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THE EFFECTIVENESS OF EXCHANGE RATE CHANNEL IN AZERBAIJAN: AN EMPIRICAL ANALYSIS

Abstract

The main purpose of this study is to make an analysis to understand whether the exchange rate channel is effective in Azerbaijan. In this framework, quarterly data between 2001:01 and 2017:02 is examined in this study. Furthermore, VAR method is taken into the consideration in the analysis process. The findings show that exchange rate channel is very important for Azerbaijani economy. In other words, the exchange rate channel is working on the total output and price axis. Hence, it is recommended that necessary actions should be taken by a central bank regarding the effective usage of exchange rate channel to contribute to industrial production and employment.

Keywords monetary transmission mechanism, exchange rate channel, VAR, Azerbaijani economy

JEL Classification E40, E50, E52, E58

INTRODUCTION

Central banks try to keep the value of domestic currencies stable for many reasons. Especially, in small and open economies, the exchange rate changes have a big impact on inflation. For example, the depression situation creates higher inflation as a result of high import prices and export demand. As a result, governments and policy makers pay more attention to currency exchange. In this case, it creates pressure on the central bank to apply different policies (Mishkin, 2001, p. 7).

The exchange rate channel explains the effect of exchange rates on the real economy, in particular with the changes in both aggregate demand and supply. The level of exchange rates for imported goods and services in terms of national currencies, and therefore for inflation, the size and the time of the devaluation and the structural characteristics of the economy. Generally, as the share of imports and the size of the devaluation increase, the efficiency of the exchange rate channel also goes up. Also, after the devaluation, which is experienced during a recession period, the transmission channel decreases (Horvarth & Maino, 2006, cited in Örnek, 2009).

Since the changes in the exchange rate in the flexible exchange rate regime affect aggregate demand and aggregate supply, it is also possible to say that it is a determinant of future price movements. When the exchange rate is fixed, the effectiveness of the monetary policy declines considerably even if it does not fully disappear. If the exchange rate is held in a broad band, protection of the effectiveness of the monetary policy can be maintained, especially if there is full substitution be-

tween domestic and foreign assets. However, if there is no full substitution, the monetary policy activity is completely out of the scope (Canbazoglu & Karaalp, 2012, p. 57).

Azerbaijan can be defined as a small open and developing economy. Moreover, as an oil producer and exporter, Azerbaijani economy improved significantly in recent years. In this period, the demand for energy has increased very much. This situation led to increase in oil prices as well. Owing to this issue, GDP growth went up in oil exporting countries, such as Azerbaijan. In addition to this situation, local currency appreciated and in spite of increasing demand, there was not a significant rise in inflation rates.

The rapid decrease in oil prices since the second quarter of 2014 led to an important decline in foreign exchange revenues. Although the country had a current account surplus for a long period, there was a current account deficit in 2015. Both the current account deficit and the reduction of government spending have significantly reduced the foreign exchange supply. On the other hand, the psychological impact of devaluations in neighboring countries has caused a sharp increase in demand for foreign currency (especially for American dollar), and the dollarization trend has strengthened. In such an environment, the Central Bank took a decision to make devaluation in February 2015 to reduce pressure on the currency market and national currency. However, the sharp decline in oil prices since July has increased the expectation that the exchange rate will reduce with the pressure on the national currency. It was decided that the “free exchange rate” regime will be adopted in December 2015 because of these reasons. Therefore, recent developments can be accepted as an important indicator for the Azerbaijani economy due to the relationship between US dollar exchange rate and oil prices.

In this study, it is aimed to make an analysis to understand whether exchange rate channel is functioning effectively or not in Azerbaijan by using VAR method. It is believed that this study has significant contributions to the literature. Firstly, it focuses on an important topic for developing countries. In addition, standard Granger causality and impulse-response tests under VAR approaches are firstly used in this concept.

Within this scope, first of all, exchange rate channel will be defined and its effect on the economy will be discussed. After that, similar studies in the literature will be explained. Next, econometric method, data and findings will be detailed. In the final part of this study, analysis results and recommendations will be emphasized.

