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Asymmetric Effects of Exchange Rate Changes in Iran

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One of the main issues in international finance is the ratio of exchange rate pass through to consumer prices. The main objective of this study is to examine the exchange rate fluctuations and its asymmetric effect on consumer prices in Iran's economy. In the present study, the effects of positive and negative impacts of the exchange rate on inflation rate and other macroeconomic variables of Iran during the period from 1988 to 2017, in the framework of a recursive VAR model have investigated. The results indicate that exchange rate pass through in the short run is 33.5% and in the long run is 43.03%, which indicates that the exchange rate is incomplete. In addition, the results indicate the asymmetric effect of the exchange rate, which is about 38.43% increase in the exchange rate and 16.38% decrease in the exchange rate negatively reflected in consumer price inflation.

Keywords: Exchange Rates Pass Through, Inflation, Asymmetric Effect, VAR Model
JEL Classification: E2, E3, E22, E33

1 Introduction

Studying the responses of prices due to exchange rate changes is of great importance in open economies. In fact, exchange rate changes, could significantly affect the level of inflation especially for countries with floating exchange rate regimes. The degree of exchange rate pass through is theoretically defined as the percentage of domestic price changes as a result of a one percent change in the exchange rate between domestic and foreign countries. Exchange rates fluctuations transmit to inflation through direct and indirect channels. The direct channel is such that the exchange rate fluctuations transmit directly to domestic prices through firm-pricing decisions based on pricing in the market and other factors. The exchange rate pass through is usually considered as one of the key determinant of monetary policy design. In fact, the exchange rate pass through implies whether central banks should make greater efforts to control nominal shocks in order to ensure price stability.

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Both the theoretical and empirical literature (such as Flamini, 2007 and Adolfson, 2007) suggest that the degree of exchange rate pass through may even be the measure of inflation targeted by the central bank. In this regard, monetary authorities should consider the inflation rate that exclusively covers domestic production or the total inflation that includes import prices as target inflation. From the brief introduction, the choice of an exchange rate regime for developing and emerging economies is one of the current issues in international finance. The type and validity of the policy regime is a fundamental factor for the exchange rate pass through. For example, pass through in countries with flexible exchange rate regimes are lower than in countries with a fixed exchange rate regime. Indeed, in fixed regimes, the firms consider that the change in the exchange rate is permanent and have a permanent effect on their production costs. Therefore, they quickly adjust their selling prices. In contrast, in flexible regimes, economic agents consider changes in exchange rates to be temporary and therefore do not change their prices quickly. When the effect of depreciation (or an appreciation) is fully reflected in import prices, in this case, the exchange rate pass through is complete.

However, if the import prices increase less than proportionally to exchange rate changes, then it is called partial or incomplete pass-through. In this case, exporters will absorb a proportion of the exchange rate changes (in sales prices). From the above discussion, the exchange rate pass through is an important factor as it determines the extent to which the exchange rate adjustment creates a sustainable external balance. Indeed, how exchange rate movements are transmitted into domestic currency is an important channel through which fluctuations in exchange rates can affect the trade volumes.

Over the past years, an extensive literature has been conducted on exchange rate pass through. For example, several empirical studies, which evaluate the degree of exchange rate pass through, assume that exchange rate changes on import and export prices are symmetric (Froot & Klemperer, 1989; Dornbusch 1987; Taylor 2000; Devereux & Yetman, 2002). This assumption suggests that an appreciation of the exchange rate will equally lead to a same change in prices than a depreciation. However, there are several reasons why this hypothesis is incorrect. In fact, firms can react differently to exchange rate changes with regard to the direction and the severity of the appreciation or depreciation of the exchange rate. Exchange rate asymmetry implies that prices react differently to exchange rate changes. Asymmetry may occur in the long term, in the short term or in both periods. This asymmetry is usually explained through price rigidities (especially downward rigidities). In

particular, the existence of price rigidities leads to a different effect of the marginal cost shocks on prices over the short and long term. When the price rigidities are high, the exchange rate pass through is smaller in the short run. On the contrary, it is expected that in the long run, the pass through is complete.

Despite the importance of the exchange rate asymmetry for monetary authorities and policymakers, there has been little attention to asymmetry of exchange rate pass through in the existing literature. On the other hand, the number of studies that have examined the possibility of non-linearity or asymmetry of exchange rates pass through in Iran is relatively scarce. In addition, due to the lack of sufficient adjustment of the exchange rate against domestic and foreign inflation in previous years and the acceleration of inflation, due to the direct effect of exchange rate fluctuations on prices, economic instability has increased in the country. Therefore, in order to keep inflation at a low and stable level, identification of the important factors involved in inflation in Iran is necessary.

A portion of the high inflation in Iran is due to the high share of imported intermediate and final products; therefore, given the high volatility of the exchange rate and the high share of imported goods in the consumer basket, the study of volatility of the exchange rate on inflation of consumer prices in Iran are necessary. Therefore, the main purpose of this study is to evaluate the degree of exchange rate pass through in Iran and its asymmetric effect on prices for monetary policy purposes. For this purpose, the dynamic reaction of inflation of the price indices to the positive and negative shocks of the exchange rate in Iran will be examined. It should be noted that in most studies of Iran, the relationship between price and exchange rate pass through asymmetries has been tested using Vector Autoregressive (VAR) and Structural Vector Autoregressive (SVAR).

In this study, two econometric models are used to study the subject, which is one of the contributions of this study. First, using the recursive VAR model to measure exchange rate pass through by Impulse Response Functions (IRF). Second, using the nonlinear econometric model to measure the asymmetries of exchange rate pass through in Iran. It should be noted that the recursive VAR model has been used in a large number of foreign exchange rate pass through studies. In this research, the effect of oil revenues, economic growth, money growth and exchange rate fluctuations on prices has been studied. However, to the best knowledge of the author, a similar study using a recursive VAR model has not been conducted in Iran; so far. Another feature of this model is its ability to examine the sustainability of the results by evaluating

the sensitivity of the results by different Cholesky's ranking. The other features of recursive VAR model, compared to other models, are the possibility of examining the effect of various monetary policies in the reaction to the various economic shocks.

The remainder of the article is organized as follows. Section II provides a brief review of the empirical literature; in the third section the theoretical literature on the exchange rate pass through have been provided. The fourth Section describes the methodology and data and fifth section presents the empirical results. Concluding remarks are presented in sixth Section.

2 Determinants of Exchange Rate Pass Through

This section reviews the theoretical models for exchange rate pass through and its determinants. One of the well-cited theoretical researches in the area of ERPT is the paper by Dornbusch (1987) that applies industrial organization model and assumes the exchange rate as an exogenous variable. The paper illustrates that exchange rate movement, in terms of sticky wages, will cause the cost shock. Hence, the firms adjust the prices and quantities in response to the cost shock.

The proposed determinants of the ERPT are degree of market concentration, relative market shares of imported and domestic products, and import penetration. Moreover, Dornbush (1987) finds that exchange rate fluctuation significantly reflects in prices of the industry, which has large import penetration. Goldberg and Knetter (1997) develop the microeconomic framework of the price adjustment to the exchange rate volatility and violation of the law of one price. More specifically, literature is more focused on importance of competitive market structure on exchange rate pass through to prices. The following model is used based on textbook definition of ERPT regarding price changes to the exchange rate movement in between importing and exporting countries.

$$p_t = \alpha + \delta X_t + \gamma E_t + \varphi Z_t + \varepsilon_t \quad (1)$$

Where, t is time, p is import price in domestic currency, X is exporter's cost, E is the exchange rate of importing country's currency relative to the exporting country's currency, Z is a control variable for change in import demand. The coefficient γ expresses the degree of exchange rate pass-through. If γ is equal to one, pass through is complete. Conversely if γ is between zero to one, pass through is incomplete.

