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EARLY WARNING INDICATORS OF THE CRISIS. FINANCIAL VULNERABILITIES IN CAUCUS AND CENTRAL ASIA

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TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
CCA	Caucus and Central Asia
ECB	European Central Bank
GFDI	Global Financial Development Indicators
IFS	International Financial Statistics
IMF	International Monetary Fund
WB	World Bank
WGI	World Governance Indicators

1. INTRODUCTION

The recent drop in commodity prices, particularly for oil, has again drawn attention to its economic effects. In the period from the mid-2014 to 2016 crude oil prices have declined by 72%, from about $100 per barrel to around $35 per barrel. According to the 2014 IMF estimates oil price shock should have boosted global economic activity by around 0.5% of the global GDP in the period of 2015 – 2016, even accounting for the incomplete pass-through in developing countries. Nevertheless, recent revision of the estimates has shown that the positive effects are substantially lower. It is claimed that positive effects of the lower oil prices have been partially offset by other shocks, and amplified by the expectations that big share of the lower oil price gains would be saved in the oil importing countries. Further, adverse oil price shock revived discussion over its impact on financial sector fragility. It is claimed that oil price drop can contribute to financial strains through different channels. In oil exporting countries falling oil revenues make it difficult for various economic agents to meet their debt obligations, which automatically weakens banks' balance sheet. In addition, it undermines country's fiscal performance, which is often pushing governments to accommodate their budgets. Falling prices can trigger the withdrawal of banks' deposits, which can potentially lead to liquidity mismatches. Also, depending on the magnitude and speed of the shock, countries may experience pressure on international reserves which can result in currency mismatches. Finally, countries and companies highly exposed to the oil sector may fall into the self-reinforcing cycle of rising credit risks, which further deteriorates refinancing conditions (Kinda, Mlachila, and Ouedraogo 2016; Husain et al 2015).

The channels presented encompass only few possible scenarios of how the drop in oil prices can deteriorate financial sector conditions. Indeed, literature lacks a systemic analysis of the lower oil prices effects on the financial sector conditions due to the difficulty of quantifying financial fragility; and for developing countries analysis is hindered by lack of available data. These findings have motivated to examine Caucus and Central Asia. First, region is relatively understudied due to the scarce data. Second, countries in the region are highly dependent on the oil revenues and pursuing a commodity-based growth, while the growth of its oil-importing countries is closely tight to economic conditions in oil producers. For both groups of countries recent oil price shock has resulted in the major economic downturn and triggered financial sector vulnerabilities. Their case is highly aligned with the ascribed above IMF projections and illustrates how positive implications of the lower oil price environment were outweighed by additional shocks. While for oil exporters the main transmission channel were declining oil revenues, for oil importers positive effects of the falling oil prices have been offset by the lower remittance flows. Both of these channels

have created inflationary and exchange rate pressure, bringing to the fore financial risks. Overall, the average GDP of the region felt to its two decade lowest point of 1.2% in 2016, and banking system distress was characterised by increasing NPLs, lower profitability, and currency mismatches. Strong economic contraction and finical system distress in the whole region have motivated an assumption, that oil price shock explains only a part of the economic downturn. In fact, it brought to the surface more in-depth financial and structural bottlenecks of the economic system, which had accumulated substantial risks before the crisis. These findings deepened the analysis and motivated an idea to construct an indicator that allows revealing the building up of the imbalances in the economy and identifying the "symptoms" of the crisis. Therefore, *the main objective of this study is to examine the evolution of vulnerabilities in CCA economies and to identify sector of the economy that drives country's vulnerabilities.*

Conventionally assessment of the early "symptoms" of the crisis was conducted within the concept of the early warning indicators of the crisis. However, this work departs from the usual approaches, which aimed at regressing different variables on crisis incidence. Instead, it follows a new methodology that allows decomposing country's instability components and then identifying sector of the economy that potentially drives the main vulnerabilities. In addition, this research will depart from the definition of the most-widely studied crisis incidence, mainly currency, banking or balance of payment, and will examine country's vulnerabilities through the lens of the negative oil price shock. Countries included to the analysis are Armenia, Georgia, Kyrgyz Republic, Tajikistan (further will be referred as a group of oil importers); Russian Federation, Azerbaijan, and Kazakhstan (further will be referred as a group of oil exporters). It should be emphasized that initially Turkmenistan and Uzbekistan were included, however, due to the very scarce data they were excluded from the research. Further, the ex-post analysis will be conducted for the period of 1996 – 2014, while the recent oil price drop and its effect on the region economic performance will be limited to the period of 2014 - 2016.

This work is organised as follows. Section 2 provides the overview of the recent oil price shock and its effect on the CCA economies. It reveals transmission channels of the oil price shock for both oil exporters and oil importers in the region. Analysis of the shock propagation channels allows identifying the main groups of vulnerabilities. In Section 3 the methodology is presented. It includes short literature review of the studies on the early warning indicators and an extensive review of the paper's methodology. In addition, this Section contains the overview of the methodological limitations and detailed description of

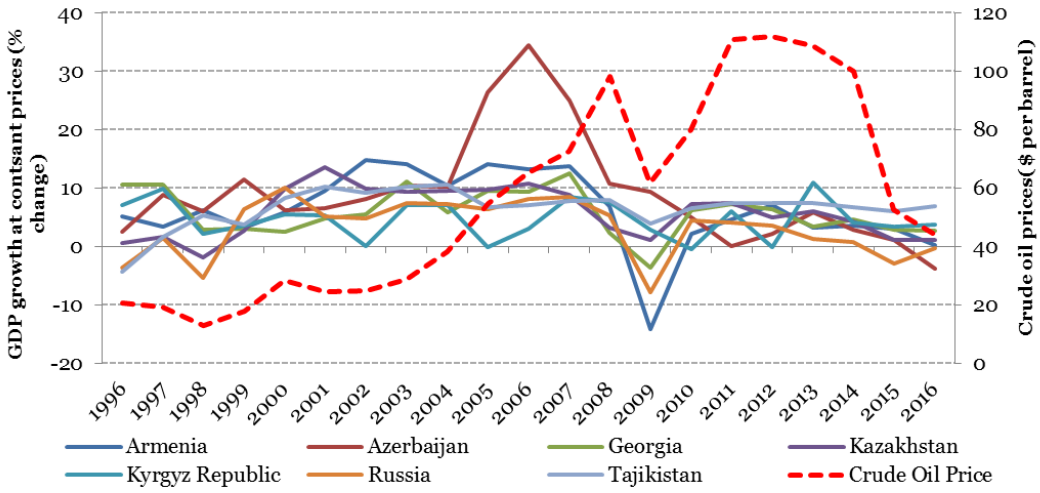
the included indicators. Section 4 presents the results for the final vulnerability index and examines its development over time. Further, it includes the results for the Granger-causality test that allow satisfying the main objective of this research. Section 5 concludes.

2. VULNERABILITIES IN CAUCUS AND CENTRAL ASIA.

2.1 TRANSITION CHANNELS OF FALLING OIL PRICES AND THE ROLE OF RUSSIA IN THE REGION

Since the late 2014 Caucus and Central Asia (further – CCA) have experienced substantial economic slowdown. Economic downturn in this region largely owns to the decline in the global commodity prices and, particularly, to the significant drop in oil prices. Overall, in the period between June 2014 and January 2016 crude oil prices have declined by 72%. Sharp decrease in oil prices had severe impact on the countries in the region, which is illustrated by declining GDP growth rates, starting from the late 2014 (Figure 1). As a result of the falling oil prices, average GDP growth in CCA region bottomed at the two decade lowest level of 1.2% in 2016.

Figure 1: GDP growth rates of CCA countries and crude oil prices



Source: World Economic Outlook (2017), Bloomberg (2017)

In fact, positive correlation between oil price developments and GDP growth could be detected throughout the observation period. For Azerbaijan, Kazakhstan and Russia it is explained by the high share of oil revenues in GDP of 27.3%, 30% and 12.8% respectively[1]. Still, heavy reliance on commodity exports explains only the part of the sharp decline in the

[1] Oil revenue minus production cost, percent of GDP in 2014; Source: World Bank (2017)

growth rates for the examined economies. In particular, falling oil prices should have had resulted in profitability gains for Armenia, Georgia, Kyrgyz Republic and Tajikistan, which are oil importing countries. As lower energy-inputs costs should have stimulated investments and, hence, total supply in net oil-importing countries (ECB 2015, pp. 26-27). However, positive implications of the lower oil prices have been offset by negative spillovers from the main trading partners, with Russia being the main contributor to the economic deterioration in CCA. Against the background of the falling oil prices, in 2014 Russia was hit by sanctions, which created substantial pressure on its balance of payments, with consequent worsening of the external financing conditions. Large increase in risk premiums and capital outflows resulted in more than 65 % depreciation in the national currency against the U.S. dollar between June and December 2014. By 2015 Russian economy contracted by 2.8%, its annual inflation rate doubled to 15% comparing to 7% in 2014. Government has provided very limited fiscal stimulus, ensured bank capital support program at around 2 percent of GDP, and has reallocated spending to the priority sectors, such as manufacturing and social payments. However, these efforts were not sufficient to prevent negative effects on real incomes and investment prospects, which have put domestic demand under pressure (Stepanyan 2015, pp. 5-8). CCA region, being closely tight with Russian economy, has experienced negative spillovers predominantly through the channels presented in Table 1.

Table 1: Caucus and Central Asia links with Russia

For Gas/Energy	Between 20-50	Between 10 - 20	Between 5-10	Less than 1	NA
For other indicators	Greater than 5	Between 2 - 5	Between 1-2	Less than 1	NA

	Gas/Energy	Imports from Russia	Exports to Russia	Remittances from Russia	FDI from Russia	Assets of Russian Banks
Armenia						
Azerbaijan						
Georgia						
Kazakhstan						
Kyrgyz Republic						
Tajikistan						

Gas/energy imports from Russia are scaled by country's energy consumption; other variables are scaled by GDP

Source: Regional Economic Outlook 2015, pp. 99

The major shock channel from Russia to CCA, and particularly to the group of oil importers, is remittances. CCA economies are among the most dependent on remittances countries globally. In Tajikistan remittances account for more than 45% of GDP, in Kyrgyz Republic

the number tops at 30% of GDP, while in Armenia remittances constitute 20% of GDP. For the outlined countries remittances from Russia account for the line share of the pie in the total share of remittances inflows and as percent of GDP. Most of the CCA migrant workers in Russia are employed in the non-tradable sector, characterised by high correlation with oil prices and flexible labour market conditions. Being highly dependent on the volatile labour market conditions in Russia, CCA countries are exposed to negative spillovers (Stepanyan 2015, pp. 11-12).

Trade channel plays less pronounced, but still important role for a number of CCA economies. For Azerbaijan and Kazakhstan Russia has become an important niche market. For instance, in Armenia export to Russia accounts for around 5% of GDP and constitutes close to 23% of the total exports (Ayvazyan and Daban Sanchez 2015). It is also highly dependent on the gas imports from Russia, which accounts for almost 80% of the total energy imports. Tajikistan and Kyrgyz Republic also have a high dependence on imports from Russia, and particularly on gas and oil imports. Nevertheless, drop in remittances outweighed the benefits of lower oil prices. On the average for oil importers in CCA region external savings from lower oil prices topped at around 3 percent to GDP, while the loss from the falling remittances resulted in the GDP contraction by about 8% (Regional Economic Outlook 2016).

