

FOREIGN EXCHANGE RESERVE ACCUMULATION AND CORPORATE INVESTMENT: THE CASE OF LISTED FIRMS IN VIETNAM

LONG HAU LE

Associate Professor, Ph.D., Department of Finance and Banking, School of Economics, Can Tho University, Can Tho, Vietnam. Email: llhau@ctu.edu.vn

TAN NGHIEM LE

Ph.D., Department of Business Administration, School of Economics, Can Tho University, Can Tho, Vietnam. Corresponding Author Email: tanngkiem@ctu.edu.vn

LANG HOANG HAC TRAN

Master, the State Bank of Vietnam, a Giang, Vietnam. Email: hac.tranhoang@sbv.gov.vn

VIET THANH TRUC TRAN

Master, Department of Finance and Banking, School of Economics, Can Tho University, Can Tho, Vietnam. Email: tvtruc@ctu.edu.vn

BICH TUYEN DUONG

Master, School of Economics, Nam Can Tho University, Can Tho, Vietnam. Email: dbtuyen@nctu.edu.vn

THI THANH TAM NGUYEN

Master, Can Tho University, Can Tho, Vietnam. Email: nguyenthithanhtam407@gmail.com

Abstract

The aim of this study is to investigate the impact of foreign exchange reserves accumulation on the investment of companies in Vietnam. A detailed data of 332 firms listed on Hochiminh Stock Exchange is collected over the period from the first quarter of 2009 to the first quarter of 2019. Generalized Method of Moments (GMM) is employed to test the proposed hypotheses in this study. Estimation results reveal that great changes in foreign exchange reserves reduce corporate investment. Besides that, according to the growth stage of reserve accumulation, to some extent, foreign exchange reserve accumulation benefits domestic investment. However, when reserves increases tremendously, it may cause negative effect to investment. The study also investigates the impact of foreign exchange reserves on investment of companies in different industries. Empirical findings point out that for firms which are newly listed, young, small, and has low investment in fixed asset and low dividend payout ratio, the investment-cash flow sensitivity is very high. Changing in foreign exchange reserves does not greatly affect firm investment. In contrast, for enterprises which are long-established, large, and has high fixed asset value and high dividend payout ratio, the investment-cash flow sensitivity is lower. However, large change in the accumulation of reserves adversely affects firm investment. The empirical findings imply that government should be more cautious in managing foreign exchange reserves and firms should develop a plan to effectively manage their cash in order to lower borrowing costs as well as to less depend on external financing sources.

Keywords: Foreign exchange reserve accumulation, Investment, Generalized Method of Moments method, Vietnam.

JEL Classification Code: E22, E51, F30, G15, H63, G21

1. INTRODUCTION

Since foreign exchange reserves play a major role in economic development, the State Bank of Vietnam has paid great attention to maintaining and increasing foreign exchange reserves. According to the International Monetary Fund (2019), foreign exchange reserves in Vietnam rose to US\$65 billion at end-April 2019. The increase in foreign exchange reserves has positively impacted many aspects of the macro-economy. It helps to ensure financial stability and liquidity of the country (Durdu et al., 2009). Foreign exchange reserves help to moderate the effects of strong external economic shocks and help avoid strong fluctuations in the real exchange rate, which can positively affect economic growth. Hedging against financial crises requires countries to maintain foreign exchange reserves at least equivalent to short-term external debt obligations, especially during economic crisis. Besides that, it certainly requires more reserves as long-term capital flows can also be cut sharply during crises. Therefore, the demand for foreign exchange reserves is proportional to the total foreign debt obligations (Mohanty and Turner, 2006).

Besides the benefits, there are always costs associated with the foreign exchange reserves accumulation. The accumulation of foreign exchange reserves probably lead to an increase in direct costs such as inflation. In addition, when the foreign currency hed by the central bank devalues or when the yields on foreign exchange reserves are lower than the rate of return on securities, the value of foreign currency reserves are likely to decline, thereby causing losses for the central bank (Reinhart and Reinhart, 2008; Aizenman and Glick, 2009).

However, the indirect costs of the accumulation of foreign exchange reserves have not been thoroughly investigated. Opportunity cost of hoarding foreign exchange reserves is very large because a large amount of capital is retained without being circulated in the economy in order to increase foreign exchange reserves. The State Bank has spent a large amount of local currency to buy USD from domestic banks, which leads to an increase in the money supply. In order to reduce inflation caused by a rise in the money supply, the State Bank will issue treasury bills to attract the local currency through spot transactions or repo transactions. Yun (2017) investigated how sterilized accumulation of reserves affects credit allocation in domestic financial markets. Through the issuance of government bonds, the central bank borrows heavily from the domestic financial sector to finance the accumulation of foreign exchange reserves. These huge loans greatly impact the domestic financial market because when banks purchase government bonds, the availability of credit allocated by banks to their customers, especially domestic enterprises, will decrease. Therefore, foreign exchange reserves accumulation may cause banks to reduce loans to businesses, which may affect the growth of the country (Reinhart et al., 2016).

In general, foreign exchange reserves have been widely studied in the field of international business over the last few decades. There are many foreign and domestic studies researching on central bank's decisions about the accumulation of foreign

exchange reserves. This topic has become very critical and managers, policymakers and other players in the international business sector need to analyze the impact of foreign exchange reserves in order to obtain a more comprehensive understanding. However, only few publications have thoroughly examined the indirect costs related to the accumulation of foreign exchange reserves. Besides that, many of those studies focus on developed and high-income countries. Thus, it is necessary to carry on a more in-depth study of the effect of foreign exchange reserve accumulation in a transition economy like Vietnam. Therefore, this study aims to investigate the influence of the accumulation of foreign exchange reserves on the investment of enterprises listed on Hochiminh Stock Exchange in Vietnam, thereby providing several implications for policy makers in order to carefully consider the potential costs associated with foreign exchange reserve accumulation to be more prudent when using foreign exchange reserves to regulate the Vietnamese economy.

