevity the table displays only the coefficient on the derivatives variable. Standard errors are corrected with the Newey-West (1987) method. All regressions include industry and year fixed effects. All variables are defined in Table A-1 in the appendix.

	United States		United Kingdom		Canada		Germany		Japan		Australia		All Other	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Std.Dev.	-0.221	[0.00]	-0.025	[0.77]	-0.214	[0.03]	0.044	[0.62]	-0.010	[0.90]	-0.775	[0.00]	-0.041	[0.33]
Beta	-0.104	[0.00]	-0.022	[0.60]	-0.022	[0.63]	0.056	[0.38]	-0.047	[0.44]	-0.207	[0.01]	-0.122	[0.00]
Net-FX-Exposure	-0.029	[0.44]	-0.019	[0.51]	-0.094	[0.13]	-0.082	[0.30]	0.010	[0.82]	-0.020	[0.63]	-0.166	[0.00]
Net-IR-Exposure	-0.007	[0.31]	0.000	[0.95]	0.006	[0.64]	0.002	[0.85]	0.000	[0.65]	-0.027	[0.11]	0.005	[0.20]
Net-CP-Exposure	-0.011	[0.13]	-0.008	[0.36]	-0.004	[0.75]	-0.007	[0.66]	-0.003	[0.83]	-0.013	[0.41]	-0.012	[0.01]
Observations	2,032		852		499		394		366		274		2,080	

Table 6: Foreign Exchange Rate Exposure and Currency Derivatives

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of Net-FX-Exposure on derivatives use and control variables. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. Net-FX-Exposure are the exchange rate coefficients of a regression of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions use the absolute value of the coefficient as dependent variable. All regressions use industry and year fixed effects. Standard errors are corrected with the Newey-West (1987) method. The table shows results separately for regressions with firms that have non-zero foreign sales, foreign income and foreign assets, respectively, and those with zero values of these variables. All variables are defined in Table A-1 in the appendix.

	Firms with						Firms without					
	Foreign Sales		Foreign Income		Foreign Assets		Foreign Sales		Foreign Income		Foreign Assets	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
FX-Derivatives	-0.063	[0.01]	-0.103	[0.00]	-0.058	[0.04]	-0.028	[0.59]	-0.049	[0.34]	-0.042	[0.39]
Foreign Debt	0.020	[0.66]	0.071	[0.34]	0.037	[0.60]	0.001	[0.98]	0.023	[0.62]	-0.001	[0.98]
Leverage	0.012	[0.81]	0.014	[0.84]	0.006	[0.91]	-0.058	[0.55]	-0.057	[0.55]	-0.042	[0.65]
Logsize	-0.009	[0.17]	-0.001	[0.89]	-0.017	[0.04]	-0.021	[0.15]	-0.015	[0.29]	-0.018	[0.21]
NumIndSeg	-0.013	[0.02]	-0.005	[0.51]	-0.001	[0.85]	-0.009	[0.48]	-0.007	[0.61]	-0.004	[0.74]
Book-to-Market	0.008	[0.62]	-0.001	[0.95]	0.003	[0.88]	0.015	[0.62]	0.022	[0.48]	0.023	[0.44]
Dividend	-0.245	[0.00]	-0.261	[0.00]	-0.261	[0.00]	-0.290	[0.00]	-0.296	[0.00]	-0.269	[0.00]
LogEXIM/GDP	0.058	[0.00]	0.058	[0.01]	0.045	[0.01]	-0.021	[0.52]	-0.013	[0.69]	-0.020	[0.55]
IR-Country	0.306	[0.00]	0.351	[0.00]	0.309	[0.00]	0.232	[0.00]	0.251	[0.00]	0.267	[0.00]
ICR-Political	-0.012	[0.00]	-0.013	[0.00]	-0.011	[0.00]	-0.006	[0.03]	-0.006	[0.05]	-0.007	[0.02]
Intercept	1.337	[0.00]	1.308	[0.00]	1.272	[0.00]	1.266	[0.00]	1.130	[0.00]	1.170	[0.00]
Adjusted R^2	0.17		0.23		0.17		0.17		0.17		0.16	
Observations	3,547		1,797		2,219		1,144		1,195		1,248	

Table 7: Derivatives Usage and Shareholder Rights

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of corporate risk measures on derivatives use and control variables. Regressions distinguish between environments of weak or strong shareholder rights. Shareholder rights are strong for firms where shareholder rights are above the median across countries. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. *, **, and *** indicate that the coefficient of the derivatives variable is significantly different for subsamples with strong and weak shareholder rights at the 10%, 5% and 1% significance level, respectively. Standard errors are corrected with the Newey-West (1987) method. Std.Dev. is the standardized standard deviation of local currency stock returns. Beta, Net-FX-Exposure, Net-IR-Exposure and Net-CP-Exposure are the coefficients of regressions of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. All regressions include country, industry and year fixed effects. All variables are defined in Table A-1 in the appendix.