With an exception of Azerbaijan, FDI from Russia account for a large share of GDP thus could be highlighted as another channel of shock transmission for CCA. Subsequently, slowdown in Russian economy deteriorates investment prospects in these countries with further negative implications for growth. Spillovers through banking system seemed to have rather limited direct effect on the CCA economies. Direct cross-border lending from Russia is rather negligible, however Russian banks have more that 10% of total banking system assets in Armenia, and around 5% in Georgia and Kazakhstan. Therefore, it doesn't exclude possible second-round negative effect for a number of CCA economies.

2.2 FIRST-ROUND EFFECT OF THE FALLING OIL PRICES OR STRUCTURAL VULNERABILITIES IN THE CCA REGION

Falling oil revenues, being the propagation channel of shocks for the group of oil exporters, resulted in the widening current account deficit. According to the Regional Economic Outlook (2016) on the average for this group, the deficit has reached 3.5% of GDP in 2016, comparing to the surplus of around 3.3% in the beginning of 2014. In case of Kazakhstan,

fiscal policies were loosened to mitigate the immediate effects of the negative spillovers, and allow for automatic stabilisers to work. In contrast, Azerbaijan already experiencing capacity constraints and large investments prior to the shock cut a spending plan. Overall, its fiscal deficit as percent of GDP ballooned to 9.9% in 2016, comparing to the 3.2% surplus in 2014. In Kazakhstan the overall fiscal deficit stood at 5.7% of GDP in the year 2016, in contrast to 1.7% surplus in 2014. Further, as a result of low oil prices, depreciation of the Russian rubble and expectations of the rising US Federal reserve policy rate[2], the CCA currencies went under pressure. In the early 2015 Azerbaijan currency was devalued by 20% in nominal terms against the US dollar and experienced another round of devaluation by 32% in the end of the year. These developments forced large deaccumulation of reserves, and total reserves in months of imports declined by 40% in 2015, comparing to 2013. Kazakhstan followed the same path and devalued its currency by 19% in 2014; with further adoption of floating exchange rate in 2015 the Kazakh tenge depreciated by another 45% against the US dollar (World Bank 2017; Horton et al., 2016, pp. 1-2).

On the average, current account deficit among oil importers accounted for 8.5% of GDP in 2016, with Georgia and Kyrgyz Republic reaching the deficit of 12.1% and 15.0%, respectively. For this group fiscal adjustment to external shock was limited by low countercyclical buffers. Stimulus packages provided by IMF to Armenia and Kyrgyz Republic in the late 2014 allowed supporting growth in these countries. Already persistent in Armenia fiscal deficit further increased to 4.5% of GDP in 2016, while in Kyrgyz Republic it reached 8.8%. In Georgia and Tajikistan fiscal adjustment resulted in the deficit of 4.7% and 4.0% of GDP in 2016, respectively. Similarly to oil importers, hence to the lesser extent, oil exporters have let their currencies to depreciate. In the period of January 2014 - March 2016 Tajik currency depreciated by 40% against the US dollar, for Kyrgyz Republic and Georgia it accounted for around 30% and 25%, respectively. In Armenia currency depreciation accounted for less than 15% in the same period. Currency adjustments for oil importers were at the costs of large deaccumulation of international reserves, that on the average decreased by 20%[3] during 2013-2015 (Regional Economic Outlook 2016).

[2] CCA currencies are linked to the US dollar

[3] Total reserves in months of imports

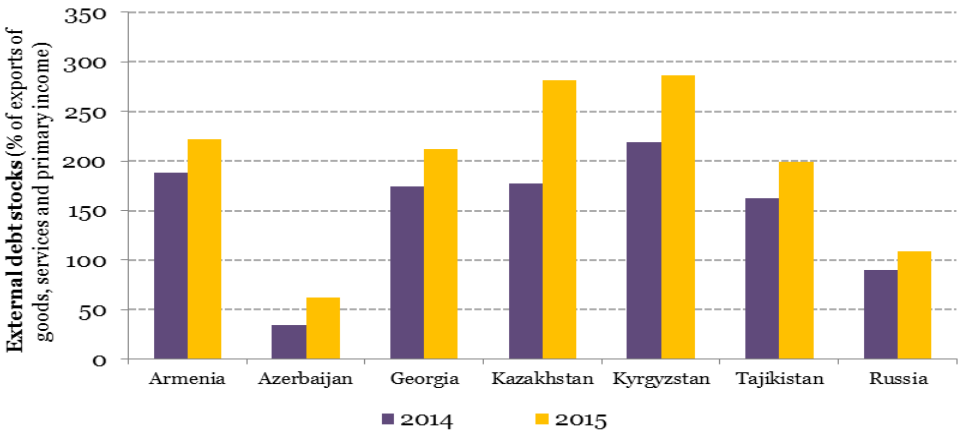
2.3 SECOND-ROUND EFFECT OR FINANCIAL VULNERABILITIES AMONG THE CCA ECONOMIES

While currency depreciation was an important step for shock mitigation, it became a domestic shock for the economy. Among oil exporters currency devaluation created substantial inflationary pressure, with Azerbaijan reaching 10.1% in 2016 and 13.1% for Kazakhstan. Inflationary pressure was not a case among oil importers with the average annual inflation rate of 2.4% in 2016. However, currency depreciation has triggered already existing financial vulnerabilities in the whole CCA region. Creditworthiness of the borrowers started declining sharply in 2015 and has consequently increased credit risks. Capital outflows and lower currency earnings dried up banks' liquidity, with latter being augmented by the rising deposit dollarization. For example, in Azerbaijan percent change in dollarized deposits accounted for around 50% over the period of 2013-2015, for Kazakhstan this number scored at 30%. Further, share of the non-performing loans as percent of total loans started increasing sharply in a number of CCA economies. In Tajikistan share of NPLs increased to 30% in the end of 2015, compared to around 15% in 2013. On the average for Armenia, Kyrgyzstan and Azerbaijan an increase accounted for around 2%, however, in all these cases the share of NPLs was below 10%. In Kazakhstan share of non-performing loans bottomed at around 8% in 2015, in contrast to 30% in 2013. In fact, reduction in the share of NPLs is explained by the de-licensing of the banks that held high share of non-performing loans. In Georgia increase in a share of NPLs was rather negligible. In addition, among oil exporters bank profitability was reported to decline, which has resulted in a number of closures and mergers to keep the banking system resilience (Regional Economic Outlook 2015; 2016; World Bank 2017).

As was mentioned above, most of the countries pursued fiscal easing to support domestic demand. However, scarce fiscal buffers have limited the policy space and hence narrowed the effects on the aggregate demand. The second-round effect of the widening fiscal deficit and currency depreciation was soaring public debt. In Azerbaijan over the period of 2014-2016 public debt grew by 25% and has reached 40% of GDP. In Kazakhstan public debt increased by around 7% during the same period, but still was below 20% of GDP. Tajikistan and Kyrgyz Republic experienced a sharp increase in public debt, both at around 20% over the period in question, and topped at 50% and 72% of GDP, respectively. The growth of public debt in Armenia and Georgia was modest, at around 5% in the period of 2014-2016, and remained below 50% of GDP in both cases (World Bank 2017a). Even though the share of public debt in most of the cases could be described as rather sustainable, subdued growth

in all the cases allow to conclude that economies would find it challenging to keep debt at current level or below. Further, external debt started increasing, as could be observed in the Figure 2. If comparing debt stocks in 2015 to the pre-crisis 2013 year, for oil importers the average increase accounted for 39%, while for exporters – close to 70%.

Figure 2: External debt stocks for CCA economies



Source: World Bank (2017)

Under these conditions the prospects of the economic recovery for both groups of countries remain rather vague. Further fiscal consolidation is amplified by persistent low oil prices[4] and subdued economic growth in Russia. The vulnerabilities revealed after the recent oil price drop left countries exposed to the future adverse shocks (Regional Economic Outlook 2016 p. 59).

To summarize, qualitative analysis of the recent oil price shock in Caucasus and Central Asia has allowed outlining a crisis scenario and revealing three main groups of vulnerabilities. It has become apparent:

- ➔ Drop in oil prices, falling demand in its main trading partners, and exposure to the currency moves leave countries vulnerable to the global shocks. This set of vulnerabilities is labelled *external* vulnerabilities
- ➔ Oil exporting countries pursue unsustainable in the mid- and long-term commodity-based growth, while economic growth among oil importers is undermined by volatile conditions in oil producing countries, and Russia, in particular. *Structural vulnerabilities* encompass these risks.

[4] under 60% per barrel, which is already considered to be a shock for the oil exporters.

➔ Financial system among CCA economies is not resilient to shocks and combined with the absence of macroprudential policies point on the *financial vulnerabilities* in the economy.

3. METHODOLOGY: COMPOSITE INDEX OF VULNERABILITY FOR CAUCUS AND CENTRAL ASIA. GRANGER CAUSALITY TEST FOR SELECTED POLES

In the previous section assessment of the CCA region after the recent oil price shock was conducted. This was a starting point of the analysis, which allowed to reveal the most vulnerable sectors of the economies and to outline the crisis scenario. Such an assessment was a crucial step in the methodology of this research, which is presented in this section. However, this study departs from the conventional approaches in identifying early warning indicators of the crisis. Therefore, to justify the methodological choice, in the following subsection the overview of the relevant literature will be presented.

3.1 EARLY WARNING INDICATORS OF THE CRISIS. LITERATURE REVIEW

The Asian crisis in 90's catalysed the studies on early warning systems, which were predominately focused on the currency crisis in emerging economies. After 2008 financial crisis, research on early warning indicators has gained more attention again. With the new wave of studies both developing and advanced economies were examined and crisis definition was extended to different types, such as debt or banking crisis. Despite the broad variety of relevant literature, Frankel and Saravelos (2012, p.5) suggest model specification that allows grouping the early studies into four broad categories:

1. Signal or non-parametric approach to predict financial crisis, originally presented in the Kaminsky, Lizondo and Reinhart (1998). Thresholds values are determined for each predefined indicator of the crisis and statistical tests are focused on identifying their out of sample performance (Berg, Borensztein and Pattillo 2004; Bussiere and Mulder 2000).
2. Models aimed at estimating statistical significance of selected indicators to predict the financial crisis within the cross-section of countries. Linear regressions or limited dependent variable probit/logic models are the most widely used techniques within this approach (Frankel and Rose 1996; Sachs, Tornell and Velasco 1996).

3. Panel studies focusing on predicting the occurrence of the crisis, with large sample of examined countries being split into crisis and non-crisis control groups. These approaches were already tested prior to the crisis (Kamin 1988; Edwards and Santaella 1993).
4. Innovative econometric techniques encompassing artificial neural networks and genetic algorithms aimed at selecting the most relevant indicators to predict the crisis; binary recursive trees to identify and predict the crisis incidence (Frankel and Wei 2004; Apoteker and Barthelemy 2001).