2. LITERATURE REVIEW

In the fifth edition of the document "Balance of Payments and International Investment Position Manual" published by the International Monetary Fund (IMF), a country's foreign exchange reserves is defined as foreign exchange assets that the Central Bank manages and uses to finance balance of payments deficits directly or indirectly through exchange rate intervention and to finance other needs. Foreign exchange reserves include the following types of foreign exchange assets: foreign currencies, monetary gold, special drawing rights (SDRs), reserve position in the IMF and other foreign exchange assets. A country's foreign exchange reserves are formed from foreign currency earning from exporting activity; remittances, foreign investment; foreign currency sources, gold which can be purchased on the domestic and international markets; foreign loans and aids in the form of foreign exchange assets; foreign currency disbursed to domestic projects funded by foreign countries; the IMF's SDR allocation according to the country's contribution to the IMF; the withdrawal of foreign exchange reserves at the IMF.

Keynes (2006) defined investment as an increase in capital, including fixed capital, working capital or liquid capital. Most researchers have focused on tangible asset capital. Modigliani and Miller (1958) argued that the cost of capital to any firm is completely independent of its capital structure. Hence, the market value of any firm is independent of its capital structure. The corporate value is measured based on the present value of future cash flows generated through making investments which have positive net present value (NPV). A company's investments are affected only by expected future returns and not be affected by internal or external funding. Thus, in a perfect market, capital structure cannot affect firm value. This hypothesis is based on the simplification of issues in finance such as brokerage costs, information transparency, accessibility of capital markets or taxes. Under these assumptions, capital structure and policy are not relevant to real investment. The investment decisions of firms are therefore unaffected by their financial decisions in perfect markets. Companies have financial flexibility and can adjust their

capital structure without fear of expense. Thus, the only determinant factor of investment is the investment opportunity.

However, capital markets are not perfect due to the presence of financial constraints. In fact, investment decisions are influenced by financial decisions. Due to financial market imperfections, the cost of external financing source is always higher than the cost of internal financing source. As a result, investments are sensitive to internal financing. The dependence of investments on the availability of internal finance is measured according to the model of Kaplan and Zingales (1997) and Fazzari et al. (1988). Referred to the Pecking Order Theory, funding for investment activities of enterprises in the world is largely from internal financial sources (Smart et al., 2004). Company chooses to use internal funding sources rather than external funding. In which the internal funds are obtained from the company's profit in the form of retained earnings (Jordan et al., 2011). According to the financing constraints theory, many researchers have measured the financial constraints of firms by examining the sensitivity of corporate investments to internal financial funds. Fazzari et al. (1988) were the very first researchers to propose the idea of using the investment-cash flow sensitivity as a proxy for firm's financial constraints. If businesses are not financially constrained, their investment will not depend on internal funds as businesses with good investment opportunities will easily convert external financial sources into investment capital. On the contrary, stemming from asymmetric information and agency problems, enterprises may be financially constrained, so that their investments will be sensitive to internal financing source.

Fazzari et al. (1988) found a positive relationship between investment and cash flow in financially constrained firms. Kaplan and Zingales (1997) stressed that firms that appear less financially constrained exhibit significantly greater investment-cash flow sensitivities than firms that appear more financially constrained. They also pointed out that higher sensitivities cannot be interpreted as evidence that firms are more financially constrained, in other words, investment-cash flow sensitivities might not increase monotonically with the level of financial constraint. Love (2003) stated that firms in countries with developed financial markets have lower investment-cash flow sensitivity than firms in countries with less developed financial markets. Laeven (2003) stated that financial liberalization affects small and large firms differently. Before financial liberalization takes place, small firms are found to be more financially constrained than large firms. Financial liberalization then relaxes the external financing constraints of small firms, but increases the financing constraints of large firms. Harrison et al. (2004) indicated that international capital flows will reduce the investment-cash flow sensitivity for firms. Similarly, Forbes (2007) concluded that small firms have higher investment-cash flow sensitivity than large firms. The authors argued that during the period that the Chilean government has implemented a capital control policy, small firms appear to have experienced significant financial constraints. Erel et al. (2015) documented that the level of cash that target European firms hold, the sensitivity of cash to cash flow, and the sensitivity of investment to cash flow all decline, while investment increases following the acquisition. These authors suggested

that acquisitions relieve financial frictions in target firms, especially when the target firm is relatively small.

Many publications have extensively reviewed the central bank decisions on foreign exchange reserve accumulation (Durdu et al., 2009; Jeanne and Ranciere, 2011; Jeanne, 2013). Several studies have modeled foreign exchange reserves which are formed from central bank loans (Gabaix and Maggiori, 2015). Some studies have focused on direct risk-neutralizing costs, or holding costs, that is, the difference between interest payments on government bonds and interest earned from foreign exchange reserve accumulation (Calvo, 1991; Rodrik, 2006). However, the costs associated with the accumulation of foreign exchange reserves have not been adequately studied. If foreign exchange reserves come from central bank's domestic borrowing, then reserves accumulation makes sense for the domestic financial market. Central bank loans from the domestic sector will reduce the amount of loans available to other borrowers, especially domestic firms. This shows that foreign exchange reserves accumulation can be detrimental to investment, which is well-known as the crowding out effect.

Reinhart et al. (2016) indicated that reserve accumulation has a strong correlation with a decline in Asia's growth rate after the 2000s and there is a high probability that private sector investments have decreased due to the accumulation of reserves. The study conducted by Reinhart et al. (2016) was the first paper showing the relationship between reserve accumulation and investment. To better define the crowding out effect of reserve accumulation on investment, Yun (2017) modeled a small open economy and provided evidence on the correlation between foreign exchange reserves and corporate investment. By using financial data of 23,365 Korean firms during the period from 2000 to 2007, this author found that if financial intermediaries reduce the credit supply for private sector in order to hold more Korean central bank securities, these financial intermediaries will choose to cut down the credit supply for large firms rather than small firms. The author demonstrated that the lending rate for large enterprises is negatively correlated with the ratio of government bonds, while the lending rate for small and medium enterprises is positively correlated. The results showed that large companies suffer a 23.8 percent decrease in investment when reserves accumulation increases by 1 percent of GDP, while small firms are not affected. Through the comprehensive review of prior studies related to the research topic, it is important to address that the authors have inherited the study of Yun (2017). More Specifically, the authors build a research model to estimate the impact of the change in Vietnam's foreign exchange reserves on the investment of enterprises listed on Hochiminh Stock Exchange.

