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CORPORATE INVESTMENT POLICY AND CURRENCY VALUE IN ASEAN-5 COUNTRIES: FIRM LEVEL ANALYSIS FOR 2001–2014

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ABSTRACT

This study analyzes the response of corporate investment to exchange rate movements in five ASEAN (ASEAN-5) countries. A theoretical framework is proposed for the real exchange rate, which affects corporate activities through at least three channels: revenue (exports), imported inputs, and imported finished goods. Estimations using dynamic panel data based on quarterly data (2001Q1–2014Q4) from 859 manufacturing corporations support the hypotheses. The results support the revenue channel for manufacturing in Indonesia, Malaysia, and the Philippines. Hence, depreciation is expected to increases sales, leading to increased corporate investment. The revenue channel in Singaporean manufacturing was significant after separating the penetration of low imported finished goods from that of high. Because exporter companies are also simultaneously big importers of inputs, the imported inputs channel generally increases corporate investment. In addition, the additional cost of imported inputs remains smaller than the additional gain from exports. The imported finished-goods channels demonstrate that the less imported finished-goods penetration the greater the impact of currency value on corporate investment. Research on investments and exchange rates is rare in the Southeast Asian context. Therefore, this paper contributes to the literature by analyzing the transmission mechanism of the impact of exchange rate movements on corporate investments.

Keywords*:* Corporate investment; Dynamic panel data; International orientation; Real exchange rate.

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1. INTRODUCTION

A proactive exchange rate policy is considered a significant incentive in fostering exports of manufacturing and economic growth (Nouira, Plane, & Sekkat, 2011; Hausmann, Pritchett, & Rodrik, 2005). As economic development proceeds, the manufacturing sector will absorb surplus labor. A currency's value becomes an incentive to shift resources from the primary sector to the manufacturing sector. This aim of this paper will be to determine the extent to which movements in real currency values impact corporate manufacturing investment policies in ASEAN-5 (Indonesia, Malaysia, the Philippines, Singapore, and Thailand)

Since the introduction of the floating exchange rate following the collapse of the Bretton Woods system in 1973, a currency's value can change through both nominal and real values. Southeast Asian countries, such as Indonesia, Thailand, and the Philippines, began to adopt a floating exchange rate during the financial crisis of 1997. This left the exchange rate vulnerable to experience large fluctuations. Currency value movements are expected to affect economic activity, including corporate investment activity, and have been analyzed by many empirical studies. Initially, earlier studies emphasized the response of pricing policies to changing exchange rates. The conclusions from this line of study have been summarized systematically by Goldberg and Knetter (1997) in the form of the exchange rate pass-through or pricing-to-market, following seminal papers by Dornbusch (1987) and Krugman (1987). Most of these studies were conducted on the aggregate industry level. Then, following the framework of Campa and Goldberg (1999), Nucci and Pozolo (2001) showed the importance of individual firm-specific factors in explaining investment behavior, which may be difficult to identify through aggregate data. Exchange rate research is more widespread on international trade, as summarized systematically by Bernard, Jensen, Redding, and Schott (2012).

The proposed theoretical framework (detailed in Section 3) predicts that real exchange rate movements may affect corporate investment through three main channels: (i) the revenue channel; (ii) the imported inputs channel; and (iii) the imported finished-goods penetration channel. A fourth channel, the balance-sheet channel, was not included in this study due to the incompleteness of the foreign currency debt data (see Aguiar, 2005 and Carranza, Cayo, & Galdon-Sanchez, 2003). When the exchange rate depreciates, export price competitiveness increases so that the corporate share of revenues from exports will increase and corporate investment will expand; this is called the revenue channel. The opposite happens when exchange rate appreciation occurs. Industries with a high share of imported inputs will experience rising input costs, leading profit margins to decline, and corporate investment to contract; this is called the imported inputs channel. Exchange rate depreciation also raises prices of imported finished goods relative to domestic products, thereby increasing the revenues of industries with a low share of imported finished goods. These firms can then increase their corporate investment; this is called the imported finished-goods penetration channel.

Empirical research on the relationship between exchange rates and investment was carried out by Nucci and Pozolo (2001) on approximately 1,000 manufacturing firms in Italy. Campa and Goldberg (1999) used aggregate data on four countries (USA, Japan, Canada, and the UK), and Caglayan and Torres (2011) used 205 three-digit manufacturing sector data on Mexico. Those studies found that exchange rate depreciation has a positive effect on investment through the revenue channel (expansionary) by raising operating profits in the export sector, but has negative effects

on investment through imported inputs (contractionary) by increasing input costs in sectors using more imported input. The exchange rate–investment relationship will vary among companies with different penetration shares of imported finished-goods.

Research on investment and exchange rates is still rare in the Southeast Asian context. Blalock, Gertler and Levine (2008) analyzed capital market imperfections that constrain investment in a financial crisis, using the 1997-1998 Indonesian case based on the annual manufacturing survey 1990–2000 (*Survei Tahunan Perusahaan Industri Pengolahan*) to achieve a picture of "before versus after" the crisis. With a real devaluation of about 100%, there is a substantial increase in terms of trade, so conventional trade theory suggests that Indonesian firms should have profited from the export boom. On the one hand, exporter firms benefit from better terms of trade, thereby increasing their investment. However, the collapse of the banking sector limits their access to credit. Access to credit is exacerbated by the IMF reforms with higher reserve requirements, so that may have reduced many banks' willingness in making loans. The real devaluation of the rupiah in the 1997 Asian financial crisis affected Indonesia manufacturing and resulted in companies with increasing profits, increasing inputs, and added workers. But it did not lead to increased investment in new capital goods. Bhandaria and Upadhyaya (2010) analyzed aggregate panel data on private investment (gross fixed capital formation) from 1972 to 2001 for four Southeast Asian countries (Indonesia, Malaysia, the Philippines, and Thailand) and found that exchange rate uncertainty negatively affects private investment.