The examination of the above outlined papers allows identifying the most significant indicators in predicting the *currency crisis*. In particular, *foreign exchange reserves, GDP, current account and the real exchange rate.*

As was mentioned above, 2008 financial crisis triggered the new wave of studies on the early warning indicators. However, unlike their predecessors, results of the more recent papers are rather mixed and couldn't be generalised, which is largely explained by the different nature of the crisis examined. Among them, works conducted by Rose and Spiegel (2010; 2012), Lane and Milesi-Ferretti (2011), and Obstfeld, Shambaugh and Taylor (2009) could be distinguished. Rose and Spiegel (2012) by focusing on the 2008 financial crisis failed to link outlined above early warning indicators to the recent crisis incidence. On the opposite, Lane and Milesi-Ferretti (2011) proved pre-crisis level of development, current account deficit, trade openness, and the ratio of private credit to GDP to largely explain the 2008 crisis. Obstfeld, Shambaugh and Taylor (2009) by defining the crisis as percentage depreciation of local currency against US dollar didn't find current account balance and short-term debt-levels to be robust predictors of the crisis. They concluded level of international reserves (as a proportion of M2) to be the only significant early warning indicator in case of the recent financial turmoil. Reinhart and Rogoff (2011) justified excessive private indebtedness to be the leading indicator in predicting banking crisis. In the paper aimed at constructing quasi real time early warning indicators for costly boom/bust cycles Alessi and Detken (2011) found growth in global credit to perform well in this regard. Yeyati and Panizza (2011) established large decrease in the GDP growth as the signalling indicator of the sovereign debt crisis.

The nature of the 2008 crisis has also shifted the focus to the early warning indicators based on market prices, such as CDS spreads, implied volatility and other price-based measures of distress. Analysis of the market based indicators has shown that they are the most appropriate for concurrent market conditions. In addition, their applicability as early

warning indicators could be doubted considering the short time they provide for meaningful remedial action (Shin 2013, pp. 4-7). Further, their relevance is limited to the advanced economies, with highly developed financial markets.

The ratio of credit to GDP, as one of the most commonly cited early warning indicators of the crisis, deserves particular attention. It was recognised as an early warning indicator with the strong predicting power by an official sector, including IMF and BIS. Regarding the later one, ratio of credit to GDP gained the central role within early warning system under its Basel III framework. The emphasis on this indicator is explained by the procyclical nature of the financial vulnerabilities (Drehmann and Juselius 2014). Still, the criticism of this indicator is attributed to the difficulty of estimating the benchmark trend that allows justifying the threshold, when the credit is actually being excessive. Further, the growth rates of credit and GDP are not much aligned over the cycle, thus the results issued by the indicators could be misleading (Shin 2013, pp. 7-8).

The overview of the studies presented allows drawing important methodological conclusions. It has become apparent that resulting early warning indicators rely heavily on what is being defined as the crisis and its nature. It also implies that the experience learnt from one crisis cannot be applied to the other crisis incidence. Another shared characteristic of the overviewed studies is the requirement of the high frequency data[5] with a relatively long period of observations. Therefore, the researchers are limited with the choice of indicators, relying not only on the economic reasoning and to some extend on the subjective judgments, but also on the data availability. As a result, those indicators that could potentially provide better reasoning of the crisis and its transmission channels could be left out of the analysis.

These findings have crucial implications for this research and especially for the choice of the methodology. Firstly, for Central Asian economies replication of any of the overviewed approaches is hindered by the data availability. As was highlighted, high frequency data is at the core of all methodologies, which for the examined countries is not available. Collected database includes indicators with exclusively yearly data, which substantially narrows down the methodological choice. Secondly, the main objective of this research differs from conventional studies on the early warning indicators, which aim at identifying set of indicators allowing to predict the crisis. The goal is to capture the dynamic interdependencies between different sectors of the economy and to identify the one, which potentially poses the main risks for the country's stability. Lastly, it was emphasized that

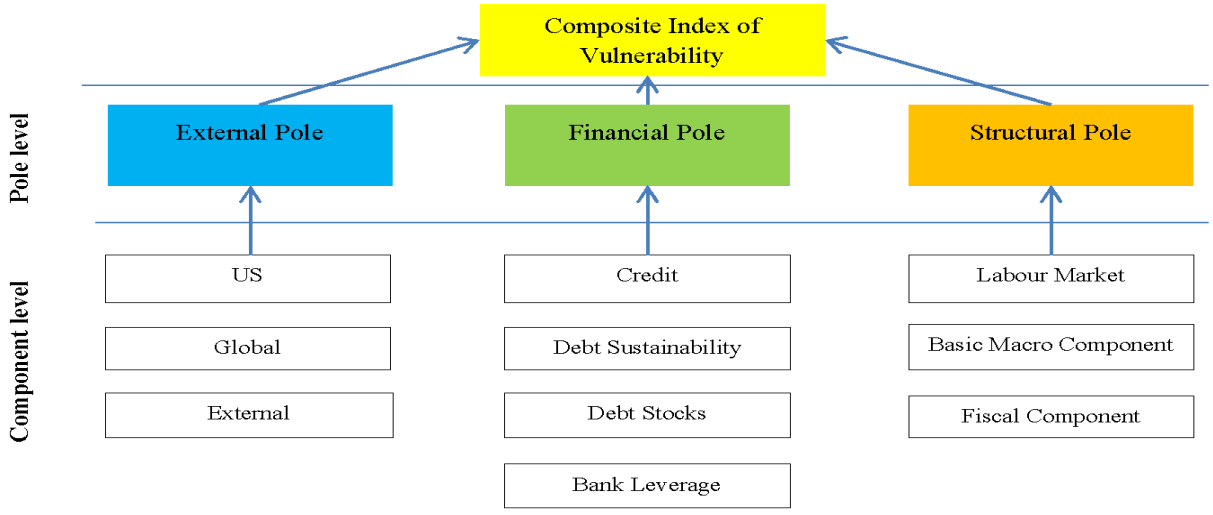
[5] at least quarterly, but preferably monthly or even with the higher frequency.

nature of the crisis defines the consequent analysis. In fact, to categorise the crisis arisen in CAE as financial, currency, banking or balance of payments would be rather inconclusive. Therefore, instead of trying to fit CAE into one of the crisis scenarios, this research aimed at finding the methodology which will be the most suitable for the given countries. Considering defined limitations of the analysis, in the next subsection the methodology of the research will be presented.

3.2 Composite Index of Vulnerability

This paper is following the new methodology suggested by Aikman et al. (2015) and further developed and tested for emerging economies by Lepers and Serrano (2017). Approach largely reflects the view that there is no single data series that is capable of capturing the systematic and build up risks. It aims at pulling together a wide range of indicators to build a composite index of vulnerability for each economy. The starting point of the methodology is analysis of the country and identification of the vulnerability sources. This analysis was conducted in the previous section and accordingly CAE should have three main blocks to build the final composite index of vulnerability: *external, structural, and financial*. Further these blocks will be referred as *poles.* Each pole consists of *components*, which allow for logical grouping of the indicators and play an important role in the aggregation process. The basic setup of the composite indicator could be observed in the Figure 3. Indicators chosen for each component will be described in more details in the subsection 3.4, while at this stage methodology has to be explained more in-depth.

Figure 3: Composite Index of Vulnerability



Source: author's representation

Following Lepers and Serrano (2017), the first stage is standardisation of the indicators within each component. Standardisation is conducted by subtracting each indicator by its country specific mean and dividing by its country specific standard deviation:

$$\tilde{X}_{l,k,i,t} = \frac{X_{l,k,i,t} - \bar{X}_{l,k,i,t}}{\sigma(X_{l,k,i,t})}$$

In this equation, l – number of selected indicators, k – number of risk components; consequently $X_{l,k,i,t}$ is the quantitative value of the risk indicator at the moment *t*, for a country *i*.

In substance, this way of standardisation is the basic step in any methodology underlying the build-up of composite index. It should be noted, that when the indicator follows the reverse direction of vulnerability, the opposite sign is taken. A good example could be GDP per capita or FDI. In both of these cases higher value has positive implications for the economy; therefore in standardisation stage they took the opposite sign. The next step is the aggregation of the standardised indicators within each component. In this paper, simple non-weighted average is taken, as Aikman et al. (2015) have proven it to perform as good as the geometric average, root mean square, principal component and weighted average. However, before moving to the aggregation stage within the pole level – normalisation of each score component has to be performed. The normalisation is important stage to render the score comparability. The main idea is to normalise the indicators in the range between 0 and 1, where 1 would denote the highest vulnerability score and correspond to the highest value in the sample, and 0 – the lowest one with the lowest value, respectively. Score is then defined as the percentile rank in the historical distribution of the aggregated indicators within the component:

$$Y_{i,k,t} = \frac{\sum_{j,\tau} l\left(\frac{1}{L} * \sum \tilde{X}_{l,k,j,\tau} \leq \frac{1}{L} * \sum \tilde{X}_{l,k,i,t}\right)}{\sum_{j,\tau} Y_{k,j,\tau}}$$

In this equation, $Y_{i,k,t}$ is the percentile rank for a component *k* at moment *t*, for a country *i*. It is worth mentioning, that considering relatively short period of observations, normalisation was conducted not within each country, but among two groups of countries. In particular, among oil importers and oil exporters, as countries in both of these groups share similar characteristics. Once the normalisation allowed obtaining the scores for each component, the aggregation at the pole level can be performed. Again, simple non-weighted average method

is applied and now the scores are aggregated at the pole level. Finally, the final composite indicator or the index of vulnerability could be obtained, by aggregating together with the simple non-weighted average three poles: financial, external and structural.

3.3 PANEL VAR AND GRANGER CAUSALITY TEST

With composite index it could be observed how the vulnerabilities evolved over time, and it also allows for the cross-country comparison. However, the main goal of this research is to identify the main source of risk for the examined countries.

This objective could be met by conducting Granger causality test. Developed by Granger (1969) it justifies: if variable B could be better predicted using the histories of both B an A, than by using the history of B alone, it could be concluded that variable A Granger-cause variable B. It means that by testing the Granger causality between the poles, it could be identified which of the poles "Granger-cause" the others two or in the context of the analysis, which pole drives the vulnerabilities within the economy. To capture the interdependencies between more than two variables Granger causality has to be tested within VAR framework. For this purpose perfectly fits the panel VAR approach, which is relatively new in econometrics and is particularly suited to capture dynamic and static interdependencies within the economy (Canova and Ciccarelli 2013, pp. 4-6). Regarding the panel VAR, this research has largely benefited from the recent Stata package developed by Abrigo and Love (2015). Authors inferred homogeneous panel VAR models in a generalized method of moments (GMM) framework and provided the Stata commands that allow executing model estimation easily. Moreover, the package of programs includes additional functionality, such as sub-routines to implement Granger causality test.

