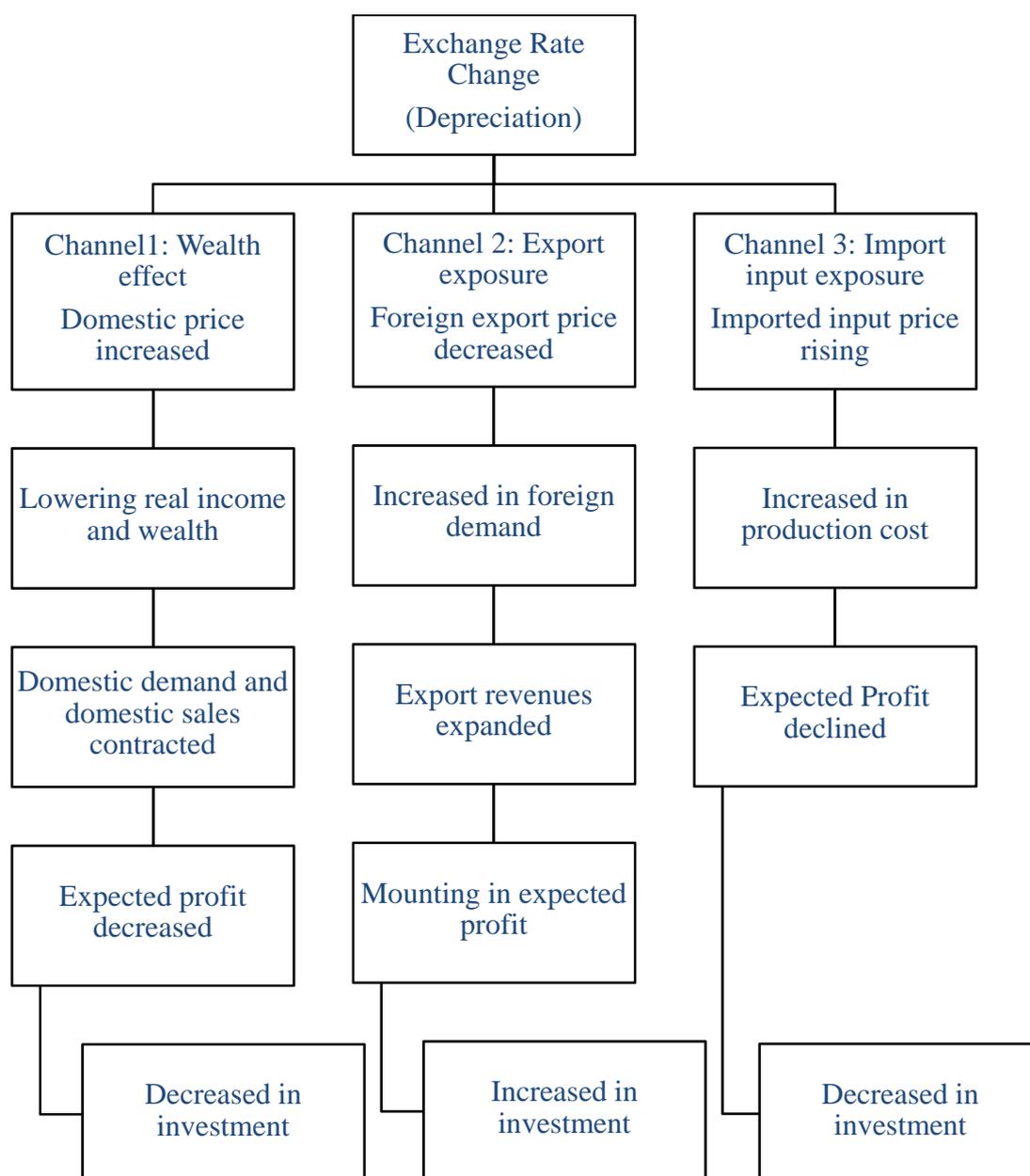# CHAPTER 4

EMPIRICAL RESULTS

Having discussed theoretical framework behind the relationship between exchange rate movements and investment, this chapter provides the empirical result of this study. The result can be divided into three parts consistent with our three objectives The first result is to examine the effect of exchange rate changes through the channel of exposure on investment and the degree of markup. The second result is to reveal the behavior of investment responsiveness to exchange rates in 9 industries. The last result is to disclose the effect of exchange rates on firm's investment in various types of firm's classification.

