



Exchange Rate Uncertainty Effect on Export-Oriented Companies at Tehran Stock Exchange (Yield) Rate of Return: A Panel-Vector Autoregressive Model

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ABSTRACT

The main purpose followed in this research is to analyze effect of exchange rate uncertainty on the export-oriented companies' rate of return at Tehran Stock Exchange applying panel-vector autoregressive model during 2004-2014. The results indicate that the companies' rate of return is affecting by factors such as (exchange rate uncertainty, profitability index, size of company, debt ratio, book value to market value of each stock ratio). In accordance with the results, the return's response to leverage index (debt ratio) is consistently negative while the return's responses to profitability index and the book value to market value are positive at first and then turn negative. In addition, the size of company initially affects the rate of return negatively and then has an insignificant positive effect on it, which means the greater the company is, the more rate of return it has in long term. Consequently, it is indicated that the effect of exchange rate's uncertainty on export-oriented companies' rate of return is positive in both short and long run; which presents that the more exchange rate uncertainty is, the more rate of return we will have in long run.

Keywords: Exchange Rate, Tehran Stock Exchange, Panel Vector Autoregressive Model

JEL Classifications: F31, G2

1. INTRODUCTION

At the time of international trade increase among countries, the exchange rate fluctuations play the role of most important resources of company's risk which is more unstable in compare with other macroeconomic variables such as interest rate (4 times) and inflation (10 times) (Jorion, 1990). This instability leads to an uncertainty in exchange market and risk increase at stock market that eventually affects rate of return in these export-base companies.

Thus, one of export-oriented companies' challenges is the trend of exchange rate that can influence the export-base companies' incomes. In fact, while the exchange rate reduces, the profitability of the companies decreases and at the same time as the exchange rate increases internal exchange resources deficit can expose the share of these companies in export and gross domestic production of country to risk. In consequence, the majority of investors

always look closely to the exchange market. Therefore, regarding the individuals' budget and the liquidity degree of markets, the exchange markets known as one of the main rivals of stock market. However, fluctuations and uncertainty existence in stock market lead to liquidity ingress or egress in this market (Chen et al., 2005).

In economics the exchange rate uncertainty literary concerns the imprecision and unpredictability of this variable, that can affect companies' returns over time. Hence, exchange rate variations an important factor in forming expectations of companies and investors and its imprecision put them in uncertainty condition. Therefore, this research will pursue the effect of uncertainty on rate of return of accepted export-oriented medicine and chemical firms at Tehran Stock Exchange applying panel vector autoregressive (PVAR) model. This paper organized in four sections. First introduction, second we have the literature review and empirical background, then the data and methodology and finally we state the estimations, results by presenting some policy suggestion.

2. LITERATURE REVIEW

Regarding the importance of the issue, different national and international studies on this subject presented subsequently.

Heydari et al. (2013), analyzing the relationship between the real exchange rate uncertainty and the total index of stock price in Tehran Stock Exchange applying bonds test which indicates a significant and negative relationship between price index and exchange rate in both short and long run. Kouchak Zadeh and Jalaie (2013), study the effect of exchange rate uncertainty on non-oil exports of Iran implementing ECM and AR methods. They concludes that the value of exchange rate uncertainty effect on the non-oil exports is approximately 1.06 in short run and in long run the this value equals to 7.29 which is negative and significant.

In another article on this subject, Mashayekhi et al. (2008) analyze the effect of macroeconomic variables on the relationship between the basic variables extracted from financial statements and accepted companies in Tehran Stock Exchange rate of return during 1993 to 2004. The results includes that the total index of stock price, the adjusted gross domestic production in basic price without oil, gross domestic expenses, oil revenues, inflation rate and the gross national income have a significant effect on this relationship. However, variables such as number of stock transfer of public sector, deficit (excess) budget, crude oil export, the unofficial market exchange rate, Gini coefficient, tax revenues, unemployment rate, current accounts balance, and the 1-year investment interest rate are ineffective and insignificant on this relationship.