This paper will contribute to the literature by analyzing the transmission mechanism of the impact of exchange rate movements on corporate investments in three important aspects. *First*, this study will provide empirical evidence using new micro-level data on channel transmission effects of exchange rates on corporate investments through the revenue channel (exports), imported inputs channel, and imported finished-goods channel for ASEAN-5 countries. The importance of micro-level data is that they enable analysis to control for unobservable individual fixed effects. Specific corporate features may affect investment decisions, whereas data are unmeasured. Fixed effects on panel data analysis allow an analysis to control for each specific feature, thus highlighting the importance of individual features of a corporate in investment decisions. This feature is difficult to track in aggregate data. *Second*, this study may be used to evaluate the impact of globalization. Specifically, globalization processes such as the ASEAN Economic Community will strengthen the role played by exchange rates as a result of increased international trade and investment linkages. Investments will be affected by exchange rate changes, and currency value depreciations are expected to attract investment. *Third*, the study provides a new implementation of the Campa-Goldberg framework (Campa & Goldberg, 1999) by applying it to listed companies.

The rest of the paper is organized as follows. Section 2 briefly reviews the methodology. Section 3 describes the data set in detail and Section 4 presents the main results. Section 5 concludes the study.

2. LITERATURE REVIEW

2.1. Real Exchange Rates

When a domestic currency is used to purchase goods from other countries, that domestic currency must be exchanged with the destination country's currency through a determined exchange rate. This exchange rate should reflect the domestic purchasing power for goods and services in the destination country. Real purchasing power parity (PPP) between the two countries was first used empirically by Cassel (1918), who examined PPP for an identical item *i*, where the price of good *i* in domestic currency, p_i, equaled the price of good *i* in foreign currency p_i^* multiplied by the exchange rate *E*, or:

$$p_i = E\, p_i^* \tag{1}$$

This allows a determination of the foreign exchange rate (E) expressed in local currency per one unit of foreign currency, also known as the nominal exchange rate. (For brevity, it will be called the exchange rate.) Tariff barriers, transportation costs, and non-tariff barriers interfere with the law of one price.

The main adjustment to the concept of long-term deviation of PPP was made by Balasa (1964) and Samuelson (1964). Empirically, when the overall price level is converted into dollars using the nominal exchange rate, rich countries tend to have a higher price level than poor countries. This phenomenon occurs because the rich countries are relatively more productive in the merchandise sector (traded sector). By stating the level of local prices (P_t) as relative weights of all commodities produced and consumed in the local state and describing the relative weights of all commodities produced and consumed in another country by the price level of other countries (P_t^*), then the real exchange rate (RER) can be calculated as:

$$RER_t = E\, \frac{P_t^*}{P_t} \tag{2}$$

An increase in the RER of the domestic currency against the foreign currency indicates real depreciation of the domestic currency (Krugman, Obstfeld, & Melitz, 2012).

2.2. Real Effective Exchange Rates

Comprehensive measurements of a country's external competitiveness are taken using the effective exchange rate (EER), which is the domestic currency's exchange rate against all foreign currencies used for international trade (MacDonald, 2007). Klau and Fung (2006) argue that the EER serves as a better indicator of the macroeconomic impact of exchange rates compared to bilateral exchange rates.

The nominal effective exchange rate (NEER) is an index of weighted averages of several bilateral exchange rates. The real effective exchange rate (REER) is the NEER adjusted by some level of relative prices. EERs published by the Bank for International Settlements (BIS) use the weighting method developed by Turner and Van't dack (1993).

2.3. Real Exchange Rate and Corporate Investment

The theoretical framework used here to examine exchange rates and investments in a market with imperfect competition follows that of Campa and Goldberg (1999). Business investment theory by Tobin (1969), known as Q theory, proposes that demand for capital goods depends on the expected present value of a stream of marginal profits from now and into the future. Capital goods, as the factors of production, are quasi-fixed, with an accumulation process subject to installation cost, $C(I_t)$, which are ascending and convex.

$$V_t(K_{t-1}, e_{t-1}) = \max\{[\pi(K_t, e_t) - I_t - C(I_t)] + \beta_{t+1}^{t} E_t[V_{t+1}(K_t)]\}.$$
$$Subject\ to K_t = (1 \overset{I_t}{-} \delta)K_{t-1} + I_t \quad (3)$$

The investment equation (I_t) can be obtained by maximizing the value of the company [equation (3)] and characterizes the optimal path of investment according to the Euler equations and the envelope theorem. The marginal profitability of capital is specified by designating its output for export ($x^*(p_t^*)$) or domestic use ($x(p_t)$), and raw materials from imported (L_t^*) or domestic (L_t) sources.

$$\pi(K_t, e_t) = \max_{p,p^*,L,L^*} p(e_t)x(p_t) + e_t p^*(e_t)x^*(p_t^*) - w_t L_t - e_t w_t^* L_t^*$$
$$subject\ to\ x_t + x_t^* = F(K_t, L_t, L_t^*), \quad (4)$$

where, at the beginning of each period, the company observes the exchange rate e_t and makes a choice regarding output prices in foreign (p_t^*) and domestic (p_t) markets, where w_t and w_t^* are the unit cost of domestic and foreign inputs; and $x(p_t)$) and $x^*(p_t^*)$ are the demand functions faced by the firm in domestic and foreign markets. The production function *F(.)* has constant returns-to-scale.

