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THE EFFECTS OF EXTERNAL SHOCKS ON AZERBAİJAN ECONOMY

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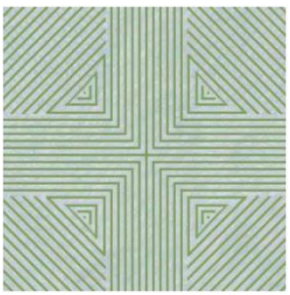

The effects of external shocks on Azerbaijan economy[1]

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Abstract

This paper examines the effects of external shocks on the economy of oil rich Azerbaijan. Using oil price and macroeconomic indicators of three major trade partners of Azerbaijan – EU, Russia, and Turkey - as the external shock variables, we analyze the effects of those shocks on the domestic macroeconomic variables of Azerbaijan during the period from 2000Q1 to 2017Q4, in the SVAR framework with block exogeneity restriction. The results show that the overall importance of the four groups of shocks, in descending terms, is in the following order: oil shock, EU origin shocks, Russia origin shocks, and Turkey origin shocks. The major findings of the paper are: a) among considered foreign shocks oil price shock is the most important foreign shock for the economy of Azerbaijan; b) in general EU origin shocks has larger impact on considered domestic variables compared to other trade partners origin shocks; c) Turkey origin shocks have almost no impact in any of the considered domestic variables of Azerbaijan, d) among considered external shocks oil price is the main determinant of the non-oil sector of economy, and e) among considered external shocks GDP growth of the trade partners is the main determinant of the inflation in Azerbaijan.

JEL classification: E10; E30; F60; C30

Keywords: VAR; non-oil GDP; CPI inflation; oil price; external shock

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Introduction

Over the last few decades, world economy became more integrated. This trend lead to the hypothesis that economies started to show co-movements in the major economic variables. Therefore, it is an important task to check the effects of the external shocks on the particular economies. This task is of major importance especially in the case of the developing and resource rich economies because those economies are more vulnerable to global economic fluctuations. In this paper, we check which external shocks has more important impact, or if there exists any impact at all, on Azerbaijan economy, which is a developing oil rich country.

Azerbaijan economy faced dramatic fluctuations during the last four years. Although, decline in oil price is naturally considered the primary reason for the recent poor performance of Azerbaijan economy, we want to check 1) whether this shock should be blamed also for the fluctuations in non-oil sector of the economy, and 2) whether non-oil shocks – in our research GDP growth and inflation in the major trade partners of Azerbaijan - have important impact on the Azerbaijan economy.

We use oil price shocks, and GDP growth and price levels[3] of three major trade partners of Azerbaijan- EU, Russia and Turkey - as external shocks. The variables to be affected by the external shocks are non-oil GDP, price levels, and non-oil exports of Azerbaijan. We use Structural Vector Autoregressive (SVAR) model with block exogeneity restriction. Block exogeneity restriction implies that domestic shocks do not affect the exogenous shocks neither contemporaneously nor with lag. The data sample covers the period from the first quarter of 2001 to the fourth quarter of 2017. We find that, in terms of the number of statistically significant responses of the domestic variables to the macroeconomic variables of the trade partners, EU

[3] In this research price level refers to consumer price index (CPI)

outweighs Russia and Turkey, which means that overall, EU origin shocks are more important for Azerbaijan economy. Our findings show that oil shock has a significant effect on non-oil GDP growth of Azerbaijan. In fact, non-oil GDP of Azerbaijan responds positively to oil price regardless the presence of the other exogenous shock variables in all of the models that we consider (to be discussed below). With regard to CPI of Azerbaijan, we find that this variable responds to the CPI of Russia more than to oil prices. This result may seem counterintuitive in the first glance but becomes less so if we take into account that Russia is the major trade partner of Azerbaijan accounting for about 30 percent of non-oil trade of the country (Table 1). Next important finding of the paper is that when oil price is present in the model, none of the endogenous variables responds significantly to the Turkey related shocks. This finding is surprising if one considers the close economic relationships between two countries.

In terms of forecast variance decomposition of the domestic variables, oil price shock again performs as a major determinant of the variability of all three domestic variables especially that of non-oil export and non-oil GDP growth accounting for approximately fifteen and fifty percent of the variability of those variables respectively. Though oil price shock account for some part of the variability of CPI of Azerbaijan, the major sources of the CPI is the GDP growth in EU and Russia. GDP growth of EU and Russia account for approximately thirty percent and twenty-five percent of variability in CPI of Azerbaijan after fourth period in respective groups.

We are familiar with the work conducted by Rahmanov (2016), Karimli et al. (2016) and Rahimov et al. (2016). Our contribution to the similar literature is that we focus on the broader set of exogenous variables other than oil prices, and we use SVAR with *block exogeneity*. To our knowledge similar work has not been conducted for

the case of Azerbaijan. The structure of the paper is as follows: Part II reviews the existing literature, part III discusses the data and methodology, part IV provides results, and discussions follow.

Literature review.

Perhaps many would agree that Calvo, Leiderman, & Reinhart (1993) could be considered as the starting literature on the effects of external shocks on domestic economies. This paper analyses the increasing performance of financial markets of ten Latin American countries in the early 1990th, especially large capital inflows to those countries and argues that this improvement can be largely attributed to the external shocks, especially shocks originated in US financial markets. Authors argue that indeed significant decline in short term interest rates in US lead to the shift of the investment decisions of the investors who started to invest into Latin American countries resulting in large capital inflows to the region.

