

Exchange Rate Exposure: Do Asymmetries and Volatilities Matter? Evidence from the Taiwan Stock Market

R. F. Franck Varga¹

¹ Department of Global Political Economy, Tamkang University, Taiwan

Correspondence: R. F. Franck Varga, Department of Global Political Economy, Tamkang University, Lanyang Campus, 180 Linwei Road, Jiaoshi, I-Lan County, Taiwan. E-mail: 134378@mail.tku.edu.tw

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Abstract

This study investigates foreign exchange exposure and the impacts of asymmetries and volatilities on the daily returns of Taiwanese non-financial firms from 1990 to 2010. 88.8% of our samples are negatively exposed, companies benefiting from an appreciation of the domestic currency. 14% of the firms have an asymmetrical profile. If this percentage is not negligible, Taiwanese firms exhibit mainly a symmetric exposure. Currency volatilities have a significant impact for only 7.5% of the firms, but for 37.38% of the sample, we observe the existence of an asymmetric volatility. Among them, 65% exhibit a negative sign meaning that good news have a greater impact on the volatility than bad news, which seems counter-intuitive. These results may be explained by a chasing good news behavior and the effects of a high level of information uncertainty.

Keywords: exchange rate exposure, asymmetric exposure, currency volatility, volatility asymmetry

1. Introduction

Since the collapse of the Bretton Woods system, changes in exchange rates have been a large subject of interest and concern, knowing that currency volatilities and their associated risks increased dramatically. Financial theory strongly supports that firm value is sensitive to exchange rates movements.

Nevertheless, most of the empirical studies show a small economical and statistical impact of currency risk on stock returns (Note 1). Bartram and Bodnar (2007) consider it as the result from “exposure reducing actions”. Bartram, Brown and Minton (2010) confirm that financial hedging limit exposure by at least forty percents. So, the question remains whether exchange rate exposure matters in financial markets by being meaningful for investors.

Some authors argue that sampling and methodologies may also explain the poor empirical evidences. Cash flows are a nonlinear function of exchange rates, so ignoring the nonlinear part of the exposure may lead to wrong conclusions. See for example Koutmos and Martin (2003). Some studies obtain better results when using a sample from a small and open economy. Moran (2005) found that more than 20% of his Chilean sample is exposed, with nonlinear characteristics.

In this study, we address the key issues mentioned above. Firstly, we are motivated to look for evidence in Taiwan, which is considered to be an open economy (Note 2). Moreover, currency volatility started to increase since Taiwan started a financial liberalization program in 1987. Secondly, we investigate the existence of asymmetric exposure generated by the sign and amplitude of the exchange rate changes. Thirdly, because the potential cash flow consequences, we examine how currency volatility affects the stock returns of Taiwanese firms. Finally, we analyze the volatility of stock returns underlying exchange rate exposure. For example, Kanas (2000) considers that this volatility should be a component of the firm exposure.

The next section presents related papers, followed by the description of the methodology and sample selection in sections 3 and 4. Section 5 reports the main empirical findings and section 6 concludes the paper.

2. Related Papers

A large literature followed the seminal paper of Adler and Dumas (1984) who define exchange rate exposure as the impact of unexpected changes in currencies on firm value. Jorion (1990) investigated this phenomenon for a sample of 287 U.S. multinationals firms, using an augmented market model (Note 3):

$$R_{i,t} = \beta_{0,i} + \beta_{1,i}Rm_t + \beta_{2,i}FX_t + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ denotes the stock return, Rm_t the return on the market index and FX_t the change in the exchange rate. But the author found a significant exposure only for 5.23% of his sample. Likewise, Amihud (1994) does not succeed too even after using for his sample, 32 companies listed in the Fortune magazine's "50 Leading Exporters" list. Bodnar and Gentry (1993), in a multi-country study, find that 21% to 25% of the firms in USA, Japan and Canada display an exposure to exchange rate changes, percentage significantly higher than the ones obtained by Choi and Prasad (1995) who used an American dollar index for their US multinational firms: 14.9% at the firm level and 10% at the industry level.

