The effects of fair value reporting on corporate foreign exchange exposures

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Abstract

We analyze the effects of fair value reporting standards (FVR) SFAS 133 and IAS 39 on foreign exchange (FX) exposures of U.S. multinational firms. We observe reductions in FX exposures to developed market currencies that coincide with the implementation of FVR. Risk reductions mainly affect U.S. multinational firms and to a much lesser extend matched control groups of domestic firms. For firms with exposures to emerging market currencies, we observe no changes in positive FX exposures but substantial shifts in negative exposures resulting in a change of exposure direction. Additionally we report changes in FX exposure asymmetry affecting multinational and domestic firms. Observed results are robust to several alternative model specifications and are unlikely explained by the launch of the euro, changes in firm-level FX exposure determinants, the rise and decline of technology shocks, shifts in systematic risk factors, and the Asian Financial Crisis.

JEL Classifications: F3, F39, G15

EFM Classifications: 610, 710, 630

Keywords: Fair value reporting, SFAS 133, IAS 39, Foreign exchange exposure, Asymmetric foreign exchange exposure

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1. Introduction and motivation

Fair value reporting (FVR) standards SFAS 133 and IAS 39 require firms to report financial derivatives at their fair market values.[1] Evidence suggests that the accounting treatment of financial derivatives can distort managers' decisions. Experiments demonstrate that individuals forgo sound hedging policies in the presence of FVR (Chen, Tan, Wang, 2013). Suboptimal hedging behavior is also reported by survey results (Glaum, Klöcker, 2011; Lins, Servaes, Tamayo, 2011) and anecdotal evidence (McKay, Niedzielsky, 2000; Osterland, 2000). Theoretical work by Sapra (2002) illustrates that FVR can even induce speculation, and Beisland, Frestad (2013) show that FVR induces firms to use suboptimal myopic hedging strategies.

However, arguments regarding SFAS 133 and IAS 39 are far from one-sided. Zhang (2009) claims that the introduction of SFAS 133 pushed ineffective hedger/speculator firms to use financial derivatives more prudently. Her study documents post-FVR decreases in risk exposures to interest rates, commodity prices, and FX rates for ineffective hedger/speculator firms, but not for effective hedgers. Decreases in FX exposures are also reported by Richie, Glegg, Gleason (2006).[2] Additional positive effects of FVR are described by Ahmed, Kilic, Lobo (2011), who find that SFAS 133 improves the relevance of accounting measures of derivative risk exposures for bond investors and lowered banks' costs of capital. Further, analytical work by

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[1] Both, SFAS 133 and IAS 39 require that: 1) all derivatives must the reported at fair value in financial statements, 2) changes in market value of derivatives not designated as hedging instruments, i.e. speculative positions and trading hedges, must be recognized in net income, 3) changes in the market values of derivatives that qualify as designated hedges are recorded in net income or as other comprehensive income (an equity account), 4) changes in the market values of hedged items must also be recognized in net income, and 5) the ineffective portion of designated hedges, i.e. changes in market value of designated hedges must be included in net income.

[2] An empirical study by Singh (2004) finds no significant decline in the use of derivatives and no significant differences in earnings volatility, cash flow volatility, and income after the implementation of SFAS 133.

Melumad, Weyns, Ziv (1999) demonstrates that the presence FVR leads to a better outcome for long-term and future shareholders.

Shifts in corporate risk management resulting from the introduction of FVR could affect the foreign exchange (FX) exposure of U.S. multinational corporations (MNCs) (Glaum, Klöcker, 2011; Lins et al., 2011). However, fair value reporting, potential distortions in currency risk management and the role of foreign currency derivatives are pieces of a larger puzzle. FX exposures of MNCs are complex and can be managed with a combination of tools (Bartram, Brown, Minton, 2010): Firms employ currency derivatives to hedge FX exposures (Bodnar, Hayt, Marston, 1998), foreign currency denominated debt (Aabo, 2006; Keloharju, Niskanen, 2001), operational hedging (Pantzalis, Simkins, Laux, 2001), and FX pass-through (Bodnar, Dumas, Marston, 2002). Whether FVR has significantly altered the FX exposure of MNCs depends on the relative importance and success of derivative-based hedging, as well as the use and effectiveness of non-derivative-based risk management.

The papers closest to ours are Richie et al. (2006) and Zhang (2009). Compared to the two studies, we do not attempt to explicitly capture the firms' use of currency derivatives, rather we attempt to study changes in FX exposures for a much broader cross section of U.S. MNCs. We choose this path because of two reasons. First, the limited availability of firm-level derivatives usage data reduces samples to relatively small subsets of MNCs.[3] Second, shifts in corporate FX exposures can also be affected by the use of largely unobservable non-financial hedging strategies and shifts in managerial risk-taking, both of which could also have been affected by the introduction of FVR.

[3] For example, Richie et al. (2006) study 422 U.S. MNCs that primarily operate in Europe — to overcome potentially offsetting FX exposures to multiple currencies, their analysis focuses on the euro. Similarly, Zhang (2009) studies the changes in economic exposures of 225 firms that started new derivatives programs between 1996 to 1999.

Finally, it is also important to recognize that confounding events could also have affected FX exposures around the same time that FVR was introduced. Although it is impossible to control for all confounding events, we explicitly address the launch of the euro, changes in firm-level FX exposure determinants, the rise and decline of technology shocks, shifts in systematic risk factors, and the Asian Financial Crisis. In addition to robustness tests, our core research design employs a matched portfolios approach of MNCs and control groups of domestic corporations (DCs). We believe this further improves the ability of our study to distinguish between FVR-related exposure changes on MNCs and confounding effects that affect all U.S. firms.

This paper expand existing literature in several important ways: 1) we investigate a broad cross section of U.S. MNCs and DCs allowing us to distinguish between small-, medium-, and large-sized firms; 2) in addition to FX exposure, we analyze the effects of FVR on FX exposure asymmetry; 3) we analyze FVR effects across different major industry groups; 4) we distinguish between FX exposures to emerging market and developed market currencies; and 5) we control for confounding effects by matching MNCs with samples of DCs. Further we explore the effects of the Asian Financial Crisis, the introduction of the euro, the rise and fall of technology stocks, shifts in systematic risk factors, and the turbulent market events during 2000 and 2001 on our results.

We find that the introduction of FVR coincides with a reduction in FX exposures to developed market currencies for subsamples of small-, medium-, and large MNCs. No reductions in FX exposures to developed market currencies are observed in matched control groups of DCs. We find no changes in currency risk of firms with positive exposures to emerging market currencies. However, we observe substantial changes in currency exposures for firms with negative FX exposures to emerging market currencies — for these MNCs FX exposures shift from being negative in the pre-FVA period to being positive in the post-FVA period. Additional test reveal changes in FX exposure asymmetry affecting samples of MNCs and DCs alike.

This study proceeds as follows. Section 2 presents related theory on FVR and its potential effect on corporate FX exposures. In section 2 we also develop the research hypotheses. Section 3 describes the sample selection process and the methodologies used to estimate FX exposures and measures of changes in FX exposures to developed and emerging market currencies. In Section 4 we present and discuss the empirical results. Section 5 concludes this paper.

2. Hypotheses development and related literature

The introduction of FVR could have impacted corporate FX exposures of U.S. MNCs in several ways. One possibility is that the introduction of FVR has increased corporate FX exposures as a result of reduced currency risk management. Survey results presented by Bodnar et al. (1998) document that 27% of U.S. sample firms altered their use of foreign currency derivatives during the early implementation stage of SFAS 133.[4] More recently, in a survey of corporate CFOs from 36 countries, Lins et al. (2011) find that 42% of companies that hedge FX exposures have substantially decreased their hedging with foreign currency derivatives. Similar behavior is reported by Glaum, Klöcker (2011) for a sample of Swiss and German firms.

Naturally, increases in FX exposures due to FVR depend on whether financial derivatives play a central role in currency risk management. Several papers highlight the importance of derivatives in currency risk management. Allayannis, Ihrig, Weston (2001) argue that operational

[4] According to Bodnar et al. (1998) the most common reported changes to the use of foreign currency derivatives were: 1) a change in types of foreign currency derivatives used, 2) a reduction in the use of derivatives, and 3) a change in the timing of hedging transactions.

hedging does not reduce FX exposure without the use of financial hedging. Allayannis, Ofek (2001) observe that S&P 500 non-financial firms use currency derivatives to reduce FX exposures and that the level of derivatives used is driven by corporate exposure to foreign sales and trade. Similarly Guay (1999) argues that corporate use of financial derivatives is primarily consistent with hedging behavior; he observes that FX exposures decline by 11% in the period following the initiation of a derivatives program. Additional support is provided by Géczy, Minton, Schrand (1997) who show that firms use derivatives to reduce cash flow volatility. More recently, Bartram, Brown, Conrad (2011), controlling for the endogeneity of derivatives usage, confirm that financial derivatives reduce total risk and systematic risk of firms.

It is also possible that the introduction of FVR could have reduced FX exposures of MNCs due to lower levels of currency speculation or the increased use of non-derivatives based FX risk management strategies. Analyzing results of a confidential survey, Géczy, Minton, Schrand (2007) find that once firms have incurred the fixed costs of a derivatives operation to hedge risks, some firms extend their derivatives trading to speculate.[5] Findings reported by Lins et al. (2011) indicate that in some cases financial managers decreased speculative behavior in their use of derivatives after the introduction of FVR.[6] Empirical results presented by Zhang (2009) and Richie et al. (2006) seem to support this argument. Zhang (2009) finds evidence that cash flow volatility and economic exposures to FX rates decreased for ineffective hedger/speculator firms but not for effective hedger firms after the introduction of FVR. Richie

[5] Géczy et al. (2007) find that currency speculators: 1) believe that they have a comparative information advantage relative to the market; 2) have a greater percentage of their operating revenues and costs denominated in foreign currencies compared to non-speculators; and 3) have significantly more tangible operations located in foreign countries compared to non-speculators.

[6] For interest rate derivatives, Chernenko, Faulkender (2012) find evidence of speculation with interest rate swaps. Similarly, Faulkender (2005) argues that interest rate risk management practices are primarily driven by speculation or myopia and not hedging considerations.

et al. (2006) find that firms that hedged their FX exposures before the implementation of SFAS 133 lowered their currency exposures after the implementation by increasing their use of operational hedging strategies.

A third possibility is that the introduction of FVR had no significant effects on corporate FX exposures. Empirical evidence on FX risk reduction resulting from the use of foreign currency derivatives is mixed. Studying a sample of U.S. non-financial firms, Guay, Kothari (2003) argue that financial hedging plays a small role in corporate risk management; the authors base their conclusion on empirical findings illustrating that derivatives generate small amounts of cash and value given the size of the firms. Further, the implementation of FVR was unlikely a surprise to financial managers. Firms with FX risk management programs heavily reliant on foreign currency derivatives could have implemented alternative FX hedging strategies well before the implementation of FVR. If this were the case, changes in the use of foreign currency derivatives could have had no effects on corporate FX exposures.

Reflecting on the arguments and results presented in prior literature, we remain agnostic about the expected effects of FVR on FX exposures of U.S. MNCs. This leads to our first research hypothesis.

H1: Non-financial MNCs exhibit larger increases or decreases in FX exposures after the introduction of FVR than DCs

The use of financial derivatives is particularly punitive for firms that fail to qualify for hedge accounting. To achieve hedge accounting status, firms must demonstrate that their derivatives are used to offset an existing economic exposure. Firms must demonstrate that their hedging positions are highly effective — the value of the hedging instrument and the economic exposure must be highly negatively correlated. Demonstrating this becomes very difficult if the underlying currency exposure is non-linear, which is the case when FX exposures are asymmetric to the direction or magnitude of FX shocks (Brown, Toft, 2002).[7] It is possible that managers decreased their use of asymmetric hedges after the implementation of FVR, since it would prevent them from qualifying for hedge accounting status. Such a shift would mainly affect the use of FX options and more exotic FX derivatives. Survey results reported by Lins et al. (2011) support this idea; their study observes a significant reduction in the use of non-linear FX hedging instruments after the introduction of FVR.

However, a reduction in the use of FX options does not necessarily need to result in increasingly asymmetric FX exposures. There are non-derivatives related factors that determine FX exposure asymmetry, such as investor reaction to FX related news, the firm's use of FX pass-through and pricing-to-market strategies, hysteresis in investment/divestment decisions of MNCs, and the presence of real options in the multinational financial environment. Whether the introduction of FVR has significantly changed FX exposure asymmetry remains an empirical question. This leads to our second hypothesis.

H2: The introduction of FVR has primarily affected the asymmetry in FX exposures of non-financial MNCs compared to the exposure asymmetries of non-financial DCs

[7] Several papers find that FX exposure is non-linear to the direction of FX rate changes and the magnitude of FX shocks. See for example Koutmos, Martin (2003), Muller, Verschoor (2006), and Bartram (2004), among others.

3. Sample and methodology

3.1. Estimating FX exposures

Dumas (1978), Hodder (1982), and Adler, Dumas (1984) define FX exposure as the sensitivity of firm value to unexpected changes in FX rates. Our first FX exposure measure is based on a model popularized by Adler, Dumas (1984) and can be estimated with the following regression:

$$R_{i,t} = \alpha_i + \delta_{1,i}^{D} R_{X,t}^{D} + \delta_{1,i}^{E} R_{X,t}^{E} + \varepsilon_{i,t} \quad (1)$$

where R_i are holding period stock returns, $R_{X,t}^{D}$ and $R_{X,t}^{E}$ are returns of two foreign currency baskets in month t. A popular choice among studies (Carrieri, Errunza, Majerbi, 2006; Chaieb, Mazzotta, 2013) is to include currency indices that capture both, changes in developed market and emerging market currencies. We use inflation-adjusted[8] monthly returns of the Major Currency Index (MCI) and the Other Important Trading Partner Index (OITP).[9] Thus, $\delta_{1,i}^{D}$ and $\delta_{1,i}^{E}$ measure the sensitivity of firm i's stock returns to changes in developed market and emerging market currencies. Using a large cross section of firms without information on which specific currencies each firm is exposed to, we rely on the two trade-weighted currency baskets as parsimonious representations of bilateral exchange rates — this is consistent with prior literature (e.g., Jorion, 1990; Wei, Starks, 2013).

[8] Researchers that includes returns of emerging country currencies prefer using inflation-adjusted currency indices (Carrieri et al., 2006; Chaieb, Mazzotta, 2013). However, in untabulated tests, we observe that using nominal currency indices yields qualitatively similar results.

[9] We follow convention used in international asset pricing literature and express R_X^D and R_X^E as percentage changes in the value of the foreign currency baskets. Thus a positive (negative) δ estimate indicates stock returns increase (decreases) with the value of the foreign currencies contained in the basket.

Several studies (Koutmos, Martin, 2003, 2007; Muller, Verschoor, 2006; Tai, 2008) argue that the assumption of $\varepsilon_{i,t}$ in Eq. (1) being i.i.d. is unlikely to hold due to the presence of conditional heteroscedasticity. Failing to account for this can lead to inefficient OLS parameter estimates and biased test statistics which in turn can affect the model's ability to detect FX exposure. To address this possibility we follow Muller, Verschoor (2006) and perform Engle (1982)'s Lagrange multiplier tests for ARCH effects. For firms where conditional volatility cannot be rejected, we model the error term in Eq. (1) as a GARCH (1,1) process: $\varepsilon_{i,t} = \mu_{i,t}\sqrt{\sigma_{i,t}^2}$ where $\sigma_{i,t}^2 = \alpha_{0,i} + \alpha_{1,i}\varepsilon_{i,t-1}^2 + \alpha_{2,i}\sigma_{i,t-1}^2$. Here α_0, α_1, and α_2 are unknown volatility parameters, $\mu_{i,t}$ is the white noise term, and $\sigma_{i,t}^2$ is the conditional variance of $\varepsilon_{i,t}$. Estimating the volatility parameters requires recursive maximization of the log-likelihood function over the sample period. Since the log-likelihood function is highly non-linear, we use the Berndt, Hall, Hall (1974) algorithm.

Our second FX exposure measure is based on a popular method introduced by Jorion (1990). Controlling for aggregate stock market returns, market-adjusted FX exposure estimates have econometric advantages over the total FX exposure estimates obtained by the model expressed in Eq. (1) (Bodnar, Wong, 2003; Jorion, 1990). Market-adjusted exposure estimates are also theoretically superior since they control for confounding factors that correlate with FX rates and affect stock returns, such as interest rate changes and macroeconomic shocks. We estimate our market-adjusted FX exposure measures based on the following model:

$$R_{i,t} = \alpha_i + \beta_{1,i}R_M + \delta_{2,i}^D R_{X,t}^D + \delta_{2,i}^E R_{X,t}^E + \varepsilon_{i,t} \tag{2}$$

where R_M are the returns of the value-weighted U.S. market index as reported by CRSP, arguably the most popular choice for the market-adjusted model. In Eq. (2), $\delta_{2,i}^{D}$ and $\delta_{2,i}^{E}$ are the market-adjusted FX exposures of firm i's stock returns. Rather than measuring the FX exposure of the firm, $\delta_{2,i}^{D}$ and $\delta_{2,i}^{E}$ are the stock's FX exposures net of the FX exposures of the market control variable; thus these measures are often referred to as partial FX exposures. The drawbacks of the market-adjusted FX exposure measures is that it can fail to detect significant FX exposure and is a relatively poor estimator of the firm's cash flow sensitivity to FX rate changes (Bodnar, Wong, 2003; Krapl, O'Brien, 2015) .