The exchange rate's impact on investment is derived from differentiation of the investment equation subject to the exchange rate. Denoting χ as the share of exports in total revenues and α as the cost of imported inputs over total variable costs, the equation highlights the main factors that determine the effect of exchange rates on investment

$$\frac{\partial I_t}{\partial e_t} = \emptyset_q(.)\frac{1}{1-\beta}\frac{TR}{Ke}\left[\frac{\chi}{\mu^*}\{\eta_{p^*,e}(1+\eta_{x^*})+1-\varepsilon_{\mu^*,e}\} - \frac{\alpha}{\bar{\mu}_t}[\eta_{w^*,e}+1]\right] +$$
$$+ \emptyset_q(.)\frac{1}{1-\beta}\frac{TR}{Ke}\left[\frac{(1-\chi)}{\mu}\{\eta_{p,e}(1+\eta_x)-\varepsilon_{\mu,e}\}\right] \quad (5)$$

where $\eta_{p,e}$ and $\eta_{p^*,e}$ are price elasticity of the firm with respect to the exchange rate in the domestic and foreign markets, respectively (elasticity of pass-through); $\varepsilon_{\mu,e}$ and $\varepsilon_{\mu^*,e}$ are the markup elasticity with respect to the exchange rate, respectively, in the domestic and in the foreign markets; $\eta_{w^*,e}$ is elasticity of the exchange rate for imported raw material input prices (in units of foreign currency); and $\bar{\mu}$ is the price-cost margin of the firm without distinguishing domestic market from foreign market.

Equation (5) depicts three channels for exchange rate effects on investment activities as well as the magnitude of these effects. For the revenue channel, the larger the value of χ (revenues from exports), the more firms benefit from exchange rate depreciation. In an export market, the positive

effect of χ interacts with pass-through elasticity of the exchange rate to export prices ($\eta_{p^*,e}$) (which takes a value from −1 to 0), the exchange rate elasticity of markup ($\varepsilon_{\mu^*,e}$), and the price elasticity of demand for exports (η_{x^*}). If the price elasticity of export demand is greater than 1 (in absolute values and called elastic), the share of exports (export orientation) will exert an increasing impact. Conversely, when export demand is inelastic ($|\eta_{x^*}| < 1$), the effect of the share of exports χ will diminish.

H1: Depreciation of the real exchange rate will increase corporate investments through the revenue channel.

The second channel is the imported input channel. A negative sign on the total cost of production indicates a weaker positive impact of real depreciation against the marginal profitability of capital and investment. The greater the share of imported inputs in the total variables' cost (α), the greater the decrease in marginal profits as a result of real depreciation, which interact with the exchange rate elasticity of imported inputs ($\eta_{w^*,e}$, is generally positive).

H2: Depreciation of the real exchange rate will decrease corporate investment through the imported input channel.

The third channel is imported finished-goods penetration in the domestic market. In the product's domestic market, the share of domestic revenues ($1 - \chi$) affects the relationship between the exchange rate and investment, which interacts with domestic price elasticity of the exchange rate ($\eta_{p,e}$, is generally positive), exchange rate elasticity of markup ($\varepsilon_{\mu,e}$, generally positive), and price elasticity of domestic demand (η_x). If domestic demand is elastic ($|\eta_x| > 1$), RER depreciation will increase prices of imported finished goods in the domestic market so that the revenue of the low share of an imported finished-good sector will rise and corporate investment will fall. Hence, the less imported finished-goods penetration, the greater the effect of the RER on corporate investment. If domestic demand is inelastic ($|\eta_x| < 1$), then the opposite pattern occurs.

H3: The lower the level of imported finished-goods penetration, the greater the effect of changes in the real exchange rate on corporate investment.

3. RESEARCH METHOD

3.1. Empirical Model

The theoretical framework of Campa and Goldberg (1999) provides the foundation for the relationship between exchange rates and corporate investment in this study, as well as showing the main factor for investment. To analyze the empirical data, a dynamic investment equation is based on equation (5) and control variables for investment opportunities and cost of capital, as follows:

$$\Delta I_{ti} = \beta_1 \Delta I_{t-1,i} + \beta_2\, \Delta S_{ti} + \beta_3\, \chi_{t-1,i} \Delta e_{ti} + \beta_4 \alpha_{t-1,i} \Delta e_{ti} + \beta_5 \Delta r_{t-1} + b' Z_{ti} + \tau_t + \lambda_i + v_{ti} \quad (6)$$

where I_{ti} is investment expenditure of corporation *i* in year *t* at constant prices; and Z_{ti} is a vector of dummy variables such as industry sector and company size. Variables are in natural logarithm form so variation (Δ) provides the growth rate of these variables. Investment is also a function of

the cost of capital r_{t-1} proxied by the loan interest rate and real sales (S_{ti}), which is additional control for investment opportunities. The investment equation uses first difference to control for non-stationary of a permanent exchange rate component. Exchange rates affect investment through interactions with a corporation's international exposure in the form of both export sales ($\chi_{t-1,i}$) and imported inputs ($\alpha_{t-1,i}$). Lagged variables for export share and imported input share are used to avoid bias due to correlation with the exchange rate. τ_t is a time-specific effect to control for movements of time-varying variables, such as changes in economic and industrial policies. The specification also contains firm-specific effects λ_i and a residual v_{ti}, which assumes that moments with E($\boldsymbol{v_{ti}}$) = E($v_{ti}v_{si}$) for all $t \neq s$.

Using the investment lag variable as a regressor makes the investment equation a dynamic equation. Investment projects have special properties when a lag is used for adjustments (Caballero, 1999). The value of the dependent variable's lag ($\Delta I_{t-1,i}$) is correlated with the unobservable firm effects λ_i, and real sales are potentially correlated with λ_i. To overcome endogeneity of regressors, this study adopts the system-GMM (generalized method of moments) estimator developed by Arrellano and Bover (1995) and Blundell and Bond (1998).