Considering the special situation of American companies and currency, authors start to extend their studies outside the USA but with very mixed results. For example, He and Ng (1998) find that 26.3% of their Japanese sample is exposed to an exchange rate index while Bartram (2004) finds that only 7.5% of his German samples are exposed. Nydahl (1999) documents a higher level of exposure for his Swedish sample (17%). Dominguez and Tesar (2001) analyze exposure in different, open, mature and developing countries at the firm and industry level. According to the country, they find that between 14% and 26% of the firms are exposed.

Among authors who do not document exposure at all, Priestley and Odegaard (2005) investigate without success seven industries in Norway, none being exposed to the USD or ECU.

Several authors choose to study firms' exposure across many countries; for example Bartram and Karolyi (2006) study the impact of the Euro introduction in the EU, and Doidge et al. (2006) who use a large sample of firms from North America, Europe and Asia. Both studies find results in conformity with Griffin and Stulz (2001): the exposure to exchange rate movements is small, both statistically and economically.

Then authors start to consider a change in the methodology usually employed when investigating exposure.

Many studies use an exchange rate index rather than a bilateral exchange rate, which can explain some mixed results. An index is not representative for an individual firm and can imply a diversification effect across currencies. But Bartram (2004) finds that using a bilateral exchange rate does not significantly improve the measure of exposure.

Another change in the methodology is the use of orthogonalized models (Note 4). Again, the results were not very different as for example Choi and Prasad (1995) and Choi et al. (1998). Nevertheless some authors using the orthogonalized model succeeded in obtaining better results, as did Glaum et al. (1998) – 49% of the sample being exposed, Priestley and Odegaard (2002) – 69% exposed to the JPY and 40% to the ECU, Kiyas (2003) – 62% or Chen et al. (2004) – 24%.

Exposure may be a complex concept to measure, especially if we take into account the time the firm needs to adjust its financial management to exchange rate fluctuations or the fact that company information is only disclosed at regular moments in the year hence the time also needed by the market to adjust its valuation process. These facts may lead to mispricing of currencies movements, and push some authors to introduce one more change in the methodology: the lag effect. Therefore, beside contemporaneous exchange rate fluctuations, authors use lagged exchange rate too. Bartov and Bodnar (1994) find some evidence at the one-month lag level, but with a very low adjusted R^2 (0.2%). Frazer and Pantzalis (2004) obtain some mixed results, with only 9% of their American sample being exposed. Di Iorio and Faff (2000) find non-significant lag effects.

Another change in methodology has also been proposed to improve the measurement of firms' exposure: time varying factors, by using sub-periods analysis. The problem is that it is not always easy to explain the time variation of the exposure which may have different economic sources or could even be caused by some estimation errors. There are studies providing evidence that exposure is generally more time dependant. Brunner et al. (2000) find that exposure coefficients are not stable over time for their German sample. Muller and Verschoor (2007) find considerable evidence of long-term exposure, the short-term seeming to be well hedged. Chow et al. (1997a, 1997b) assert that market participants may wrongly assess the exchange rate risk in the long run. Koutmos and Martin (2007) find that the variability in the time-varying exposure is smaller (larger) for the largest (smallest) firms and for industrial (technology) firms. The size effect is also confirmed by Hunter (2005).

But ignoring the nonlinear (asymmetric) exposure may also explain why empirical results are mixed. Some authors study asymmetric response to changes in exchange rate, as Bartram (2004), Carter et al. (2005) and Tai (2005). Anyway, they only succeed to display a low marginal improvement.

According some authors such as Muller and Verschoor (2006), the asymmetric link between firms' values and currency changes may have several explanations such as asymmetric hedging (e.g. Allayannis & Ofek, 2001;

Miller & Reuer, 1998; Rossi, 2008; Andren, 2001), incorrect pricing of assets (see for example Muller & Verschoor, 2006), hysteresis (see Baldwin, 1988; Dixit, 1989; for their description of hysteresis models), pricing policies and market structures (e.g. Marston, 1990; Froot & Klemperer, 1989; Knetter, 1994).