Mackowiak (2006) uses structural VAR approach to learn the effects of external shocks – US monetary shocks on one hand and other shocks on the other hand - on the selected emerging economies. His sample covers Korea, Malaysia, Philippines, Thailand, Hang Kong, Chile, and Mexico. The identification method of structural parameters that the author uses is block exogeneity restriction, which is common approach in similar literature. This restriction implies that there is a one directional impact from external shocks to domestic variables. The paper finds that external shocks are an important source of fluctuations in emerging markets; however, different countries are affected differently. The interesting finding of the paper is that the US monetary shocks have larger impact on the price levels and output of the emerging markets than price and output levels in US itself.

Allegrat (2012) conducts a similar work. Using quarterly data from 1990Q1 to 2012Q2, the author learns the effect of global shocks on 10 East Asian countries. He uses SVARX model where domestic variables do not affect external shock variables neither contemporaneously nor with lags. The author uses four external shocks – real oil prices, the real US GDP, the Fed Funds interest rate, and the volatility of the MSCI index. As the domestic variables the authors use real output, the domestic producer index, and the nominal exchange rate against U.S. dollar. The results show that for all countries the external shocks explain at least 11 percent of the fluctuation in the GDP. Among all external shocks, oil shock is more important.

The following two papers learn the impact of external shocks on Sri Lankan and Croatian economies respectively. Duma (2008) examines the effect of external shocks – exchange rate, oil prices and import prices - on the price levels in Sri Lanka using vector autoregressive model. The paper finds low and incomplete pass through of external shocks, which can be explained by the presence of administrative prices. Effects of external shocks on Croatian economy is important according to Krznar & Kunovac (2010). The results show that world prices account for 49 and 39 percent of variation on producer and consumer price indexes respectively, and EU GDP shocks account for 49 percent of the variation in Croatian economy.

Raddatz (2005) uses panel VAR to learn the impact of external shock on low-income countries. Three external shocks that the author focused on are commodity prices, natural disasters and aid flows. The finding of the paper is that although there is *meaningful effect* of the external shocks on low-income countries, those shocks account for only small fraction of the *fluctuations* of the GDP.

Using VAR framework Rahimov, Adigozalov, & Mammadov (2016) assesses the determinants of inflation in Azerbaijan. Together with several domestic variables authors also use the inflation in the trade partners of Azerbaijan and find that

inflation of the trade partners has a significant effect on the inflation of Azerbaijan. Karimli et al. (2016) learns the pass-through of oil prices into inflation in three oil exporting countries – Azerbaijan, Kazakhstan and Russia. Using SVAR framework. Authors find that the inflation in those countries responds significantly to oil prices. Hasanov (2010) analyses the impact of real oil price on real exchange rate of Azerbaijan. Using behavioral equilibrium exchange rate (BEER) the author finds that there is significant relationship between real oil price and real effective exchange rate – 1 percent increase in real oil price causes the real effective exchange rate to appreciate 0.7 percent.

Data and methodology

Similar literature primarily uses VAR model. VAR allows tracking the effect of one-time shock to one variable on the other variables. By imposing proper restrictions, the structural shocks (at the same time structural parameters) can be identified. In addition, VAR allows finding which portion of the forecast variance of one variable is explained by other variables. The VAR model (reduced VAR) we use is in the following form:

$$y_t = \sum_{i=1}^{p} A_i \, y_{t-i} + \sum_{j=0}^{q} A_j \, x_{t-j} + u_t \qquad (1)$$

where y_t is a kx1 vector of k variables (domestic and foreign), A_i is a kxk dimensional matrix of parameters, A_j is kxn matrix of coefficients of exogenous variables, x is nx1 vector of exogenous variables, u_t is kx1 vector of error terms. According to above model each variable is explained by the lagged values of all of the endogenous variables, and current and lagged values of the exogenous variables in the system. There is no contemporaneous relationship among the endogenous variables. One drawback of the VAR model is that error terms (u_t) are actually

weighted averages of all contemporaneous structural shocks. (Only in one special case when there really is not any contemporaneous relationship between endogenous variables, errors in the VAR model correspond to the true structural errors). Consider the following structural system of equations:

$$By_t = \sum_{i=1}^{p} B_i\, y_{t-i} + \sum_{j=1}^{p} B_j\, x_{t-j} + \mathcal{E}_t$$

where y_t kx1 vector of endogenous variables, B is the kxk matrix of structural parameters, B_i are kxk matrix of structural lagged parameters, B_j is a kxn matrix of structural parameters of exogenous variables and $\mathcal{E}_t$ is a kx1 vector of structural errors. B is the matrix of contemporaneous impacts. Multiplying by B^{-1} we obtain VAR (reduced VAR) representation of the system – equation (1). Where $B^{-1}B_i = A_i$ for i=1,2..p, and $B^{-1}\mathcal{E}_t = u_t$. It is obvious from the formulas that estimated reduced VAR errors are in fact weighted averages of true errors. In order to trace the dynamic relationship between the variables we should obtain the true error covariance matrix. This is a challenge that can be meet by imposing restrictions on the B^{-1} matrix. One standard approach in the literature is to apply Cholesky decomposition, which forces the matrix B to be a lower triangular matrix. B matrix being lower triangular means that the first variable in the system is not contemporaneously affected by any of the endogenous variables, the second variable is contemporaneously affected only by the first variable and so on, and the last variable is contemporaneously affected by all other variables. Variety of restrictions similar to Cholesky decomposition can be applied, however the restriction pattern should be backed by economic theory.