3.2. Data

Corporate investment data at the quarterly firm level were taken from the Thomson Reuters Eikon database. The samples are unbalanced panel data from 859 manufacturing companies listed on a stock exchange in one of the five ASEAN countries during 2001–2014. These manufacturing companies comprise about 34% of all listed companies, with the dispersion presented in Table 1. Details of the data and sources are given in Appendix 1. Business fixed investment is measured by capital expenditure for plants, property, and equipment from the companies' cash flow reports. Capital expenditure and other monetary data are calculated according to constant prices based on the year 2010.

The Thomson Reuters Eikon database does not offer reliable export and imported input data. Export share (χ) and imported input share (α) are therefore estimated from the Asian Input-Output Table (IO Table) and summerized in Table 2 (IDE-JETRO, 2013). Sectoral export share is the percentage of all exports out of a sector's total output.

Table 1: The Dispersion of Samples in ASEAN-5 Countries

Country	Indonesia	Malaysia	Philippines	Singapore	Thailand	Total
Manufacture Companies	137	384	33	82	223	859
Observation 2001q1-2014q2	5,074	11,035	906	2,704	8,820	28,539
Total of Listed Companies	477	846	206	432	603	2,564

***Source*:** Thomson Reuters Eikon, processed.

To obtain a comprehensive measure of a country's external competitiveness, we used the REER (i.e., the domestic currency's exchange rate against all major trading partner currencies). REER data were obtained from BIS.

Table 2: International Exposure of Corporations in ASEAN-5 Manufacturing

	ASEAN-5	Indonesia		Malaysia		Philippine		Singapore		Thailand	
ISIC2	Manufacture sector	χ	α	χ	α	χ	α	χ	α	χ	α
10	Food products	0.009–0.161	0.003–0.071	0.031–0.302	0.059–0.261	0.000–0.071	0.015–0.035	0.085–0.330	0.163–0.184	0.066-0.268	0.034-0.116
11	Beverages	0.029	0.017	0.064	0.123	0.005	0.047	0.164	0.084	0.022	0.058
12	Tobacco products	0.019	0.092	0.246	0.101						
13	Textiles	0.135–0.171	0.096-0.127	0.232–0.289	0.064–0.146					0.212-0.257	0.060-0.098
–	wearing apparel	0.178	0.043	0.303	0.098					0.163	0.027
15	Leather & related	0.178–0.216	0.016–0.043							0.163–0.243	0.027–0.127
16	Wood products	0.000	0.043	0.179	0.037			0.026	0.076	0.139	0.095
17	Paper products	0.123	0.107	0.055	0.112			0.204	0.164	0.120	0.167
20	Chemical products	0.038–0.128	0.050–0.272	0.155–0.198	0.095–0.118	0.026–0.135	0.072–0.172	0.264–3.358	0.210–0.446	0.092–0.256	0.102–0.208
21	Pharmaceuticals	0.043	0.128	0.195	0.118	0.010	0.111	0.364	0.421	0.023	0.116
22	Plastics & rubbers	0.039–0.134	0.045–0.120	0.130–0.156	0.033–0.117			0.181–0.303	0.091–0.148	0.110–0.410	0.038–0.073
23	Glass & cements	0.024–0.085	0.047–0.085	0.085–0.146	0.066–0.070	0.022–0.057	0.047–0.064	0.040–0.077	0.059–0.235	0.090–0.109	0.053–0.091
24	Basic iron	0.080	0.162	0.132	0.133	0.022	0.040	0.145	0.266	0.113	0.110
25	Fabricated metals	0.040–0.046	0.038–0.089	0.125–0.128	0.108–0.173	0.02–5–0.088	0.004–0.150	0.165–0.855	0.162–0.171	0.147–0.378	0.210–0.450
26	Electronics	0.016–0.222	0.052–0.116	0.185–0.237	0.103–0.131	0.073–0.300	0.037–0.187	0.241–1.447	0.090–0.216	0.149–0.175	0.115–0.179
27	Electrics equipment	0.042–0.077	0.042–0.107	0.188–0.356	0.074–0.138	0.026–0.198	0.253–0.354	0.861–1.079	0.116–0.231	0.094–0.288	0.132–0.160
28	Special machinery	0.109	0.144	0.173	0.107			0.213	0.150	0.235	0.122
29	Motor vehicles	0.020	0.079	0.018	0.094			0.105	0.123	0.081	0.101
30	Building of ships			0.479	0.071			0.186	0.105	0.046	0.065
31	Furniture	0.388	0.020	0.311	0.044			0.068	0.081	0.094	0.097
32	Jewelry & related			0.273	0.149			1.870	0.394	0.234	0.300

***Notes*:** International exposure as an export share (χ) and an imported input share (α).

***Source**:* Asian Input-Output Table *(IDE-JETRO, 2013)*, processed.

Imported input share is the percentage of imported intermediate inputs that is out of a sector's total intermediate inputs. A corporation's export orientation is measured by quarterly sales times export share. Imported inputs are measured as input costs [cost of goods sold (COGS)] times imported input share. Both types of international exposure have two limitations. First, imported inputs (and export sales) are not based on individual corporate data, but both are estimated from the Asian IO Table. Second, the structure of production (imported input and export shares) are assumed to be relatively constant.