Yang (1997) states that the substitution effect of the products negatively affects the degree of exchange rate pass through in the industry. Moreover,

exporting firms do not differentiate the prices of the domestically produced products. If there is a strong substitution effect between domestic and importing products, change in the exchange rate may not reflect in prices so that pass through is zero.

Krugman (1986) suggests the pricing to market hypothesis as an additional factor of the exchange rate pass through. A nation's specific market power and ability of market segmentation of the firm affect its decision of markup adjustments.

Wickremasinghe and Silvapulle (2004) study the exchange rate of pass through depending on product differentiation and nature of competitions as a market or industry specific determinants. The model for the discussion is based on the principles of the monetary approach.

$$\mathrm{PM} = PX * E = (1+\delta)\mathrm{C} * \mathrm{E} \tag{2}$$

Where, PM is the import price, PX is the exporters' price, C is the cost of production, E is the exchange rate, and δ is the profit margin. From the model, profit mark-up can be expressed as $(1+\delta) = \mu$. Alternatively, profit markup is computed as $\mu = x(PD/(C*E))^{\alpha}(1+\delta)$. If $\alpha = 1$ in $\mathrm{PM} = \alpha PD + (1+\alpha)C + (1-\alpha)\mathrm{E}$, the degree of pass through is zero for the price takers in the market. The import prices in the domestic market are not influenced by exchange rate movement. On the contrary, ERPT is complete if the there is no competition between domestic and foreign producers. In this case, exporting firms fully adjust their prices to the exchange rate movement by keeping markups constant.

Campa and Goldberg (2002) examine the determinants of exchange rate fluctuation into price. The model takes market integration and segmentation, a role of market microstructure, and price discrimination power of the firm. The proposed model is shown below:

$$\mathrm{P}_t^{M,j} = E_t \mathrm{P}_t^{X,j} = E_t MA\mathrm{P}_t^{X,j} \left(\frac{\mathrm{P}_t^{M,j}}{P_t}\right) C^{\alpha,j}\left(C_t^j, Y_t, E_t\right) \tag{3}$$

$$MA\mathrm{P}_t^{X,j} = \left(\frac{\mathrm{P}_t^{X,j}}{\mathrm{C}_t^{X,j}}\right) \tag{4}$$

where, X is foreign exporting country, M is domestic importing country, $\mathrm{P}_t^{M,j}$ is import price in domestic country, E is the nominal exchange rate, C is the marginal cost function, and MAP is the mark up of the prices. Markup rate is the industry specific and depends on demand which expressed by $\mathrm{P}_t^{X,j}/C_t$.

The formula implies that price adjustment of the exporting firm depends on markup of the demand and marginal costs.

Bailliu and Fujii (2004) formulate the model for pass through considering simple static profit maximization problem. In this model, foreign firm exports product to the importing country referred as domestic country as well. The firms input cost is assumed to be dominated in the currency of the exporting country.

MAX $\pi = e^{-1}PQ - C(Q)$ is the profit maximizing behavior, where, π and P are profits in domestic currency (exporting firm's currency), exchange rate of domestic currency relative to currency of an exporting firm, and price in domestic currency respectively and C( ) is a cost function expressed by the quantity demanded (Q). The firm solves the profit maximization problem as follows;

$P = eC_q\mu$ is the first order condition of maximization, where, $C_q$is the marginal cost and μ is the mark-up over marginal cost, which depend on the price elasticity of demand of the good $\mu = \lambda/1 - \lambda$ where, λ is the price elasticity of the demand. Hence, exchange rate movement, marginal cost and mark up cause price change in domestic currency. Specifically, marginal cost changes due to domestic input cost and mark up changes depending on demand factors in domestic economy. Therefore, we can write the price equation in following way.

$P = \alpha_0 + \alpha_1 e_t + \alpha_2 P_t^* + \alpha_3 Y_t + \varepsilon_t$ is the reduced form of price equation. P* is the marginal cost of foreign firm and Y is demand condition (Goldberg & Knetter, 1997). Consequently, α_1 measures the degree of ERPT. Moreover, Goldberg and Knetter (1996) findings suggest that violation of law of one price and incomplete pass through are resulted from third degree price discrimination.

2.1 Factors Affecting Asymmetric Transitions

A significant part of the exchange rate pass through literature has focused on asymmetry of exchange rate pass through in terms of size, direction, economic situation, inflationary regime, and the rate of exchange rate fluctuations in the exchange rate pass through to domestic prices. Possible explanation for asymmetric reactions of prices to exchange rate changes in literature is discussed extensively. This section reviews the theoretical explanations for the asymmetric response of trade prices to exchange rate changes.

2.1.1 Binding Quantity Constraints

In the case of firms with capacity constraints, the passage of the exchange rate can be higher for a currency exchange rate (a devaluation of the domestic currency) than a decline in the exchange rate (an increase in the value of domestic currency). A depreciation of the home currency gives a choice of a foreign firm to choose either to decrease their makeup, keeping import prices fixed in the home country, or to maintain their markup by increasing the price in the home country, which may lead to a decrease in market share of the firm, or to combine the both implementations. There is no pass through when firm keeps a price constant in importing country and keeps a market share, however, it decreases the firm's profit margin. On the other hand, pass through is complete when the firm increases the import price by fully reflecting the depreciation. During the complete pass through, sales in importing country will decrease and it will cause to reduce the profit. In case of partial pass-through, sales and price decrease with the corresponding decline in profit. Thus, pass through is higher during the exchange rate depreciation than appreciation (Pollard & Coughlin, 2003).

2.1.2 Market Share Objective

Another potential reason for the asymmetry of the exchange rate pass through is the goals of the firm's market share. Exchange rate appreciation of the importing country allows foreign firms to increase their market share at the same time keeping the markup. However, during the depreciation, foreign firms face difficulties to decrease their markup in order to keep their market share. Thus, exchange rate appreciation leads higher pass-through than depreciation (Knetter, 1994).

2.1.3 Production Input Switching

In order to explain production switching as Ware and Winter (1988) suggest, we should consider a price-taking firm which uses inputs produced in domestic country or abroad and sells their products in a domestic and an export market. Having an operation in two markets allows the firm to shift the production technology depending on exchange rate fluctuation. More specifically, during the exchange rate appreciation, firm can choose their domestically produced inputs for the production procedure while during the depreciation, firm uses inputs imported from abroad. Hence, the fact that there is no change in output and price, leads zero pass-through. Webber (2000) formulates the

asymmetric effect of pass-through using production switching model. A dual profit functions are shown below.

$\pi^D = P^D(Q)\,Q/E - P^{iM} i^M/E$ Depreciation phase

$\pi^A = P^D Q/E - P^i i$ Appreciation phase

where, $P^D(Q)$is the inverse of the import demand curve, expressed by in domestic currency, E is the exchange rate, i and i^M are the quantity of the domestic and imported input respectively, Q is the quantity of export output, P^{iM} and P^i are price of importers and domestic's respectively. In the model that we provided above assume that there is perfect input switching from one production technology to another production technology without any cost. Specifically, domestic currency appreciation would lead increase in marginal revenue by same amount keeping a marginal cost constant, for a given domestic price. If domestic price of the firm declines, output will increase. Thus, it would lead partial pass through. On the contrary, during the exchange rate depreciation, marginal revenue and cost of the firm will decline by same amount as depreciation. Hence, output and price do not change and there is no exchange rate pass through during the depreciation. As a result, pass through is higher during the appreciation than depreciation.

2.1.4 Menu Cost

Changes in exchange rate may reflect asymmetry (nonlinearity) to the price due to presence of menu cost. Firms respond to the large and small exchange rate changes depending on the cost of changing prices. The menu cost includes administrative costs, technical costs, and costs of price changes notification to consumers. Firms react to small and large changes in exchange rates depending on the absolute (small or large) price changes.