To address the drawbacks of our first two FX exposure measures, we use an alternative approach. Prior studies suggest the use of interest rate-based control variables in addition to or instead of equity market returns (e.g., Bartram, 2008; Krapl, O'Brien, 2015). We estimate the following model:

$$R_{i,t} = \alpha_i + \phi_{1,i} R_{ST,t} + \phi_{2,i} R_{DS,t} + \delta_{3,i}^{D} R_{X,t}^{D} + \delta_{3,i}^{E} R_{X,t}^{E} + \varepsilon_{i,t} \tag{3}$$

Bartram (2008) suggest the use of two interest rate-based macroeconomic control variables. R_{ST} and R_{DS} are short-term interest rate and term-spread variables which are defined as: $R_{ST} = \Delta SR/(1 + LR)$ and $R_{DS} = \Delta\,(LR - SR)/(1 + LR)$ where Δ denotes a one-month change, SR is the short-rate (1-Year U.S. Treasury yield), and LR is the long-rate (10-Year U.S. Treasury yield).[10] The motivation behind using this model is to obtain total FX exposure measures, like from the model expressed in Eq. (1) while controlling for confounding macroeconomic factors

[10] In untabulated results we use U.S. Treasury bond return control variables of different maturities as suggested by Krapl, O'Brien (2015) but find very little change in results.

that correlate with FX rate changes. In theory the macro-controlled FX exposures $\delta_{3,i}^{D}$ and $\delta_{3,i}^{E}$ should more closely reflect the firms' cash flow sensitivity to changes in FX rates than $\delta_{2,i}^{D}$ and $\delta_{2,i}^{E}$.

3.2. Analyzing the time-variation in FX exposures

The Statement of Financial Accounting Standards "Accounting for Derivative Instruments and Hedging Activities" (SFAS 133) was passed in June 1998 with an implementation date of June 15th 2000; the International Accounting Standard "Financial Instruments: Recognition and Measurement" (IAS 39) was issued in December 1998 and had an implementation date of January 1 2001 with a further major revisions in 2003 (Effective date January 1, 2005). To measure the differences in FX exposures between the first and second sub-periods, we expand the models presented in Eqs. (1) through (3) with several interaction terms. We estimate the following models to test the significance of time-variation in FX exposures:

$$R_{i,t} = \alpha_i + \left(\delta_{1,i}^{D} + \delta_{I1,i}^{D} D_t\right) R_{X,t}^{D} + \left(\delta_{1,i}^{E} + \delta_{I1,i}^{E} D_t\right) R_{X,t}^{E} + \varepsilon_{i,t} \tag{4}$$

$$R_{i,t} = \alpha_i + \left(\beta_{1,i} + \beta_{I1,i} D_t\right) R_M + \left(\delta_{2,i}^{D} + \delta_{I2,i}^{D} D_t\right) R_{X,t}^{D} + \left(\delta_{2,i}^{E} + \delta_{I2,i}^{E} D_t\right) R_{X,t}^{E} + \varepsilon_{i,t} \tag{5}$$

$$\begin{aligned} R_{i,t} = \alpha_i &+ \left(\phi_{1,i} + \phi_{I1,i} D_t\right) R_{ST,t} + \left(\phi_{2,i} + \phi_{I2,i} D_t\right) R_{DS,t} + \left(\delta_{3,i}^{D} + \delta_{I3,i}^{D} D_t\right) R_{X,t}^{D} \\ &+ \left(\delta_{3,i}^{E} + \delta_{I3,i}^{E} D_t\right) R_{X,t}^{E} + \varepsilon_{i,t} \end{aligned} \tag{6}$$

where D_t is a dummy variable taking on the value of 1 for all monthly observations from January 2001 to December 2005 and zero for all observations from January 1996 to December 2000. Recasting the models in Eqs. (1) through (3) in this way allows to directly test the statistical significance of changes in FX exposure measures which are given by the estimates of $\delta_{I,i}^{D}$ and $\delta_{I,i}^{E}$. The estimates of δ_{i}^{D} and δ_{i}^{E} can be interpreted as the FX exposures during the first sub-periods (before the effective date of FVR standards). The post-FVR FX exposures are given by $\delta_{i}^{D} + \delta_{I,i}^{D}$ for developed market currency exposures and $\delta_{i}^{E} + \delta_{I,i}^{E}$ for exposures to emerging market currencies.

Following Bartov, Bodnar, Kaul (1996) and Bartram, Karolyi (2006) we test the significance of FX exposures and changes in FX exposures with two tests. 1) Based on the cross-sectional distributions of firm-level FX exposure estimates, we evaluate median estimates and their significance by using two-sided sign tests, and 2) Using the individual t-statistics of FX exposure estimates, we compute the following Z-statistic for the null hypothesis that all exposure estimates are equal to zero:

$$Z = \left(\frac{1}{\sqrt{N}}\right)\sum_{i=1}^{N}\frac{t_i}{\sqrt{k_i/(k_i-2)}} \tag{7}$$

where t_i is the t-statistic for the exposure estimates of firm i; k_i are the degrees of freedom for estimating the exposure estimate for firm i; and N are the number of firms in the sample. As Bartov et al. (1996) state, assuming that FX exposure estimates are independent across firms, the sum of the firm-level standardized t-statistics is normally distributed with a variance of N. Further, we test for differences in exposure estimates between the MNC and DC sub-samples by using two-sided Wilcoxon rank sum tests.

3.3. Asymmetry of FX exposure

To test for asymmetry in FX exposures to the direction of FX shocks, we adopt the approach introduced by Koutmos, Martin (2003) and Muller, Verschoor (2006) and decompose currency returns into negative and positive return vectors: $R_{X,t}^{D-} = Max\left(R_{X,t}^{D}, 0\right)$ and $R_{X,t}^{D+} = Min\left(0, R_{X,t}^{D}\right)$. Correspondingly, $R_{X,t}^{E-} = Max\left(R_{X,t}^{E}, 0\right)$ and $R_{X,t}^{E+} = Min\left(0, R_{X,t}^{E}\right)$. To assess the asymmetry of total FX exposures, the model expressed in Eq.(1) is recast to:

$$R_{i,t} = \alpha_i + \delta_{1,i}^{D-} R_{X,t}^{D-} + \delta_{1,i}^{D+} R_{X,t}^{D+} + \delta_{1,i}^{E-} R_{X,t}^{E-} + \delta_{1,i}^{E+} R_{X,t}^{E+} + \varepsilon_{i,t} \tag{8}$$

Given this specification, $\delta_{1,i}^{D-}$ measures the sensitivity of stock returns to depreciations in developed country currencies against the USD. Conversely, $\delta_{1,i}^{D+}$ measures stock return sensitivity to appreciations of developed country currencies. Analogously, $\delta_{1,i}^{E-}$ and $\delta_{1,i}^{E+}$ estimate total FX exposures to depreciations and appreciations of emerging market currencies.

To assess statistical significance and magnitude of FX exposure asymmetry more directly Koutmos, Martin (2003) and Muller, Verschoor (2006) suggest the following model:

$$R_{i,t} = \alpha_i + \left(\delta_{1,i}^{D*} + \delta_{I1,i}^{D*} D_t^{D*}\right) R_{X,t}^{D} + \left(\delta_{1,i}^{E*} + \delta_{I1,i}^{E*} D_t^{E*}\right) R_{X,t}^{E} + \varepsilon_{i,t} \tag{9}$$

where, D_t^{D*} takes on the value of 1 if $R_{X,t}^{D} < 0$, otherwise D_t^{D*} takes on the value of 0. D_t^{E*} is designed in the same fashion and captures the sign of $R_{X,t}^{E}$. The use of the asterisk in the superscript is to distinguish the dummy variables and estimated model coefficients from our main model shown in Eq. (1). Note that the dummy variable here is designed to identify the direction of FX rate shock. Magnitudes and statistical significance of FX exposure asymmetry is provided by the estimated coefficients of $\delta_{I1,i}^{D*}$ and $\delta_{I1,i}^{E*}$ and their respective standard errors since $\delta_{I1,i}^{D*} = \delta_i^{D+} - \delta_i^{D-}$ and $\delta_{I1,i}^{E*} = \delta_i^{E+} - \delta_i^{E-}$. Analogous modifications are performed for the models expressed in Eqs. (2) and (3) to estimate FX exposure asymmetry of the market-adjusted and interest rate-controlled FX exposures:

$$R_{i,t} = \alpha_i + \beta_{1,i} R_M + \left(\delta_{2,i}^{D*} + \delta_{I2,i}^{D*} D_t^{D*}\right) R_{X,t}^D + \left(\delta_{2,i}^{E*} + \delta_{I2,i}^{E*} D_t^{E*}\right) R_{X,t}^E + \varepsilon_{i,t} \qquad (10)$$

$$R_{i,t} = \alpha_i + \phi_{1,i} R_{ST,t} + \phi_{2,i} R_{DS,t} + \left(\delta_{3,i}^{D*} + \delta_{I3,i}^{D*} D_t^{D*}\right) R_{X,t}^D + \left(\delta_{3,i}^{E*} + \delta_{I3,i}^{E*} D_t^{E*}\right) R_{X,t}^E + \varepsilon_{i,t} \qquad (11)$$

To test for changes in FX exposure asymmetry, we estimate the models for the first sub-period (pre-FVR) using data from January 1996 to December 2000 and the second sub-period (post-FVR) using data from January 2001 to December 2005 separately. We then use two-sided Wilcoxon rank sum tests to assess the differences in FX asymmetry estimates, as well as whether FX asymmetry is different between MNCs and DCs.

3.4. Changes in stock return volatilities, CAPM betas, and Fama and French factors

To strengthen our findings we explore alternative explanations for changes in FX exposures. As part of this analysis, we estimate and test changes in monthly stock return variances and variance ratios. We also analyze changes in non-FX related systematic risk factors. To do this we estimate the following modified CAPM and Fama and French three-factor models:

$$R_{i,t} = \alpha_i + \left(\beta_{2,i} + \beta_{I2,i} D_t\right) R_M + \varepsilon_{i,t} \qquad (12)$$

$$R_{i,t} = \alpha_i + \left(\beta_{3,i} + \beta_{I3,i} D_t\right) R_M + \left(\beta_{4,i} + \beta_{I4,i} D_t\right) SMB + \left(\beta_{5,i} + \beta_{I5,i} D_t\right) HML + \varepsilon_{i,t} \qquad (13)$$

where $R_{i,t}$ are monthly stock returns of firm i, R_M are the monthly log returns of the U. S. value-weighted market index, SMB and HML are the returns of the size (Small minus Big), and value (High minus Low) factors (Fama, French, 1992, 1993), and D_t is a dummy variable that takes on the value of 1 for monthly observations from January 2001 to December 2005 and zero for observations from January 1996 to December 2000.

As a measure of stock return volatility we compute variance of monthly stock returns and variance ratios, which are defined as the ratio of post-FVR return variances to pre-FVR return variances. To test the statistical significance of changes in stock return volatilities, we follow Bartov et al. (1996) and Bartram, Karolyi (2006) and compute the following aggregate measures of firm-specific tests:

$$\chi^2(2N) = -2\sum_{i=1}^{N} ln(p_i) \tag{13}$$

where the p-values p_i obtained from individual F-tests of a change in the monthly stock return variance of firm i. N is the number of firms in the sample. This is an asymptotically distributed χ^2 statistic with $2N$ degrees of freedom (Bartov et al., 1996; Bartram, Karolyi, 2006), assuming independent sample observations.

3.5. Sample description and summary statistics

We use sample data of all U.S. domestic (DC) and multinational companies (MNC) contained in the CRSP/Compustat intersection between January 1996 and December 2005. We follow the approach used by Bartov et al. (1996) and Bartram, Karolyi (2006) and focus on two sub-periods: five years prior to and five years after the implementation of FVR. Our main analysis uses January 2001 as the adoption date of FVR, thus the first sub-period spans January 1996 to December 2000 and the second sub-period goes from January 2001 to December 2005.

Monthly stock return data is obtained from CRSP. Due to their unique FX exposure characteristics we exclude firms from finance, insurance, and real estate (SIC 60-67) and public service (SIC 91-99) industries from this study. We also exclude firms that have less than 36 consecutive monthly stock return observations and the bottom and top 1% of extremely small and large firms (based on average market capitalization). Our research design requires firms to be identified as either domestic corporations (DC) or multinational corporations (MNC). For this sorting we rely on annual accounting data from the Compustat geographical database. After excluding firms with obvious data errors, the sample spans 5,705 firms with a total of 499,121 monthly return observations.

To separate firms into sub-samples of MNCs and matched DC control groups, we define a firm as multinational[11] if it reports either: 1) a positive foreign sales ratio, or 2) a positive foreign asset ratio, during at least one year in the sample period. Foreign sales and foreign asset ratios are computed by dividing foreign sales and foreign assets by total sales and total assets. For the matching procedure we follow Villalonga (2004) and Choi, Jiang (2009) and use the propensity score method. Based on the definition stated above, our unmatched sample contains 3,430 multinational firms (313,863 monthly return observations) and 2,275 domestic firms (185,258 monthly return observations). Compared to prior studies (Bartov et al., 1996; Bartram, Karolyi, 2006; Choi, Jiang, 2009), we use a relatively low threshold to classify firms as multinational, which results in a large number of firms being identified as MNCs.[12] We take

[11] Aggarwal et al. (2011) point out that there is no consensus on how literature measures corporate multinationality. Studies use a wide range of internationalization proxies; widely used variables include foreign sales and foreign asset ratios. Often information on the geographic footprint of the firm is included. Alternatively studies also use published directories to classify firms as multinational (e.g., Muller, Verschoor, 2006).

[12] We adopt this relatively low threshold for corporate multinationality to capture relatively small firms that despite low levels of foreign sales and foreign assets are substantially exposed to changes in FX rates. Several studies show that firm size is negatively correlated with FX exposure (e.g., Bodnar, Wong, 2003; Dominguez, Tesar, 2006).

advantage of this broad sample of MNCs and separate them into groups of small-, medium-, and large-sized firms. To avoid losing many of the MNC observations during the matching procedure, we match each sub-sample of MNCs with firms from the same pool of DCs. Although this results in control groups that are to an extent overlapping, we opt for the gain in using a larger sample of firms.[13]

We match MNCs within industries with one domestic firm whose propensity score is closest. To assure a sufficient number of firms within each industry category, we organize firms based by their major SIC groups: SIC 01-17 forestry and fishing, mining and construction; SIC 20-39 manufacturing; SIC 40-49 transportation, communication, electric, gas, and sanitary services; SIC 50-59 wholesale and retail trade; SIC 70-89 services. We consider a match as successful if the propensity score of the DC is within ±25% of the corresponding propensity score of the MNC. To construct the propensity scores, we use logit models capturing the following firm characteristics: 1) Risk: measured by the standard deviation of returns on asset (ROA), 2) Profitability: measured by average ROA, and 3) Size: measured as the natural log of average annual sales. Averages and variances of the firm characteristics are computed over the whole sample period.

Table 1 presents summary statistics of the unmatched data set (Panel A) and the matched sub-samples (Panel B). In the unmatched sample we observe that overall MNCs are significantly larger than DCs. Whereas the average MNC has a market capitalization of 1.86 billion dollars, the average DC has a market capitalization of 459 million dollars. Similarly, the average MNC has 2.19 billion dollars of assets compared to 653 million of assets of an average DC.

[13] Earlier versions of this paper used alternative matching procedures based on size-matched and industry-matched control portfolios (Bartov et al., 1996; Bartram, Karolyi, 2006). We find no material difference in results when non-overlapping control groups are used. These results are available from the authors upon request.

The matching procedure is successful for 724 large firms, 1,110 medium-sized firms, and 949 small firms, leaving between 63,427 and 100,294 monthly return observations for the sub-samples. Not surprisingly large MNCs have higher foreign asset ratios (8.7%) than medium-sized MNCs (7.2%) and small MNCs (4.8%). Although large MNCs also have higher foreign sales ratios than medium and small MNCs, it is important to notice that average foreign sales ratios for small MNCs are relatively high at 24.3% compared to 32.1% for large MNCs. Also, after the matching within each industry group, MNC and DC groups are more closely comparable in size, particularly for the sub-samples of medium-sized firms. For the sub-samples of large firms and small firms the size matching is not as precise, although it is important to keep in mind that DCs and MNCs are also matched based on their profitability and risk.

[Insert Table 1 approximately here]

In Table 2 we report summary statistics of stock returns, currency returns, and control variables. Mean, median and standard deviations of stock, market, and currency returns are reported in percent. Table 2 also reports measures of skewness (S) and kurtosis (K), as well as p-values of Jarque-Bera tests[14]. In addition to stock returns, Panel B reports the summary statistics of monthly returns of the U.S. value-weighted market index (R_M), the developed (R_X^D) and emerging (R_X^E) market currency indices, as well as the short-term (R_{ST}) and term-spread (R_{DS}) interest rate control variables. Correlation coefficients for the market, currency and interest rate control variables are presented in the bottom part of Panel B showing Spearman rank correlations in the bottom triangle (shaded) and Pearson correlation coefficients in the upper triangle.