	Total Risk				Exposures																	
	Std.Dev.				Beta				Net-FX-Exposure				Net-IR-Exposure				Net-CP-Exposure					
	weak		strong		weak			strong		weak			strong		weak		strong		weak			strong	
Variable	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value		Coef.	*p*-value	Coef.	*p*-value		Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value		Coef.	*p*-value
Derivatives	-0.08	[0.10]	-0.08	[0.03]	-0.09	[0.00]	***	-0.15	[0.00]	-0.09	[0.00]	***	-0.16	[0.00]	0.00	[0.88]	0.00	[0.85]	0.00	[0.97]	*	-0.01	[0.07]
Gross-FX-Exposure	0.06	[0.15]	0.02	[0.50]	0.01	[0.59]		0.05	[0.00]	0.01	[0.71]		0.06	[0.01]	0.00	[0.60]	0.00	[0.24]	0.00	[0.81]		0.00	[0.34]
Foreign Debt	0.08	[0.21]	0.13	[0.00]	0.04	[0.17]		0.09	[0.00]	0.07	[0.08]		-0.03	[0.28]	0.01	[0.26]	-0.02	[0.00]	0.00	[0.73]		0.00	[0.75]
Leverage	-0.40	[0.00]	-0.26	[0.00]	-0.66	[0.00]		-0.50	[0.00]	-0.04	[0.43]		-0.01	[0.84]	-0.04	[0.00]	-0.03	[0.00]	-0.02	[0.08]		-0.01	[0.35]
Logsize	-0.07	[0.00]	-0.09	[0.00]	0.11	[0.00]		0.11	[0.00]	-0.04	[0.00]		0.01	[0.02]	-0.01	[0.00]	0.00	[0.00]	0.00	[0.06]		0.00	[0.13]
NumIndSeg	-0.04	[0.00]	-0.04	[0.00]	0.01	[0.04]		0.01	[0.00]	-0.01	[0.08]		0.00	[0.46]	-0.01	[0.00]	0.00	[0.00]	0.00	[0.00]		0.00	[0.00]
Book-to-Market	-0.09	[0.03]	-0.06	[0.03]	0.00	[0.92]		0.02	[0.09]	-0.05	[0.04]		0.05	[0.00]	0.00	[0.79]	0.00	[0.47]	0.00	[0.63]		0.00	[0.45]
Dividend	-1.13	[0.00]	-1.09	[0.00]	-0.42	[0.00]		-0.46	[0.00]	-0.26	[0.00]		-0.37	[0.00]	-0.05	[0.00]	-0.05	[0.00]	-0.06	[0.00]		-0.06	[0.00]
Intercept	3.77	[0.00]	3.81	[0.00]	0.4	[0.00]		0.36	[0.00]	1.07	[0.00]		0.77	[0.00]	0.19	[0.00]	0.09	[0.00]	0.19	[0.00]		0.16	[0.00]
Adjusted R^2	0.37		0.32		0.25			0.26		0.13			0.10		0.23		0.23		0.13			0.08	
Observations	2,507		4,201		2,357			4,140		2,357			4,140		2,357		4,140		2,357			4,140	

Table 8: Derivatives Usage and Creditor Rights

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of corporate risk measures on derivatives use and control variables. Regressions distinguish between environments of weak or strong creditor rights. Creditor rights are strong for firms where creditor rights are greater than the median across countries. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. *, **, and *** indicate that the coefficient of the derivatives variable is significantly different for subsamples with strong and weak creditor rights at the 10%, 5% and 1% significance level, respectively. Standard errors are corrected with the Newey-West (1987) method. Std.Dev. is the standardized standard deviation of local currency stock returns. Beta, Net-FX-Exposure, Net-IR-Exposure and Net-CP-Exposure are the coefficients of regressions of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. All regressions include country, industry and year fixed effects. All variables are defined in Table A-1 in the appendix.

	Total Risk					Exposures																	
	Std.Dev.					Beta				Net-FX-Exposure				Net-IR-Exposure				Net-CP-Exposure					
	weak			strong		weak		strong		weak			strong		weak			strong		weak			strong	
Variable	Coef.	*p*-value		Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value		Coef.	*p*-value	Coef.	*p*-value		Coef.	*p*-value	Coef.	*p*-value		Coef.	*p*-value
Derivatives	-0.20	[0.00]	***	-0.04	[0.29]	-0.13	[0.00]	-0.10	[0.00]	-0.07	[0.01]	***	-0.18	[0.00]	-0.01	[0.11]	***	0.00	[0.96]	0.00	[0.83]	***	-0.01	[0.00]
Gross-FX-Exposure	-0.05	[0.18]		0.13	[0.00]	0.06	[0.00]	0.02	[0.29]	0.05	[0.07]		0.03	[0.18]	-0.01	[0.09]		0.00	[0.25]	0.00	[0.89]		0.00	[0.45]
Foreign Debt	0.23	[0.00]		0.10	[0.07]	0.05	[0.02]	0.07	[0.01]	-0.05	[0.09]		0.14	[0.00]	0.00	[0.59]		0.01	[0.04]	0.00	[0.68]		0.01	[0.07]
Leverage	-0.53	[0.00]		-0.13	[0.06]	-0.75	[0.00]	-0.39	[0.00]	-0.04	[0.50]		-0.01	[0.77]	-0.02	[0.03]		-0.02	[0.00]	-0.02	[0.04]		0.00	[0.83]
Logsize	-0.16	[0.00]		-0.05	[0.00]	0.12	[0.00]	0.10	[0.00]	0.00	[0.91]		-0.02	[0.00]	-0.01	[0.00]		0.00	[0.17]	0.00	[0.60]		0.00	[0.00]
NumIndSeg	-0.01	[0.30]		-0.04	[0.00]	0.00	[0.96]	0.02	[0.00]	-0.03	[0.00]		0.01	[0.03]	0.00	[0.01]		0.00	[0.00]	-0.01	[0.00]		0.00	[0.87]
Book-to-Market	0.00	[0.91]		-0.08	[0.00]	0.01	[0.52]	0.02	[0.07]	-0.03	[0.17]		0.05	[0.01]	0.00	[0.97]		0.00	[0.13]	0.00	[0.93]		0.00	[0.20]
Dividend	-1.15	[0.00]		-0.94	[0.00]	-0.50	[0.00]	-0.38	[0.00]	-0.33	[0.00]		-0.28	[0.00]	-0.05	[0.00]		-0.04	[0.00]	-0.06	[0.00]		-0.05	[0.00]
Intercept	4.49	[0.00]		3.22	[0.00]	0.40	[0.00]	0.34	[0.00]	0.95	[0.00]		0.78	[0.00]	0.16	[0.00]		0.09	[0.00]	0.19	[0.00]		0.16	[0.00]
Adjusted R^2	0.40			0.30		0.32		0.18		0.11			0.11		0.22			0.14		0.07			0.10	
Observations	3,321			3,387		3,258		3,239		3,258			3,239		3,258			3,239		3,258			3,239	

