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The Effect of Real Exchange Rate Volatility on Strategic Investment in Iran

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Abstract

This study examines the impacts of real exchange rate fluctuations on the companies' strategic investments in Iran. The data of 92 listed companies in Tehran Stock Exchange during the period of 2002-2015 are used. First, the volatility of exchange rate is estimated by the Generalized Autoregressive Conditional Heteroskedasticity (GARCH). The model is estimated by GMM and system GMM methods. The results show that the relationship between exchange rate volatility and companies' strategic investments has an inverse U-shaped. The estimation result of GMM method shows that the inflection points for volatility of exchange rate and its lag are 0.08% and 0.13% respectively. When we estimate the model with system GMM the inflection point for exchange rate volatility and its lag are 0.05% and 0.11%, respectively. Moreover, we find out that the first lag of investment and cash flow variables have had positive and significant effects on strategic investment.

Keywords: Strategic investment, Tobin's Q, real exchange rate volatility, Iran, GMM.
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1. Introduction

The exchange rate has deep and broad implications in determining the competiveness of an economy. Exchange rate volatility has important effects on macro-economic variables and has major implications for economic activities.

In the traditional theory of investment, it is assumed that investment decisions are made in a secure environment. Two features of investment spending have not been considered in these theories; first, the majority of investment spending is irreversible. Second, investments could be delayed to obtain new information about prices, costs and other market conditions. Wide fluctuations in the real exchange rate which is the characteristic of developing countries such as Iran can have negative impacts on domestic and foreign investment behavior.

“First of all, the exports of developing economies often include products with low added value whose prices are not stable. Having a low power market, developing economies are often confronted with strong fluctuations of their export prices. Besides, a large part of the incomes provided by their exports serves to repay their external debt. Secondly, developing countries strongly depend on foreign capital and on intermediate inputs imported for their productions. On the basis of these specificities, it is straightforward to conclude that international price fluctuations (primary product prices, intermediate product prices, and foreign interest rate) can have important effects on the cyclic fluctuations and notably on real exchange rate fluctuations" (Drine & Rault, 2004).

Real exchange rate uncertainty causes reallocation of resources among the sectors, causes reallocation of resources across countries, and creates an uncertain environment for investment decisions if the investments are irreversible.

The variety of factors, such as the reliance on imported inputs and the share of foreign sales in total sales determine firm’s investment policy to movements in the exchange rate. For a firm dependent on imported inputs, exchange rate depreciation leads to increase invariable costs and the reduction in the marginal value of capital; so, the investment level is reduced. By contrast, for a firm with a larger share of revenues from the export markets, the increase in price competitiveness following an exchange rate depreciation is likely to imply an increase in the expected value of its capital and therefore in its level of investment (Nucci & Pozzolo, 2001).

In this article, we evaluated the effect of exchange rate volatility on strategic investment decisions of firms in Iran. Strategic investment is one of the most important decisions that commercial companies should make; since such investments can lead to competitive advantage through cost reduction and product differentiation which in turn leads to value creation. The following is the reason why we focused on investment instead of other aspects such as the value of the firm. The exchange rate might affect the value of the firm. However, the direct effect of exchange rate volatility on firms' investment is highly appreciated in the literature. It is commonly agreed that exchange rate movements that change a firm's profitability also change its incentives for investment. Secondly, investment activity is an important channel through which exchange rate fluctuations may affect the long-term growth rate of the economy and is arguably the greatest source of aggregate fluctuations. Additionally, because of the irreversible nature of investment, exchange rate movements are likely to have persistent effects on the level of investment. Therefore, this study, with the purpose of investigating the relationship between exchange rate volatility and strategic investment, developed a model of strategic investment. The results showed how exchange rate volatility influences the strategic investment decisions. The paper is organized as follows. The following section renders the empirical studies. Section 3 outlines the empirical specification. Section 4 is devoted to the data and model estimation and Section 5 concludes.

