Adjustments of the Non-Financial Sector to the Rise in Exchange Rate Volatility and Their Policy Implications in Indonesia

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Abstract

This paper presents evidence on exchange rate exposure of the returns of five non-financial sectors—agriculture, mining, consumer goods, basic industry, and manufacturing—in Jakarta Stock Exchange. The data covers the period from January 2000 to July 2006 with monthly frequency. Using different measures of industry-specific real exchange rates, the results of this paper show that none of the five sectors are significantly exposed to exchange rate fluctuations at 5 percent significance level. From an anecdotal survey of a sample of non-financial publicly traded firms, we find that the hedging strategy of the firms in facing exchange rate risk vary across firms. Some firms engage in hedging while others do not. Hedging instruments used by the hedged firms include forwards, swaps, and options. For non-hedged firms, the main reason for not hedging is that the cost of currency hedging is greater than its benefit.

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1. Introduction

Following the crisis in 1997, Indonesia has shifted its exchange rate regime from managed floating to free floating. Not surprisingly, the most obvious result of the new regime is that exchange rate of the rupiah has become more fluctuated (see for example, Sahminan, 2005b). The implication of such a more fluctuated exchange rate on the corporate sectors, however, is not so obvious. Under the managed floating regime before the 1997's crisis, it was easier for corporate sectors to manage exposure to exchange rate fluctuations: firms were much easier to assess the magnitude of the change in exchange rate. Although the government devalued the rupiah against the US dollar under the managed regime, it only took place rarely. On the other hand, under the current regime—a free floating regime—exchange rate can change abruptly much more often.

The implications of exchange rate fluctuations on corporate sectors have been continuously debated both in academics as well as by practitioners. For many firms, fluctuations of exchange rate may represent a major risk, while for other companies such fluctuations are not a significant concern. Exchange rate changes can have substantial influences on the investment behavior, pricing behavior, and profitability of the firms that in turn influence the value of the firms. When the value of a firm is affected by fluctuations in exchange rate, the firm is said to be exposed to exchange rate risk. The effects of exchange rate fluctuations on a firm, of course, depend on factors inside the firm, including currency composition of the balance sheet of the firm, their dependence on imported inputs and the amount of output for exports. Moreover, the effect of the exchange rate fluctuations also hinges on hedging strategy of the firm[2].

The purpose of this paper is to examine exchange rate exposure of Indonesian non-financial sectors and hedging strategy undertaken by firms to deal with exchange rate risks. Specifically, we estimate the exposure of the non-financial sectors in Jakarta Stock Exchange (JSX). Then we examine the hedging strategy of non-financial firms in reducing exchange rate risks. Here we use industry-specific real exchange rate of the rupiah. The results of the paper shed light on the extent to which publicly traded firms in

[2] Internal factors can also be type of firm (domestic or multinational), market orientation of the firm (local or foreign), investment and financing policy.

Indonesia are exposed to exchange rate fluctuations and hedging strategy used by the firms to minimize the risk emanating from the exchange rate exposure.

The paper proceeds as follows. Section 2 reviews related literature on foreign exchange rate exposure. Section 3 presents conceptual frameworks of exchange rate exposure and empirical method. Section 4 lays out method used to calculate industry-specific real exchange rate. Section 5 presents data and their descriptive statistics. Section 6 provides estimation results of the exchange rate exposure models. Section 7 presents evidence on hedging strategy by a sample of publicly traded firms in Indonesia. The evidence on hedging is anecdotal—rather than statistical—which is based on interview on a number of firms. Finally, this paper concludes with Section 8.

2. Literature Review

This paper is related to the strand of literature on firms' exposure to exchange rate fluctuations. Adler and Dumas (1984) is one of the most cited studies on the definition and measurement of corporate exposure to exchange rate fluctuations. Their paper provides a concept of foreign exchange exposure and hedging of exchange rate risk based on a regression analysis. As Adler and Dumas (1984) argue, the regression coefficient concept of exposure can provide a single comprehensive measure that summarizes the sensitivity of the whole firm to all various ways in which exchange rate changes affect it. In their paper, Adler and Dumas (1984) do not provide empirical estimates of their model.

Following Adler and Dumas (1984), the study on the exposure to exchange rate fluctuations has been growing. Bodnar and Gentry (1993) examines exchange rate exposure at industry level in Canada, Japan, and the US. They found that, in all three countries, some industries show significant exchange rate exposure while other industries do not face significant exposure. For a sample of Japanese multinational corporations, He and Ng (1998) conducted a study to examine the exposures of those corporations to exchange rate fluctuations. They found that about 25 percent of the sample experienced significant positive foreign exchange exposure, and the extent of the exposure is determined by export ratio, leverage ratio, and firm size. Recently, Bartram and Bodnar (2005), provides a survey of the existing research on the exchange rate exposure of non-

financial firms. They show that only a small percentage of firms that have significant stock price exposure.