3. RESEACRCH METHODOLOGY

3.1. Sample Selection

The data used in the study are collected from the balance sheets and the income statements of 332 enterprises listed on Hochiminh Stock Exchange during the period from the first quarter of 2009 to the first quarter of 2019. The data on foreign exchange reserves

of Vietnam, GDP, exchange rate are gathered from data published by the International Monetary Fund.

After examining the impact of foreign exchange reserves on investment of enterprises in general, this paper also investigates the effect of foreign exchange reserves on investment of enterprises in different industries. Therefore, the companies listed on Hochiminh Stock Exchange are divided into 08 industries. Based on the scale as well as the nature of the industry, the authors divide the sampled firms into 2 groups, specifically:

- Group 1 consists of firms in the fields of telecommunications services; materials; energy and information technology. The characteristics of enterprises in this industry group are low capital, low amount of fixed assets, young, small scale, low dividend payout ratio.
- Group 2 consists of firms in the fields of real estate; heavy industry; consumer goods. The characteristics of enterprises in this industry group are large capital, great amount of fixed assets, old-established, large scale, high dividend payout ratio.

3.2. Estimation Method

Many previous studies such as the study conducted by Hubbard and Kashyap (1992); Hubbard et al. (1995); Harrison et al. (2004); Forbes (2007) make use of an Euler equation approach to estimate the effect of financial constraints on investment of firms in developed countries. In this model, shareholders maximize firm value which is equal to the discounted value of all future dividend payments, in which dividend is subjected to capital accumulation and the financial constraints of external financing. Firm value is calculated by the following formula:

$$V_t(K_t, \xi_t) = \max_{\{I_{t+s}\}_{s=0}^{\infty}} D_t + E_t \left[\sum_{s=1}^{\infty} \beta_{t+s-1} D_{t+s} \right] \quad (1)$$

$$D_t = \Pi(K_t, \xi_t) - I_t - C(I_t, K_t) \quad (2)$$

$$K_{t+1} = (1 - \delta)K_t + I_t \quad (3)$$

$$D_t \geq 0 \quad (4)$$

Where K is tangible capital (tangible assets); D_t is dividend; ξ_t is capital shock; $\Pi(K_t, \xi_t)$ is the revenue function; $C(I_t, K_t)$ is adjusted cost function.

Equation (4) shows that firm has financial constraints. Yun (2017) has set the coefficient λ_t as the multiplier for the financial constraint. The authors then measure the shadow price of external financing source. Shadow price is the price or equivalent value of goods and services when they are not accurately determined due to the lack of a normal market for price determination, or due to price distortions in the market.

Equation (1) can be rewritten according to the Bellman mathematical formula:

$$\frac{\partial V_t}{\partial I_t} = - \left(\frac{\partial C_t}{\partial I_t} + 1 \right) (1 + \lambda_t) + E_t \beta_{t+1} \frac{\partial V_{t+1}}{\partial K_{t+1}} = 0 \quad (5)$$

$$\frac{\partial V_t}{\partial K_t} = \left(\frac{\partial \Pi_t}{\partial K_t} - \frac{\partial C_t}{\partial K_t} \right) (1 + \lambda_t) + E_t \beta_{t+1} (1 - \delta) \frac{\partial V_{t+1}}{\partial K_{t+1}} = 0 \quad (6)$$

By combining Equations (5) and Equation (6), the following equation is presented as follows:

$$1 + \frac{\partial C_t}{\partial I_t} = \beta E_t \frac{1 + \lambda_{t+1}}{1 + \lambda_t} \left[\frac{\partial \Pi_{t+1}}{\partial K_{t+1}} + (1 - \delta) \left(\frac{\partial C_{t+1}}{\partial I_{t+1}} + 1 \right) \right] \quad (7)$$

Where λ_t is shadow price of external financing source; $(1 + \lambda_{t+1})/(1 + \lambda_t)$ is the cost of external financing source at time $t+1$ compared to that at time t . This ratio can be used to measure financial constraint. If financial market is perfect, λ_t is equal to λ_{t+1} as well as time t and time $t+1$ are the same. If financial market is imperfect, λ_t is greater than λ_{t+1} , which indicates that today's cost of external finance is higher than future's cost, in other words, firm currently experiences financial constraints.

The authors assume that $(1 + \lambda_{t+1})/(1 + \lambda_t)$ represents the financial constraints of firm and the ratio of cash flows to net capital invested by the firm is realized for the previous period. Yun (2017) claimed that the reserves accumulation held by the central bank will create a crowding out effect on the credit sources provided by financial intermediaries to domestic enterprises. Therefore, to examine whether the external financial constraints of firms are influenced by foreign exchange reserve accumulation, Yun (2017) generated an equation which illustrates the effect of the change in investment on the accumulation of foreign exchange reserves as follows:

$$\frac{1 + \lambda_{t+1}}{1 + \lambda_t} = \psi_{0,i} + (\psi_1 + \psi_2 \Delta res) \frac{cash_{i,t-1}}{K_{i,t-1}} \quad (8)$$

Where Δres is the change in foreign exchange reserves accumulation over GDP between time t and time $t-1$. In fact, it takes time for the change in reserve accumulation to affect the firm's investment, so the variables in the equation are lagged by one period. To test whether the impact of the change in foreign exchange reserve accumulation on firm's investment is different for firms of different sizes, Equation (8) can be adjusted as follows:

$$\frac{1 + \lambda_{t+1}}{1 + \lambda_t} = \psi_{0,i} + (\psi_1 d_L + \psi_2 + \psi_3 d_L \cdot \Delta res + \psi_4 \Delta res) \frac{cash_{i,t-1}}{K_{i,t-1}} \quad (9)$$

Where d_L is a dummy variable representing firm size.