Derived from the theoretical model developed by Campa and Goldberg (1999), the empirical investigation of changes in exchange rate and investment could be summarized through three channels. The first channel is called the wealth effect channel. Exchange rate depreciation will increase domestic prices, in response to an increase in competing imported goods. This rise in prices would lower the real income and wealth, which induces firms to revise their future demand. The contraction in domestic revenues would destroy the firm's profitability and investment. We expect the negative relationship between exchange rates and firm's investment through the wealth effect channel. Strictly speaking, β_1 is expected to be negative. The second channel is concerned with export revenues. A depreciation would decrease export prices in terms of foreign currency. This leads to an increase in foreign demands and export revenues which benefits investment. The relationship between exchange rates and investment is positive through export channel, and we expect that β_2 is positive. The third channel is through imported input channel. Exchange rate depreciation will increase imported input prices in terms of local currency. The escalation in import production cost will decrease a firm's profitability and dampen investment. Exchange rates and investment are expected to be negative through imported input channel, we expect that β_3 is negative. Figure

4.1 illustrates the mechanism of exchange rate transmission to investment as mentioned earlier.

Figure 4.1

Channels of exchange rates transmission to firm's investment

```
                    ┌─────────────────┐
                    │  Exchange Rate  │
                    │     Change      │
                    │ (Depreciation)  │
                    └─────────────────┘
          ┌──────────────────┼──────────────────┐
 ┌─────────────────┐ ┌─────────────────┐ ┌─────────────────┐
 │ Channel1: Wealth│ │ Channel 2: Export│ │ Channel 3: Import│
 │     effect      │ │    exposure     │ │  input exposure │
 │ Domestic price  │ │Foreign export price│ Imported input price│
 │   increased     │ │   decreased     │ │     rising      │
 └─────────────────┘ └─────────────────┘ └─────────────────┘
 ┌─────────────────┐ ┌─────────────────┐ ┌─────────────────┐
 │Lowering real income│Increased in foreign│ │  Increased in   │
 │  and wealth     │ │    demand       │ │ production cost │
 └─────────────────┘ └─────────────────┘ └─────────────────┘
 ┌─────────────────┐ ┌─────────────────┐ ┌─────────────────┐
 │Domestic demand and│Export revenues  │ │Expected Profit  │
 │  domestic sales │ │   expanded      │ │   declined      │
 │   contracted    │ │                 │ │                 │
 └─────────────────┘ └─────────────────┘ └─────────────────┘
 ┌─────────────────┐ ┌─────────────────┐
 │ Expected profit │ │Mounting in expected│
 │   decreased     │ │    profit       │
 └─────────────────┘ └─────────────────┘
    ┌─────────────────┐ ┌─────────────────┐ ┌─────────────────┐
    │  Decreased in   │ │  Increased in   │ │  Decreased in   │
    │   investment    │ │   investment    │ │   investment    │
    └─────────────────┘ └─────────────────┘ └─────────────────┘
```

Source: Summary from Campa and Goldberg (1999)

4.1 The channel of exposure and the role of price-cost markup

We estimated equation (2.12) to investigate how exchange rate affects investment through the three channels of exposure. Pooled panel data was estimated by the feasible generalized least square. We corrected the heteroskedasticity problem across panels since we found the evidence of this problem arising in the model. The rejection of a modified Waldtest statistic under the null hypothesis that variance of each cross-sectional units will be equal means that there exists the groupwise heteroskedasticity problem. The correction is to use GLS estimator that is weighted for each group's variance. However, regarding the autocorrelation problem, we scrutinized by Wooldridge test. The acceptance of the null hypothesis at 0.1375 p-value means that there is no autocorrelation in the model.

Table 4.1 shows the estimation result. Two years are lost from the sample period of estimation due to the lag of the growth rate in sale. We have 645 firms each year, hence the total are 1,935 observations. The result shows the coefficient associated with exchange rate changes, and exchange rate interacted with export share and imported input share. As Campa and Goldberg (1995) suggested that the relationship between exchange rates and pattern of investment has strongly relied on the channel of exposure. Thereby, the responsiveness of investment to exchange rates has shifted over time depending on which channel exchange rates would be more exposed.

