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Oil Price Pass-Through into Inflation: The Evidence from Oil Exporting Countries

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Oil Price Pass-Through into Inflation: The Evidence from Oil Exporting Countries[1]

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Abstract

This paper evaluates different channels of oil price pass through into inflation for the countries Azerbaijan, Kazakhstan and Russia. We propose a methodology to disentangle the effects of different channels after an oil price shock hits international markets. We measure the relative importance of the two distinct channels through which oil price shocks are transmitted into inflation in these economies. For that, we employ an approach which is in the spirit of the methodology proposed by Sims and Zha (1995). The empirical evidence shows that the level of inflation in these oil-exporting countries responds significantly to oil price shocks. The fiscal and cost channels are major amplifiers of the effects of oil price shocks on inflation. By providing new evidence from emerging oil-exporting countries, the paper also has important policy implications on the maintenance of price stability by central banks.

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I. Introduction

As documented in many studies, rising oil prices may at least partially pass into inflation. However, higher oil prices have diverse effects across country groups. In the case of an oil importing country, higher oil price is a negative shock as it contracts output and increases inflation in the economy. For an oil exporting country, a rise in oil prices is a positive shock which boosts the domestic economy, but in general leads to higher inflation (Huseynov and Ahmadov, 2014). In both country groups, higher oil prices create higher inflation pressures in the domestic economy, but through different channels.

Three commonly accepted channels can be differentiated through which oil price fluctuations are transmitted into inflation. First, the cost channel implies that higher oil prices lead to higher production costs in oil importing countries. This channel is also relevant for oil exporting countries, but not through the same mechanisms as for an oil importer. Since energy prices are strictly administered and subsidized in oil exporting countries, production costs in the economy increase not because authorities adjust energy prices in line with international markets, but because the prices of intermediate and final imported goods adjust to higher oil prices.

The second channel operates through deterioration in the terms of trade and exchange rate. If not properly managed, rising oil prices lead to appreciation of local currency for oil-exporters by eroding the competitiveness of the non-oil sector. On the other hand, lower oil prices may lead to depreciation of the domestic currency for oil exporters by putting additional pressure on domestic inflation.

We call the third channel the "fiscal channel" or "demand channel" which is in general relevant for an oil exporting country. In an oil exporting country, the fiscal spending channel can be regarded as one of the most influential channels through which oil revenues are distributed across different sectors or groups. As fiscal expenditures demonstrate pro-cyclicality in these economies (Ilzetski and Vegh, 2008; Huseynov and Ahmadov, 2013, 2014) excessive budget spending can trigger inflationary pressures during oil price booms.

This paper studies the effect of oil price shocks on domestic inflation in oil exporting countries. As mentioned before, higher oil prices transmit to inflation through different channels. That is, though we observe higher inflation after a rise in an oil price, it is the result of the operation and interaction of different channels. In this paper, we propose a methodology to disentangle the possible effects of these different channels on inflation after an oil price shock. To that end, we employ an SVAR framework to implement *"unconditional"* and *"conditional"* impulse-response functions.

In the SVAR framework the incorporated proxy variables, which capture the transmission channels, endogenously respond to an oil price shock. That is, as oil price goes up the cost and fiscal channel variables respond to this shock. The oil price shock is not responsible for the much of variation in inflation. Instead the endogenous response of fiscal and cost variables in the end leads to higher inflation. To disentangle the effects of different channels, we follow an approach which is in the spirit of the methodology proposed by Sims and Zha (1995), Bernanke, et al (1997) and Waggoner and Zha (1998).

To implement this methodology, we examine the response of inflation after an oil price shock. Using our identification strategy in the SVAR framework, we obtain *"unconditional"* impulse-responses of these variables. Second, after an oil price shock, we shut off the response of different channel variables one-by-one and obtain *"conditional"* impulse-responses of these variables. Technically, to implement it, at each period we find such shock combinations in the SVAR framework that keep the channel variable responses at levels close to zero. We interpret the difference between *"conditional"* and *"unconditional"* responses of inflation as the relative effect of that specific channel (which is shut off).

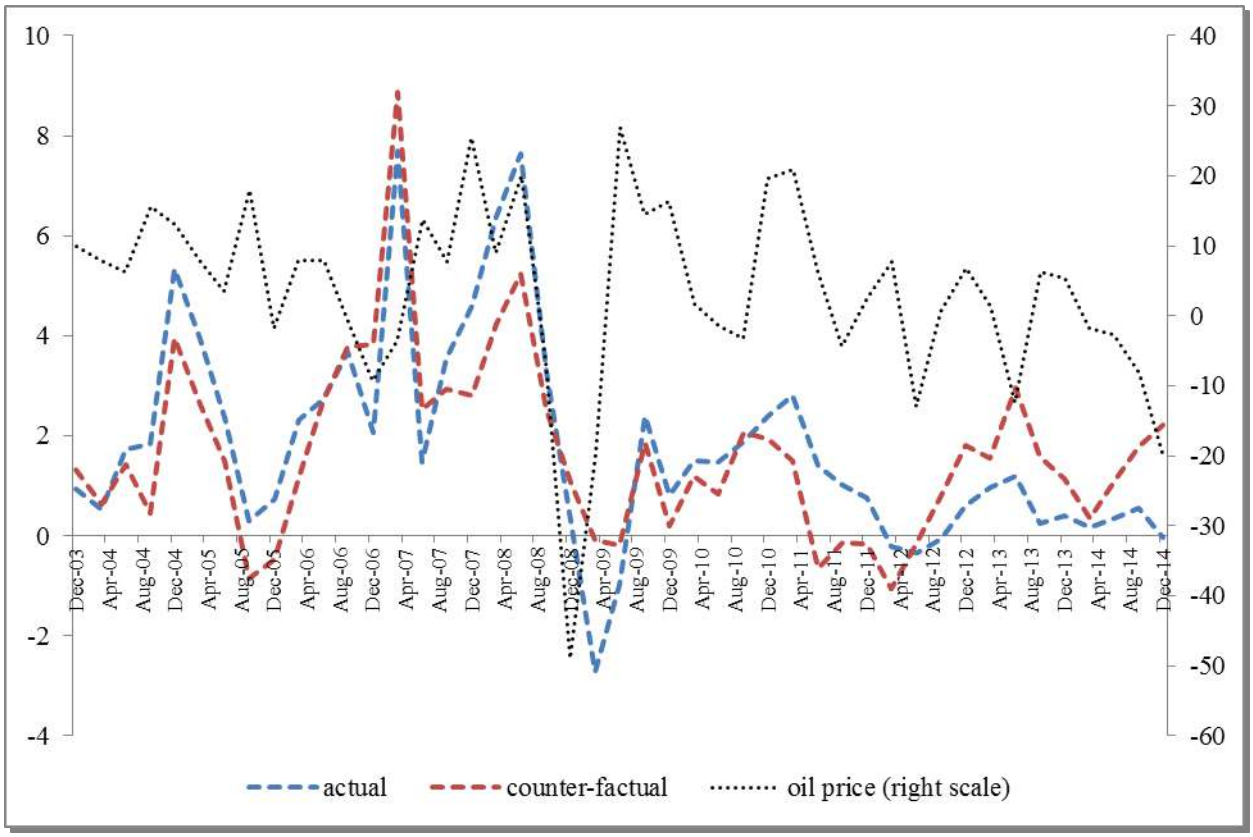
This paper is primarily focused on the Caspian region oil exporting countries by laying out the possible channels of oil price shocks into inflation. We will only study Azerbaijan, Kazakhstan and Russia excluding Iran and Turkmenistan from our sample. The motivation behind the paper is obvious. As oil revenues cover most part of total export revenues (Azerbaijan 93%, Kazakhstan 78%, and Russia 71%)[6], macroeconomic stability is highly sensitive to oil price volatility in those countries. Especially underdeveloped non-oil sector, excessive and disorganized budget expenditures and growing reliance on imported goods accelerate inflationary pressures. Furthermore, the recent oil price decline that started from November 2014 has also raised a special interest on oil price volatility since the process has led to significant fiscal losses, especially in Central and Middle East Asian countries. To confirm the existence of the transmission mechanism between oil price changes and domestic inflation and provide a graphical preview of our main findings, Figure 1 depicts the actual (where oil price shocks fed into inflation) and counterfactual inflation dynamics in Azerbaijan[7] vis-à-vis oil price changes. By isolating oil price effects, we can observe that during oil price hikes in 2007-08, inflation would have been much lower than it was at that time; however, in 2009 when oil prices declined significantly, the actual inflation went down too much in comparison with counterfactual inflation. It becomes clear that oil prices have indeed accelerated the effects of shocks on domestic inflation. In

[6] World Bank Databank

[7] The reader can refer to Appendix A for decomposition analysis of the remaining countries.

recent years, a lower and more sustainable level of inflation has been achieved following a decline in oil prices.