4. RESULTS AND DISCUSSION

4.1. Currency Value and Corporate Investment Policy in ASEAN-5: Export and Imported Input Channels

An analysis of currency values and corporate investment policies in each of the ASEAN-5 countries was carried out by country. The dynamic panel approach used the GMM-system estimator (xtdpdsys, Arellano-Bover and Blundell-Bond (1995)linear dynamic panel data estimation) with a choice of standard robust error to satisfy the assumption of homoscedasticity and independence of the residual autocorrelation. A few outlying investment observations (116 out of 32,553 observations, or 0.356%) (ΔI_{ti}) were removed. The results for the specification of the dynamic panel estimated from the panel data are summarized in Table 3. Currency value is measured by REER from BIS.

Table 3: GMM-system Estimates of a Dynamic Investment Model for ASEAN-5: Quarterly Data 2001q1 to 2014q4. Exchange rate (Δe_{it}) is measured by REER from BIS.

–	Indonesia	Malaysia	Philippines	Singapore	Thailand
Dependent variable: ΔI_{ti}					
$\Delta I_{t-1,i}$	−0.3439	−0.2951	−0.2881	−0.3144	−0.2819
	(0.00***)	(0.00***)	(0.00***)	(0.00***)	(0.00***)
$\chi_{t-1,i}\Delta e_{ti}$	−0.0590	−0.1437	−1.5990	0.0557	0.1227
	(0.00***)	(0.043**)	(0.001***)	(0.131)	(0.088*)
$\alpha_{t-1,i}\Delta e_{ti}$	−0.0418	−0.2188	−0.4107	−0.0962	−0.4447
	(0.053**)	(0.086*)	(0.218)	(0.182)	(0.007***)
Δr_{t-1}	2.0719	3.3664	5.0528	4.4892	1.3434
	(0.001***)	(0.00***)	(0.00***)	(0.699)	(0.00***)
$\Delta ASET$	0.5886	−0.0271	1.1257	0.3494	−1.4930
	(0.049**)	(0.921)	(0.00***)	(0.190)	(0.00***)
ΔS_{ti}	0.3391	0.2997	0.0460	0.8070	0.3407
	(0.005***)	0.000***	(0.709)	(0.00***)	(0.00***)
_cons	0.0662	0.0614	0.1503	0.0092	0.0535
	(0.00***)	(0.00***)	(0.00***)	(0.219)	(0.00***)
Wald Test, Chi2(5)	673.96	1552.68	413.49	875.22	1791.97
Prob.>Chi2	0.000***	0.000***	0.000***	0.000***	0.000***
Observation	5074	11035	906	2704	8820
Corporation	137	384	33	82	223

***Notes*:** Significance value (P>|z|) based on robust standard errors are reported beneath the parameter estimates.

* Significant at the 0.10 level; ** significant at the 0.05 level; *** 0.01 level.

The strength test of the dynamic equation model is shown by a Wald test with the chi-square distribution. If the significance (Prob. > Chi2) is less than 0.05, then all the coefficients differ significantly from zero at a 95% confidence level. Each model for the five countries was found to be valid based on Wald statistics. If the error term has a homoskedastic distribution then the Sargan test will distribute chi-squared asymptotically, whereas if heteroscedastic the Sargan test rejects the null hypothesis that overidentifying restrictions are valid. Since the vce (robust) estimation model in the stata software estimates the variance of error term with the Huber/White estimator so that create variance with robust or homoscedastic estimation. Because of the homoscedastic variance, xtdpdsys does not compute Sargan statistics when estimates are specified as vce (robust) [xtdpdsys-posestimation, stata manual].

The revenue (or export) channel of the exchange rate is determined by the interaction variable between corporate exports in the previous period and growth of the REER ($\chi_{t-1,i}\Delta e_{ti}$). The coefficient for Indonesian manufacturing is negative and significant, implying that depreciation of the rupiah (lower REER) tends to increase corporate income in line with the rate of increasing exports out of total sales. The estimation results for the corporate investment model in Indonesia are consistent with the theoretical prediction. The same result was found for Malaysian and Philippine manufacturing but with greater negative coefficients. The revenue channels for the exchange rate are consistent with theoretical predictions.

As the most stable currency in Southeast Asia, the Singapore dollar exhibits corporate investment behavior different from that of the other four countries' currencies. The revenue channel for the exchange rate in Singaporean manufacturing is not significant in the full sample. However, corporate investment decisions are significant when the sample is divided into high and low import penetration of finished goods. (These results are presented in subsequent sections.) This corporate behavior may also reflect corporations' belief in the stability of the Singapore dollar. During 1991–2014, the Singapore dollar maintained a stable value with a slight appreciation trend. Using the full sample, the revenue channel for exchange rate transmission in Thai manufacturing had coefficient signs opposite of the theoretical predictions. This is because a sector's behavior influenced other sectors, leading to a result different from predictions. The revenue channel of exchange rates does support the theoretical prediction when the sample is separated by manufacturing sector. (These results are presented in subsequent sections.)

The imported input channel for the exchange rate is shown in the interaction variable between imported inputs in the previous period and growth of the effective RER ($\alpha_{t-1,i}\Delta e_{ti}$). For Indonesian manufacturing, this relationship is significant but with a negative coefficient, the opposite of the theoretical predictions. These data show that export-oriented corporations also tend to have a quite high share of imported inputs; accordingly, exchange rate depreciation will encourage corporations to increase their exports, so that they will raise imported inputs. Rising costs of imported inputs are still expected to be lower than the increased gain from exports. The export-oriented corporations tend to use imported production technology and mostly used imported inputs, so these cannot be flexibly substituted by domestic raw materials. The same and significant relationship was found in Malaysian and Thai manufacturing. In the full sample, the imported input channel is not significant in Philippine and Singaporean manufacturing, but becomes significant when evaluated on a per-manufacturing-sector basis (These results are presented in subsequent sections.)