[14] The Jarque-Bera test statistic is for the null hypothesis that the dependent variable is normally distributed.

Average monthly stock returns for large firms are on average positive (0.604% for MNCs and 0.073% for DCs) in our sample but decrease with firm size and become negative for medium- and small-sized firms. On average the worst performing sub-group are small MNCs with average monthly returns of -1.216% (-0.931% median returns). All stock returns are negatively skewed, with the highest amount of negative skew being for large DCs. The returns of large DCs also are the most leptokurtic indicating higher probabilities of large positive and negative return surprises.

Average real returns are -0.092% for the developed country currency index and -0.097% for the emerging country currency index. Perhaps not surprisingly, emerging market currency returns are negatively skewed (-1.330), indicating that large negative shocks are more frequent than large positive shocks. Emerging market currency returns are also more leptokurtic than developed market currency returns, indicating a higher probability of high-magnitude shocks; the kurtosis of R_X^D is 0.281, whereas the kurtosis of R_X^D is 5.187. Additionally, returns of the developed and emerging market currency indices are positively correlated, illustrating that there are periods during which the USD appreciates/depreciates against both developed market and emerging market currencies. Excess kurtosis is substantial for stock returns and emerging market currency returns. This is further confirmed by Jarque-Bera tests; all variables are non-normally distributed.

[Insert Table 2 approximately here]

4. Empirical results and discussion

4.1. A preliminary benchmark estimation for the whole sample period

Before analyzing the changes in FX exposures, we estimate and analyze FX exposures using data for the whole sample period (January 1996 to December 2005). Table 3 reports statistics of estimated total FX exposures, market-adjusted FX exposures, and FX exposures using interest rate-based macroeconomic control variables. For sake of brevity we do not report the estimated coefficients of the control variables ($\beta_{1,i}$, $\phi_{1,i}$, and $\phi_{2,i}$) nor do we report the estimated conditional volatility parameters. All of these results are available from the authors upon request. Our analysis focuses on median values and sign tests for median values and removes firms with the most extreme FX exposures (bottom and top 1%) to reduce the effects of outliers (Panel B). We adopt this approach throughout the rest of this paper — this procedure is similar to the Bartram, Karolyi (2006) study that also estimates firm-level FX exposures for a large cross-section of firms.

Since FX exposures can be negative as well as positive, we present results for firms with negative exposure separately from firms with positive exposures. We also provide the percentage of firms with statistically significant FX exposure estimates at the 95% confidence level (Panel A).

Many firms, domestic and multinational, are significantly exposed to FX rate changes during our sample period. Between 19.62% and 31.08% of firms have significant total FX exposures to at least one of the two currency indices. Similarly, between 20.25% and 28.73% of firms have significant macro-controlled FX exposures. Not surprisingly the number of firms with partial FX exposures is lower. Market-adjusted FX exposures are partial exposures; based on the model specification shown in Eq. (2), $\delta_{2,i}^{D}$ and $\delta_{2,i}^{E}$ measure the FX exposures of firm i net of the

FX exposures of the U.S. value-weighted market index. Based on the estimates of $\delta_{1,i}^{D}$ and $\delta_{1,i}^{E}$ it is highly likely that the U.S. market index itself is significantly exposed to changes in FX rates.

Panel A also illustrates the value of separating FX exposures to developed market currencies from exposures to emerging market currencies. Results reveal that firms are more frequently exposed to changes in emerging market currencies than developed market currencies; 25.83% of large MNCs are significantly exposed to changes in emerging market currencies compared to 5.80% of firms being exposed to changes in developed market currencies. Cursory analysis also suggests that MNCs are more frequently exposed to FX rates than DCs, although this pattern goes away when one looks at market-adjusted FX exposures.

In Panel B, tests of overall statistical significance (Z-score and associated p-values) show that FX exposures are statistically significant for all groups of firms. It is interesting to note that DCs also have significant FX exposure, which in most cases is not different from MNCs. The bold print in Panel B indicates that FX exposures of DCs are statistically different from those of MNCs based on two-sided Wilcoxon rank sum tests. It is only for positive FX exposures to emerging country currencies, where MNCs display significantly higher FX exposures than DCs. Although this result may initially surprise, it is consistent with the findings reported in prior literature (e.g., Aggarwal, Harper, 2010; Choi, Jiang, 2009). Finally, results presented in Panel B show that for negative FX exposures there is little difference in exposures to developed and emerging market currencies. This is very different from positive FX exposures; here median FX exposures to emerging market currencies are noticeably higher than median exposures to developed market currencies.

[Insert Table 3 approximately here]

4.2. The effects of FVR on FX exposures

Table 4 presents estimated FX exposures based on the expanded models presented in Eqs. (4) through (6). Similar to Table 3, we focus on FX exposures and omit the estimated control variable coefficients and conditional volatility parameters.

FX exposures to developed market currencies decrease in magnitude after the introduction of FVR. For firms with negative exposures to developed market currencies, the risk reductions appear negatively related to firm size and occur exclusively in the MNC groups. We observe even larger risk reductions in firms with positive exposures to developed market currencies. As hypothesized, these changes in FX exposures mainly affect the MNCs, although the difference for small firms is not statistically significant. We also notice that firms with negative exposures to emerging market currencies in the pre-FVR period exhibit substantial shifts in their exposures during the post-FVR period resulting in a switch in exposure direction; for large and medium sized firms these risk shifts are twice as big for MNCs as for DCs. Interestingly, there are no changes in FX exposures for firms with positive exposures to emerging market currencies. Across all groups of firms, median estimates of changes in exposure are zero for $\delta_{I1,i}^{E}$ and $\delta_{I3,i}^{E}$.

Overall, results are qualitatively similar for all three of the FX exposure measures while being particularly close for estimates of total FX exposures and macro-controlled FX exposures. In sum the results of Table 4 support *H1* by first, documenting significant changes in FX exposures that primarily affect MNCs.

[Insert Table 4 approximately here]

FX exposures can be substantially different for firms across different industries (Bodnar, Gentry, 1993; Choi, Prasad, 1995; Dominguez, Tesar, 2006). Naturally we ask ourselves whether changes in FX risk are different across the industry groups represented in our sample. The following analysis, which is presented in Table 5, breaks out our tests of *H1* for each of the major industry groups. We report results organized by the same five industry groups used for the matching procedure (see sub-section 3.4.), which are: Forestry, Fishing, Mining and Construction (SIC: 01-17); Manufacturing (SIC: 20-39); Transportation, Communication, Electric, Gas, and Sanitary Services (SIC: 40-49); Wholesale and Retail Trade (SIC: 50-59); and Services (SIC:70-89).

We observe risk reductions in positive FX exposures to developed market currencies in all of the major industry groups. In addition we find statistical support for *H1* in three of the industry groups — Manufacturing, Transportation, and Services. Evidence of reductions in negative FX exposures to developed market currencies is present in the same three industry groups (except large firms in the Transportation industry group). For firms with negative FX exposures to emerging market currencies, we see risk reductions in mainly two industry groups, Services and Transportation, as well as large manufacturing firms. We also observe that risk reductions in large manufacturing firms for negative OITP exposures are limited to MNCs. Finally, consistent with the results reported in Table 4, we find no changes in positive FX exposures to emerging market currencies with one notable exception. Small service firms with positive exposures to emerging market currencies exhibit a substantial increase in FX exposures, particularly the MNC group, which is consistent with *H1*.

In sum, we find evidence of a reduction in FX exposures, mainly for firms with significant exposures to developed market currencies, and negative exposures to emerging market currencies. With the exception of small service industry firms, there is no change in positive FX exposures to emerging market currencies. Results are surprisingly consistent across major industry groups but evidence in support of *H1* is mainly present in Manufacturing, Transportation, and Services.

[Insert Table 5 approximately here]

4.3. The effects of FVR on the asymmetry of FX exposures

Table 6 reports the results of exposure asymmetries to the direction of exchange rate changes for all three of our FX exposure measures. Estimates are based on the models presented in Eqs. (8) through (10). To test the statistical significance of changes in exposure asymmetries (*H2*) we estimate the models for the pre-FVR and post-FVR periods and then use sign tests and Wilcoxon rank sum tests; p-values for both of these tests are reported as tests for change.

Based on total FX exposures, between 1.96% and 8.33% of firms are asymmetrically exposed to changes in developed market currencies. For exposures to emerging market currencies, between 3.48% and 10.92% of firms are asymmetrically exposed. The stock returns of firms are less sensitive to depreciations of foreign currencies than to appreciations — this is consistent across all sub-samples and holds true in both sub-periods. Perhaps not surprisingly, the FX exposures of MNCs are more asymmetric than the FX exposures of DCs — the exception is firms with negative FX exposures in the post-FVR period. We would expect FX exposures to be more asymmetric in MNCs due to the use of FX pass-through and pricing to market, the presence of real options, and hysteretic investment/divestment behavior.

Less clear is the pattern in the changes of FX exposure asymmetry. For exposures to developed market currencies, the asymmetry in positive exposures is unaffected by the introduction of FVR. However, negative exposures to developed market currencies become less asymmetric for the second sub-period. The decreases are statistically significant for all groups except for small DCs. For exposures to emerging market currencies, the asymmetry in positive exposures increases for all groups of firms with the exception of large DCs; small firms display substantial amounts of exposure asymmetry in the post-FVR period. For firms with negative exposures to emerging market currencies, asymmetry increases during the second sub-period — results are statistically significant for all groups except for large MNCs. Here asymmetry in exposures seems to remain unchanged.

In sum, FX exposure asymmetry affects a modest number of firms in our sample. Asymmetry increased for FX exposure to emerging market currencies but decreased for firms with negative exposures to developed market currencies. Although changes in FX exposure asymmetry mainly seem to affect MNCs, the results are not conclusive; changes in FX exposure asymmetry are not limited to MNCs.

[Insert Table 6 approximately here]

4.4. Additional tests and robustness

4.4.1. The effects of FVR on stock return volatility and systematic risk

It is possible that the exposure measures used in our analysis do not fully capture FX risk. Changes in currency exposure can also be reflected in CAPM betas and stock return volatilities (Bartov et al., 1996; Bartram, Karolyi, 2006). To provide a more complete picture of firm-level changes in systematic and idiosyncratic risk during our sample period, Table 7 presents estimated changes in stock return volatilities, CAPM betas, and Fama and French factors.

In Panel A of Table 7 we observe that median monthly stock return variances decrease during the post-FVR sub-period for large and medium sized firms. Variance ratios, which are computed by dividing the post-FVR stock return variance by the pre-FVR stock return variance are lower for large and medium-sized MNCs than DCs. Wilcoxon rank sum tests and sign tests confirm that these differences are statistically significant at conventional levels. This indicates that the observed reductions in FX exposures are accompanied by overall decreases in stock return volatility.

Panel B of Table 7 presents the estimated changes in CAPM betas, and the market-, size-, and value factors of Fama and French. Interestingly we observe higher CAPM betas for MNCs than DCs. This is consistent with results reported in prior research where some studies argue that corporate international diversification increases systematic risk (Krapl, 2015; Reeb, Kwok, Baek, 1998). Results show small increases in CAPM betas after the introduction of FVR to large and medium-sized MNCs. Although statistically significant, the changes are very small — for large MNCs median betas for the post-FVR period increase by 0.038, which is equal to a 3.53% increase over the pre-FVR sub-period. For medium MNCs the increase is even smaller. Changes in estimated coefficients of the Fama and French three-factor model, reflect a similar picture. Medians of estimated changes in market and size factors are zero for all groups of firms. The exception is small decreases in coefficients of value factors for the second sub-period. Here we see a decrease of 0.011, which is equivalent to a drop in median value factor estimates of 2.44%.

Overall the results in Table 7 illustrate that stock return volatilities have decreased during the second sub-period but no other changes to systematic risk factors are observed.

[Insert Table 7 approximately here]

4.4.2. Changes in firm-level determinants of FX exposure

Another potential explanation for the observed changes in FX exposures after the introduction of FVR is coinciding changes in firm-level determinants of FX exposure. Prior literature identifies several firm characteristics that correlate with FX exposure magnitudes. A relation between hedging incentives and FX exposure is reported by He, Ng (1998) and Choi, Kim (2003), among others. Studying a sample of Japanese multinational firms He, Ng (1998) observe that firms with high leverage, smaller firms, and firms with weak short-term liquidity positions have lower exposures. Similarly, Choi, Kim (2003), analyzing a sample of U.S. multinational firms with exposure to Asian markets, find that FX exposures are lower for firms with higher growth opportunities, higher debt ratios, and lower liquidity. In contrast to the aforementioned two landmark studies Wei, Starks (2013) argue that financially distressed firms have higher FX exposures due to their limited ability to hedge exposures. Their study finds that FX exposures are positively related to proxy variables of expected distress costs. Most importantly, Wei, Starks (2013) observe a positive relation between a firm's default probability and FX exposure. In another landmark study, Dominguez, Tesar (2006) observe that FX exposures are negatively correlated with firm size, and positively correlated with multinational status, foreign sales, and international assets.

In Table 8 we present changes in firm-level determinants of FX exposure of our sample firms. Included in our analysis are: *Size*, which is measured as the natural log of market capitalization; *Liquidity*, which is the acid test ratio; *Leverage*, which measured by dividing market value of assets by the market value of equity; *Growth opportunities*, where we use the market-to-book ratio of equity; *Likelihood of financial distress*, we use the Altman Z-score [15];

[15] We follow Wei, Starks (2013) and use the Altman z-score to proxy for firm-level likelihood of financial distress: $Z = 1.2WCAP + 1.4REARN + 3.3EBIT + 0.6DEBT + 1.0SALE$

and *International activity*, we employ foreign sales ratios, foreign asset ratios, and the number of geographic segments in which firms operate in for firms in the MNC groups. We report median values of these measures for the pre-FVR and post-FVR sub-periods and then conduct two-sided sign tests and Wilcoxon rank sum tests to validate the statistical significance of changes in the FX exposure determinants. Table 8 also reports median values of change ratios, which are defined by dividing the value of the determinant in the post-FVR period by the value of the determinant in the pre-FVR period. Sign tests and Wilcoxon rank sum tests are used to report the statistical significance of differences in ratio values for MNCs and DCs.

Table 8 shows that there was little change in median market capitalizations, liquidity, and leverage of firms in our sample. Median market-to-book ratios decreased during the post-FVR period for all groups of firms, indicating a decrease in firm-level growth opportunities. Decreasing growth opportunities are tied to a decrease in the underinvestment problem and thus should lower the incentive for firms to hedge their FX exposures (Froot, Scharfstein, Stein, 1993; Géczy et al., 1997). Based on arguments put forth by He, Ng (1998) this would likely lead to increases in FX exposures.

In addition to changes in growth opportunities, Table 8 shows a significant increase in the firm-level likelihood of financial distress. Median Altman z-scores decline for all groups of firms during the post-FVR period. For large and medium-sized firms the increases in distress probabilities are larger for MNCs than DCs. For small firms there is no difference in the changes of distress probabilities between MNCs and DCs. According to optimal hedging theory increased likelihood of financial distress provides firms with more incentive to hedge and thus could lead to lower FX exposures (He, Ng, 1998). However the opposite could also be the case; Wei, Starks

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where WCAP = working capital/total assets; REARN = retained earnings/total assets; EBIT = EBIT/total assets; DEBT = total liabilities/total assets; and SALE = sales/total assets. Further, *Foreign sales*, is the ratio of foreign sales to total sales, and *Foreign assets*, is the ratio of foreign asset to total assets.

(2013) document a positive relation between the likelihood of financial distress and FX exposure, arguing that financially distressed firms have diminished ability to hedge their exposures.

Finally, median foreign sales and foreign asset ratios increase substantially for the post-FVR period for small, medium, and large firms. Such increases in relative levels of international activity of the MNC firms in our sample are more likely tied to increases in FX exposures. Although increased foreign asset ratios and operations in multiple geographic segments could also proxy for operational hedging activities of firms. Unfortunately more detailed data would be needed to establish which the case is.

[Insert Table 8 approximately here]

4.4.3. Additional robustness checks

In this sub-section we perform additional robustness tests and report the results in Table 9. First, we study the extent to which our results are affected by the introduction of the euro; to do this we exclude firms with significant FX exposures to the euro. Second, we investigate to which extent our results are affected by the bursting of the technology/internet stock bubble by excluding firms from telecom, media, and technology industries. Finally, we investigate whether our results are sensitive to the turbulent events of 2000 and 2001 — for this part of the analysis we exclude observations for the years 2000 and 2001 and consider January 1995 to December 1999 as the pre-FVR sub-period and January 2002 to December 2006 as the post-FVR period.

Bartram, Karolyi (2006) find that the introduction of the euro increased stock return volatilities but overall reduced CAPM betas and FX exposures of firms with real operations in the Eurozone. To check whether our main results are substantially affected by the introduction of the euro in 1999, we exclude firms with significant FX exposures to the euro from our sample.[16] For large MNCs (DCs) we exclude 42 firms (41firms); for medium-sized MNCs (DCs) we exclude 60 firms (60 firms); and for small MNCs (DCs) we drop 40 firms (51 firms) with significant FX exposures to the euro from our initial sample. Results of this analysis are presented in Panel A of Table 9.