2. Empirical Studies

Zardashty (2014) evaluated the impact of real exchange rate uncertainty on private investment behavior of the Iran during the period 1961-2008. He used the GARCH model to obtain the uncertainty. The results showed that the index of real exchange rate uncertainty has a significant negative effect on private investment to GDP ratio, and imports of capital commodity.

Lubinga and Kiiza (2013) examined the impact of the real exchange rate volatility on the level and volatility of Uganda's bilateral trade flows with several major trade partners. Panel data methods were used in the analysis. They use GARCH (1,1) to develop measures of volatility for the real exchange rate and bilateral trade flows. The results showed that real exchange rate volatility has a negative and significant effect on the level of Uganda's bilateral trade flows. The results also showed that real exchange rate volatility had a positive and significant effect on the volatility of bilateral trade flows.

Safdari and Soleymani (2011) presented a paper titled “Exchange rate Uncertainty and Investment in Some of Middle East and North African Countries" which studied the relationship between uncertainty of exchange rate and domestic investment by using the fixed effect approach of panel data model. Fifteen sub-Sahara African countries were selected, and GARCH method was used to exchange rate uncertainty for each country. The results showed that there was a nonlinear relation between uncertainty of exchange rate and investment and the exchange rate uncertainty and its lag impact on the investment, effectively.

Henriques and Sadorsky (2011) investigated how the oil price volatility affects the strategic investment decisions of a large panel of US firms. The model was estimated using generalized method of moment estimation techniques for panel data sets. Empirical results showed that there was a U- shaped relationship between the oil price volatility and the firm investment.

Dhakalet al. (2010) have used the panel data to examine the effect of exchange rate uncertainty on foreign direct investment in China, Indonesia, Malaysia, the Philippines, South Korea, and Thailand. They concluded that exchange rate volatility had a favorable effect on foreign direct investment in their sample countries using the model estimates of error correction and a panel cointegration test.

Ahmad and Qayyum (2009) analyzed investment behavior of the private sector in large scale industries. The main emphasis in this paper has been to explore the role of public expenditures (development and non-development) and macroeconomic uncertainty in determining private sector’s fixed investment in large scale manufacturing.The results of the study supported the proposition that public development expenditures lead to enhance private investment in large scale manufacturing and public non-development expenditures have considerable negative effect on private investment. They also showed that economic instability and uncertainty tend to depress the private investment in large-scale manufacturing. The study also supported that the larger the size of the market, the higher will be the private investments.

Koetse et al. (2006) analyzed the (differential) impact of expectations and uncertainty on investment spending in small and large firms. They analyzed two types of investment, viz. aggregate investment and investment in energy-saving technologies, using Dutch firm level data. The results showed that expectations and uncertainty about input- and output prices and domestic demands have substantial but different effects on investment spending in firms with different sizes. Furthermore, they found evidence, at least for small firms, that there were important differences between the effects of uncertainty about the input and the output variables.

Bulan (2005) using a panel of U.S. companies, found that uncertainty (based on the volatility of stock returns) had a strong negative impact on firm level investment that was robust to the inclusion of Tobin's q or cash flow variables.

Halletet al. (2004) estimated investment equations for 13 different industries using data for nine OECD countries over the period 1970–2000. They found that the impact of price uncertainty was negative or insignificant in all but one case whereas the impact of (nominal) exchange rate uncertainty was negative in only six cases, positive in four cases, and insignificant in three others. In addition, there were conflicting effects from the real exchange rate. The net effect depended on whether the source of the uncertainty was in domestic markets or in foreign markets.

Atellaet al. (2003) have analyzed that how exchange rate volatility could influence the innovation process of a firm. Using a large panel data of Italian firms and a model of signal extraction they have found that as the market power of a firm reduces more and more, the exchange rate volatility would cause to the reduction of investment.