The only consideration that has to be accounted with the panel VAR estimation is the model selection, which is determined by the optimal lag specification. Abrigo and Love (2015, p.5) has suggested to follow the most widely used maximum likelihood-based model selection criteria: the Bayesian information criteria (MBIC), Aikaike information criteria (MAIC), and the Hannan-Quinn information criteria (HQIC). Therefore, for the GMM estimator has to be selected the pair of vectors (p, q) that minimizes:

$$MBIC_n(k,p,q) = J_n(k^2p, k^2q) - (|q| - |p|)k^2 \ln n$$

$$MAIC_n(k,p,q) = J_n(k^2p, k^2q) - 2k^2(|q| - |p|)$$

$$MHQIC_n(p,q) = J_n(k^2p, k^2q) - Rk^2(|q| - |p|) \ln \ln n\,, \qquad R > 2$$

Where $J_n(k, p, q)$ is the statistic of over-identifying restriction for a k-variate panel VAR of order p and moment conditions based on q lags of the dependent variables with sample size n. Therefore, the lag model with the smallest MBIC, MAIC and MHQIC will be selected. Finally, once the model has been selected and the panel VAR was estimated, the Granger causality routine could be implemented. Those results where null hypothesis (mainly Variable 1 doesn't Granger cause Variable 2) could be rejected at the 5% significance level will be selected.

3.4 DATASET

Indicators used for the build-up of each component and, hence, for the final pole score require additional specification. Firstly, scarce data for CCA has resulted in rather limited number of indicators that can cover the observed period. Secondly, methodology implies to some extend subjective judgments, which also impact selection of indicators. Finally, relevance and selection of the more representative indicator is augmented by country-specific characteristics. The comparability and soundness of data are additional constraints that have to be accounted. In this fashion, the World Bank and IMF databases were considered as the primary sources. In case of some indicators, the data was retrieved from Asian Development Bank and Bloomberg databases. Finally, preliminary list of the indicators was motivated to some extend by the early studies on the early warning indicators (Bussiere, 2013; Frankel and Saravelos 2012; Kamin, Schindler and Samuel 2001; Kaminsky and Reinhart 1998), which was further narrowed down based on the considerations described above. The detailed breakdown by the pole component and respective indicators, the direction of vulnerability, and the source of the indicator could be found in the Annex A. In this section, detailed description of the selected indicators is presented.

External Vulnerability Pole consists of three components, with global one potentially capturing the risks of the falling oil prices for the oil exporters and drop in remittances for oil importers[6]. Inclusion of the US component and, consequently, of the VIX indicator and Fed funds rate, allows accounting for the possible periods of turmoil that could be transmitted to the developing countries (Lepers and Serrano 2017, p. 9). The external component reflects the imbalances steaming from the capital flows and with an inclusion of

[6] At the stage of the aggregation of the indicators, the opposite effect of the falling oil prices for oil exporters was accounted, by taking the opposite sign of the indicator.

the indicator of the currency composition of the PPG debt[7] it also covers the level of exposure to the FX movements. Lastly, the real effective exchange rate is aimed at identifying the possible risks of the under- or overvaluation of the exchange rate.

Financial Vulnerability Pole comprises four components: credit, debt sustainability, debt stocks and bank leverage. The latter one represents the possible risks of the financial system, with banking sector at its core. Included within the bank leverage component, indicator of the bank z-score captures the probability of default of a country's commercial banking system. Maturity transformation is covered by the ratio of the liquid assets to deposits and short term funding, while the bank credit to bank deposits ratio implying the liquidity risks

Debt stocks component reflects the risk of the country's insolvency, with indicators included being the proxy of the private and public sector indebtedness. Debt sustainability follows the logic of the liquidity risk component, including traditional indicator of reserve adequacy measured by the months of imports, and by the ratio of short-term debt to reserves also providing indication of the potential liquidity problems (IMF 2000).

Finally, the credit component includes the indicators of the domestic credit to the private sector and lending interest rate. Regarding the former indicator, it is conventionally presumed that the excessive growth of the domestic credit in advanced economies correlates with the high possibility of the crisis (Hahm, Shin and Shin 2013). However, for the examined developing economies it would be rather misleading judgment, as increasing domestic credit to private sector would be rather an evidence of growth and poverty reduction. Therefore, at the standardisation stage this indicator took to the opposite sign of vulnerability.

Structural Vulnerability Pole encompasses the basic macro, labour market and fiscal components. The former contains core macroeconomic indicators, such as the GDP per capita growth, inflation, gross national savings and total investments. Unemployment rate and labour force participation rate are included within the labour market component. Finally, the fiscal component comprises only one indicator of the fiscal balance.

[7] Apparently, the indicator of the currency composition of the total external debt would lead to more robust results. However, for CCA this indicator is not available and is a good illustration of the scarce data issues for the selected economies.

4. INTERPRETATION OF RESULTS

4.1 FINAL VULNERABILITY INDEX

The results obtained for the composite indicator of the crisis are represented by the heat maps (Annex B, B.1). By simplifying the matrix of indicators, heat maps reveal the evolution of vulnerabilities and allow for a more straightforward comparison of accumulated risks among countries. The heat maps for each economy were generated by assigning colours to each value of a component. After normalization, each component varied between 0 and 1 with colours ranging from green to red, respectively. The deepest green represented a risk-free year for a particular component while and the brightest red represented the highest risk. The heat maps present not the aggregated score for each pole, but the breakdown by the components. This way of illustration allows for the more detailed description of the results, and makes the interpretation more conclusive.

4.1.1 EVOLUTION OF VULNERABILITIES AMONG OIL EXPORTERS

In Kazakhstan, Russia and Azerbaijan the highest risk was observed in the period between 1996 and 2001. The financial pole alerts, with the highest vulnerability stemmed predominantly from the credit and debt sustainability components. Compared to its peers, the financial system distress of Azerbaijan was the most prolonged, with the debt sustainability component reflecting liquidity constraints in the economy up to 2005. As a result of the financial crisis in 1998: Russia's period of distress was augmented by the solvency component, with structural pole also alarming about risks in the economy.

These results are also aligned with the actual structural break occurring in the CCA region. Mainly, it was the beginning of the transformation period for the post-Soviet economies and the starting point of institutional building. Overall, transformation period has resulted in the large GDP contraction on the average of around 50% over 1990 - 1995. Consequently, early 90's were characterised by very tight credit conditions and sharp increase in lending rates. Economies were challenged by transition period to the market economy, amplified by institutional disorder. New market conditions required adjustments in the labour market, thus putting it under the period of substantial distress (Dowling and Wignaraja 2006).

It is interesting how the transition period is also depicted by the external pole. It could be observed that in both Azerbaijan and Kazakhstan global and external components warn about prevailing risks, while in Russia the risks heightened only for the two year period 1997-1998. In fact, low oil prices are not a sufficient explanation, as in that case they would

also magnify the global risks during same period in Russia. In practice, the components illustrate how structural break has hindered the export performance of Kazakhstan and Azerbaijan. During the Soviet Union these countries distributed and marketed their exports through Moscow, therefore in the early transition years the trade links were disrupted and exports felt drastically (Sabonis-Helf 2004). Accordingly, global and external components illustrate the current account deficits and low FDI. Again, the drop in commodity exports resulted in the large decrease of government revenues, which is also reflected in the fiscal component.

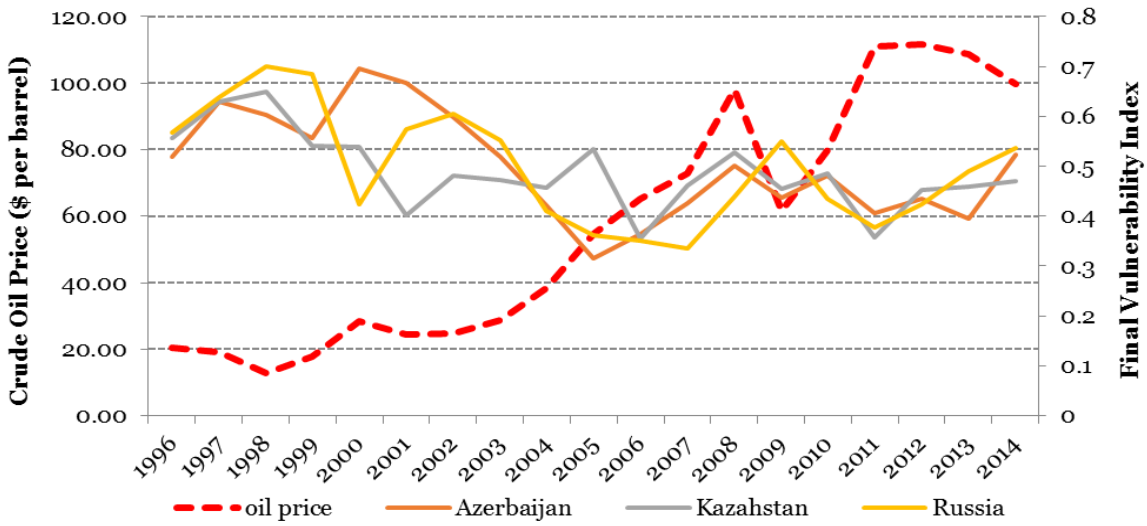
After 2002 the risk patterns of the countries started to diverge. Over the period of 2002 - 2005 world commodity prices started increasing rapidly. In particular, crude oil prices surged from $24 per barrel to $53. For Russia, Kazakhstan and Azerbaijan it implied a period of accelerating oil revenues. Notably for Russia, that during the period of transition took advantage of the monopoly on the former Soviet agencies, which distributed the oil and gas products below market levels (Dowling and Wignaraja 2006, p.6). It has further determined its dominant role in the region. As could be observed in the heat map, improvement in commodity price prospects resolved Russian financial and structural problems. However, rapid economic expansion wasn't accompanied by establishing a resilient financial system. Clearly, starting from 2004 Russia continuously accumulated financial risks, which mounted during the 2008 financial crisis. From the heat map it could be also concluded that financial vulnerabilities had a pronounced effect on the whole economy. As a result, in 2009 fiscal and macro components signalised about escalating risks in the economy.

In Kazakhstan the period of accelerating oil price was accompanied by a substantial improvement of its macroeconomic conditions. The fiscal component seemed to underperform as compared to the macro one. Simultaneously rapid credit expansion was accompanied by an increase in bank leverage that continued to grow until 2008. Together with the credit expansion the debt stocks component started to accumulate risk. It could be attributed to the rapidly increasing short-term debt, which implies that banks started borrowing excessively from abroad. The same goes for the increase in private sector liabilities, simply reflecting a credit expansion in the economy. Undoubtedly, these developments exposed country to the adverse shocks, which were observed during the 2008 crisis. From the heat map it becomes obvious that the government stepped in to mitigate the financial shocks, which is reflected in its fiscal component.

For Azerbaijan positive oil price shock resulted in considerable improvement of its external pole and boosting oil revenues resulted in the overall macroeconomic recovery observed in macro component. In fact, the fiscal component shows that Azerbaijan pursued tight fiscal policies compared to its peers. Oil revenue also helped with accumulation of reserves, which were reflected in the diminished risk of the debt sustainability component. Unlike in Russia and Kazakhstan, the labour market in Azerbaijan experienced a prolonged period of distress until 2007. Interestingly enough, until 2007 the bank leverage component could be described as risk-free. This might be a result of a very low dependency on the domestic banks of hot capital flows and the strengthening of its foreign reserves. This premise is supported by the low risk allocated within debt stocks component, which started to signal about weakness only in 2007, with the consequent response of the bank leverage component. Relatively resilient financial system allowed Azerbaijan to avoid the major economic breakdown during the 2008 crisis, which was also reflected in the fiscal and macro risk components. Finally, in the period of 2008 and 2014 risks in all oil exporters started evolving in a similar way. In all of the observed cases, after 2008 crisis financial pole has become the main source of risk for the oil exporters.