Another recent empirical study on the exchange rate exposure is Dominguez and Tesar (2006). Their study is a cross-country study using firm level data covering developing countries as well developed countries. Countries in their sample consist of Chile, France, Germany, Italy, Japan, Netherland, Thailand, and the UK. They found that the extent of exposure is robust at the country level and the direction of exposure depends on the specific exchange rate and varies over time. In addition, they also found that exposure is more prevalent in small-sized firms and, not surprisingly, in firms engaged in international activities.

From theoretical side, recently Bodnar, Dumas, and Marston (2002) provide theoretical models to predict exchange rate exposure of firms. They developed models of how pricing behavior of firms affect exposure of firms' profits to exchange rate. Their model results in an optimal pass-through decision by the firms to mitigate their exposure to exchange rate fluctuations. Unfortunately, using data of Japanese firms, empirical estimation of their models provide no consistent evidence. Bartram, Brown, and Minton (2006) have tried to resolve the puzzle on the foreign exchange rate exposure—discrepancy between theoretical predictions and observed foreign exchange exposure. They show that pass-through of exchange rate fluctuations to customers, choices of factory location, and financial products play an important role in creating discrepancy between theoretical predictions and observed foreign exchange exposure.

A study on the implications of exchange rate fluctuations on Indonesian non-financial firms can be found in Sahminan (2006). He estimates the effects of exchange rate fluctuations on the investments of the non-financial firms through balance-sheet effects. The sample in Sahminan (2006) covers non-financial firms traded in the JSX. The data he uses cover the period from 1995 to 2004 with yearly frequency. He found that exchange rate depreciation has a negative effect on the investment in current assets, but no significant effect on the investment in inventory.

In another study, Sahminan (2005a) examines the balance-sheet effects of exchange rate fluctuations on commercial banks in Indonesia. He uses firm-level data of commercial banks in Indonesia that covers the period from January 1995 to December

1999 with monthly frequency. He found that due to a higher amount of foreign currency assets relative to the amount of foreign currency liabilities, exchange rate depreciation results in a lower probability of bank failures. But, through reduced profit on lending in foreign currency, exchange rate depreciation results in a higher probability of bank failures.

While there are many empirical studies on the exchange rate exposure in industrialized countries, the study on the exchange rate exposure in many developing countries are limited. This paper fills such a gap in the literature. Specifically, this paper contributes to the literature in a number of respects. First, this paper provides estimates of industry-specific real exchange rate of the rupiah. Second, this paper provides empirical evidence on the exchange rate exposure of non-financial sectors in Indonesia. Finally, this paper provides anecdotal evidence on the foreign exchange hedging strategies of non-financial firms in Indonesia.

3. Concepts of Exchange Rate Exposure and Empirical Method

Adler and Dumas (1984), defines foreign exchange currency exposure as *"the amounts of foreign currencies which represent the sensitivity of the future, real domestic-currency (market) value of any physical or financial asset to random variations in the future domestic purchasing powers of these foreign currencies, at some specific future date."* The exchange rate fluctuations may affect traded goods and non-traded goods in different ways. By definition, non-traded goods are goods for which cannot be traded internationally for various reasons. By their nature, some goods and services must be produced and sold within domestic economy. Sometimes goods and services are non-traded because of government policies that they should not be exported or imported. Some goods and services may also be non-traded because they cannot be sold internationally due to their quality. Standard open economy macroeconomic models predict that the appreciation of the home currency induce a shift of resources from traded to non-traded sectors. The shifting in the allocation of resources causes the market value of capital in non-traded good industries rises in the short run given the capital is sector specific. This predicts a positive relation between the appreciation and the value of non-traded sectors.

For traded goods, goods that can be traded internationally, the movements of exchange rate change the relative prices of inputs and outputs that in turn affects the firm's current and future operating cash flows and thus its value. Consider a country in which all inputs for production are available from domestic markets that are insulated from international conditions. An appreciation of home currency, *ceteris paribus*, lowers the amount of domestic currency needed to purchase foreign goods and raises the amount of foreign currency to purchase domestic goods. In terms of domestic currency, this appreciation reduces cash flows of exporters because it may cause a decrease in foreign demand and a lower price cost margin. On the other hand, if domestic input markets are not insulated from international conditions, *ceteris paribus*, an appreciation of home currency lowers the home currency price of internationally-priced inputs. This in turn causes a fall in production costs and the firm's profitability rises.

