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Spillovers from Global and Regional Shocks to Armenia

by Knarik Ayvazyan and Teresa Dabán

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Spillovers from Global and Regional Shocks to Armenia[1]

Prepared by Knarik Ayvazyan and Teresa Daban

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Abstract

Using a structural vector auto-regression (SVAR) model, this paper examines the size, geographical sources, and transmission channels of global and regional shocks to the Armenian economy. Results show that Armenian economic activity is strongly influenced by global demand shocks and changes in oil prices, yet relatively immune to financial volatility. Transmission takes place through the Russian and EU economies, remittances, and external borrowing. The role of exports and tourism is low. Russia is key in transforming the potentially negative impact of an increase in oil prices into a positive event, through stronger remittances and exports. Services and construction, which depend significantly on remittances and external borrowing, are the most affected by global and regional shocks.

Contents

I. INTRODUCTION

As a small open economy, Armenian economy is highly exposed to global developments, either directly or indirectly through the impact these developments produce in its main trading partners. In addition, Armenia is highly exposed to spillovers from specific shocks that originate in its main trading partners. Despite its relevance, empirical work on global and regional spillovers to the Armenian economy is limited and mostly focuses on describing stylized facts, especially Armenia's large exposure to Russia. To help fill the gap, this paper aims at assessing, in an empirical way, the size, geographical sources, and transmission channels of spillovers from external shocks to Armenia. The goal is to identify the relative contribution of different channels such as trade, remittances, tourism and external borrowing and the role played by different geographical areas such as Russia, the EU and the U.S. The paper aims to answer several questions. First, what is the impact of global shocks on the Armenian economy? Second, what are the countries and regional areas through which this impact takes place? Third, what are the main transmission channels? Fourth, which economic activities in Armenia are most impacted?

These are all important questions, given the substantive increase in Armenia's openness over the past decade. Linkages to Russia and the EU have greatly expanded through trade—especially exports of minerals and metals, tourism, cross-border financing, and remittances. Russia and EU are Armenia's most important trading partners, with Russia being the major source of remittances, FDI, and other financial inflows. As these linkages have strengthened, Armenia's exposure to global and regional shocks has increased. Recent examples of these shocks are: (i) the global financial crisis of 2008–09 and ensuing high volatility in commodity prices; (ii) the geopolitical tensions in Russia and Ukraine in 2014; and (iii) the sharp decline in international oil prices in 2014. Information on the size, geographical sources and transmission channels of these external shocks is important to policymakers to guide the design of macroeconomic policies that help to limit or offset their impact.

In line with recent studies of shocks and spillovers, this paper uses a structural vector auto-regression (SVAR) model. As shown in the paper, this technique is both powerful and robust in measuring the response of Armenian GDP growth to shocks. However, the identification of the relative contribution of different transmission channels and geographical areas poses challenges in the case of Armenia. These derive from the oil-exporting nature of the Russian economy, the EU's high dependence on oil imports, and Armenia's relatively low direct exposure to changes in oil prices. Under these conditions, an increase in international oil prices, which usually is characterized as a negative supply shock in EU countries, may have a positive impact on Armenia, because of increases in Russia's economic activity. In addition, and despite being an energy-importing country, the increase in oil prices may not have a significant negative impact on Armenia's economy, given the high level of gasification, the use of long-term energy supply agreements with Russia, and the prevalence of non-hydrocarbon energy sources (nuclear, hydroelectric). To overcome these identification difficulties, this paper uses the econometric strategy proposed by Bayoumi and Swiston (2009) and Reinout, Daniel and Joel (2010). This strategy relies on the estimation of a *baseline* SVAR to capture the impact of global GDP growth on Armenian growth, which is augmented one at a time with data on different sectoral and regional factors.

The findings show a strong response of Armenia's real GDP growth to shocks to global GDP growth and commodity prices, while it remains relatively immune to instability in international financial markets. Impacts are mainly transmitted through the Russian and EU economies and through remittances and external borrowing. The role of exports and tourism remains low. Russia is important in transforming the negative impact of an increase in oil prices into a positive event in Armenia, through stronger Armenian remittances and exports. Services and construction are the two sectors that depend the most on remittances and external borrowing and are the most affected by global and regional shocks.