To obtain an estimation model, it is necessary to determine the adjusted cost function and the marginal product of capital (MPK). The adjusted quadratic cost function is as follows:

$$C(I_{it}, K_{it}) = \frac{1}{2\alpha_1} \left[\frac{I_{it}}{K_{it}} + \alpha_i + \alpha_t \right]^2 \quad (10)$$

By using a Cobb–Douglas production function, MPK is calculated based on the ratio of revenue to net investment. After replacing Equation (8) into Equation (7), the authors use the variable $sales_{t-1}$ instead of sales to avoid concurrency. The following model is proposed as follows:

$$\left(\frac{I_{i,t}}{K_{i,t-1}}\right) = f_i + d_i + \theta_1 \left(\frac{cash}{K}\right)_{i,t-1} + \theta_2 \left(\frac{sales}{K}\right)_{i,t-1} + \theta_3 \Delta res \left(\frac{cash}{K}\right)_{i,t-1} + \epsilon_{it} \quad (11)$$

In summary, based on the theory of internal financing, investment, financial constraints and the results of empirical studies on the relationship between foreign exchange reserve accumulation and firm investment, this study employs Model (11) to estimate the effect of the change in reserve accumulation on corporate investment.

To test the robustness of the model, the authors add a lagged variable of the dependent variable into Model (11) to see whether a period of delay will change the estimated results.

$$\left(\frac{I_{i,t}}{K_{i,t-1}}\right) = f_i + d_i + \theta_1 \left(\frac{cash}{K}\right)_{i,t-1} + \theta_2 \left(\frac{sales}{K}\right)_{i,t-1} + \theta_3 \Delta res \left(\frac{cash}{K}\right)_{i,t-1} + \left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \epsilon_{it} \quad (12)$$

Where $I_{i,t}$ is the investment of firm i at time t ; $I_{i,t-1}$ is the investment of firm i at time $t-1$; $K_{i,t-1}$ is the tangible asset of firm i at time $t-1$; $K_{i,t-2}$ is the tangible asset of firm i at time $t-2$; $I_{i,t} = K_{i,t} - K_{i,t-1}$; cash is the cash flow of firm; sales is the net revenue of firm; Δres is the change in foreign exchange reserve accumulation at time t compared to time $t-1$.

Table 1 summarizes the characteristics of the variables in the research model and the expected signs of the impact of the independent variables on the dependent variable.

Table 1: Summary of independent variables affecting the investment of firm in the research model

Variables	Measurement Method	Expected Signs
Change in foreign exchange reserve (ΔRes)	$res_t - res_{t-1}$	
Tangible asset (K)	Fixed asset + Long-term investment	
Net investment (I)	Tangible asset _t – Tangible asset _{t-1} (Excluding depreciation)	
Cashflow (C)	Net profit + Depreciation	
Sales (S)	Total revenue	
Dependent Variable		
Ratio of investment to tangible asset (I/K)	Net investment/Tangible asset x 100	
Independent variables		
Ratio of cashflow to tangible asset (C/K)	Cashflow/Tangible asset x 100	+
Ratio of sales to tangible asset (S/K)	Sales/Tangible asset x 100	+
Interactions between changes in foreign exchange reserves and ratio of cashflow to tangible asset ($\Delta Res \times (C/K)$)	$\Delta Res \times (Cashflow/Tangible\ asset)$	-
Interactions between firm size and ratio of cashflow to tangible asset ($asize \times (C/K)$)	$asize \times (Cashflow/Tangible\ asset)$	-

This study applies the fixed effect model (FEM) method and the random effects model (REM) method to choose a suitable model. Then, this research employs several methods to check whether multicollinearity, heteroskedasticity, autocorrelation occur in these models. This article uses the feasible generalized least square (FGLS) method to fix the problem occurring in the selected model. Finally, this paper employs generalized method of moments (GMM) estimation method to check the robustness of the estimated model.

4. RESULTS AND DISCUSSIONS

4.1. Descriptive Statistics and Model Testing

Table 2 illustrates the descriptive statistics of the variables used in the regression model.

Table 2: Descriptive statistics of the variables in the regression model

Variables	Observation	Mean	Standard Deviation	Minimum	Maximum
Firm	13,612	166.50	95.84	1.00	332.00
Ratio of investment to tangible asset (I/K)	10,233	0.40	27.22	-1.00	2,738.07
Ratio of investment to tangible asset at time t-1 (I_{t-1}/K_{t-1})	9,919	0.41	27.65	-1.00	2,738.07
Ratio of cashflow to tangible asset (C/K)	10,678	0.49	1.70	-2.42	90.31
Ratio of sales to tangible asset (S/K)	10,426	1.93	45.49	0.00	4,444.31
Firm size (asize)	10,990	14.00	1.26	11.18	19.57
Change in foreign exchange reserve (ΔRes)	13,280	0.51	29.23	-50.44	100.11
Interaction between firm size and ratio of cashflow to tangible asset (asize x (C/K))	10,647	6.87	24.25	-32.32	1,142.48
Interaction between changes in foreign exchange reserves and ratio of cashflow to tangible asset (ΔRes x (C/K))	10,678	2.24	93.79	-1,467.47	6,750.88

Based on the results of the correlation matrix in Table 3, it can be seen that all the pairs of correlation coefficients among the variables in the model are less than 0.8 (Farrar and Glauber, 1967). Hence, it can be concluded that there is no serious multicollinearity phenomenon.

Table 3: Correlation matrix among the variables in the model

Variables	$\Delta Res_{t-1} \times C_{i,t-1}/K_{i,t-1}$	$C_{i,t-1}/K_{i,t-1}$	$S_{i,t-1}/K_{i,t-1}$	ΔRes_{t-1}	asize _t
$\Delta Res_{t-1} \times C_{i,t-1}/K_{i,t-1}$	1.0000				
$C_{i,t-1}/K_{i,t-1}$	0.5377***	1.0000			
$S_{i,t-1}/K_{i,t-1}$	0.0394***	0.2406***	1.0000		
ΔRes_{t-1}	0.2074***	0.0272***	-0.0024	1.0000	
asize _t	0.0081	-0.0035	0.0036	0.0349***	1.0000

Note: *** indicates statistical significance at the 1% level.

The VIF values for all independent variables noted in the model are below 10 (see Table 4). Thereby, it can be concluded that multicollinearity is no issue in our current models when these variables are included in our research models.