Table 9: Derivatives Usage and Derivative Market Access

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of corporate risk measures on derivatives use and control variables. Regressions distinguish between environments of easy and difficult market access to derivatives. Access to derivatives is easy for firms where derivatives market rank is greater than the median across countries. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. *, **, and *** indicate that the coefficient of the derivatives variable is significantly different for subsamples with easy and difficult access to derivatives at the 10%, 5% and 1% significance level, respectively. Standard errors are corrected with the Newey-West (1987) method. Std.Dev. is the standardized standard deviation of local currency stock returns. Beta, Net-FX-Exposure, Net-IR-Exposure and Net-CP-Exposure are the coefficients of regressions of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. All regressions include country, industry and year fixed effects. All variables are defined in Table A-1 in the appendix.

	Total Risk				Exposures															
	Std.Dev.				Beta				Net-FX-Exposure				Net-IR-Exposure				Net-CP-Exposure			
	easy		difficult		easy		difficult		easy		difficult		easy		difficult		easy		difficult	
Variable	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Derivatives	-0.16	[0.00] ***	0.02	[0.64]	-0.09	[0.00] **	-0.13	[0.00]	-0.06	[0.03] ***	-0.18	[0.00]	-0.01	[0.05] ***	0.01	[0.00]	0.00	[0.51]	-0.01	[0.17]
Gross-FX-Exposure	0.09	[0.02]	0.01	[0.75]	0.06	[0.01]	0.02	[0.30]	-0.02	[0.37]	0.09	[0.00]	-0.01	[0.22]	0.00	[0.29]	0.00	[0.84]	0.00	[0.65]
Foreign Debt	0.11	[0.01]	0.00	[0.96]	0.08	[0.00]	0.05	[0.09]	-0.02	[0.50]	0.12	[0.00]	-0.01	[0.14]	0.00	[0.58]	0.00	[1.00]	0.00	[0.72]
Leverage	-0.64	[0.00]	-0.08	[0.32]	-0.73	[0.00]	-0.39	[0.00]	-0.07	[0.22]	0.03	[0.63]	-0.03	[0.00]	-0.02	[0.03]	-0.03	[0.02]	0.00	[0.65]
Logsize	-0.03	[0.00]	-0.12	[0.00]	0.12	[0.00]	0.10	[0.00]	0.02	[0.00]	-0.04	[0.00]	0.00	[0.00]	-0.01	[0.00]	0.00	[0.03]	0.00	[0.00]
NumIndSeg	-0.04	[0.00]	-0.04	[0.00]	-0.02	[0.00]	0.03	[0.00]	-0.02	[0.01]	0.00	[0.43]	0.00	[0.86]	-0.01	[0.00]	0.00	[0.00]	0.00	[0.00]
Book-to-Market	0.04	[0.29]	-0.13	[0.00]	0.04	[0.02]	-0.02	[0.19]	0.02	[0.27]	0.01	[0.55]	0.01	[0.01]	-0.01	[0.01]	0.00	[0.46]	0.00	[0.14]
Dividend	-1.12	[0.00]	-1.04	[0.00]	-0.54	[0.00]	-0.31	[0.00]	-0.39	[0.00]	-0.25	[0.00]	-0.06	[0.00]	-0.04	[0.00]	-0.06	[0.00]	-0.06	[0.00]
Intercept	3.46	[0.00]	4.11	[0.00]	0.40	[0.00]	0.36	[0.00]	0.80	[0.00]	0.88	[0.00]	0.08	[0.00]	0.16	[0.00]	0.16	[0.00]	0.18	[0.00]
Adjusted R^2	0.40		0.31		0.33		0.18		0.11		0.11		0.23		0.20		0.07		0.11	
Observations	3,278		3,430		3,278		3,219		3,278		3,219		3,278		3,219		3,278		3,219	

Table 10: Regressions for G4+1 Countries

The table reports regression coefficients and their *p*-values (in brackets) from OLS regressions of corporate risk measures on general derivatives use and control variables. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. Std.Dev. is the standardized standard deviation of local currency stock returns. Beta, Net-FX-Exposure, Net-IR-Exposure and Net-CP-Exposure are the coefficients of regressions of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. Standard errors are corrected with the Newey-West (1987) method. All regressions include country, industry and year fixed effects. The table is based on firms in G4+1 countries and those complying with IAS. All variables are defined in Table A-1 in the appendix.