Figure 1. Inflation dynamics 2003Q4-2014Q4



Source: The State Statistical Committee of Azerbaijan, IMF and authors' calculations.

The results of the paper are consistent with the existing literature on pass through of oil price changes into inflation. We find that in Azerbaijan and Russia both fiscal (demand) and cost channels are important, whereas in Kazakhstan only the cost channel appears to be significant in the transmission of oil price shocks. When proxied by alternative variables, the demand channel exhibits significant behavior for the case of Kazakhstan.

The rest of the paper is organized as follows. Section 2 reviews the relevant literature on this topic. In section 3 we describe the data and variables used in the model specification and discuss the applied methodology. Section 4 provides the results for the estimated model. Section 5 concludes.

II. Literature review

Over the years, a vast amount of literature has been devoted to exploring the relationship between oil prices and macroeconomic variables, especially, inflation and output. In this section, we first provide briefly the relevant literature review on the inflationary effects of oil prices in oil importing countries, and then proceed with the oil exporters. Such approach will enable the readers to understand the differences across oil exporting and importing countries and to assess the quality of policy responses in these two country groups.

Oil importing economies

The common ground for oil importing countries is the declining level of oil price transmission into domestic prices, especially since 1980s. Using Philips curve framework, Hooker (1996, 2002), LeBlanc and Chinn (2004), Blanchard and Gali (2007), Valcarcel and Wohar (2013) conclude that in countries such as the US, Japan, UK, Germany, France, Italy, the effect of oil prices on inflation and economic activity has dropped substantially over the time. The major argument for declining role of oil prices are effective monetary policy responses to unanticipated shocks, less rigid labor markets and lower energy intensity of industries. Additionally, some studies reveal an asymmetric pattern in oil price fluctuations, which means that although oil price hikes lead to a rise in domestic inflation even in negligible amount, on the hand, an oil price decline does not yield any conclusive results (Lown and Rich, 1997).

A number of studies have focused on emerging oil importing Asian and Sub-Saharan countries to investigate empirical and theoretical mechanism of oil price pass through. A study by Jongwanich and Donghyun (2011) concludes that the magnitude of oil price pass-through is limited in nine Southern and Southeast Asian countries. Subsidies and price controls by governments are major factors for mitigating or delaying the undesirable effects of oil price shocks to inflation. Using SVAR model for China for the period of 1998-2008, Tang, Wu and Zhang (2010) explain that a surge in oil prices reduces output and investment, and simultaneously raises inflation and interest rates. However, due to price controls in China, in the long run the effect of oil price changes on inflation is negligible. The empirical findings for Kenya show that 10% percent increase in oil prices lead to 0.5% upsurge in inflation rate in the short-run and 1% in the long run (Kiptui, 2009). Using recursive VAR for Turkey, Chen (2008) finds that the pass-through effect of oil prices on domestic CPI has increased over time. The higher import dependency and as a result, a substantial amount of current account deficit cause Turkey be vulnerable to oil price and exchange rate fluctuations. Moreover, the ongoing growth rate of

the economy creates higher demand for energy resources as most industries mainly depend on fuel energy (Dedeoglu and Kaya, 2014).

Oil exporting economies

Four oil-exporting countries, namely Iran, Saudi Arabia, Kuwait and Indonesia have been analyzed using SVAR approach. While in Iran and Saudi Arabia oil prices are the major source of macroeconomic fluctuations, Kuwait with the help of oil fund and Indonesia through intensive diversification of its industry have been able to absorb undesirable effects of oil price volatility more successfully (Mehrara and Oskui, 2006).

As a major oil exporter in African continent, Nigeria also exhibits higher sensitivity to oil price volatility. Using the ARDL methodology in the Phillips curve framework, the authors estimate that 1 percent increase in oil prices lead to 0.04 percent increase in domestic inflation in the short run and 0.06 percent rise in the long run (Adeniyi and others, 2012).

Katsuya Ito (2008) examines how much oil prices affect macroeconomic environment using VEC model for the period of 1997:Q1-2007:Q4 in Russia. His findings show that inflation would increase by 0.36 percent if oil prices rise by 1 percent. The similar findings are obtained for Kazakhstan by concluding negative reaction of all macroeconomic variables to oil price fluctuations (Gronwald et al. 2009). Farzanegan and Markwardt (2009) analyze the dynamic relationship between oil price shocks and macroeconomic variables in Iran by using impulse response and variance decomposition approach. Their findings point out that both positive and negative oil price shocks raise inflation significantly.

The main conclusion of aforementioned researches is that oil price shocks exert influence on domestic inflation through two main channels. The fiscal channel operates through government expenditures that are funded by oil revenues and the cost channel works through the price of imported goods and services. Intuitively, in times of oil price hikes, budget expenditures rise and aggregate demand is boosted in the country. On the contrary, falling oil prices hurt the terms of trade through more expensive imports and reduced budget expenditures.

Existing literature makes such distinction between two channels only theoretically for some oil exporters; however empirically no paper has ever tried to assess the role of each channel. To our knowledge, this is the first study that applies the methodology *a la* Sims and Zha (1995) to measure the relative importance of different channels.

III. Data and methodology

The variables of interest are the amount of *oil production (OPROD)*, *real budget expenditures (FEXP)*, *world oil prices (WOP)*, *trading partners' CPI (TP_CPI)* and *CPI* of each specified country. Additionally, for robustness purposes for will employ nominal GDP to dispel concerns about whether the fiscal variable is just capturing the business cycle due to the pro-cyclicality of fiscal policy and nominal expenditures. Data on CPI and oil prices are obtained from the International Finance Statistics, oil production is from US Energy Information Administration Database, and budget expenditures are from the state statistics offices' of each country. Data on trading partners' CPI has been derived using the data on NEER and REER that are regularly published by Bruegel. The time period used in the paper ranges from 2000Q1 to 2014Q4. Due to data inadequacy, we cannot go back further in time which of course reduces the sample size of our research.

In this paper, we apply VAR approach drawing on variables on world oil (Brent) prices, domestic oil production, trade partners' CPI, real fiscal expenditures and domestic CPI. We incorporate quarterly changes of these variables into our model and then estimate a reduced form VAR. For SVAR analysis, Cholesky decomposition of the variance-covariance matrix of the incorporated variables will allow us to properly identify structural shocks. The decomposition for identifying shocks has been carried out in the following order:

$$\begin{pmatrix} e^{oil}_{price} \\ e^{oil}_{prod} \\ e^{cpi}_{tr\_p} \\ e^{exp}_{fiscal} \\ e^{inf} \end{pmatrix} = \begin{pmatrix} a_{11} & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 0 & 0 \\ a_{41} & a_{44} & a_{43} & a_{44} & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} \end{pmatrix} \begin{pmatrix} \varepsilon^{p}_{oil} \\ \varepsilon^{s}_{oil} \\ \varepsilon^{p}_{imp} \\ \varepsilon^{d}_{pb} \\ \varepsilon^{inf} \end{pmatrix}$$

This identification scheme allows us to find the effect of an oil price shock on domestic inflation. Here, *world oil price* is ordered as the first variable. In other words, it is assumed that other structural shocks do not have any *contemporaneous* effect on oil prices. As oil prices are determined exogenously in international markets, one can claim that structural shocks in every period should have negligible effect on oil prices. Though this identification scheme excludes contemporaneous effect by assumption, shocking other variables do not produce significant changes in oil prices even in other

periods as well. That is, "let the data speak" approach does not contradict exogeneity assumption of oil prices in this framework.