Reflecting upon the component scores, heat maps have illuminated important conclusions regarding the evolution of risks within the aforementioned economies. Another possible way to analyse how the final index of vulnerability have evolved over time is to test it against some main assumptions of the research presented here. Considering the commodity-based growth model, evolution of oil prices could be utilised as a benchmark to compare the performance of the final index. In Figure 4, the inverse relationship between oil prices and the final vulnerability index could be observed. It is aligned with the underlying assumptions referred to this group and proves index to perform well throughout the observation period. The indexes of the examined economies have followed the same path. They entered observation period with the index value of around 0.5, which peaked at around 0.7 in 1998. Overall, the period between the 1996 and 2000 resulted in the highest historical values for the final vulnerability index. After the beginning of 2000's countries have enjoyed the lowest risks, which started to alleviate after 2008.

Figure 4: Final vulnerability index and crude oil prices, 1996-2014



Source: author's representation; Bloomberg (2017)

4.1.2 Evolution of vulnerabilities among oil importers

From the heat maps of Armenia, Georgia, Kyrgyzstan and Tajikistan it is clear that the transition period highlighted the massive shock in the economy. Stylized facts on the transition period presented in the previous subsection are valid for the group of oil importers, as well. However, the implications are different, as these countries have poor natural endowments. For them transition to the market economy was undermined by adjustment period to the new energy prices and was equivalent in terms of trade shock around 15% to GDP. Trade shock in these economies was accompanied by the drying up fiscal transfers and capital investments, with subsequent breakdown of national payment systems. Furthermore, in the beginning of 90's Georgia, Tajikistan and Armenia suffered from internal conflicts and civil wars. These developments became the main impediment to growth and have postponed urgently needed market reforms. High energy prices have forced governments, which were already dramatically constrained by their budgets, to accumulate debt. Clearly most of them were indebted to Russia, which by that time constituted itself as the main energy exporter in the region. To cope with dried budgets and hiking energy payments, countries have received assistance from a number of international organisations, including IMF and World Bank (Odling-Smee and Linn 2001).

External component was aligned with these developments illustrating high risk in all the cases up to 1997, and reflected large current account deficits and falling FDI. Further, the prevailing risk in external pole in 1998 was one year lagged effect of the Russian 1997

financial crisis. In fact, for this period the data was still scarce for the external pole, thus might not reflect the actual depth of the crisis[8]. Still, fiscal component in most of the cases alerted about fiscal pressure and unsustainable fiscal spending. It was amplified by negative labour market conditions that prevailed up to the beginning of 2000's. Crisis in Russia implies falling remittances, which were recorded under external pole and reflected on the poor performance of the basic macroeconomic component. Further, with the exception of Tajikistan debt sustainability component indicated the liquidity constraints among oil importers. In fact, under perfect circumstances the debt stock component should have posed the risk as well. However, this case perfectly illustrates the data constraints imposed on this methodology. As for the examined economies no information on the total debt or external debt as percent of GDP is available. Short-term debt included into the debt stock component does not encompass the actual risks existing at that time within oil importers. As was mentioned above, in these countries substantial debt was accumulated, which also resulted from the support provided by international donors. This point is highlighted in purpose, as further substantial debt burden was not accompanied by the actual structural improvements. It has undermined their economic performance for a decade, and is important explanation of the evolution of the vulnerabilities in these economies (Helbling, Mody and Sahay 2004). With an exception of Tajikistan, the risk accumulated in bank leverage component started to decline after 1997. It allows concluding that banking system among oil importers was relatively well capitalised, liquid and profitable. In case of Tajikistan, the banking system vulnerabilities were driven by the mounting bank credit to bank deposit ratio that in the beginning of the observation period reached up to 500% (World Bank 2017). In addition, Tajikistan experienced a prolonged period of negative interest rates.

After 2002 positive effects of the oil price increase spillovered to the oil importers. In Armenia this positive shock is recorded within external, macro and fiscal components. Up to the breakdown of financial crisis Armenia experienced the period of economic growth, resilient fiscal balance and improvements in its current account. At the same time, debt stock component signalised about the risk accumulation and corresponded to the excessive external borrowing. Despite the period of the prolonged growth, Armenia failed to achieve structural transformation and the heat map after the 2008 financial crisis perfectly illustrated this case. Global component posed the main risk during 2008, possibly signalising about currency risks; also about drop in remittances and capital inflows that obviously negatively impacted its fiscal performance. The consequent effect on its macroeconomic aggregates

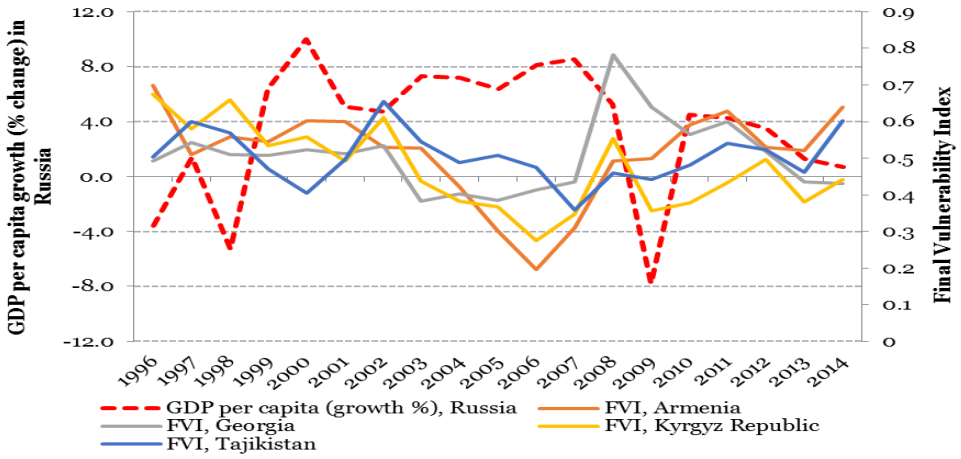
[8] For Georgia external component doesn't include data for 1996; For Tajikistan external component doesn't include remittances until 2002.

was immediate. Macro component showed that Armenia entered the period of prolonged economic recession. In addition, it triggered financial vulnerabilities in the country, presumably due to the sharp depreciation of the currency, which might have challenged the banking system with liquidity constraints. Bank leverage component was aligned with these assumptions, as well as the debt stock and sustainability components. Obviously, currency depreciation has increased debt burden. Georgian story of risk accumulation is the same as in Armenia, as could be observed in its heat map. The only difference is the external component that issues higher risks alarms after 2008. It could be explained by the Russian-Georgian crisis, which started in April 2008. As a result diplomatic and economic links were torn, with subsequent decrease in FDI, remittances and trade volumes (Mikhelidze 2009).

Kyrgyz and Tajik vulnerabilities starting from 2002 evolved in a similar way, albeit with small differences. It should be noted that for Tajikistan the global pole doesn't include the data on remittances up to the year 2002. Therefore, the component up to this date relies solely on the developments in oil prices. This point is emphasized to avoid misleading conclusions. Still, in both economies external and global pole showed weaker performance compared to the peers in the region. Favourable external conditions after 2002 should have resulted in large remittances inflows, but external pole still signalised about risks. It could be concluded that the problem lied in the persistent current account deficit and low FDI. In both cases economies experienced long period of fiscal deficits accompanied with rather modest growth. Economic conditions seemed to improve only after the year 2006; however, financial weaknesses were magnified by an increase in debt stocks and bank liabilities in Kyrgyzstan, while Tajikistan started experiencing liquidity issues reflected in debt sustainability component. As a result after 2008 crisis, it impacted debt stocks component, which remained in the high-risk zone up to 2014. Negative external conditions had an immediate effect on the macroeconomic stance in Tajikistan, with fiscal component becoming the main source of vulnerability. In Kyrgyz Republic prudent government policies allowed to prevent drastic effect on the economy. Nevertheless, its financial system entered the period of prolonged distress. As could be judged from the components presented, weakened external conditions and currency depreciation undermined consumer conditions that could result on the declining capital adequacy ratio. At the same time, in all CCA economies borrowers were unhedged against FX movements, which consequently increase NPLs ratio, and triggered the chain of banking system distortions (World Bank 2017; 2017a; 2017b).

As in the previous case with oil exporters, evolution of the final vulnerability index could be analysed by comparing it with a benchmark indicator that proved to be highly significant in explaining economic performance for oil importers. In this case GDP growth in Russia could be taken as a reference point.

Figure 5: Final vulnerability index and GDP per capita growth in Russia



Source: author's representation; World Economic Outlook (2017)

Figure 5 illustrates a positive correlation between the final vulnerability index and GDP growth in Russia. In addition, it could be observed that spillovers affect oil importers with a two year lag, which is much aligned with the first-and second-round effects of the shock. Once comparing with the exporter's group it is clear, that vulnerability index was a bit lower among oil importers and varied between 0.5 and 0.7, however the risk was more prolonged. Index started decreasing only towards the end of 2002 (which is also explained by the two year lag mentioned above) and reached its lowest value in 2006 for Kyrgyz Republic and Armenia, and in 2007 for Tajikistan. Georgia is standing out of the group, as its index reached the lowest point already in 2003, but since then has been increasing. For all oil importers index started climbing steadily already in 2007, signalising about the risk accumulation, with Georgia reaching the highest value in the group of 0.8 in 2008. After financial crisis index started varying between 0.4 and 0.6, with Kyrgyz Republic being the least vulnerable country in the group.