According to the menu cost, an absolute change of the exchange rate compared with threshold level and currency denomination of invoice determines the asymmetry of the exchange rate pass through. In following two cases, pass-through is larger; (1) absolute changes in exchange rate are higher than threshold level associated with currency denomination of the invoice expressed in foreign currency; or (2) absolute exchange changes are smaller than threshold level when currency denomination of the invoice is expressed by domestic currency. In summary, firms can absorb small changes in the exchange rate (smaller than the menu cost) on their mark-up (reduce their mark-up), but they react to exchange rate larger than the threshold (greater than menu cost) through price changes.

Even though most of the models explained above examine the asymmetry effect of pass-through into import prices, there are same price adjustment strategies for the domestic producers. Exchange rate shocks on the import price are eventually reflected in domestic prices and consumer prices, which implies the indirect transmission mechanism of the ERPT (Karoro, 2007).

Overall, market share objective and production input switching models state that exchange rate appreciation may lead to higher pass through than depreciation. However, in terms of sticky price or binding quantity constraints, asymmetry effect is found in different direction, which is higher for the depreciation than appreciation

3 Literature Review

Based on theoretical approaches, researchers have focused more on empirical studies since the 1990s. For instance, Feinberg (1989), Knettler (1993), Choudhri, et al. (2005) empirically examine the price adjustment in terms of the degree of market concentration, relative market shares of imported and domestic products, import penetration and exchange rate fluctuations. Researchers such as Choudhri and Hakura (2001), Gagnon and Igrig (2004), Bailliu and Fujii (2004) find that higher inflation rate leads to higher pass through. Moreover, Campa and Goldberg (2004), Taylor (2000), Frankel et.al (2012) consider exchange rate volatility as an important determinant of the pass through. Additionally, Khundrakpam (2007), McCarthy (1999), Feinberg (1989) find that degree of openness, import structure, international trade barriers are the important factors explaining the pass through. Furthermore, Barhoumi (2005), Ca'Zorzi, et al. (2007), and Razafimahefa (2012) examine the degree of exchange rate pass-through to consumer prices and import prices for emerging markets and developing countries.

In addition, exchange rate pass-through can have an asymmetric effect on prices, depending on depreciation or appreciation of the exchange rate and the absolute value of its fluctuation. More precisely, in empirical studies, evidence suggests that the ERPT in the case of depreciation is larger than the appreciation. Rozafimahefa (2012) finds that the pass-through coefficients for the depreciation of the exchange rate are greater than the appreciation. In contrast, estimations by Khundrakpam (2007) and Przystupa & Wrobel (2009) show that impact of exchange rate appreciation on consumer price is higher than depreciation.

Investigating the non-linearity in the ERPT to emerging markets by utilizing a panel of 28 emerging countries, Caselli and Roitman (2016) reveal that ERPT during depreciations are statistically larger than ERPT during

appreciations. Similarly, analyzing the main determinants of ERPT in sub-Saharan African countries, Razafimahefa (2012) finds that the pass-through is larger following a depreciation of local currency than appreciation. Mihaljek and Klau (2008) also reveal that while exchange rate depreciations have a significant and stronger effect on domestic inflation than appreciation in some countries, in a few countries appreciation seems to have a significant and stronger effect on inflation. Similar results in time series studies of countries such as Brazil, Colombia, Poland, and Romania, Peru, and Chile conclude that while ERPT for appreciations are either insignificant or very low, it is significant and high for depreciation episodes.

The degree of the pass-through could also depend on the level of inflation. As Taylor (2000) states, ERPT is expected to be low in low inflationary environments. Lopez-Villavicencio and Mignon (2016), analyzing the determinants of the ERPT for 15 emerging economies from January 1994 to July 2015, find that inflation environment matters in the sense that a declining ERPT is evidenced with more stable and anti-inflationary environments and adopting inflation targeting regime leads to a significant decline in ERPT for most countries.

The same conclusion is obtained in country-specific studies as well. Analyzing the asymmetric ERPT in Colombia, Rincón and Rodríguez (2016) show that while the ERPT for high inflationary periods is around 0.29, it is about 0.23 for low inflationary environments after a year. The findings of Hajnal et al. (2015) for Hungary, Stoian and Murarașu (2015) for Romania, and Aleem and Lahiani (2014) for Mexico also corroborate the notion that the pass-through is lower in low inflationary environments than in high inflationary environment.

Although many foreign studies have been analyzed exchange rate asymmetry, it has been less considered in domestic studies. Pedram et al. (2012), using the monthly data in the period of 1997-2010, have examined the exchange rate asymmetry by distinguishing between the positive and negative impacts of the exchange rate with the Mork standard. The results indicate the asymmetry of the reaction of export prices to the appreciation and depreciation and the size of exchange rate changes.

In their study, Shajari et al. (2005) examine the degree of ERPT dynamics in the years 1959-2001 using VAR approach. They conclude that the ERPT in Iran is incomplete and the effect of real exchange rate fluctuations on the price of imported goods is positive and significant. Additionally, Asgharpour et al. (2011), in their study using ARDL approach examine the rate of exchange rate in the period of 1971-2007 and conclud that exchange rate fluctuations on non-

oil exports index is positive. Kazerouni et al. (2012), using the TVP and Kalman filtering methods, propose that implementing inflation targeting monetary policy and the independent floating exchange regime simultaneously, reduce the ERPT. Moreover, Bahrami et al. (2014) examine the asymmetric exchange rate transitions to domestic price indices using SVAR approach. The results confirm the existence of asymmetry of ERPT in Iran's economy. In addition, Arbab Afzzali and Ebrahimi (2016) study the effect of positive and negative impacts of exchange rate shocks on inflation and conclude that in Iran the sensitivity of the inflation rate to depreciation is more than the appreciation.

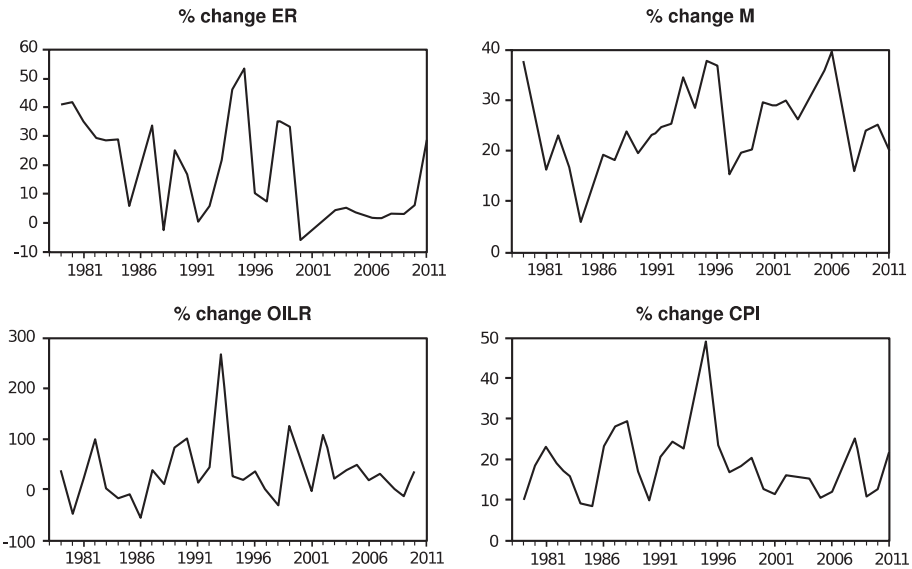

Figure 1. Trend of annual percentage change in variables.
Source: Time Series Database, Central Bank of Iran

In Figure 1, the trend of the annual percentage change of Consumer Price Index (CPI), Oil Revenues (OIL), Nominal Exchange Rate (ER) and liquidity (M) are presented. According to Figure 1, the developments in the foreign exchange market in the country indicates turbulence in this market and sharp fluctuations over the last few decades.