1. EXCHANGE RATE CHANNEL

Unlike closed economies, the liberalization of capital movements in open economies and the instability caused by the flexible exchange rate system have led the monetary authorities to use the exchange rate channel to reach the price stability target (Guloğlu & Orhan, 2008, p. 97). The theoretical basis of this channel emerging in open economies is valid in the free exchange rate system. The main reason behind this aspect is that according to this model, monetary policy influences both domestic and foreign investment decisions through exchange rate (Buyukakın et al., 2008, p. 174). In this context, it can be said that the exchange rate channel is effective in open economies because of the application of a free exchange rate system. In other words, the greater the financial and com-

mercial openness of a country, the greater the efficiency of the exchange rate channel in the transfer mechanism (Loayza & Hebbel, 2002, p. 9, cited in Yapraklı, 2011, p. 18).

When there is a decrease in domestic interest rate ($ir \downarrow$), the exchange rate actually includes the interest rate effect because domestic currency deposits have lost their appeal compared to foreign exchange deposits. As a result of this issue, domestic deposits lose values in comparison with foreign deposits, so there is an increase in the value of foreign currency ($E \uparrow$). The depreciation of the national currency caused an increase in net exports ($NX \uparrow$) as domestic commodities made them cheaper in comparison with foreign commodities. Additionally, rise in the net export has an increasing effect on the output ($Y \uparrow$). This pro-

cess was summarized below (Mishkin, 2004, p. 618): $M \uparrow \Rightarrow ir \downarrow \Rightarrow E \uparrow \Rightarrow NX \uparrow \Rightarrow Y \uparrow$.

In the opposite case (monetary tightening), real interest rates increase and domestic money deposits become more attractive than foreign currency deposits. Hence, foreign capital comes to the country in order to benefit from this situation and because of this aspect, the amount of foreign currency in the country increases. This increase causes the appreciation of the domestic currency by lowering the exchange rate. In this case, net exports decreases since domestic commodities become more expensive in comparison to the foreign commodities. This decrease in net exports causes the total revenue to fall. This process was demonstrated below. $M \downarrow \Rightarrow ir \uparrow \Rightarrow E \downarrow \Rightarrow NX \downarrow \Rightarrow Y \downarrow$.

Exchange rate changes also affect the budget of households and firms. In many countries, households and companies borrow directly from abroad or through domestic banks. When these debts are not fully covered by foreign currency assets, changes in exchange rate have significant impacts on spending and borrowing behavior of households and firms by affecting the net values and asset-liability ratios (Kamin et al., 1998, pp. 12-13).

The effect of the exchange rate on the budget is explained by both the bank balance and the company balance. While rising exchange rates increase the debt burden of financial intermediaries which have open foreign exchange positions, households and companies fail to pay their debts due to the increase in the foreign exchange rate. This situation makes it difficult for banks to collect their debts and causes banks to lose their balance sheet structure. The deterioration in the financial intermediaries' balance sheet will diminish the lending capacity of banks. Also, aggregate output and investment will decrease due to the liquidity problem (Mishkin, 2001, pp. 7-8).

2. LITERATURE REVIEW

Some selected studies related to the exchange rate channel are demonstrated in Table 1.

Table 1 states that lots of studies evaluate the effectiveness of the exchange rate channel. Martinez et

al. (2001) made a study to identify this situation in Mexico with VAR method and determined that exchange rate channel is effective in Mexico. Parallel to this study, Camarero et al. (2002), Arabaci and Baştürk (2013), Turhan and Gumus (2014), Çiçek (2005), Poddar et al. (2006), Aslanidi (2007), Erdoğan and Yıldırım (2008), Isakova (2008), Büyükakın et al. (2009), Cambazoğlu and Karaalp (2012), Roşoiu and Roşoiu (2013), Özcan (2016), Shahraki et al. (2016), Duman (2016) and Cambazoğlu et al. (2013) defined similar aspects as well.