We also include *domestic oil production* in this identification scheme. This is due to the reason that domestic oil production shocks are generally positively correlated with oil price shocks (at least, for Azerbaijan). Therefore, we include oil production variable in order to disentangle the effect of an oil supply shock from that of an oil price shock. In addition, since oil sector covers significant part of domestic GDP, it enables us to capture business cycle effects to a certain extent.

The third variable, *trade partners' CPI* is included to capture *"import inflation channel"* (or *"cost channel"*). One can argue that trade partners' producer price index, tradable price index or import price index could be a good measure for import inflation. Unfortunately, data on these variables for sample countries is either unavailable or unreliable. Therefore, we opt to use available and mostly, reliable data to capture "*cost channel"*.

The fourth variable is *real fiscal expenditure* which is included to identify *"fiscal channel"* or *"demand channel"*. In these countries, fiscal expenditure channel is regarded as one of the most influential channels of transmitting oil shocks into the economy. In most part of our sample, these economies strictly controlled the external value of their national currency and pegged their exchange rate to US dollar. Despite existing Stabilization Fund where oil revenues are expected to accrue and is supposed to isolate the domestic economy from terms-of-trade shocks, fiscal authority rarely obey spending rules. Huseynov and Ahmadov (2014) show that in most cases fiscal authority follows a procyclical policy in these countries. Therefore, procyclical fiscal policy coupled with peg regime transmits terms-of-trade shocks and de-stabilizes the domestic economy. In other words, fiscal spending behavior is one of the main determinants of business cycles in these economies. Excess spending bias of the fiscal authority overheats the domestic economy and leads to higher inflation in such countries. Hence, by including fiscal spending variable we aim to identify *"fiscal channel"* or *"demand channel"*.

Using above identification strategy, we intend to identify the relative strength of different channels, namely, the *"cost channel"* and *"fiscal channel"*. Here, we assume that an oil price shock can affect domestic inflation indirectly through these two channels. One challenge here is that when we shock the system with an unanticipated oil price shock, these "channels" are responding endogenously to a hike in oil prices. That is, after a surge in oil prices domestic inflation increases not because higher oil prices directly create inflation pressures, but because *"cost channel"* and *"fiscal channel"* are also responding to the same shock and thus, leading to higher inflation. Here, our challenge is to somehow identify the relative strength of these channels in a SVAR framework.

For that, we follow an approach which is in the spirit of the methodology proposed by Sims and Zha (1995), which was later utilized by Bernanke et.al (1997) for the analysis of systematic monetary policy. The conditional forecasting methodology proposed by Waggoner and Zha (1998) for a system of equations also follows the same line of thinking.

The idea here is that first, we shock the system with a positive oil price shock and find the *"unconditional"* response of the domestic inflation. Then to identify the *"cost channel"* or *"fiscal channel"*, we shock the system with an oil price, but this time we find such shock combinations that will keep the response of the *"cost channel"* (i.e. trade partners' CPI) or *"fiscal channel"* variable at a level close to zero. We label this *"conditional"* response of domestic inflation to an oil price. Then the relative strength of a *"channel"* variable is obtained by deducting "*unconditional*" response of the domestic inflation from *"conditional"* response of it. Since the "*conditional"* response excludes the effects of the fiscal or cost channel on inflation, the value of such response is less than the "*unconditional"* one. Thus, the difference between two scenarios will be negative in value.

To implement *conditional* impulse-response analysis, we need to find the *conditional* distribution of the structural shock vector ε under the constraint that responses of *"channel"* variables are zero at each time period. We know that *unconditional* distribution of the structural shock ε vector is normal with density $\varphi(0; I_{kxk})$ that is with zero expected value and unit variance. To find the conditional distribution, we need to take into account the given constraint.

For conditional forecasting exercise, Waggoner and Zha (1998) show that the conditional distribution of the structural shock vector ε is as follows:

$$p(\varepsilon | a, R(a)'\varepsilon = r(a)) = \varphi(R(a)\left(R(a)R(a)'\right)^{-1} r(a);$$

$$I - R(a)(R(a)R(a)')^{-1} R(a)')$$

where $R(a)$ matrix is obtained from impulse-responses, $r(a)$ vector is the constraint imposed on the future paths of variables of interest. Note that, in their paper, Waggoner and Zha (1999) also show that marginal conditional distribution is also invariant to any orthonormal transformation obtained from variance-covariance matrix. That is, any orthonormal decomposition of the variance-covariance matrix other than Cholesky decomposition will also produce the same *conditional* impulse-responses.

We also construct confidence intervals for impulse-response functions using "bootstrap-after-bootstrap" technique due to Kilian (1998). Because our sample size is relatively small, as in Kilian (1998) we also correct for biases in the coefficient vector resulted from small sample size and also construct 68% confidence intervals for impulse-responses. Here, first, we run 1000 replications and

obtain bias term due to small sample size. Then we use it in another 2000 bootstrap replications to construct confidence intervals for the variables.

IV. Empirical results

4.1 The case of Azerbaijan

The figures below lay out the responses of domestic CPI, fiscal expenditures and trading partners' CPI to the changes in oil prices under two different scenarios. As mentioned above, we define two main channels through which oil price shocks are assumed to transmit into domestic inflation. Figure 4 depicts both the *unconditional* and *conditional* responses of fiscal expenditures to an oil price shock in order to assess the role of that channel. We can see in the upper left panel of the Figure 4 that in conformity with ex-ante expectations for the *unconditional* case, the fiscal expenditures increase significantly following a positive oil price shock. The upper right panel of the Figure 4 shows the *conditional* response of the fiscal expenditures to an oil price shock, which is effectively zero for all periods. Note that though confidence intervals seem to be different from zero, this is due to the scaling in the figure (10e-14). That is, they are also zero in that sense.

We also depict the graphs showing the response of CPI to oil price shocks at both unconditional (with a channel variable) and conditional scenarios (without a channel variable). The *unconditional* response of inflation to a positive oil price shock is statistically significant for about 5 quarters. We also observe the statistically significant response of inflation in the *conditional* case as well. The difference between two scenarios is significant indicating that the fiscal channel is important due to its contributions to domestic inflation.

Figure 5 is constructed in a similar manner to capture the role of the cost channel which is approximated by trading partners' CPI. From the upper left panel of the Figure 5, we can see that the trade partners' CPI significantly responds to an oil price shock and increase. Note that comparing *unconditional* responses for domestic and trade partners' CPI, we can see that the response of the domestic inflation to an oil price shock is much stronger. The upper right panel shows that the *conditional* response of this variable is effectively made zero for all periods.

The *unconditional* response of the inflation to an oil price shock is the same as in the previous figure, i.e., in the upper left panel of the Figure 4. However, the *conditional* response of the inflation to an oil price shock is different from the previous one. The difference between *unconditional* and *conditional* responses is again significant indicating that the cost channel also plays a crucial role in oil

price pass through in Azerbaijan (see Figure 5). In fact, the cost channel appears to be much stronger (2-3 times) than the fiscal channel most probably due to huge reliance on imported goods. Considering the fact that in the sample period the country retained a fixed exchange rate regime, then the exchange rate will accelerate the effects of oil price shocks through the cost channel.