Table 4: Results of VIF test

Variables	VIF	1/VIF
$I_{i,t-1}/K_{i,t-2}$	1.00	0.999809
$\Delta Res_{t-1} \times C_{i,t-1}/K_{i,t-1}$	2.35	0.426028
$C_{i,t-1}/K_{i,t-1}$	3.43	0.291721
$S_{i,t-1}/K_{i,t-1}$	1.84	0.543001
ΔRes_{t-1}	1.07	0.932383
$asize_t$	1.00	0.997914
Mean VIF	1.78	

4.2. Evaluation of Financial Constraints in Sampled Firms

The study measures the sensitivity of firm investment to cash flow in order to assess the financial constraints of firms in the selected sample, the results are presented in Table 5.

Model (1) is used to check whether sampled firms are financially constrained. The estimated results in Table 5 indicate that cash flow has a positive relationship with firm investment with the estimated coefficient ($\beta = 8.7851$) at the significance level of 1 percent. This empirical finding is in accordance with the study of Fazzari et al. (1998); Yun (2017); Pham and Phan (2018).

Model (2) is applied to examine whether the degree of the financial constraints of firms is different according to firm size. The results in Table 5 show that firm size is particularly useful predictor of financial constraint levels. More specifically, large firms are less financially constrained than small firms since small firms have limited access to external financing sources. This result is similar to the study of Forbes (2007); Hadlock and Pierce (2010).

Table 5: Results of the sensitivity of firm investment to cash flow in the sample

Variables	Model (1)	Model (2)
$C_{i,t-1}/K_{i,t-1}$	8.7851*** (0.1423)	96.6058*** (1.0389)
$asize \times C_{i,t-1}/K_{i,t-1}$		-6.2074*** (0.0730)
$S_{i,t-1}/K_{i,t-1}$	0.0647*** (0.0051)	0.0266*** (0.0039)
$asize_t$		2.9508*** (0.1431)
Constant	-3.9501*** (0.2376)	-45.7298*** (2.0218)
Number of observations	9,988	9,985
Prob > Chi2	0.0000	0.0000

Note: The values in parentheses () are standard errors; *** indicates statistical significance at the 1% level.

4.3. The Impact of Changes in Foreign Exchange Reserves on Firm Investment

The estimated results of the influence of changes in foreign exchange reserves on the investment of firms listed on Hochiminh Stock Exchange are summarized in Table 6.

Table 6: The impact of changes in foreign exchange reserves on firm investment

Regression Model	REM	FEM	FGLS	GMM
Dependent variable $I_{i,t}/K_{i,t-1}$				
$I_{i,t-1}/K_{i,t-2}$				0.2330*** (0.0355)
$I_{i,t-2}/K_{i,t-3}$				0.2509 (0.3095)
$C_{i,t-1}/K_{i,t-1}$	96.8873*** (1.0520)	104.1449*** (1.1233)	96.8873*** (1.0516)	51.5539*** (2.4240)
$\Delta Res \times C_{i,t-1}/K_{i,t-1}$	-0.0038* (0.0022)	-0.0092*** (0.0022)	-0.0038* (0.0022)	-0.0168*** (0.0034)
$asize \times C_{i,t-1}/K_{i,t-1}$	-6.2181*** (0.0733)	-6.6812*** (0.0796)	-6.2181*** (0.0733)	-3.6626*** (0.1637)
$S_{i,t-1}/K_{i,t-1}$	0.0258*** (0.0039)	0.0176*** (0.0039)	0.0258*** (0.0039)	3.2468*** (0.0463)
$asize_t$	2.9591*** (0.1432)	2.8181*** (0.4199)	2.9591*** (0.1431)	4.9845*** (0.8525)
ΔRes	0.0005 (0.0059)	0.0023 (0.0057)	0.0005 (0.0059)	0.0002 (0.0031)
Constant	-45.8994*** (2.0246)	-44.2576*** (5.9062)	-45.8994*** (2.0239)	
Number of observations	9,985	9,985	9,985	8,421
R ²	0.6305	0.6309		
Wald chi2	15,170.96		15,181.60	
Prob > Chi2	0.0000		0.0000	
F test that all $u_i = 0$		2,748.53		
Prob > F		0.0000		
Hausman test		1,410.85		
Prob>Chi2		0.0000		
Wald test Chi2		1.7e+10		
Prob>Chi2		0.0000		
Wooldridge test Prob>F		0.2735		
Arellano-Bond test for AR(1)				0.000
Arellano-Bond test for AR(2)				0.452
Sargan test				1.000

Note: The values in parentheses () are standard errors; * and *** indicate statistical significance at the 10%, and 1% level, respectively. Two-step system GMM uses the lagged independent variable as the instrumental variable. AR(2) is used to test the quadratic series correlation in the residuals, normally distributed $N(0,1)$. The Sargan test is used to test the validity of the instrumental variables.

The result of the Hausman in Table 6 test shows that the fixed effect model (FEM) is more suitable than the random effect model (REM). The estimation results of FEM point out that the interaction between changes in foreign exchange reserves and ratio of cashflow

to tangible asset variable negatively impacts firm investment with the estimated coefficient ($\beta = -0.0092$) at the significance level of 1 percent. This result is in line with the proposed hypothesis. However, the Wald test result demonstrates that heteroskedasticity is a serious issue in FEM. Similarly, the result of Wooldridge test shows that there is no serious autocorrelation phenomenon. Therefore, this study uses a feasible generalized least squares (FGLS) estimation method to solve the problem of heteroskedasticity. The results of FGLS estimation show that as expected, the interaction between changes in foreign exchange reserves and ratio of cashflow to tangible asset variable has a negative influence on firm investment with the estimated coefficient ($\beta = -0.0038$) at the significance level of 10 percent. Although the FGLS estimation method can be used to solve the phenomenon of heteroskedasticity, Yun (2017) suggested that the biases related to the endogeneity problem still exist when testing the relationship between foreign exchange reserve accumulation and investment. Hence, this study applies the generalized method of moments (GMM) estimation method as proposed in the study of Arellano and Bond (1991). GMM chooses instrumental variables by using exogenous variables at different time period, or by taking the lag of variables as instrumental to endogenous variables at the current time. The GMM estimation results show that the interaction between changes in foreign exchange reserves and ratio of cashflow to tangible asset variable has a negative and statistically significant relationship with firm investment at the significance level of 1 percent with the estimated coefficient ($\beta = -0.0168$). This result is consistent with the estimation results of REM, FEM, FGLS. Additionally, the estimated coefficient of the one-period lag variable of the ratio of investment to tangible asset variable is positive and statistically significant at the significance level of 1 percent. This means that the current investment is affected by the previous investment decision made at one prior period. Besides that, as can be seen in Table 6, the result of Arellano-Bond test for AR(2) gives p-value = 0.452, which is greater than 0.1, showing that there is no second-order autocorrelation in the GMM model. Therefore, all results in the GMM model are statistically significant. The Sargan test with p-value = 1.000, which is greater than 0.1, shows that instrumental variables are powerful.