In spite of these studies, there are also some other studies which underlined that this channel is not effective. Dovciak (1999) made an analysis so as to understand if exchange rate channel is effective in Slovakia or not. For this purpose, regression analysis was used. He identified that exchange rate channel does not work in Slovakia. Similarly, Barran et al. (1996), Erarslan and Kati (2015), Bagus et al. (2013), Mishra et al. (2016), and Zenon (2001) emphasized the same conclusion in their studies by using a different methodology.

Moreover, some studies compared the effectiveness of exchange rate channel with other channels. Atabaev and Ganiyev (2013) tried to evaluate this situation for Kyrgyzstan. They used VAR method to achieve this objective. As a result of this analysis, it is defined that exchange rate channel is more effective than other channels. Parallel to this study, Le and Pfau (2009), and Örnek (2009) underlined the similar conclusions by using the same methodology. Additionally, Patnaik et al. (2011) determined that exchange rate channel is more effective in the countries that have high inflation rates with VECM.

Some studies also examined the relationship between exchange rate channel and inflation rate. Nagayasu (2007) tried to identify this relationship in Japan by using VECM and concluded that exchange rate channel has an important influence on the inflation rate. McFarlane (2002), and Yaprakli (2011) also underlined the similar aspect in their studies with the same methodology. Furthermore, Huseynov (2013), Saraçoğlu and Köse (1999), Dabla-Norris and Floerkemeier (2006), Fetia and Zeqiri (2010), and Özcan (2016) also concluded that exchange rate channel affects inflation rate

Table 1. Selected studies for exchange rate channel

Author	Scope	Method	Result
Barran et al. (1996)	9 EU countries	VAR	It was defined that exchange rate channel is only appropriate in Spain.
Cushman and Zha (1997)	Canada	VAR	They reached a conclusion that there is not a paradox between currency exchange rate and interest rate (liquidity).
Smets and Wouters (1999)	Germany	VAR	It was determined that after the monetary tightening, local currency was appreciated, the import prices were stronger than the export prices, and the import prices were cheaper.
Dovciak (1999)	Slovakia	Regression	It was concluded that exchange rate channel is not effective in Slovakia.
Saraçoğlu and Köse (1999)	Turkey	VAR	Currency exchange rate is an important indicator that affects inflation rate.
Zenon (2001)	Peru	VAR	It was defined that exchange rate channel is not effective.
Martinez et al. (2001)	Mexico	VAR	Exchange rate channel is effective in Mexico.
Camarero et al. (2002)	Spain	VAR	Exchange rate channel is effective in Spain.
McFarlane (2002)	Jamaica	VECM	Exchange rate channel has an important influence on the inflation rate.
Çiçek (2005)	Turkey	VAR	Exchange rate channel increases the effectiveness of monetary policy on the prices.
Dabla-Norris and Floerkemeier (2006)	Armenia	VAR	They identified that exchange rate channel has a significant impact on the prices.
Poddar et al. (2006)	Jordan	VAR	It was defined that none of monetary transmission channels are important.
Nagayasu (2007)	Japan	VECM	Exchange rate channel only affects inflation rate.
Aslanidi (2007)	Georgia	VAR	It was determined that exchange rate channel has a powerful impact on the economy.
Erdoğan and Yıldırım (2008)	Turkey	VAR	They underlined that exchange rate channel is valid for Turkey.
Isakova (2008)	Kazakhstan, Kyrgyzstan and Tajikistan	VAR	Exchange rate channel works effectively.
Güloğlu and Orhan (2008)	Turkey	VECM	Exchange rate channel has a powerful influence on industry production.
Örnek (2009)	Turkey	VAR	Exchange rate channel works in Turkey whereas bank credit channel does not.
Büyükakın et al. (2009)	Turkey	VAR	They concluded that exchange rate channel is successful in Turkey.
Fetia and Zeqiri (2010)	Macedonia	VAR	They reached a conclusion that exchange rate channel affects inflation rate.
Le and Pfau (2009)	Vietnam	VAR	It was defined that bank loan and exchange rate channels work more effectively than interest rate channel.
Bhattacharya et al. (2011)	India	VECM	It was determined that exchange rate channel is more effective in the countries that have high inflation rates.
Yapraklı (2011)	Turkey	VECM	It was concluded that exchange rate channel affects inflation rate in Turkey.
Awad (2011)	Egypt	SVAR	The exchange rate channel plays the most important role among the foreign and domestic variables for the Central Bank of Egypt
Pelinescu (2012)	Romania	SVAR	Romanian currency appreciation increases local goods demand.
Fan and Jianzhou (2011)	China	VAR	The role of the asset price channel became passive.
Tahir (2012)	Brazil, Chile and Korea	SVAR	Exchange rate channel affects interest rate and industrial production.
Cevik and Teksoz (2012)	Gulf Cooperation Council (GCC) countries	SVAR	Exchange rate channel is not effective for Gulf area.
Cambazoğlu and Karaalp (2012)	Turkey	VAR	It was emphasized that exchange rate channel is effective in Turkey.
Cambazoğlu et al. (2013)	Turkey and Argentina	VAR	They reached a conclusion that exchange rate channel works successfully in both Turkey and Argentina.
Atabaev and Ganiyev (2013)	Kyrgyzstan	VAR	They determined that exchange rate channel is the most important channel in Kyrgyzstan.
Huseynov (2013)	9 CIS countries	ARDL	Exchange rate channel is effective on both total output and inflation.
Roşoiu and Roşoiu (2013)	Romania, Poland, Czech Republic and Hungary	Bayesian VAR	Exchange rate channel is effective for Hungary and Czech Republic.
Gumata et al. (2013)	South Africa	Bayesian VAR	Interest rate channel works more effectively than the others.