4.2 Descriptive statistics

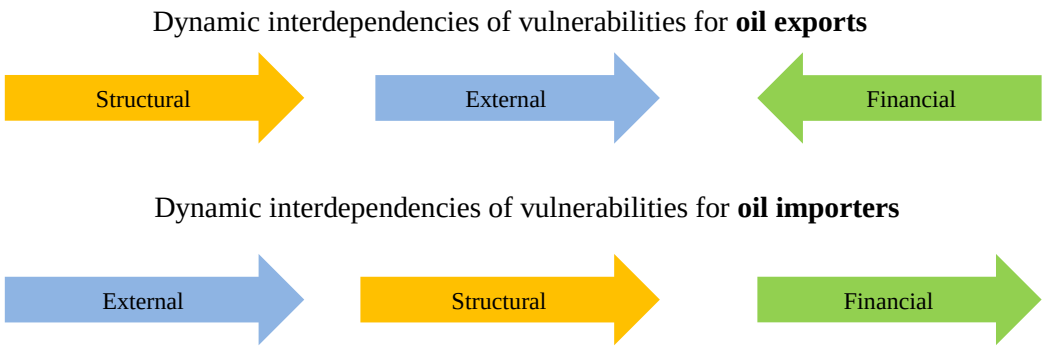
4.2.1 Granger causality test for the main set of vulnerabilities

With the help of the vulnerability index and its components the evolution of the risks in CCA region was examined. However, the dynamic interdependencies between the poles are

still remaining an open question. They will shed light on the main source of the risks for the countries and, hence, have to satisfy the research objective of this study. Following the methodology, first the panel VAR was estimated and for each panel VAR the first order lag model has been selected, as they contained the smallest MBIC, MAIC and MQIC. The results on the panel VAR lag order selection on estimated sample could be found in Annex C. Further, the panel VAR with GMM instruments was estimated for each particular country, for the group of oil exporters and oil importers separately and finally for all countries together. However, once the panel VAR was estimated for each country separately, with consequent performance of Granger causality test, the results were not robust. It was found that for all the countries the null hypothesis, mainly that Variable 1 doesn't Granger-cause Variable 2, couldn't be rejected at 5% significance level. It was assumed that number of observations is not sufficient to conduct the estimations for each separate country. From the statistical point of view it is a valid explanation and further analysis conducted with the higher number of panels has proven this assumption. It was found, that once the panel VAR and, hence, the Granger causality test were performed for the group of oil exporters and oil importers separately, and for all countries jointly, the robust conclusions could be drawn. Therefore, analysis of the dynamic interdependencies between poles was limited to the groups and to the whole sample of countries analysed jointly.

Granger causality test results are presented in Annex D and the graphical interpretation of the group results is presented in the Figure 6. The arrows represent the direction of vulnerability and the sequence corresponds to the actual chain of the risk evolution. Granger causality test conducted for the group of oil exporters has shown the structural vulnerabilities are the main source of economic weaknesses.

Figure 6: Chain of vulnerabilities for oil exporters and oil importers



Source: author's illustration

The results of the test and hence the chain should be read in this way: structural weaknesses make oil exporters exposed to the external shocks, which in turn trigger financial risks. According to the results, external and financial poles have a symmetrical effect; mainly they increase a predicting power of each other or in other words occur at the same period of time. Breaking down the pole by the components included, it could be argued that for Azerbaijan, Kazakhstan and Russia distortions in the labour market, fiscal balance and basic macro components serve as the main source of risk for sovereigns. It allows concluding that commodity based growth model serves as the main impediment to growth. It implies that without correcting distortions in the labour market, substantially increasing investments in the economy, and most importantly diversifying sources of growth, these economies will preserve the risks.

For oil importers the chain of vulnerabilities is much different. According to the Granger causality test, external pole drives the chain of risks in Armenia, Georgia, Kyrgyz Republic and Tajikistan. Unlike with oil exporters no symmetrical relationship is observed among poles. The results are much aligned with the previous findings: high dependence on remittances and FDI from Russia combined with the exposure to the currency moves have become the major source of risk for oil importers. Further, it has a direct effect on the growth prospects in the country, considering the chain effect on the structural pole. Finally, financial vulnerabilities appeared to close the chain.

The Granger test performed for all the countries jointly has drawn interesting results. Despite the differences between the groups, the test has shown that for the whole CCA region structural weaknesses are the main source of risk. This pole has the strongest predicting power for financial and external poles separately and jointly. Symmetrical interdependence between external and structural pole, shows that occurrence of the external shock simply amplifies structural weaknesses.

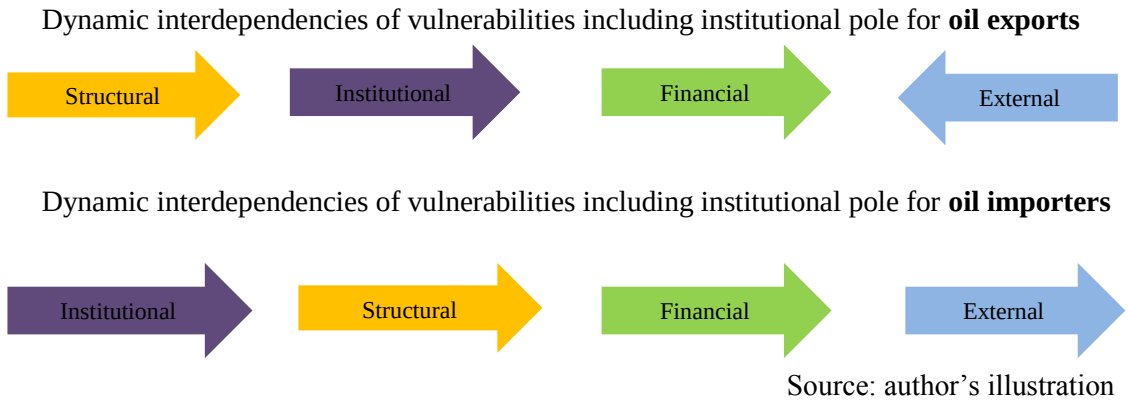
4.2.2 GRANGER CAUSALITY TEST WITH AN INCLUSION OF INSTITUTIONAL POLE

In the overview of the country's individual heat maps it was justified that the beginning of independence was undermined by the absence of effective institutions. It gave incentives to extend the analysis and to perform the same exercise, but with an inclusion of additional pole – institutional pole. It is worth highlighting, that most of the examined economies are autocratic regimes. They are characterized by deeply rooted corruption, ineffective governance and unprotected property rights (Collins 2009). Therefore, as an extension of the analysis it could be assumed that institutional vulnerabilities in CCA countries are highly

detrimental to sustainable and inclusive economic growth, and could be the main cause of the accumulated economic risks.

To test this assumption institutional pole has been included, and its indicators have followed the same methodology as the other poles, and are reported in the Annex A. Further, Granger causality test was conducted for the group of countries, but now with an inclusion of the institutional dimension. For the group of oil exporters the situation hasn't changed drastically, with structural flaws still being the main source of risk:

Figure 7: Chain of vulnerabilities (with institutional pole)



Source: author's illustration

As could be observed in the Figure 7, they are at the roots of the institutional flaws in economies. This, at the first glance puzzling causation, finds its strong support in the reality. Starting from the early 2000's oil exporters have enjoyed excessive inflows of the "oil money", by supporting growth at the same time they disincentivized any institutional changes. Autocratic regimes that have been established since the independence in the CCA are basically ruled by oligarchic structures. The latter, being on the top of the corrupted hierarchy have constantly enjoyed increasing oil revenues, but also prevented promotion of redistribution policies. As a result the structure of the economy has been built in a way to reproduce its institutional build up, that in turn help to sustain current oligarchic regime (Collins 2009). Further, the case of the self-reproducing regime is illustrated with the chain of institutional vulnerabilities triggering financial risks, or in other words shaping current ineffective financial market. At the same time financial risks are also amplified by external vulnerabilities.

With an inclusion of the institutional dimension Granger causality test showed quite different results for oil importers. For them institutional flaws are the main source of vulnerabilities and drivers behind the structural flaws. Unlike with the previous case, no symmetrical interdependencies are observed, which allows establishing clear links between

the poles. It could be argued that corruption, political instability, unsecured property rights, and ineffective judicial system are the main impediments for growth in these groups of countries. For economies, which natural endowments haven't allowed to enjoy enormous inflows of oil money and "fed" their growth, market reforms and creation of new effective institutions are the ultimate precondition for successful development. Facing just the opposite developments, these economies were forced into the vicious cycle were ineffective institutions have dictated the market conditions. Undoubtedly it has shaped the flaws in the labour markets, has fuelled shadow economy, which is flourishing now, and, most importantly, prevented creation of market based economy. As in the previous exercise, structural vulnerabilities drive financial weaknesses within the economy. It allows concluding that there is a relatively strong dependence between these poles. Finally, once analysis encompassed institutional set-up, external weaknesses has become the result rather than cause of the vulnerabilities.

Once all the countries were tested jointly, at the first glance the case seemed to be puzzling. However, if starting with the causality that works only in one way, the conclusion could be drawn. According to the results obtained the only one-sided causality is between structural pole that triggers the risks in external one. This case partly shadows the lights on the previous exercise when the countries were tested jointly. Precisely, it shows that structural flaws are now again pushing the whole chain of vulnerabilities, resolving the mixed case of the previous symmetrical dependence with an external one. Further, following the chain it becomes obvious that external, financial and institutional increase predicting power of each other, or in other words are occurring contemporaneous. It allows to conclude that overall for the region the vulnerabilities are driven by structural flaws.

CONCLUSIONS

This paper aimed at identifying evolution of vulnerabilities in Caucus and Central Asia and by examining dynamic interdependencies between sectors of the economy to determine one that drives the risks. The originality of this paper was accentuated by the choice of the countries itself and by the research methodology. Due to the very scarce data, CCA region is generally understudied, therefore this paper contributed to the comprehensive assessment of countries' risks, which could be rather ascribed as systemic. Applied methodology allowed constructing a composite index, which has built a narrative of countries' vulnerabilities in the period of 1996-2014. Static ex-post analysis of country's vulnerabilities was complemented by examination of their dynamic causalities, which satisfied the main

objective of this research. In addition, quality data was one of the core principles of the analysis, which reassured soundness of the final results.

The massive drop in oil prices in the year 2014 was highlighted, as a starting point of the analysis, and through its lens the main groups of vulnerabilities, mainly external, structural and financial, were revealed. It also allowed breaking the region by the groups of oil exporters and oil importers. In addition, normalisation performed within the historical distribution of indicators at the group, as the opposite to country's individual distribution, allowed for the cross-country comparison. It strengthened the results of the final vulnerability index, by eliminating the issue of the short-time series. As a result, the heat maps representing the components of the composite index have provided accurate caveats. Such a conclusion is supported by a number of findings. First, the heat maps with a high precision have shown the period of the structural break in the region. Second, for the year 2008, another tipping point, heat maps also alarmed about the high risk in the economies. Third, the benchmark comparison with the oil prices and Russian GDP per capita proved final index to issue highly precise signals. Finally, the accuracy of the results was supported by a number of publications quoted in the corresponding subsections. Composite index allowed assessing how vulnerabilities in CCA region have evolved over time, and finally explain the drastic performance of countries during the recent oil price shock. Moreover, the predictability of the index could be substantially improved in case higher frequency data is available, which will allow to use it as an effective policy tool.

Dynamic effects of the vulnerabilities were explored by testing Ganger-causalities between the poles. This sub-routine was conducted within the panel VAR approach, which is designed specifically to capture dynamic interdependencies within the economy. However, the main shortcoming of this research – short data-series – didn't allow performing Granger – causality test for each country separately. Instead, it was conducted for two groups separately, and for the whole region jointly. According to the obtained results for Russia, Azerbaijan and Kazakhstan structural weaknesses are the main drivers of the risks within the economy, they increase external's sector exposure, which together with financial risks amplify the shocks in the economy. For Armenia, Georgia, Kyrgyz Republic and Tajikistan external sector appeared to be the main driver of country's risks, which triggers its structural weaknesses and finally brings to the fore financial risks. In fact, for the whole region structural weaknesses have the main predicting power for the other risks. It allows concluding, that structural transformation is urgently needed. It implies that predominately

countries should aim at diversifying the sources of growth, boosting investments in the economy, and creating new job opportunities.