Chang (2001), in a research on the exporting companies accepted in Taiwan during the financial crisis of Asia, realized that the exchange rate volatilities have a significant impact on most of these companies' return. However, he did not get a specific result from the effect of exchange rate volatilities on importing companies' return.

In 1998, Michael presented a survey the impact of exchange rate volatilities on Australia's trade applying conditional heteroskedasticity model, which indicates the positive possible effect of exchange rate volatilities on exports sector and its negative effect on imports, aversely.

Liang et al. (2013) had a review on the relationship between stock prices and the exchange rate implementing Granger panel method. He discovered the negative effect of exchange rate on stock prices through investment.

Serletis et al. (2009) studied the effect of exchange rate uncertainty on export applying augmented conditional heteroskedasticity and multi variable VAR methods, which indicate the negative effect of exchange rate uncertainty on export.

Grossmann et al. (2014), in analyzing the most destabilizers dynamics of exchange rate volatilities components implementing spectral separation method, discover the dynamics among macroeconomics, financial variables and exchange rate

volatilities as well as exchange rate volatilities feedback effects on macroeconomic and financial variables which is greater in developing countries in compare with developed ones.

Christiana (2012) studied the relationship between stock return and exchange rate variations in 13 countries applying Granger casualty method since 1997 to 2012. The remarkable results of this study indicate capital market and exchange rate transition as two interactive time series in Korea revealing a two-side casualty significant in 1% criterion. Moreover, they realized that the exchange rate transition has a significant effect on stock returns in Brazil and Russia while the capital market is a risky factor for USA's exchange rate.

Caporale et al. (2014) in a survey on the nature of stock price and exchange rate relationship in six developed economies (USA, England, Canada, Japan, Euro region, Switzerland) using Banking crisis data for 2007-2010, at first for analyzing the relationship between the two variables applies VAR-generalized autoregressive conditional heteroskedasticity (GARCH) model and in the next step uses unrestricted extended dynamic conditional correlation-GARCH model. The correlation results indicate that the dependence of the variables have increased during the recent crisis.

In accordance with the empirical studies implemented, there is no study, which specifically analyzes the impact of exchange rate uncertainty on export-oriented companies' returns applying PVAR model. Most of the studies indicate that for estimating the exchange rate uncertainty different approaches applied which in the majority the ARCH and GARCH models utilized for assessing the exchange rate uncertainty and several different econometrics methods for analyzing the relationship between the two variables. Therefore, in here for estimating the exchange rate uncertainty and analyzing the relationship between this variable with rate of return, the Panel-VAR model applied in which the necessity of estimating the exchange rate uncertainty in separate, resolves.

3. THEORETICAL BACKGROUND

Mehrabi and Bashrabadi (2011) argue that the relationship between firm's profitability and exchange rate changes depends on the type and the nature of industry. The exchange rates increase causes rise in value of exchange assets of firm. In fact, the firms which acquire exchange assets will be more valuable if the exchange rate rises and conversely for those which have exchange debts, a rise in exchange rate leads to increase in their debts as well as decrease in firm's value for stockholders (Naeni et al., 2003).

3.1. Yield Rate

Stock yield is an important and complex concept which affected by different factors. Stock yield depends on factors such as profitability index, leverage index (debt ratio), firm's size and book value to each stock value ratio and etc. (Shahroudiani et al., 2013).

A normal (common) stock investment return, in a specific period, obtained regarding the primary and end of period price and benefits yield of possession. Benefits of possession accrue to the stockholders in case the company holds the general assembly that

period unless, the benefits equals to zero. The investment rate of return in stocks is estimated as follow:

$$r_{it} = \frac{P_t - P_{t-1} + d_t}{P_t} \times 100$$

P_t : Price of each share at the end of period t ,

P_{t-1} : Value of each share at the beginning of period t ,

d_t : Stocks' benefits of possession, which accrue to the stockholder t period (Sayadi, 2010).

Benefits of possession can be paid to stockholders in different ways, whereby we mean to use the dividend.