The right hand side of the ordinary VAR is usually symmetric with respect to lags - that is to say, each variable in the system is affected by the lags of its own and the lags of the all other endogenous variables. However, it may not always be the most desirable structure. For example, we would like Azerbaijan related shocks to have

neither contemporaneously nor lagged effect on oil prices – a small economy argument. Imposing such type of a restriction on the lagged coefficient matrix is called block exogeneity restriction. We use SVAR model with block exogeneity.

In what follows, unless otherwise stated, by exogenous variable, we mean variable characterizing external shock and by endogenous variable, we mean the variable characterizing the economy of Azerbaijan. Endogenous variables are non-oil GDP growth, consumer price index (CPI), non-oil export of Azerbaijan. The global shock variables are oil price, and GDP growth and inflation in the three major trade partners of Azerbaijan – EU, Russia, and Turkey. Table 1 provides the information about the share of major trade partners in the foreign trade of Azerbaijan. Together those countries account for the more than half of the non-oil foreign trade of Azerbaijan.

Table1. Share of EU, Russia, and Turkey in nonoil trade of Azerbaijan in 2017.

	Turnover	Import	Export
EU	0.213	0.241	0.076
Russia	0.281	0.241	0.482
Turkey	0.148	0.149	0.144

We add a dummy variable to capture the effect of Global Financial Crisis. The dummy variable is one for the period from 2008Q2 to 2009Q2. Data are quarterly. Data related to Azerbaijan comes from the Central Bank of Azerbaijan. All variables are in yearly growth terms. Motive for using non-oil part of the GDP and exports is that - first, we want to learn the effect of oil prices on non-oil sector, and second non-oil sector of the economy is of major importance from the policy perspective.

The size of the sample data heavily affects our decision on selection the optimal number of the exogenous shock variables and lags in the model. Lag length is two

in the all models[4]. Except from non-oil GDP growth, none of the variables in growth terms has unit root at 5 percent significant level (for non-oil GDP growth p values from Augmented Dickey-Fuller and Philips Perron tests are 0.0523 and 0.0599 respectively).

While conducting the research we face a tradeoff between numbers of exogenous variables included in the model, and achieving more stable model because of the relatively small size of the data. Therefore, in order to extract as much and as diverse information from the data we construct three groups of foreign variables – EU group, Russia group, and Turkey group – and conduct the estimation for each group separately. In each group, the exogenous variables include oil price, GDP growth and price levels in the respective country. Ordering of the exogenous variables in each group are as follows: oil price, GDP growth, and inflation. Oil price is the most exogenous[5] variable – other variables do not have impact on oil prices neither contemporaneously nor with lags. Our motivation for using oil price shocks in each model comes from the findings of the several previous research such as Bayramov & Orujova (2017), Karimli et al. (2016), Rahmanov (2016), Rahimov et al. (2016) that indicate the importance of oil for Azerbaijan economy. Endogenous variables in each group are three and are in the following order – non-oil exports, non-oil GDP growth, and CPI. The reasoning for a such identification is that we assume that neither non-oil GDP growth nor CPI can have instant (contemporaneous) impact on the level of non-oil exports because the foreign factors especially that of the demand from trade partners mainly determines the level of exports. In addition, CPI does not have instant impact on non-oil GDP growth, because it takes some time for

[4] With two lags all models are stable.

[5] The search for the most exogenous variable comes from the aim of imposing identifying restrictions. The most exogenous variable – in our research oil price – comes first in the variable list that is it becomes the upper left element of triangular restriction matrix when we use Cholesky decomposition.

producers to adjust the production level to new prices[6]. This kind of sequence of domestic variables is common in the literature. In what follows the concept of significance is used to address the significance of the impulse response reactions unless otherwise stated. We use Cholesky decomposition for identification restrictions throughout this paper and the confidence level for significance is two standard deviations unless otherwise stated.

Results.

We conduct the estimation for all three groups - EU, Russia, and Turkey related variables groups- separately. Exogenous shocks in each group include oil price, and GDP growth and inflation of the respective economies. The structure of each model is as follows:

$$y_t = \sum_{i=1}^{2} A_{yi}\, y_{t-i} + A_x x + u_t$$

where:

$$y_t = \begin{bmatrix} Oil \\ S \\ D \end{bmatrix}, \qquad A_{yi} = \begin{bmatrix} Aoo & 0 & 0 \\ Aos & Ass & 0 \\ Aod & Asd & Add \end{bmatrix}, \quad x_t = \begin{bmatrix} cons \\ cris\_d \end{bmatrix} \text{ and}$$

A_x is 6x2 matrix of coefficients, u_t is a 6x1 vector of the error terms. *Oil* is oil price variable *S* is a 2x1 vector of the foreign shocks, *D* is a 3x1 vector of domestic variables. In addition;

A_{yi} is a 6x6 matrix of coefficients consisting of following matrixes (submatrixes);

Aoo is a scalar measuring the impact of lagged oil price on itself

Aos is a 2x1 vector of impact coefficients of lagged oil price on foreign shocks

[6] We assume price stickiness does not hold.