After removing euro-sensitive firms, total FX exposures of the remaining firms become more extreme. Compared to the results reported in Table 4, FX exposures to developed and emerging market currencies are substantially higher in their magnitude. More importantly, FX exposures drop substantially during the post-FVR sub-period for firms with positive exposures; for firms with negative exposures to the currency indices, FX exposures become significantly less negative during the second sub-period. We conclude that removing firms with significant euro exposures would rather increase the main results of our paper.

To assess the extent to which our main results are affected by the rise and fall of internet stocks (Bartram, Karolyi, 2006; Ofek, Richardson, 2003), we conduct two tests. First, we exclude telecom, media, and technology companies from the analysis. In the manufacturing division, we exclude SIC industry group 357 (Computer and Office Equipment). We also exclude SIC major group 48 (Communications), and SIC industry group 737 (Computer Programming, Data Processing, And Other Related Services). Second, we replicate our analysis but exclude data from January 2000 to December 2001. We keep the length of the sub-periods at 5 years to be consistent with our methodology. Thus we redefine the pre-FVR period to be

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[16] We estimate total FX exposures to the euro for each firm in our sample and then exclude firms that have statistically significant euro exposures at the 85% confidence level. We use the following model to obtain estimates of euro sensitivities: $R_i = \alpha_i + \gamma_i R^{€}_{X,t} + \varepsilon_{i,t}$ where $R^{€}_{X,t}$ is the appreciation/depreciation of the euro relative to the USD in month t.

January 1995 to December 1999, and the post-FVR period to span January 2002 to December 2006. The latter test also allows us to test the sensitivity of our main results to tumultuous market events during 2000 and 2001.

Panel B of Table 9 presents total FX exposures and changes in total FX exposures using the sub-sample excluding telecom, media, and technology companies. We exclude, for large MNCs (DCs) 166 firms (83 firms), for medium MNCs (DCs) 255 firms (159 firms), and for small MNCs (DCs) 201 firms (143 firms). We observe very similar results compared to the total FX exposures reported in Table 4 suggesting that our main findings are not affected by the rise and fall of internet and technology stocks.

To further confirm the robustness of our results, we present total FX exposures and changes in total FX exposures using alternative pre- and post-FVR sub-periods — the results of this analysis are presented in Panel C of Table 9. Even if we consider the years 2000 and 2001 transition years for FVR or are concerned about the bursting of the technology stock bubble and the turbulent financial market events of 2001, Panel C shows that results remain unchanged when we change the pre-FVR sub-period to January 1995 to December 1999 and the post-FVR period to January 2001 to December 2006. In sum, Table 9 demonstrates that our main findings reported in Table 4 are robust to the events of 2000 and 2001, as well as the rise and fall of internet and technology stocks.

In a similar fashion results reported in Panel E test the effects of the Asian Financial Crisis on pre-FVR exposures. Here D_t takes on the value of 1 for observations from July 1997 to December 1998 and zero for all other observations during the pre-FVR period. We do not observe unusually high FX exposures during the period of turmoil in emerging economies, thus significantly increased FX exposures for the pre-FVR sub-period. We conclude that our results are not mainly determined by unusual levels of FX exposures during the Asian Financial crisis.

[Insert Table 9 approximately here]

5. **Conclusion**

We analyze the effects of fair value reporting (FVR) — SFAS 133 and IAS 39 on firm-level FX exposures of U.S. MNCs. To our surprise we find that FX exposures are significantly lower for firms with positive and negative exposures to developed market currencies after the implementation of FVR. No changes in exposures to developed market currencies are observed in control groups of small-, medium-, and large-size domestic firms. FX exposures to emerging market currencies are not affected by implementation of FVR for firms with positive exposures. However, firms with negative exposures during the pre-FVR period see substantial shifts in their exposures, changing the average direction of exposure to positive.

We also observe changes in FX exposure asymmetry after the introduction of FVR. For exposures to developed market currencies, the asymmetry in positive exposures is unaffected by the introduction of FVR but negative exposures to developed market currencies become less asymmetric for the second sub-period. For exposures to emerging market currencies, overall the asymmetry in positive and negative exposures increases during the second sub-period. Although changes in FX exposure asymmetry mainly seem to affect MNCs, the results are not as conclusive as with FX exposure levels.

The findings reported in this paper have several important implications. Investors holding stock of U.S. MNCs must understand that stock returns can react substantially to changes in FX rates and that this relation can change over time. For researchers the reported results highlight that managerial reactions to changes in accounting standards can be more complex than initially expected. Future research could benefit from further exploring time-variation in FX exposures, particularly break-points in exposures that are results from changes in FX exposure determinants or changes in operating environments of MNCs. Our study also has important implications for policy makers; Changes in accounting standards can affect FX exposures. Perhaps future research could further explore the potential causes of the FX exposure shift which coincided with the implementation date of FVR. This could lead to a better understanding of FX exposure.

References

Aabo, T., 2006. The importance of corporate foreign debt in managing exchange rate exposures in non-financial companies. European Financial Management 12, 633-649.

Adler, M., Dumas, B., 1984. Exposure to currency risk: definition and measurement. Financial Management, 41-50.

Aggarwal, R., Berrill, J., Hutson, E., Kearney, C., 2011. What is a multinational corporation? Classifying the degree of firm-level multinationality. International Business Review 20, 557-577.

Aggarwal, R., Harper, J.T., 2010. Foreign exchange exposure of "domestic" corporations. Journal of International Money and Finance 29, 1619-1636.

Ahmed, A.S., Kilic, E., Lobo, G.J., 2011. Effects of SFAS 133 on the risk relevance of accounting measures of banks' derivative exposures. Accounting Review 86, 769-804.

Allayannis, G., Ihrig, J., Weston, J.P., 2001. Exchange-rate hedging: Financial versus operational strategies. American Economic Review, 391-395.

Allayannis, G., Ofek, E., 2001. Exchange rate exposure, hedging, and the use of foreign currency derivatives. Journal of International Money and Finance 20, 273-296.

Bartov, E., Bodnar, G.M., Kaul, A., 1996. Exchange rate variability and the riskiness of US multinational firms: evidence from the breakdown of the Bretton Woods system. Journal of Financial Economics 42, 105-132.

Bartram, S.M., 2004. Linear and nonlinear foreign exchange rate exposures of German nonfinancial corporations. Journal of International Money and Finance 23, 673-699.

Bartram, S.M., 2008. What lies beneath: Foreign exchange rate exposure, hedging and cash flows. Journal of Banking & Finance 32, 1508-1521.

Bartram, S.M., Brown, G.W., Conrad, J., 2011. The effects of derivatives on firm risk and value. Journal of Financial and Quantitative Analysis 46, 967-999.

Bartram, S.M., Brown, G.W., Minton, B.A., 2010. Resolving the exposure puzzle: The many facets of exchange rate exposure. Journal of Financial Economics 95, 148-173.

Bartram, S.M., Karolyi, G.A., 2006. The impact of the introduction of the Euro on foreign exchange rate risk exposures. Journal of Empirical Finance 13, 519-549.

Beisland, L.A., Frestad, D., 2013. How fair-value accounting can influence firm hedging. Review of Derivatives Research 16, 193-217.

Berndt, E.K., Hall, B.H., Hall, R.E., 1974. Estimation and inference in nonlinear structural models, Annals of Economic and Social Measurement, Volume 3, number 4. NBER, pp. 103-116.

Bodnar, G.M., Dumas, B., Marston, R.C., 2002. Pass-through and exposure. Journal of Finance 57, 199-231.

Bodnar, G.M., Gentry, W.M., 1993. Exchange rate exposure and industry characteristics: evidence from Canada, Japan, and the USA. Journal of International Money and Finance 12, 29-45.

Bodnar, G.M., Hayt, G.S., Marston, R.C., 1998. 1998 Wharton survey of financial risk management by US non-financial firms. Financial Management, 70-91.

Bodnar, G.M., Wong, M.F., 2003. Estimating exchange rate exposures: issues in model structure. Financial Management, 35-67.

Brown, G.W., Toft, K.B., 2002. How firms should hedge. Review of Financial Studies 15, 1283-1324.

Carrieri, F., Errunza, V., Majerbi, B., 2006. Does emerging market exchange risk affect global equity prices? Journal of Financial and Quantitative Analysis 41, 511-540.

Chaieb, I., Mazzotta, S., 2013. Unconditional and conditional exchange rate exposure. Journal of International Money and Finance 32, 781-808.

Chen, W., Tan, H.T., Wang, E.Y., 2013. Fair value accounting and managers' hedging decisions. Journal of Accounting Research 51, 67-103.

Chernenko, S., Faulkender, M., 2012. The two sides of derivatives usage: Hedging and speculating with interest rate swaps. Journal of Financial and Quantitative Analysis 46, 1727-1754.

Choi, J.J., Jiang, C., 2009. Does multinationality matter? Implications of operational hedging for the exchange risk exposure. Journal of Banking & Finance 33, 1973-1982.

Choi, J.J., Kim, Y.-C., 2003. The Asian exposure of US firms: operational and risk management strategies. Pacific-Basin Finance Journal 11, 121-138.

Choi, J.J., Prasad, A.M., 1995. Exchange risk sensitivity and its determinants: a firm and industry analysis of US multinationals. Financial Management, 77-88.

Dominguez, K.M., Tesar, L.L., 2006. Exchange rate exposure. Journal of International Economics 68, 188-218.

Dumas, B., 1978. The theory of the trading firm revisited. The Journal of Finance 33, 1019-1030.

Engle, R.F., 1982. Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. Econometrica: Journal of the Econometric Society, 987-1007.

Fama, E.F., French, K.R., 1992. The cross-section of expected stock returns. Journal of Finance 47, 427-465.

Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3-56.

Faulkender, M., 2005. Hedging or market timing? Selecting the interest rate exposure of corporate debt. Journal of Finance 60, 931-962.

Froot, K.A., Scharfstein, D.S., Stein, J.C., 1993. Risk management: coordinating corporate investment and financing policies. Journal of Finance 48, 1629-1658.

Géczy, C., Minton, B.A., Schrand, C., 1997. Why firms use currency derivatives. Journal of Finance 52, 1323-1354.

Géczy, C.C., Minton, B.A., Schrand, C.M., 2007. Taking a view: corporate speculation, governance, and compensation. Journal of Finance 62, 2405-2443.

Glaum, M., Klöcker, A., 2011. Hedge accounting and its influence on financial hedging: when the tail wags the dog. Accounting and business research 41, 459-489.

Guay, W., Kothari, S.P., 2003. How much do firms hedge with derivatives? Journal of Financial Economics 70, 423-461.

Guay, W.R., 1999. The impact of derivatives on firm risk: an empirical examination of new derivative users. Journal of Accounting and Economics 26, 319-351.

He, J., Ng, L.K., 1998. The foreign exchange exposure of Japanese multinational corporations. Journal of Finance 53, 733-753.

Hodder, J.E., 1982. Exposure to exchange-rate movements. Journal of international Economics 13, 375-386.

Jorion, P., 1990. The exchange-rate exposure of US multinationals. The Journal of Business 63, 331-345.

Keloharju, M., Niskanen, M., 2001. Why do firms raise foreign currency denominated debt? Evidence from Finland. European Financial Management 7, 481-496.

Koutmos, G., Martin, A.D., 2003. Asymmetric exchange rate exposure: theory and evidence. Journal of International Money and Finance 22, 365-383.

Koutmos, G., Martin, A.D., 2007. Modeling time variation and asymmetry in foreign exchange exposure. Journal of Multinational Financial Management 17, 61-74.

Krapl, A., 2015. Corporate international diversification and risk. International Review of Financial Analysis 37, 1-13.

Krapl, A., O'Brien, T.J., 2015. Direct versus indirect estimates of foreign exchange cash flow exposure. International Review of Financial Analysis 37, 103-112.

Lins, K.V., Servaes, H., Tamayo, A., 2011. Does fair value reporting affect risk management? International survey evidence. Financial Management 40, 525-551.

McKay, P.A., Niedzielsky, J., 2000. New accounting standard gets mixed reviews Wall Street Journal.

Melumad, N.D., Weyns, G., Ziv, A., 1999. Comparing alternative hedge accounting standards: Shareholders' perspective. Review of Accounting Studies 4, 265-292.

Muller, A., Verschoor, W.F., 2006. Asymmetric foreign exchange risk exposure: evidence from US multinational firms. Journal of Empirical Finance 13, 495-518.

Ofek, E., Richardson, M., 2003. DotCom mania: the rise and fall of internet stock prices. Journal of Finance 58, 1113-1138.

Osterland, A., 2000. Good morning, volatility. CFO 16, 129-132.

Pantzalis, C., Simkins, B.J., Laux, P.A., 2001. Operational hedges and the foreign exchange exposure of US multinational corporations. Journal of International Business Studies, 793-812.

Reeb, D.M., Kwok, C.C., Baek, H.Y., 1998. Systematic risk of the multinational corporation. Journal of International Business Studies, 263-279.

Richie, N., Glegg, C., Gleason, K.C., 2006. The effects of SFAS 133 on foreign currency exposure of US-based multinational corporations. Journal of Multinational Financial Management 16, 424-439.

Sapra, H., 2002. Do mandatory hedge disclosures discourage or encourage excessive speculation? Journal of Accounting Research 40, 933-964.

Singh, A., 2004. The effects of SFAS 133 on the corporate use of derivatives, volatility, and earnings management. The Pennsylvania State University.

Tai, C.-S., 2008. Asymmetric currency exposure and currency risk pricing. International Review of Financial Analysis 17, 647-663.

Villalonga, B., 2004. Does diversification cause the" Diversification Discount"? Financial Management, 5-27.

Wei, K.D., Starks, L.T., 2013. Foreign exchange exposure elasticity and financial distress. Financial Management 42, 709-735.

Zhang, H., 2009. Effect of derivative accounting rules on corporate risk-management behavior. Journal of Accounting and Economics 47, 244-264.

Table 1
Descriptive statistics for the matched and unmatched samples

Panel A: Unmatched sample firms

	All MNC N = 313,863 (3,430 firms)			All DC N = 185,258 (2,275 firms)			Test for Differences	
	Mean	Median	SD	Mean	Median	SD	p-Median	p-Wilcox
Market cap	1,859.6	271.6	6,033.2	459.1	91.0	1,214.8	<.0001	<.0001
Total assets	2,188.8	266.6	8,826.2	653.4	112.4	1,971.1	<.0001	<.0001
Sales	495.5	61.2	2,027.8	147.2	28.1	479.0	<.0001	<.0001
Foreign sales ratio	28.6%	21.1%	28.8%	0.0%	0.0%	0.0%	<.0001	<.0001
Foreign asset ratio	7.3%	0.0%	19.3%	0.0%	0.0%	0.0%	<.0001	<.0001

Panel B: Matched sample

	Large MNC N = 70,022 (724 firms)			Large DC N = 63,427 (724 firms)			Test for Differences	
	Mean	Median	SD	Mean	Median	SD	p-Median	p-Wilcox
Market cap	1,996.8	1,129.7	2,805.8	1,023.8	381.2	1,872.0	<.0001	<.0001
Total assets	1,879.8	861.5	3,812.6	1,636.8	569.3	3,206.2	<.0001	<.0001
Sales	377.5	177.9	802.2	379.4	167.8	766.2	<.0001	<.0001
Foreign sales ratio	32.1%	28.0%	28.4%	0.0%	0.0%	0.0%	<.0001	<.0001
Foreign asset ratio	8.7%	0.0%	20.1%	0.0%	0.0%	0.0%	<.0001	<.0001

	Medium MNC N = 100,294 (1,110 firms)			Medium DC N = 92,644 (1,110 firms)			Test for Differences	
	Mean	Median	SD	Mean	Median	SD	p-Median	p-Wilcox
Market cap	323.1	232.2	326.3	313.5	137.4	434.8	<.0001	<.0001
Total assets	436.5	205.9	1,360.8	518.9	202.1	1,461.2	0.0253	0.0002
Sales	113.2	47.6	309.7	136.9	61.3	362.2	<.0001	<.0001
Foreign sales ratio	27.6%	20.0%	28.4%	0.0%	0.0%	0.0%	<.0001	<.0001
Foreign asset ratio	7.2%	0.0%	19.1%	0.0%	0.0%	0.0%	<.0001	<.0001

	Small MNC N = 79,822 (949 firms)			Small DC N = 72,967 (949 firms)			Test for Differences	
	Mean	Median	SD	Mean	Median	SD	p-Median	p-Wilcox
Market cap	65.4	45.0	68.9	108.8	46.7	176.0	<.0001	<.0001
Total assets	148.6	49.1	864.4	164.8	56.7	1,309.2	<.0001	<.0001
Sales	39.7	13.1	221.0	42.5	13.3	307.0	0.1442	0.8862
Foreign sales ratio	24.3%	13.5%	28.8%	0.0%	0.0%	0.0%	<.0001	<.0001
Foreign asset ratio	4.8%	0.0%	16.7%	0.0%	0.0%	0.0%	<.0001	<.0001

Note: This table presents descriptive statistics; Panel A presents statistics on the unmatched sample of U.S. MNC (2,262 firms) and DC (1,327 firms) from January 1996 to December 2005. For the purpose of this study, we define an MNC as a firm that during the sample period reports a positive foreign sales ratio or a positive foreign asset ratio. Firms that report neither are considered a DC. This sample starts with all U.S. firms traded on Nasdaq, NYSE, and Amex. Firms with less than 36 consecutive monthly stock return observations are excluded. To limit the effects of outliers we further exclude extremely small and large firms (the bottom and top 1% of firms based on market capitalization). Due to their different FX exposures, we also exclude firms in the financial industries (SIC 60-67) and public service industries (SIC 91-99). Market capitalization, total assets, and sales are reported in millions of dollars. Foreign dales and foreign asset ratios measure foreign sales as a percentage of total sales, and foreign assets as a percentage of total assets. Panel B reports summary statistics on matched samples of large-, medium-, and small sized MNCs and DCs. We follow the approach of Villalonga (2004) and Choi, Jiang (2009) and use propensity score matching based on risk, profitability, and firm size. Each MNC is matched within its industry with one domestic firm (closest propensity score). The matching is considered successful if the propensity score of the domestic firm is within ±25% of the propensity score of the MNC. This table also reports p-values of median sign tests (two-sided) and p-values of Wilcoxon rank sum tests for differences between MNCs and DCs.