Table 1 (cont.). Selected studies for exchange rate channel

Author	Scope	Method	Result
Ishioro (2013)	Nigeria	Granger causality analysis	All channels are very effective in Nigeria.
Bagus et al. (2013)	Indonesia	VAR	Exchange rate channel cannot be used as a good channel to explain trade competitiveness in Indonesia.
Arabaci and Baştürk (2013)	Turkey	VAR	The effectiveness of exchange rate channel may change for different time period.
Turhan and Gumus (2014)	Turkey	VAR	Exchange rate channel is the most important channel for the economy.
Erarslan and Kati (2015)	Turkey	VAR	Exchange rate channel does not work effectively in Turkey.
Obafemi and Ifere (2015)	Nigeria	FAVAR	Credit channel mainly affects macroeconomic factors in Nigeria.
Özcan (2016)	Turkey	VAR	Exchange rate channel influences inflation rate.
Shahraki et al. (2016)	Iran	General Dynamic Stochastic Equilibrium Models	Exchange rate channel plays an important role for Iran.
Mishra et al. (2016)	India	SVAR	Exchange rate channel is not effective in India.
Duman (2016)	Turkey	VAR	Exchange rate channel is effective in Turkey.

by using VAR method. To conclude, exchange rate channel was examined many times with different approaches such as VAR, vector error correction method and regression analysis. Hence, it is concluded that there is a need for a new study that has not been evaluated so far, such as Azerbaijan.

3. ECONOMETRIC ANALYSIS AND RESULTS

3.1. Data and methodology

The quarterly data between 2001:01 and 2017:02 is used in the analysis process. Producer price index (PPI), consumer price index (CPI), credit interest rates among the banks (INT), currency exchange rate (EXC) and net exports (NX) are the endogenous variables. On the other side, exogenous variables are oil prices (OIL) federal funds rate (FEDFUNDS). In this analysis, the variable of PPI represents goods market, while CPI represents inflation rate. Moreover, INT refers to the money market. Furthermore, the data of these variables was provided from FED, Central Bank of Azerbaijan and Azerbaijan State Statistical Institute.