Ass is a 2x2 matrix of impact coefficients of the lagged foreign shocks on the foreign shocks

Aod is 3x1 vector of impact coefficients of the lagged oil price on domestic variables

Asd is 3x2 matrix of impact coefficient of lagged foreign shocks on domestic variables

Add is 3x3 matrix of impact coefficients of lagged domestic variables on domestic variables

"Cons" is a constant, "cris_d" is a dummy accounting for the effect of financial crisis.

Appendix I provides the list and the explanation of the variables, Appendix II presents the impulse response graphs, and Appendix III presents the variance decomposition tables. We start by discussing the results of the impulse response functions. Table 2 summarizes the results of the impulse response functions.

Table 2. The summary table of (accumulated) impulse response results.

Exogenous variables

Endogenous variables	EU group			Russia group			Turkey group		
	Oil.pr	EU.GDP.gr	EU.CPI	Oil.pr	Rus.GDP.gr	Rus.CPI	Oil.pr	Tur.GDP.gr	Tur.CPI
Az.Exp	+**	+*	+*	+*			+**		
Az.GDPgr	+**	+*	+*	+**			+**	+*	
Az. CPI	+**	+**		+*	+**	+**	+**		

Signs show the direction of the effect.

* significant at 1 standard deviation level, ** significant at 2 standard deviation level

In all three groups responses of domestic variables to oil price shocks have the expected positive sign and are significant[7]. This result is consistent with the existing literature. By the second period a 10 percent positive oil price shock transmits to approximately 5-7 percent increase in the non-oil exports, 1 percent increase in non-oil GDP growth, and 0.5 percent increase in CPI in Azerbaijan.

In EU group the responses of all three domestic variables to EU GDP growth is significant at least at one standard deviation confidence interval. A 10 percent positive shock to EU GDP growth transmits to accumulated 3.4 percent increase in non-oil export by the fourth period and then starts to die out, to about 0.4 percent increase in non-oil GDP growth by the fourth period and remains fairly constant, and to a 1.7 percent increase in inflation by the eighth period and remains constant. A 0.1 percent positive shock to EU CPI transmits to accumulated 7 percent increase in non-oil exports by the fourth period and remains constant, and to about 3 percent increase in non-oil GDP growth by the eights period. One surprising finding of the research is the *insignificant* response of domestic CPI to EU CPI which needs further explanation. One explanation would be the structure of the imported goods from EU and the calculation methodology and structure of CPI baskets of the countries. So that Azerbaijan mainly imparts capital goods from EU which does not enter the CPI basket of Azerbaijan directly[8]. In addition, if EU CPI basket contains more "capital goods" but Azerbaijan CPI basket does not then the insignificant effect of EU CPI on Azerbaijan CPI becomes intuitive rather than being surprising. Another interesting finding is the large magnitude of the response of non-oil exports and non-oil GDP growth of Azerbaijan to EU CPI. One explanation might be the fact that inflation in EU has been consistently low during last decades, therefore a one percent

[7] The responses of Az.Exp and Az.CPI are significant at 1 standard deviation level in Russia group

[8] In that case the extension of the model would be to conduct an exercise by using producer price index (PPI) instead of CPI in the model.

increase in the inflation during a year would mean an extremely large change in the economy. Therefore, it would be more accurate to compare percent change in the domestic variables of Azerbaijan to a fraction of the percent change of the inflation in EU which we did above.

In Russia group both Russian GDP and inflation has significant impact only on the inflation of Azerbaijan. A 10 percent positive shock to Russian GDP growth transmits to about 1 percent increase in the domestic inflation by the second year and continues to increase slowly, and a 1 percent increase in Russian CPI transmits to about 2.5 percent increase in the domestic inflation by the fourth quarter and about 4 percent increase by the eighth quarter. This might be one explanation to the above mentioned "surprise" finding, so that the impact of Russian economy especially the CPI of Russia on Azerbaijan is relatively stronger which leaves less room for the impact of EU CPI.

Perhaps another unintuitive finding of this research is the insignificant effect of Turkey related shocks on domestic variables so that among considered variables only non-oil GDP growth of Azerbaijan responds to only GDP growth in Turkey and this response is significant only at one standard deviation confidence level. This finding might be less unintuitive if we take into account the fact that Turkey accounts for a smaller portion of the foreign trade of Azerbaijan compared to other two trade partners. In addition, Turkey economy itself might be relatively more vulnerable to exogenous shocks especially to the oil shocks.

One interesting finding of the research is that while non-oil exports and non-oil GDP growth of Azerbaijan fails adequately respond to increasing GDP growth in trade partners, domestic inflation increases following such a growth -positive "demand" shock from trade partners. This might be a sign of an underdevelopment of the non-

oil sectors - increase in the foreign demand leads to trade diversion rather than export creation.