Volatility (creating asymmetries and nonlinearities) may also be the key variable (or component) to explain foreign exchange exposure. Authors as Giurda and Tzavalía (2004) and Kanas (2000) show evidence for the existence of asymmetric volatilities. Leverage effect may explain this phenomenon, good (bad) news impacting the ratio debt / equity. But appreciations and depreciations are not automatically good or bad news (Note 5). Maghrebi et al. (2006) state “*whether depreciation of domestic currency should be viewed as good news or bad news is an open question*” (Note 6).

But beside currency changes, exchange rate volatility should also be a component of firm’s exposure through its impact on cash flow. Exchange rate volatility should affect cash flows by modifying the volume of international trade. Several studies as for example Sercu and Vanhulle (1992) or Kroner and Lastrapes (1993) among others provide evidence on a relationship between the volume of trade flows and foreign exchange rate volatility (even though the sign of this relationship is subject to disagreement). Hence, the value of the firms should be impacted too. Moreover, currency volatility affects hedging activities and their related financial costs, thus, cash flows should also be affected. Brown (2001) indicates that cash flows of the firms which are actively involved in hedging should be negatively affected when the currency volatility increases.

3. Methodology

3.1 Orthogonalized Model

In the augmented CAPM model (see Eq. 1), $\beta_{2,i}$ may under/overestimate the firm’s true exposure, since currency movements and market returns are correlated (Note 7). To address this issue, we follow Entorf and Jamin (2003) and use an auxiliary regression, described as:

$$R_{m,t} = \delta_0 + \delta_1 FX_t + \delta_{m,t} \quad (2)$$

with $\delta_{m,t}$, the orthogonalized market returns, representing the component of market returns uncorrelated with currency changes. Then rearranging Eq. (1) and Eq. (2), we obtain the orthogonalized model:

$$R_{i,t} = \beta_{0,i}^* + \beta_{1,i} \delta_{m,t} + \beta_{2,i}^* FX_t + \varepsilon_{i,t} \quad (3)$$

where:

$$\beta_{0,i}^* = \beta_{0,i} + \beta_{1,i} \delta_0 \quad (4)$$

$$\beta_{2,i}^* = \beta_{2,i} + \beta_{1,i} \delta_1 \quad (5)$$

$\beta_{0,i}$, $\beta_{1,i}$ and $\beta_{2,i}$ are from the unorthogonalized model $R_{i,t} = \beta_{0,i} + \beta_{1,i} R_{m,t} + \beta_{2,i} FX_t + \varepsilon_{i,t}$ (Eq. 1). Under (3), $\beta_{2,i}^*$ is supposed to show the total impact of exchange rate fluctuations on the firm value. It contains the direct effect $\beta_{2,i}$ as well as the indirect effect $\beta_{1,i} \delta_1$.

The indirect effect is also a firm-specific component of the exposure (as the direct effect) in the sense that $\beta_{1,i}$ varies across firms: each company may have a specific relationship with the market portfolio.

3.2 Multiple Asymmetries and Volatilities

As mentioned in section 2, asymmetric currency exposure is mainly motivated by the literature investigating asymmetric hedging, hysteresis and pricing-to-market. We will follow related asymmetric models (e.g. Koutmos & Martin, 2003) by adding to the orthogonalized augmented model (eq. 3) a control variable measuring the impacts of a change in the currency (sign asymmetry).

But as argued by different authors such as Miller and Reuer (1998), firms will start to react only if the change in the currency exceeds a certain threshold (see section 2). We add another control variable to our model to take into account this fact (magnitude asymmetry).

In the previous section, we cited arguments that cash flows (thus the value of the firm) are affected by the exchange rate volatility through the volume of trade and hedging (transaction) cost. So we incorporate a time-varying currency variable into our model in view to investigate how currency volatility may impact the Taiwanese stock returns.

The final adjustment in our model concerns a second kind of volatility: the volatility of stock returns underlying exchange rate exposure. For instance, Kanas (2000) and Giurda and Tzavalía (2004) argued that a part of the

volatility asymmetry in stocks returns is related to currency changes.