The policy of exchange rate unification in Iran in 1993 was accompanied by a sharp increase in exchange rates due to the imbalance of payments,

mainly because of the fall in oil prices and the problem of repayment of debt maturities. Later, once again, in 2002, the implementation of the policy of currency unification by financial support from the Central Bank's foreign exchange reserves and the financial coverage of the Central Bank, reduced the distance between the free market and official rates to a considerable extent, thus provided relative stability in the foreign exchange market.

In addition, during the period from 2002 to mid-2010, a managed floating regime was in progress. However, because the main supply side of the country was dependent on the foreign exchange earnings from oil exports, the fluctuation in world oil prices, as well as the decisions to use oil revenues in annual budgets, led to fluctuations in the foreign exchange market. Since the mid-2010, after spreading the gap between market and official exchange rate, the sever volatility has emerged over the years of 2011 and 2012 in the exchange market. The most important reasons for rising exchange rates are the growing speculative demand for the currency, an increase in the expected return of the foreign currency and an increase in the expected profits of the currency purchase.

The continuing increase in the foreign exchange market, a negative outlook for the future due to the sanctions, currency revenues and foreign exchange reserves of the country, the expansion of rental space, increased inflationary pressures in late 2011 and mid-2018 are on the verge of a currency crisis. On the other hand, the growth rate of liquidity and oil revenues in the past years, and more importantly, the quality of its distribution, are other important factors in the continuation of currency volatility.

One of the channels of influencing liquidity on currency volatility is the speculative demand channel. It should also be noted that the accumulation of harmful liquidity over the years has driven the economic volatility in various sectors, such as land, housing market, gold market and recently in the foreign exchange market. In addition, factors such as high inflation over the past few years, the lack of exchange rate adjustments and the high dependence on oil revenues has been factors influencing the currency fluctuations of recent years. Nevertheless, the sanctions are the most influential factor at the beginning of recent currency volatility. Hence, due to the close relationship between exchange rate fluctuations, liquidity and oil revenues, we examine the relationship among them.

4 Research Method

The purpose of this study is to investigate the pass through of exchange rate fluctuations to consumer prices in Iran. Hence, we use the VAR model

proposed by Sims (1980) that assumes all variables are endogenous, without any limitation on their relationships in a macroeconomic model. The recursive VAR model not only involves the lags of endogenous variables, but also includes non-lagged values of the endogenous variables.

Oil exports in oil-rich countries are a very important source of currency earnings; but the exogenous nature of these revenues leads to uncertainty in their economies and their economic policies. Thus, the high dependence of Iran's economy on oil revenues and the randomness of oil price shocks has led to uncertainty in the macroeconomic environment. On the other hand, the macroeconomic instability leads to an increase in the rate of exchange rate pass-through. With the increase in oil revenues, the uncertainty is reduced and so the ERPT.

Increasing oil revenues can increase the exchange rate and import prices through increase in the demand for imports. Therefore, the growth of oil revenues is in the first stage in the distribution chain of impulses and affects other variables in the model. The variable economic growth rate can be used in the theoretical literature of exchange rate pass-through as an indicator for domestic demand-pull. Economic growth has increased demand, and given the lack of production responsiveness to demand; it will increase domestic demand and ultimately leads to an increase in demand for imported goods, an increase in exchange rates and rising prices for imported goods (Aguerre et al., 2012). As the effect of the exchange rate on import prices influences consumer prices through imported inputs, thus, in the distribution-chain of shocks the consumer price index placed after the exchange rate. Since monetary policy may affect the exchange rate fluctuations, so, the Central Bank's reaction function estimated such that the money demand function relates the growth of money with other variables in the model (McCarthy, 2007).

According to McCarthy (2007), in the present study, the monetary-growth equation is considered as a reaction function of Central Bank. In oil exporting countries, rising oil revenues leads to supply of large amounts of money in the economy, so the volume of money is also a function of oil revenues. According to the above, the model has the following order:

$$X_t = \{\Delta Oil \rightarrow \Delta Y_t \rightarrow \Delta e_t \rightarrow \pi_t^{CPI} \rightarrow \Delta M1_t\} \quad (5)$$

where ΔOil is oil revenue, ΔY_t GDP growth, Δe_t is change in nominal exchange rate, π_t^{CPI} is change in consumer price inflation, and $\Delta M1_t$ is growth in money. In this framework, the system allows trace dynamic effect of an exchange rate shock on consumer prices along the distribution chain.

According to McCarthy (2007) consumer price inflation at each stage contains five components. The first component is that expected inflation which is the information available at period t-1. The effects of domestic supply and demand shocks to inflation are used as a second and third component in period t. The fourth component is the effect of exchange rate shocks on inflation. The next component includes the effects of shocks to inflation at the previous stages of the chain. The last component includes the effect of all stages' shocks in the distribution chain.

Structural shocks are recovered from the VAR residuals using a Cholesky decomposition of variance- covariance matrix. Oil revenues (ΔOil) is used as a supply shock and output growth (ΔY_t) is used as a demand shock. Furthermore, model includes M1 money as a monetary policy variable that responds to all the other variables via a reaction function. Under these assumptions, shocks in the VAR system can be represented with a recursive VAR in the following manner:

$$\Delta Oil_t = E_{t-1}[\Delta Oil] + \varepsilon_t^{\Delta Oil} \quad (6)$$
$$\Delta Y_t = E_{t-1}[\Delta Y_t] + \alpha_1 \varepsilon_t^{\Delta Oil} + \varepsilon_t^{\Delta Y} \quad (7)$$
$$\Delta e_t = E_{t-1}[\Delta e_t] + \beta_1 \varepsilon_t^{\Delta Oil} + \beta_2 \varepsilon_t^{\Delta Y} + \varepsilon_t^{\Delta e} \quad (8)$$
$$\pi_t^{CPI} = E_{t-1}[\pi_t^{CPI}] + \gamma_1 \varepsilon_t^{\Delta Oil} + \gamma_2 \varepsilon_t^{\Delta Y} + \gamma_3 \varepsilon_t^{\Delta e} + \varepsilon_t^{CPI} \quad (9)$$
$$\Delta M1_t = E_{t-1}[\Delta M1_t] + \theta_1 \varepsilon_t^{\Delta Oil} + \theta_2 \varepsilon_t^{\Delta Y} + \theta_3 \varepsilon_t^{\Delta e} + \theta_4 \varepsilon_t^{CPI} + \varepsilon_t^{\Delta M1} \quad (10)$$

where, $\varepsilon_t^{\Delta Oil}$ is supply shock, $\varepsilon_t^{\Delta Y}$ is demand shock, $\varepsilon_t^{\Delta e}$ is exchange rate shock, ε_t^{CPI} is consumer price inflation shock, and $\varepsilon_t^{\Delta M1}$ is money supply shock. $E_{t-1}[]$ Shows expectations of the variables based on information set at the end of period t-1, where, the time period t expresses one quarter. The conditional expectation equations can be replaced by linear projections based on lags of the five endogenous variables.

5 Estimations and Discussions

5.1 Stationarity

To specify and define proper VAR model, some commonly used procedures, namely stationarity and cointegration are tested to explore the data properties, and the results reported in Table (1) and Table (5).

First, the series are checked for stationarity by using Augmented Dickey – Fuller (ADF) test. Table (1) shows ADF statistics for all endogenous variables in the system.

Table 1
Unit Root Tests

Variables	critical value at 5%	ADF statistic	Result	Variables	critical value at 5%	ADF statistic	Result
Results at Levels				Results at first difference			
OIL	-2.88	-1.5438	n.s	D(OIL)	-2.89	-10.4523	s.
ER	-2.88	-1.3457	n.s	D(ER)	-2.89	-11.1367	s.
CPI	-2.88	1.4984	n.s	D(CPI)	-2.89	-11.7359	s.
M1	-2.88	-0.2346	n.s	D(M1)	-2.89	-8.1598	s.
GDP	-2.88	1.8021	n.s	D(GDP)	-2.89	-7.1746	s.
P*	-2.88	1.5012	n.s	D(P*)	-2.89	-9.1264	s.

note. "n.s." means non-stationary and "s." means stationary.
Source: Research calculations

Table (1) reports the results of ADF test for constant without trend. As the results show, by comparing the ADF statistics and the ADF critical value (-2.88 at 95% confidence level), values of test statistic are smaller than critical values, thus, we cannot reject the existence of unit root and series are not stationary. However, variables in first differences are stationary and we estimate a VAR model with first difference variables.