Figure 4. Oil price shocks-fiscal channel (Azerbaijan)[8]

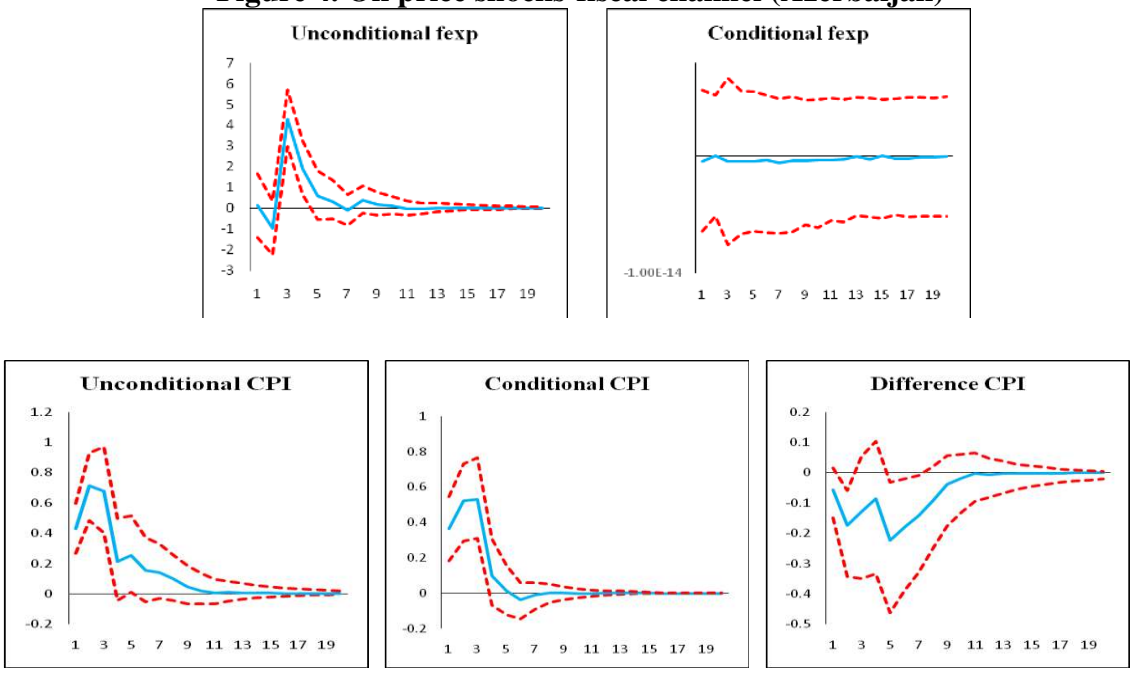
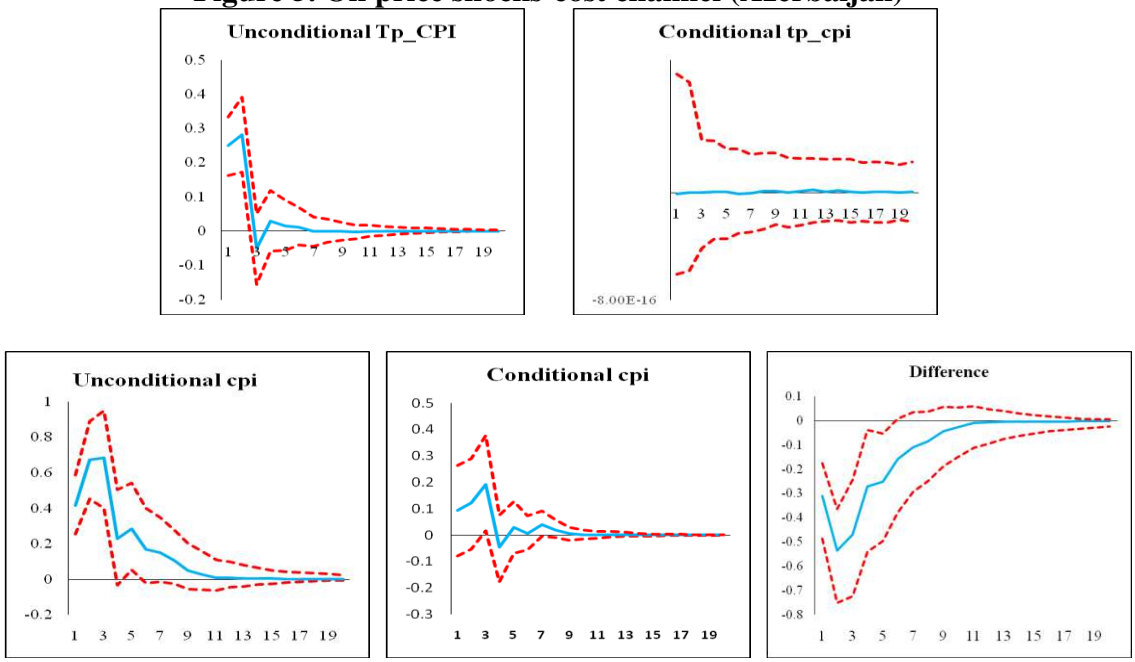


Figure 5. Oil price shocks-cost channel (Azerbaijan)



[8] 68% confidence interval bands with 16% lower and 84% upper confidence interval limits

4.2 The case of Kazakhstan

We proceed with the same procedures for Kazakhstan and Russia in order to examine the role of each channel for all sample countries. The effect of oil price shocks on the CPI of Kazakhstan and its trading partners' CPI is significant (Appendix A, Figures 6, 7); however, interestingly the fiscal expenditures do not respond significantly to oil price volatility (Figure 6). Time range for Kazakhstan is between 2000Q4 and 2014Q4. Being contrary to our economic intuition, the fiscal channel does not play any role for the inflation dynamics in Kazakhstan (Figure 6). The reason underlying it might be both the poor quality of the dataset or the efficient operation of Sovereign Wealth Fund which is a little bit ambiguous. Despite having a negligible effect on inflation, the cost channel seems to appear as a significant variable for inflation dynamics (Figure 7). In other words, the country imports particular share of inflation from its trade partners through imported goods and services during oil price volatility, while budget expenditures do not play any role in the pass through of oil price fluctuations. Therefore, lack of high productivity and competitiveness in non oil sector remain the main challenges for Kazakhstan economy.

4.3 The case of Russia

For Russian case, budget expenditures, domestic inflation and trading partners' CPI exhibit positive and significant responses to oil price changes (Appendix A, Figures 8, 9). The time period ranges between 2003Q4 and 2014Q4.

It is clear from the Figure 8 that the fiscal channel is the main transmitter of oil price shocks to domestic inflation. The existence of fiscal dominance in Russian economy is also in line with such finding. Despite the fact that Russia has a huge National Wealth Fund, there are still some implicit impediments to its efficient operation. As suggested by the IMF recent report, the fiscal rule could be improved by revising two operational aspects of it. The first revision is related to oil price benchmark, the other one is the amount of savings that is generated by the fiscal rule (IMF, 2015).

On the other hand, trading partners' CPI plays a certain role for oil price pass through since the difference between two scenarios is significant as well (Figure 9). However, the cost channel is significant only in the very short run after oil price shocks hit the economy and, thus contributes to inflation slightly less than the fiscal channel does. The remaining portion of inflationary pressures is coming from other sub channels including the fiscal channel itself. More precisely, the fiscal channel is stronger by almost 50% than the cost channel. Taking into account the fact that Russia is a large country which has less dependency on imports than Azerbaijan or Kazakhstan, the results are

promising. Drawing more insightful conclusions, we can note that transparency and efficient way of oil revenue management is critical for Russia.

V. Robustness checks

For robustness purposes, we use alternative variables to identify the effects of oil price shocks on domestic inflation. The results are provided in Appendix C for each sample country. First, we use nominal budget expenditures as a fiscal channel variable instead of real budget expenditures. The results do not differ to a great extent implying the structural validity of our empirical model.[9]

Secondly, we use nominal GDP instead of government expenditures to capture the demand channel effects in the economy. In all sample countries domestic inflation exhibits similar patterns to previous results from originally estimated models. Still there are some differences across countries. In Kazakhstan the demand channel (proxied by GDP) now exhibits significant behavior (Figure 18-19). To put it differently, although budget expenditures being a proxy of a demand channel is not capable of transmitting oil price shocks to the inflation, there are still some other implicit channels hidden in GDP through which domestic inflation is affected. The poor quality of dataset can also be the reason why fiscal channel is insignificant. Since GDP is a much more aggregated variable covering many sub channels in it, shocks to domestic inflation through GDP for the remaining countries are naturally stronger than it was with fiscal expenditures (see Figures 16, 17 for Azerbaijan, Figures 20, 21 for Russia).