The capital cost factor in investment decisions is proxied by growth of interest rates on loans (Δr_{t-1}). Except for Singapore, a significant positive coefficient was found as the bigger impact, which shows that a corporation perceives an increase in quarterly lending rates as an increase in business activity, so that corporate sales will rise, leading to increased investment. This significant finding differs from the insignificant findings of Nucci and Pozollo (2001) and Campa and Goldberg (1999). This investment behavior may appear in emerging countries because corporate investment remains dependent on loans. Another factor influencing corporate investment decisions: investment opportunities, which are measured by sales growth (ΔS_{ti}). Corporations see significant investment opportunities in ASEAN-5 countries, except the Philippines. These increasing investment opportunities (positive sales growth) will increase corporate investment.

4.2. Currency Value and Corporate Investment Policy in ASEAN-5: Imported Finished-Goods Channel

Currency depreciation will reduce import prices, including imported finished goods, in the domestic market, so corporations who make a relatively large proportion of sales domestically ($1 - \chi_{t,i}$) will experience a decrease in both sales and investment due to competition from imported finished goods. To analyze the effect of competition from imported finished goods on the domestic market or to determine the extent to which penetration of imported finished goods influences the sensitivity of corporate investment to exchange rates, the dynamic panel model results are compared between manufacturing sectors with low import penetration versus high import penetration.

Ideally, the imported finished-goods channel is estimated with quarterly panel data, but data are not available. The import penetration of finished goods is estimated from the Asian IO Table (IDE-JETRO, 2013), which is the total import of final product (final demand) of each sector (ISIC 4 digit) from all over the world divided by the total of finished-goods import and domestic production. The percentage of penetration will change with the change in technology used by the manufacture so that its value is a structural measure with relatively non-dynamic change and is relatively little affected by changes in market prices or currency values. Due to the production structure, no search for turning points is attempted, but comparing the effect of the value of the currency to the group with the high import penetration versus the low import penetration. The comparison would be fair if both groups had the same amount of observation, so the median statistic would be more appropriate. The median will separate 50% of the observations above and 50% observations below the median.
Estimation of the median statistic that separates the sector with the high imported finished-goods penetration (*PeImpor*↑) and the low imported finished-goods penetration (*PeImpor*↓), which is 9.819% for Indonesia, 24.301% for Malaysia, 4.639% for the Philippines, 35.802% for Singapore, and 13.479% for Thailand. Summaries are presented in Table A2.

The sensitivity of the corporate investment due to the exchange rate is analyzed by comparing the coefficient on the interaction variable of the exchange rate and exports in the revenue channel ($\chi_{t-1,i}\Delta e_{ti}$), as well as by comparing the coefficient on the interaction variable of exchange rates and imported inputs for the imported input channel ($\alpha_{t-1,i}\Delta e_{ti}$). Higher and more significant coefficient values show a stronger influence. The effect of imported finished-goods penetration on corporate investment sensitivity in ASEAN-5 is presented in Table 4. Results for each country are shown in two columns: one column for the sample with low import penetration (*PeImpor*↓) and

the second column for the high (*PeImpor*↑). For the revenue channel of Indonesian manufacturing, low import penetration

Table 4: The Effect of Import Penetration on the Sensitivity of Corporate Investment Due to Exchange Rate in ASEAN-5, Quarterly Data 2001q1-2014q4 (*vce robust*)

	Indonesia		Malaysia		Philippines		Singapore		Thailand	
Variables	*PeImpor*↓	*PeImpor*↑	*PeImpor*↓	*PeImpor*↓	*PeImpor*↑	*PeImpor*↓	*PeImpor*↑	*PeImpor*↑	*PeImpor*↓	*PeImpor*↑
–										
–	−0.3203	−0.3796	−0.2969	−0.2999	−0.3111	−0.2915	−0.3229	−0.3065	−0.2809	−0.2950
	*−0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****
$\chi_{t-1,i}\Delta e_{ti}$	−0.3012	−0.0282	−0.1268	−0.1220	−2.3977	−0.9106	−0.0836	0.2298	0.1453	0.2642
	*0.006****	*0.045***	*0.048***	*0.205*	*0.00****	*0.116*	*0.002****	*0.00****	*0.069**	*0.234*
$\alpha_{t-1,i}\Delta e_{ti}$	0.0447	−0.0471	−0.1784	−0.4786	−0.0690	−0.8479	1.6681	−0.4387	−0.5207	−0.6916
	0.311	*0.021***	*0.109*	*0.118*	*0.766*	*0.223*	*0.00****	*0.00****	*0.007****	*0.083****
Δr_{t-1}	2.1713	1.0764	2.7583	3.7116	4.9821	4.6481	−10.9508	0.1436	0.9950	1.3730
	*0.003****	*0.143*	*0.00****	*0.00****	*0.00****	*0.005****	*0.420*	*0.993*	*0.008****	*0.001****
ΔS_{ti}	0.4823	0.3057	0.4763	0.1963	−0.1094	0.1493	0.5194	1.3387	0.0308	0.6699
	*0.001****	*0.053**	*0.00****	*0.006****	*0.474*	*0.449*	*0.043***	*0.00****	*0.714*	*0.00****
_cons	0.0551	0.0770	0.0640	0.0565	0.1599	0.1619	−0.0237	0.0052	0.0391	0.0364
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.062*	*0.700*	*0.000*	*0.000*
Wald Test, Chi2(5)	242.78	651.51	1039.49	690.51	109.16	463.98	472.76	450.11	1010.98	883.83
Prob.> chi2	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****
Observation	2640	2442	5300	5780	503	425	1331	1425	5200	4059
Corporation	70	67	189	195	18	15	40	42	126	97

***Notes*:** The low import penetration *(PeImport ↓)* and the high (*PeImpor*↑);

* Significant at the 0.10 level; ** significant at the 0.05 level; *** 0.01 level.

has a larger and more significant coefficient, implying that effective real exchange rate depreciation (REER down) will lead to a bigger increase in exports and corporate investment. This supports the theoretical prediction. This hypothesis is also supported by empirical data from manufacturing in Malaysia, the Philippines, Singapore, and Thailand. For Singaporean manufacturing, the effect of exchange rates through the revenue channel indicates a weak relationship according to the full samples. But after the sample is separated, depreciation of the Singapore dollar will increase corporate investment significantly for Singaporean manufacturing with low import penetration. For samples with high import penetration, depreciation of the Singapore dollar will significantly reduce corporate investment.