The paper is organized as follows. Section II provides background on the stylized facts regarding spillovers of global and regional shocks to the Armenian economy and on the main transmission channels. Section III describes the modeling technique. It also presents the sectoral analysis and provides data information. Section IV shows the main econometric results. Section V concludes.

II. GLOBAL AND REGIONAL SHOCKS AND TRANSMISSION CHANNELS TO THE ARMENIAN ECONOMY

A. Global and Regional Shocks

Armenia is a small economy with a relatively high degree of openness, especially when compared to peer countries (Table 1). All key external flow variables, including exports, imports, remittances, and FDI are sizeable in Armenia. This implies that global economic developments affect substantially the Armenian economy, either directly or indirectly through the impact that global developments have on Armenia's main trading partners.

Table 1: Economy openness in Selected Countries (2010-2013) (In percent of GDP)				
	FDI	Remittances	Export	Trade 1/
Commonwealth of Independent States (CIS)	3.4	1.1	34.8	62.0
CIS (non oil producing)	4.1	6.9	53.5	116.3
Middle income	0.9	0.4	8.9	59.7
High income	2.0	0.3	31.8	59.5
Europe & Central Asia (developing only)	2.8	2.0	40.9	81.6
World	2.3	0.7	31.0	59.7
Armenia	**5.2**	**19.0**	**24.0**	**72.2**
Georgia	6.6	11.0	38.5	94.3
Kyrgyz Republic	8.2	28.2	51.5	138.5
Tajikistan	1.1	45.1	18.5	82.8

Source: World Bank's World Development Indicators
1/ Trade refers to the sum of imports and exports

As a result, economic activity in Armenia usually displays strong co-movement with global activity and with the activity of its main trading partners, including Russia, the EU and the U.S. Figure 1 and Table 2 show that the correlation coefficients between annual GDP growth in Armenia and in trading partners are high, and consistent with world shocks having a material influence on Armenia.

Table 2: Co-movement of Armenia GDP growth with Selected Countries, 2001q1–2014q1[1]					
Cross-correlation of GDP yoy growth in period *t* and trading partners, world GDP yoy growth in period:					
	t-2	t-1	t	t+1	t+2
Russia	0.6	0.8	**0.88**	0.73	0.51
EU	0.63	**0.75**	0.74	0.62	0.36
US	0.62	**0.69**	0.67	0.48	0.29
World	0.61	0.78	**0.81**	0.66	0.39

Source: Authors' calculations.
[1] Figures in bold denote the highest correlation for each row.

Figure 1: Real GDP growth (yoy) in Armenia, Key Trading Partners, and the World GDP
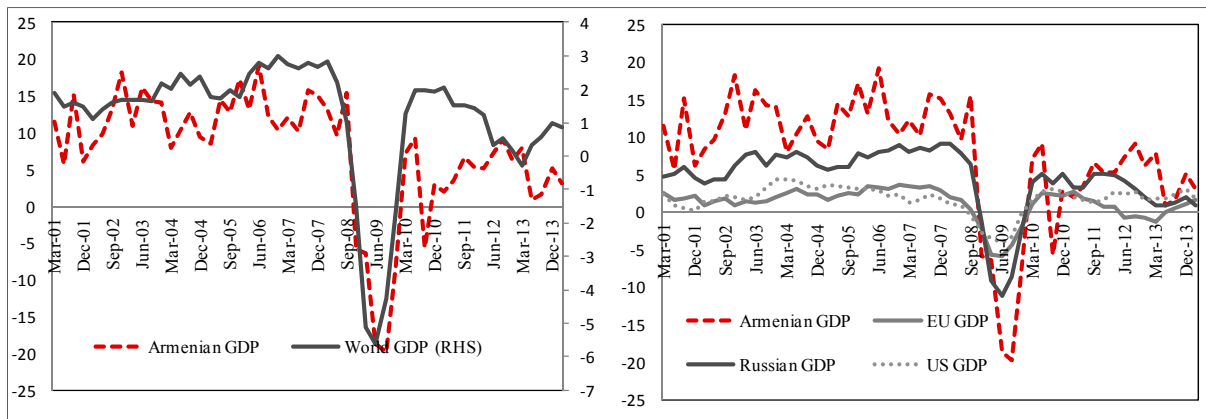
Source: Countries' statistical services and authors' calculations.