Column 2 in table 4.1 presents the result of the whole sample. Investment regression generates the negative sign on the changes in exchange rates through β_1 (wealth effect) as expected, and statistically significant at 1% level. This suggests that depreciation lowers the real income and wealth, and induces firms to postpone the investment project, regardless of the orientation of the firm. The coefficient of the interaction between export share and exchange rate changes ($x_{t-1}\Delta e_t$) is positive and statistically significant, implying that baht depreciation against US dollar stimulates firm's investment in relation to export exposure. Exchange rate depreciation would enhance the competitiveness in export market which could increase more export revenues, marginal profitability in capital, and hence investment. The positive effect

of exchange rate depreciation on export revenues and investment is the answer why many of developing countries favor depreciation strategy. However, the interaction between imported variables and exchange rate changes ($\alpha_{t-1}\Delta e_t$) is positive but insignificant. The insignificant result on imported input channel could be due to the fact that the average imported share of the sample is small (about 17.52 percent), and the sample is dominated by firms with small share of imported contents. Specifically, there are 68 percent of firms containing imported input share lower than the average of 17.52 percent. The lack of variation of this share might cause the insignificant result.

Table 4.1

Estimation Results of the following equation:

$$I_t^i = (\beta_1 + \beta_2 x_{t-1} + \beta_3 \alpha_{t-1})\Delta e_t + \beta_4 \Delta S_{t-1}^i + \beta_5 r_{t-1}^i + \varepsilon_t^i$$

Variables	Whole sample	High-Markup firms	Low-Markup firms
Δe_t	-0.0649***	-0.0126*	-0.0695***
	(-11.10)	(-1.82)	(-10.29)
$x_{t-1}\Delta e_t$	0.0129**	0.0178***	0.0184***
	(2.27)	(3.12)	(2.83)
$\alpha_{t-1}\Delta e_t$	0.0100	-0.0239***	0.0169**
	(1.27)	(-2.80)	(2.05)
S_{t-1}	0.1252***	0.2622***	0.1053***
	(6.26)	(15.00)	(7.81)
r_{t-1}	-0.0464***	0.0276*	-0.0435***
	(-3.25)	(1.74)	(-2.76)
Wald test	[0.0000]	[0.0000]	[0.0000]

Source: Author's estimation from sample data

Note:

- Sectoral dummies are included in estimation.

Note (continued):

- Numbers in parenthesis are Z values, numbers in square brackets are p-values.

- * indicates significance at the 10% level, ** at 5% level, and *** at 1 % level.

- Wald test is a test of joint significance for all explanatory variables in the model.

- The number of the whole sample is 1,935 observations. The number of high markup observation is 656, and low markup observation is 1,279 observations.

The effects of other variables such as growth rate in sales and interest rate, as additional control for investment decision, are statistically significant, and of the expected sign. A growth in sale has a positive effect on investment while interest rate has a negative effect on investment. The Wald test shows the joint significance of all explanatory variables in the model.

We also explore the relationship between exchange rates, investment, and the role of price-cost markup by splitting the whole sample by their mean markup value into high and low markup firms to test the sensitivity of exchange rates on investments of these two groups. In this sample data, firms with markup larger than the average of 1.62 are considered as the high-markup firms, while firms with markup of less than 1.62 are considered as the low-markup firms. The result of the two groups is shown in table 4.1 in column 3 and 4.

Exchange rate changes have statistically significant impact on investment in both high- and low-markup firms, but the absolute size of each channel of exchange rate implications is larger in low markup group as expected. This implies that high markup firms absorb the impact of exchange rate changes in their markup more than low markup firms; thereby investment in this group are less sensitive to exchange rate changes.