Erdal (2001) analyzed the depressing effects of real exchange rate uncertainty on investment spending by using option pricing techniques. He showed that real exchange rate volatility caused optimal stopping point (optimal real exchange rate level to undertake investment,) to be higher for export-oriented sectors and lower for import-oriented sectors. The real investment spending fell as volatility increased regardless of whether the sector was an export-oriented or import-oriented sector.

Bleaney and Greenaway (2001) have estimated the impacts the real effective exchange rate on the growth and investment for a panel of 14 sub-Saharan African countries over 1980–1995.The results showed that growth was negatively affected by terms of trade instability, and investment by real exchange rate instability. Both growth and investment increased when the terms of trade improved and real exchange rate overvaluation was eliminated.

Sarkar (2000) used the canonical real options model of investment, demonstrated that the notion of a negative uncertainty-investment relationship is not always correct. He showed that an increase in uncertainty has a positive impact on investment.

Abel and Eberly (1994) extended the theory of investment under uncertainty to incorporate fixed costs of investment and potential irreversibility of investment. They showed that there were potentially three investment regimes, which depended on the value of q relative to two critical values. For values of q above the upper critical value, investment was positive and was an increasing function of q, as was standard in the theory branch of the adjustment cost literature. For intermediate values of q, between two critical values, investment was zero.

Hartman (1972) examined the effects that increased uncertainty in future output prices, wage rates, and investment costs would have on the quantity of investment undertaken by a firm. He emphasized a different mechanism that could rationalize a positive effect of higher uncertainty on investment, and showed that as the non-negativity constraints are surely never binding, current investment would not decrease with increased uncertainty and was invariant to increased uncertainty in future investment costs.

3. Empirical Specification

Tobin's q is the ratio of the market value of the firm to the replacement value of its assets and can be justified using transaction cost economics. Tobin's q theory of investment, which relates investment to the ratio q, provides a starting point for the empirical specification used in this paper.

Tobin's q is a measure of the value being created in a firm. If q is greater than one, the market value of the firm is greater than the replacement costs and managers can raise the market value of their firms' stock by buying more capital. If q is less than one, the stock market value of capital is less than the replacement costs. In this case, managers will not replace capital as it wears out. Under standard neoclassical assumptions about firm behavior, Tobin's q theory can be represented by a fairly simple relationship between investment and q.

We consider a representative profit-maximizing firm operating in a perfectly competitive environment. The profit function is assumed to be of the form:

$$\pi(\mathrm{K_t}, \mathrm{I_t}, \epsilon_t) = \mathrm{p_t F(K_t)} - \mathrm{p_t^I}[\mathrm{I_t} + \mathrm{G}(\mathrm{I_t}, \mathrm{K_t}, \epsilon_t)] \quad (1)$$

Where $\mathrm{p_t}$ is the price of output, $\mathrm{F(K_t)}$ is output, $\mathrm{p_t^I}$ is the price of investment goods, $\mathrm{I_t}$ is investment, $\mathrm{G(I_t, K_t}, \epsilon_t)$ is anadjustment cost function, $K_t$is capital stockand ϵ_t is a stochasticshock to the adjustment cost function.

We assume that adjustment costs are quadratic, and of the form:

$$G(I_t, K_t, \epsilon_t) = \frac{b}{2}\left[\left(\frac{I_t}{K_t}\right) - a - \epsilon_t\right]^2 K_t \tag{2}$$

The firm maximizes the present value of future discounted profits, given by

$$V_t = E_t \sum_{i=0}^{\infty} \beta^i \pi(K_{t+i}, I_{t+i}, \epsilon_{t+i}) \tag{3}$$

Subject to

$$K_{t+i} = (1-\delta)K_{t+i-1} + I_{t+i} \tag{4}$$

The two first-order conditions of this maximization problem are:

$$\frac{\partial \pi_{t+i}}{\partial I_{t+i}} = -\lambda_{t+i} \tag{5}$$

$$\frac{\partial \pi_{t+i}}{\partial K_{t+i}} = \lambda_{t+i} - (1-\delta)\beta E_t \lambda_{t+i+1} \tag{6}$$