	Total Risk		Exposures							
	Std.Dev.		Beta		Net-FX-Exposure		Net-IR-Exposure		Net-CP-Exposure	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Derivatives	-0.063	[0.04]	-0.026	[0.12]	-0.071	[0.00]	-0.008	[0.02]	-0.010	[0.01]
Gross-FX-Exposure	0.033	[0.28]	0.015	[0.34]	0.019	[0.33]	-0.012	[0.00]	0.000	[0.95]
Foreign Debt	0.071	[0.05]	0.017	[0.36]	0.032	[0.22]	0.010	[0.03]	0.016	[0.00]
Leverage	-0.011	[0.88]	-0.419	[0.00]	0.011	[0.81]	-0.014	[0.06]	-0.013	[0.14]
Logsize	-0.104	[0.00]	0.108	[0.00]	-0.019	[0.00]	-0.002	[0.02]	-0.003	[0.01]
NumIndSeg	-0.030	[0.00]	-0.011	[0.01]	-0.008	[0.12]	0.001	[0.18]	0.000	[0.78]
Book-to-Market	0.014	[0.61]	0.012	[0.29]	0.001	[0.96]	0.007	[0.02]	0.004	[0.20]
Dividend	-0.724	[0.00]	-0.285	[0.00]	-0.283	[0.00]	-0.047	[0.00]	-0.052	[0.00]
LogEXIM/GDP	-0.010	[0.64]	-0.014	[0.26]	-0.011	[0.44]	0.007	[0.01]	-0.003	[0.22]
IR-Country	-0.190	[0.00]	-0.096	[0.00]	0.354	[0.00]	0.046	[0.00]	0.028	[0.00]
ICR-Political	-0.003	[0.16]	-0.001	[0.46]	-0.011	[0.00]	0.000	[0.23]	0.000	[0.65]
Intercept	0.878	[0.00]	0.400	[0.00]	1.343	[0.00]	-0.007	[0.74]	0.108	[0.00]
Adjusted R^2	0.22		0.17		0.17		0.23		0.10	
Observations	4,644		4,577		4,577		4,577		4,577	

Table 11: Examination of Risk Measures and Derivatives Use in Simultaneous Equations Model

The table reports in Panel A coefficients and corresponding *p*-values (in brackets) of OLS regressions of corporate risk measures on general derivatives use and control variables. Below the coefficients, information about the adjusted R^2 and the number of observations is reported. Std.Dev. is the standardized standard deviation of local currency stock returns. Beta, Net-FX-Exposure, Net-IR-Exposure and Net-CP-Exposure are the coefficients of regressions of stock returns on market index returns, exchange rate changes, short-term interest rate changes and commodity price changes. Regressions with exchange rate, interest rate and commodity price exposures use the absolute value of the coefficient as dependent variable. Panel B shows regression coefficients, their marginal effects and *p*-values (in brackets) from logit regressions of the relation between the likelihood of general derivatives use, firm-specific and country-specific proxies of incentives for hedging, proxies of exposure, and control variables. Marginal effects (MarEff) are calculated as the change in the probability of using derivatives that comes from a change in the exogenous variable of interest from (mean - 0.5 Std.Dev.) to (mean + 0.5 Std.Dev.), where all other variables are evaluated at the mean. R-Square is the generalized coefficient of determination proposed by Cox and Snell (1989, pp. 208 -209). All regressions include country, industry and year dummies. The estimation is based on a simultaneous equation approach, following Graham and Rogers (2002) and Bartram, Brown and Fehle (2009).

Panel A: OLS Results

	Total Risk		Exposures							
	Std.Dev.		Beta		Net-FX-Exposure		Net-IR-Exposure		Net-CP-Exposure	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Derivatives	*-0.151*	*[0.00]*	*-0.113*	*[0.00]*	*-0.091*	*[0.00]*	*-0.004*	*[0.13]*	*-0.007*	*[0.04]*
Gross-FX-Exposure	0.035	[0.18]	0.056	[0.00]	0.048	[0.01]	-0.006	[0.04]	0.002	[0.60]
Foreign Debt	0.199	[0.00]	0.069	[0.00]	-0.001	[0.96]	0.003	[0.43]	0.005	[0.23]
Leverage	-0.256	[0.00]	-0.589	[0.00]	-0.046	[0.22]	-0.020	[0.00]	-0.007	[0.35]
Logsize	-0.097	[0.00]	0.107	[0.00]	-0.006	[0.28]	-0.003	[0.00]	-0.002	[0.08]
NumIndSeg	-0.024	[0.00]	-0.002	[0.63]	-0.014	[0.00]	-0.002	[0.00]	-0.003	[0.00]
Dividend	-1.078	[0.00]	-0.468	[0.00]	-0.305	[0.00]	-0.044	[0.00]	-0.056	[0.00]
Book-to-Market	-0.050	[0.01]	0.016	[0.13]	0.002	[0.88]	0.001	[0.64]	-0.001	[0.76]
LogEXIM/GDP	-0.142	[0.00]	-0.052	[0.00]	0.047	[0.00]	-0.008	[0.00]	-0.004	[0.06]
IR-Country	-0.144	[0.00]	-0.067	[0.00]	0.239	[0.00]	0.019	[0.00]	0.022	[0.00]
ICR-Political	0.005	[0.01]	-0.012	[0.00]	-0.008	[0.00]	0.001	[0.00]	0.000	[0.33]
Intercept	4.091	[0.00]	1.811	[0.00]	1.109	[0.00]	0.010	[0.65]	0.146	[0.00]
Adjusted R^2	0.35		0.28		0.15		0.23		0.10	
Observations	6,213		6,017		6,017		6,017		6,017	

(continued)

Table 11: Examination of Risk Measures and Derivatives Use in Simultaneous Equations (continued)