Next, we present the forecast variance decomposition of domestic variables in each group. Again oil price accounts for a large part in the variance of the forecast error of the domestic variables. It accounts for approximately fifteen percent of the variation in non-oil export, fifty percent in non-oil GDP growth, and approximately fifteen percent in CPI of Azerbaijan by the second period which is again intuitive result which is in line with the findings of previous research[9].

When learning the effects of EU related shocks we find that EU GDP growth accounts for three percent of the variation of the domestic exports, five percent variation of non-oil GDP growth, and seven percent of variation of domestic inflation in the first period. The respective numbers are six, four and twenty-nine percent in the fourth period, and seven, three and thirty-two percent in the eighth period respectively. EU CPI accounts for five percent variation of domestic exports, three percent variation of non-oil GDP growth, and less than one percent variation of the domestic variables in the first period. The respective numbers are three, nine, and about zero percent for the fourth period, and three eleven and four percent for the eight period respectively.

With regard to Russian origin shocks Russian GDP growth accounts for less than one percent variation in the non-oil exports, about one percent variation in non-oil GDP growth, and three percent variation in the CPI of Azerbaijan in the first period. The respective numbers are one and half percent, one percent, and twenty five percent in the fourth period and three percent, one percent, and twenty seven percent in the eighth period respectively. Russian CPI accounts for less than one percent

[9] The magnitude of the effect of oil price differs in different groups. Above numbers are approximate numbers

variation in the non-oil export, about two percent variation in the non-oil GDP growth and eleven percent variation in the CPI of Azerbaijan in the first period. The respective numbers are eleven, two and sixteen percent for the fourth period and fourteen, two and fifteen percent for the eighth period.

With regard to Turkey origin shocks, Turley GDP growth accounts for the one percent variation in the non-oil export, two percent variation in the non-oil GDP growth and four percent of the variation in the variance of the CPI of Azerbaijan in the first period. The respective numbers are one, three and three percent in the second period and two, two, and six percent for the eighth period. Turkey CPI accounts for two percent variation in non-oil export, and less than one percent variation in both non-oil GDP growth and CPI of Azerbaijan in the first period. The respective numbers for the subsequent periods are approximate equal to the first period numbers.

Analysis of the variance decomposition show that oil price is the main determinant of the variability in the non-oil export of Azerbaijan followed by the inflation in Russia. Russian economy is the largest market for Azerbaijan exports and volatility in the price levels in this market certainly affects the volatility of the exports from Azerbaijan. The main determinant of the forecast variance of non-oil GDP growth in Azerbaijan is oil prices accounting approximately fifty percent of variation. This result is also intuitive because for example increase in oil prices leads to the revival of the overall economy of Azerbaijan including non-oil sector. An interesting finding is that in both impulse response and variance decomposition analysis we see that changes in oil prices transmits to non-oil GDP with about four lags. For example, while accounting only less than ten percent of volatility in non-oil GDP growth in the first period, oil price accounts for about fifty percent of volatility in the fourth period. It might be partially explained by the existence of the Oil Fund which

prevents oil revenues from directly entering the economy. With regard to inflation, though oil price accounts for some part of variability in inflation in Azerbaijan (about 15 percent) the effect is less than that of other exogenous variables. Especially GDP growth of EU and Russia accounts for the larger portion of the variability in inflation in Azerbaijan. With regard to Turkey origin shocks findings from variance decomposition coincide with that of impulse response functions so that Turkey origin shocks account for only small part of the variability of the domestic variables of Azerbaijan.

Discussions and policy recommendation

The general results of the research are that exogenous shocks – in this research oil shocks and macroeconomic indicators of the major trade partners – have significant impact on the economy of Azerbaijan. Among other shocks, oil shock – proxied by oil price fluctuations – has the largest impact on the Azerbaijan economy, which is in line with the findings of related literature. The natural policy response for such situation is the diversification of the economy – this policy recommendation has been largely documented in the several papers. For example, Bayramov & Orujova (2017) extensively learns the structure and the parformance of the three Caspian basin resourse exporting countries – Kazakhstan, Azerbaijan, and Turkmenistan and concludes that being less diversified hugely contribued to the resent poor performance of those countries. Therefore, by diversification the dependency of Azerbaijan economy – in our research non oil sector – from the oil shocks can be reduced significantly. Another important finding of the paper is that the inflation in Azerbiajan is largely effected by the inflation in trade partners, especially by that of Russia. This kind of fenomena, sometimes called an imported inflation is usual for the economies pursuing fixed exchange rate. When exchange rate is not fixed, by adjusting automatically exchange rate partially absorbes the pressure on domestic

inflation caused by the inflation of the partner countries. However, when the exchange rate is fixed, it fails to achieve this goal and the inflation in the partner countries can more easily transmit to the domestic inflation. Therefore, gradually shifting to floating, or managed and floating, exchange rate would decrease the pressure of foreign inflation on the domestic inflation. In addition, diversification of the economy, especially achieving growth in the import sector can contribute to this goal significantly. The fact that inflation rather than non-oil GDP growth increases more following the increase in "foreign demand" might be a sign of the underdeveloped non-oil sector which is again a drowback linked to the less diversification of the economy.