If we assume linear homogeneity of the profit function, then we can write:

$$\pi_t = K_t \frac{\partial \pi_t}{\partial K_t} + I_t \frac{\partial \pi_t}{\partial I_t} \tag{7}$$

By substituting equations (5) and (7) into (6), we obtain:

$$\lambda_t = \left(\frac{\pi_t}{K_t} + \frac{I_t \lambda_t}{K_t}\right) + \beta(1-\delta)E_t \lambda_{t+1} \tag{8}$$

Using equation (4), we can rearrange this as:

$$\lambda_t (1-\delta) K_{t-1} = \pi_t + \beta E_t \lambda_{t+1} (1-\delta) K_t \tag{9}$$

Solving this forward, we recover the value of the firm as:

$$\lambda_t (1-\delta) K_{t-1} = E_t \sum_i^{\infty} \beta^i \pi_{t+i} = V_t \tag{10}$$

We now define marginal q_t as the ratio of the shadow value of a unit capital, λ_t , to its replacement cost, p_t^I . Expressing q_t in terms of observable variables, we get:

$$q_t \equiv \frac{\lambda_t}{p_t^I} = \frac{V_t}{p_t^I (1-\delta) K_{t-1}} \tag{11}$$

This is Hayashi’s (1982) result that under linear homogeneity of the profit function, marginal q equals average q. To obtain an investment equation, we rewrite the first-order condition (5) and Eq. (11), making use of the functional form for π_t that we have assumed. This gives the familiar investment equation as:

$$\frac{I_t}{K_t} = a + \frac{1}{b} Q_t + \varepsilon_t \text{Where} Q_t \equiv (q_t - 1) \tag{12}$$

In Eq. (12), I_t is the firm gross investment, K_t is the firm fixed capital stock,‹Q_t is the marginal q, (Q=q−1) and ε_t is a random error term. Eq. (12) forms the backbone of many empirical tests of Q theory. The well-known Q model of investment relates investment to thefirm's stock market valuation, which is meant to reflect thepresent discounted value of expected future profits.

In the special case of perfectly competitive markets and constant returns to scale technology, Hayashi (1982) showed that average Q would be a proper sign for investment. The usual empirical measure, which we call Tobin's Q, further assumes that the maximized value of the firm can be measured by its stock market valuation.

Under these assumptions, the stock market valuation would capture all relevant information about expected future profitability. However if the Hayashi conditions are not satisfied, or if stock market valuations are influenced by "bubbles", or factors other than the present discounted value of expected future profits, Tobin's Q would not capture all relevant information about the expected future profitability of the current investment. In this case, additional explanatory variables like current or lagged sales or cash-flow terms could proxy for the missing information about expected future conditions.

In empirical specifications, Eq. (12) is usually augmented with fixed effects for cross section, time, and other explanatory variables of interest; in this paper, additional variables such as cash flow and real exchange rate volatility are included. The use of cash flows to explain strategic investment can be justified using agency theory. An agency problem with regard to strategic investments can occur because of information asymmetries and incentive incompatibilities (Jensen & Meckling, 1976).

Managers making strategic investment decisions have more information about the expected net present value of the investments than, owners, and shareholders. Managers have a strong incentive to invest in projects where the private benefits to them are greater than the social benefits to the organization as a whole. As a result, over investment can occur at the firm level.

Recognizing the potential for agency problems, lenders of financial capital may be less willing to lend money to companies for the purpose of strategic investments. This makes it difficult and costly (in terms of higher costs for debt and equity) for firms to raise money (Fazzari et al., 1988; Stulz, 1990). Financing constraints can prevent firms from pursuing profitable investment opportunities. In order to overcome information asymmetries, firms are more likely to make strategic investments when they have positive internally generated cash flows.

Real exchange rate, as an important variable, will be affect investment through channel of imports and exports. Domestic investment is heavily dependent on imports of capital goods in most developing countries. Since most capital goods are imported to Iran, exchange rate and its volatility are important.