Other than purchasing and selling goods in foreign currency, exchange rate movements may also directly affect the values of assets and liabilities of a firm thorough a change in domestic currency values of foreign currency denominated assets and liabilities. For example, firms holding foreign denominated debt have current and future domestic currency cash flows that depends on exchange rates. Similarly, firms with foreign investments have current and future cash flows denominated in foreign currency and therefore the home currency value of this stream of cash flows depends on exchange rate. In general, the value of the firms with net foreign denominated assets decreases with an appreciation of home currency, and increases with depreciation of home currency.

Following Adler and Dumas (1984), the definition of exchange rate exposure can be formulated mathematically as follows. Consider random return, *R*, of a risky asset on a given future date, and number of states of nature *K* is finite with known probabilities. In a given state *k*, the outcome R_K is associated with a vector of state variables, $S_k = \{S_1,...,S_n\}_k$. In the case of exchange rate exposure, the state variable is exchange rate E. Adler and Dumas (1984) define exposure as the current expectation of the partial sensitivity of R to S_i given other variables held constant, that is

$$\text{Exposure of } R \text{ to } S_i = E(\partial R / \partial S_i) \qquad (1)$$

If R and S are jointly normal, exposure of R to S_i becomes the partial regression coefficient of S_i in a linear regression of R on S. The definition of exposure can then be rewritten as

$$E(\partial R / \partial S_i) = E\left\{\frac{\partial[(R)|S]}{\partial S}\right\}$$

$$= \frac{\text{cov}[S_i, R|S]}{\text{var}(S_i)}$$

$$= b_{R,S_i|\bar{S}} \qquad (2)$$

which is a regression coefficient on S_i in the regression of R on S.

Adler and Dumas (1984) argue that regression analysis is the best way to measure currency exposure. Although their claim that regression technique is the best way may be too strong, but the regression technique seems to be one of the best ways to measure the exposure. The study by Bodnar and Gentry (1993) on the exchange rate exposure, for example, employ linear regression model to estimate currency exposure. Similarly, in estimating foreign exchange exposure, Dominguez and Tesar (2006) also employ the linear regression approach.

The empirical model in this paper follows the model widely used in assessing exchange rate exposure, as found in the literature. In this type of model, each firm's exchange rate exposure is measured relative to the market average. Let R_{it} be return of industry *i* at time *t*, and R_{mt} be return on market portfolio[3], then

$$R_{i,t} = \beta_{0,i} + \beta_{1,i} R_{m,t} + \beta_{2,i} \Delta E_{i,t} + \varepsilon_{i,t} \qquad (3)$$

Where,

$\beta_{0,i}$ = constant terms

β_{1i} = industry *i*'s market beta

β_{2i} = changes in returns due to movements in exchange rate

[3] In Dominguez &Tesar's (2006) paper, returns are weekly observations sampled on Wednesdays.

ΔE_{it} = change in relevant exchange rate

Coefficient β_{2i} captures the change in returns that can be explained by the exchange rate changes given market returns. In fact, the model above is Capital Asset Pricing Model (CAPM) in which only market risk's that relevant to firm's asset price in equilibrium. This implies that only changes in the market return that should be systematically related to firm returns. If the CAPM is the true model then β_{2i} should equal to zero, and there is no exchange rate risk. But if stock return is significantly exposed to exchange rate risk then β_{2i} should differ from zero. If exchange rate is defined as foreign currency in terms of domestic currency per foreign currency, then positive sign of β_{2i} means that an appreciation of domestic currency raises the value of the firm. On the contrary, negative sign of β_{2i} means that appreciation of domestic currency reduces value of the firm.

4. Industry-Specific Real Exchange Rate

While the analysis of real exchange rate movements at the national level relies on aggregate trade-weighted exchange rate, however, in conducting industry-level analysis such a measure can be less effective than industry-specific measure of real exchange rate (Goldberg, 2004). The importance of particular countries as competitors within an industry can differ substantially from their importance in the aggregate trade. The aggregate trade-weighted exchange rate does not take into account industry-specific distinctions concerning trade partners and competition.