5.2 Optimal Lag Selection

In addition to determining the variables that are included in the system, determining the number of optimal lags is also important. One of the methods for determining the number of appropriate lags is entering different lags of each variable in the system of equations. However, in order a system to be symmetric, and using the OLS approach to achieve effective estimates, typically, the number of lags of the equations is considered to be the same.

In order to choose proper lag length for our VAR estimation, we perform several tests, which are sequential modified LR test (LR), lag exclusion Wald test, Hannan Quinn information criterion (HQ), Akaike information criterion (AIC), Schwarz information criterion (SC) and Final Prediction Error (FPE). The VAR model with proper lags avoids to over fit by limiting the length of lags in the short term. In addition, it minimizes model misspecification by not selecting too small lag length. The lag length criteria tests are shown in Table 2.

Table 2
Lag Selection Criteria

Lag Lenght	Log L	LR	FPE	AIC	SC	HQ
0	-434.3258	NA	2.08 E-04	6.4932	6.6765*	6.712
1	-367.2314	148.1534	6.54 E-05	5.9421	6.6928	6.103*
2	-322.1834	52.4590	6.75 E-05	5.9913	7.2685	6.923
3	-263.3452	35.1921*	6.11 E-05*	5.8432*	8.8712	6.483
4	-232.571	45.9321	6.85 E-06	5.9874	8.4376	7.7421

Source: Research Calculations

Sequential modified LR test (LR), Final Prediction Error (FPE) and Akaike Information Criterion (AIC) suggest us to use VAR (3) model, because in the third lag compared to other lags, these three criteria have the highest amount. Although, based on the Schwartz (SC) and the Hannan-Quinn (HQ) criteria, the optimal lag is zero and one respectively, but due to the seasonality of the data, and the specification bias we use VAR with 3 lags. In addition, the Akaike criterion is usually used for annual and daily data. Therefore, the VAR model is estimated with three lags in this study.

VAR Lag Exclusion Wald tests is performed in Table 3 to check whether lags with significant information content are not excluded from the model. The results show that three lags in the VAR system are jointly significant by Wald test.

Table 3
VAR Lag Exclusion Wald Tests

	DOIL	DGDP	DEX	DCPI	DMPI	DM1	Joint
Lag 1	15.1356	11.0654	19.2237	40.1089	4.2531	31.5378	159.4521
	(0.0115)	(0.1346)	(0.0049)	(0.0116)	(0.6325)	(1.5324)	(0.0001)
Lag 2	3.4581	14.1935	14.8923	7.8712	12.1831	9.3219	72.1972
	(0.7245)	(0.0311)	(0.0168)	(0.3819)	(0.0843)	(0.1875)	(0.0002)
Lag 3	17.3931	24.0345	5.8612	11.8123	14.6128	14.7216	89.1667
	(0.0085)	(0.0006)	(0.4316)	(0.0514)	(0.0167)	(0.0112)	(1.0012)

Source: Research Calculations

Moreover, VAR residual serial correlation Lagrange Multiplier (LM) test is performed with the null hypothesis of no serial correlation at lag order three. The results in Table 4 indicate that the null hypothesis cannot be rejected and there is no serial correlation in the VAR system.

Table 4
Serial Correlation LM Test

Lags	1	2	3	4	5
LM Statistics	42.224	35.873	46.368	39.343	44.513
Probability	0.217	0.558	0.117	0.315	0.1542

Source: Research Calculations

5.3 Cointegration Test

According to results in Table 1, all of the variables are I (1), thus, it is possible to use the Johansen cointegration test to estimate the cointegration between the variables. The Johansen's Maximum Likelihood Estimation (MLE) for Cointegration method provides the number of cointegrating vectors, estimation of these vectors, and the test of applying linear constraints on these vectors are conducted using standard asymptotic inference. In addition, there is no small sample bias or normalization problems with the OLS method in the Johansen approach. In this regard, first we have to get the number of co-integrated vectors.

Table 5
Cointegration Test

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				Unrestricted Cointegration Rank Test (Trace)			
Null Hypothesis	Alternate Hypothesis	Test Statistics	Critical value	Null Hypothesis	Alternate Hypothesis	Test Statistics	Critical value
r=0	r = 1	32.124	26.432	r=0	r ≥ 1	173.036	91.683
r ≤1	r = 2	28.332	24.531	r ≤1	r ≥ 2	122.259	68.724
r ≤ 2	r = 3	21.146	17.328	r ≤ 2	r ≥ 3	75.283	46.627
r ≤ 3	r = 4	15.122	13.496	r ≤ 3	r ≥ 4	32.924	29.232
r ≤ 4	r = 5	9.268	5.328	r ≤ 4	r ≥ 5	17.422	15.178
r ≤ 5	r = 6	5.234	2.467	r ≤ 5	r ≥ 6	7.642	3.190

Source: Research Calculations

At this stage, using the Trace and Maximum Eigenvalue statistics, we examine the existence of co-integrating vectors among the model variables. The maximum eigenvalue statistics, tests a null of r co-integrating vectors against the specific alternative of r +1. The existence of r co-integrating vector is accepted when the quantity of the test statistics is smaller than its critical value. Trace statistic, tests the null hypothesis that the number of co-integrating vectors is less than or equal to r against a general alternative. The results of the co-integration test between variables are presented in Table 5 using the Johansen Cointegration Test.

According to results of both tests, the null hypothesis based on the absence of the co-integration relation (first row) is rejected and, on the other hand, the hypothesis of the existence of at least six co-integrated vectors is confirmed (sixth row). This suggests a long-term relationship between the variables. Therefore, it can be concluded that the results of the co-integration test using the Trace statistics show that there are six co-integrated equations in the 5% significance level.

5.4 Estimation Results of Pass-Through Coefficients:

Using impulse response function, the cumulative pass through coefficients are computed by dividing the cumulative impulse responses of prices after *m* months by the cumulative impulse response of exchange rate to the exchange rate shock after *m* months. Thus, the exchange rate pass through (ERPT) at time t is defined as:

$$ERPT_t = Price\ index_{t,t+m} / Exchange\ rate_{t,t+m}$$

Where, P and E are respectively the change in cumulative price and change in cumulative exchange rate after m periods. Table 6 exhibits calculated ERPT to consumer prices in 20 period's horizon. The pass through of exchange rate to consumer price rises from 14.71 percent in the first period, to 51.88 percent in the thirteen periods after the depreciation shock.

Table 6
ERPT Coefficients

period	Consumer Price	Period	Consumer Price
After 1 period	14.71	After 10 period	50.43
After 4 period	24.69	After 13 period	51.88
After 5 period	27.47	After 16 period	45.72
After 8 period	45.63	After 20 period	46.77

Source: Research Calculations

According to the results, the transmission of exchange rate movement to consumer prices in Iran is incomplete. These findings are in line with the results of the previous empirical analysis of the exchange rate pass-through in Iran such as Bahrami et al. (2014) and Ebrahimi and Madani Zadeh (2016). About 46.77 percent of the exchange rate depreciation is eventually reflected in consumer prices after 20 periods of the shock. In addition, the results of the transmission of the exchange rate suggest that the ERPT decreases over time, which is in line with the findings of the Ghosh (2013).

5.5 Impulse Response Functions and Variance Decomposition

Using the analysis of the variance decomposition, the inflation sources of consumer prices depicted in Fig. 2.