In this paper, Eq. (12) is augmented with a cash-flow variable (cf_{it}), real exchange rate volatility variable ($rxrv_t$), real exchange rate volatility squared ($rxrv_t^2$), and fixed effects for individual firm effects (η_i) and time period effects (v_t). The stochastic error term isψ_{it}. Individual firms are indexed by i and time periods are indexed by t.

$$\left(\frac{I}{K}\right)_{it} = a + \frac{1}{b}Q_{it} + \gamma_1 cf_{it} + \gamma_2 rxrv_t + \gamma_3 rxrv_t^2 + \eta_i + v_t + \psi_{it} \quad (13)$$

Following Mohn and Misund (2009) we assume that the error term ψ follows an AR (1) process:

$$\psi_{it} = \rho\psi_{it-1} + \varphi_{it} \quad (14)$$

Where φ is white noise, substituting Eq. (14) into Eq. (13) yields the following dynamic firm investment Eq. (15).

$$\left(\frac{I}{K}\right)_{it} = a(1-\rho) + \rho\left(\frac{I}{K}\right)_{it-1} + \frac{1}{b}Q_{it} - \frac{\rho}{b}Q_{it-1} + \gamma_1 cf_{it} - \rho\gamma_1 cf_{it-1} + \gamma_2 rxrv_t - \rho\gamma_2 rxrv_{t-1} + \gamma_3 rxrv_t^2 - \rho\gamma_3 rxrv_{t-1}^2 + (1-\rho)\eta_i + v_t - \rho v_{t-1} + \varphi_{it} \quad (15)$$

For econometric estimation purposes, Eq. (15) can be more conveniently written as Eq. (16).

$$\left(\frac{I}{K}\right)_{it} = b_0 + b_1\left(\frac{I}{K}\right)_{it-1} + b_2 Q_{it} + b_3 Q_{it-1} + b_4 cf_{it} + b_5 cf_{it-1} + b_6 rxrv_t + b_7 rxrv_{t-1} + b_8 rxrv_t^2 + b_9 rxrv_{t-1}^2 + (1-\rho)\eta_i + v_t - \rho v_{t-1} + \varphi_{it} \quad (16)$$

The empirical model relates the strategic investment to the variables of capital ratio, one lag period of itself, Tobin's Q, cash flows, exchange rate volatility and squared of exchange rate volatility.

4. Data and Model Estimation

This study has used the data of 92 listed companies in Tehran Stock Exchange during the period of 2002-2015. The data have been collected from the financial statements of these companies. The variables used in the model were:

I_t: Investment of companies which includes investments in property, equipment's, machineries, etc.
K_t: The volume of the firm's fixed capital is considered equal to its total assets. So, this variable has been replaced by data of firm's total assets.
Tobin's Q: The sum of market value of equity and total debt is divided by total assets and
Market value of equity= year-end price per stock ×number of Stock
$Q_t = q_t - 1$
cf_{it}:Operating cashflow which includes input and outputcashflow associated with operating activities which includes the production and sale of goods and provide services and calculated costs and revenues associated with it in profit and loss statement.
rxrv: Real exchange rate volatility, real exchange rate is defined as the nominal exchange rate adjusted for relative national price levels. The real exchange rate has been calculated using the nominal exchange rate of the free market and according to the following formula:
$RER = \frac{CPI_{US}}{CPI_D}.NER$NER= nominal exchange rate
CPI_{US}= America's consumer price indexCPI_D= Iran's consumer price index

Exchange rate data are obtained from the World Bank website and the volatility of exchange rate is estimated through the generalized autoregressive conditional heteroskedasticity (GARCH) model.
$rxrv^2$: The squared of real exchange rate volatility.

Table 1 presents the results of unit root test by using the Levin, Lin, Chu test. The results indicated that all variables were stationary at level (I(0)). Thus, the results clearly showed that the null hypothesis of the unit root can be rejected.