To construct industry-specific trade-weighted real exchange rate we follow the method used by Goldberg (2004). As pointed out by Dominguez and Tesar (2006), many (if not most) studies on the exchange rate exposure use trade weighed exchange rate. In this respect we construct three industry-specific real exchange rates: imports-weighted real exchange rate, exports-weighted real exchange rate, and imports and exports weighted real exchange rate. Let, XER_t^i be exports-weighted real exchange rate of product *i*, MER_t^i be imports-weighted real exchange rate of product *i*, and TER_t^i imports

and exports-weighted real exchange rate of product *i*. Then each of those measures can be formulated as:

$$XER_t^i = \sum_c w_t^{ic} \cdot RER_t^c \quad \text{, where } w_t^{ic} = \frac{EXP_t^{ic}}{\sum_c EXP_t^{ic}} \tag{4}$$

$$MER_t^i = \sum_c w_t^{ic} \cdot RER_t^c \quad \text{, where } w_t^{ic} = \frac{IMP_t^{ic}}{\sum_c IMP_t^{ic}} \tag{5}$$

$$TER_t^i = \sum_c \left(\left(.5\frac{EXP_t^{ic}}{\sum_c EXP_t^{ic}} + .5\frac{IMP_t^{ic}}{\sum_c EMP_t^{ic}} \right) \cdot RER_t^c \right) \tag{6}$$

where EXP_t^{ic} is exports of product i to country c, IMP_t^{ic} is imports of product i from country c, RER_t^c is bilateral real exchange rate with country c, and subscript t refers to time.

Table 1: Commodity Groups in Indonesian Trade and Jakarta Stock Exchange

Trade Sector*)	JSX Sector
Food and Live Animals	Agriculture
Beverage and Tobacco	Consumer Goods
Crude Materials, Inedible	Agriculture
Mineral, Fuels, Lubricants, etc.	Mining
Animal & Vegetable, Oils & Fats	Agriculture
Chemical	Basic Industry
Manufactured Goods	Manufacturing
Machinery and Transport	Manufacturing
Miscellaneous Manufactured Goods	Manufacturing

Note: *) Based on 1-digit SITC

The first step undertaken is to match trade sectors with the sectors in the JSX. Here we take one-digit Standard International Trade Classification (SITC) of the exports and imports and then that classification is matched with the JSX sectors, the result is shown in Table 1. The second step is to calculate share of exports and imports of the

Indonesian main trading partners. Countries included in calculating the weights are Japan, US, Singapore, Korea, China, Taiwan, German, and the UK. Those countries are also the countries used by Bank Indonesia in calculating real effective exchange rate of the rupiah[4].

Composition of Indonesian exports by country of destination and imports by country of origin are presented in Table 2. As shown in Table 2, the US, Japan and Singapore are the main countries destination of Indonesian exports. Meanwhile, although Japan and the US remain the main country of origin of Indonesian imports, China also plays an important role. Finally, using equations (4), (5), and (6), together with the weights obtained in the second steps, we calculate industry-specific real exchange rates for agriculture, mining, consumer goods, basic industry, and manufacturing.

Table 2: Composition of Indonesian Exports by Country of Destination and Imports by Country of Origin, 2000-2006.

Country	Exports by Destination	Imports by Origin
USA	15.01	10.53
Singapore	10.89	7.39
Japan	14.87	17.22
China	5.33	9.62
S. Korea	3.77	5.45
Taiwan	2.74	3.58
U.K.	2.52	1.92
Germany	2.76	4.68