Panel B: Derivatives Use (Logit) Results

	Derivatives		Derivatives		Derivatives		Derivatives		Derivatives	
	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value	Coef.	*p*-value
Std. Dev.	*0.022*	*[0.26]*								
Beta			*-0.170*	*[0.00]*						
Net-FX-Exposure					*-0.135*	*[0.00]*				
Net-IR-Exposure							*0.220*	*[0.23]*		
Net-CP-Exposure									*-0.101*	*[0.49]*
Coverage (3y)	-0.001	[0.82]	0.000	[0.97]	-0.001	[0.71]	0.000	[0.91]	0.000	[0.99]
Quick Ratio	-0.074	[0.00]	-0.058	[0.00]	-0.071	[0.00]	-0.075	[0.00]	-0.074	[0.00]
Logassets	0.347	[0.00]	0.362	[0.00]	0.341	[0.00]	0.346	[0.00]	0.345	[0.00]
Dividend	-0.009	[0.84]	-0.106	[0.02]	-0.081	[0.06]	-0.043	[0.32]	-0.057	[0.19]
GrossProfitMargin (3y)	0.294	[0.00]	0.275	[0.00]	0.268	[0.00]	0.282	[0.00]	0.276	[0.00]
Income Tax Credit	0.299	[0.03]	0.284	[0.04]	0.272	[0.05]	0.279	[0.04]	0.282	[0.04]
Market-to-Book*Leverage	0.171	[0.00]	0.152	[0.00]	0.158	[0.00]	0.169	[0.00]	0.165	[0.00]
Multiple Share Classes	0.310	[0.00]	0.311	[0.00]	0.324	[0.00]	0.333	[0.00]	0.334	[0.00]
Stock Options	0.409	[0.00]	0.391	[0.00]	0.391	[0.00]	0.390	[0.00]	0.393	[0.00]
PctMktCap	2.016	[0.00]	2.211	[0.00]	2.093	[0.00]	2.222	[0.00]	2.232	[0.00]
USROW	-0.470	[0.00]	-0.484	[0.00]	-0.451	[0.00]	-0.506	[0.00]	-0.495	[0.00]
Intercept	-3.196	[0.00]	-3.163	[0.00]	-3.016	[0.00]	-3.234	[0.00]	-3.203	[0.00]
R^2	0.24		0.24		0.24		0.24		0.24	
Observations	6,213		6,017		6,017		6,017		6,017	

Table A-1: Variable Definitions

The table reports the independent variables of the study and their definition. Panel A refers to firm characteristics and Panel B to country-specific variables. A suffix of "(3y)" to a variable indicates a three-year average.

Variable	Definition
Panel A: Firm characteristics	
Derivatives	Indicator variable with value 1 if the firm uses derivatives; 0 otherwise
FX-Derivatives	Indicator variable with value 1 if the firm uses FX derivatives; 0 otherwise
IR-Derivatives	Indicator variable with value 1 if the firm uses IR derivatives; 0 otherwise
CP-Derivatives	Indicator variable with value 1 if the firm uses CP derivatives; 0 otherwise
Foreign Assets	International Assets / Total Assets
Foreign Income (3y)	International Operating Income / Operating Income
Foreign Sales	International Sales / Net Sales or Revenues
Gross-FX-Exposure	Indicator variable with value 1 if any foreign assets, foreign income or foreign sales are reported; 0
Foreign Debt	Indicator variable with value 1 if any foreign debt is reported; 0 otherwise
Leverage	Total Debt / Size
Coverage (3y)	EBIT / Interest Expense on Debt
Quick Ratio	(Cash & Equivalents + Receivables (Net)) / Total Current Liabilities
NumIndSeg	Number of business segments (SIC codes) that make up the company's revenue (between 1 and 8)
Logsize	Natural logarithm of the sum of market capitalization, total debt and preferred stock
Logassets	Natural logarithm of Total Assets
Dividend	Indicator variable with value 1 if dividend yield, dividend payout or dividend per share is positive; 0 otherwise
GrossProfitMargin (3y)	Gross Income / Net Sales or Revenues
Income Tax Credit	Indicator variable with value 1 if income tax credits exist; 0 otherwise
Book-to-Market	Book Value Per Share / Market Price-Year End
MB*Leverage	Market-to-Book* Leverage
MultShareClass	Indicator variable with value 1 if currently multiple share classes exist; 0 otherwise
Stock Options	Indicator variable with value 1 if stock options are reported in the annual report; 0 otherwise
Closely Held (Pct)	Number of closely held shares / common shares outstanding; closely held shares are shares held by insiders (shares held by officers, directors and their immediate families, shares held in trust, shares of the company held by any other corporation (except shares held in a fiduciary capacity by banks or other financial institutions), shares held by pension/benefit plans, shares held by individuals who hold 5% or more of the outstanding shares)
Std.Dev.	Ratio of the daily local currency stock return standard deviation and the local currency market index standard deviation
Beta	Coefficient of the market index from a regression of returns on the market index, exchange rate index, short-term interest rate and the commodity price index on stock returns
Net-FX-Exposure	Absolute value of the coefficient of exchange rate index from a regression of returns on the market index, exchange rate index, short-term interest rate and the commodity price index on stock returns
Net-IR-Exposure	Absolute value of the coefficient of interest rate from a regression of returns on the market index, exchange rate index, short-term interest rate and the commodity price index on stock returns
Net-CP-Exposure	Absolute value of the coefficient of commodity price index from a regression of returns on the market index, exchange rate index, short-term interest rate and the commodity price index on stock returns

(continued)

Table A-1: Variable Definitions (continued)

Variable	Definition
Panel B: Country characteristics	
IR-Country	Standard deviation of short-term interest rate (1999-2001)
FX-Country	Standard deviation of trade-weighted exchange rate (1999-2001)
LogEXIM/GDP	Natural logarithm of ((Exports + Imports) / GDP)
ICR-Composite	International Country Risk composite index
ICR-Financial	International Country Risk index of financial risk (from PRS Group)
ICR-Economic	International Country Risk index of economic risk (from PRS Group)
ICR-Political	International Country Risk index of political risk (from PRS Group)
LogGDP	Natural logarithm of GDP
Shareholder Rights	Anti-Self-Dealing Index (from Djankov, La Porta, Lopez-de-Silanes, and Shleifer, 2008)
Creditor Rights	Aggregate index of creditor right protection with values from 0 (low) to 4 (high) (from La Porta et al., 1998)
DerMktRank	Inverse ranking of the size of the derivatives market relative to the market of the other countries in the sample. Size is calculated by summing daily turnover in the FX and IR markets in 2001 for non-financial firms and standardizing by nominal GDP. We use the rank because the unranked values are extremely positively skewed by countries with FX trading centers (e.g., the U.K.).
PctMktCap	Percentage of market capitalization covered by the sample firms in a particular country
Year	Dummy variable with value 1 if the annual report is from year 2000; 0 otherwise