Table1: Unit Root Test by Levin, Lin, Chu Test

Variable Level	first order difference

	Statistic	Prob	Statistic	Prob
I/K	-12.1215	0.00	-	-
CF/K	-8.67300	0.00	-	-
Q	-12.5916	0.00	-	-
rxrv	-16.5521	0.00	-	-
$rxrv^2$	-18.6036	0.00	-	-

Eq. (16) is an example of a linear dynamic panel model. In the models, lag(s) of the dependent variable enters into the model on right side as an explanatory variable. As a result, a correlation is created between the dependent variable and the error term. In order to solve the problem of depended variable and other explanatory variables endogenous, Arellano and Bond (1991) developed a generalized method of moments (GMM) estimator which yielded consistent parameter estimations for models of this type. The Arellano and Bond (1991) approach is specifically designed for situations where there are a large number of cross sections (N) and a small number of time periods (T). The panel data set used in this paper contained a large number of firms and a small number of time periods.

In this study, the investment equation is estimated using two different econometric approaches including GMM and system GMM. The purpose of using two different estimation methods was to see how sensitive empirical results were to the choice of estimating technique. In addition, system GMM method is more consistent than other dynamic panel methods and change in instrumental variables would not affect efficiency of the estimates (Baltaghi, 2005). Considering these two advantages, system GMM method was also utilized. Consistency of the GMM estimators depends on the validity of the instruments used. The statistical analysis suggested by Arellano and Bond (1991), Blundell and Bond (1998), and Arellano and Bover (1995) was used to test this issue. The Sargan test was also used for the determination of any kind of correlation between instruments and errors. Confirming the null hypothesis means that the instruments are suitable. The second test was serial correlation test of regression residual. The tests that are called first-order AR (1) and second-order AR (2) residual correlation were also used to assess the validity of the instrumental variable. Arellano and Bond (1991) said that error terms should have the first order serial correlation and did not have second order serial correlation in the GMM estimates.

Table 2 shows the results obtained from Sargan, AR (1), AR (2) tests.

Table 2: Validity of Instrumental Variable

		System GMM		GMM	
Type of test	**Test statistic**	**Statistic**	**Prob.**	**Statistic**	**Prob.**
Sargan	χ^2	80.98	0.82	77.37	0.70
AR(1)	Z	-2.68	0.007	-2.19	0.02
AR(2)	Z	1.61	0.10	1.43	0.15

Based on the table above, the Sargan, AR (1) and AR (2) tests, confirmed the validity of the estimated model results. Sargan test did not reject the null hypothesis meaning that instrumental variables were not correlated with the error term. In the AR (1) test the null hypothesis is rejected at the 5% level (exists first order serial correlation) and in the AR (2) test the null hypothesis is confirmed (lack of second order serial correlation).

Fig. 1 shows how real exchange rate volatility has been changed over the estimation period. Exchange rate fluctuations have been increased and decreased during different years. So that in the year2009 (1388),which was the election year in Iran, there were sharp fluctuations in the exchange rates.

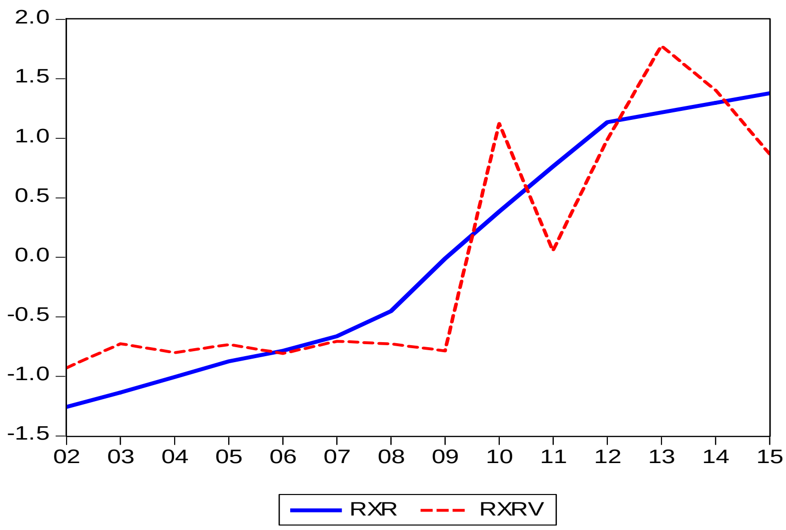

Figure 1: Real Exchange Rate (rxr) and Volatility of Real Exchange Rate (rxrv)