3.1.1. Effective factors on yield rate (rate of return)

3.1.1.1. Firm's size

One of the internal and structural factors of companies, which affect their yield and profitability, is the size of company. This issue has closely studied by many scholars but there is not an agreement on which type of companies (small size or larger companies) are more profitable. Some of them believe in larger companies more profitability due to the following reasons:

3.1.1.2. Debt to asset ratio

This ratio shows the financed assets percentage by debt and compares all commitments (in both short and long term) with all assets (Drake and Fabozzi, 2012). This ratio obtained by dividing total debts to total assets. Managers intend to finance the companies' financial necessities through debts, due to its advantages. Nevertheless, financing through debt has interest cost and this makes companies to pay a part of their incomes financing costs. In subsequent, their future profitability will decrease (Sayednejad and Aghaei, 2002).

3.1.1.3. Book value to market price ratio

This ratio is defined as B/M and indicates the percent change in book value to market value. This ratio is also used as M/B alternatively that state the percent of increase in market value to history value (Deane and Pringle, 1984).

3.1.1.4. Profitability of company

Consists of the price to income ratio of each share, which shows the required time for capital return from stocks' future proceed (Ghaemi and Toosi, 2006).

Baso, during a period including April 1957 to March 1971, indicated that the stocks with low P/E ratio (or with high E/P ratio) significantly gained more yields of stocks (Saghafi and Salimi, 2005).

3.1.1.5. Exchange rate uncertainty

Exchange rate is one of determinant factors in profitability and efficiency assessment of investment projects. In fact, the exchange rate stability leads to a secure domestic economy and consequently, investors can make a decision on investing at present and future easily (Samimi et al., 2013).

Uncertainty includes unanticipated changes in an economic variable as these changes are unpredictable in future and could highly affect other economic variables. Uncertainty in exchange rate leads to future price's uncertainty of goods and through this, economic factors' decisions are affected (Moradpooladi et al., 2008).

During three past decades, many researchers conducted on surveying of the relationship between companies' stock return and exchange rate. Although in literary point of view, exchange rate fluctuations have significant effect on stock returns, empirical evidences show that this relationship is vulnerable.

4. RESEARCH METHODOLOGY AND MODEL PRESENTATION

The current studying applied descriptive-analysis method. The data used in the current sample are the annual export-oriented companies' return index at Tehran Stock Exchange and free market exchange rate compiled from the Iranian Central Bank report and Tehran Stock Market website and spans the time period 2004-2014. In order to test the exchange rate uncertainty effect on return rate of accepted medicine and chemical firms at Tehran Stock Exchange employing a VAR panel data model which is similar to VAR model structurally, i.e. all the variables are considered endogenous.

The two variables PVAR models generally generated as follow:

$$\begin{bmatrix} Z_{it}^1 \\ Z_{it}^2 \end{bmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \end{bmatrix} + \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} Z_{i,t-1}^1 \\ Z_{i,t-1}^2 \end{bmatrix} + \begin{bmatrix} e_{it}^1 \\ e_{it}^2 \end{bmatrix}$$

$$\begin{pmatrix} e_{it}^1 \\ e_{it}^2 \end{pmatrix} \sim N(0, \Sigma)$$

$$\text{Where, } \Sigma = \begin{bmatrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{bmatrix} \Rightarrow Z_{i,t} = A_0 + A_1 Z_{i,t-1} + A_2 Z_{i,t-2} + A_3 Z_{i,t-3} + e_{it} e_{it} \sim N(0, \Sigma)$$

$$\text{Where, } A_0 = B^{-1}\Gamma_0, A_1 = B^{-1}\Gamma_1 \text{ and } e_{it} = B^{-1}\epsilon_{it} \quad (1)$$

Where i ($i = 0, \dots, N$) show the surveyed companies and t ($t = 0, \dots, T$) show the time and $z_{i,t}$ is dependent variable which consist of yield rate (r), ($\frac{P}{E}$) indicating company's profitability, (lev) is the debt to asset ratio, (me) firm' size, (btm) book value to price ratio and is exchange rate uncertainty.

$$z_{i,t} = \left(\frac{P}{E_{it}}, lev_{it}, me_{it}, r_{it}, ex_{it}, btm_{it} \right)$$