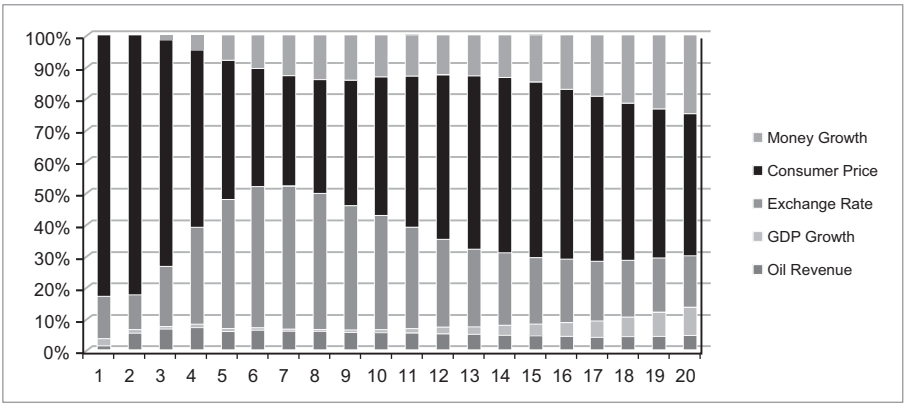

Figure 2. Sources of consumer price fluctuations.

Source: Research Calculations

According to Figure 2, in the first period, among all sources of inflation, the CPI inflation is in the first place, and exchange rate changes, economic growth and oil revenues are in next places, respectively. In subsequent periods, the percentage explanatory of CPI inflation decreases and is added to other variables. The impact of the exchange rate on consumer inflation is initially increasing and then declining in the long run. This phenomenon is consistent with the empirical and theoretical literature of exchange rate pass-through. However, the impact of the liquidity on consumer price inflation has declined in the short run and increased in the long run. This indicates the importance of the liquidity in explaining the fluctuations of inflation in Iran's economy.

The impulse response functions show the possibility of analyzing the behavior of the target variables against other variables' shocks. Figure three, using impulse response functions represents the response of the variables of the economic growth rate and the consumer price index to the exchange rate shocks. In these figures, the dashed lines represent a positive currency shock and continuous lines representing negative currency shocks.

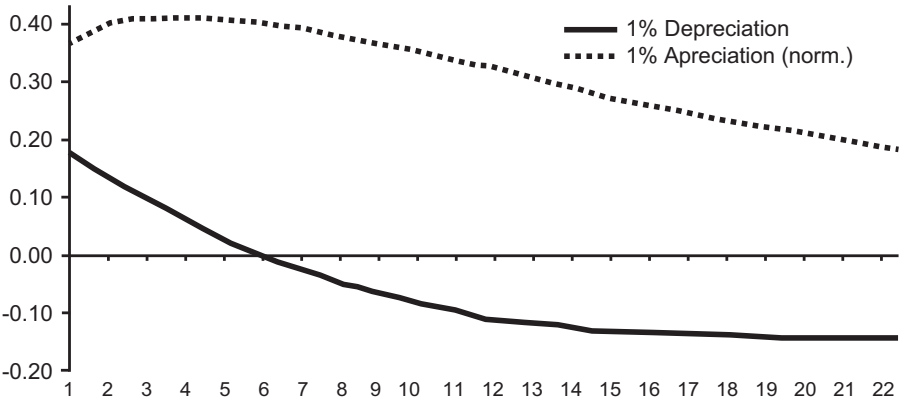

Figure 3. Reaction of consumer price to positive and negative shocks of exchange rate.
Source: Research Calculations

Regarding how the inflation rate responds to exchange rate shocks, which is in fact the same as the exchange rate pass-through analysis, Figure 3 shows that the consumer price index reaction to the positive shock of the exchange rate is far more than a negative shock. In the case of a positive currency shock, the inflation rate experiences a significant increase and gradually decreases its intensity, but when negative shock occurs, the consumer price index with the exception of the first period, in all other periods is decreasing. Thus, in the case of positive currency shocks, the exchange rate pass-through is more (more complete) than the negative shocks.

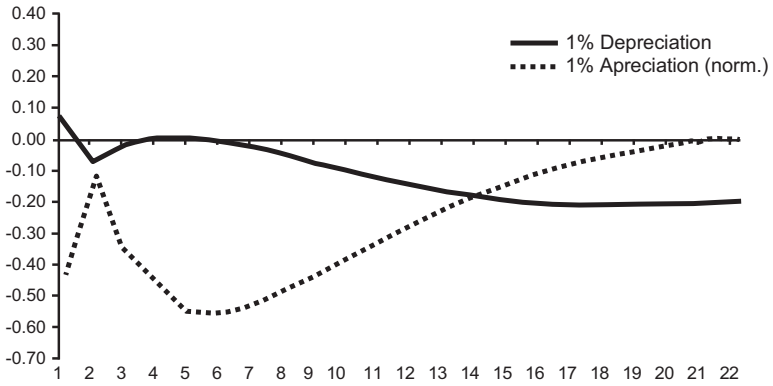

Figure 4. Reaction of the economic growth to the shocks of the exchange rate.

Source: Research Calculations

As shown in Figure 4, the economic growth rate declines when there is a positive currency shock (devaluation of the national currency and an increase in exchange rates). In explaining this phenomenon, it is possible to highlight the high dependency of domestic enterprises on the supply of raw materials, other intermediate goods and capital goods through imports. When raising exchange rate, firms face a major challenge in meeting basic production needs. Thus, in the short term, they will cut down on their products, or withdraw from the market in the long-term.

On the other hand, the figure shows that in the case of a negative shock, the growth rate of production, after a slight increase, continues to slow down. This phenomenon can also be explained that by increasing the value of the national currency, in the short term, due to the lower price of domestic products that depends on foreign inputs; production has been slightly improved. On the other hand, due to the reduced competitiveness of these imported products, which are henceforth much cheaper, in the subsequent periods, domestic production will be inaccurate. As shown in the figure, the domestic production sensitivity to the increase of the exchange rate is larger than to reducing it.

5.6 A Model for Asymmetry of ERPT

The model used to analyze the asymmetric effect of the exchange rate pass-through to consumer prices is derived based on the studies of Bailliu and Fujii, (2004) and Khundrakpam (2007), which are described in literature review. Thus, the specification of the main model for analyzing the exchange rate pass-through and its asymmetric effect are determined in the following formula which includes the impacts of lags of variables and the oil revenues shocks.

Model 1:

$$\pi_t^{cpi} = \alpha_0 + \alpha_1 \sum_{i=0}^{n} \Delta e_{t-i} + \alpha_2 \sum_{i=0}^{n} \Delta P_{t-i}^{*} + \alpha_3 \sum_{i=0}^{n} \Delta Y_{t-i} + \alpha_4 \sum_{i=0}^{n} \Delta \pi_{t-i}^{cpi} + \alpha_5 \sum_{i=0}^{n} \Delta \mathrm{Oil}_{t-i} + \varepsilon_t \quad (11)$$

Where, α_2 is the coefficient of short run pass-through, $\alpha_2/1-\alpha_2$ is the coefficient of long run pass- through. The lagged inflation term expresses the speed of pass-through to inflation (Khndrkapam, 2007). The number of lags in our estimation is chosen using general to specific method. We estimate the model with up to three lags (quarterly data) and then progressively exclude

the insignificant lags. We employ the dummy variables for measuring asymmetry effect relative to appreciation and depreciation of exchange rate (Pollard & Coughlin, 2004; Khundrakpam, 2007). The dummies are for exchange rate appreciation and depreciation, respectively.