Conclusion

We examined the response of a set of domestic variables to the set of external shocks. The domestic variables included non-oil GDP growth, inflation, and non-oil exports of Azerbaijan, and the external shocks include fluctuation in the oil prices, and GDP growth and inflation rate of the three major trade partners of Azerbaijan – EU, Russia, and Turkey. Applying Structural Vector Autoregressive (SVAR) model with block exogeneity to the quarterly data from 2001Q1 to 2017Q4 we find that among external shocks considered, oil shock has the most profound impact on domestic variables overall. Among trade partners considered EU origin shocks have relatively more, and Turkey origin shock have relatively less impact on the economy of Azerbaijan. While the most important determinant of non-oil GDP growth and exports of Azerbaijan is oil price shocks, that of inflation is the GDP growth of the trade partners. Our findings show that while non-oil GDP growth and exports fail to adequately react to increasing "demand" from the economies of trade partners' inflation in Azerbaijan increases which might be a sign of the underdeveloped non-oil sector.

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Appendix I. The list of the variables.

Oil.pr – Yearly growth rate of real oil price. The data is from U.S Energy Information Administration

EU.GDP.gr – Yearly growth rate of GDP of Euro Area countries. The data is from Eurostat webpage

EU.CPI – Consumer Price Index in Euro Area countries. The data is from Eurostat webpage

Rus.GDP.gr – Yearly growth rate of the GDP of Russia. The data is from OECD Statistics

Rus.CPI – Consumer Price Index in Russia. The data is from OECD Statistics

Tur.GDP.gr – Yearly growth rate of the GDP of Turkey. The data is from OECD Statistics

Tur.CPI – Consumer Price Index in Turkey. The data is from OECD Statistics

Az.Exp.gr - Yearly growth rate of *nominal* non-oil exports of Azerbaijan. The data is from The Central Bank of The Republic of Azerbaijan

Az.GDPgr – Yearly growth rate of non-oil GDP of Azerbaijan. The data is from The Central Bank of The Republic of Azerbaijan

Az.CPI – Consumer Price Index in Azerbaijan. The data is from The Central Bank of The Republic of Azerbaijan

During the course of the research we considered a pool of domestic and foreign variables. Below we discuss some of the major candidate variables and the reasons why we decided to rule those variables out. Perhaps one of the most important variables to include in the model would be the exchange rate variable. To conduct an effective exchange rate policy is one of the functions of the central bank of the country and is critical for achieving internal and external balance. Therefore, it would be interesting to learn the effect of foreign shocks on the exchange rate of the country. Similar literature focuses on this variable very often. The reason we could not use the

exchange rate in our research was that Azerbaijan pursued fixed exchange rate during the large portion of the period that our research focuses. One option would be to use an effective exchange rate, however this variable also exhibits little variation. Using the real effective exchange rate was also impossible at least for two reasons -first the real effective exchange rate is heavily influenced by the nominal exchange rate and the second we already include CPI of Azerbaijan and that of the major trade partners in our model which is the another component of the real effective exchange rate. However, we acknowledge that the including the exchange rate in the model may be the subject of further research. Another candidate domestic variable was non-oil current account balance (CAB). However, while non-oil imports account for the larger part of the imports of Azerbaijan non-oil exports account for only small part of the total exports – the major part of the exports being oil products. Therefore, CAB heavily follows the trend in the imports of the country. Taking into account the importance of the non-oil exports from the policy perspective we decided directly focus on the non-oil export rather than CAB of Azerbaijan.

Similar literature mainly uses FED interest rate as a foreign monetary shock. However, the focus countries of many of those research (Mackowiak (2006), Nguyen & Nguyen (2013)) are South Asian or Latin American countries which are directly linked to US economy. For the purpose of our research we could use the interest rate in the trade partners of Azerbaijan. However, we ruled out this option also for the following reasons: first the interest rates in EU are in the negative horizon already for few years and quantitative easing policies have been conducted extensively for many years which means that interest rates do not have sufficient impact in EU economy. In case of Russia and Turkey money base instead of interest rate have been a major monetary tool for many years – the same is true also for Azerbaijan. Finally, our

choice of the foreign variables can be justified in the ground that the monetary and the fiscal policies usually show up in the GDP growth and inflation of the country.

In this research we use nominal rather than real non-oil exports of Azerbaijan because export price index is not available. As a robustness check we used producer price index (PPI) of Azerbaijan to construct the real non-oil exports and used this variable in the model. The main results did not change – the effects of trade partners' economic variables did not change, the effect of oil price on non-oil exports became slightly negative in all three groups (impulse responses being significant at one standard deviation level). This result can be indicator of the fact that increasing oil price tends to decrease non-oil exports – perhaps through real exchange rate appreciation - but increasing price of exports offsets this effect.

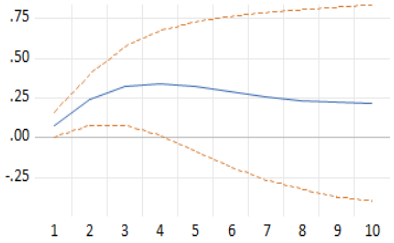
Another modification of the model would be to use non-oil export to only the respective country in each group. The main reason we cannot construct this model is that currently such data is not available. Another caution with regard to such model would be the presence of the redistribution effect – for example increase in the demand from one of trade partners might lead to shifting of the exports from other trade partners to that particular trade partner. We could observe the increase in the exports to that particular trade partner even if there was not an increase in the total exports.