Equation (1) is a PVAR standard model. Considering theoretical frameworks and empirical studies on yield and its effective factors, the measured variables are generated as follow:

$$\begin{aligned}
 EX_{it} &= a_{1i}pe_{it-1} + b_{1i}lev_{it-1} + c_{1i}ME_{it-1} + d_{1i}R_{it-1} + e_{1i}BTM_{it-1} + \varepsilon_{it} \\
 pe_{it} &= a_{2i}EX_{it-1} + b_{2i}lev_{it-1} + c_{2i}ME_{it-1} + d_{2i}R_{it-1} + e_{2i}BTM_{it-1} + \varepsilon_{it} \\
 lev_{it} &= a_{3i}EX_{it-1} + b_{3i}pe_{it-1} + c_{3i}ME_{it-1} + d_{3i}R_{it-1} + e_{3i}BTM_{it-1} + \varepsilon_{it} \\
 ME_{it} &= a_{4i}EX_{it-1} + b_{4i}pe_{it-1} + c_{4i}lev_{it-1} + d_{4i}R_{it-1} + e_{4i}BTM_{it-1} + \varepsilon_{it} \\
 R_{it} &= a_{5i}EX_{it-1} + b_{5i}pe_{it-1} + c_{5i}lev_{it-1} + d_{5i}ME_{it-1} + e_{5i}BTM_{it-1} + \varepsilon_{it} \\
 BTM_{it} &= a_{6i}EX_{it-1} + b_{6i}pe_{it-1} + c_{6i}lev_{it-1} + d_{6i}ME_{it-1} + e_{6i}R_{it-1} + \varepsilon_{it} \quad (2)
 \end{aligned}$$

Variables used in above equations are defined in Table 1.

4.1. Empirical Results of Estimation of Paradigms and Interpretation of Results

4.1.1. Unit root test

The main idea of stationarity of variables is concerned the stability of moments of a time series. Stationarity is important as all statistical deductions on estimated coefficients of regression equations based on the variables constancy assumption, unless none of the statistical deductions is true. Thus, the stationarity of the variables need to be tested before estimation as non-stationarity can leads to spurious regression in both time series and panel data types. However, unlike time series, in panel data we cannot use the common Dickey-Fuller (DF) and augmented DF tests. Hence, we should test the stationarity of variables applying the co-integration approaches (Dehshiri et al., 2012). In so doing, Loven Lin Cho test, specifically designed for panel data, performed which results are presented in the Table 2.

The null hypothesis of Loven Lin Cho test considered as non-stationarity of variables. So, in case the estimated statistic is larger than the confidence level value, the null hypothesis will be rejected. According to Table 2, the results suggest that the non-stationarity of variables has been rejected, i.e., all the variables are stationary. As we assure that all the variables are stationary, there is no need

to implement the co-integration test and as a result we will not encounter with an spurious regression and we can estimate the model safely.

4.1.2. Analyzing the spontaneous reaction equations

In this part, the estimation of the coefficients proceeded using a PVAR model and concentrating on fixed effects approach. Analyzing the impulse response functions reveals the schedule of shocks' effects. In these functions, the effect of a standard deviation of one variables' shock is regressed on the other variables. In order to estimate the function, the Lao and Zikchino approach in STATA software applied. The results could be observed in Chart 1.

Regarding the impulse response functions it is concluded that the exchange rate uncertainty effect on rate of return is negative at first two periods and then became positive, i.e., with an increase in exchange rate uncertainty, the companies' return falls and then rises. In fact, due to an abrupt increase in exchange rate price in long-term, the export-oriented companies gain more benefit through rising the export to foreign countries. In addition, the profitability index effect on return is positive at first but becomes negative during the time. i.e., with an increase in each stock's price or decrease in companies' income, the return will decrease. Debt to asset ratio is negative and insignificant meaning the debt increase of company leads to decrease in its return, while the response of this ratio to return is positive at first and then switches negative. Company's return response to firm size is negative at first but then it is positive and negligible, i.e., at early periods the smaller the company is, the more return it has but this relation changes inversely in long run. In fact, firm's growth in size will provide the capability to reduce the trade risk through products diversification. Products diversity, market magnitude, increase in company's share in product's market, economies of scale and product's low costs are potential advantages which increase the firm's profitability power. Furthermore, the great number of stock and stockholders of big-size companies enables numerous vendees to buy or sell the company's stocks. As a result, the liquidity risk will decrease for stockholders of big companies and less return is expected for them. Consequently, the book value