In high markup firms, exchange rate depreciation causes a negative consequence on investment without considering the foreign exposure. Regarding the channel of exchange rate exposure, a depreciation stimulates investment in relation to

export exposure and contracts investment in relation to imported input share. The Wald test rejects the null hypothesis that all coefficients are jointly equal to zero. However, in low markup firms, exchange rate depreciation lowers investment, without the interaction of any foreign exposure, an opposition effect occurs with the interaction of exchange rate changes and export share. The negative impact of exchange rates on investment through the imported input channel is not exhibited in low markup firms. Instead, there exists the positive relationship between exchange rates and investment through this channel. The opposition sign through imported input channel between the two groups may explain why the pooled result of this channel is insignificant. Moreover, since the sample is dominated by the group of low markup firm; that is, 66 percent of firms in the sample are classified by low-markup firms, the sign of the pooled result is likely to be positive as appearing the same as low markup firms' result.

Overall effect of exchange rate on investment

We incorporate the idea of exposure channel and the price-cost markup interacting with the exchange rate. The result of estimation equation (2.13) in the whole sample is provided in table 4.2. We utilize the generalized least square estimator to estimate coefficients of explanatory variables. We also correct for the heteroskedasticity problem across panels as we reject the null hypothesis of a Modified Wald test that $\sigma_i^2 = \sigma^2$ for all $i = 1,..., N_g$, where N_g is the number of cross-sectional units, at 1% level.

For the effect of exchange rate changes through the wealth effect, baht currency depreciation against US dollar decreases the investment since the coefficient of β_1 shows significantly negative relation between exchange rate changes and investment. Exchange rate depreciation decreases the purchasing power which causes the revision of investment project. The interaction with a decreasing function of price-cost markup implies that this effect will be higher in firm with low price-cost markup value, as we show the evidence in previous section. Regarding export channel, the effect of exchange rate depreciation on investment is positive, increasing with the exposure to exports but decreasing with the degree of price-cost markup. The

coefficient of the exchange rate changes in relation to imported input is positive and statistically significant. However, the sale growth is a statistically positive significance to investment while interest rate is a statistically negative significance, as we expected. Besides, the hypothesis that all coefficients are jointly equal to zero is rejected.

Table 4.2

Results of the estimation allowing for the foreign exposure and price-cost markup in the whole sample

$$I_t^i = \left(\frac{\beta_1}{AMKUP_{t-1}^i} + \frac{\beta_2 X_{t-1}^i}{AMKUP_{t-1}^i} + \frac{\beta_3 \alpha_{t-1}^i}{AMKUP_{t-1}^i}\right)\Delta e_t + \beta_4 S_{t-1}^i + \beta_5 r_{t-1}^i + \varepsilon_t^i$$

Variables	Result
$\Delta e_t / amkup_{t-1}$	-0.0880***
	(-13.57)
$x_{t-1}\Delta e_t / amkup_{t-1}$	0.0104*
	(1.30)
$\alpha_{t-1}\Delta e_t / amkup_{t-1}$	0.0277***
	(2.67)
S_{t-1}	0.1240***
	(6.24)
r_{t-1}	-0.0416***
	(-4.18)
Wald test	[0.0000]

Source: Author's estimation from sample data

Note:

- The results are from estimation of equation (2.13) including sectoral dummies.
- Numbers in parenthesis are Z values, numbers in square brackets are p-values.

Note (continued):

- * indicates significance at the 10% level, ** at 5% level, and *** at 1 % level.
- Wald test is a test of joint significance for all explanatory variables in the model.

The average investment exposure to exchange rates can be calculated by multiplying the estimated coefficient interacting with exchange rate changes in each channel and sum up $\left[\beta_1(\frac{1}{amkup_{it}})+\beta_2(\frac{x_{it}}{amkup_{it}})+\beta_3(\frac{\alpha_{it}}{amkup_{it}})\right]$. According to the result shown above, the average effect of exchange rate on investment in the sample is -0.052, implying that 10 percent depreciation of baht against US dollar decreases investment by 0.5 percent. The decrease in investment caused by a depreciation comes from the domination of the negative effect by changes in exchange rate through wealth effect channel.

4.2 The effect of exchange rate on firm's investment: industry-level analysis

We also estimated and reported the result in 9 industries (table 4.3). There are 6 out of 9 industries statistically significant with the expected sign through β_1, 4 out of 9 industries are positively significant through β_2. Only 2 out of 9 industries are significant through β_3, one with the correct sign. Overall, 6 out of 9 industries are significant through at least one channel of exposure; that is, investment in two thirds of industry in manufacturing are affected by the changes in exchange rates.