$D(depreciation)$ $\begin{matrix}1\ for\ \ \Delta e<0\\0\ otherwise\end{matrix}$, and $D(apreciation)$ $\begin{matrix}1\ for\ \ \Delta e>0\\0\ otherwise\end{matrix}$

Model 2:

$$\Delta P_t = \alpha_0 + \alpha_{1A} D_A \sum_{i=0}^{n} \Delta e_{t-i} + \alpha_{1D} D_D \sum_{i=0}^{n} \Delta e_{t-i} + \alpha_2 \sum_{i=0}^{n} \Delta P^*_{t-i} + \alpha_3 \sum_{i=0}^{n} \Delta Y_{t-i} + \alpha_4 \sum_{i=0}^{n} \Delta \mathrm{P}_{t-i} + \alpha_5 \sum_{i=0}^{n} \mathrm{Oil\ shock}_{t-i} + \varepsilon_t \quad (12)$$

Where, α_{1A} and α_{1D} are the pass through coefficients for appreciation and depreciation, respectively. The variables that we used in the model of asymmetry are following: Consumer Price Index (P), exchange rate (e), GDP (Y), and Trade weighted foreign prices (P*). The trade weighted foreign prices will be calculated as *P* = (NEER × CPI) ÷ REER*. Where, REER is real effective exchange rate and NEER is nominal effective exchange rate.

5.7 Asymmetry of ERPT Estimation

We will use same dataset as we used in VAR estimation. Additionally we calculate the trade weighted foreign price (P*). Before analyzing asymmetry effects of pass-through, we estimate general pass-through coefficients to consumer prices using Model 1.

Table 7
Estimation Result of Model 1

Variable	Coefficient	T Statistics
constant	0.0137	1.8432 *
Exchange rate Rial/USD	0.2214	3.5782 ***
Trade weighted foreign price	0.3356	2.1324 **
Output	-0.0217	-5.1823 ***
Inflation (CPI)	0.3653	4.38412 ***
Oil price shock	0.0589	3.3316***
ERPT coefficients to consumer prices in short and long run		
Short run (α_2) 33.5	Long run $\left({}^{\alpha_2}/_{1-\alpha_2}\right)$	43.03

* Significance at 10% ** significance at 5% *** significance at 1%.
Source: Research Calculations.

All variables are statistically significant. Results show that short-run pass-through to consumer price is 33.5 percent; while long run pass-through is 43.03 percent. Next, we check whether estimated pass-through coefficients using model 1 are statistically different from those which estimated using recursive VAR in previous section. Using a Wald test, we cannot reject the null hypothesis that coefficients are not different. Thus, pass-through coefficients to consumer prices, using these two methods are not statistically different both in the short run and long run. In addition, we examine how changes in exchange rate are transmitted to consumer prices depending on appreciation or depreciation. The results are shown in Tables 8 and 9.

Table 8
Wald Test for Asymmetry Effect

Test Statistics	**Value**	**Probability**
F-Statistic	9.76623	0.0011
Chi-Square	9.76723	0.0009
Null Hypothesis Summary		
Normalized Restriction(=0)	Value	Std. Err.
C(1) – C(2)	0.38323	0.13467

Source: Research Calculations

The asymmetry effect is supported by Wald test Table (8). We reject the null hypothesis that the coefficients of two dummy variables are equal at the 99 percent confidence level.

Table 9
Asymmetry and Non-Linearity in Pass-Through

Model 2:	**Appreciation**	**Depreciation**	**R-squared**
Direction	0.3843	- 0.1638	41.05
	(3.32)	(1.94)	

Source: Research Calculations

According to the results reported in Table 9, around 38.43 percent of the exchange rate depreciation positively and 16.38 percent of the appreciation negatively reflects in consumer price inflation. Therefore, we conclude that there is an asymmetry effect, which is higher for the appreciation than depreciation as we expect it in the case of Iran.

Due to the insufficient development of the industrial plants in Iran and the consumption culture of the society, there is a high percentage of imported goods in the consumer basket. On the other hand, when the domestic currency

appreciates, importing firms do not tend to lower their prices as much as they increased during the depreciation in order to increase their mark up. These results are in line with the findings of Pedram et al (2012), Bahrami et al. (2014), Arbab Afzali, and Ebrahimi (2016).

6 Conclusion

The findings of this paper show that the transmission of exchange rate movement into consumer price in Iran is incomplete. Using impulse response functions and variance decompositions derived from a recursive VAR model, it is found that exchange rate pass-through to consumer price rises from 14.71 percent in the first period to 45.63 percent in eight period after the appreciation shock. In addition, the exchange rate transmission caused by this shock in the long run is 43.03 percent. Overall, the bulk of the pass-through to consumer price occurs in the thirteen periods after the shock.

Alternatively, we estimate the degree of ERPT to consumer prices using the non-linear econometric model. Estimated pass-through coefficients are 33.5 percent in the short run and 43.03 percent in the long run. Using a Wald test, we find that pass-through coefficients that we obtained using these two methods are not statistically different. Our findings are consistent with other papers, i.e. Ca'Zorzi, et al. 2007; Barhoumi, 2005; Razafimahefa, 2012; Goldfaij and Werlang, 2000 and McFarlane, 2009. They have found that ERPT to consumer prices is considerably higher, about 30 – 40 percent, in emerging and developing countries than in developed countries.

The results of variance decomposition analysis show that the main variation of the consumer price inflation is explained by shocks to the CPI itself, and then by exchange rate, output growth and oil revenues. Thus, we conclude that the relatively high exchange rate pass-through implies high significance of exchange rate for explaining the consumer price inflation volatility and forecasting. Furthermore, we find a statistically significant asymmetry effect of pass-through with respect to the direction of the exchange rate change. ERPT to consumer prices is higher for the appreciation (38.43%) than depreciation (15.37%) as we expected in case of Iran.

The results of variance decomposition analysis also confirm the effect of the exchange rate on inflation. However, due to the high share of imported goods in the consumer basket and import-oriented manufacturing industries in Iran, increasing the exchange rate has led to an increase in the prices of imported goods. In addition, the growth of the oil sector and oil revenues, as an effective factor in national income, has led to an increase in the overall demand of the economy and, consequently, rising prices. Therefore, according

to the results of this research and the importance of currency fluctuations in explaining inflation in the Iran's economy, which confirmed by the study of Sarem and Mehrara (2013), the Central Bank monetary policy must respond to exchange rate fluctuations.

Moreover, in small open economies, due to the effect of the exchange rate on macroeconomic variables (such as inflation), the central bank's response to exchange rate fluctuations is of particular importance. It is also necessary to create an inflation targeting system in the economy, because the effect of the low exchange rate transfers to domestic prices of free trade and provides more opportunities for pursuing an independent monetary policy, in particular through an inflation targeting system. The results also show that the ERPT is not completely in line with the previous studies in the case of Iran. The imperfect exchange rate pass-through is not just a function of the exchange rate, but other factors, such as increasing domestic demand and etc. that have been effective in variation of these prices.

References

Adolfson, M. (2007). *Implications of Exchange Rate Objectives under Incomplete Exchange Rate Pass-Through* (135). Sveriges Riksbank (Central Bank of Sweden).

Aguerre, R. B., Fuertes, A. M., & Phylaktis, K. (2012). Exchange Rate Pass-Through into Import Prices Revisited. *Journal of International Money*, 3, 818-844.

Aleem, A., & Lahiani, A. (2014). A Threshold Vector Autoregression Model of Exchange Rate Pass-Through in Mexico. *Research in International Business and Finance*, 30, 24-33.

Arbab Afzali, M., & Ebrahimi, I. (2016). The Asymmetric Exchange Rate Pass Through in Iranian Economy. *Journal of Monetary and Banking Researches*, 3(27), 29-52.

Asgharpour, H., Sojoodi, S., Aslani Nia, N. M. (2011). Exchange Rate Pass-Through to Non-oil Export Price of Iran. *Quarterly Journal of Economic Research*, 11(3), 111-134.

Bahrami, J., Mohammadi, T., & Bozorg, S. (2014). Asymmetric Exchange Rate Pass-Through to Domestic Price Indexes with the Approach of SVAR. *Iranian Journal of Economic Research*, 19(60), 37-65.

Bailliu, J., & Fujii, E. (2004). *Exchange Rate Pass-Through and the Inflation Environment in Industrialized Countries: An Empirical Investigation*. Bank of Canada.