Table 1: Introducing of used variables in research

Variables	Defining	How to calculate	Data collecting resource
R_{it}	Return rate	$R_{it} = \frac{P_t - P_{t-1} + D_t}{P_t}$	Tehran Stock Exchange website
ME_{it}	Firm's size	Log of total assets	Tehran Stock Exchange website
lev_{it}	Asset to debt ratio	Dividing total asset to total debts	Tehran Stock Exchange website
ex_{it}	Exchange rate uncertainty	Using PVAR model	Central Iranian Bank
$\frac{P}{E_{it}}$	Profitability ratio	Price to cash profit of each share ratio	Tehran Stock Exchange website
btm_{it}	Book value to market value ratio	Dividing book value to market value of stocks at the end of each year	Tehran Stock Exchange website

Table 2: Testing stationarity of variables using Loven Lin Cho test

Variables	Pe	Me	lev	r	btm	Ex
Test statistics	1/79,760	2/98,623	-6/28,009	-35/9829	70/1683	-1/80,721
Probability	0/0361	0/0014	0/0000	0/0000	0/0000	0/0354

Resource: Research finding

Chart 1: Impulse response functions

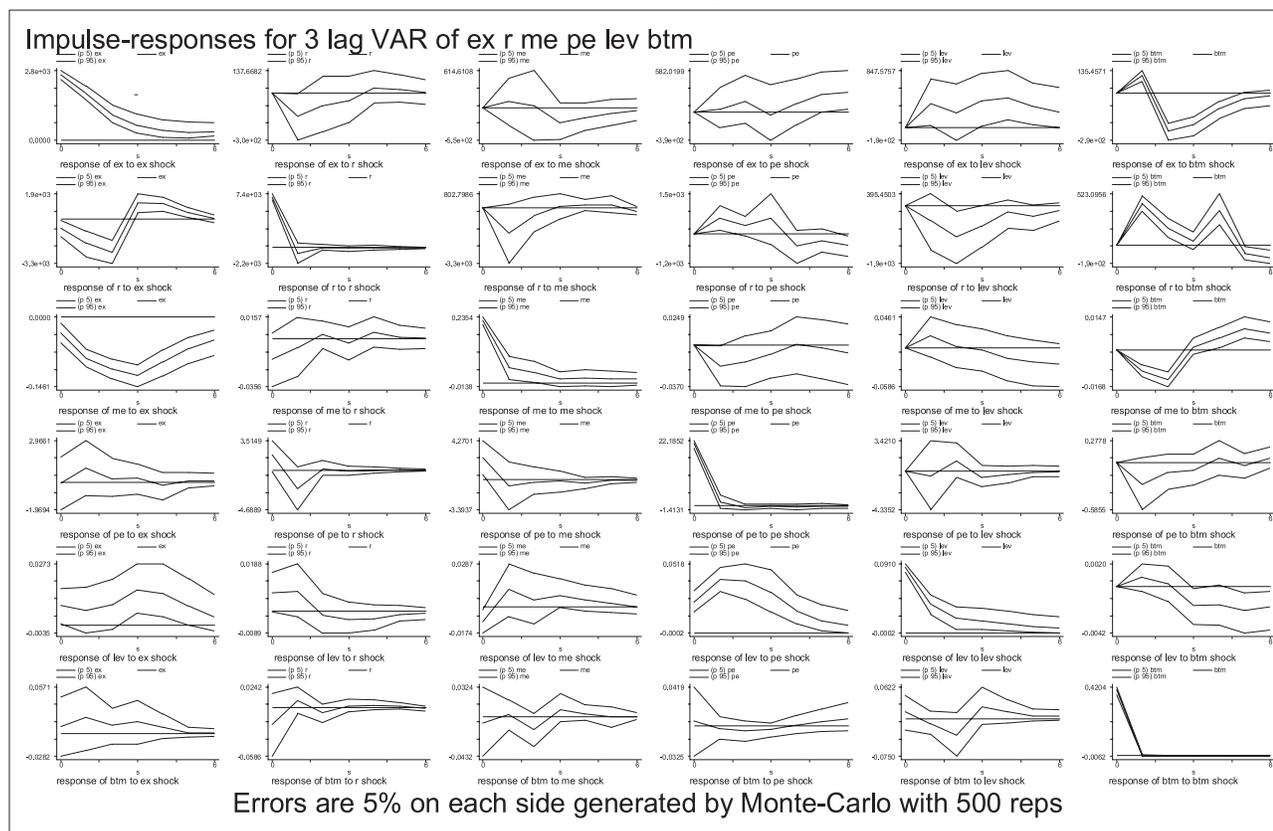


Table 3: Variance decomposition results

	<i>s</i>	<i>pe</i>	<i>me</i>	<i>Lev</i>	<i>r</i>	<i>Btm</i>	<i>ex</i>
<i>pe</i>	10	0/97898389	0/00215337	0/00491695	0/01221936	0/00021025	0/00151618
<i>me</i>	10	0/01224262	0/5526617	0/02994472	0/00834405	0/00447574	0/39233118
<i>lev</i>	10	0/31721585	0/01404638	0/62507886	0/0111389	0/00090763	0/03161238
<i>r</i>	10	0/02171052	0/02897935	0/03787338	0/71823291	0/00500903	0/18819481
<i>btm</i>	10	0/00122169	0/00186824	0/01287775	0/00362954	0/97551726	0/00488553
<i>ex</i>	10	0/01883214	0/02767745	0/08092345	0/02121597	0/00848571	0/84286529
<i>pe</i>	20	0/97894134	0/00215932	0/00492298	0/01221941	0/00021047	0/00154649
<i>me</i>	20	0/01592573	0/5402521	0/03583384	0/00892144	0/00451507	0/39455182
<i>lev</i>	20	0/31733867	0/01404182	0/62458358	0/01118181	0/00091284	0/03194127
<i>r</i>	20	0/02176718	0/02898433	0/03789343	0/71789797	0/00501293	0/18844415