Tables 3 and 4 show the correlations between the variables and summary of statistical analysis. As expected, investment is positively correlated with Q and cash flow and is negatively correlated with real exchange rate volatility and the square of real exchange rate volatility.

Table 3: Correlation Matrix

variable	I/K	CF/k	Q	rxrv	$rxrv^2$
I/K	1				
CF/k	0.15	1			
Q	0.07	0.41	1		
rxrv	-0.10	-0.03	-0.16	1	
$rxrv^2$	-0.09	-0.02	-0.16	0.98	1

Table 4: Summary Statistics

Variable	Obs	Mean	Std.Dev	Min	Max
I/K	1288	0.062	0.11	0.000049	2.81
CF/K	1288	0.13	0.16	-0.31	3.20
Q	1288	0.66	1.17	-0.78	10.80

Variable	Obs	Mean	Std.Dev	Min	Max
rxrv	1288	0.09	0.04	0.04	0.19
$rxrv^2$	1288	0.01	0.01	0.001	0.03

Table5showsthe results of the model estimation. Results obtain educing both GMM and system GMM methods, significantly were close to one another and were confirming each other. So that the first lag of investment, Tobin's Q and its first lag, cash flow and first lag of its exchange rate volatility and first lag of its variables have positive and significant effects on investment. Also the square of exchange rate volatility and first lag of its variables had negative and significant effects on investment. To explain the positive relationship between investment and Tobin's Q, Tobin argued that rising stock prices would increase the value of Q; this means that alternative capital is relatively cheaper for firms (for example through issuing shares to gain more funds). This leads to a growth for the investment. Myers and Majluf (1984) justified positive relationship between investment and cash flow by agency theory. According to this theory, information asymmetry between management and investors, increases the hierarchically that cost of external funds will be higher than internal funds. Therefore, the information asymmetry causes the foreign capital to be more costly from internal funds and the firm is limited in terms of financing. So, only companies with large cash flows can attract investment opportunities.

Table 5: Results of the Model Estimation Using Both GMM and System GMM Methods

Variable	System GMM	GMM
I/K(-1)	0.13 (123.9)	0.10 (55.07)
Q	0.003 (11.59)	0.002 (4.31)
Q(-1)	0.006 (21.93)	0.006 (7.41)
CF	0.14 (45.24)	0.16 (30.48)

Variable	System GMM	GMM
CF(-1)	0.01 (5.12)	0.05 (8.37)
rxrv	0.08 (6.65)	0.15 (7.60)
rxrv(-1)	0.32 (36.39)	0.34 (15.29)
$rxrv^2$	-0.72 (-13.56)	-0.91 (-11.77)
$rxrv^2(-1)$	-1.43 (-43.69)	-1.28 (-14.87)
drxrv ^ drxrv(-1)^	0.05 0.11	0.08 0.13

Note: drxrv ^ and drxrv (-1)^ are inflection points for the curvilinear relationship between real exchange rate volatility and firm level investment. Numbers in parentheses are Z statistics.

Also results obtain educing GMM and system GMM methods showed that the relationship between the exchange rate volatility and companies' strategic investments was inversely U-shaped. So that, before the inflection point, an increase in exchange rate volatility increased investment. However, after the inflection point, an increase in exchange rate volatility reduced the investment.

There are two different views about the relationship between uncertainty and investment:

The first view: The negative relationship between uncertainty and investment. This view believes that as long as there is uncertainty despite the irreversible investment, the decision to invest in the present destroys the opportunity of selected for the effective investment in future. Therefore, irreversible investment leads to the inverse relationship between uncertainty and investment.