For the imported input channel, the effect of import penetration of finished goods in Singapore manufacturing shows a strong impact consistent with theoretical predictions. Depreciation of the Singapore dollar will raise the cost of inputs, which will lower sales and reduce corporate invest-

ment significantly in low import penetration sectors. In sectors with high import penetration, however, depreciation of the Singapore dollar will lower the cost of imported inputs, which will raise profit margins and increase corporate investment. For the other four countries, the effect of import penetration of finished goods is relatively small.

5. CONCLUSIONS

This paper investigated the effect of the effective REER on corporate investment activity on the manufacturing sector of listed corporations in ASEAN-5 countries during 2001–2014. The analysis used a simple theoretical model that separated three transmission channels through which exchange rate movements influence corporate investment. Currency value (REER) affects corporate investment policies through the revenue (export) channel, imported input channels, and imported finished-goods channel.

Estimations with GMM-systems from the Arellano-Bover and Blundell-Bond (1995) formulations and quarterly data from 859 companies support most of the hypotheses. Corporate investment in the form of capital expenditures strongly supports the revenue channel whereby currency depreciation will increase both sales and corporate investment. This channel was found to be significant for manufacturing in Indonesia, Malaysia, and the Philippines. The revenue channel in Singapore manufacturing was significant when samples were separated into firms with low and high imported finished-goods penetration. The revenue channel for Thai manufacturing was significant only for some sectors. Because exporter companies also simultaneously import large quantities of inputs, the transmission effect from the RER to investment through imported inputs generally serves to increase investment. This also reflects the tendency of the additional costs of imported inputs to remain smaller than the additional gains from exports.

The effect of import penetration on the sensitivity of corporate investment in ASEAN-5 mostly supported the hypothesis. For the revenue channel in the Indonesian manufacturing context, low import penetration has a larger and more significant coefficient, implying that depreciation of the effective real exchange lower REER will increase the greater of exports and the greater of corporate investment in five countries. Except for Singaporean manufacturing, the effect of import penetration of finished goods is relatively small for the imported input channel.

This study confirms prior research that links corporate investment and exchange rates. Campa and Goldberg (1999) and Nucci and Pozolo (2001) showed the importance of exchange rate and individual firm-specific factors in explaining investment behavior. Research on investment and exchange rates is still rare in the Southeast Asian context. Blalock, Gertler, and Levine (2008) analyzed capital market imperfections constrain investment in the financial crisis with 1997/1998 Indonesian case based on annual manufacturing survey 1990–2000 (*Survei Tahunan Perusahaan Industri Pengolahan*) before versus after crisis. Our study fills the research gap on this issue.

For manufacturing in Indonesia, Malaysia, and the Philippines, policies that encourage corporate investment should be implemented through an integrated policy that depreciates the value of the rupiah, ringgit, and peso. Slow, steady depreciation will boost the competitiveness of export products so that export sales will increase, which should lead to an increase in corporate investment as well.

Corporate investment policies are relatively unaffected by changes in RERs through imported inputs in five countries. Imported inputs used in manufacturing look very rigid, meaning that manufacturing does not have the option of replacing them with domestic raw materials. This may be because production technology is difficult to change or the quality of domestic raw materials has not reached corporate standards. Industry needs policies that support improvements in production technology that could help reduce this rigidity.

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Appendix A

Table A.1: Description of data

No	Variable	Description	Source
1	Corporate investment (I)	Business fixed investment as a capital expenditure for property, plant, & equipment from cash flow report at constant prices	Thomson Reuters Eikon
2	Sales (S)	Sales, net after discounts and allowances at constant prices	Thomson Reuters Eikon
4	Asset	The size of companies in the natural logarithm of assets	Thomson Reuters Eikon
5	Sector	Sector of each company with ISIC two and four digits	Company web
6	Export exposure (χ)	Export exposure in the form of sectoral export share multiplied by the sales. Sectoral export share calculated from Asia Input-Output Table with four digit ISIC	Asia Input-Output Table (IDE-JETRO, 2013)
7	Imported input exposure (α)	Imported input exposure in the form of sectoral imported input share multiplied by the cost of good sold (COGS). Sectoral imported input share calculated from Asia Input-Output Table with four digit ISIC.	Asia Input-Output Table (IDE-JETRO, 2013)
8	COGS	Cost of inputs as a Cost of Goods Sold	Thomson Reuters Eikon
9	The interest rate of loan (r)	The interest rate of loan in five countries. Because the interest rate is expressed in a year, then the quarterly interest rate is the annual interest rate divided by four.	IFS
10	Real exchange rate (e)	Real effective exchange rate (REER) published by Bank for International Settlement (BIS)	BIS

***Notes**:* Capital expenditure had been used as a proxy for investment by researchers, namely Kaplan and Zingales (1997), Chirinko, Fazzari and Meyer (1999), Moyen (2004), Bhagat, Moyen and Suh (2005), Love and Zicchino (2006), also Kang, Lee and Ratti (2014).