<i>btm</i>	20	0/00125105	0/00186889	0/0129063	0/00363305	0/97544249	0/00489822
<i>ex</i>	20	0/02044071	0/02793944	0/083228	0/02132745	0/00849309	0/83857132
<i>pe</i>	30	0/97894037	0/00215938	0/00492333	0/01221943	0/00021048	0/00154701
<i>me</i>	30	0/01600391	0/5400469	0/0359446	0/00893143	0/00451609	0/39455707
<i>lev</i>	30	0/31733773	0/01404211	0/62458064	0/01118203	0/00091291	0/03194458
<i>r</i>	30	0/02176826	0/0289845	0/03789529	0/71789314	0/00501296	0/18844586
<i>btm</i>	30	0/00125116	0/00186891	0/01290643	0/00363307	0/97544208	0/00489836
<i>ex</i>	30	0/02046967	0/02794251	0/08326129	0/02132921	0/00849281	0/83850452

Resource: Research finding

to market value of each stock (BTM) on rate of return had been positive at first, but then had become negative, means it is possible that the book value increase or the market increase of each share leads to return's increase in long run. As we can see in Chart 1, the exchange rate uncertainty has the most significant effect on companies' return, so that the policy makers should pay a closer attention to exchange rate index and the consequent volatilities accompanied by a set of policies, which lead to further exports and less imports.

4.1.3. Variance decomposition

One the VAR model analysis tools is the variance decomposition. variance decomposition is method that measures prediction errors of the power of Granger causality continuum or the indigeneity degree of variables. The point of estimating the variance decomposition index is relatively to demonstrate the amount and importance of a shock resulted by one variable and the other variables. This method applied to describe the dynamism of the model and reveals the explanatory percent of each variable caused by the dependent

variable over the time. In other words, it means that how much of the dependent variable's changes are explained through each explanatory variable over time (Nasrollahi et al., 2013).