Recent global and regional events have demonstrated Armenia's sensitivity to external shocks. The global financial crisis of 2008–2009 and high volatility of commodity prices during 2008–2011 (Figure 2) hit the Armenian economy hard. From the onset of the crisis, remittances and capital inflows declined dramatically and the exchange rate depreciated. Purchasing power weakened, which reduced significantly consumption and activity in the construction sector (the main growth driver during the pre-crisis period).

Figure 2: Commodity prices (2005=100)
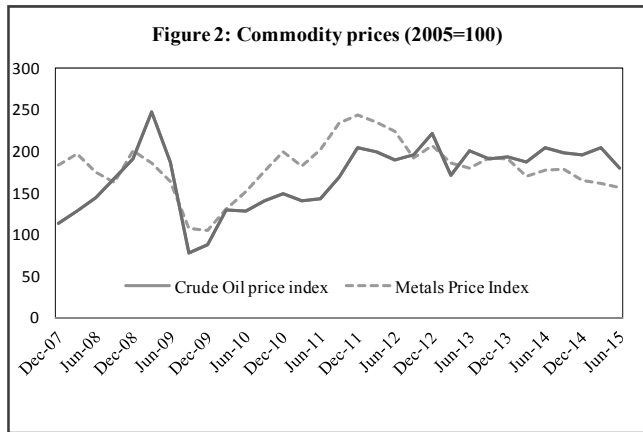
Source: IMF.

Export-oriented industrial sectors, such as mining and metallurgy were also hit hard, reflecting lower prices and weak global demand. As a result, the economy contracted by 14.1 percent in 2009, the second largest contraction of GDP during the crisis in the world, after Ukraine. The

contraction triggered a decline of tax revenues and the implementation of supportive macroeconomic policies that led to large increases in the fiscal deficit and public debt and a reduction in international reserves.

At the regional level, the escalation of tensions between Russia and Ukraine in 2014 and the decline in international oil prices also affected Armenia. These developments led to an increase in uncertainty about Russia's economy and a downgrading of Russia's growth forecasts.

Figure 3: Oil price and Ruble/US$ Exchange Rate in 2014
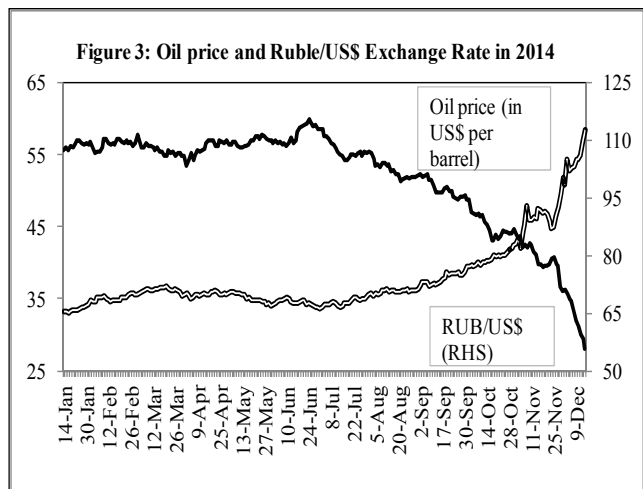
Source: IMF.

They led, along with sanctions and the appreciation of US dollar vis-a-vis emerging market currencies, to a reduction in external funding available for Russian companies and banks and depreciation of the ruble (Figure 3). Neighboring countries have been affected by these developments. In the case of Armenia, the most visible signs so far have been the significant deceleration in remittances and exports and the depreciation of the exchange rate in late 2014 (Figure 4).