Table 4.3

Industry investment exposure to exchange rates

Industry	β_1	β_2	β_3	Average effect
Food and Beverage (Export-oriented industry)	-0.0766***	0.0665**	0.0773	-0.0647
Textile, Apparel and Leather (Export-oriented with high import content industry)	-0.0508***	0.0245*	0.0484***	-0.0339
Wood products and Furniture (Export-oriented industry)	-0.1107***	0.0817**	-0.2468***	-0.0657
Paper Printing Publishing (Domestic-oriented industry)	-0.1331***	0.0163	0.1385	-0.0823
Chemicals, Petroleum, Coal, Rubber and Plastic Products (Import content industry)	-0.0821***	0.0268	-0.0056	-0.0522
Non-metallic, Mineral products (Domestic-oriented industry)	0.0436	-0.0211	0.0733	-
Basic metal and Metal product (Import content industry)	0.0108	0.0076	0.0421	-
Machinery and Equipment (Export-oriented with high import content industry)	-0.0943***	0.0584*	-0.0224	-0.0440
Vehicle, Transportation (Import content industry)	0.0164	0.1861	-0.1728	-

Source: Author's estimation from sample data
Note: * indicates significance at the 10% level, ** at 5% level, and *** at 1 % level.

The effect of exchange rates on investment through the wealth effect channel is negatively significant in all industries except in non-metallic industry, basic metal industry, and vehicle industry. This finding implies that a depreciation discourages firm's investment by lowering real income and wealth of an investor. The effect of exchange rates through wealth effect has influenced on investment in most industries no matter whether they are domestic-oriented, export-oriented, or import content industries.

However, for those three industries that are not significant with exchange rates, the effect of exchange rates on investment is insignificant not only through β_1 but also through β_2 and β_3. These industries have similar characteristics in the sense of domestic-market oriented with high degree of markup (as specified in chapter 4). The reliance on domestic-market causes these industries not to be sensitive through export exposure channel. Moreover, the high degree of markup in these industries may totally dilute the effect of exchange rates on investment in any channels. When exchange rates change, their markups will absolutely absorb these changes, and pass no effect on investment so that investment of these industries is not sensitive by the exchange rate changes.

The effect of exchange rate on investment through export exposure channel is only significant in industries with high export share (export-oriented industries), namely, wood and furniture industry, machinery and equipment industry, food industry, and textile industry. The positive effect through this channel suggests that investment would be expanded in response to depreciation, and the strongest effect occurs in wood and furniture industry since it has the largest export share in the sample set. On the contrary, investment in domestic-oriented industries, namely, paper and chemical industries, are not sensitive with exchange rates through export exposure channel.

Investment in most industries is not affected by the change in exchange rates through imported input channel. Though imported content industries, such as chemical, metal, machinery, and vehicle industries contain high share of imported variables, the effect of exchange rates on investment is not significant in these industries. The lack of variability in the interaction with imported input share term

and the domination of low share of import content firms in the sample might explain the insignificant effect of exchange rate on investment through this channel.

Investment in only two industries, namely textile industry, and wood and furniture industry, is exposed to exchange rates, with two of them have different sign. Investment is exposed positively to exchange rate changes in textile industry while investment in wood and furniture industry is exposed negatively to movements in exchange rate. Textile industry contains high share of export and imported input share (export-oriented with high import content industry). Most of import contents are natural textile fiber, synthetic textile fiber, yarn, thread, and fabric. The positive significance induced by depreciation through imported input channel may imply industry characteristic of the production that is highly dependent on imported content. That is, when a depreciation stimulates export production and investment to expand, it is a must to utilize import content, such as synthetic fiber, and yarn, more in the production (Simon, 1996). Although depreciation brings about an increase in imported input cost in production, it is a sign of investment to be stimulated in response to export expansion. Moreover, one important attribute of production in textile industry is the flexibility to adapt their production to customer's order. Textile industry usually produces under sub-contracting and made-to-order. To produce under customer's order and contract, it is binding by the item specification of produced goods and input. Investment followed by the demand of export expansion is still stimulated although depreciation leads to an increase in import cost since producer had already received the order. However, for wood and furniture, it happens to be a negative relationship between exchange rates and investment through imported input channel. Wood and furniture industry has relied heavily on export share (54.62 percent of export share in total sales), but lightly relied on imported content (16.56 percent of imported input share). Although most of the production of wood and furniture industry is under made-to-order, the feature of reliance on imported input between textile and wood industry is different. Investment response to export expansion induced by a depreciation does not bring an increase in imported input exploitation in wood and furniture industry since its major input such as rubber tree and particle board is domestically available. Because imported content is not much important and might not be in line with export production, a rise in import variables

cost may generate a negative relationship between exchange rates and investment in the sense that a depreciation increases import variable cost, and discourages profitability of capital and hence investment.