By analysing the performance of the vulnerability index another set of potential vulnerabilities – institutional – were revealed. It motivated a performance of the additional exercise, with an inclusion of the institutional pole. It was hypothesised that autocratic regimes with ineffective institutional setup could be the main source of countries' vulnerabilities. According to the results, institutions play a pivotal role in explaining the vulnerabilities for oil importers. On the opposite, for oil exporters structural weaknesses still remain the main source of risks. Finally, once all countries were tested jointly, it was found that institutional pole has the smallest predicting power among the poles. In fact, structural vulnerabilities appeared to have the strongest explanation capacity for the region's economic risks. Overall, the results of both exercises do not contradict with each other, but rather complement, reassuring that structural flaws are the main source of risk for the region. Institutional dimension simply points on the fact that structural transformations to be effective, have to be market-driven: they have to promote competition, eliminate corruption and ensure property rights.

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ANNEX A

Pole	Component	Indicators	Direction of Vulnerability	Source
External vulnerabilities	US	FFRE	-	Bloomberg
		VIX	+, Absolute Value of the gap, lambda 6.5	Bloomberg
	Global	Oil prices _crude	+/-	Bloomberg
		Remittance inflows to GDP (%)	-	GFDI, WB
	External vulnerabilities	Current account balance (% of GDP)	-	ADB
		Foreign direct investment, net inflows (% of GDP)	-	WDI, WB
		Real effective exchange rate index (2010 = 100)	+, Absolute Value of the gap, lambda 6.5	IFS IMF
		Currency composition of PPG debt, U.S. dollars (%)	+	WDI, WB
Financial vulnerabilities	Bank Leverage	Bank credit to bank deposits (%)	+	GFDI, WB
		Liquid assets to deposits and short term funding (%)	-	GFDI, WB
		Bank Z-score	-	GFDI, WB
	Debt Stocks	Short-term debt (% of total external debt)	+	WDI, WB
		Short-term debt (% of total reserves)	+	WDI, WB
		Claims on central government (annual growth as % of broad money)	+	WDI, WB
		Claims on private sector (annual growth as % of broad money)	+	WDI, WB
	Debt Sustainability	Total reserves (% of total external debt)	-	WDI, WB
		Total reserves in months of imports	-	WDI, WB
		Total debt service (% of exports of goods, services and primary income)	+	WDI, WB
	Credit	Lending interest rate (%)	+	GFDI, WB
		Domestic credit to private sector (% of GDP)	-	WDI, WB
Structural Vulnerabilities	Basic Macro Component	GDP per capita growth (annual %)	-	WDI, WB
		Inflation, average consumer prices (% change)	-	WEO IMF
		Gross national savings (% of GDP)	-	WEO 2017, IMF
		Total investment (% of GDP)	-	WEO 2017, IMF
	Labour market	Labour force participation rate, total (% of total population ages 15+)	-	WDI, WB
		Unemployment, total (% of total labour force)	+	WDI, WB
	Fiscal Component	Fiscal Balance	-	WEO 2017, IMF
Additional set of indicators				
Institutional Vulnerabilities	Institutional development	Rule of Law (in a range between 0 and 100, 100-max)	-	WGI, WB
		Control of Corruption (in a range between 0 and 100, 100-max)	-	WGI, WB
		Political stability and Absence of Violence (in a range between 0 and 100, 100-max)	-	WGI, WB
		Regulatory quality (in a range between 0 and 100, 100-max)	-	WGI, WB

ANNEX B

	Armenia	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.592	0.247	0.38	0.53	0.769	0.734	0.646	0.663	0.185	0.097	0.159	0.221	0.796	0.176	0.265	0.867	0.849	0.681	0.716
	External	0.946	0.813	0.613	0.88	0.933	0.893	0.6	0.306	0.053	0.24	0.16	0.493	0.586	0.28	0.426	0.226	0.133	0.253	0.533
Financial	Bank Laverage	*1*	*0.56*	*0.59*	*0.58*	*0.59*	*0.37*	*0.13*	*0.05*	*0.04*	*0.12*	*0.16*	*0.29*	*0.45*	*0.53*	*0.62*	*0.76*	*0.79*	*0.72*	*0.86*
	Debt stocks	0.247	0.026	0.451	0.088	0.053	0	0.38	0.743	0.946	0.787	0.345	0.769	0.876	0.159	0.681	0.92	0.752	0.619	0.867
	Debt sustainability	0.758	0.392	0.437	0.482	0.383	0.642	0.401	0.553	0.705	0.419	0.053	0.008	0.455	0.08	0.687	0.714	0.866	0.883	0.982
	Credit	0.875	0.696	0.687	0.625	0.553	0.66	0.5	0.589	0.669	0.482	0.267	0.151	0.437	0.25	0.517	0.491	0.607	0.633	0.723
Structural	Basic macro	0.955	0.911	0.849	0.716	0.699	0.734	0.495	0.265	0.433	0.017	0.008	0	0.079	0.752	0.619	0.61	0.513	0.761	0.69
	Labor market	0.778	0.398	0.628	0.522	0.902	0.858	0.823	0.725	0.663	0.575	0.504	0.353	0.15	0.849	0.69	0.407	0.079	0.017	0.115
	Fiscal					0.719	0.392	0.242	0.71	0.177	0.299	0.28	0.383	0.214	1	0.915	0.56	0.168	0.186	0.252
Inst		0.866		0.933		1			0.8	0.2	0.666	0.6	0.733	0.333	0.266	0.133	0.4	0.533	0	0.066

	Georgia	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.035	0.168	0.061	0	0.141	0.84	0.566	0.823	0.973	0.964	0.876	0.831	1	0.23	0.61	0.92	0.814	0.584	0.345
	External	0.546	0.84	0.56	0.386	0.773	0.866	0.706	0.146	0.066	0.44	0.52	0.2	0.973	0.733	0.4	0.72	0.68	0.026	0.106
Financial	Bank Laverage	*0.84*	*0.23*	*0.17*	*0.21*	*0.3*	*0.26*	*0.06*	*0.08*	*0.09*	*0.24*	*0.44*	*0.77*	*0.93*	*0.87*	*0.73*	*0.86*	*0.8*	*0.69*	*0.82*
	Debt stocks	0.46	0.584	0.3	0.389	0.371	0.123	0.07	0.106	0.212	0.238	0.814	0.982	0.761	0.274	0.513	0.637	0.796	0.858	0.884
	Debt sustainability	0.151	0.517	0.964	0.83	0.875	0.723	0.732	0.803	0.616	0.348	0.125	0.026	0.589	0.205	0.214	0.5	0.464	0.491	0.633
	Credit	0	0.008	0.107	0.258	0.321	0.357	0.33	0.339	0.375	0.562	0.651	0.741	0.794	0.776	0.803	0.83	0.866	0.937	0.964
Structural	Basic macro	0.964	0.787	0.769	0.902	0.858	0.725	0.566	0.044	0.256	0.097	0.203	0.061	0.646	0.92	0.592	0.424	0.15	0.407	0.221
	Labor market	0.088	0.123	0.513	0.442	0.424	0.044	0.601	0.168	0.619	0.805	0.769	0.716	0.982	0.991	0.867	0.539	0.265	0.336	0.061
	Fiscal	0.925	0.971	0.775	0.841	0.588	0.345	0.261	0.336	0.028	0.093	0.037	0.158	0.579	0.953	0.831	0.373	0.355	0.429	0.523
Inst		1	0.226	0.937	0.226	0.75	0.226	0.875	0.812	0.687	0.625	0.562	0.5	0.437	0.375	0.312	0.25	0.187	0.125	0

	Kyrgystan	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.548	0.513	0.283	0.371	0.69	0.619	0.495	0.424	0.362	0.433	0.398	0.486	0.707	0.194	0.238	0.725	0.575	0.442	0.318
	External	0.986	0.853	0.96	0.12	0.413	0.626	0.64	0.48	0	0.453	0.173	0.293	0.573	0.506	0.093	0.08	0.76	0.653	0.906
Financial	Bank Laverage	*0.95*	*0.92*	*0.18*	*0.23*	*0.03*	*0.1*	*0.14*	*0.07*	*0.39*	*0.35*	*0.33*	*0.66*	*0.77*	*0.38*	*0.52*	*0.6*	*0.7*	*0.74*	*0.89*
	Debt stocks	0.557	0.061	0.486	0.433	0.902	0.185	0.141	0.23	0.973	0.69	0.601	0.566	0.991	0.654	0.318	0.256	0.309	0.407	0.442
	Debt sustainability	0.937	0.785	0.955	0.839	0.928	0.821	0.696	0.651	0.33	0.285	0.16	0.116	0.375	0.098	0.258	0.276	0.223	0.25	0.446
	Credit	0.892	0.91	0.991	0.946	0.919	0.767	0.616	0.473	0.544	0.428	0.312	0.508	0.223	0.241	0.187	0.303	0.214	0.053	0.017
Structural	Basic macro	0.796	0.539	0.991	0.982	0.672	0.477	0.628	0.176	0.132	0.469	0.371	0.327	0.805	0.353	0.557	0.442	0.504	0.07	0.309
	Labor market	0.345	0.212	0.584	0.141	0.097	0.132	1	0.637	0.318	0.176	0.221	0.194	0.194	0.274	0.362	0.318	0.3	0.238	0.159
	Fiscal	0.803	0.822	0.962	0.981	0.906	0.672	0.626	0.476	0.448	0.327	0.196	0.102	0.046	0.121	0.598	0.401	0.542	0.308	0.065
Inst		0.062		0		0.125		0.187	0.25	0.375	0.937	1	0.875	0.437	0.687	0.75	0.812	0.562	0.625	0.312

	Tajikistan	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.035	0.026	0.008	0.017	0.07	0.053	0.938	0.911	0.946	0.929	0.557	0.256	0.637	0.522	0.654	0.893	0.884	0.778	0.858
	External	0.946	0.786	1	0.373	0.346	0.826	0.693	0.466	0.04	0.333	0.013	0.36	0.8	0.666	0.186	0.32	0.213	0.266	0.746
Financial	Bank Laverage			*0.98*	*0.99*	*0.94*	*0.95*	*0.85*	*0.31*	*0.05*	*0.41*	*0.32*	*0.28*	*0.43*	*0.46*	*0.5*	*0.68*	*0.55*	*0.22*	*0.51*
	Debt stocks	0.035	0.716	1	0.504	0.592	0.522	0.336	0.283	0.044	0.194	0.115	0.398	0.176	0.203	0.61	0.929	0.893	0.964	0.955
	Debt sustainability		0.017	0.044	0.035	0.294	0.267	0.366	0.357	0.535	0.598	0.767	0.625	0.58	0.901	0.741	0.66	0.526	0.428	0.339
	Credit		1	0.928	0.41	0.58	0.16	0.294	0.392	0.785	0.732	0.714	0.571	0.044	0.205	0.526	0.419	0.446	0.366	0.285
Structural	Basic macro	1	0.973	0.876	0.884	0.3	0.522	0.398	0.283	0.247	0.318	0.486	0.088	0.362	0.23	0.185	0.115	0.141	0.345	0.654
	Labor market	0.566	0.814	0.707	0.946	0.831	0.761	0.955	0.884	0.929	0.84	0.796	0.61	0.309	0.469	0.415	0.07	0.026	0.008	0
	Fiscal			0.14	0.224	0.074	0.411	0.644	0.691	0.654	0.485	0.99	0.084	0.13	0.112	0.457	0.663	0.943	0.794	0.887
Inst		1		0.937		0.875		0.75	0.312	0.812	0.625	0.5	0.125	0.187	0.437	0.375	0.25	0.562	0.687	0