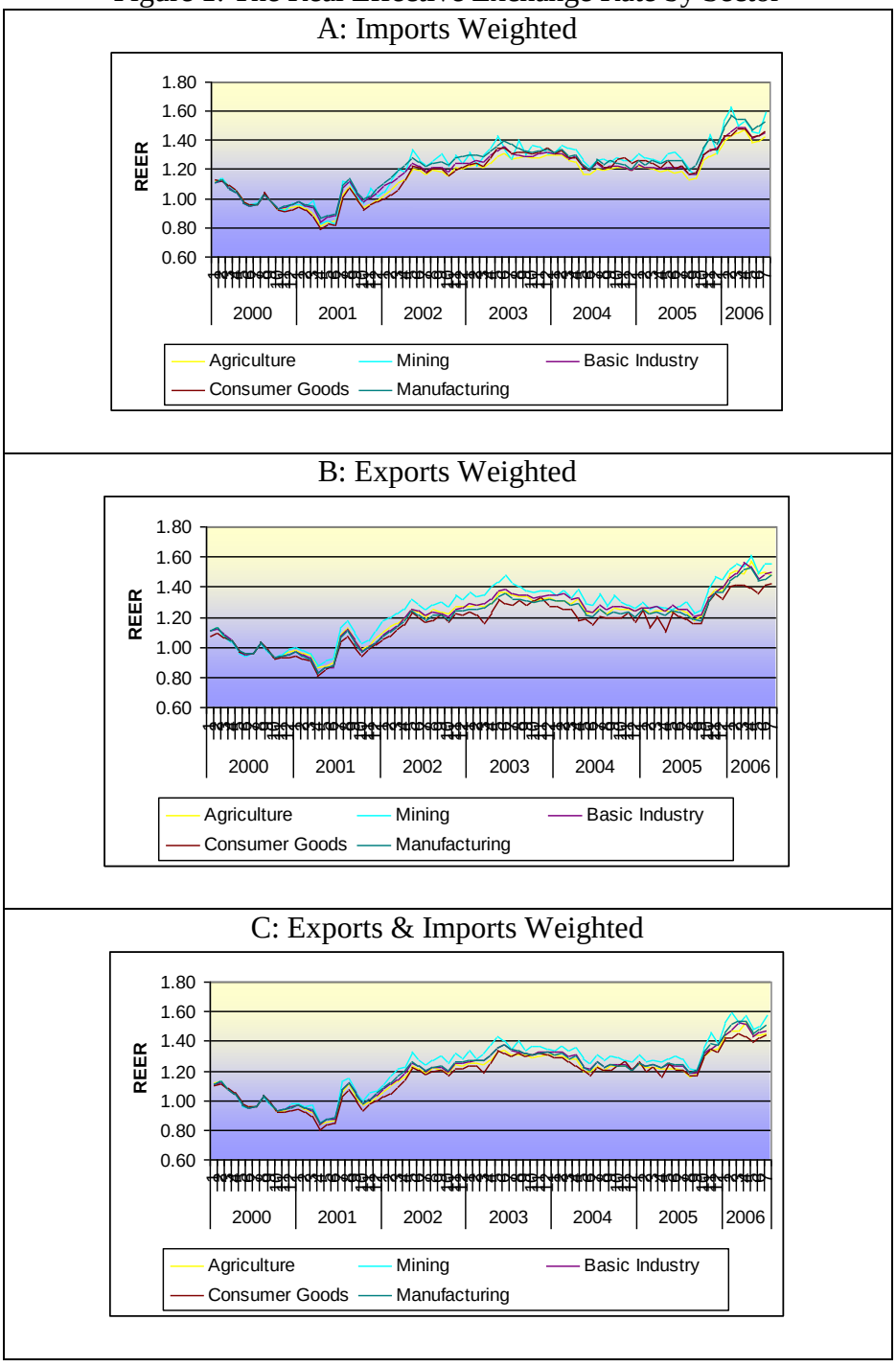
Source: Author's calculation

Figure 1 exhibits the movements of Indonesian trade-weighted real exchange rates over the period of January 2000-July 2006. As shown in Figure 1, trade-weighted real exchange rate for different sectors moved quite close to each other. The coefficient correlations of the changes in industry-specific real exchange rates across industries range from 0.75 to 0.97. Similarly, using different weight, the dynamics of the real effective exchange rate also show quite similar patterns. Coefficient correlation of the

[4] Bank Indonesia, for example, calculates monthly trade-weighted real exchange rate of the rupiah.

changes in industry-specific real exchange ranges using different weights range from 0.75 to 0.99. From January 2000 to mid-2001, all industry-specific real effective exchange rate tended to depreciate, and then tended to appreciate until mid-2003. In late 2005, a substantial appreciation of the real effective exchange rate took place.

Figure 1: The Real Effective Exchange Rate by Sector



5. Data and Descriptive Statistics

Data we use in this paper cover the period from January 2000 to July 2006 with monthly frequency. Stock index data by sector are obtained from CEIC Database. Return on industry *i* is calculated as a percentage monthly change of the stock price index of sector *i* in the JSX. For the purpose of the study we only take tradable sectors consists of five sectors: agriculture, mining, basic industry, consumer goods, and manufacturing. Base year used to construct the index is the year 2000, considering that macroeconomic situation in Indonesia was relatively stable in that year[5].

Table 3: Descriptive Statistics of the Monthly Stock Return

Sector	Mean	Std Dev	Min	Max
All	1.18	6.95	-13.75	15.20
Agriculture	2.02	10.77	-24.52	25.65
Mining	2.37	11.53	-15.44	63.62
Basic Industry	0.23	8.50	-19.34	18.88
Consumer Goods	0.91	7.72	-20.33	25.13
Manufacture	0.68	7.04	-14.23	18.62

Descriptive statistics of the stock return by sector is presented in Table 3. Over the period of the study, among the five sectors, mining is the sector with the highest return (2.37 percent), and basic industry is the sector with the lowest return (0.23 percent). Looking at the volatility—measured by coefficient of variation—, the return of basic industry is the most volatile while the least volatile is the return of mining.

Descriptive statistics of the industry-specific real exchange rate are presented in Table 4. As shown in Table 4, among the five sectors the trade-weighted exchange rate of the mining sector experienced the highest change while the trade-weighted exchange rate of mining experienced the lowest. Measured by coefficient of variation, the trade-weighted exchange rates of the five sectors do not show substantial differences.