The average effect of exchange rates on firms' investment in each industry show the negative result, ranging from -0.039 to -0.0823. The negative effect is severe in paper and publishing industry. This industry is characterized as domestic market-oriented with small export and imported input shares. While the exposure on export and import input channels is less important, exchange rate depreciation itself is likely to lower real demand and wealth, thus delaying the investment project. On the other hand, the negative effect of exchange rates on investment is the least in textile industry because the positive significance through export and import input channels counterbalances the negative effect through channel of exchange rates itself.

4.3 The effect of exchange rates on firm's investment: the form of ownership and firm's size

4.3.1 The effect of exchange rates on firm's investment classified by ownership

In order to examine whether investment in distinct type of ownership behave differently in response to exchange rate movements, we divide the whole sample into two sub-samples; foreign firms and Thai firms. Firms are considered as foreign firms if they report more than 30 percent of capital held by foreigners, otherwise they are Thai firms. Both of these sub-samples are estimated separately. The result of this estimation is shown in table 4.4.

For foreign firms, the only significance is of the non-interacted, with export and imported input share, exchange rate changes term suggesting that a depreciation will decrease a firm's investment through wealth effect. However, exchange rate depreciation does not cause any effects on investment in foreign firms through either export or imported input channel. For Thai firms, the result is quite similar to the behavior in the whole sample. That is, we found that the negative effect of exchange rates on investment induced by a depreciation is counterbalanced by the

positive effect of a depreciation on investment through export and imported input channel, albeit the effect through export channel is insignificant.

On average, the effect of exchange rates on investment is -0.0274 in foreign firm group, and -0.0501 in Thai firm group. The pattern of investment responsiveness to exchange rate changes is more present in Thai firms, and suggesting that Thai firms' investment will be more reduced by exchange rate depreciation.

Table 4.4

Results for the estimation in foreign firms and Thai firms

Variable	Foreign firms	Thai firms
$\Delta e_t / amkup_{t-1}$	-0.0465**	-0.0841***
	(-2.26)	(-11.28)
$x_{t-1}\Delta e_t / amkup_{t-1}$	-0.0238	0.0151
	(-1.46)	(1.62)
$\alpha_{t-1}\Delta e_t / amkup_{t-1}$	0.0179	0.0365***
	(0.87)	(3.18)
S_{t-1}	0.0726**	0.1433***
	(3.55)	(5.92)
r_{t-1}	-0.0053	-0.0365***
	(-0.20)	(-3.15)
Wald test	[0.0000]	[0.0000]

Source: Author's estimation from sample data
Note:

- All regressions are included in sectoral dummies.
- Numbers in parenthesis are Z values, numbers in square brackets are p-values.
- * indicates significance at the 10% level, ** at 5% level, and *** at 1 % level.
- Wald test is a test of joint significance for all explanatory variables in the model.

Although foreign firms have relied on more export share and imported input share than Thai firms, but the effect of exchange rates is not significant through both channel. There are four reasons to explain this finding. First, the degree of markup price in foreign firms, which is around 1.70, is higher than in Thai firms, which is around 1.56, so that high degree of markup is likely to be more dilute the effect of exchange rates on investment in foreign firms. Second, investment will be less suppressed by exchange rate depreciation in foreign firm group because the decision to invest in foreign firms may be determined from parent companies in the form of intra-firm credit and capital increased without concern for the level of exchange rates in terms of baht against dollar. As evidenced in chapter 3, the percentage of foreign source of funding in foreign firms accounted for 32 percent, comparing to only 4 percent of foreign source of funding in Thai firms. Third, the possible explanation is that the positive effect through export channel is offset by the negative effect of import cost since foreign firms contain high both share of export and imported inputs. As a matter of fact, the average export share and imported input share of foreign firms is 48 percent and 30 percent respectively. However, the average export share and imported input share of Thai firms is 25 percent and 13 percent respectively. Fourth, foreign firms would have strong export experience, international background and management skills (Vishuphong, 2007). Therefore, the mechanism to protect them from exchange rate risk and the advantage in management skills in coping with exchange rates could be explained why foreign firms have insignificant of exchange rate changes on investment.