Table A-2: Summary Statistics of Derivatives Use of Sample Firms

The table shows summary statistics of derivatives use by country and industry. In particular, it shows the number of firms, the percentage of firms using derivatives, the hedging intensity (i.e. number of different instruments), as well as derivatives usage by underlying risk and type of instrument. Panel A shows statistics by country, while Panel B shows statistics by industry. Other countries are Bahamas, Bermuda, Cayman Islands, Egypt, Indonesia, Peru, Portugal, Turkey, and Venezuela.

Panel A: Derivatives Usage by Country

			Hedging	Foreign Exchange Rate Derivatives				Interest Rate Derivatives				Commodity Price Derivatives			
	Firms	User	Intensity	General	Forward	Swap	Option	General	Forward	Swap	Option	General	Future	Swap	Option
Argentina	10	70.0	2.2	70.0	40.0	20.0	0.0	60.0	0.0	40.0	30.0	40.0	0.0	20.0	30.0
Australia	301	66.4	1.6	52.2	48.5	8.6	17.9	42.2	3.7	38.9	15.0	14.3	2.0	3.7	5.0
Austria	41	56.1	1.3	56.1	43.9	17.1	22.0	22.0	0.0	17.1	7.3	7.3	2.4	4.9	2.4
Belgium	60	50.0	0.8	36.7	26.7	8.3	6.7	23.3	0.0	21.7	3.3	3.3	0.0	1.7	0.0
Brazil	16	81.3	1.2	56.3	18.8	25.0	12.5	18.8	0.0	12.5	6.3	18.8	0.0	6.3	0.0
Canada	537	60.3	1.1	46.2	34.3	8.0	8.2	27.2	0.4	24.2	3.2	17.7	2.8	5.2	5.4
Chile	13	100.0	1.8	84.6	61.5	23.1	7.7	53.8	0.0	38.5	7.7	15.4	0.0	7.7	7.7
China	32	12.5	0.2	6.3	6.3	3.1	0.0	3.1	0.0	3.1	0.0	3.1	3.1	0.0	0.0
Czech Republic	23	26.1	0.4	13.0	13.0	4.3	4.3	17.4	0.0	13.0	0.0	0.0	0.0	0.0	0.0
Denmark	80	87.5	1.5	80.0	72.5	12.5	18.8	26.3	1.3	21.3	6.3	5.0	1.3	2.5	1.3
Finland	100	64.0	1.7	58.0	45.0	18.0	27.0	37.0	9.0	29.0	17.0	8.0	3.0	1.0	3.0
France	159	66.0	1.6	52.8	37.1	22.6	25.8	44.7	1.9	38.4	15.1	3.8	1.3	1.3	0.6
Germany	395	47.1	1.0	39.0	27.3	10.6	12.4	24.1	1.8	17.7	9.4	4.8	1.8	0.5	0.5
Greece	19	21.1	0.5	21.1	10.5	5.3	5.3	10.5	0.0	10.5	0.0	5.3	5.3	0.0	0.0
Hong Kong	319	23.2	0.3	18.5	13.8	4.4	1.3	7.2	0.3	5.6	1.3	0.3	0.0	0.0	0.0
Hungary	15	40.0	0.8	33.3	33.3	6.7	13.3	13.3	0.0	13.3	0.0	13.3	0.0	6.7	0.0
India	40	70.0	0.9	62.5	60.0	7.5	0.0	12.5	0.0	12.5	0.0	5.0	2.5	0.0	0.0
Ireland	47	85.1	1.9	70.2	61.7	27.7	8.5	53.2	4.3	46.8	8.5	14.9	2.1	6.4	4.3
Israel	48	72.9	1.1	68.8	43.8	2.1	22.9	12.5	0.0	10.4	4.2	2.1	2.1	0.0	0.0
Italy	93	61.3	1.0	38.7	29.0	16.1	3.2	33.3	3.2	23.7	3.2	2.2	1.1	2.2	0.0
Japan	366	81.1	2.1	75.4	71.0	33.1	17.8	60.4	0.5	59.3	14.2	9.6	3.8	1.6	1.6
Korea, Republic of	24	70.8	1.3	54.2	41.7	20.8	12.5	25.0	0.0	25.0	0.0	8.3	0.0	0.0	4.2
Luxembourg	11	63.6	1.3	45.5	45.5	9.1	18.2	27.3	0.0	18.2	9.1	9.1	9.1	0.0	0.0
Malaysia	289	20.1	0.2	16.3	12.5	1.4	0.7	4.2	0.0	3.8	1.0	1.0	0.7	0.0	0.0
Mexico	35	60.0	1.2	34.3	25.7	5.7	11.4	37.1	2.9	37.1	0.0	14.3	8.6	2.9	2.9
Netherlands	131	56.5	1.2	48.1	38.9	18.3	12.2	33.6	1.5	27.5	9.2	4.6	0.8	0.8	0.8
New Zealand	39	94.9	2.6	79.5	74.4	17.9	35.9	76.9	5.1	71.8	33.3	17.9	0.0	10.3	10.3
Norway	85	67.1	1.4	56.5	48.2	17.6	17.6	29.4	2.4	24.7	5.9	8.2	2.4	0.0	3.5
Other countries	27	55.6	0.9	40.7	29.6	18.5	3.7	14.8	0.0	14.8	0.0	7.4	0.0	3.7	7.4
Philippines	12	50.0	0.8	41.7	41.7	16.7	0.0	16.7	0.0	16.7	0.0	8.3	0.0	8.3	0.0