Figure 4: Armenia's Remittances and Exchange Rate Developments
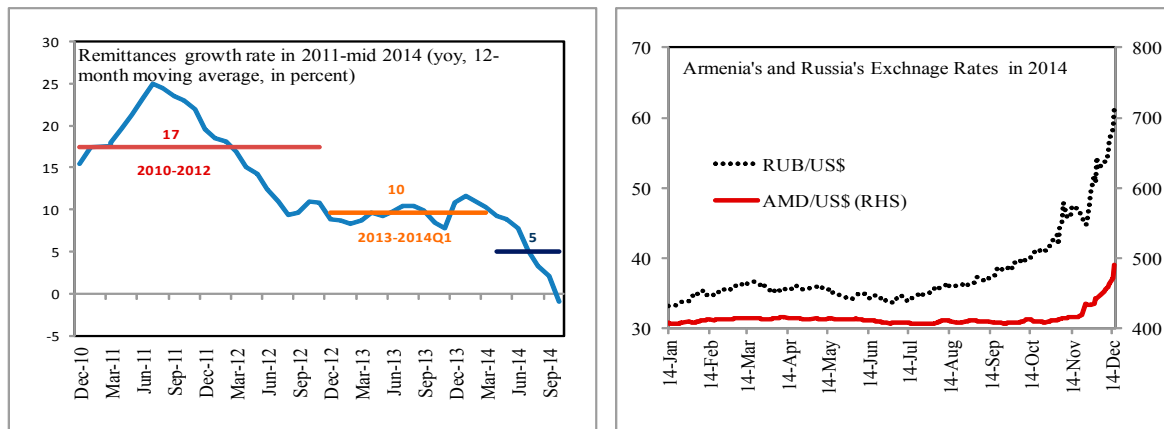
Source: Central Bank of Armenia, Central Bank of Russia

B. The Main Transmission Channels: Links with Trading Partners

Trade

In terms of the geographical structure, the EU is the main destination of Armenian exports (Figure 5). The EU's average share in Armenian exports for the period 2010–2013 was 41 percent, quite above the share of Armenia exports to Russia, which accounts for 23 percent of total exports. Germany is the EU country that absorbs the largest part of Armenian exports, accounting for 22.5 percent of total Armenian exports to the EU. As regards imports, the geographical structure is more diversified, with the EU accounting for 26 percent of total imports and Russia for 18 percent. When considered altogether, Russia and other post-Soviet countries account for the largest share of Armenian imports, around 31 percent.

Figure 5: Armenia: Geographical Structure of External Trade 2010–2013
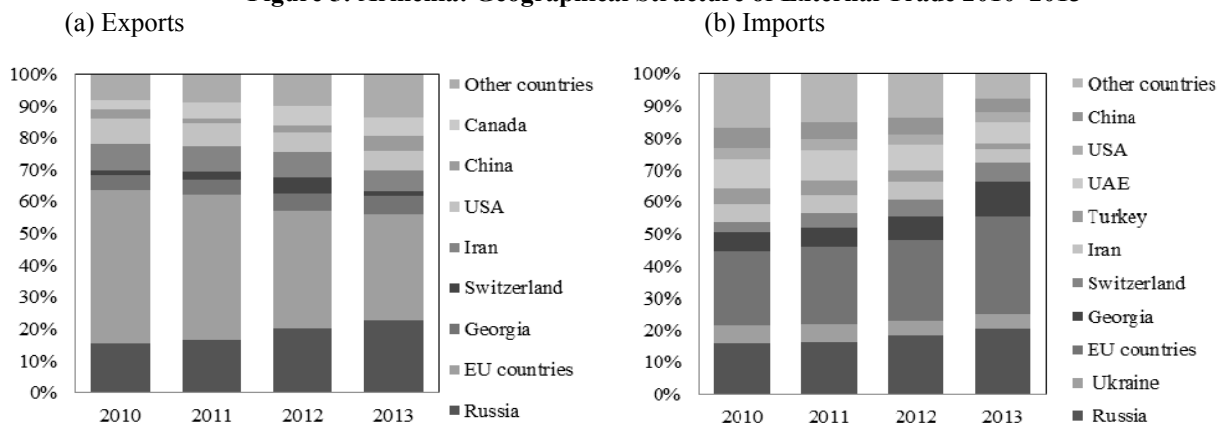
(a) Exports   (b) Imports

Source: National Statistical Service (NSS) of the Republic of Armenia and author's calculations.

In the last few years, commodities have increased their shares in Armenian exports and imports (Figure 6). A significant part of EU exports consists of ores and metals. Fluctuations of commodity prices in international markets therefore affect the value and volume of exports to the EU, and economic activity in Armenia. Exports to Russia, however, tend to concentrate on processed goods, suggesting less exposure to changes in commodity prices.