Therefore, our final model is as follows:

$$R_{i,t} = \beta_{0,i}^* + \beta_{1,i}\delta_{m,t} + (\beta_{2,i}^* + \beta_{3,i}D_{sign,t} + \beta_{4,i}D_{amp,t})s_t + \beta_{5,i}h_{s,i,t} + \varepsilon_{i,t} \quad (6)$$

where

s_t = the unexpected change in the exchange rate

$D_{sign,t}$ = 1 if $s_t < 0$ and 0 otherwise (sign asymmetry)

$D_{amp,t}$ = 1 if $|s_t| > x$ and 0 otherwise; $x = 0.5\%$ (threshold firms are supposed to react to – magnitude asymmetry)

$h_{s,i,t}$ = the time-varying exchange rate volatility

$\varepsilon_{i,t}$ = error term which follows a GJR GARCH (1,1) process as:

$$\varepsilon_{i,t} = \mu_{i,t}\sqrt{h_{\varepsilon,i,t}}, \text{ and}$$

$$h_{\varepsilon,i,t} = \omega\varepsilon + \alpha_{\varepsilon,i}\varepsilon_{t-1}^2 + \gamma_i D_{t-1}\varepsilon_{t-1}^2 + \beta_{\varepsilon,i}h_{\varepsilon,i,t-1} \quad (\text{conditional variance of } \varepsilon_{i,t})$$

where D_{t-1} is equal to 1 if $\varepsilon_{i,t}$ is negative and 0 otherwise.

Existence of foreign exchange exposure is confirmed if $\beta_{2,i}^*$, $\beta_{3,i}$ (sign asymmetry) and/or $\beta_{4,i}$ (magnitude asymmetry) are statistically significant. So according their signs, asymmetries may increase or decrease the currency exposure. The difficulty in measuring magnitude asymmetries is to find an effective threshold which may depend on several factors such as the size of the firm or the industry to which the company belongs. The way to choose it is quite arbitrary. The rule of thumb is to use as a starting point, the average exchange rate changes during the sample period. More details about the threshold are given in the next section.

In the literature, when $\varepsilon_{i,t}$ (the error term which follows a GJR GARCH (1,1) process – see eq. 6) is positive, it implies that the market has a positive unexpected shock in period $t-1$, defined as good news. Conversely, if $\varepsilon_{i,t}$ is negative, it means that the market has a negative unexpected shock in the previous period, defined as a bad news. In the latter case, the model produces a higher estimate of conditional volatility ($\alpha_i + \gamma_i$), compared to the former case (α_i), assuming that γ_i is positive.

γ_i (see conditional variance for equation 6) if significant, implies asymmetric volatility of stock returns caused by currency exposure.

The last step to complete our system is to define the exchange rate dynamics. Many previous studies as for example Meese and Singleton (1982), find that exchange rates follow martingale processes, so the best forecast for time $t+1$ is the value at time t . Therefore, changes in FX_t follow a martingale of the form:

$$FX_t = \theta + FX_{t-1} + s_t \quad (7)$$

where s_t is the unexpected change (Note 8) in the exchange rate (innovation) used in equation (6). The conditional variance of s_t follows a GARCH (1,1) process defined as:

$$s_t = \rho_{i,t}\sqrt{h_{s,i,t}}, \text{ and}$$

$$h_{s,i,t} = \omega_{s,i} + \alpha_{s,i}s_{t-1}^2 + \beta_{s,i}h_{s,i,t-1} \quad (\text{conditional variance of } s_t)$$

The time-varying exchange rate volatility $h_{s,i,t}$ is used as a predetermined variable in equation (6).

The system is estimated using a two-step procedure: first, s_t and $h_{s,i,t}$ are estimated via maximum likelihood and then their values are used as predetermined variables in the estimation of equation (6).

Exchange rate volatility is measured by $\beta_{5,i}$. For non-financial firms this coefficient is supposed to be negative, companies being not supposed to benefit from larger currency volatility.

4. Sample Selection

We obtained our data from TEJ, a database maintained in Taiwan. Our sample is made of 107 non-financial Taiwanese firms from 1990 to 2010 (Note 9), and listed on the Taiwan Stock Exchange (TSE). We use daily adjusted stock prices. We follow Dominguez and Tesar (2001) by choosing the firm level to avoid the aggregated effect from the industry level.