Table 2
Summary statistics of stock returns, currency returns, and control variables
Panel A: Summary statistics – monthly stock returns January 1996 to December 2005

							Test for Differences	
Group	Mean	Median	SD	S	K	p-JB	p-Median	p-Wilcox
Large MNC	0.604	1.170	17.121	-0.674	6.967	<.0001	<.0001	<.0001
Large DC	0.073	0.480	15.861	-0.810	9.782	<.0001		
Medium MNC	-0.413	0.000	20.190	-0.559	6.246	<.0001	0.4819	0.3132
Medium DC	-0.478	0.000	18.525	-0.677	7.436	<.0001		
Small MNC	-1.216	-0.931	21.342	-0.247	5.654	<.0001	<.0001	0.0338
Small DC	-1.182	-0.539	20.779	-0.355	5.781	<.0001		

Panel B: Summary statistics and correlation coefficients: currency index returns and control variables

Variable	Mean	Median	SD	S	K	p-JB
R_X^D	-0.092	-0.456	1.588	0.737	0.281	0.0044
R_X^E	-0.097	0.096	1.122	-1.330	5.187	<.0001
R_M	0.743	1.576	4.713	-0.840	0.991	<.0001
R_{ST}	0.000	0.000	0.002	-0.839	1.819	<.0001
R_{DS}	0.000	0.000	0.002	1.138	2.104	<.0001

Spearman rank correlations in lower triangle (shaded) and Pearson correlation coefficients in upper triangle

	R_X^D	R_X^E	R_M	R_{ST}	R_{DS}
R_X^D	1	0.205**	0.156*	-0.209**	-0.118
R_X^E	0.139	1	0.271***	0.169*	-0.016
R_M	0.141	0.352***	1	0.070	0.042
R_{ST}	-0.191**	0.170*	0.048	1	-0.339***
R_{DS}	-0.106	-0.057	0.001	-0.161*	1

Note: This table provides summary statistics of monthly stock returns (reported in %) in Panel A, and correlation coefficients in Panel B for the following variables: R_X^D and R_X^E are inflation-adjusted monthly log-returns (reported in %) of the developed and emerging markets currency indices. We use the Major Trading Partner Currency Index (MCI) and the Other Important Trading Partner Index (OITP) that are reported by the U.S. Federal Reserve Bank. R_M are monthly returns of the U.S. value-weighted market index (in %); R_{ST} and R_{DS} are short-term interest rate and term-spread variables which are defined as: $R_{ST} = \Delta SR/(1 + LR)$ and $R_{DS} = \Delta(LR - SR)/(1 + LR)$ where Δ denotes a one-period change, SR is the short-rate (1-Year U.S. Treasury yield), and LR is the long-rate (10-Year U.S. Treasury yield). Selected summary statistics include skewness (S), kurtosis (K) and the P-value of the Jarque-Bera test (JB) of the null hypothesis that the variable is normally distributed. This table also reports p-values of median sign tests (two-sided) and p-values of Wilcoxon rank sum tests for differences between stock returns of MNCs and DCs. Panel B reports Spearman rank correlations in the lower triangle (shaded) and Pearson correlation coefficients in the upper triangle. Statistical significance for the correlation coefficients is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 3
Foreign exchange exposures January 1996 to December 2005

Panel A: Percentage of firms with significant FX exposures at the 95% confidence level

		Total exposures			Market-adjusted exposures			Exposures with macro controls		
	No. firms	δ_1^D	δ_1^E	At least one	δ_2^D	δ_2^E	At least one	δ_3^D	δ_3^E	At least one
Large MNC	724	5.80%	25.83%	31.08%	5.25%	9.39%	13.54%	6.08%	23.62%	28.73%
Large DC	724	8.01%	19.75%	25.97%	7.18%	9.25%	15.19%	7.18%	17.27%	23.07%
Medium MNC	1,110	5.95%	23.06%	27.93%	6.31%	7.75%	13.15%	8.65%	20.27%	27.57%
Medium DC	1,110	8.20%	16.40%	22.97%	6.58%	8.11%	14.05%	8.38%	14.95%	21.89%
Small MNC	943	8.38%	15.16%	22.38%	9.01%	7.53%	15.06%	11.13%	13.47%	22.80%
Small DC	943	9.01%	12.30%	19.62%	7.85%	8.06%	14.95%	9.97%	11.77%	20.25%

Panel B: FX exposure estimates
Negative FX exposures

	Total exposures: δ_1^D and δ_1^E				Market-adjusted exposures: δ_2^D and δ_2^E				Exposures with macro controls: δ_3^D and δ_3^E			
	Median	P-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Exposures to developed market currencies												
Large MNC	-0.448	<.0001	-9.548	<.0001	**-0.569**	<.0001	-14.964	<.0001	**-0.386**	<.0001	-7.817	<.0001
Large DC	-0.504	<.0001	-10.650	<.0001	**-0.649**	<.0001	-15.467	<.0001	**-0.551**	<.0001	-10.642	<.0001
Medium MNC	-0.523	<.0001	-11.377	<.0001	-0.651	<.0001	-17.348	<.0001	-0.553	<.0001	-10.295	<.0001
Medium DC	-0.561	<.0001	-12.599	<.0001	-0.728	<.0001	-17.612	<.0001	-0.604	<.0001	-12.160	<.0001
Small MNC	-0.722	<.0001	-12.101	<.0001	-0.866	<.0001	-15.972	<.0001	-0.751	<.0001	-11.028	<.0001
Small DC	-0.711	<.0001	-12.867	<.0001	-0.872	<.0001	-16.242	<.0001	-0.776	<.0001	-11.601	<.0001
Exposures to emerging market currencies												
Large MNC	-0.437	<.0001	-4.655	<.0001	-0.767	<.0001	-11.303	<.0001	-0.462	<.0001	-4.269	<.0001
Large DC	-0.475	<.0001	-6.934	<.0001	-0.721	<.0001	-12.364	<.0001	-0.495	<.0001	-6.636	<.0001
Medium MNC	-0.731	<.0001	-4.638	<.0001	**-0.997**	<.0001	-12.658	<.0001	-0.832	<.0001	-4.923	<.0001
Medium DC	-0.582	<.0001	-8.557	<.0001	**-0.780**	<.0001	-14.381	<.0001	-0.640	<.0001	-8.983	<.0001
Small MNC	-0.682	<.0001	-5.188	<.0001	-0.891	<.0001	-10.431	<.0001	-0.809	<.0001	-6.005	<.0001
Small DC	-0.583	<.0001	-8.310	<.0001	-0.957	<.0001	-13.682	<.0001	-0.808	<.0001	-9.191	<.0001

Table 3 (Continued)

Positive FX exposures

	Total exposures: δ_1^D and δ_1^F				Market-adjusted exposures: δ_2^D and δ_2^F				Exposures with macro controls: δ_3^D and δ_3^F			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Exposures to developed market currencies												
Large MNC	0.702	<.0001	19.062	<.0001	0.588	<.0001	15.121	<.0001	0.793	<.0001	20.756	<.0001
Large DC	0.688	<.0001	19.570	<.0001	0.591	<.0001	16.086	<.0001	0.788	<.0001	19.596	<.0001
Medium MNC	0.916	<.0001	23.926	<.0001	0.790	<.0001	20.407	<.0001	1.077	<.0001	27.867	<.0001
Medium DC	0.939	<.0001	25.293	<.0001	0.780	<.0001	20.444	<.0001	1.101	<.0001	26.954	<.0001
Small MNC	1.139	<.0001	24.214	<.0001	0.896	<.0001	21.151	<.0001	1.363	<.0001	27.591	<.0001
Small DC	1.199	<.0001	23.533	<.0001	1.065	<.0001	20.604	<.0001	1.326	<.0001	25.954	<.0001
Exposures to emerging market currencies												
Large MNC	**1.856**	<.0001	38.873	<.0001	1.003	<.0001	20.784	<.0001	**1.832**	<.0001	36.672	<.0001
Large DC	**1.603**	<.0001	32.555	<.0001	1.075	<.0001	20.375	<.0001	**1.630**	<.0001	31.077	<.0001
Medium MNC	**2.126**	<.0001	44.952	<.0001	1.244	<.0001	25.986	<.0001	**2.062**	<.0001	42.621	<.0001
Medium DC	**1.726**	<.0001	37.330	<.0001	1.139	<.0001	24.017	<.0001	**1.684**	<.0001	35.260	<.0001
Small MNC	**1.924**	<.0001	35.150	<.0001	1.324	<.0001	23.744	<.0001	1.882	<.0001	32.861	<.0001
Small DC	**1.738**	<.0001	30.528	<.0001	1.268	<.0001	21.416	<.0001	1.727	<.0001	29.062	<.0001

This table reports results for the following firm-level regressions using data from the whole sample period, January 1996 to December 2005: $R_{i,t} = \alpha_i + \delta_{1,i}^D R_{X,t}^D + \delta_{1,i}^F R_{X,t}^E + \varepsilon_{i,t}$, $R_{i,t} = \alpha_i + \beta_{1,i} R_M + \delta_{2,i}^D R_{X,t}^D + \delta_{2,i}^E R_{X,t}^E + \varepsilon_{i,t}$, and $R_{i,t} = \alpha_i + \phi_{1,i} R_{ST,t} + \phi_{2,i} R_{DS,t} + \delta_{3,i}^D R_{X,t}^D + \delta_{3,i}^E R_{X,t}^E + \varepsilon_{i,t}$, where $R_{i,t}$ are monthly stock returns of firm i, $R_{X,t}^D$ and $R_{X,t}^E$ are monthly inflation-adjusted returns of the developed (MCI) and emerging market (OITP) currency indices; R_M are the monthly log returns of the U. S. value-weighted market index; R_{ST} and R_{DS} are short-term interest rate and term-spread variables which are defined as: $R_{ST} = \Delta SR/(1 + LR)$ and $R_{DS} = \Delta(LR - SR)/(1 + LR)$ where Δ denotes a one-period change, SR is the short-rate (1-Year U.S. Treasury yield), and LR is the long-rate (10-Year U.S. Treasury yield). We perform Engle's Lagrange multiplier tests for ARCH effects. For firms where conditional heteroscedasticity cannot be ruled out, we assume that the error terms, $\varepsilon_{i,t}$, follow a GARCH (1,1) process.

Panel A reports the percentage of firms with statistically significant FX exposure estimates at the 95% confidence level. Results reported in Panel B are limited to estimates of FX exposure coefficients but report results separately for negative and positive FX exposures. For each sub-sample of firms, median and p-values of two-sided sign tests are presented. The Z-score test statistic is for a test of joint significance of the parameter estimates and is computed as follows: $Z = \left(\frac{1}{\sqrt{N}}\right)\sum_{i=1}^{N} \frac{t_i}{\sqrt{k_i/(k_i-2)}}$, where t_i is the t-statistic for firm-level FX exposure estimates for firm i, k_i are the degrees of freedom for firm i, and N is the number of firms in the sample. The p-value of the Z-test is reported in the adjacent column to the right. Further the table reports the results of a two-sided Wilcoxon rank sum test of equal FX exposure coefficients between MNCs and DCs. Medians in bold print show that exposure estimates of the DCs are statistically different from the MNCs at the 95% confidence level.

Table 4

Estimates of FX exposures using the expanded model

Panel A: $R_{i,t} = \alpha_i + (\delta^D_{1,i} + \delta^D_{I1,i} D_t)R^D_{X,t} + (\delta^E_{1,i} + \delta^E_{I1,i} D_t)R^E_{X,t} + \varepsilon_{i,t}$

	δ_1^{Neg}				δ_{I1}^{Neg}				δ_1^{Pos}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	-0.672	<.0001	-11.677	<.0001	**0.306**	<.0001	6.254	<.0001	**1.457**	<.0001	27.994	<.0001	**-1.352**	<.0001	-19.262	<.0001
Large DC	-0.697	<.0001	-10.505	<.0001	**0.000**	0.0051	2.905	0.0037	**1.130**	<.0001	24.187	<.0001	**-0.651**	<.0001	-12.547	<.0001
Med. MNC	-0.803	<.0001	-13.621	<.0001	**0.691**	<.0001	9.203	<.0001	**1.706**	<.0001	33.344	<.0001	**-1.529**	<.0001	-20.167	<.0001
Med. DC	-0.734	<.0001	-12.291	<.0001	**0.000**	<.0001	4.590	<.0001	**1.356**	<.0001	29.692	<.0001	**-0.643**	<.0001	-13.969	<.0001
Small MNC	-1.050	<.0001	-13.125	<.0001	**0.888**	<.0001	8.353	<.0001	1.627	<.0001	26.275	<.0001	-0.809	<.0001	-10.837	<.0001
Small DC	-0.961	<.0001	-13.020	<.0001	**0.000**	<.0001	5.227	<.0001	1.454	<.0001	25.764	<.0001	-0.241	<.0001	-10.075	<.0001
Currency exposures to emerging market currencies																
Large MNC	-0.702	<.0001	-6.792	<.0001	**3.400**	<.0001	10.346	<.0001	**1.906**	<.0001	35.212	<.0001	0.000	0.1391	1.443	0.1490
Large DC	-0.576	<.0001	-10.581	<.0001	**1.898**	<.0001	13.329	<.0001	**1.540**	<.0001	28.561	<.0001	0.000	0.0075	3.245	0.0012
Med. MNC	**-0.965**	<.0001	-6.635	<.0001	**3.869**	<.0001	11.206	<.0001	**2.028**	<.0001	40.014	<.0001	0.000	0.0773	2.370	0.0178
Med. DC	**-0.630**	<.0001	-11.548	<.0001	**1.371**	<.0001	11.407	<.0001	**1.733**	<.0001	34.540	<.0001	0.000	0.6995	1.410	0.1585
Small MNC	-0.636	<.0001	-6.681	<.0001	1.239	<.0001	6.726	<.0001	**1.996**	<.0001	33.861	<.0001	**0.000**	<.0001	-4.799	<.0001
Small DC	-0.635	<.0001	-9.792	<.0001	0.000	<.0001	5.943	<.0001	**1.785**	<.0001	30.145	<.0001	**0.000**	0.0156	-2.642	0.0082

Panel B: $R_{i,t} = \alpha_i + (\beta_{1,i} + \beta_{I1,i} D_t)R_M + (\delta^D_{2,i} + \delta^D_{I2,i} D_t)R^D_{X,t} + (\delta^E_{2,i} + \delta^E_{I2,i} D_t)R^E_{X,t} + \varepsilon_{i,t}$

	δ_2^{Neg}				δ_{I2}^{Neg}				δ_2^{Pos}				δ_{I2}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	-0.894	<.0001	-17.843	<.0001	**0.555**	<.0001	10.560	<.0001	**1.045**	<.0001	22.627	<.0001	**-1.045**	<.0001	-13.743	<.0001
Large DC	-0.845	<.0001	-15.778	<.0001	**0.054**	<.0001	5.413	<.0001	**0.900**	<.0001	20.495	<.0001	**-0.467**	<.0001	-10.035	<.0001
Med. MNC	**-1.131**	<.0001	-22.548	<.0001	**0.918**	<.0001	17.856	<.0001	**1.336**	<.0001	25.319	<.0001	**-1.020**	<.0001	-13.519	<.0001
Med. DC	**-0.891**	<.0001	-19.459	<.0001	**0.088**	<.0001	9.080	<.0001	**1.110**	<.0001	23.740	<.0001	**-0.376**	<.0001	-11.689	<.0001
Small MNC	-1.247	<.0001	-21.586	<.0001	**1.131**	<.0001	12.905	<.0001	1.189	<.0001	20.629	<.0001	-0.220	<.0001	-7.038	<.0001
Small DC	-1.108	<.0001	-19.424	<.0001	**0.215**	<.0001	8.934	<.0001	1.254	<.0001	21.474	<.0001	-0.194	<.0001	-7.777	<.0001

Table 4 (Continued)