VI. Conclusion

The paper empirically assesses the extent of oil price pass through and its main channels of transmission in Azerbaijan, Kazakhstan and Russia. The response of domestic CPI to oil price shocks in oil exporting countries are mainly driven by fiscal and cost channels that are proxied respectively by budget expenditures and trading partners' CPI. Even if oil price shocks do not fully pass into domestic CPI, the extent of pass through is relatively high in comparison with oil importing countries. In Azerbaijan and Russia, both channels are important for its contributions to overall domestic inflation. On the other hand, for Kazakhstan only the cost channel has a certain role for spreading the effects of oil price shocks into domestic inflation. In most cases, Oil Funds which are established with the aim to manage oil revenues efficiently follow procyclical policies that create additional inflationary

[9] See Figures 10-11 for Azerbaijan, Figures 12-13 for Kazakhstan and Figures 14-15 for Russia.

pressures in the economy. Higher import dependency in all three countries also accelerates the effects of oil price shocks on domestic inflation. All in all, domestic inflation is not independent of international commodity price movements.

Similar to the previous findings of the literature, our results once more emphasize the importance of the fiscal channel in amplifying or absorbing terms-of-trade shocks to the domestic economy. These economies' intention to move towards an IT regime and better control the domestic inflation cannot be successful without necessary fiscal discipline. Counter-cyclical fiscal policies and effectively binding fiscal rules will help the monetary authority in achieving lower inflation and stable economic growth targets. An appropriate fiscal framework can help to implement a more desirable fiscal policy that will enhance wealth and sustainability of the economy in all resource rich countries. Here, once again the proper management of Sovereign Wealth Funds, their transparency and accountability should not be under-estimated. Moreover, the role of the cost channel in transmitting oil price shocks is supposed to be weakened with the further diversification of the economy and enhancement of import substitution strategies. Thus, through effective reform policies all three countries can strengthen their economies in the longer term.

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Appendix A. Counterfactual analysis of inflation

Figure 2. Kazakhstan

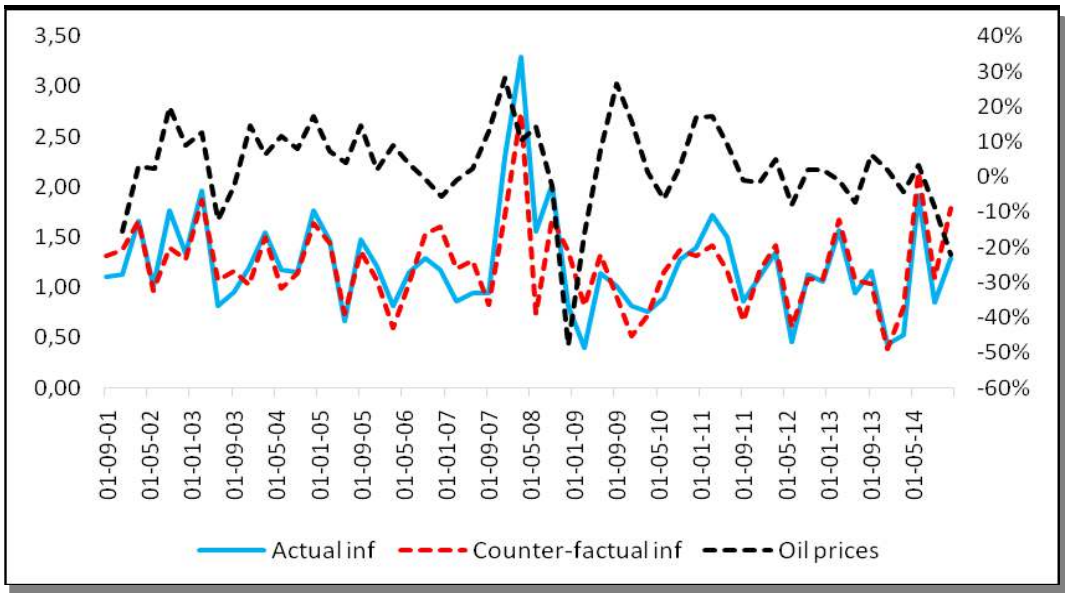
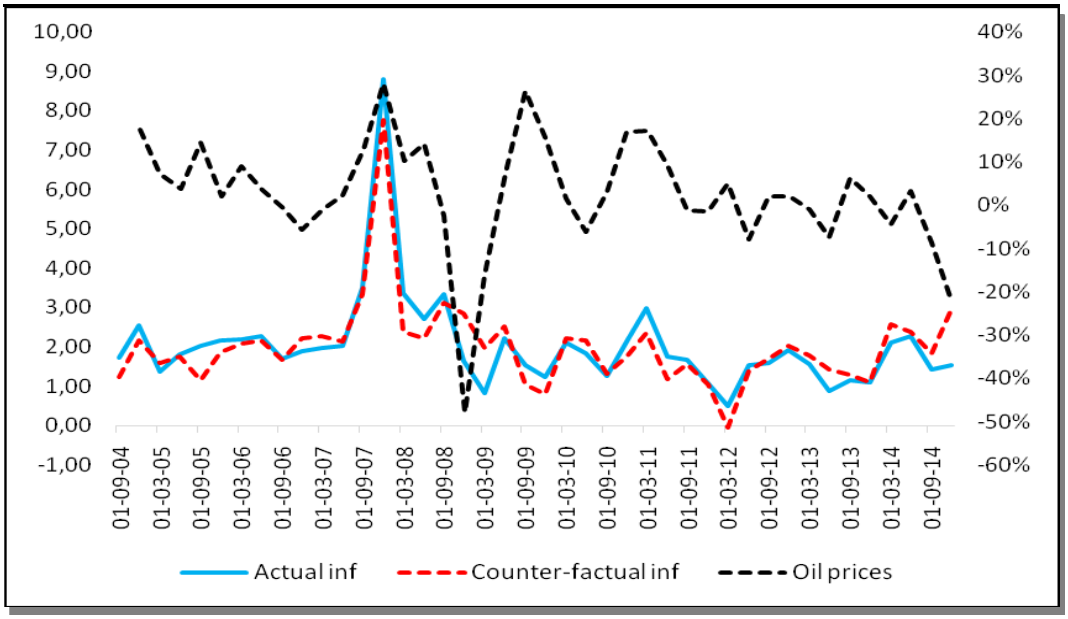


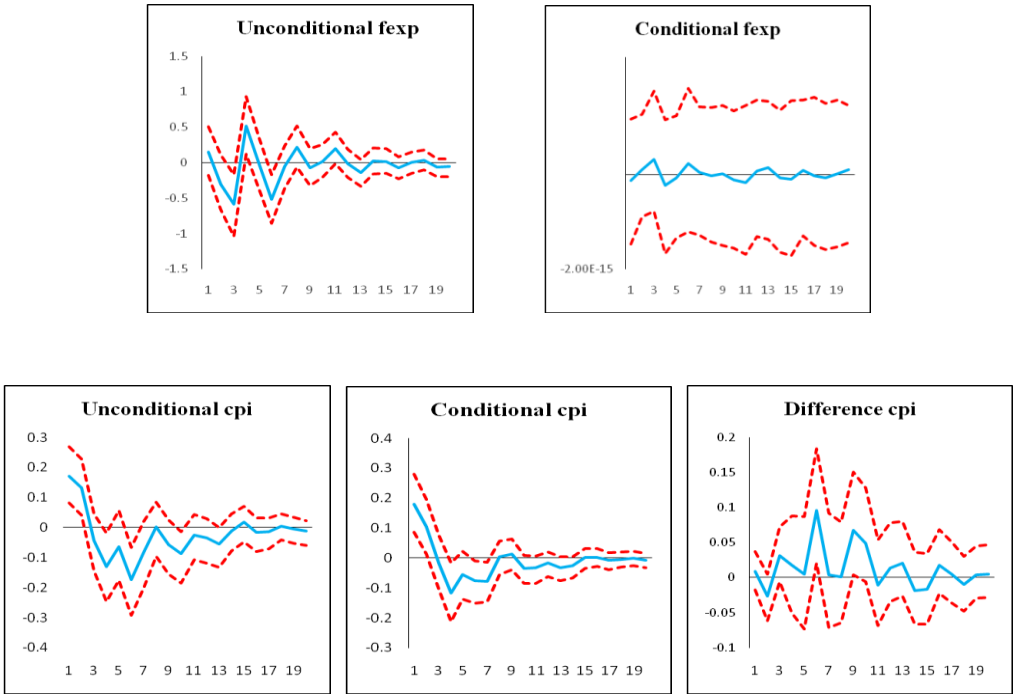
Figure 3. Russia



Appendix B. IRF results[10]