Moreover, asymmetric behavior can best be captured at the company level. We use the TAIEX, the leading index in the TSE, as a proxy for the market's return.

To avoid currency aggregated effects issues, we use a nominal bilateral exchange rate instead of an index. The nominal rate eliminates the need to convert the other variables, as argued by Khoo (1994). Besides, Mark (1990) shows that real and nominal changes are correlated for the seven countries used in his study, which is also supported by Atindehou and Gueyie (2001).

The most commonly currency used by Taiwanese companies is the American dollar therefore we employ the currency rate USD/TWD, meaning that if the domestic currency is appreciating, the change in the rate will be negative and the firm will benefit from it if the sign of the exposure coefficient is negative.

Our sample is made of 5245 observations, said 571,705 daily data.

As mentioned in the previous section, the difficulty in measuring magnitude asymmetries is to find an effective threshold which may depend on several factors such as the size of the firm or the industry to which the company belongs. The way to choose it is quite arbitrary. A rule of the thumb is to use as a starting point, the average exchange rate changes during the sample period.

Between 1990 and 2010, the average exchange rate change is 0.15%. This low level is explained by the regular interventions of the CBC (Central Bank in Taiwan), especially at the end of the daily session. Even though the domestic currency (TWD) is appreciating, Taiwanese firms use to deal with a stable currency. Nevertheless, the average currency variation is increasing too: between 2009 and 2010, it is about 0.22%. Thus, it is logical to believe that Taiwanese firms will start to react if the change is greater than 0.22%. Giving the fact that CBC uses to intervene on the foreign exchange market, we cannot expect a high daily change. We estimate that the threshold should be between 0.3% and 0.5% and decide to test the 0.5% level. As mentioned before, we are aware that it is an arbitrary choice.

5. Empirical Results and Major Findings

Table 1 provides the main results from our model (eq. 6).

Table 1. Main results

| | | Sample Size | | | | 107 | | Average Adj R ² | | | | 35.31% | |
|--------------------|-----------|-------------|-----------|----------|-----------|----------|-----------|----------------------------|----------|--------|--|--------|--|
| Firms Exposed at | β_2 | | β_3 | | β_4 | | β_5 | | γ | | | | |
| | Qty | % | Qty | % | Qty | % | Qty | % | Qty | % | | | |
| 10% | 95 | 88.8% | 15 | 14.0% | 15 | 14.0% | 8 | 7.5% | 40 | 37.38% | | | |
| 5% | 90 | 84.1% | 8 | 7.5% | 11 | 10.3% | 4 | 3.7% | 35 | 32.71% | | | |
| 1% | 79 | 73.8% | 4 | 3.7% | 6 | 5.6% | 4 | 3.7% | 21 | 19.63% | | | |
| Details | >0 | <0 | >0 | <0 | >0 | <0 | >0 | <0 | >0 | <0 | | | |
| Firms Exposed(10%) | 1 | 94 | 2 | 13 | 11 | 4 | 3 | 5 | 14 | 26 | | | |
| % of Exposed (10%) | 1.05% | 98.95% | 13.3% | 86.7% | 73.3% | 26.7% | 37.5% | 62.5% | 35.00% | 65.00% | | | |
| Firms Exposed(5%) | 0 | 90 | 0 | 8 | 7 | 4 | 0 | 4 | 12 | 23 | | | |
| % of Exposed (5%) | 0% | 100% | 0% | 100% | 64% | 36% | 0% | 100% | 34% | 66% | | | |
| Firms Exposed(1%) | 0 | 79 | 0 | 4 | 4 | 2 | 0 | 4 | 7 | 14 | | | |
| % of Exposed (1%) | 0% | 100% | 0% | 100% | 67% | 33% | 0% | 100% | 33% | 67% | | | |
| Mean | 0.010563 | -0.02128 | 0.012347 | -0.0121 | 0.013525 | -0.01661 | | | | | | | |
| Median | | -0.01983 | 0.012347 | -0.01055 | 0.012872 | -0.01621 | | | | | | | |
| Standard Deviation | | 0.006789 | 0.001902 | 0.004575 | 0.003277 | 0.002812 | | | | | | | |
| Maximum | | -0.05217 | 0.013691 | -0.02583 | 0.018699 | -0.01985 | | | | | | | |
| Minimum | | -0.00876 | 0.011002 | -0.00725 | 0.009086 | -0.01418 | | | | | | | |