Vector autoregression (VAR) method is the most used in the studies that focused on monetary transmission mechanism. Hence, it will be possible to simulate the short-term reactions against a possible shock which will occur because of the dynamic relationship between the variables. Greene

(1993) asserted that VAR method is more effective than other methods to analyze the dynamic relationship among the factors. This method was firstly developed by Sims (1980). The main benefit of this method in comparison with others is that there is not a difficulty to determine which variables are internal or external. Within this scope, a standard VAR method that have two different variables can be demonstrated as follows.

$$y_t = a_1 + \sum_{i=1}^p b_{1i} y_{t-i} + \sum_{i=1}^p b_{2i} x_{t-i} + v_{1t}, \quad (1)$$

$$x_t = c_1 + \sum_{i=1}^p d_{1i} y_{t-i} + \sum_{i=1}^p d_{2i} x_{t-i} + v_{2t}. \quad (2)$$

In these equations, y_t and x_t show the variables, a_1 and c_1 represent constant terms, b and d explain the coefficients that will be estimated. Additionally, p refers to the lag interval and v_i shows white-noise error term.

3.2. Analysis results

In order to make VAR analysis, first of all, log values of all variables were calculated. Secondly, Augmented Dickey-Fuller (ADF) unit root test is performed for stationary analysis. It is seen that none of the variables are stationary on their level values, but they become stationary with their first differences. Owing to this situation, it was expected that there can be a cointegration relationship between the variables. The details of this analysis were given in Table 2.

Table 2. Unit root test results

Variable	Level				First difference				Result
	<i>k</i>	t-test	p-value	Critical value**	<i>k</i>	t-test	p-value	Critical value**	
Log (PPI)	4	-1.8189	0.3679	1% – 3.5482	3	-8.9357	0.0000	1% – 3.5482	I(1)
Log (CPI)	1	-2.5361	0.1121	5% – 2.9126	0	-5.9804	0.0000	5% – 2.9126	I(1)
Log (NX)	2	-1.3835	0.5845	10% – 2.5940	1	-8.7739	0.0000	10% – 2.5940	I(1)
Log (EXC)	4	-1.9858	0.2921		0	-7.9959	0.0000		I(1)
Log (INT)	0	-0.3850	0.9040		0	-9.8214	0.0000		I(1)

Note: * – Schwarz information criteria, ** – MacKinnon (1996) one-sided p value.

Table 3. Lag interval tests

Lag	Information criteria					
	Log. prob.	Prob. ratio	NTH	Akaike	Schwarz	Hannan-Quinn
0	109.1692	NA	3.02e-08	-3.128743	-2.411883	-2.411883
1	290.6704	305.6862	1.26e-10	-8.620013	-7.007078*	-7.007078*
2	319.9311	44.14770	1.13e-10	-8.769511	-6.260501	-6.260501
3	338.8006	25.15940	1.51e-10	-8.554407	-5.149322	-5.149322
4	386.1063	54.77496	8.01e-11	-9.337061	-5.035901	-5.035901
5	443.0702	55.96455*	3.33e-11*	-10.45860*	-5.261367	-5.261367

So as to estimate a VAR model, firstly, optimal lag interval of this model should be defined. After that, lag interval test is performed given in Table 3. As a result of this test, it was decided that lag interval will be 5 in this study because three different criteria indicate this aspect.

Also, Lagrange Multiplier (LM) test is conducted for autocorrelation problem in the model. The findings show that there is not such a problem. Table 4 states these results.

Figure 1 explains the details of inverse roots. It is understood that our model satisfies the requirement of the stability. The main reason is that all roots are lower than “1”.

Table 4. LM test results

Lag	LM statistics	Probability
1	32.91487	.1332
2	31.81708	.1634
3	20.01203	.7462
4	24.29138	.5026
5	24.00061	.5193
6	18.36892	.8263
7	37.04869	.0571
8	16.21236	.9084
9	14.13181	.9594
10	24.74846	.4765
11	27.18501	.3467
12	19.27952	.7835

Additionally, to examine heteroscedasticity problem, White test is conducted. Table 5 gives information that there is not such a problem due to the greater probability value than 0.05.

Table 5. White test results

Chi square	df	Probability
842.3814	825	0.3295

The Johansen test (Johansen, 1995) approach to cointegration was utilized for testing the cointegration relationship. The results are given in Table 6.