Figure 6: Armenia: Structure of External Trade by Type of Products 2010–2013

(a) Exports

(b) Imports

Source: National Statistical Service (NSS) and authors' calculations

Imports of energy inputs, including natural gas, oil, petroleum products, and nuclear fuel are sizeable. Russia plays a major role as a supplier. Armenia imports 80 percent of its gas from Russia (the remainder is imported from Iran via a gas-for-electricity transaction). Armenia has no oil refining capacity, and Russian companies supply most of the petroleum products used in Armenia.

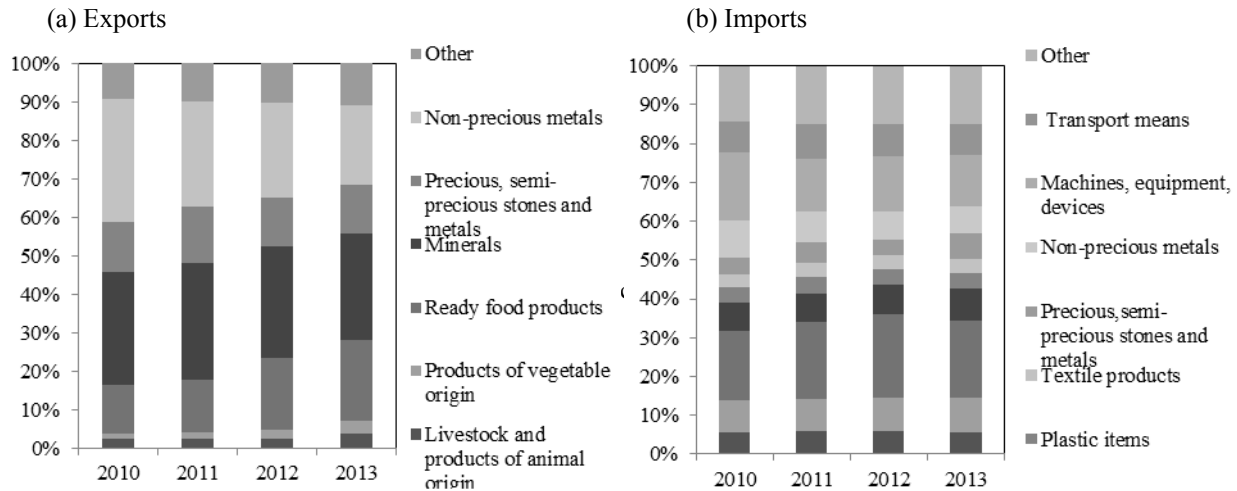Despite Armenia's dependence on imported energy, the economy exhibits a relative isolation from increases in oil price shocks. This is the result of : (i) high level of gasification, especially in transport, because of the favorable taxation enjoyed by Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) in comparison to other fuels (most motor vehicles have switched from gasoline and diesel to gas); (ii) the provision of gas to Armenia has been typically through five-year agreements with Russia, with pre-agreed gas prices that are maintained during the period; and (iii) a prevalence of non-hydrocarbon energy sources (nuclear, hydroelectric) for electricity generation. Historically, these factors have mitigated the impact of increases in international oil prices on the Armenian economy.

Remittances[2]

Remittances are another important transmission channel. They have increased significantly since 2004, especially from Russia (Figure 7), from which at present originates almost 90 percent of total remittances. Although remittances have provided a relatively stable source of external

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[2]This term refers to non-commercial money inflows made by individuals through the banking system.

financing, they have exhibited significant volatility, notably with the global downturn in 2008–2009. During 2010–2013, remittances averaged 15–20 percent of GDP, with a U.S. dollar value that is 22.2 percent higher than total exports, 3.7 times higher than FDI net inflows, and almost equal to external borrowing. Remittances are equivalent to 43 percent of Armenia's total imports.