(continued)

Table A-2: Summary Statistics of Derivatives Use of Sample Firms (continued)

Panel A: Derivatives Usage by Country (continued)

			Hedging	Foreign Exchange Rate Derivatives				Interest Rate Derivatives				Commodity Price Derivatives			
	Firms	User	Intensity	General	Forward	Swap	Option	General	Forward	Swap	Option	General	Future	Swap	Option
Poland	11	45.5	1.1	36.4	18.2	18.2	27.3	18.2	9.1	9.1	9.1	9.1	0.0	0.0	0.0
Singapore	219	55.3	0.8	50.7	42.5	5.9	3.7	11.4	0.5	9.6	1.8	2.3	0.0	1.8	0.0
South Africa	55	89.1	1.7	89.1	87.3	9.1	14.5	38.2	0.0	32.7	5.5	14.5	5.5	0.0	1.8
Spain	29	62.1	1.5	37.9	27.6	10.3	10.3	37.9	3.4	34.5	13.8	20.7	6.9	6.9	6.9
Sweden	135	63.7	0.9	45.2	35.6	7.4	8.1	13.3	2.2	9.6	2.2	4.4	0.7	0.7	1.5
Switzerland	119	77.3	1.6	68.1	61.3	14.3	23.5	42.9	3.4	35.3	7.6	5.9	0.8	0.8	0.8
Thailand	25	72.0	1.2	68.0	56.0	36.0	0.0	24.0	4.0	20.0	0.0	0.0	0.0	0.0	0.0
United Kingdom	860	64.4	1.3	55.0	49.4	17.1	7.8	36.5	0.6	32.1	10.8	3.7	1.5	1.4	0.7
United States	2,076	65.1	1.2	37.8	30.9	6.4	7.5	40.4	0.7	36.0	6.8	16.1	6.0	5.2	3.3
US & Canada	2,613	64.1	1.2	39.5	31.6	6.7	7.6	37.7	0.6	33.6	6.1	16.5	5.4	5.2	3.8
Europe	2,421	61.5	1.3	51.1	42.3	15.3	12.5	32.3	1.8	26.9	9.2	5.0	1.6	1.4	1.0
Asia & Pacific	1,676	51.6	1.1	44.6	39.8	12.3	8.9	27.3	1.1	25.7	7.2	6.0	1.4	1.6	1.6
Africa/Middle East	104	81.7	1.4	79.8	66.3	6.7	18.3	26.0	0.0	22.1	4.8	8.7	3.8	0.0	1.0
Latin Amer./Carib.	82	72.0	1.4	50.0	31.7	14.6	8.5	37.8	1.2	31.7	6.1	19.5	3.7	7.3	8.5
OECD	5,799	64.4	1.3	47.5	39.7	12.2	11.1	37.3	1.3	32.9	8.5	11.1	3.5	3.3	2.6
Non-OECD	1,097	39.8	0.6	34.8	28.1	5.8	3.3	10.8	0.3	9.0	1.9	3.0	0.7	0.9	0.6
United States	2,076	65.1	1.2	37.8	30.9	6.4	7.5	40.4	0.7	36.0	6.8	16.1	6.0	5.2	3.3
Non-US	4,820	58.5	1.2	48.9	40.9	13.2	10.8	29.9	1.3	26.2	7.7	7.1	1.7	1.9	1.8
All firms	6,896	60.5	1.2	45.5	37.9	11.2	9.8	33.1	1.1	29.1	7.4	9.8	3.0	2.9	2.3

(continued)

Table A-2: Summary Statistics of Derivatives Use of Sample Firms (continued)
Panel B: Derivatives Usage by Industry