Table 6 indicates that there is not a cointegration relationship. Therefore, we conclude that there is no a cointegrating relationship between the vari-

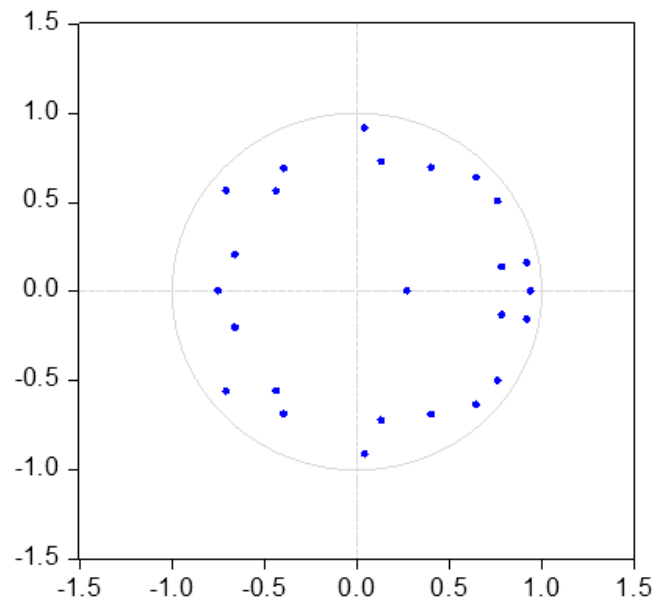


Figure 1. Inverse roots

Table 6. Johansen cointegration test results

Null hypothesis	Eigenvalue	Trace statistics	0.05 Critical value	P-value
Panel A: Johansen cointegration rank test (trace)				
None *	0.772380	177.2512	69.81889	0.0000
At most 1*	0.564712	94.36694	47.85613	0.0000
At most 2 *	0.430418	47.78911	29.79707	0.0002
At most 3 *	0.198421	16.26941	15.49471	0.0382
At most 4 *	0.067003	3.883763	3.841466	0.0487
Panel B: Johansen cointegration rank test (maximum eigenvalue)				
None *	0.772380	82.88427	33.87687	0.0000
At most 1	0.564712	46.57783	27.58434	0.0001
At most 2 *	0.430418	31.51970	21.13162	0.0012
At most 3 *	0.198421	12.38564	14.26460	0.0970
At most 4 *	0.067003	3.883763	3.841466	0.0487

ables. In such a case, the first-best solution would be using standard VAR model. Also, standard VAR approach is applied. Furthermore, standard Granger causality test under VAR assumptions was performed to see this relationship. Table 7 explains these results.

As it can be seen from Table 7, probability values of two different null hypotheses are more than 0.05. This situation shows that these hypotheses cannot be rejected. Owing to this condition, it was identified that producer price index (PPI) and consumer price index (CPI) are not the cause of exchange

Table 7. Granger causality test results

Null hypothesis	F-value	P-value
LOGEXC does not Granger cause LOGPPI	36.35944	0.0000
LOGPPI does not Granger cause LOGEXC	0.881887	0.9715
LOGEXC does not Granger cause LOGCPI	18.96405	0.0020
LOGCPI does not Granger cause LOGEXC	0.75730	0.9797