According to the study conducted by Yun (2017), in many countries, central bank has borrowed heavily from domestic financial sector, which has caused a great impact on domestic financial market. Specifically, this has affected banks' loans to the private sector. Yun (2017) demonstrated the crowding-out effect due to the accumulation of foreign exchange reserves. Through the issuance of risk-free securities, central bank borrows debt from domestic banks. Buying risk-free securities is not only for the purpose of lending to the central bank, but also for the purpose of investing to earn profit. When domestic banks invest heavily in government bonds, these banks will choose to cut down the credit supply for firms, especially risky loans. This means that the accumulation of foreign exchange reserves negatively affects firm investment. In other words, when the accumulation of foreign exchange reserves increases, it will reduce the investment of firms. These findings of Yun (2017) are similar to the author's research results. Therefore, it can be concluded that the change in foreign exchange reserve accumulation as

measured by the interaction between changes in foreign exchange reserves and ratio of cashflow to tangible asset variable is negatively correlated with firm investment measured by the ratio of investment to tangible asset variable at the significance level of 1 percent. According to the General Statistics Office, commercial banks held about 80 percent of the total outstanding government bonds in 2015, then decreased to 52 percent and 47.8 percent in 2017 and in 2018, respectively. Although commercial banks do not account for a large proportion of the government securities portfolio, their holdings of government securities are still very high. Due to limited capital, investing heavily in government securities has limited outstanding loans in general and loans to the private sector in particular. This proves the crowding out effect of government loans to increase foreign exchange reserve accumulation on the private sector. The results from Table 6 also show that cash flow as measured by the ratio of cashflow to tangible asset variable has a positive relationship with firm investment with the estimated coefficient ($\beta = 51.5539$) at the significance level of 1 percent. This research finding is in accordance with the results of many previous studies such as Moyen (2004); Bhagat et al. (2005). In addition, the research results in Table 6 also show a positive correlation between revenue as measured by the ratio of sales to tangible asset variable and firm investment with the estimated coefficient ($\beta = 3.2468$) at the significance level of 1 percent. In fact, the larger the revenue, the higher the profit, the higher the investment opportunity.

4.4. The influence of changes in foreign exchange reserves on firm investment in different stages

Estimated results of the impact of change in foreign exchange reserves on investment during two different periods, including the period from Q1/2009 to Q1/2015 and the period from Q2/2015 to Q1/2019, are presented in Table 7.

The results from Table 7 show that in the first period, the independent variable of the change in foreign exchange reserves as measured by the interaction between changes in foreign exchange reserves and ratio of cashflow to tangible asset positively influences firm investment with the estimated coefficient ($\beta = 0.0731$) at the significance level of 1 percent. During this phase, the amount of foreign exchange reserves does not fluctuate much, the reserves increase to a level that could create a positive impact on investment. In other words, firm investment increases when foreign exchange reserves increase because through foreign exchange reserves, government creates protective barriers to help businesses hedge against economic shocks in exchange rates and financial crises. In the first phase, abundant foreign exchange reserves helps the State Bank be more flexible in managing monetary policy, stabilizing the foreign exchange rate, and increasing the value of domestic currency, thereby increasing the confidence of foreign investors when investing in Vietnam's stock market. Besides that, during this period, in order to increase foreign exchange reserves, the State Bank aggressively buys foreign currencies, and at the same time, provides a corresponding amount of local currency into the market, which helps the banking system maintain a high level of liquidity as well as stabilize interest rates, thus helping businesses reduce financial costs when taking loans from

commercial banks. In contrast, during the second period from Q2/2015 to Q1/2019, the amount of foreign exchange reserves of Vietnam increased significantly. The estimation results from Table 7 point out that in this stage, the relationship between the change in foreign exchange reserve accumulation and investment is negative with the estimated coefficient ($\beta = -0.0105$) at the significance level of 1 percent. Thus, it can be concluded that to some extent, foreign exchange reserve accumulation brings great benefits to domestic investment. However, when reserves increases tremendously, it may cause negative effect to firm investment.

Table 7: The influence of changes in foreign exchange reserves on firm investment in different stages

	Period from Q1/2009 to Q1/2015	Period from Q2/2015 to Q1/2019
$C_{i,t-1}/K_{i,t-1}$	5.4718*** (0.5584)	90.6573*** (2.0826)
$\Delta Res \times C_{i,t-1}/K_{i,t-1}$	0.0731*** (0.0024)	-0.0105*** (0.0033)
$asize \times C_{i,t-1}/K_{i,t-1}$	-0.3809*** (0.0419)	-5.7986*** (0.1360)
$S_{i,t-1}/K_{i,t-1}$	0.0287*** (0.0003)	0.3661*** (0.0319)
$asize_t$	0.1255*** (0.0196)	3.3676*** (0.2719)
ΔRes	- 0.0271*** (0.0012)	0.0056 (0.0088)
Constant	-1.7946*** (0.2694)	-52.8454*** (3.9230)
Number of observations	5,292	4,693
Prob > Chi2	0.0000	0.0000

Note: The values in parentheses () are standard errors; *** indicates statistical significance at the 1% level.

4.5. The influence of changes in foreign exchange reserves on firm investment in different sectors

Estimated results of the impact of the change in foreign exchange reserves on the investment of enterprises in different industry groups, are presented in Table 8.