Figure 7: Armenia: Remittance Net Inflows (In million of Armenian drams)
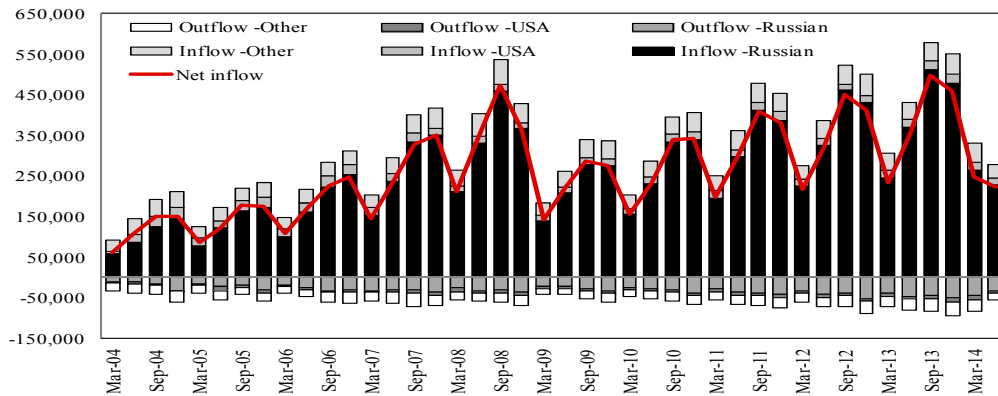
Source: Central Bank of Armenia (CBA).

Historically, remittances have exhibited a growth rate that is highly correlated with Russian nominal GDP growth (Figure 8). This correlation has strengthened even further since the global crisis of 2008–2009, reaching 0.95 in the period 2009–2013. Growth of remittances has also shown a high correlation with Armenian GDP growth (Figure 9).

Figure 8: Growth Rates (yoy) of Russian Nominal GDP and Armenian Remittances (In percent)
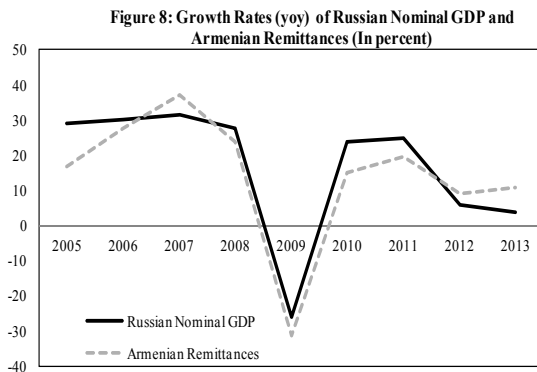
Source: Federal State Statistics Service of Russia and Central Bank of Armenia

Figure 9: Growth Rates (yoy) of Armenian Nominal GDP and Armenian Remittances (In percent)
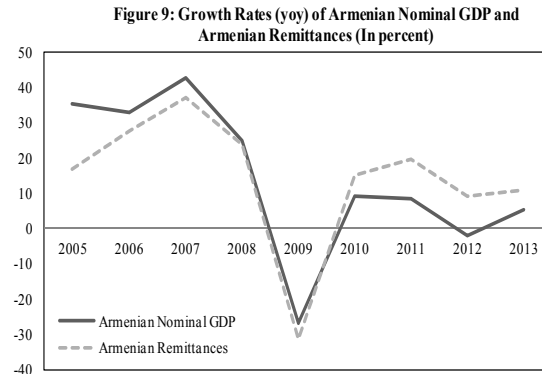
Source: Armenia's National Statistical Service.

Financial account

Another important transmission channel for external economic developments is the capital account. Armenia has an open capital account, critical to financing Armenia's large external current account deficit. The main items of the financial account are FDI net inflows and external borrowing. Historically, both have played an important role in providing funding to the public and private sectors. Portfolio investment has been negligible, except for the issuances of Eurobond in 2013 and 2015 (Figure 10).

Figure 10: Armenia Capital Inflows In percent of GDP
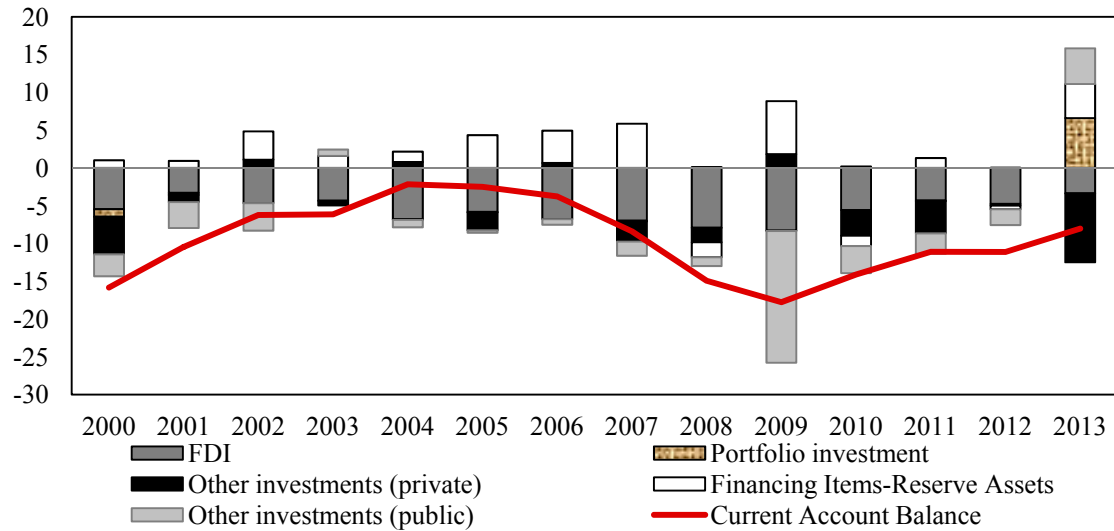
Source: Central Bank of Armenia.