			Hedging	Foreign Exchange Rate Derivatives				Interest Rate Derivatives				Commodity Price Derivatives			
	Firms	User	Intensity	General	Forward	Swap	Option	General	Forward	Swap	Option	General	Future	Swap	Option
Agriculture	33	69.7	1.3	57.6	54.5	12.1	9.1	39.4	0.0	33.3	6.1	3.0	0.0	3.0	3.0
Aircraft	27	92.6	1.8	77.8	55.6	18.5	14.8	59.3	0.0	51.9	11.1	14.8	0.0	7.4	0.0
Apparel	64	70.3	1.1	56.3	45.3	6.3	10.9	31.3	0.0	26.6	6.3	3.1	1.6	1.6	1.6
Automobiles	136	77.9	1.6	69.9	59.6	20.6	16.2	40.4	1.5	40.4	8.1	6.6	2.2	0.7	0.0
Beer & Liquor	56	67.9	1.8	55.4	48.2	16.1	19.6	50.0	7.1	48.2	12.5	12.5	5.4	3.6	1.8
Books	97	57.7	1.1	43.3	39.2	8.2	10.3	35.1	2.1	30.9	15.5	0.0	0.0	0.0	0.0
Business Serv.	1,078	40.8	0.6	30.0	23.7	4.1	4.8	17.3	0.3	13.9	4.1	1.5	0.4	0.2	0.2
Business Suppl.	116	74.1	1.4	58.6	49.1	10.3	15.5	44.0	1.7	37.9	10.3	10.3	1.7	4.3	0.9
Candy & Soda	32	65.6	1.6	50.0	40.6	18.8	12.5	37.5	0.0	37.5	12.5	15.6	12.5	0.0	3.1
Chemicals	173	75.7	1.8	66.5	61.8	17.3	16.2	48.6	0.6	46.2	9.2	15.6	5.2	5.2	2.9
Coal	12	58.3	1.5	50.0	50.0	8.3	16.7	33.3	0.0	33.3	8.3	16.7	8.3	0.0	8.3
Computers	285	52.6	0.9	43.5	37.2	7.7	10.2	19.6	0.4	16.5	4.2	1.1	0.7	0.0	0.0
Constr. Material	207	66.2	1.4	55.1	46.4	17.4	10.1	41.5	0.5	35.7	11.1	10.6	3.4	2.9	2.4
Construction	187	50.3	0.8	30.5	21.4	12.8	4.3	31.0	1.6	25.7	6.4	1.1	0.5	0.0	0.0
Consumer Goods	133	66.9	1.4	57.1	50.4	14.3	14.3	40.6	1.5	38.3	7.5	8.3	3.8	2.3	0.8
Defense	6	100	1.3	50.0	50.0	0.0	0.0	50.0	0.0	50.0	0.0	16.7	0.0	0.0	0.0
Drugs	277	40.8	0.8	34.3	29.6	9.4	10.8	19.1	1.8	15.9	4.3	2.2	0.0	0.0	1.1
Electric Equip.	95	60.0	1.3	51.6	46.3	12.6	10.5	34.7	1.1	28.4	6.3	11.6	5.3	2.1	0.0
Electron. Equip.	364	61.8	1.0	54.4	46.4	7.1	10.7	22.0	0.8	19.5	5.2	2.5	0.0	0.0	0.5
Entertainment	120	51.7	0.7	30.8	21.7	5.0	4.2	33.3	0.0	28.3	3.3	0.0	0.0	0.0	0.0
Fabr. Products	21	76.2	1.4	57.1	47.6	14.3	4.8	42.9	0.0	38.1	9.5	0.0	0.0	0.0	0.0
Food Products	160	66.9	1.7	47.5	39.4	20.6	10.6	45.0	3.1	42.5	8.8	21.3	17.5	2.5	3.1
Healthcare	74	50.0	0.6	16.2	12.2	1.4	1.4	27.0	0.0	27.0	6.8	1.4	0.0	0.0	0.0
Lab Equipment	102	75.5	1.2	66.7	54.9	8.8	17.6	30.4	1.0	27.5	3.9	1.0	0.0	0.0	0.0
Machinery	267	76.0	1.4	67.0	60.3	10.5	15.0	36.0	1.5	31.1	7.9	4.1	0.7	1.1	0.0
Medical Equip.	115	60.9	1.1	55.7	47.0	10.4	16.5	23.5	0.9	21.7	5.2	1.7	0.0	0.9	0.0
Mines	79	58.2	1.2	46.8	40.5	7.6	12.7	21.5	0.0	20.3	3.8	27.8	3.8	3.8	8.9
Miscellaneous	45	64.4	1.3	37.8	24.4	8.9	11.1	48.9	0.0	40.0	13.3	20.0	4.4	6.7	4.4
Oil	245	71.4	1.8	38.4	31.0	10.6	8.2	39.6	1.2	35.1	5.3	50.6	15.1	26.5	12.2
Personal Serv.	48	50.0	0.8	29.2	18.8	4.2	4.2	29.2	0.0	27.1	8.3	2.1	0.0	0.0	0.0
Precious Metals	116	56.9	1.2	35.3	25.9	1.7	8.6	14.7	0.0	10.3	3.4	45.7	0.9	3.4	22.4
Recreation	68	58.8	1.1	57.4	51.5	11.8	14.7	23.5	1.5	16.2	5.9	2.9	0.0	0.0	0.0
Restaurants	139	57.6	0.8	23.7	19.4	7.9	3.6	46.0	0.0	38.8	8.6	2.2	0.0	0.0	0.0
Retail	379	62.0	1.1	41.4	33.5	9.8	7.4	37.7	1.1	32.7	7.7	2.9	0.5	0.5	0.3
Rubber	55	65.5	1.3	58.2	52.7	10.9	12.7	38.2	3.6	34.5	5.5	5.5	0.0	0.0	0.0
Shipping Cont.	33	66.7	1.6	45.5	36.4	21.2	6.1	48.5	0.0	36.4	12.1	24.2	12.1	6.1	3.0
Ships	13	61.5	1.4	61.5	46.2	23.1	0.0	46.2	0.0	46.2	7.7	0.0	0.0	0.0	0.0
Steel	160	73.8	1.8	60.6	52.5	16.3	11.9	43.8	1.9	38.8	8.8	31.3	11.3	3.8	3.8
Telecom	303	66.3	1.3	44.9	35.3	20.1	9.2	43.9	0.7	39.6	14.5	1.0	0.3	0.0	0.0
Textiles	43	60.5	1.0	51.2	37.2	11.6	9.3	27.9	0.0	20.9	4.7	7.0	4.7	0.0	0.0
Tobacco Products	16	87.5	2.2	81.3	68.8	37.5	25.0	62.5	0.0	50.0	6.3	12.5	6.3	0.0	6.3
Transportation	272	66.2	1.5	48.5	39.3	18.0	12.5	46.3	1.5	42.6	11.0	19.1	2.6	9.6	4.8
Utilities	220	83.2	2.3	42.7	33.6	25.9	10.5	61.4	3.6	57.3	13.6	44.5	17.3	18.6	15.9
Wholesale	425	63.1	1.3	52.2	44.0	11.1	11.3	33.2	2.4	28.7	9.4	7.5	3.8	1.4	1.4