	δ_2^{Neg}				δ_{I2}^{Neg}				δ_2^{Pos}				δ_{I2}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to emerging market currencies																
Large MNC	-0.856	<.0001	-12.170	<.0001	1.415	<.0001	8.357	<.0001	1.348	<.0001	24.058	<.0001	**-1.001**	<.0001	-10.330	<.0001
Large DC	-0.781	<.0001	-15.499	<.0001	0.733	<.0001	9.592	<.0001	1.123	<.0001	20.933	<.0001	**0.000**	0.0030	-4.178	<.0001
Med. MNC	**-1.048**	<.0001	-12.477	<.0001	**1.727**	<.0001	8.426	<.0001	1.457	<.0001	28.567	<.0001	**-0.574**	<.0001	-10.442	<.0001
Med. DC	**-0.808**	<.0001	-16.373	<.0001	**0.260**	<.0001	9.467	<.0001	1.312	<.0001	26.499	<.0001	**0.000**	<.0001	-6.934	<.0001
Small MNC	-0.880	<.0001	-10.829	<.0001	0.000	0.4297	0.714	0.4752	1.511	<.0001	25.848	<.0001	**-1.435**	<.0001	-11.140	<.0001
Small DC	-1.006	<.0001	-14.014	<.0001	0.000	0.0041	2.789	0.0053	1.464	<.0001	24.171	<.0001	**0.000**	<.0001	-8.384	<.0001

Panel C: $R_{i,t} = \alpha_i + (\phi_{1,i} + \phi_{I1,i}D_t)R_{ST,t} + (\phi_{2,i} + \phi_{I2,i}D_t)R_{DS,t} + (\delta_{3,i}^D + \delta_{I3,i}^D D_t)R_{X,t}^D + (\delta_{3,i}^E + \delta_{I3,i}^E D_t)R_{X,t}^E + \varepsilon_{i,t}$

	δ_3^{Neg}				δ_{I3}^{Neg}				δ_3^{Pos}				δ_{I3}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	-0.670	<.0001	-14.151	<.0001	**0.717**	<.0001	9.111	<.0001	**1.584**	<.0001	24.990	<.0001	**-1.124**	<.0001	-14.387	<.0001
Large DC	-0.773	<.0001	-12.005	<.0001	**0.300**	<.0001	6.644	<.0001	**1.266**	<.0001	21.824	<.0001	**-0.487**	<.0001	-9.492	<.0001
Med. MNC	-0.902	<.0001	-15.101	<.0001	**0.885**	<.0001	11.927	<.0001	**1.927**	<.0001	31.506	<.0001	**-1.053**	<.0001	-15.047	<.0001
Med. DC	-0.838	<.0001	-15.080	<.0001	**0.261**	<.0001	7.994	<.0001	**1.562**	<.0001	29.359	<.0001	**-0.483**	<.0001	-11.865	<.0001
Small MNC	-1.026	<.0001	-16.225	<.0001	**0.804**	<.0001	19.766	<.0001	1.987	<.0001	26.844	<.0001	-0.513	<.0001	-9.078	<.0001
Small DC	-0.962	<.0001	-11.250	<.0001	**0.000**	<.0001	14.781	<.0001	1.734	<.0001	26.294	<.0001	-0.084	<.0001	-8.882	<.0001
Currency exposures to emerging market currencies																
Large MNC	-0.752	<.0001	-5.756	<.0001	**3.993**	<.0001	9.128	<.0001	**2.050**	<.0001	37.043	<.0001	0.000	0.0912	2.036	0.0418
Large DC	-0.599	<.0001	-7.411	<.0001	**1.917**	<.0001	11.877	<.0001	**1.569**	<.0001	27.474	<.0001	0.000	0.0002	4.267	<.0001
Med. MNC	**-1.210**	<.0001	-7.612	<.0001	**3.863**	<.0001	9.008	<.0001	**2.057**	<.0001	41.490	<.0001	0.000	0.0005	2.278	0.0227
Med. DC	**-0.759**	<.0001	-10.029	<.0001	**1.695**	<.0001	11.547	<.0001	**1.766**	<.0001	32.759	<.0001	0.000	0.0120	2.100	0.0357
Small MNC	**-0.660**	<.0001	-5.724	<.0001	0.651	<.0001	5.542	<.0001	**2.063**	<.0001	33.630	<.0001	0.000	0.0068	-1.334	0.1822
Small DC	**-0.959**	<.0001	-9.648	<.0001	0.041	<.0001	5.932	<.0001	**1.782**	<.0001	27.055	<.0001	0.000	0.4066	-0.914	0.3607

Note: This table reports estimated total FX exposures (Panel A), market-adjusted FX exposures (Panel B), and FX exposures based on models with interest rate-based control variables (Panel C). The models presented above contain the following variables: $R_{i,t}$ are monthly stock returns of firm i, $R_{X,t}^D$ and $R_{X,t}^E$ are monthly inflation-adjusted returns of the developed (MCI) and emerging market (OITP) currency indices; R_M are the monthly log returns of the U. S. value-weighted market index; R_{ST} and R_{DS} are short-term interest rate and term-spread variables which are defined as: $R_{ST} = \Delta SR/(1 + LR)$ and $R_{DS} = \Delta(LR - SR)/(1 + LR)$ where Δ denotes a one-period change, SR is the short-rate (1-Year U.S. Treasury yield), and LR is the long-rate (10-Year U.S. Treasury yield). D_t is a dummy variable that takes on the value of 1 for monthly observations from January 2001 to December 2005 and zero for observations from January 1996 to December 2000. We perform Engle's Lagrange multiplier tests for ARCH effects. For firms where conditional heteroscedasticity cannot be ruled out, we assume that the error terms, $\varepsilon_{i,t}$, follow a GARCH (1,1) process. Results reported are limited to estimates of FX exposure coefficients and changes in such. Results for negative and positive FX exposures and corresponding changes are presented separately. For each sub-sample of firms, median and p-values of two-sided sign tests are presented. The Z-score test statistic is for a test of joint significance of the parameter estimates and is computed as follows: $Z = \left(\frac{1}{\sqrt{N}}\right)\sum_{i=1}^{N}\frac{t_i}{\sqrt{k_i/(k_i-2)}}$, where t_i is the t-statistic for firm-level FX exposure estimates for firm i, k_i are the degrees of freedom for firm i, and N is the number of firms in the sample. The p-value of the Z-test is reported in the adjacent column to the right. Further the table reports the results of a two-sided Wilcoxon rank sum test of equal FX exposure coefficients between MNCs and DCs. Medians are shown in bold print when FX exposure of the DC is statistically different from the MNC's exposure at the 95% confidence level.

Table 5
Changes in total FX exposures for firms in different industry groups

	Currency exposures to developed market currencies								Currency exposures to emerging market currencies							
	δ_{I1}^{Neg}				δ_{I1}^{Pos}				δ_{I1}^{Neg}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Forestry, Fishing, Mining, and Construction																
Large MNC	0.000	0.7744	1.280	0.2005	-1.300	<.0001	-5.271	<.0001	4.321	0.0391	3.065	0.0022	0.084	0.2430	-0.071	0.9434
Large DC	0.000	0.7744	0.110	0.9124	-1.200	<.0001	-3.523	0.0004	3.490	0.0044	4.781	<.0001	0.226	0.0708	1.226	0.2202
Med. MNC	0.759	0.0703	1.321	0.1865	-1.027	0.0039	-3.750	0.0002	0.205	0.6250	0.047	0.9625	0.000	0.9985	-0.635	0.5254
Med. DC	0.056	0.0352	2.107	0.0351	-0.858	<.0001	-3.172	0.0002	3.596	0.0192	3.595	0.0003	0.000	0.5424	0.168	0.8666
Small MNC	0.000	0.4531	0.949	0.3426	-0.311	0.1153	-2.237	0.0253	1.885	0.1250	1.353	0.1761	0.000	0.8238	-0.4734	0.6359
Small DC	0.000	1.0000	0.134	0.8934	-0.413	0.0029	-2.589	0.0096	2.460	0.0386	1.551	0.1209	0.000	0.8714	-0.027	0.9785
Manufacturing																
Large MNC	0.394	0.0001	5.098	<.0001	**-1.300**	<.0001	-13.608	<.0001	**3.914**	<.0001	6.424	<.0001	0.117	0.0484	2.359	0.0183
Large DC	0.000	0.6076	0.696	0.4864	**-0.068**	0.0034	-3.485	0.0005	**0.038**	0.2379	1.795	0.0727	0.000	0.7520	0.730	0.4654
Med. MNC	0.759	0.0703	1.321	0.1865	-1.027	0.0039	-3.750	0.0002	0.205	0.6250	0.047	0.9625	0.000	0.9961	-0.635	0.5254
Med. DC	0.056	0.0352	2.107	0.0351	-0.858	<.0001	-3.172	0.0015	3.596	0.0192	3.595	0.0003	0.000	0.5424	0.168	0.8666
Small MNC	**0.869**	<.0001	5.248	<.0001	-0.431	<.0001	-8.369	<.0001	0.872	0.0151	4.045	<.0001	0.000	0.0138	-2.311	0.0208
Small DC	**0.000**	0.0748	2.246	0.0247	-0.300	<.0001	-6.099	<.0001	0.000	0.0017	2.750	0.0060	0.000	0.3674	-1.760	0.0784
Transportation, Communication, Electric, Gas, and Sanitary Services																
Large MNC	0.056	0.1796	1.270	0.2041	-0.395	0.0007	-2.756	0.0059	2.505	0.0001	4.718	<.0001	0.000	0.6358	0.171	0.8642
Large DC	0.004	0.1433	1.526	0.1270	-0.482	<.0001	-7.682	<.0001	1.979	<.0001	11.517	<.0001	0.000	0.8243	1.841	0.0656
Med. MNC	**1.054**	0.0010	2.789	0.0053	-0.514	0.0001	-3.766	0.0002	0.730	0.0078	3.009	0.0026	0.000	0.7660	0.476	0.6341
Med. DC	**0.032**	0.0336	2.620	0.0088	-0.434	<.0001	-6.752	<.0001	1.548	<.0001	8.200	<.0001	0.000	0.8482	0.763	0.4455
Small MNC	**2.162**	0.0039	2.958	0.0031	**-1.381**	0.0013	-3.407	0.0007	1.440	0.3750	2.654	0.0080	-0.002	0.5235	-1.128	0.2593
Small DC	**0.028**	0.0931	2.426	0.0153	**-0.049**	0.0038	-4.400	<.0001	0.000	0.1671	2.149	0.0316	0.000	1.0000	-0.639	0.5228

Table 5 (Continued)

	Currency exposures to developed market currencies								Currency exposures to emerging market currencies							
	δ_{I1}^{Neg}				δ_{I1}^{Pos}				δ_{I1}^{Neg}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Wholesale and Retail Trade																
Large MNC	0.181	0.2632	0.559	0.5762	-1.358	<.0001	-5.263	<.0001	1.102	0.1250	1.337	0.1812	0.102	0.6655	1.506	0.1321
Large DC	0.000	0.2529	0.801	0.4231	-0.789	<.0001	-7.391	<.0001	1.480	<.0001	4.188	<.0001	0.107	0.0026	3.084	0.0020
Med. MNC	0.689	0.0923	1.461	0.1440	-1.682	<.0001	-5.573	<.0001	1.606	0.1250	1.844	0.0652	0.000	0.8991	-0.305	0.7604
Med. DC	0.000	0.1360	0.899	0.3687	-0.772	<.0001	-7.281	<.0001	1.125	0.0003	4.292	<.0001	0.000	0.2297	1.033	0.3016
Small MNC	1.120	0.0169	3.448	0.0006	-0.754	0.0470	-2.252	0.0243	1.390	0.5488	1.502	0.1331	0.000	0.4709	-1.224	0.2210
Small DC	0.057	0.0113	1.974	0.0484	-0.102	0.0003	-3.964	<.0001	0.696	0.1892	2.359	0.0183	0.000	1.0000	0.423	0.6723
Services																
Large MNC	0.942	<.0001	3.502	0.0005	**-1.920**	<.0001	-11.506	<.0001	3.797	<.0001	5.148	<.0001	0.000	0.2449	-1.980	0.0477
Large DC	0.588	0.0428	2.472	0.0134	**-1.358**	<.0001	-6.956	<.0001	3.882	0.0002	4.354	<.0001	0.000	0.9142	-0.680	0.4965
Med. MNC	**1.164**	<.0001	3.036	0.0024	**-2.339**	<.0001	-12.942	<.0001	**5.821**	<.0001	6.979	<.0001	0.000	0.124	-2.207	0.0273
Med. DC	**0.000**	0.0153	2.173	0.0298	**-0.837**	<.0001	-8.814	<.0001	**3.185**	<.0001	6.053	<.0001	0.000	0.3616	-1.793	0.0730
Small MNC	0.901	<.0001	3.319	0.0009	-1.273	<.0001	-6.790	<.0001	2.286	0.0015	2.734	0.0063	-2.082	<.0001	-6.471	<.0001
Small DC	0.000	0.0331	2.446	0.0144	-0.282	<.0001	-6.288	<.0001	0.000	0.0019	3.554	0.0004	-0.088	0.0002	-4.537	<.0001

Note: This table reports estimated changes in total FX exposures based on the following model: $R_{i,t} = \alpha_i + (\delta^D_{1,i} + \delta^D_{I1,i}D_t)R^D_{X,t} + (\delta^E_{1,i} + \delta^E_{I1,i}D_t)R^E_{X,t} + \varepsilon_{i,t}$ where $R_{i,t}$ are monthly stock returns of firm i, $R^D_{X,t}$ and $R^E_{X,t}$ are monthly inflation-adjusted returns of the developed (MCI) and emerging market (OITP) currency indices, D_t is a dummy variable that takes on the value of 1 for monthly observations from January 2001 to December 2005 and zero for observations from January 1996 to December 2000. We perform Engle's Lagrange multiplier tests for ARCH effects. For firms where conditional heteroscedasticity cannot be ruled out, we assume that the error terms, $\varepsilon_{i,t}$, follow a GARCH (1,1) process. Results reported are limited to estimates of changes in total FX exposures and separately reported for firms with negative and positive total FX exposures. Results are summarized by major industry groups based on the following classifications: SIC 01-17 forestry and fishing, mining and construction; SIC 20-39 manufacturing; SIC 40-49 transportation, communication, electric, gas, and sanitary services; SIC 50-59 wholesale and retail trade; SIC 70-89 services. For each sub-sample of firms, median and p-values of two-sided sign tests are presented. The Z-score test statistic is for a test of joint significance of the parameter estimates and is computed as follows: $Z = \left(\frac{1}{\sqrt{N}}\right)\sum_{i=1}^{N}\frac{t_i}{\sqrt{k_i/(k_i-2)}}$, where t_i is the t-statistic for firm-level FX exposure estimates for firm i, k_i are the degrees of freedom for firm i, and N is the number of firms in the sample. The p-value of the Z-test is reported in the adjacent column to the right. Further the table reports the results of a two-sided Wilcoxon rank sum test of equal FX exposure coefficients between MNCs and DCs. Medians are shown in bold print when FX exposure of the DC is statistically different from the MNC's exposure at the 95% confidence level.

Table 6
FX exposure asymmetry

Panel A: $R_{i,t} = \alpha_i + (\delta_{1,i}^{D*} + \delta_{I1,i}^{D*} D_t^{D*}) R_{X,t}^{D} + (\delta_{1,i}^{E*} + \delta_{I1,i}^{E*} D_t^{E*}) R_{X,t}^{E} + \varepsilon_{i,t}$

	Negative FX exposures								Positive FX exposures							
	Exposure asymmetries						Tests for change		Exposure asymmetries						Tests for change	
	Pre FVA			Post FVA					Pre FVA			Post FVA				
	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox
Asymmetry of currency exposures to developed market currencies																
Large MNC	**2.956**	<.0001	4.15%	**1.211**	<.0001	1.96%	<.0001	<.0001	**-3.714**	<.0001	8.33%	-3.362	<.0001	5.31%	0.3311	0.1526
Large DC	**3.852**	<.0001	6.76%	**1.723**	<.0001	4.10%	<.0001	<.0001	**-1.876**	<.0001	2.98%	-2.651	<.0001	4.38%	0.0267	0.0017
Med. MNC	3.912	<.0001	6.83%	2.640	<.0001	3.28%	0.0013	0.0002	**-3.673**	<.0001	7.36%	-3.787	<.0001	7.48%	0.8350	0.4781
Med. DC	4.510	<.0001	6.03%	2.883	<.0001	5.35%	<.0001	<.0001	**-2.425**	<.0001	4.78%	-3.040	<.0001	6.02%	0.0856	0.0108
Small MNC	5.093	<.0001	7.61%	3.871	<.0001	5.88%	0.0036	0.0527	-3.052	<.0001	2.93%	-3.202	<.0001	7.94%	0.4761	0.0982
Small DC	4.574	<.0001	7.87%	3.961	<.0001	6.06%	0.3007	0.1995	-2.797	<.0001	3.72%	-3.458	<.0001	7.98%	0.0857	0.0135
Asymmetry of currency exposures to emerging market currencies																
Large MNC	**4.394**	<.0001	8.62%	**3.614**	<.0001	5.81%	0.7765	0.3344	-3.468	<.0001	3.87%	**-5.509**	<.0001	10.38%	<.0001	<.0001
Large DC	**2.387**	<.0001	4.20%	**6.411**	<.0001	5.22%	0.0001	0.0001	-3.734	<.0001	6.37%	**-4.245**	<.0001	7.24%	0.4673	0.5572
Med. MNC	3.506	<.0001	4.08%	6.891	<.0001	6.75%	<.0001	0.0003	-3.675	<.0001	5.02%	**-7.275**	<.0001	10.09%	<.0001	<.0001
Med. DC	3.761	<.0001	6.47%	6.984	<.0001	7.62%	<.0001	<.0001	-4.030	<.0001	6.67%	**-5.388**	<.0001	7.33%	0.0008	0.0014
Small MNC	3.739	<.0001	3.48%	7.094	<.0001	4.37%	0.0007	0.0001	-4.146	<.0001	6.35%	-9.099	<.0001	10.92%	<.0001	<.0001
Small DC	3.992	<.0001	4.02%	7.611	<.0001	9.31%	<.0001	<.0001	-4.092	<.0001	6.79%	-7.442	<.0001	9.69%	<.0001	<.0001