The second view: The positive relationship between uncertainty and investment. This view believes that though irrevocability of the investment spending can cause delay in investment but it is likely that price to acquire capital in future time compared with current time and the cost of capital expansion increase. The cost of capital expansion for some industries is very important. Because most of them are facing with cases such as limitation of land and natural resources, limitation of special permissions for activity of firm and waiting for entry of new competitors into the industry which make the firm invest at current time despite the uncertainty and irrevocability of the investment spending.

So, two types of cost should be considered, namely, cost of irreversibility and cost of capital expansion and then the relationship between uncertainty and investment should be determined.

These results are consistent with Sarkar study (2000). He showed that the relationship between uncertainty and investment can show a threshold effect. This means that at low levels of uncertainty, the relationship is positive, but above at the critical level of uncertainty, the relationship will be negative. Also Lee and Shin (2000) showed that convexity effect of the profit function becomes stronger with the increase in the share of variable inputs, therefore investment increases most likely with increasing uncertainty. In the absence of a fixed adjustment cost, a higher labor share strengthens the positive relationship between investment and uncertainty in the sense that it increases the elasticity of investment with respect to uncertainty. When a lumpy adjustment cost is present, if the labor share is low, the option-value effect is more likely to dominate the convexity effect so that, as uncertainty increases, optimal investment drops to zero. On the other hand, if the labor share is high, the convexity effect dominates the option-value effect so that the optimal investment can only increase in uncertainty.

These results can be interpreted in this way that although the existing firms reduce their investments in response to the increase of uncertainty, the investment level increases in total due to the entry of risk seeking firms and firms that are optimistic about the increasing uncertainty. It is notable that as long as the macro investment is low in the country there are still investment opportunities with high profit. Second, because from investor views, postponing and wait to reach new information may lead to loss of market share and desirable opportunities and sometimes the loss of consumer forever. So, uncertainty will not reduce investment necessarily.

On the other hand, in Iranian economy, especially in the years after the revolution, considering the gap between the official and market exchange rates, investment has become a common phenomenon to benefit from currency quotas. In other words, the impact of exchange rate on investment, which is shown through its effects on the firms' profits, will be increased in the existence of different rates of exchange.

Notice that the inversely U-shaped relationship between investment and exchange rate volatility also is held at the one period lag of exchange rate volatility. In the GMM method, inflection point has been 0.08% for volatility of exchange rate variable and 0.13% for the lag of volatility of exchange rate and in the system GMM method, it has been 0.05% and 0.11%, respectively. Table 6 shows the results obtained from Wald tests.

Table 6:Validity of the Estimated Coefficients

		GMM		System GMM	
Type of test	Test statistic	Statistic	Prob.	Statistic	Prob.
Wald	χ^2	358291	0.000	23986	0.000

The null hypothesis in the Wald test that implies all coefficients are zero is rejected at the 1% level. Therefore, these estimations have confirmed validity of estimated coefficients.

5. Conclusion

This study has examined the relationship between real exchange rate volatility and strategic investment in Iran using panel data for 92 companies listed in Tehran Stock Exchange during the period of 2002-2015. The volatility of exchange rate is estimated by the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The model is estimated by GMM and system GMM methods.

Estimation is done using Stata 10 software. Results obtained using both methods verify an inverted U-shaped relationship between exchange rate volatility and companies' investment. In the GMM method, inflection point has been 0.08% for volatility of exchange rate variable and 0.13% for the lag of volatility of exchange rate and in the system GMM method, it has been 0.05% and 0.11%, respectively. So that, before the inflection point, an increase in exchange rate volatility increases investment. And after the inflection point, an increase in exchange rate volatility reduces investment. It was shown that Tobin's Q and cash flow variables have positive and significant effects on companies' investment. Moreover, the first lag of these variables have direct impact on investment.

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