Barhoumi, K. (2005). Exchange Rate Pass-Through into Import Prices in Developing Countries: An Empirical Investigation. *Economics Bulletin*, 3(26), 1-14.

Campa, J. M., & Goldberg, L. S. (2005). Exchange Rate Pass-Through into Import Prices. *Review of Economics and Statistics*, 87(4), 679-690.

Caselli, F. G., & Roitman, A. (2016). *Non-Linear Exchange Rate Pass-Through in Emerging Markets* (16/1). International Monetary Fund.

Ca'Zorzi, M., Hahn, E., & Sánchez, M. (2007). Exchange Rate Pass-Through in Emerging Markets. *The IUP Journal of Monetary Economics*, 4, 84-102.

Choudhri, E. U., & Hakura, D. S. (2001). *International Trade in Manufactured Products; A Ricardo-Heckscher-Ohlin Explanation with Monopolistic Competition* (01/41). International Monetary Fund.

Choudhri, E. U., Faruqee, H., & Hakura, D. S. (2005). Explaining the Exchange Rate Pass-Through in Different Prices. *Journal of International Economics*, 65(2), 349-374.

Devereux, M., & Yetman, J. (2002). *Price Setting and Exhange Rate Pass-Through* (No. 222002). Hong Kong Institute for Monetary Research.

Dornbusch, R. (1987). Exchange Rates and Prices. *American Economic Review*, 77(1), 93-106.

Ebrahimi, S., M. Adanizadeh, S. (2016). Changes in Exchange Rate Pass-Through in Iran. *Journal of Applied Economics Studies in Iran*, 5(18), 147-170.

Feinberg, R. (1989). The Effects of Foreign Exchange Movements on US Domestic Prices. *The Review of Economics and Statistics*, 71(3), 505-11.

Flamini, A. (2007). Inflation Targeting and Exchange Rate Pass-Through. *Journal of International Money and Finance*, 26(7), 1113-1150.

Frankel, J., Parsley, D., & Wei, S. J. (2012). Slow Pass-Through Around the World: A New Import for Developing Countries?. *Open Economies Review*, 23(2), 213-251.

Froot, K., & Klemperer, P. (1989). Exchange Rate Pass-Through When Market Share Matters. *American Economic Review*, 79(4), 637-54.

Gagnon, J. E., & Ihrig, J. (2004). Monetary Policy and Exchange Rate Pass-Through. *International Journal of Finance & Economics*, 9(4), 315-338.

Ghosh, A. (2013). Exchange Rate Pass Through, Macro Fundamentals and Regime Choice in Latin America. *Journal of Macroeconomics*, 35, 163-171.

Goldberg, P. K., & Knetter, M. M. (1997). Goods Prices and Exchange Rates: What Have We Learned? *Journal of Economic Literature*, 35(3), 1243-1272.

Goldfajn, I., & Werlang, S. R. D. C. (2000). The Pass-Through from Depreciation to Inflation: a Panel Study. *Werlang, Sergio R., The Pass-Through from Depreciation to Inflation: A Panel Study (July 2000). Banco Central de Brasil Working Paper*, (5).

Hajnal, M., Molnár, G., & Várhegyi, J. (2015). *Exchange Rate Pass-Through after the Crisis: The Hungarian Experience* (2015/121). Magyar Nemzeti Bank (Central Bank of Hungary).

Kadiyali, V. (1997). Exchange Rate Pass-Through for Strategic Pricing and Advertising: An Empirical Analysis of the US Photographic Film Industry. *Journal of International Economics*, *43*(3-4), 437-461.

Karoro, T. D. (2007). *An Analysis of Exchange Rate Pass-Through to Prices in South Africa* (Doctoral dissertation, Rhodes University).

Kazerouni, A., Salmani, B., & Feshari, M., (2012). The Impact of Exchange Rate Volatility on the Exchange Rate Pass-Through in Iran (TVP Approach). *Quarterly Journal of Applied Economics Studies*, 1(2), 85-114.

Khundrakpam, J. (2007). *Economic Reforms and Exchange Rate Pass-Through to Domestic Prices in India* (225). Bank for International Settlements.

Knetter, M. M. (1993). International Comparisons of Price-to-Market Behavior. *American Economic Review*, 83(3), 473-86.

Knetter, M. M. (1994). Is Export Price Adjustment Asymmetric? Evaluating the Market Share and Marketing Bottlenecks Hypotheses. *Journal of International Money and Finance*, 13(1), 55-70.

Krugman, P. (1986). *Pricing to Market When the Exchange Rate Changes* (No. 1926). National Bureau of Economic Research, Inc.

Lopez-Villavicencio, A., & Mignon, V. (2016). *Exchange Rate Pass-Through in Emerging Countries: Do the Inflation Environment, Monetary Policy Regime and Institutional Quality Matter?* (2016-18). University of Paris Nanterre, Economics.

McCarthy, J. (2007). Pass-Through of Exchange Rates and Import Prices to Domestic Inflation in Some Industrialized Economies. *Eastern Economic Journal*, 33(4), 511-537.

McFarlane, L. (2009). *Time-Varying Exchange Rate Pass-Through: An Examination of Four Emerging Market Economies.* Bank of Jamaica. Retrieved from http://www.cemla.org/red/papers2009/JAMAICAMcFarlane.pdf

Pedram, M., Shirinbakhsh Masulle, S., & Rezaei Abyaneh, B. (2012). Asymmetric Exchange Rate Pass-Through to Export Prices. *Journal of Economic Modeling Research*, 3(9), 143-166

Pollard, P. S., & Coughlin, C. C. (2003). *Size Matters: Asymmetric Exchange Rate Pass-Through at the Industry Level. Federal Reserve Bank of St*. Louis Working Paper Series, (2003-029).

Przystupa, J., & Wróbel, E. (2011). Asymmetry of the Exchange Rate Pass-Through: An Exercise on Polish Data. *Eastern European Economics*, 49(1), 30-51.

Razafimahefa, I. F. (2012). *Exchange Rate Pass-Through in Sub-Saharan African Economies and Its Determinants*. 12/141). International Monetary Fund.

Rincón-Castro, H., & Rodríguez-Niño, N. (2016). Nonlinear Pass-Through of Exchange Rate Shocks on Inflation: A Bayesian Smooth Transition VAR Approach. *Borradores de Economía*,. (930).

Sarem, M., Mehrara, M. (2014). Analyzing Central Bank Responses to Exchange Rate Volatility in Iran. *Journal of Economic Research (Tahghighat- E- Eghtesadi)*, 49(1), 137-154.

Shajari, H., Tayebi, K., & Jalaei, A. M. (2005). Analysis of Exchange Rate Pass-Through in Iran. *Science and Development Journal,* 16, 51-76.

Sims, C. A. (1980). Macroeconomics and Reality. Econometrica: Journal of the Econometric Society, 1-48.

Stoian, A., & Murarașu, B. (2015). On The Exchange Rate Pass-Through in Romania. *National Bank of Romania Occasional Papers*, 18, 76-90.

Taylor, J. B. (2000). Low Inflation, Pass-Through, and the Pricing Power of Firms. *European Economic Review*, 44(7), 1389-1408.

Ware, R., & Winter, R. (1988). Forward Markets, Currency Options and the Hedging of Foreign Exchange Risk. *Journal of International Economics*, 25(3-4), 291-302.

Webber, A. G. (2000). Dynamic and Long Run Responses of Import Prices to the Exchange Rate in the Asia-Pacific. *Asian Economic Journal*, 13(3), 303-320.

Wickremasinghe, G., & Silvapulle, P. (2004). *Exchange Rate Pass-Through to Manufactured Import Prices: The Case of Japan*. University Library of Munich, Germany.

Yang, J. (1997). Exchange Rate Pass-Through in US Manufacturing Industries. *Review of Economics and Statistics*, *79*(1), 95-104.