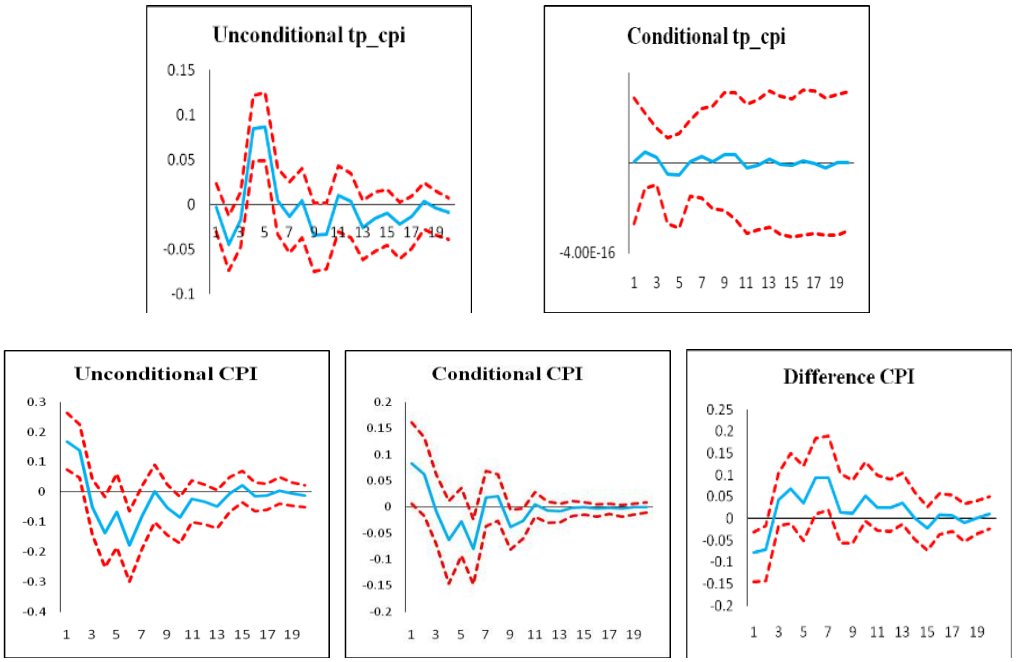
Kazakhstan

Figure 6. Oil price shocks- fiscal channel



[10] **Note**: Unconditional response of each variable to oil price shocks captures the whole effect; conditional response mutes the response of fiscal expenditures or trading partners' cpi. Difference is obtained by deducting unconditional response from conditional one. For each country we estimate the response function of a channel variable (budget expenditures-(fexp) or trading partners' cpi (tp_cpi)) to oil price shocks and then mute it out under conditional scenario. Here, the confidence intervals are technically zero. To assess the role of that particular channel we obtain impulse responses of domestic cpi to oil price shocks under conditional and unconditional scenarios. The difference cpi depicts whether the given channel has a significant effect on domestic inflation dynamics. The confidence bands around the impulse response estimates are constructed using 68% confidence interval band with 16% lower and 84% upper confidence interval limits.

Figure 7. Oil price shocks-cost channel



Russia

Figure 8. Oil price shocks-fiscal channel

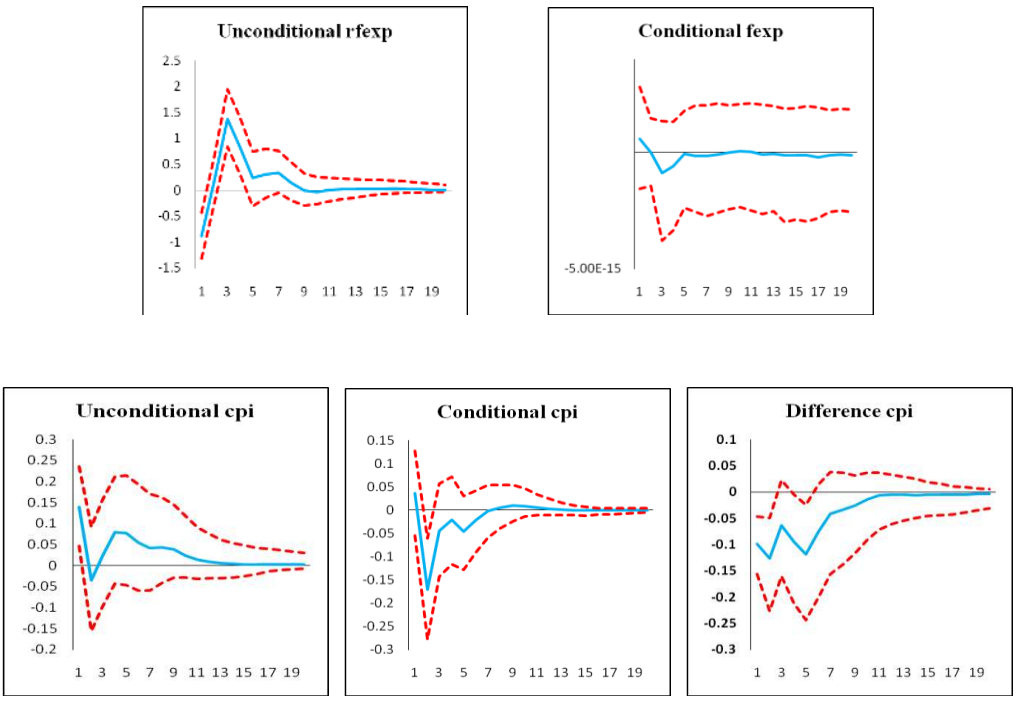
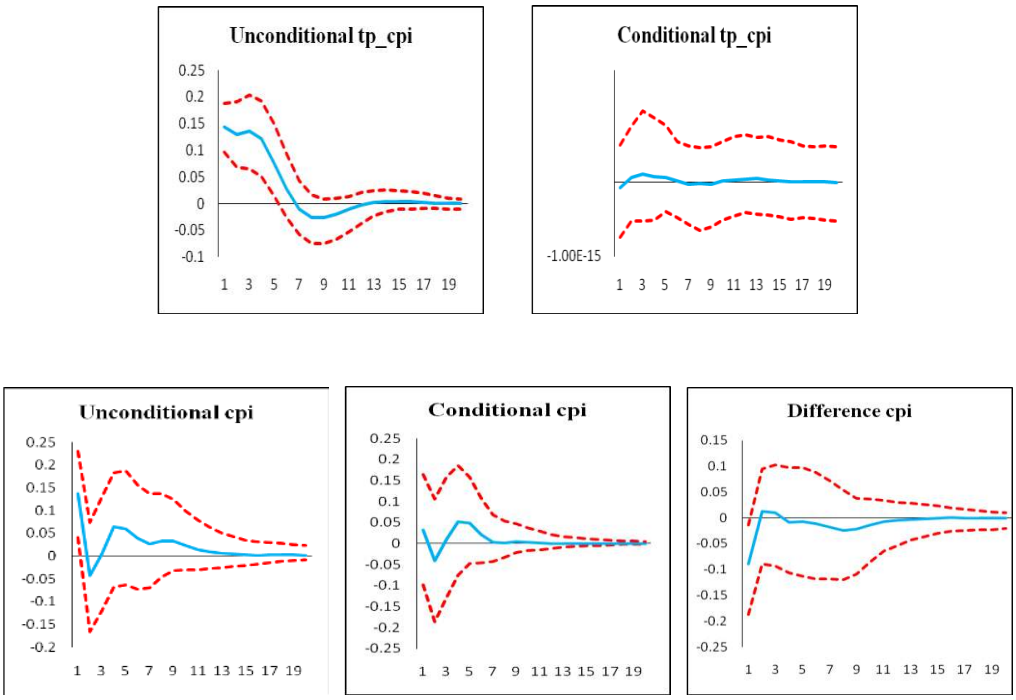