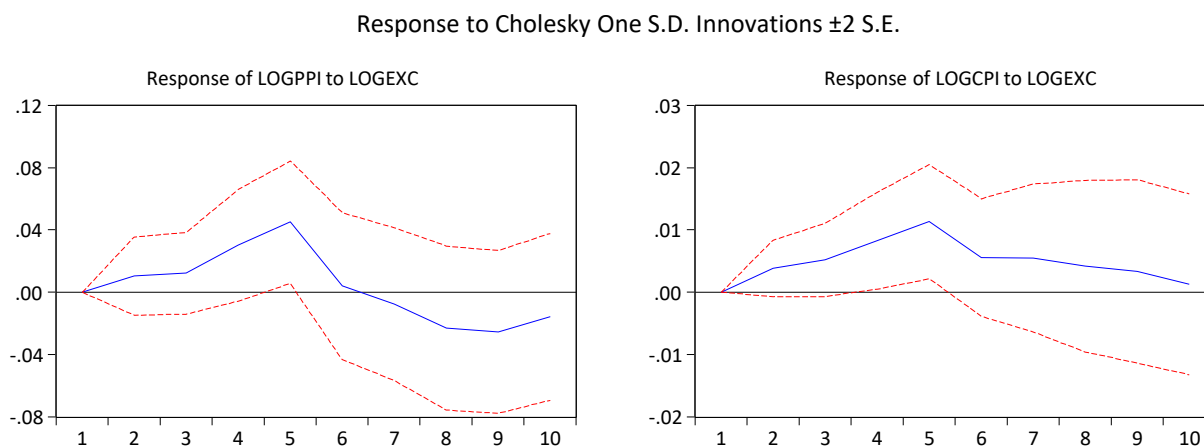


Figure 2. The results of impulse-response functions

rate. On the other hand, it was also defined that probability values of other two different hypotheses are less than 0.05. Due to this result, these null hypotheses can be rejected. This situation explains that exchange rate is the main cause of consumer and producer price indices. In other words, it was concluded that exchange rate channel is effective in Azerbaijan.

After this test, impulse-response analysis was also performed to understand the effects of the shocks on the variables. That is to say, by making this test, it will be possible to see which variables are affected by the shocks and the reactions given by these variables. Within this scope, it was aimed to identify the responses of the variables against any shock in currency exchange rates in order to evaluate the effectiveness of the exchange rate channel in Azerbaijan. For this purpose, impulse-response functions for 10 quarters (2.5 years) were calculated according to Cholesky method. The results are illustrated in Figure 2.

As it can be seen from Figure 2, producer and consumer price indices give positive results to the shocks in currency exchange rate. This situation supports the previous results of this study. However, it was also defined that the effect of this shock is longer for consumer price index. A rise in exchange rates (depreciation of local currency) led to an increase in both the producer and consumer price indices in the first six periods. It was seen that this result is appropriate with the theory of exchange rate channel. According to this theory, any increase in currency exchange rate (depreciation of local currency) causes economic growth to go up by increasing net export amount. Moreover, the transmission level of exchange rates to the inflation depends on the import amount, the level of devaluation and structural characteristics of the economy. Generally, exchange rate channel is more effective when there is an increase in the level of devaluation and import amount. In conclusion, it was identified that exchange rate channel is very significant for Azerbaijan.

CONCLUSION

The rapid decrease in oil prices led to an important decline in foreign exchange revenues in Azerbaijan especially after 2014. In addition to this situation, neighbor countries made devaluation at the same period. Due to these factors, there was an increase in the demand of foreign currency in this period. In this environment, Central Bank of Azerbaijan decided to make two different devaluations in 2015 lower these problems.

This study aims to understand whether exchange rate channel is effective in Azerbaijan or not. In this scope, quarterly data between 2001:01 and 2017:02 is analyzed. Furthermore, Granger causality analysis under VAR assumptions was used. Moreover, Augmented Dickey-Fuller (ADF) unit root test is

conducted firstly. It is identified that none of the variables are stationary on their level values, but they become stationary with their first differences. Because of this aspect, it was expected that there can be a cointegration relationship between the variables. After stationary analysis, a VAR model was created. Within this scope, a test was made to determine the optimal lag interval. It was defined that lag interval will be 5 in this study, because three different criteria indicate this aspect. It is concluded that there is no autocorrelation and heteroscedasticity problems.

The findings show that both producer price index and consumer price index are not the cause of exchange rate. Nevertheless, it was also concluded that exchange rate is the main cause of consumer and producer price indices. That is to say, it was identified that exchange rate channel is effective in Azerbaijan. While considering the results of this study, it was recommended that Azerbaijan can use exchange rate channel in order to minimize the negative effects of current account deficit problem and radical decrease in oil prices.

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