Appendix II. The impulse response functions (accumulated impulses).

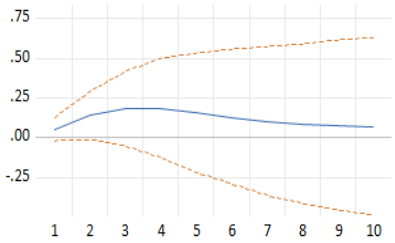
a. EU group

Response of non-oil exports to

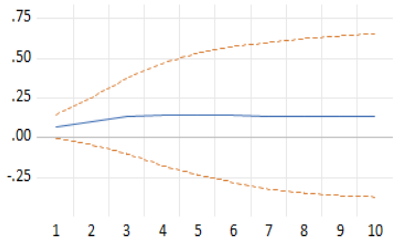
Oil price



EU GDP growth

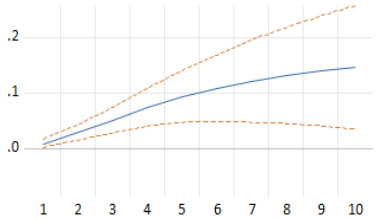


EU CPI

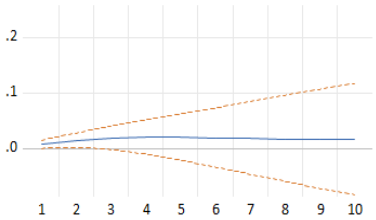


Response of non-oil GDP growth to

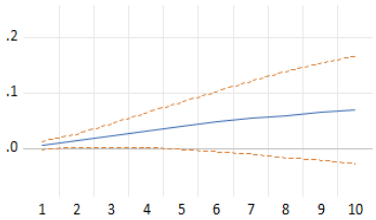
Oil price



EU GDP growth

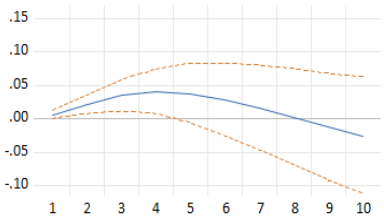


EU CPI

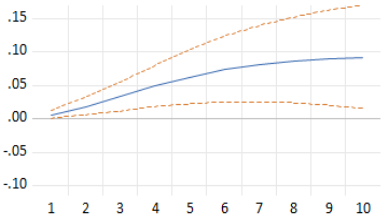


Response of CPI to

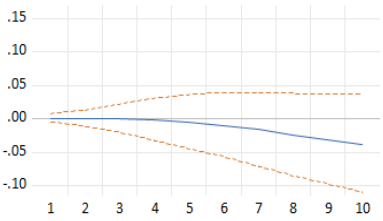
Oil price



EU GDP growth



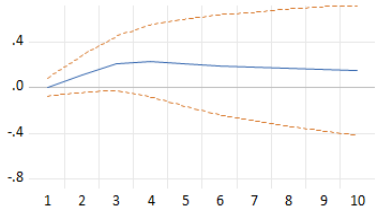
EU CPI



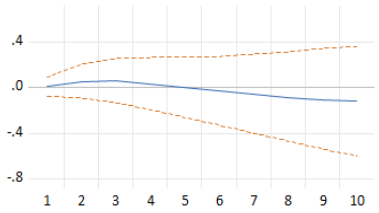
b. Russia group

Response of non-oil exports to

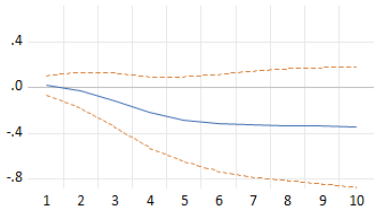
Oil price



GDP growth in Russia

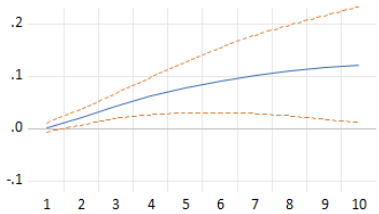


CPI in Russia

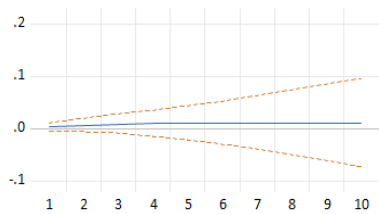


Response of non-oil GDP growth to

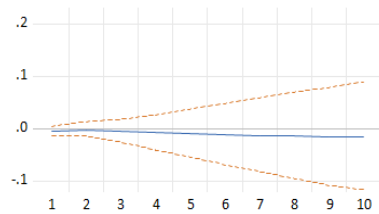
Oil price



GDP growth in Russia

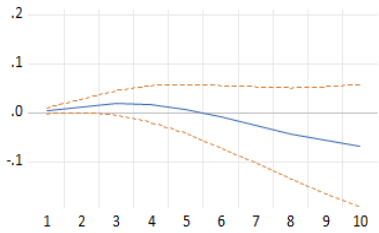


CPI in Russia

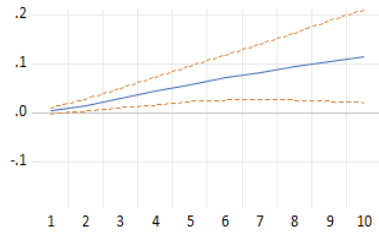


Response of CPI to

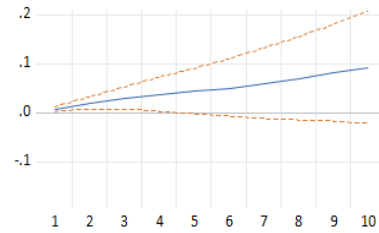
Oil price



GDP growth in Russia



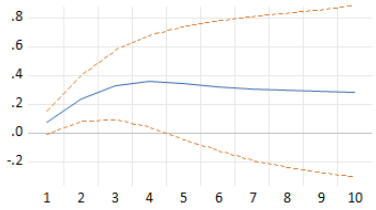
CPI in Russia



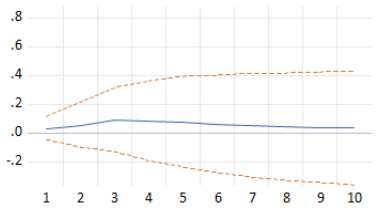
c. Turkey group

Response of non-oil exports to

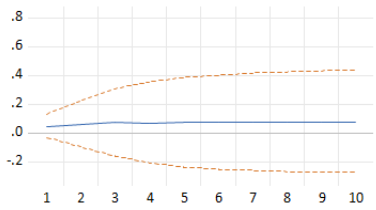
Oil price



GDP growth in Turkey

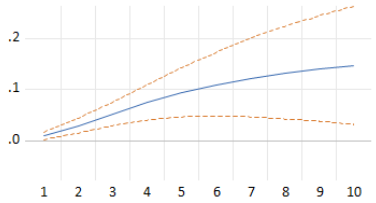


CPI in Turkey