Table A.2: Imported finished-goods penetration in ASEAN5

Manufacture sector	ISIC4	Indonesia	Malaysia	Philippine	Singapore	Thailand
Milled grain and flour	106	0.0305	0.1997	0.0464	**0.6286**	0.0026
Fish products	102	0.0397	0.6295	0.0330	**0.6712**	0.6065
Slaughtering, meat products, and dairy products	101–105	0.1697	0.4123	0.0705	**0.7386**	0.0928
Other food products	103, 104, 107, 108, 1071–2–3–4–5	0.1811	0.2430	0.0688	**0.4893**	0.1348
014–15 food products	100	0.1754	0.3277	0.0696	**0.6140**	0.1138
Beverage	110	0.0305	0.2268	0.0384	**0.5878**	0.0711
Tobacco	120	0.0045	0.5676	0.0088	**0.8018**	0.1231
Spinning		0.2072	0.0000	0.0042	−7.4118	−0.0001
Weaving and dyeing		0.0357	0.0000	**0.9113**	−0.4690	−0.0369
Knitting		0.0517	0.0885	0.0328	−1.8479	−3.7849
018-20 Spinning, Weaving, dyeing knitting	131	0.0982	0.0295	**0.3161**	−3.2429	−1.2740
–	140 141 152	0.0182	**0.9378**	0.0095	**0.8383**	0.0575
Other made-up textile products	1393	**0.2109**	**0.4547**	**0.4327**	**2.1084**	0.1131
Leather and leather products	151	0.0463	**0.6498**	**0.0955**	**0.9161**	0.0738
Timber	160	0.0261	0.0000	0.0009	0.1037	0.0529
Wooden furniture	310	0.0206	**0.4282**	0.0150	**0.8507**	0.0104
Other wooden products		0.0329	0.0789	0.0078	0.0732	0.0138
Pulp and paper	170	**0.3023**	0.3403	0.0737	**5.6565**	**0.2447**
Printing and publishing		0.0530	0.1624	0.0222	0.0854	**0.6911**
Synthetic resins and fiber		**0.1810**	**0.9973**	0.0000	−0.0189	−0.0001
Basic industrial chemicals	201	**0.4308**	0.0000	0.0000	0.1750	0.0015
Chemical fertilizers and pesticides	2012–21	**0.4896**	0.3978	0.0136	−0.0191	−0.0721
Drugs and medicine	210	0.2397	**0.7544**	0.2774	0.0653	0.1360
Other chemical products	2013–22–23–29–202	0.1536	**1.0663**	0.1720	−0.0342	0.3740
Refined petroleum and its products		**0.9758**	0.0000	0.0165	−1.3055	0.1870
Plastic products	222	0.0473	0.1994	0.0197	**2.6146**	0.2185
Tires and tubes	2211	0.0865	0.0000	0.0749	**0.5073**	0.0280

Manufacture sector	ISIC4	Indonesia	Malaysia	Philippine	Singapore	Thailand
Other rubber products	2219	0.0220	0.3934	0.0322	**0.7211**	−0.0725
Glass and glass products	231, 2310	0.0592	0.2828	0.0044	-2.6103	**0.5478**
–	2392–93	0.0729	0.0957	0.0019	−0.2685	0.0861
Iron and steel	241	**0.3803**	0.0000	0.0002	0.2058	0.0000
Non-ferrous metal	2599	0.0576	0.0668	0.0000	−0.0976	**0.7172**
Metal products	251, 259	0.0954	0.1544	0.0008	0.3580	0.1321
Boilers, Engines, and turbines		0.0386	**0.9196**	**0.2177**	**1.6190**	−0.5868
General machinery		**0.7115**	**0.6423**	**0.1513**	**19.0021**	**0.8159**
Metal working machinery		**0.1990**	**0.9312**	**0.6306**	**2.2546**	**1.1778**
Specialaized machinery	2813, 2816, 282	**0.7291**	**0.9831**	**0.5193**	**0.7184**	**1.5309**
Heavy Electrical equipment	271	**0.4721**	**1.6267**	**0.4880**	−0.1263	**1.7825**
Television sets, radios, audios, and communication equipment	264	0.0841	0.3498	**0.2105**	−0.1371	**1.3999**
Electronic computing equipment	262	0.0013	**1.0088**	**0.2063**	−0.1757	0.5682
Semiconductors and integrated circuits	261	0.0212	0.3721	0.0000	0.0738	**1.7712**
Other electronics and electronic products	268, 2660, 263	0.0972	**0.4344**	**0.6326**	−0.1546	**0.6527**
Household electrical equipment	274	**0.1968**	**0.6864**	0.0600	**2.1162**	**0.8681**
Lighting fixtures, batteries, wiring, and others	272–273	0.0435	**0.9522**	**0.1633**	**75.5648**	**0.3421**
Motor vehicles	291–293	0.0833	0.0907	**0.3289**	**0.6375**	0.0205
Motor cycles		0.0149	**0.8529**	**0.5250**	**0.7447**	0.0116
Shipbuilding	301	**0.8730**	**0.8064**	0.0435	0.0954	**0.3599**
Other transport equipment		0.1131	**0.9740**	**0.5510**	**1.5602**	**1.0154**
Precision machines	265	**0.2826**	**0.7674**	**0.0948**	−0.4439	**0.5204**
Other manufacturing products	321	0.0921	**0.5090**	**0.2357**	**3.7580**	**0.2241**
Median statistic		*0.08649*	*0.39779*	*0.04639*	*0.48932*	*0.13207*

Source: Asian Input-Output Table *(IDE-JETRO, 201–3)*, processed.