Figure 9. Oil price shocks-cost channel



Appendix C. Robustness tests (nominal budget expenditures)

Azerbaijan

Figure 10. Oil price shocks- fiscal channel

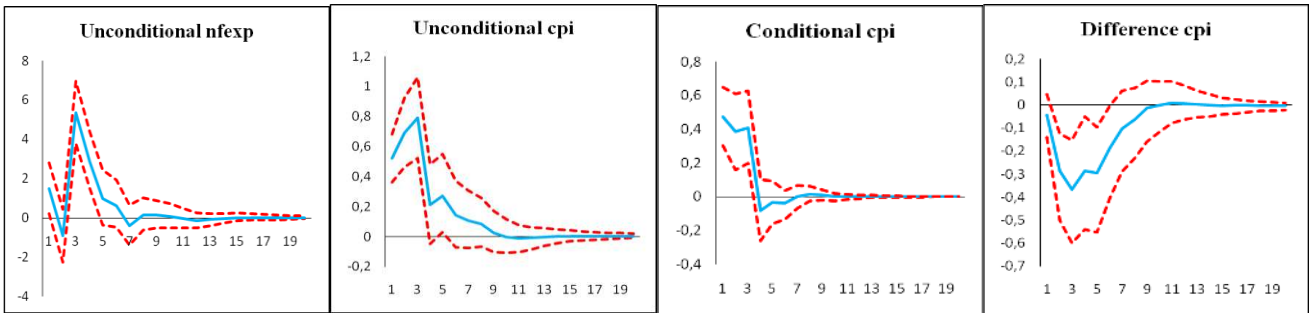
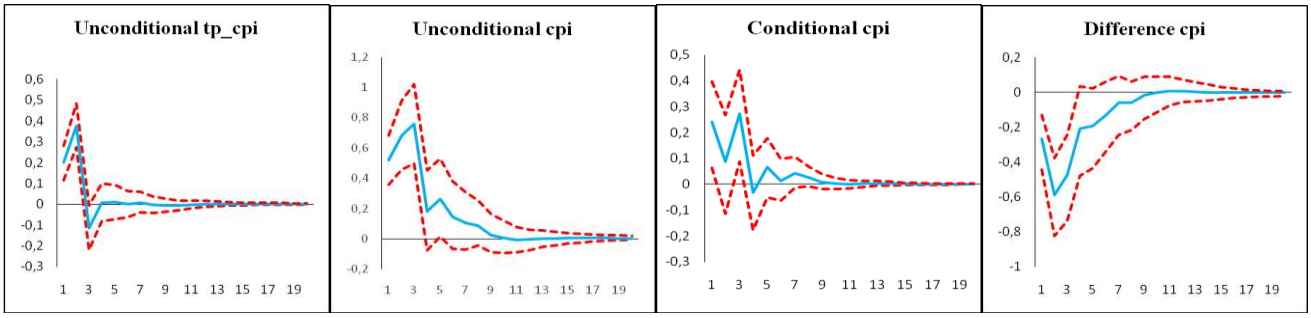


Figure 11. Oil price shocks-cost channel



Kazakhstan

Figure 12. Oil price shocks-fiscal channel

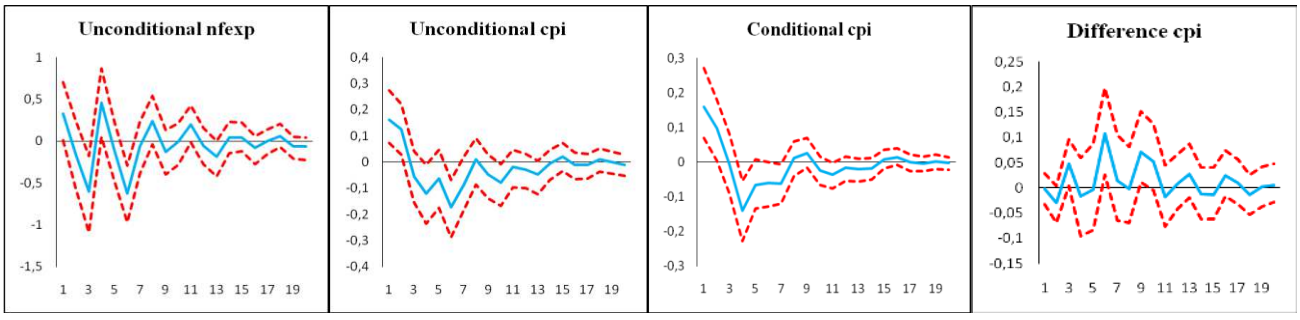
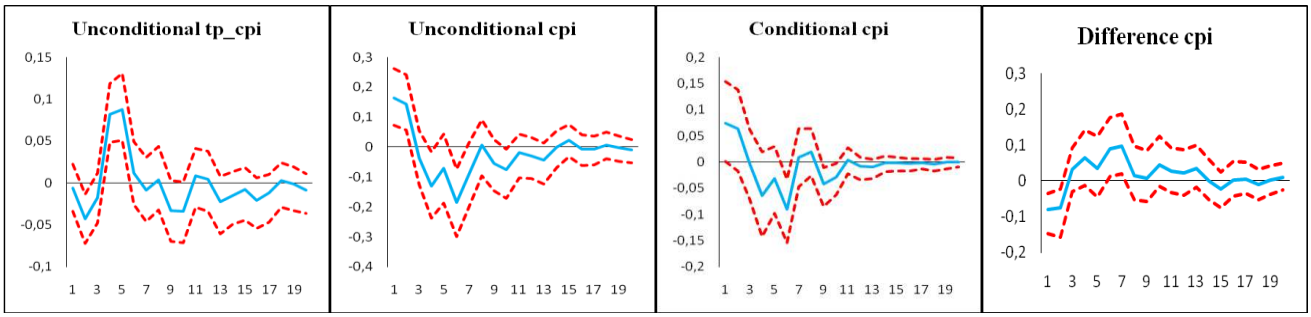


Figure 13. Oil price shocks-cost channel



Russia

Figure 14. Oil price shocks- fiscal channel

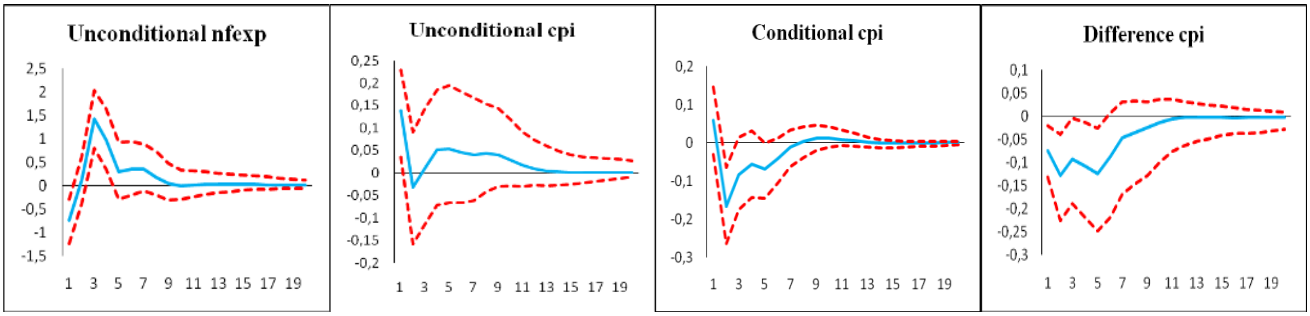
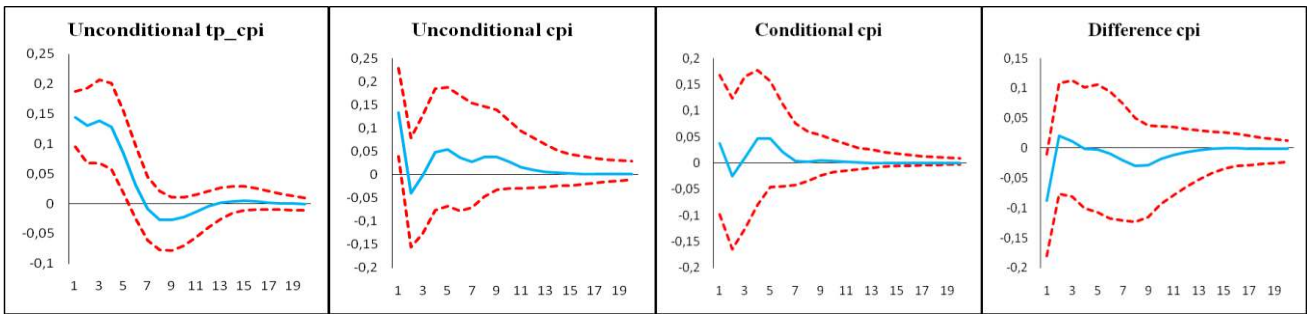