ANNEX B.1

	Azerbaijan	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.964	0.982	1	0.946	0.928	0.892	0.696	0.767	0.642	0.035	0.107	0.071	0.053	0.357	0.214	0.017	0	0.089	0.142
	External	0.375	0.982	1	0.892	0.857	0.732	0.428	0.053	0.017	0.107	0.142	0.16	0.392	0.571	0.464	0.357	0.5	0.41	0.642
Financial	Bank Laverage	0	0.053	0.035	0.017	0.16	0.375	0.178	0.589	0.196	0.303	0.571	0.785	0.857	0.839	0.875	0.946	0.928	0.964	0.982
	Debt stocks	0.232	0.107	0.035	0	0.892	0.482	0.446	0.428	0.464	0.66	0.928	0.982	0.821	0.553	0.75	0.017	0.696	0.607	0.785
	Debt sustainability	0.678	0.839	0.607	0.732	0.91	0.875	0.946	1	0.928	0.785	0.392	0.178	0.017	0.089	0.16	0.142	0.25	0.107	0.035
	Credit		0.892	0.875	0.821	0.785	0.732	0.553	0.178	0.16	0.41	0.482	0.571	0.625	0.589	0.678	0.5	0.321	0.107	0.017
Structural	Basic macro	0.946	0.732	0.625	0.482	0.75	0.714	0.464	0.214	0.232	0.071	0.053	0.41	0.821	0.517	0.696	0.803	0.553	0.589	0.642
	Labor market	0.178	0.446	0.535	0.464	0.946	0.892	0.875	0.839	0.785	0.75	0.732	0.678	0.375	0.142	0.214	0.339	0.285	0.107	0.035
	Fiscal	0.84	0.76	0.9	0.92	0.62	0.64	0.66	0.78	0.58	0.42	0.54	0.44	0	0.24	0.02	0.1	0.34	0.52	0.68
Inst		1		0.875			0.937	0.812	0.562	0.75	0.625	0.687	0.437	0.187	0.25	0.312	0.375	0.5	0.125	0

	Kazakstan	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.714	0.857	0.839	0.785	0.25	0.16	0.125	0.5	0.571	0.821	0.732	0.625	0.446	0.66	0.464	0.267	0.285	0.321	0.41
	External	0.214	0.839	0.964	0.089	0.196	0.589	0.535	0.303	0.035	0.678	0.517	0.66	0.071	0.178	0.696	0.321	0.91	0.946	0.821
Financial	Bank Laverage	0.089	0.267	0.41	0.071	0.25	0.446	0.428	0.625	0.553	0.75	0.535	0.892	0.91	0.107	0.821	0.5	0.732	0.696	0.714
	Debt stocks	0.071	0.053	0.339	0.392	0.589	0.214	0.625	0.91	0.803	1	0.964	0.857	0.571	0.089	0.196	0.25	0.267	0.285	0.142
	Debt sustainability	0.857	0.66	0.482	0.446	0.625	0.571	0.535	0.41	0.321	0.714	0.196	0.642	0.589	0.375	0.5	0.357	0.285	0.428	0.267
	Credit	0.982	0.857	0.91	0.946	0.964	0.839	0.714	0.446	0.464	0.303	0.053	0	0.035	0.125	0.267	0.375	0.392	0.357	0.196
Structural	Basic macro	1	0.892	0.875	0.91	0.785	0.107	0.017	0.142	0.267	0.125	0.035	0.089	0.571	0.66	0.392	0.428	0.5	0.535	0.607
	Labor market	0.964	0.91	0.857	0.821	0.66	0.571	0.517	0.607	0.803	0.642	0.589	0.482	0.303	0.428	0.267	0.053	0.017	0.071	0
	Fiscal					0.94	0.4	0.82	0.46	0.56	0.6	0.18	0.26	0.8	0.98	0.74	0.04	0.14	0.12	0.32
Inst		1		0.75		0.937		0.875	0.562	0.812	0.375	0.437	0.312	0.125	0	0.187	0.5	0.625	0.687	0.25

	Russia	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
External	US	0.053	0.266	0.16	0.32	0.213	0.426	0.906	0.64	0.48	0.106	0	0.373	0.96	0.693	0.533	0.8	0.746	0.586	0.853
	Global	0.178	0.553	0.232	0.303	0.678	0.803	0.875	0.91	0.75	0.482	0.589	0.607	0.392	0.517	0.535	0.339	0.428	0.375	0.196
	External	0.267	0.928	0.767	0	0.232	0.714	0.607	0.285	0.125	0.553	0.482	0.339	0.446	0.25	0.625	0.785	0.875	0.803	0.75
Financial	Bank Laverage	0.321	0.142	0.214	1	0.125	0.357	0.232	0.392	0.464	0.517	0.642	0.678	0.803	0.607	0.339	0.285	0.482	0.66	0.767
	Debt stocks	0.714	0.303	0.946	0.875	0.642	0.732	0.5	0.767	0.517	0.16	0.535	0.839	0.678	0.125	0.375	0.41	0.357	0.321	0.178
	Debt sustainability	0.803	0.767	0.964	0.982	0.821	0.892	0.696	0.75	0.339	0.464	0.232	0	0.303	0.517	0.053	0.071	0.125	0.214	0.553
	Credit	1	0.767	0.75	0.803	0.696	0.66	0.642	0.607	0.535	0.517	0.428	0.339	0.285	0.214	0.25	0.232	0.142	0.089	0.071
Structural	Basic macro	0.857	0.767	0.982	0.964	0.16	0.321	0.446	0.357	0.285	0.339	0.25	0	0.196	0.928	0.375	0.178	0.303	0.678	0.839
	Labor market	0.767	0.982	1	0.928	0.696	0.714	0.625	0.553	0.5	0.41	0.392	0.25	0.196	0.357	0.321	0.232	0.125	0.16	0.089
	Fiscal			1	0.88	0.28	0.3	0.48	0.38	0.2	0.08	0.06	0.16	0.22	0.96	0.86	0.36	0.5	0.72	0.7
Inst		0.866		0.933		1		0	0.266	0.8	0.533	0.4	0.333	0.666	0.733	0.466	0.6	0.2	0.066	0.133

Panel VAR lag order selection on estimate panel for **all countries jointly**

lag	CD	J	J pvalue	MBIC	MAIC	MQIC
1	.678708	30.1253	.3085533	-93.66882	-23.8747	-52.10498
2	.7795728	19.16747	.3815794	-63.36194	-16.83253	-35.65271
3	.5305558	7.387822	.5968097	-33.87689	-10.61218	-20.02227

Panel VAR lag order selection on estimate panel for **oil exporters**

lag	CD	J	J pvalue	MBIC	MAIC	MQIC
1	.702109	31.74543	.2416436	-69.17165	-22.25457	-39.45153
2	.8539326	24.8863	.1280802	-42.39175	-11.1137	-22.57834
3	.8362767	7.41685	.5938041	-26.22218	-10.58315	-16.31547

Panel VAR lag order selection on estimate panel for **oil importers**

lag	CD	J	J pvalue	MBIC	MAIC	MQIC
1	.3362536	26.1258	.5116273	-82.5587	-27.8742	-49.07526
2	.6973095	17.21147	.508614	-55.24486	-18.78853	-32.92258
3	-.046248	10.28301	.3280638	-25.94516	-7.716992	-14.78401

Granger causality for **all countries jointly**

Equation \ Excluded	chi2	df	Prob > chi2
ext			
fin	0.123	1	0.725
struc	4.035	1	0.045
ALL	5.145	2	0.076
fin			
ext	2.516	1	0.113
struc	2.299	1	0.129
ALL	3.282	2	0.194
struc			
ext	10.128	1	0.001
fin	6.447	1	0.011
ALL	11.157	2	0.004

Granger causality for **oil importers**

Equation \ Excluded	chi2	df	Prob > chi2
ext			
fin	3.983	1	0.046
struc	14.313	1	0.000
ALL	17.457	2	0.000
fin			
ext	0.254	1	0.615
struc	3.981	1	0.046
ALL	4.749	2	0.093
struc			
ext	0.807	1	0.369
fin	0.131	1	0.717
ALL	0.807	2	0.668

Granger causality for **oil exporters**

Equation \ Excluded	chi2	df	Prob > chi2
ext			
fin	28.099	1	0.000
struc	0.624	1	0.430
ALL	29.103	2	0.000
fin			
ext	4.092	1	0.043
struc	0.313	1	0.576
ALL	4.565	2	0.102
struc			
ext	11.620	1	0.001
fin	1.293	1	0.255
ALL	18.309	2	0.000

Granger causality for **oil importers (with Inst. Pole)**

Equation \ Excluded	chi2	df	Prob > chi2
ext			
fin	12.401	1	0.000
struc	1.974	1	0.160
inst	25.491	1	0.000
ALL	82.687	3	0.000
fin			
ext	0.000	1	1.000
struc	0.028	1	0.868
inst	1.392	1	0.238
ALL	2.367	3	0.500
struc			
ext	7.813	1	0.005
fin	2.843	1	0.092
inst	4.578	1	0.032
ALL	15.772	3	0.001
inst			
ext	2.823	1	0.093
fin	13.633	1	0.000
struc	8.552	1	0.003
ALL	14.010	3	0.003

Granger causality for **oil exporters (with Inst. Pole)**

Equation \ Excluded	chi2	df	Prob > chi2
ext			
fin	9.019	1	0.003
struc	0.000	1	0.997
inst	0.566	1	0.452
ALL	10.896	3	0.012
fin			
ext	0.372	1	0.542
struc	0.013	1	0.908
inst	0.764	1	0.382
ALL	2.547	3	0.467
struc			
ext	3.111	1	0.078
fin	0.230	1	0.631
inst	8.189	1	0.004
ALL	8.344	3	0.039
inst			
ext	1.742	1	0.187
fin	4.131	1	0.042
struc	0.313	1	0.576
ALL	6.003	3	0.111

Granger causality for **all countries jointly (with Inst. Pole)**

Equation \ Excluded	chi2	df	Prob > chi2
ext			
fin	0.168	1	0.682
struc	1.368	1	0.242
instl	21.756	1	0.000
ALL	26.548	3	0.000
fin			
ext	0.331	1	0.565
struc	0.942	1	0.332
instl	10.103	1	0.001
ALL	14.200	3	0.003
struc			
ext	10.547	1	0.001
fin	0.027	1	0.868
instl	2.160	1	0.142
ALL	11.204	3	0.011
instl			
ext	4.956	1	0.026
fin	0.000	1	0.990
struc	1.691	1	0.194
ALL	6.633	3	0.085