Panel B: $R_{i,t} = \alpha_i + \beta_{1,i} R_M + (\delta_{2,i}^{D*} + \delta_{I2,i}^{D*} D_t^{D*}) R_{X,t}^{D} + (\delta_{2,i}^{E*} + \delta_{I2,i}^{E*} D_t^{E*}) R_{X,t}^{E} + \varepsilon_{i,t}$

	Negative FX exposures								Positive FX exposures							
	Exposure asymmetries						Tests for change		Exposure asymmetries						Tests for change	
	Pre FVA			Post FVA					Pre FVA			Post FVA				
	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox
Asymmetry of currency exposures to developed market currencies																
Large MNC	2.814	<.0001	5.94%	1.761	<.0001	3.80%	0.0003	<.0001	**-3.824**	<.0001	7.85%	-2.374	<.0001	5.90%	<.0001	<.0001
Large DC	3.595	<.0001	7.80%	1.775	<.0001	4.98%	<.0001	<.0001	**-2.030**	<.0001	4.49%	-2.523	<.0001	4.84%	0.1778	0.0757
Med. MNC	**3.353**	<.0001	7.71%	2.995	<.0001	5.33%	0.5710	0.1142	**-3.845**	<.0001	7.58%	-3.109	<.0001	4.63%	0.0266	0.0034
Med. DC	**4.328**	<.0001	8.18%	2.823	<.0001	5.98%	<.0001	0.0002	**-2.474**	<.0001	4.45%	-2.846	<.0001	5.59%	0.3329	0.7321
Small MNC	4.661	<.0001	9.29%	3.612	<.0001	6.82%	0.7291	0.3780	-2.863	<.0001	2.03%	-3.009	<.0001	9.69%	0.0292	0.0035
Small DC	4.425	<.0001	9.02%	4.023	<.0001	8.55%	0.3772	0.5184	-2.927	<.0001	2.95%	-3.214	<.0001	7.43%	0.0344	0.0833

Table 6 (Continued)

	Negative FX exposures								Positive FX exposures							
	Exposure asymmetries						Tests for change		Exposure asymmetries						Tests for change	
	Pre-FVA			Post-FVA					Pre-FVA			Post-FVA				
	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox
Asymmetry of currency exposures to developed market currencies																
Large MNC	**3.044**	<.0001	10.26%	**3.727**	<.0001	7.21%	0.1211	0.4649	-2.502	<.0001	4.61%	-3.356	<.0001	4.67%	0.0701	0.2472
Large DC	**2.135**	<.0001	4.20%	**4.635**	<.0001	5.82%	<.0001	<.0001	-2.844	<.0001	5.83%	-3.447	<.0001	6.35%	0.5277	0.7483
Med. MNC	**3.750**	<.0001	7.29%	4.969	<.0001	6.99%	0.0017	0.1496	-2.911	<.0001	4.48%	-5.580	<.0001	4.53%	<.0001	<.0001
Med. DC	**3.232**	<.0001	5.41%	5.480	<.0001	7.21%	<.0001	<.0001	-3.160	<.0001	5.33%	-5.059	<.0001	6.47%	0.0005	0.0051
Small MNC	3.931	<.0001	6.27%	5.343	<.0001	5.81%	0.0019	0.0565	-3.026	<.0001	6.27%	-7.926	<.0001	10.71%	<.0001	<.0001
Small DC	3.874	<.0001	6.05%	6.075	<.0001	7.34%	<.0001	<.0001	-3.685	<.0001	7.28%	-8.098	<.0001	11.88%	<.0001	<.0001

Panel C: $R_{i,t} = \alpha_i + \phi_{1,i} R_{ST,t} + \phi_{2,i} R_{DS,t} + (\delta_{3,i}^{D*} + \delta_{13,i}^{D*} D_t^{D*}) R_{X,t}^{D} + (\delta_{3,i}^{E*} + \delta_{13,i}^{E*} D_t^{E*}) R_{X,t}^{E} + \varepsilon_{i,t}$

	Negative FX exposures								Positive FX exposures							
	Exposure asymmetries						Tests for change		Exposure asymmetries						Tests for change	
	Pre-FVA			Post-FVA					Pre-FVA			Post-FVA				
	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox	Median	p-value	% Sig	Median	p-value	% Sig	p-Median	p-Wilcox
Asymmetry of currency exposures to developed market currencies																
Large MNC	2.840	<.0001	3.11%	1.702	<.0001	3.11%	0.0014	<.0001	**-4.778**	<.0001	8.26%	-2.542	<.0001	5.65%	<.0001	<.0001
Large DC	3.297	<.0001	4.67%	1.609	<.0001	2.71%	<.0001	<.0001	**-2.533**	<.0001	5.51%	-2.316	<.0001	6.33%	0.7340	0.8986
Med. MNC	**3.286**	<.0001	5.69%	2.853	<.0001	4.94%	0.1666	0.0107	**-4.731**	<.0001	7.67%	-3.327	<.0001	7.40%	0.0006	<.0001
Med. DC	**4.177**	<.0001	6.36%	2.640	<.0001	4.74%	<.0001	<.0001	**-3.152**	<.0001	6.67%	-2.731	<.0001	8.88%	0.2144	0.4040
Small MNC	**4.651**	<.0001	7.49%	3.852	<.0001	6.62%	0.1188	0.2230	-3.480	<.0001	3.33%	-3.372	<.0001	9.84%	0.7764	0.9278
Small DC	**5.004**	<.0001	6.08%	3.449	<.0001	6.69%	0.0037	0.0008	-3.662	<.0001	5.39%	-3.301	<.0001	12.27%	0.5269	0.5041
Asymmetry of currency exposures to emerging market currencies																
Large MNC	**3.977**	<.0001	6.25%	**2.263**	<.0001	3.75%	0.0798	0.0224	-3.678	<.0001	4.19%	**-5.901**	<.0001	12.84%	<.0001	<.0001
Large DC	**2.372**	<.0001	4.80%	**4.673**	<.0001	3.20%	0.0080	0.0164	-3.775	<.0001	7.87%	**-4.434**	<.0001	9.25%	0.0903	0.4541
Med. MNC	3.510	<.0001	5.58%	5.454	<.0001	6.79%	0.0051	0.0899	-3.801	<.0001	7.31%	**-7.945**	<.0001	11.94%	<.0001	<.0001
Med. DC	3.421	<.0001	7.28%	5.680	<.0001	9.05%	0.0033	0.0168	-4.120	<.0001	8.21%	**-5.410**	<.0001	9.63%	0.0010	0.0035
Small MNC	3.348	<.0001	5.85%	5.196	<.0001	7.91%	0.0249	0.0291	-4.526	<.0001	7.64%	-8.516	<.0001	12.66%	<.0001	<.0001
Small DC	3.675	<.0001	6.42%	5.977	<.0001	9.00%	0.0139	0.0152	-4.154	<.0001	8.88%	-7.609	<.0001	13.39%	<.0001	<.0001

Note: This table reports estimated changes in total FX exposures (Panel A), market-adjusted FX exposures (Panel B), and FX exposures based on models containing interest rate control variables (Panel C). The models presented above contain the following variables: $R_{i,t}$ are monthly stock returns of firm i, $R_{X,t}^{D}$ and $R_{X,t}^{E}$ are monthly inflation-adjusted returns of the developed (MCI) and emerging market (OITP) currency indices; R_M are the monthly log returns of the U. S. value-weighted market index; R_{ST} and R_{DS} are short-term interest rate and term-spread variables which are defined as: $R_{ST} = \Delta SR/(1+LR)$ and $R_{DS} = \Delta(LR - SR)/(1+LR)$ where Δ denotes a one-period change, SR is the short-rate (1-Year U.S. Treasury yield), and LR is the long-rate (10-Year U.S. Treasury yield). D_t^{D*} is a dummy variable that takes on the value of 1 for negative changes in the developed market currency index and zero otherwise. Similarly, D_t^{E*} is a dummy variable that captures the direction of changes in emerging market currencies. For sake of brevity this table only reports estimates of FX exposure asymmetry. As in the previous tables, results are reported separately for negative and positive FX exposures. %Sig reports the percentage of firms with statistically significant asymmetry in FX exposures at the 95% confidence level. Tests for change report the p-values for sign tests and Wilcoxon rank sum tests (two-tailed) for equal exposure asymmetries during pre-FVA and post-FVA sub-periods. Bold print indicates that FX exposure asymmetries are different for MNCs and DCs based on two-tailed Wilcoxon rank sum tests.

Table 7
Changes in stock return volatilities, CAPM betas and Fama and French factors

Panel A: Stock return volatilities

	Median		Test for change			Variance ratios		
Group	Pre-FVA	Post-FVA	Chi	p-Med	p-Wilcox	Median	p-Median	p-Wilcox
Large MNC	**0.028**	0.017	<.0001	<.0001	<.0001	0.629	<.0001	<.0001
Large DC	**0.020**	0.016	<.0001	0.0024	0.0026	0.807		
Medium MNC	**0.037**	**0.033**	<.0001	0.0106	0.0009	0.796	0.0153	0.0090
Medium DC	**0.028**	**0.024**	<.0001	0.0006	0.0215	0.885		
Small MNC	0.040	0.039	<.0001	0.6589	0.6662	0.934	0.3428	0.2694
Small DC	0.039	0.033	<.0001	0.0085	0.0913	0.913		

Panel B: CAPM betas and Fama and French factors

Estimates are based on the following model: $R_{i,t} = \alpha_i + (\beta_{2,i} + \beta_{I2,i}D_t)R_M + \varepsilon_{i,t}$

		β_2				β_{I2}		
Group	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Large MNC	**1.075**	<.0001	94.159	<.0001	0.038	<.0001	8.331	<.0001
Large DC	**0.719**	<.0001	62.396	<.0001	0.000	<.0001	7.685	<.0001
Medium MNC	**1.117**	<.0001	88.518	<.0001	0.021	<.0001	9.070	<.0001
Medium DC	**0.837**	<.0001	71.586	<.0001	0.000	<.0001	7.305	<.0001
Small MNC	**0.940**	<.0001	60.505	<.0001	0.000	0.0012	5.229	<.0001
Small DC	**0.865**	<.0001	59.975	<.0001	0.000	0.0271	2.943	0.0033

Estimates are based on the following model: $R_{i,t} = \alpha_i + (\beta_{3,i} + \beta_{I3,i}D_t)R_M + (\beta_{4,i} + \beta_{I4,i}D_t)SMB + (\beta_{5,i} + \beta_{I5,i}D_t)HML + \varepsilon_{i,t}$

		β_3				β_{I3}		
Group	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Large MNC	**1.242**	<.0001	77.698	<.0001	0.000	0.2003	0.766	0.4437
Large DC	**0.987**	<.0001	67.705	<.0001	0.000	0.0020	-2.842	0.0045
Medium MNC	**1.123**	<.0001	73.072	<.0001	**0.000**	0.0158	4.248	<.0001
Medium DC	**1.002**	<.0001	67.321	<.0001	**0.000**	0.0713	0.334	0.7384
Small MNC	0.879	<.0001	45.403	<.0001	0.000	0.0754	2.129	0.0333
Small DC	0.828	<.0001	42.022	<.0001	0.000	0.4020	2.990	0.0028

		β_4				β_{I4}		
Group	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Large MNC	0.495	<.0001	33.274	<.0001	**0.000**	0.0144	2.532	0.0113
Large DC	0.495	<.0001	32.472	<.0001	**0.000**	<.0001	7.138	<.0001
Medium MNC	**0.818**	<.0001	50.307	<.0001	0.000	<.0001	7.727	<.0001
Medium DC	**0.625**	<.0001	42.949	<.0001	0.000	<.0001	9.739	<.0001
Small MNC	**0.829**	<.0001	41.630	<.0001	0.000	0.0183	6.366	<.0001
Small DC	**0.701**	<.0001	35.733	<.0001	0.000	<.0001	9.711	<.0001

Table 7 (Continued)

	β_5				β_{I5}			
Group	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Large MNC	**0.451**	<.0001	19.957	<.0001	-0.011	0.0001	-4.887	<.0001
Large DC	**0.689**	<.0001	36.023	<.0001	0.000	0.0120	-2.498	0.0125
Medium MNC	**0.379**	<.0001	18.062	<.0001	0.000	0.3508	0.485	0.6277
Medium DC	**0.552**	<.0001	27.332	<.0001	0.000	0.5180	0.042	0.9665
Small MNC	0.146	0.0051	4.880	<.0001	0.000	0.1369	1.778	0.0754
Small DC	0.228	<.0001	8.494	<.0001	0.000	0.0038	4.682	<.0001

Note: This table reports estimated changes in stock return volatilities (Panel A), CAPM betas, and Fama and French factors (Panel B). Stock return volatilities are computed as variances of monthly stock returns. We report median monthly stock return volatilities for the pre-FVA and post-FVA periods and report three tests for changes in variances. Bold print indicates that the variance of returns of MNCs is different from DCs based on F-tests, at the 95% confidence level. To analyze the change in stock return variances for the two sub-periods we report p-values associated with the following aggregate measure (Bartov et al., 1996; Bartram, Karolyi, 2006): $\chi^2(2N) = -2\sum_{i=1}^{N} ln(p_i)$ where the p-values p_i are from individual F-tests of a change in the monthly stock return variance of firm i. N is the number of firms in the sample. We also report p-values of sign tests and Wilcoxon rank sum tests (two-sided). In the last three columns of Panel A we present median estimates of variance ratios. We compute variance ratios by dividing the stock return variance of the post-FVA period by the return variance of the pre-FVA period. In the two adjacent columns we report p-values for sign tests and two-sided Wilcoxon rank sum tests for differences in parameter estimates between MNCs and DCs.

Panel B reports the estimated coefficients of modified CAPM and Fama and French three-factor models. In the models presented above, $R_{i,t}$ are monthly stock returns of firm i; R_M are the monthly log returns of the U. S. value-weighted market index; and SMB and HML are the returns of the Small minus Big, and High minus Low, size and value factors (Fama, French, 1992, 1993); and D_t is a dummy variable that takes on the value of 1 for monthly observations from January 2001 to December 2005 and zero for observations from January 1996 to December 2000. For each sub-sample of firms, median and p-values of two-sided sign tests are presented. The Z-score test statistic is for a test of joint significance of the parameter estimates and is computed as follows: $Z = \left(\frac{1}{\sqrt{N}}\right)\sum_{i=1}^{N}\frac{t_i}{\sqrt{k_i/(k_i-2)}}$, where t_i is the t-statistic for firm-level model estimates for firm i, k_i are the degrees of freedom for firm i, and N is the number of firms in the sample. The p-value of the Z-test is reported in the adjacent column to the right. Further the table reports the results of a two-sided Wilcoxon rank sum test of equal coefficients between MNCs and DCs. Medians are shown in bold print when parameter estimate of the DC is statistically different from the MNC's parameter estimate at the 95% confidence level.