Notes: β_2 , β_3 , β_4 and β_5 measure respectively exchange rate exposure, sign asymmetry, magnitude asymmetry and currency volatility. γ represents the volatility of stock returns underlying exchange rate exposure.

Clearly, Taiwanese firms are exposed and we did not see similar percentages in the existing literature (at any level of acceptance). Moreover, Taiwanese companies (without exception, except 1 firm at the 10% level) see their value increasing when the TWD is appreciating.

Only 14% of the sample exhibit sign and/or magnitude asymmetries. Among companies having a sign asymmetry, the large majority shows a negative coefficient sign. It means that it not only increases the level of exposure, but it also works in favor of Taiwanese firms.

The magnitude asymmetry exhibits an opposite effect: for a large majority of the concerned firms, the coefficient is positive. This asymmetry reduces the level of exposure meaning that Taiwanese firms suffer from a large variation of the exchange rate.

The percentages of sign and magnitude asymmetries are too large to be ignored, but results show that the majority of Taiwanese firms is symmetrically exposed.

Concerning volatilities, only a small percentage of the sample exhibit significant exchange rate volatility impacts on stock returns: 7.5% at the 10% level of acceptance (3.7% at the 1% and 5% levels). At the 10% level, for 37.5% of the concerned firms, the sign of the coefficient is positive, meaning that currency volatility has a positive impact on stock return. It does not match the conventional wisdom especially that our sample includes only non-financial firms. Normally from its effects on cash flows (as mentioned in section 2) exchange rate volatility should have a negative relationship with stock returns. But at the 1% and 5% levels of acceptance, all currency volatilities coefficients are negative which is conforms to the conventional wisdom (Note 10). Therefore at the 10% level, we may just have a statistical effect.

For a large part of our sample, we observe the existence of a volatility of stock returns underlying exchange rate exposure (the second volatility we investigated in this study): 37.38% (32.71% and 19.63% respectively at the 5% and 1% levels). Strangely, 3.7% of our sample (Note 11) exhibit it while not being exposed. We cannot ignore it, even though the asymmetric volatility is not an easy process to explain.

Besides, our study shows clearly that stock return volatilities are time dependant. All significant coefficients provide evidence (not reported here) that stock return volatilities are a function of its past value as well as past squared errors. Persistence, measured by $\beta_{\varepsilon,i}$ (in conditional variance of $\varepsilon_{i,t}$), is quite high with an average of 0.874. It suggests that there is a long memory in the stock return volatility process.

In this model, association to good news happens when $\varepsilon_{i,t} > 0$ ($\gamma_i = 0$) and bad news when $\varepsilon_{i,t} < 0$ ($\gamma_i \neq 0$ is significant); If γ_i is positive, bad news increases volatility (Note 12).

Our results show that only 35% of the volatility coefficients (γ_i) are positive (thus increasing the volatility for the concerned firms). Usually, literature seems to mostly report positive coefficients, fact explained by the leverage effect or volatility feedback effect. So a large part of our Taiwanese sample facing volatility asymmetry exhibits a negative coefficient. The average positive coefficient γ_i is 0.027 and -0.030 for the negative one (+12.50%). It may seem counter-intuitive because it means that good news have a greater impact on the volatility than bad news, at least for 65% of the concerned firms. It shows that when good news hit the market, stock prices react positively and volatility increases all the more than if investors chase after good news, prices and volatility continue to rise. One explanation may be related to the trading noise hypothesis, investors having less useful trading information compared to investors in other stock markets and thus “chasing good news”, see for example French and Roll (1986) who linked trading volume and return volatility.