More importantly, investigating the effect of ownership by using the structure of shareholding alone does not guarantee the control power of foreign companies. Firms that report small portion of capital held by foreigners may be controlled by foreigners in practice. Thus, the effect of exchange rates on investment in different types of ownership is still unclear.

4.3.2 The effect of exchange rates on firm's investment classified by firms' size

The effect of exchange rate changes on investment may vary across firms' size. Investment in large firms and small firms should respond differently with respect to the changes in exchange rates, but which size of firm has striking effect is unclear. However, table 4.5 provides the result of estimation across size of firms.

The investment in small firms is distinguishing significance responsiveness to exchange rate changes in all three channels. That is investment in small firms is more sensitive to exchange rate changes than in large firms. Again, the relationship of exchange rates and investment is both negative and positive. The investment is condensed by baht depreciation regardless of the interaction term with exchange rate changes through wealth effect. However, a depreciation increases the investment though the export exposure and imported input exposure. In terms of large firms, the only significant effect is through the non-interaction of exposure channel.

Although large firms are likely to engage more on international activities, the effect of exchange rates is insignificant through export and imported input channels. Dominguez and Tesar (2004) found that large firms are likely to have less exposure to exchange rates. The rationale for their findings is that larger firms have more access to mechanism for hedging exposure than small firms. Moreover, another explanation is that the availability of internal and external funds plays a major role in determining investment expansion in small firms since the credit constraint is obviously found in this type of firms (Theerawongseri (2003), Nucci and Pozzolo (2001)). As evidenced in chapter 4, the availability of external funds through the percent source of credit from financial institutions in small firms is lower than in large firms. This implies that small firms have severity of financial constraint, and have less ability to acquire credit than large firms. With the problem of external fund acquisition, small firms tend to rely more on internal funds. Unfortunately, exchange rate changes affect firms' profitability which is considered as its internal funds. The greater reliance on internal funds of small firms leads their investment expenditure to be more sensitive to exchange rate changes. Besides, small firms tend to be Thai-

owned, therefore the effect of exchange rates on investment in small firms is found to be more sensitive, similar to the result of Thai firms.

Table 4.5

Results for the estimation in large firms and small firms

Variable	Large firms	Small firms
$\Delta e_t / amkup_{t-1}$	-0.0814**	-0.0735***
	(-6.41)	(-7.59)
$x_{t-1} \Delta e_t / amkup_{t-1}$	-0.0118	0.0302***
	(-1.09)	(2.66)
$\alpha_{t-1} \Delta e_t / amkup_{t-1}$	0.0073	0.0476***
	(0.40)	(3.40)
S_{t-1}	0.1249***	0.1077***
	(3.63)	(4.58)
r_{t-1}	-0.0810***	0.0009
	(-5.77)	(0.06)
Wald test	[0.0000]	[0.0000]

Source: Author's estimation from sample data
Note:

- All regressions are included in sectoral dummies.
- Numbers in parenthesis are Z values, numbers in square brackets are p-values.
- * indicates significance at the 10% level, ** at 5% level, and *** at 1 % level.
- Wald test is a test of joint significance for all explanatory variables in the model.

4.4 Discussion on the empirical results

Movements in exchange rates pass its effect on investment through three channels of exposure. The first channel is through the wealth effect, the second channel is through export share, and the last is through imported input share. Those of three channels are expected to have effects on investment differently with the sign suggested in theory, but the magnitude of the effects is scaled down by the degree of price-cost markup.