Table 8: The influence of changes in foreign exchange reserves on firm investment in different industry groups

	Industry group 1	Industry group 2
$C_{i,t-1}/K_{i,t-1}$	335.0252***(5.6992)	3.4845***(0.2893)
$\Delta Res \times C_{i,t-1}/K_{i,t-1}$	0.1954***(0.0059)	-0.0041***(0.0004)
$asize \times C_{i,t-1}/K_{i,t-1}$	-24.0262***(0.4199)	-0.2104***(0.0189)
$S_{i,t-1}/K_{i,t-1}$	-0.9082***(0.0311)	0.0239***(0.0007)
$asize_t$	9.7824***(0.2660)	0.0863***(0.0280)
ΔRes	-0.1034***(0.0099)	0.0016(0.0011)
Constant	-136.4052***(3.6684)	-1.3544***(3.990)
Number of observations	2,332	8,063
Prob > Chi2	0.0000	0.0000

Note: The values in parentheses () are standard errors; *** indicates statistical significance at the 1% level.

It is clearly shown in Table 8 that in industry group 1 and industry group 2, the relationship between cash flow and investment is positive at the significance level of 1 percent with the regression coefficients having values of 335.0252 and 3.4845, respectively. This shows that firms in industry group 1 have higher investment-cash flow sensitivity than those in industry group 2. This means that firms which are newly listed, young, small, and has low investment in fixed asset as well as low dividend payout ratio are more financially constrained than firms which are long-established, large, and has high fixed asset value as well as high dividend payout ratio. This empirical finding is similar to the study conducted by Alti (2003).

The research results also show that the impact of the change in foreign exchange reserves as proxied by interaction between changes in foreign exchange reserves and ratio of cashflow to tangible asset on the investment of firms in industry group 1 is positive with the estimated coefficient ($\beta = 0.1954$) at the significance level of 1 percent, while the effect in industry group 2 is negative with the estimated coefficient ($\beta = -0.0041$) at the significance level of 1 percent. This can be explained as follows:

For firms which are newly listed, young, small, and has low investment in fixed asset as well as low dividend payout ratio, the investment-cash flow sensitivity is very high, in other words, these firms are more financially constrained as they have difficulty in accessing external financial sources. However, changing in foreign exchange reserves does not greatly affect firm investment. The accumulation of foreign exchange reserves helps government have policies to protect these businesses against exchange rate shocks as well as financial crisis.

In contrast, for enterprises which are long-established, large, and has high fixed asset value as well as high dividend payout ratio, the investment-cash flow sensitivity is lower, in other words, these businesses are less financially constrained since they have large asset value and operate with large scale, so they can easily access external financial sources at a cheaper cost. However, large change in the accumulation of reserves will adversely impact firm investment. The external capital flow from financial intermediaries will be reduced due to crowding out effect, thereby affecting the investment of enterprises.

5. CONCLUSIONS

By adopting the theory of internal financing, theory of investment, theory of financial constraints and previous empirical evidence, the study develops the theoretical arguments on foreign exchange reserves accumulation and conducts tests to examine the impact of foreign exchange reserves accumulation on the investment of companies in Vietnam. A detailed data of 332 firms listed on Hochiminh Stock Exchange is collected over the period from the first quarter of 2009 to the first quarter of 2019. The study employs FEM, REM, FGLS method and finally applies GMM method to solve endogeneity problems. The research results show that foreign exchange reserve accumulation as measured by interaction between changes in foreign exchange reserves and firm's cash flow-investment has a negative correlation with investment measured by the value of

tangible capital. In addition, the study also examines the influence of foreign exchange reserves accumulation on corporate investment in two stages where stage I from Q1/2009 to Q1/2015 has a relatively small fluctuation in foreign exchange reserves and stage II from Q2/2015 to Q1/2019 has a strong fluctuation in foreign exchange reserves. The results show that in phase I, the change of foreign exchange reserves has a positive relationship with investment of enterprises. This can explain that, during this time, the amount of foreign exchange reserves does not fluctuate much, the reserves increase to a level that creates a positive impact on investment. In other words, investment of enterprises increases when foreign exchange reserves increase because through foreign exchange reserves, government creates protective barriers to help businesses hedge against economic shocks in exchange rates and financial crises. However, in Phase II, when the amount of reserves increases too high, it negatively affects business investment, causing financially constrained firms to experience the crowding effect when accessing to credit from domestic financial intermediaries.

Besides that, the study also investigates the impact of foreign exchange reserves on the investment of companies in different industries. Empirical findings point out that for firms which are newly listed, young, small, and has low investment in fixed asset as well as low dividend payout ratio, the investment-cash flow sensitivity is very high, in other words, these firms are more financially constrained as they have difficulty in accessing external financial sources. However, changing in foreign exchange reserves does not greatly affect firm investment. The accumulation of foreign exchange reserves helps government have policies to protect these businesses against exchange rate shocks as well as financial crisis. In contrast, for enterprises which are long-established, large, and has high fixed asset value as well as high dividend payout ratio, the investment-cash flow sensitivity is lower, in other words, these businesses are less financially constrained since they have large asset value and operate with large scale, so they can easily access external financial sources at a cheaper cost. However, large change in the accumulation of reserves will adversely impact firm investment. The external capital flow from financial intermediaries will be reduced due to crowding out effect, thereby affecting the investment of enterprises.

Currently, although the accumulation of foreign exchange reserves in Vietnam is at a record level compared to the history of national foreign exchange reserves. However, the foreign exchange reserves accumulation level of Vietnam only ranks 6th among countries in Southeast Asia and Vietnam's accumulation level is still lower than that of the leading country in the region. Therefore, government should continue to increase foreign exchange reserves at a moderate growth rate; increase budget revenue and limit the increase of domestic debt through the issuance of treasury bills; create preferential programs on lending interest rates and lending conditions so that businesses can easily access the bank's credit. Enterprises should develop a plan to accumulate cash to limit borrowing costs and bring higher business efficiency to enterprises. Additionally, firms should invest more in fixed assets through financial leasing companies.