The obtained results show that the portion of "pe" in explanation of errors made by itself is 97% and the portion of return and exchange rate uncertainty is 0/01 and 0/001 respectively (Table 3). In rate of return decomposition the biggest share belongs to itself and in the second level it goes to the exchange rate uncertainty with 18%, i.e., the exchange rate uncertainty has the greatest effect on rate of return. Further, the biggest share of exchange rate uncertainty after itself belongs to the leverage ratio (debt to asset ratio) and finally most significant share of firm's size after itself is belongs to the exchange rate uncertainty. The results are same for the second and the third decades.

5. RESULTS AND SUGGESTIONS

The main purpose followed in this research is the analysis of the exchange rate uncertainty effect on rate of return on data compiled from 50 export-oriented firms at Tehran Stock Exchange using a PVAR model covering the period 2004-2014. The stationarity test of the data based on the Levin approach revealed the stationarity of all variables. Then the estimation was conducted applying the PVAR model.

The results of evaluating the relationship between the exchange rate uncertainty and rate of return indicate that with an increase in firm's debt, the return decrease in long run. Thus it is suggested to managers to consider this problem seriously in both designing and financing the firm and regard the cost-benefit analysis in utilizing the bank loans. In addition, with an increase in price of each share or a decrease in companies' income, the return rate will decrease in long run. Furthermore, if the book value of each share increases or the market value of each share decreases, the firm's return will decrease in long run. Moreover, in long run, the bigger the company is, the more return it has. In fact, firm's growth in size will provide the capability to reduce the trade risk through products diversification, and increase the profitability of the company.

Therefore, it is suggest to investors to consider the mentioned parameter in selling or buying the shares and adjust their decisions based on this factor. Finally, with an increase in the exchange rate uncertainty, the firm's return will decrease in short term but increases in long run.

The results suggest that the exchange rate and its volatilities can cause turbulences and instabilities in future of export-oriented companies, which draws governments' attention to determine a set of exchange rate policies so that it leads to more export and less import (Table 4). Further researches on exchange rate uncertainty analysis needs to apply other control variables (such as beta, other leverage indices and so on). However, a comparison analysis on the effectiveness of rate of return from exchange rate uncertainty in import and export companies could be conducted for future researches.

Table 4: List of surveyed export-based companies

R	Company
1	Tosse-e- Maadeneroye Iran
2	Maadani & SanatiGolGohar
3	Maaden-e- Bafgh
4	Petroshimi-e- Esfahan
5	Maadene-e- Amlahe Iran
6	Petroshimi-e- Shiraz
7	Sannaye-e- Shimiaifars
8	Pars International
9	Petroshimi-e- Farabi
10	Petroshimi-e- Shazand
11	Simane-e- Shahrood
12	Simane-e- Ilam
13	Simane-e- Fars and Khozestan
14	Simane-e- Karoon
15	Simane-e- Dorood
16	Simane-e- Tehran
17	Simane-e- Mazandaran
18	Simane-e- Sepahan
19	Simane-e- Hegmatan
20	Simane-e- Darab
21	Simane-e- Ghaen
22	Simane-e- Khazar
23	Naft-e- Pars
24	Sanayemelli Mess Iran
25	Sanayemelli Roy Iran
26	Kalisimin
27	Maaden-e- Manganez Iran
28	Iran transfor
29	Petroshimi-e- Abadan
30	Petroshimi-e- Esfahan
31	Sannaye-e- Shimiaii Iran
32	Dodesannati Pars
33	Petroshimi-e- Fanavaran
34	Petroshimi-e- Khark
35	Simane-e- Esfahan
36	Simane-e- Sofyan
37	Simane-e- Kerman
38	Simane-e- Oromyeh
39	Simane-e- Shargh
40	Simane-e- Hormozgan
41	Simane-e- Behbahan
42	Simane-e- Arta Ardabil
43	Simane-e- Fars
44	Simane-e- Khash
45	Simane-e- Gharb
46	Simane-e- Bojnord
47	Simane-e- Shomal
48	Naft-e- Behran
49	Folade-e- Khozestan
50	Folade-e-Mobareke Isfahan

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