We may say that chasing good news behavior is related to positive-feedback trading which is a price- or trend-chasing trading strategy. Shi et al. (2012) studying individual US stocks from 1980 to 2009 found that 9.4% of their sample exhibit positive-feedback activities. They also found that “*these activities have a more profound effect on stocks with a higher level of information uncertainty*”.

Their findings may be another explanation of our results and support the “chasing good news behavior” hypothesis.

6. Concluding Remarks

Understanding exchange rate exposure and the various forms of volatilities is important in terms of firm valuation and risk management. If theory supports that firm value is impacted by currency changes, empirical evidences are mixed. We argue that sampling and methodology may be the reason for the weak evidences. In this study, we address the key issues mentioned in our introduction by choosing Taiwan which is a small and open economy. We also investigate asymmetries generated by the sign and amplitude of the exchange rate changes.

Finally, we study the impacts of currency volatilities and volatilities of stock returns underlying exchange rate exposure.

Taiwan is clearly a good laboratory: we find that 88.8%, 84.1% and 73.8% (respectively at the 10%, 5% and 1% levels of acceptance) are exposed to exchange rate fluctuations. This high percentage has been seldom found in previous studies. Moreover, all Taiwanese firms are negatively exposed (except one at the 10% level) meaning that conversely to the theory, firms' value increase when the domestic currency is appreciating. Nevertheless, this result is supported by Moran (2005) who also investigated an open economy.

Only 14% of the sample exhibit a sign and/or magnitude asymmetries. Results show that Taiwanese firms benefit from the sign asymmetry (mostly having a negative coefficient sign) and suffer from the magnitude asymmetry (coefficients are mostly positive). If this percentage is too large to be ignored, it still shows that the majority of Taiwanese companies is symmetrically exposed.

Concerning volatilities, only a small percentage of the sample exhibit significant exchange rate volatility impacts on stock returns: 7.5% (3.7% at the 1% and 5% levels). At the 1% and 5% levels of acceptance, all currency volatilities coefficients are negative which is conforms to the conventional wisdom and compatible with our results from the magnitude asymmetry.

For a large part of our sample, we also observe the existence of a volatility of stock returns underlying exchange rate exposure: 37.38% at the 10% level of acceptance (32.71% and 19.63% respectively at the 5% and 1% levels). We also notice that there is a long memory in the stock return volatility process.

Our results show that 35% of the volatility coefficients are positive (thus increasing the volatility for the concerned firms). This sign is explained by the leverage effect or volatility feedback effect. So a large part of our Taiwanese sample facing volatility asymmetry exhibits a negative coefficient (while literature mostly report positive signs). It may seem counter-intuitive because it means that good news have a greater impact on the volatility than bad news, at least for 65% of the concerned firms.

It may be explained by a chasing good news behavior from the investors in the Taiwan stock market, hypothesis being supported by the trading noise assumption of French and Roll (1986) and the effects of a high level of information uncertainty according Shi et al. (2012).

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Notes

Note 1. See for example Jorion (1990, 1991) or Dominguez and Tesar (2006).

Note 2. See Friberg and Nydahl (1999); Total trade represents 140% of the GDP in 2008, compared to 24% in U.S.

Note 3. See Jorion (1990) and Bodnar and Wong (2000) for a discussion on the importance to include the market return.

Note 4. See more about orthogonalized models in section 3.

Note 5. Bodnar and Gentry (1993) for example link it to the status of the market participants (exporter...).

Note 6. A company may be simultaneously an exporter and an importer.

Note 7. If $\beta_{2,i}$ is not significant, it may just mean that the firm has the same exposure behavior than the market.

Note 8. Finance theory stipulates that only unexpected changes in the exchange rate matters.

Note 9. We investigate firms' currency risk on the longest possible period of time and only 107 firms have available data for the sample period. We are aware of the potential survivorship bias in our conclusions.

Note 10. This is compatible with our results from the magnitude asymmetry (coefficients are mostly positive, thus affecting negatively the stock returns).

Note 11. Not reported here.

Note 12. It implies that in this case, bad news introduces more volatility than good news.

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