Figure 15. Oil price shocks-cost channel



Robustness tests (with nominal GDP)

Azerbaijan

Figure 16. Oil price shocks- fiscal channel

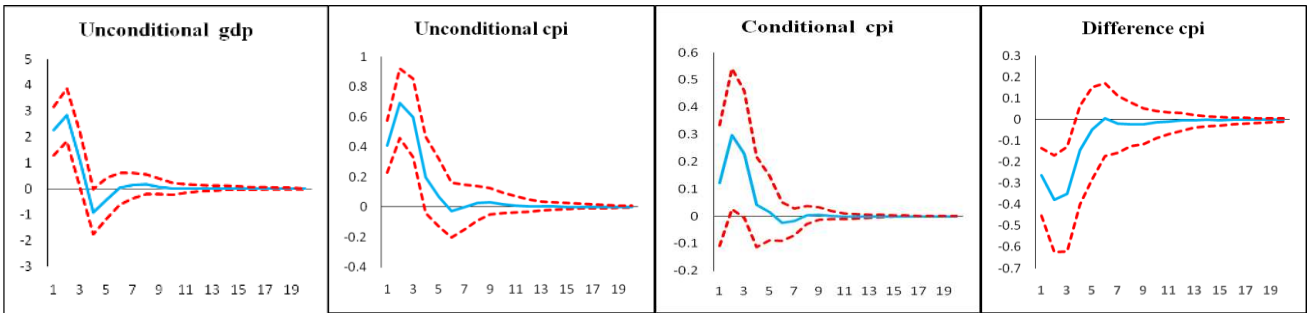
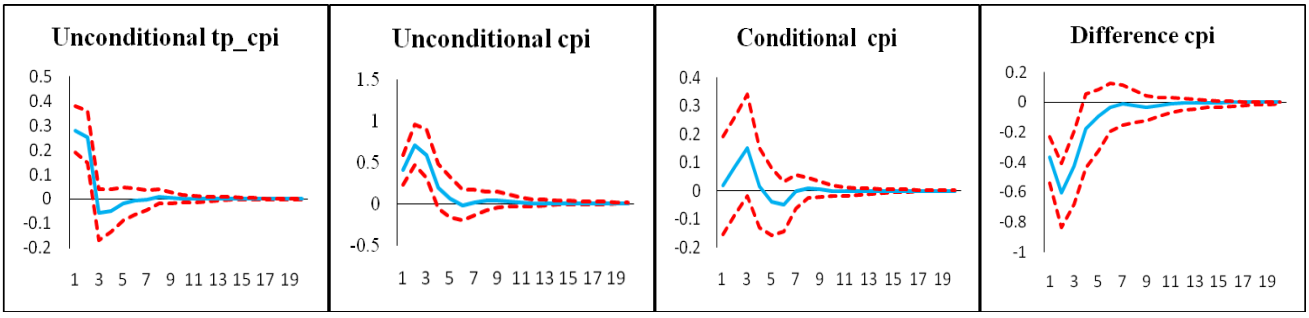


Figure 17. Impulse response for Trading partners' CPI



Kazakhstan

Figure 18. Oil price shocks-fiscal channel

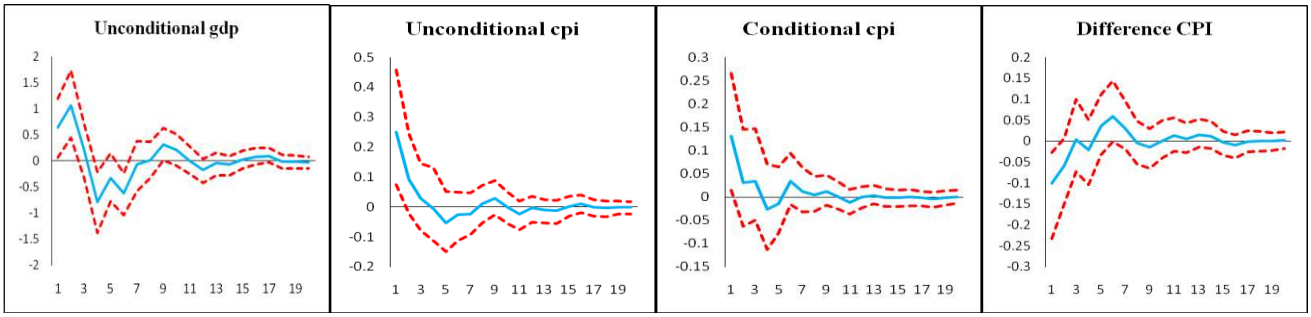
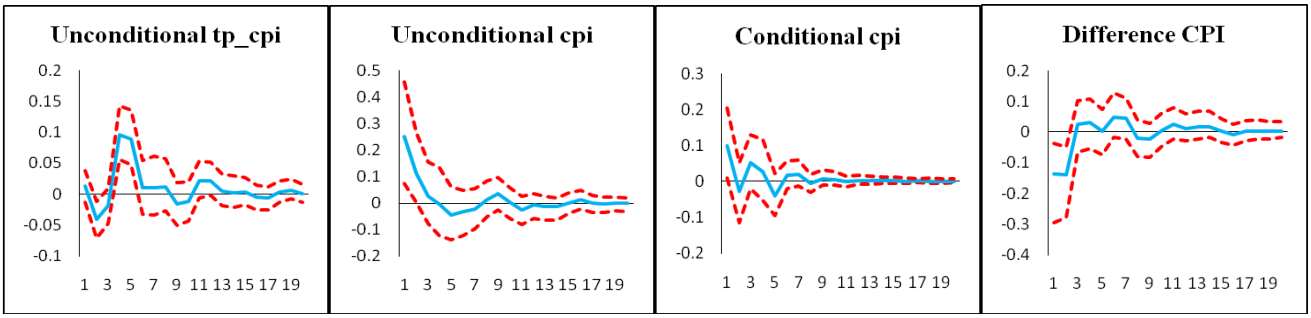


Figure 19. Oil price shocks-cost channel



Russia

Figure 20. Oil price shocks-fiscal channel

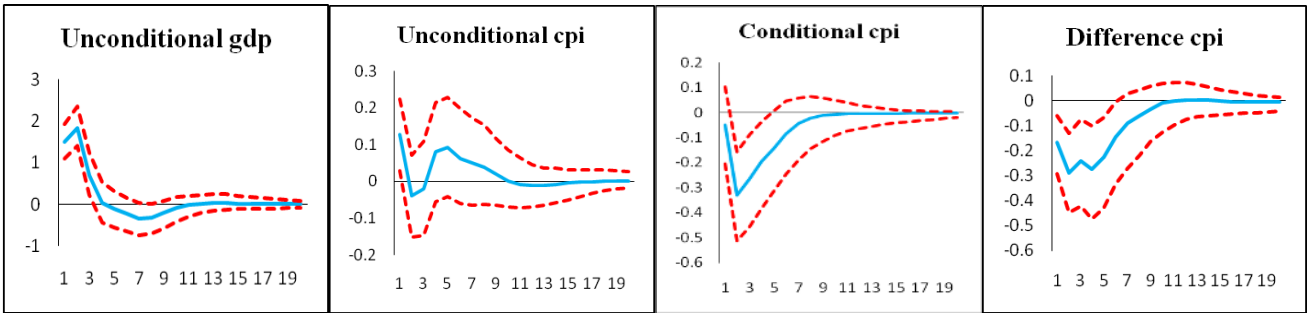


Figure 21. Oil price shocks-cost channel