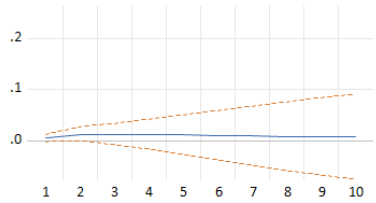


Response of non-oil GDP growth to

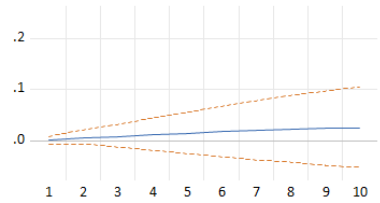
Oil price



GDP growth in Turkey

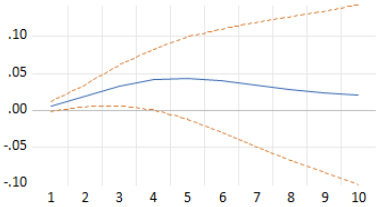


CPI in Turkey

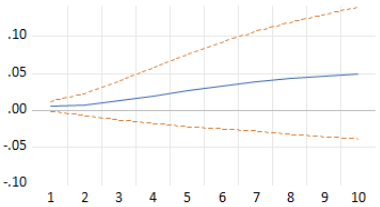


Response of CPI to

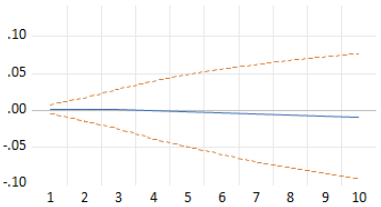
Oil price



GDP growth in Turkey



CPI in Turkey



Appendix III. Variance decomposition.

a. Variance decomposition of the domestic variables due to the shock in ***EU group*** external variables (in percent)

Period	non-oil export			non-oil GDP growth			CPI(Az)		
	Oil price	GDP growth	CPI	Oil price	GDP growth	CPI	Oil price	GDP growth	CPI
1	6.6	2.6	5.2	6.9	5.2	2.5	7.1	6.6	0.2
4	18.2	5.7	3.4	52.0	4.1	9.1	21.7	29.0	0.2
8	19.0	6.6	3.3	59.1	3.0	11.6	28.4	32.2	4.1

b. Variance decomposition of the domestic variables due to the shock in ***Russia group*** external variables (in percent)

Period	non-oil export			non-oil GDP growth			CPI(Az)		
	Oil price	GDP growth	CPI	Oil price	GDP growth	CPI	Oil price	GDP growth	CPI
1	0.0	0.1	0.4	0.7	1.3	1.8	3.2	3.3	11.0
4	12.4	1.4	11.6	47.2	1.2	1.6	6.7	25.5	16.5
8	12.2	3.2	13.7	55.7	1.0	1.6	24.8	27.7	14.9

c. Variance decomposition of the domestic variables due to the shock in ***Turkey group*** external variables (in percent)

Period	non-oil export			non-oil GDP growth			CPI(Az)		
	Oil price	GDP growth	CPI	Oil price	GDP growth	CPI	Oil price	GDP growth	CPI
1	4.7	0.8	1.8	7.4	2.2	0.0	4.0	3.9	0.1
4	20.4	1.4	1.2	51.2	2.5	1.5	15.5	3.3	0.0
8	20.5	1.6	1.2	58.6	1.9	1.7	13.6	6.0	0.2