[5] Year 2000 is also the most recent year used by Indonesia's Central Statistics Agency (BPS) as a base year for various economic indicators.

Qualitatively, the statistics of the trade-weighted exchange rate using different weight also show consistency among each other.

Table 4: Descriptive Statistics of the Changes in Industry-Specific Real Exchange Rate Changes

Sector	Mean	Std Dev	Min	Max
Weight: Import				
Agriculture	0.40	4.28	-9.32	21.18
Mining	0.71	7.15	-16.40	35.38
Basic Industry	0.43	4.31	-10.64	21.86
Consumer Goods	0.44	4.65	-10.03	22.63
Manufacture	0.51	4.39	-9.47	22.21
Weight: Exports				
Agriculture	0.46	4.35	-9.59	21.81
Mining	0.55	4.76	-9.35	23.03
Basic Industry	0.47	4.34	-10.80	23.16
Consumer Goods	0.48	4.94	-10.95	18.81
Manufacture	0.46	4.32	-10.03	22.27
Weight: Imports & Exports				
Agriculture	0.42	4.24	-9.46	21.51
Mining	0.60	5.54	-12.92	28.87
Basic Industry	0.45	4.29	-10.72	22.50
Consumer Goods	0.45	4.55	-10.50	20.66
Manufacture	0.48	4.31	-9.75	22.24

6. Estimation Results

Using equation (3) we estimate exchange rate exposure of every sector covered in this study, and the results are presented in Table 5. The estimation is conducted using ordinary least square (OLS). In estimating the model, two issues may arise. The first issue is the possibility of simultaneity between exchange rate and stock return. Despite the possible simultaneity, however, the partial equilibrium assumption that the exchange rate is exogenous to industry value is justifiable for a single industry. As argued by Bodnar and Gentry (1993), if industry is a small part of a country's activity in

international economy, the exchange rate depends much more on events in other industries than on events in the industry under consideration. Another issue is the possibility of high correlation between market return and exchange rate return. The coefficient correlation between market return and exchange rate return do not show high correlation, ranging from 0.14 to 0.38.

Table 5. Estimation Results of the Exposure Equations

Variables	Agriculture	Mining	Basic Industry	Consumer Goods	Manufacturing
Panel A: Using Import Weighted RER					
Constant	1.009	1.443	-1.006*	-0.158	-0.471**
	(1.041)	(1.129)	(-0.541)	(0.439)	(0.235)
Market return	0.730**	0.930**	1.005**	0.975**	0.959**
	(0.160)	(0.162)	(0.082)	(0.068)	(0.035)
RERm	0.465*	-0.042	0.127	-0.053	0.038
	(0.260)	(0.158)	(0.133)	(0.101)	(0.056)
No. of Obs.	78	78	78	78	78
Adjusted R^2	0.3024	0.2895	0.7000	0.7540	0.9157
Panel B: Using Export-Weighted RER					
Constant	0.980	1.502	-1.004*	-0.176	-0.466**
	(1.049)	(0.119)	(0.543)	(0.439)	(0.236)
Market return	0.756**	0.985**	1.010**	0.951**	0.961**
	(0.158)	(0.167)	(0.083)	(0.065)	(0.036)
RERx	0.399	-0.284	0.101	0.047	0.024
	(0.253)	(0.245)	(0.133)	(0.092)	(0.058)
No. of Obs.	78	78	78	78	78
Adjusted R^2	0.2960	0.3014	0.699	0.7540	0.9154
Panel C: Using Import and Export Weighted RER					
Constant	0.992	1.473	-1.005*	-0.165	-0.468**
	(1.043)	(1.126)	(0.542)	(0.440)	(0.236)
Market return	0.740**	0.949**	1.007**	0.961**	0.960**
	(0.159)	(0.164)	(0.083)	(0.067)	(0.036)
RERxm	0.447*	-0.137	0.116	0.0005	0.031
	(0.262)	(0.207)	(0.134)	(0.103)	0.058)
No. of Obs.	78	78	78	78	78
Adjusted R^2	0.3000	0.2930	0.699	0.7531	0.9156

Notes: Numbers in in the parentheses are standard error of the estimates

**) Significant at 5 percent alpha; *) Significant at 10 percent alpha

The estimation results show that, regardless of the weight used in calculating trade-weighted real exchange rate, the coefficients of market return in all sectors are significant at 5 percent significance level. On the other hand, in none of the sector the coefficient of exchange rate is significant at 5 percent significance level. The results are quite robust to different weight used in constructing industrial real exchange rates. Using different weight in calculating the trade-weighted real exchange rate, the qualitative of the results do not change.