References

- ❖ Aizenman J and Glick R (2009). Sterilization, Monetary Policy, and Global Financial Integration. *Review of International Economics*, 17(4): 777–801. <https://doi.org/10.1111/j.1467-9396.2009.00848.x>.
- ❖ Altı A (2003). How Sensitive is Investment to Cash Flow when Financing is Frictionless? *Journal of Finance*, 58(2):707-722. <https://doi.org/10.1111/1540-6261.00542>.
- ❖ Arellano M and Bond S (1991). Some Test of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations. *The Review of Economic Studies*, 58(2): 277-297. <https://doi.org/10.2307/2297968>.
- ❖ Bhagat S, Moyen N, and Suh I (2005). Investment and Internal Funds of Distressed Firms. *Journal of Corporate Finance*, 11(3): 449-472. <https://doi.org/10.1016/j.jcorpfin.2004.09.002>.
- ❖ Calvo GA (1991). The Perils of Sterilization. *International Monetary Fund Staff Papers*, 38: 921–926. <https://doi.org/10.2307/3867130>.
- ❖ Durdu CB, Mendoza EG, and Terrones ME (2009). Precautionary Demand for Foreign Asset in Sudden Stop Economies: An Assessment of the New Mercantilism. *Journal of Development Economics*, 89(2): 194-209. <https://doi.org/10.1016/j.jdeveco.2008.01.010>.
- ❖ Erel I, Jang Y, and Weibach MS (2015). Do Acquisitions Relieve Target Firms Financial Constraints? *The Journal of Finance*, 70(1): 298-328. <https://doi.org/10.1111/jofi.12155>.
- ❖ Farrar DE and Glauber RR (1967). Multicollinearity in Regression Analysis: The Problem Revisited. *The Review of Economics and Statistics*, 49(1): 92-107. <https://doi.org/10.2307/1937887>.
- ❖ Fazzari SM, Hubbard RG, and Petersen B (1988). Financing Constraints and Corporate Investment. *Brooking Papers on Economic Activity*, 1: 141-195. <https://doi.org/10.3386/w2387>.
- ❖ Forbes KJ (2007). One Cost of the Chilena Capital Controls: Increased Financial Constrasts for Smaller Traded Firms. *Journal of International Economics*, 71(2): 294-323. <https://doi.org/10.1016/j.jinteco.2006.03.005>.
- ❖ Gabaix X and Maggiori M (2015). International Liquidity and Exchange Rate Dynamics. *The Quarterly Journal of Economics*, 130(3): 1369–1420. <https://doi.org/10.1093/qje/qjv016>.
- ❖ Hadlock CJ and Pierce JR (2010). New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. *Review of Financial Studies*, 23(5): 1909-1940. <https://doi.org/10.1093/rfs/hhq009>.
- ❖ Harrison AE, Love I, and McMillan MS (2004). Global Capital Flow and Financing Constraints. *Journal of Development Economics*, 75(1): 269-301. <https://doi.org/10.1016/j.jdeveco.2003.10.002>.
- ❖ Hubbard RG and Kashyap AK (1992). Internal Net Worth and the Investment Process: An Application to U.S. Agriculture. *Journal of Political Economy*, 100(3): 506–534. <https://doi.org/10.1086/261827>.
- ❖ Hubbard RG, Kashyap AK, and Whited TM (1995). Internal Finance and Firm Investment. *Journal of Money, Credit and Banking*, 27(3): 683-701. <https://doi.org/10.2307/2077743>.
- ❖ International Monetary Fund (2019). Vietnam: 2019 Article IV Consultation; Press Release; Staff Report; and Statement by the Executive Director for Vietnam. *International Monetary Fund Country Report*, No. 19/235. <https://doi.org/10.5089/9781498326803.002>.
- ❖ Jeanne O (2013). Capital Account Policies and the Real Exchange Rate. *NBER International Seminar on Macroeconomics*, 9(1): 7-42. <https://doi.org/10.1086/669583>.
- ❖ Jeanne O and Ranciere R (2011). The Optimal Level of International Reserves for Emerging Market Countries: A New Formula and Some Applications. *The Economic Journal*, 121(555): 905-930. <https://doi.org/10.1111/j.1468-0297.2011.02435.x>.

- ❖ Jordan B, Westerfield R, and Ross S (2011). *Corporate Finance Essentials*. New York: McGraw-Hill/Irwin.
- ❖ Kaplan SN and Zingales L (1997). Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? *The Quarterly Journal of Economics*, 112(1): 169–215. <https://doi.org/10.1162/003355397555163>.
- ❖ Keynes JM (2006). *General Theory of Employment, Interest and Money*. Atlantic books.
- ❖ Laeven L (2003). Does Financial Liberalization Reduce Financing Constraints? *Financial Management*, 32(1): 5-34. <https://doi.org/10.2307/3666202>.
- ❖ Love I (2003). Financial Development and Financing Constraints: International Evidence from the Structural Investment Model. *Review of Financial Studies*, 16(3): 765-791. <https://doi.org/10.1093/rfs/hhg013>.
- ❖ Modigliani F and Miller MH (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. *The American Economic Review*, 48(3): 261–297.
- ❖ Mohanty MS and Turner P (2006). Foreign Exchange Reserve Accumulation in Emerging Markets: What are the Domestic Implications? *BIS Quarterly Review*.
- ❖ Moyen N (2004). Investment-Cash Flow Sensitivities: Constrained versus Unconstrained Firms. *The Journal of Finance*, 59(5): 2061–2092. <https://doi.org/10.1111/j.1540-6261.2004.00692.x>.
- ❖ Pham H and Phan DQT (2018). Effect of Financial Constraints on Cash Holdings of Vietnamese Listed Companies. *Ho Chi Minh City Open University Journal of Science*, 13(2): 205-218. <https://doi.org/10.46223/HCMCOUJS.econ.vi.13.2.519.2018>.
- ❖ Reinhart CM and Reinhart VR (2008). Capital Inflows and Reserve Accumulation: The Recent Evidence. *National Bureau of Economic Research Working Paper*, No. 13842. <https://doi.org/10.3386/w13842>.
- ❖ Reinhart CM, Renhart V, and Tashiro T (2016). Does Reserves Accumulation Crowd Out Investment? *Journal of International Money and Finance*, 63: 89-111. <https://doi.org/10.1016/j.jimonfin.2015.11.004>.
- ❖ Rodrik D (2006). The Social Cost of Foreign Exchange Reserves. *International Economic Journal*, 20(3): 253–266. <https://doi.org/10.1080/10168730600879331>.
- ❖ Smart SB, Megginson WL, and Gitman LJ (2004). *Corporate Finance*. Mason, OH: Thomson/South Western.
- ❖ Yun Y (2017). *Essays on Foreign Exchange Reserve Accumulation*. University of Maryland, College Park. ProQuest Dissertations Publishing, No. 10282540.