We found that the effect of exchange rates on investment is negative relating to changes in exchange rates itself through the wealth effect, as the idea suggesting that depreciation is likely to contract investment since the demand and wealth are lower by a depreciation. Regarding export channel, depreciation leads to an increase in export sales, and expansion in export drives more investment. In addition, we also found the positive effect of exchange rates on investment through imported input channel. This finding is contrast with the theoretical idea that depreciation would increase cost of production which lessen the marginal profitability and hence investment. We explain this finding that the export production of Thai manufactures is usually dependent on high imported contents. In order to expand export production, imported inputs would be more utilized in the production further for export. Therefore, investment is stimulated by the increase in export expansion and imported input used in the production. This implied the production structure of manufacturing sector that evolved from production that used less imported inputs to production which utilized a higher proportion of imported inputs.

The effect of exchange rates through the channel interacting with external exposure share seems to have less impact on investment. The wealth effect of exchange rates plays more roles in determining the investment. The overall effect of exchange rates on investment is thus negative, and it suggests that depreciation is likely to decrease investment by lower the real income and wealth of an investor. Since manufacturing outputs are mostly sold in domestic market, the effect of exchange rates through domestic channel is more outstanding. That is, the decision to invest does not depend on how exchange rates benefit through export and import input positions. Rather, income and wealth of investors are factors determining the

decision to invest. However, the effect of exchange rates on investment through export and imported input shares may underestimate because we have no data to examine the impact of indirect effect of exchange rates that might happen in the firm that does not directly have export sale but supplies output to exporting firm. Although firm relies on domestic inputs, it will be affected by exchange rates if those inputs were imported in the first place. This implies that the effect of exchange rates on investment in the real world may be larger than what we found.

We also found that the effect of exchange rates on investment is smaller in magnitude in high markup group, consistent with the literature that high markup firms will absorb much of the exchange rate movements in markups and pass little effect on investment. The behavior of investment in responsiveness with exchange rate changes in distinct markup is a country-specific phenomenon (Campa and Goldberg, 1995). For example, only low markup industries in Japan and the United States show significant investment behavior with respect to exchange rate movements. However, for Canada, the exchange rate terms are not statistically significant for both high and low markup industries, and have no clear pattern of coefficients' sign.

To investigate the investment responsiveness to exchange rate changes across industries, we found that the effect of exchange rates on investment is not significant in any channels in three industries, namely, non-metallic industry, basic metal and fabricated industry, and vehicle industry. We explain that markups in these industries are the three highest in the sample, the effect of exchange rates on investment are diluted with the high degree of markup so that exchange rate movements seem to have insignificant impact on these industries.

The effect on investment through export exposure is significant in industry with high export share, namely, food industry, textile industry, wood and furniture industry, and machinery and equipment industry. However, the effect on investment through imported input share is not significant in some industries with high imported input share. This might come from the fact that data of imported input share in our sample does not have enough variability since the sample is dominated by high percentage of firms with less reliance on imported input; that is, 68 percent of firms in the sample contain the share of imported input which is lower than the

average of the sample. Incorporating the three effects of exposure, we found that the effect of exchange rates on investment is negative in all industries because the result is overcome by the negative effect of exchange rates through wealth channel. Overall effect of exchange rates on investment ranges from -0.03 in textile industry to -0.06 in food industry, and wood and furniture industry. However, with no positive counterbalance, domestic-oriented industries, namely, paper industry, and chemical industry face more negative effect induced by a depreciation, with -0.08, and -0.05, respectively.

Moreover, the additional information for our estimation is that the effect of exchange rates in foreign firms is relatively less sensitive than in Thai firms. Although foreign firms engaged in more share of export and imported inputs used in the production, investment is not affected through these channels. This might be the cancellation effect between the opposition effects of the two channels. In addition, foreign firms tend to have high degree of markup (markup of foreign firms is 1.70 while markup of Thai firms is 1.56) so that the effect of markup dilutes the impact of exchange rates on investment. Besides, foreign firms would have more international background to cope with exchange rate changes. Furthermore, investment decision in foreign firms might be influenced by the parent company without much concern with the exchange rates.

We also found that investment in small firms, which tends to be Thai-owned firms, is likely to be exposed with exchange rate changes, comparing to large foreign-owned firms. This confirms the view that a stronger sensitivity of investment spending to exchange rates in small firms due to the fact that not only have small firms less ability to access mechanism to hedge against exchange rates, but they also have severe financial constraints.