At 10 percent significance level, only the coefficient of exchange rate in agricultural sector that is significant. This result shows that a one percent increase (appreciation) in real exchange rate leads to roughly 0.5 percent increase in the stock return of agricultural sector. While this result is contradicted with the prediction of the theory that appreciation lower export competitiveness that can lead to lower competitiveness, we can conjecture that this result could be driven by improving balance sheet of this sector as a result of appreciation. Companies with highly indebted in foreign currency may gain from appreciation in exchange rate.

Table 6. Estimation Results of the Exposure Using Panel Data Regression

Variables	Model 1	Model 2	Model 3
Constant	0.160	0.164	0.161
	(0.430)	(0.431)	(0.431)
Market return	0.932**	0.935**	0.932**
	(0.051)	(0.051)	(0.051)
RERm	0.060		
	(0.069)		
RERx		0.045	
		(0.079)	
RERxm			0.057
			(0.077)
No. of Obs.	390	390	390
R^2	0.4974	0.4969	0.4972

Notes: Numbers in in the parentheses are standard error of the estimates
**) Significant at 5 percent significance level

In addition to estimating the model for each sector separately, we also estimate a model for all five sectors using panel regression method. The main issue in panel regression is whether the estimation uses fixed effects or random effects. As argued by

Greene (2000), using fixed effect model is a more appropriate approach when the difference between individuals can be viewed as parametric shifts of the regression function. On the other hand, random effects model is preferable if individual specific constant terms are viewed as randomly distributed across cross-sectional units. Thus, random effect is appropriate if the sample cross-sectional units were drawn from large population. In addition, from a purely practical standpoint, the random effects model has some intuitive appeal since the dummy variable approach is costly in terms of degrees of freedom lost. Based on that argument, in this paper we use random effect model[6]. As shown in Table 6, real exchange rate does not significantly affect the stock return in the JSX. Also, the results show that there is no significant difference of the stock return across sectors in the JSX.

Overall, the estimation results—both regressions for individual sector as well as panel regression—show that, at 5 percent significance level, none of the sectors of the publicly traded firms in Indonesia is significantly exposed to the exchange rate fluctuations. The results we found here is consistent with the results found in the literature (see for example, Bartram, Brown, and Minton (2006)) in which there is only a weak response of stock price index to exchange rate fluctuations. As found by Bartram, Brown, and Minton (2006), corporations may manage the exchange rate risk through various channels including passing part of the exchange rate through customers, and employing financial risk management strategies such as foreign exchange rate derivatives transactions. In the following section we discuss how firms in Indonesia manage the risk of exchange rate movements.

7. Hedging Practices on Foreign Exchange Risk in Indonesia

Adler and Dumas (1984) define hedges as *"the amount of the foreign-currency financial transactions required to render the future, real, domestic-currency market value of an exposed position statistically independent of unanticipated, random variations in the future domestic purchasing powers of these foreign currencies."* Hedging is not elimination of risk, but it is a matter of choosing what risk one is willing to assume Børsum and Ødegaard (2005). According to Børsum and Ødegaard (2005), hedging does

[6] In fact, we also estimated using fixed effects, but none of the sector-specific parameter is significant at 5 percent significance level.

not necessarily use financial derivative, instead hedging can also be in the form of natural hedging which refers to situations where income and expenses are denominated in the same currency.

The survey literature found in Børsum and Ødegaard (2005) shows that the use of derivatives in non-financial firms is relatively high. Across countries, the companies using derivatives account for 40 percent to 60 percent, and the most frequently hedged risk is exchange rate risk, followed by interest rate risk. Moreover, they also find that the larger companies are more inclined to engage in hedging compared to smaller firms. Loderer and Pichler (2000) classify corporate exchange rate risk management into four possible strategies. First, corporate avoid exchange rate risk by avoiding risk through avoiding transactions that expose the company to exchange risk. Second, corporate reduce the risk of loss through, for example, the choices production locations. Third, corporate passes the risk to others through hedging instruments, insurance, and diversification. Finally, corporate choose to bear the risk on the ground that risk to a certain level is a rational decision.

In the case of companies do not hedge their exposure naturally they may hedge through financial derivatives. The most important instruments for derivative financial markets for currency are forward, swaps, and options (Børsum and Ødegaard, 2005). An outright foreign currency forward fixes the future exchange rate at a given value and a given future transaction date. Foreign currency swaps fixes the future exchange rate at a given value and given future transaction, but both parties swap cash flows. Foreign currency option is an agreement that guarantees a set exchange rate at a set future date for a set amount of currency, but the holder may choose whether to use the option or not.