FDI inflows have been relatively large (around 5 percent of GDP), but volatile, with a reduction in recent years, following the conclusion of privatization. Inflows have mainly originated from Russian investors, which account for 57 percent of the total FDI stock (Figure 11), followed by France (7 percent), Argentina (6 percent), Germany (4 percent) and Switzerland (3 percent). Although some studies (e.g., Arslanalp and Poghosyan (2014)) identify FDI inflows as an important transmission channel of global and regional shocks, this paper considers that the effect of FDI inflows are structural in nature and with an impact on growth that materializes only in the medium to long term. Therefore, this paper does not include them in the analysis of the sensitivity of Armenian economic activity to shocks.

External borrowing historically has played a greater role than FDI in funding Armenian private and public sectors, and the stock of external debt is relatively large (Figure 11). In principle, one might expect that the link between external borrowing and the business cycle in Armenia might be weak, as most public debt has a long maturity, with a high degree of concessionality and is used to finance capital projects. In addition, most banks' external borrowing still takes the form of loans with IFIs to support access to finance. However, in practice, it is also possible to expect a link between external borrowing and the business cycle, as borrowing usually increases in response to external shocks, either because of larger fiscal deficits or higher recourse to bank borrowing by households. External borrowing is an important source of financing for the budget and for the domestic banking system, with the impact on GDP mainly through budgetary capital spending and lending to the economy, respectively.

Figure 11: Armenia: External Borrowing and FDI Geographical Composition
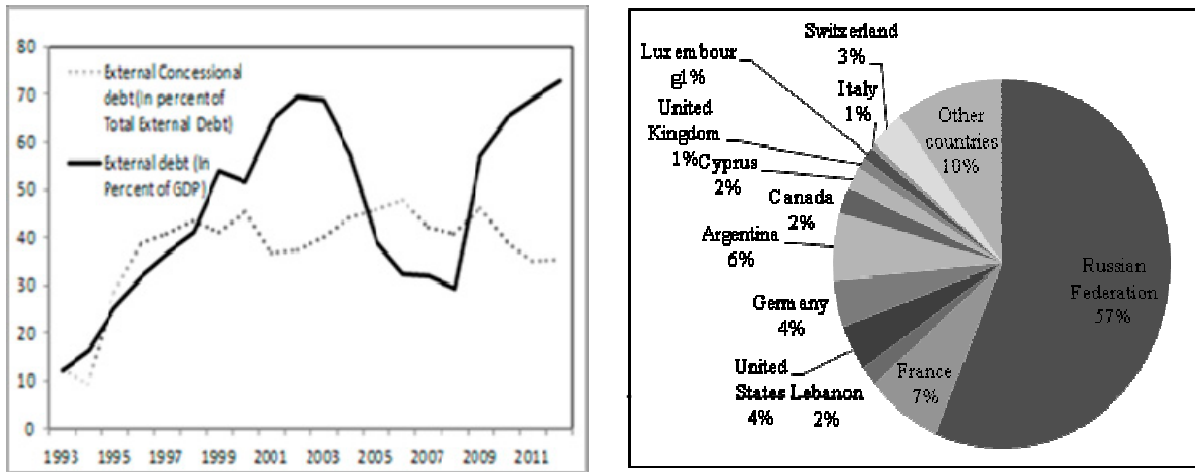
Source: Armenia's National Statistical Service and Central Bank of Armenia.