Table 8
Changes in other determinants of FX exposure

	Median		Test for change		Change ratios: $New\ Value/Old\ Value$		
	Pre-FVA	Post-FVA	p-Median	p-Wilcox	Median	p-Median	p-Wilcox
Size: $\log(market\ capitalization)$							
Large MNC	**6.981**	**7.139**	0.0181	0.0019	1.054	0.0015	0.0035
Large DC	**5.849**	**6.341**	0.0031	0.0035	1.033		
Medium MNC	**5.522**	**5.495**	0.7655	0.2496	1.008	0.0380	0.1098
Medium DC	**4.861**	**5.028**	0.0227	0.0623	1.028		
Small MNC	3.880	3.715	0.0074	0.0034	0.956	0.0188	0.1269
Small DC	3.783	3.867	0.4783	0.8678	0.981		
Liquidity: $\frac{current\ assets - inventory}{current\ liabilities}$							
Large MNC	**0.628**	**0.807**	0.0289	0.0031	1.159	0.0001	<.0001
Large DC	**0.190**	**0.209**	0.3912	0.8593	0.914		
Medium MNC	**0.855**	**0.864**	0.8741	0.2193	0.972	0.0073	0.0018
Medium DC	**0.359**	**0.357**	0.9393	0.1522	0.839		
Small MNC	0.569	0.575	0.9010	0.8480	0.804	0.3316	0.4021
Small DC	0.588	0.528	0.3624	0.0990	0.817		
Leverage: $\frac{market\ value\ of\ equity + book\ value\ of\ debt}{market\ value\ of\ equity}$							
Large MNC	**1.274**	**1.329**	0.0154	0.0005	1.033	0.0377	0.0566
Large DC	**2.014**	**1.971**	0.6846	0.3888	1.060		
Medium MNC	**1.334**	**1.366**	0.2842	0.0011	1.057	0.0708	0.1589
Medium DC	**1.791**	**1.738**	0.2546	0.4255	1.035		
Small MNC	**1.486**	1.524	0.3744	0.0601	1.069	0.1777	0.1840
Small DC	**1.605**	1.624	0.6190	0.0932	1.047		
Growth opportunities: $\frac{market\ value\ of\ equity}{book\ value\ of\ equity}$							
Large MNC	**3.632**	**2.763**	<.0001	<.0001	0.746	0.0002	0.0012
Large DC	**1.835**	**1.629**	0.0082	0.0008	0.853		
Medium MNC	**2.522**	**2.018**	<.0001	<.0001	0.747	0.0358	0.0310
Medium DC	**1.897**	**1.628**	<.0001	<.0001	0.812		
Small MNC	1.902	**1.643**	0.0026	0.0119	0.831	0.1411	0.0311
Small DC	1.781	**1.515**	0.0007	<.0001	0.778		
Financial distress: Altman Z-Score							
Large MNC	**5.193**	**3.979**	<.0001	<.0001	0.817	0.0025	0.0030
Large DC	**3.333**	**2.979**	0.0824	0.0010	0.900		
Medium MNC	**4.754**	**3.644**	<.0001	<.0001	0.741	0.0003	<.0001
Medium DC	**3.554**	**2.936**	<.0001	<.0001	0.875		
Small MNC	3.457	2.788	<.0001	<.0001	0.706	0.4893	0.2453
Small DC	3.451	2.507	<.0001	<.0001	0.705		

Table 8 (Continued)

	Median		Test for change		Change ratios: $New\ Value/Old\ Value$		
	Pre-FVA	Post-FVA	p-Median	p-Wilcox	Median	p-Median	p-Wilcox
Foreign sales: $\frac{foreign\ sales}{total\ sales}$							
Large MNC	20.00%	33.70%	<.0001	<.0001	1.295	NA	NA
Medium MNC	15.68%	26.58%	<.0001	<.0001	1.325	NA	NA
Small MNC	13.24%	20.23%	<.0001	<.0001	1.262	NA	NA
Foreign assets: $\frac{foreign\ assets}{total\ assets}$							
Large MNC	4.32%	12.99%	<.0001	<.0001	2.629	NA	NA
Medium MNC	3.71%	11.31%	<.0001	<.0001	2.500	NA	NA
Small MNC	2.23%	8.75%	<.0001	<.0001	2.500	NA	NA
Number of Geographic Segments							
Large MNC	2.5	3.0	<.0001	<.0001	1.667	NA	NA
Medium MNC	2.3	3.0	<.0001	<.0001	1.154	NA	NA
Small MNC	2	2.6	<.0001	<.0001	1.076	NA	NA

Note: This table reports changes in firm-level determinants of FX exposure. We report medians for pre-FVA (January 1996 to December 2000) and post-FVA (January 2001 to December 2005) sub-periods. We also report p-values of sign tests and Wilcoxon rank sum tests (two-sided) for differences in ratios between the two sub-periods. In the last three columns we present median estimates of change ratios. We compute change ratios by dividing the new value of the variable based on the post-FVA period by the old value of the variable based on the pre-FVA period. In the two adjacent columns we report p-values for sign tests and two-sided Wilcoxon rank sum tests for differences in FX determinants between MNCs and DCs. We report summary statistics for the following FX determinants: *Size*, natural log of market capitalization; *Liquidity*, acid test ratio; *Leverage*, market value of assets to the market value of equity; *Growth opportunities*, market-to-book value of equity; *Financial distress*, Altman Z-score that is computed as follows: $Z = 1.2WCAP + 1.4REARN + 3.3EBIT + 0.6DEBT + 1.0SALE$ where WCAP = working capital/total assets; REARN = retained earnings/total assets; EBIT = EBIT/total assets; DEBT = total liabilities/total assets; and SALE = sales/total assets. Further, *Foreign sales*, is the ratio of foreign sales to total sales, *Foreign assets*, is the ratio of foreign asset to total assets; and *Number of Geographic Segments* is the number of geographic segments reported by the firm in the Compustat geographic database.

Table 9
Robustness tests

Panel A: Excluding firms with significant euro exposures

	δ_1^{Neg}				δ_{I1}^{Neg}				δ_1^{Pos}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	**-1.380**	<.0001	-14.508	<.0001	**1.131**	<.0001	10.703	<.0001	**2.105**	<.0001	23.216	<.0001	**-1.898**	<.0001	-17.851	<.0001
Large DC	**-0.958**	<.0001	-10.064	<.0001	**0.416**	<.0001	6.390	<.0001	**1.760**	<.0001	21.352	<.0001	**-0.899**	<.0001	-13.871	<.0001
Med. MNC	**-1.445**	<.0001	-13.551	<.0001	**1.104**	<.0001	11.029	<.0001	**2.758**	<.0001	33.264	<.0001	**-2.373**	<.0001	-21.306	<.0001
Med. DC	**-1.189**	<.0001	-11.464	<.0001	**0.491**	<.0001	8.059	<.0001	**2.306**	<.0001	27.022	<.0001	**-1.148**	<.0001	-15.036	<.0001
Small MNC	-1.710	<.0001	-11.698	<.0001	**1.819**	<.0001	10.254	<.0001	2.791	<.0001	26.091	<.0001	**-1.376**	<.0001	-14.530	<.0001
Small DC	-1.578	<.0001	-9.997	<.0001	**0.145**	<.0001	6.698	<.0001	2.625	<.0001	24.738	<.0001	**-0.805**	<.0001	-12.330	<.0001
Currency exposures to emerging market currencies																
Large MNC	-2.496	<.0001	-8.944	<.0001	**4.692**	<.0001	11.350	<.0001	5.478	<.0001	32.993	<.0001	**-1.862**	<.0001	-14.318	<.0001
Large DC	-2.152	<.0001	-8.869	<.0001	**2.862**	<.0001	10.104	<.0001	4.894	<.0001	28.769	<.0001	**-0.766**	<.0001	-10.232	<.0001
Med. MNC	-2.250	<.0001	-8.935	<.0001	**4.109**	<.0001	11.246	<.0001	**6.941**	<.0001	40.907	<.0001	**-2.174**	<.0001	-16.207	<.0001
Med. DC	-2.362	<.0001	-10.379	<.0001	**2.744**	<.0001	10.783	<.0001	**5.428**	<.0001	33.214	<.0001	**-1.052**	<.0001	-12.770	<.0001
Small MNC	-2.072	<.0001	-6.932	<.0001	1.604	<.0001	6.246	<.0001	**7.350**	<.0001	34.120	<.0001	**-4.068**	<.0001	-18.717	<.0001
Small DC	-2.560	<.0001	-8.066	<.0001	0.483	<.0001	5.989	<.0001	**5.824**	<.0001	27.900	<.0001	**-1.426**	<.0001	-13.246	<.0001

Panel B: Excluding telecom, media, and technology sector firms

	δ_1^{Neg}				δ_{I1}^{Neg}				δ_1^{Pos}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	-0.602	<.0001	-10.327	<.0001	**0.245**	<.0001	4.983	<.0001	**1.285**	<.0001	23.739	<.0001	**-1.282**	<.0001	-16.853	<.0001
Large DC	-0.672	<.0001	-10.161	<.0001	**0.000**	0.0216	2.418	0.0156	**1.014**	<.0001	21.823	<.0001	**-0.602**	<.0001	-11.405	<.0001
Med. MNC	-0.732	<.0001	-12.571	<.0001	**0.617**	<.0001	8.071	<.0001	**1.495**	<.0001	28.001	<.0001	**-1.407**	<.0001	-17.088	<.0001
Med. DC	-0.686	<.0001	-11.621	<.0001	**0.000**	0.0003	3.596	0.0003	**1.228**	<.0001	25.820	<.0001	**-0.515**	<.0001	-12.345	<.0001
Small MNC	-0.961	<.0001	-12.538	<.0001	**0.866**	<.0001	8.002	<.0001	1.407	<.0001	21.878	<.0001	-0.668	<.0001	-8.940	<.0001
Small DC	-0.860	<.0001	-12.513	<.0001	**0.000**	0.0039	4.137	<.0001	1.385	<.0001	23.548	<.0001	-0.236	<.0001	-9.091	<.0001

Table 9 (Continued)

	δ_1^{Neg}				δ_{I1}^{Neg}				δ_1^{Pos}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to emerging market currencies																
Large MNC	-0.467	<.0001	-5.313	<.0001	**3.057**	<.0001	8.992	<.0001	**1.750**	<.0001	31.635	<.0001	0.002	0.0174	2.877	0.0040
Large DC	-0.569	<.0001	-10.415	<.0001	**1.671**	<.0001	12.743	<.0001	**1.399**	<.0001	26.059	<.0001	0.000	0.0002	4.307	<.0001
Med. MNC	-0.795	<.0001	-5.155	<.0001	**2.801**	<.0001	9.095	<.0001	**1.873**	<.0001	35.884	<.0001	0.000	0.0029	4.018	<.0001
Med. DC	-0.622	<.0001	-11.085	<.0001	**1.096**	<.0001	10.043	<.0001	**1.645**	<.0001	30.560	<.0001	0.000	0.0489	3.434	0.0006
Small MNC	-0.676	<.0001	-6.691	<.0001	1.239	0.0005	6.117	<.0001	1.841	<.0001	29.493	<.0001	0.000	0.0014	-2.486	0.0129
Small DC	-0.645	<.0001	-9.528	<.0001	0.000	<.0001	5.559	<.0001	1.712	<.0001	27.574	<.0001	0.000	0.3327	-1.553	0.1204

Panel C: Excluding transition years 2000 and 2001 (pre-FVA Jan 1995-Dec 1999 and post-FVA Jan 2002-Dec 2006)

	δ_1^{Neg}				δ_{I1}^{Neg}				δ_1^{Pos}				δ_{I1}^{Pos}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	-0.758	<.0001	-107.23	<.0001	**0.529**	<.0001	32.433	<.0001	**1.201**	<.0001	76.476	<.0001	**-1.014**	<.0001	-18.424	<.0001
Large DC	-0.704	<.0001	-49.130	<.0001	**0.000**	<.0001	18.014	<.0001	**0.885**	<.0001	113.39	<.0001	**-0.215**	<.0001	-10.959	<.0001
Med. MNC	-0.876	<.0001	-94.674	<.0001	**0.175**	<.0001	30.073	<.0001	1.272	<.0001	87.940	<.0001	**-0.694**	<.0001	-14.551	<.0001
Med. DC	-0.817	<.0001	-102.14	<.0001	**0.000**	<.0001	32.752	<.0001	1.132	<.0001	103.02	<.0001	**-0.149**	<.0001	-12.091	<.0001
Small MNC	-0.999	<.0001	-22.704	<.0001	**0.000**	<.0001	6.153	<.0001	1.254	<.0001	21.778	<.0001	-0.168	<.0001	-9.671	<.0001
Small DC	-0.936	<.0001	-27.377	<.0001	**0.000**	0.0003	3.944	<.0001	1.374	<.0001	24.380	<.0001	0.000	<.0001	-8.994	<.0001
Currency exposures to emerging market currencies																
Large MNC	**-0.622**	<.0001	-63.181	<.0001	1.942	<.0001	46.564	<.0001	**1.491**	<.0001	61.999	<.0001	0.000	0.0889	0.362	0.7174
Large DC	**-0.490**	<.0001	-33.645	<.0001	1.271	<.0001	26.272	<.0001	**1.187**	<.0001	80.869	<.0001	0.000	<.0001	5.178	<.0001
Med. MNC	-0.730	<.0001	-82.677	<.0001	**3.162**	<.0001	76.581	<.0001	**1.747**	<.0001	69.286	<.0001	0.000	<.0001	6.745	<.0001
Med. DC	-0.570	<.0001	-63.978	<.0001	**1.218**	<.0001	71.372	<.0001	**1.357**	<.0001	76.396	<.0001	0.000	0.0005	4.369	<.0001
Small MNC	-0.576	<.0001	-17.904	<.0001	**2.171**	<.0001	10.081	<.0001	1.563	<.0001	32.742	<.0001	0.000	0.0218	4.057	<.0001
Small DC	-0.675	<.0001	-20.682	<.0001	**0.000**	<.0001	8.912	<.0001	1.552	<.0001	30.005	<.0001	0.000	0.4805	3.620	0.0003

Table 9 (Continued)

Panel D: Estimates of the effects of the Asian Financial crisis on first sub-period FX exposures

	δ_1^{Pos}				δ_{I1}^{Pos}				δ_1^{Neg}				δ_{I1}^{Neg}			
	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value	Median	p-value	Z-score	p-value
Currency exposures to developed market currencies																
Large MNC	**1.946**	<.0001	23.227	<.0001	**0.000**	0.0041	-2.573	0.0101	-0.993	<.0001	-7.000	<.0001	1.909	<.0001	8.925	<.0001
Large DC	**1.487**	<.0001	22.010	<.0001	**-0.428**	<.0001	-5.113	<.0001	-0.785	<.0001	-8.258	<.0001	1.399	<.0001	8.007	<.0001
Med. MNC	**2.352**	<.0001	29.644	<.0001	-0.461	<.0001	-8.100	<.0001	-1.042	<.0001	-9.810	<.0001	1.827	<.0001	8.529	<.0001
Med. DC	**1.885**	<.0001	28.247	<.0001	-0.750	<.0001	-8.462	<.0001	-0.998	<.0001	-11.108	<.0001	1.782	<.0001	10.381	<.0001
Small MNC	2.294	<.0001	25.196	<.0001	**-1.269**	<.0001	-9.570	<.0001	-1.348	<.0001	-10.041	<.0001	1.376	<.0001	7.436	<.0001
Small DC	2.149	<.0001	24.208	<.0001	**-0.921**	<.0001	-7.657	<.0001	-1.204	<.0001	-11.609	<.0001	1.930	<.0001	10.026	<.0001
Currency exposures to emerging market currencies																
Large MNC	**5.658**	<.0001	33.106	<.0001	-3.467	<.0001	-21.940	<.0001	-1.480	<.0001	-4.193	<.0001	0.884	<.0001	3.967	<.0001
Large DC	**4.126**	<.0001	31.891	<.0001	-3.263	<.0001	-24.561	<.0001	-1.673	<.0001	-5.960	<.0001	1.313	<.0001	4.816	<.0001
Med. MNC	**6.797**	<.0001	41.514	<.0001	-4.186	<.0001	-27.840	<.0001	-2.078	<.0001	-6.120	<.0001	0.752	<.0001	5.069	<.0001
Med. DC	**5.248**	<.0001	39.774	<.0001	-3.753	<.0001	-29.219	<.0001	-1.992	<.0001	-7.525	<.0001	1.636	<.0001	6.715	<.0001
Small MNC	**6.661**	<.0001	39.480	<.0001	-4.932	<.0001	-27.177	<.0001	-2.312	<.0001	-5.939	<.0001	1.965	<.0001	7.076	<.0001
Small DC	**5.768**	<.0001	34.595	<.0001	-4.581	<.0001	-25.451	<.0001	-2.129	<.0001	-9.680	<.0001	1.931	<.0001	7.187	<.0001

Note: In this table we test the robustness of our main findings. We exclude firms with significant Euro exposures (Panel A); exclude firms from telecom, media, and technology sectors (Panel B); exclude data from turbulent trading years 2000 and 2001; and assess the effects of the Asian Financial Crisis on pre-FVR FX exposures (Panel E).This table reports estimated changes in total FX exposures based on the following model: $R_{i,t} = \alpha_i + (\delta^D_{1,i} + \delta^D_{I1,i}D_t)R^D_{X,t} + (\delta^E_{1,i} + \delta^E_{I1,i}D_t)R^E_{X,t} + \varepsilon_{i,t}$ where $R_{i,t}$ are monthly stock returns of firm i, $R^D_{X,t}$ and $R^E_{X,t}$ are monthly inflation-adjusted returns of the developed (MCI) and emerging market (OITP) currency indices, D_t is a dummy variable that takes on the value of 1 for monthly observations from January 2001 to December 2005 and zero for observations from January 1996 to December 2000 for results reported in Panels A and B. Results presented in Panel C are based on the same model but D_t takes on the value of 1 for observations from January 2002 to December 2006 and zero for observations from January 1995 to December 1999. In a similar fashion results reported in Panel E test the effects of the Asian Financial Crisis on pre-FVR exposures. Here D_t takes on the value of 1 for observations from July 1997 to December 1998 and zero for all other observations during the pre-FVR period. We perform Engle's Lagrange multiplier tests for ARCH effects. For firms where conditional heteroscedasticity cannot be ruled out, we assume that the error terms, $\varepsilon_{i,t}$, follow a GARCH (1,1) process. Results reported are limited to estimates of changes in total FX exposures and separately reported for firms with negative and positive total FX exposures. For each sub-sample of firms, median and p-values of two-sided sign tests are presented. The Z-score test statistic is for a test of joint significance of the parameter estimates and is computed as follows: $Z = \left(\frac{1}{\sqrt{N}}\right)\sum_{i=1}^{N}\frac{t_i}{\sqrt{k_i/(k_i-2)}}$, where t_i is the t-statistic for firm-level FX exposure estimates for firm i, k_i are the degrees of freedom for firm i, and N is the number of firms in the sample. The p-value of the Z-test is reported in the adjacent column to the right. Further the table reports the results of a two-sided Wilcoxon rank sum test of equal FX exposure coefficients between MNCs and DCs. Medians are shown in bold print when FX exposure of the DC is statistically different from the MNC's exposure at the 95% confidence level.