In Table 7 we present over the counter (OTC) foreign exchange derivatives turnover in Indonesia in 2001 and 2004. These data are obtained from the Bank for International Settlement (BIS) triannual survey on foreign exchange markets. As the table shows, foreign exchange derivatives in Indonesia were dominated by swaps. In total, the amount of foreign exchange derivative increased by 150 percent during the period of 2001-2004. The role of foreign exchange swaps increased substantially from 57 percent in 2001 to 89 percent in 2004.

Table 7: Daily Average of the OTC Foreign Exchange Derivative Turnover in Indonesia in 2001 and 2004

Foreign Exchange Derivative	April 2001		April 2004	
	In mill US$	(%)	In mill US$	(%)
Outright forwards	210	39.3	110	8.1
Foreign Exchange Swaps	305	57.1	1213	89.5
Currency Swaps	18	3.4	20	1.5
Options	-	-	11	0.8
Total	534	100	1355	100

Source: Triennial Central Bank Survey of Foreign Exchange and Derivatives Market Activity in April 2004 published by the BIS.

To take a closer look at hedging practices by firms in Indonesia, we conducted an anecdotal survey on a sample of non-financial firms. The firms in the sample are chosen based on their size in terms of value of assets. All the firms chosen are the publicly traded firms at the JSX, considering the exposure model are estimated for publicly traded firms. The questions asked in the questionnaire consist of: (i) foreign exchange transactions, (ii) method used to assess foreign exchange risk, (iii) hedging instruments used by the firms engaged in hedging, (iv) hedging motivation of the firms engaged in hedging, and (v) the reasons for not hedging for firms do not engage in hedging.

We interviewed a sample of twenty firms and then sent each of them a questionnaire containing questions mentioned above. Out of the 20 questionnaires sent, we receive back 10 answered questionnaires. The information we obtain from the questionnaires are as follows. Nine out of the 10 firms are engaged in purchasing and selling goods in foreign currencies, while 4 firms engage in borrowing and saving in foreign currencies. In assessing foreign currency risk, 4 firms employ exposure estimation while 6 firms employ cash flow and/or value at risk. Out of the 10 firms, 5 firms use financial hedging instruments in which 4 firms use forwards, 2 firms use swaps, and 3 firms use options. All firms engaged in hedging say that the motivation for hedging is to reduce fluctuations in income or expenses in foreign currency, while only 1 firm that uses hedging to reduce cost of capital. For the firms that do not hedge, 1 firm says that it is sufficiently financially robust to bear exchange rate fluctuations, 2 firms say that cost

of currency hedging is greater than its benefit, and 1 firm says currency hedging is not available to the firm.

The findings from the anecdotal survey show that although firms are engaged in foreign currency purchasing and selling or foreign borrowing and saving, only part of them that are engaged in hedging, in which the main instrument used for foreign currency hedging is forwards. For the firms that are not engaged in hedging, the cost of hedging larger than its benefits seems to be the main reason, although it can also be the case that firm is financially robust to bear exchange rate fluctuations.

8. Conclusions

This paper presents evidence on exchange rate exposure of non-financial sectors in Indonesia. The study covers five sectors—agriculture, mining, consumer goods, basic industry, and manufacturing—in the JSX. The data covers the period from January 2000 to July 2006 with monthly frequency. Following a method widely used in estimating exchange rate exposure, we estimate exchange rate exposure of the stock return at industry level at the JSX. The exchange rate used in this paper is industry-specific real exchange rate. We constructed industry-specific real exchange rate weighted by Indonesian trades with its eight main trading partners: Japan, US, Singapore, Korea, China, Taiwan, German, and UK.

The results of this paper show that, using different measure of industry-specific real exchange rates, none of the five sectors are significantly exposed to exchange rate fluctuations at 5 percent significance level. This means that using data at industry level, the domestic currency returns of publicly traded firms are not affected by the movement in real exchange rate.

To examine how non-financial firms deal with exchange rate risks, we conducted an anecdotal survey of a sample of non-financial publicly traded firms. We find that the hedging strategy of the firms in facing exchange rate risk varies across firms. Some firms engage in hedging while others do not. Hedging instruments used by the hedged firms include forwards, swaps, and options. For non-hedged firms, the main reason for the firms not to hedge is that the cost of currency hedging is greater than its benefit.

In sum, the exchange rate fluctuations since 2000 do not seem to significantly affect the value of the non-financial sectors in the JSX. On the other hand, given the fluctuated exchange rate, some firms are not engaged in hedging mainly due to the cost of hedging. Developing and increasing the efficiency of markets for foreign exchange hedging seems to be essential in order to make firms more attracted to engage in hedging their foreign currency risk that in turn make them more robust to the exchange rate fluctuations.

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