Banking system

In many countries, the banking system is an important transmission channel of spillovers from global and regional shocks. The power of this channel depends on the integration of the banking system into international and regional capital markets, the share of foreign investors in bank liabilities, and the general soundness of the banking system. In the case of Armenia, the transmission of external shocks through the banking system appears to be limited. First, Armenian banks are largely funded with domestic deposits, with limited exposure to international financial markets. Second, the banking system is not one of the economic sectors that have received significant FDI inflows in recent years (see Figure 12).

Figure 12: Armenia: Structure of FDI Stocks and Flows
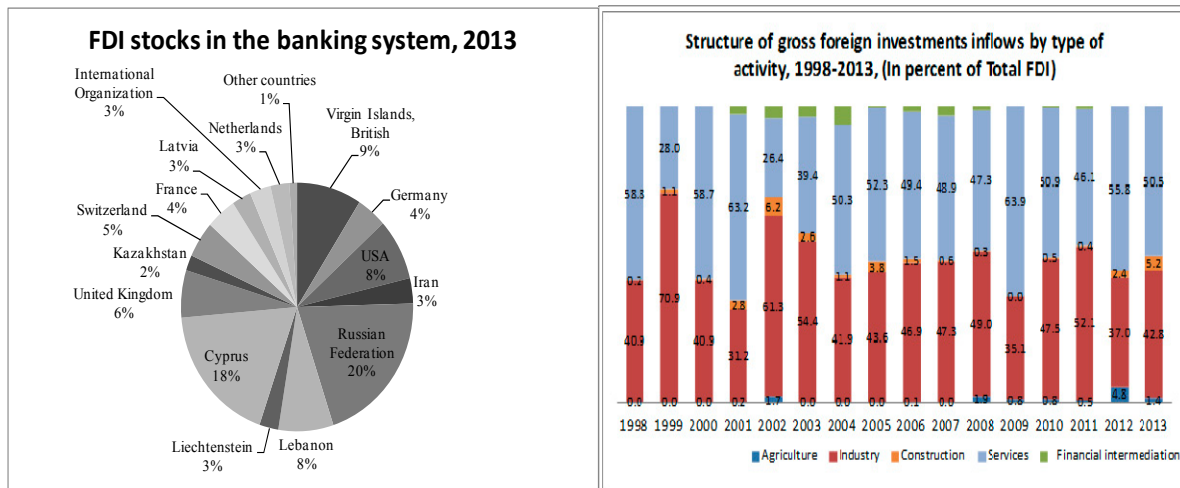
Source: Armenia's National Statistical Service.

Moreover, although foreign participation[3] in bank statutory capital is large (74.6 percent at the end of 2013, with Russia as the biggest shareholder, see Figure 12), the operations of the foreign-owned Armenian banks are small compared to the size of their parent banks. Under these circumstances, it is unlikely that parent banks would withdraw liquidity from Armenian subsidiaries in a situation of stress, although they may not provide new or additional liquidity. Therefore, this paper does not include the banking channel in the analysis of the sensitivity of the Armenian economy to global and regional shocks.

III. ESTIMATION AND IDENTIFICATION TECHNIQUES

A. The baseline Structural Vector Auto-regression Model

A frequently used approach to identifying the nature and impacts of macroeconomic shocks is the structural vector auto-regression (SVAR) model[4], which helps capture interconnectedness and endogeneity. SVAR models provide a framework in which all variables can, in principle, be affected by each other, helping capture interdependence. The paper's starting point is a *baseline* SVAR model that estimates the impact of global shocks on Armenian non-agricultural GDP growth. Following Chowla, Quaglietti and Rachel (2014), the *baseline* SVAR includes three types of shocks: (i) *world demand shocks*, which are represented by changes in the growth rate of an indicator of world GDP; (ii*) world supply shocks*, which are given by changes in an indicator of international commodity prices; and (iii) *world financial shocks*, represented by changes in international financial conditions (see Annex I for an overview of relevant literature). The *baseline* SVAR imposes structure on the data, which helps trace shock impacts on Armenian GDP growth.

Following Blanchard and Quah (1989), the variables included in the *baseline* SVAR are ordered as:

$$Z_t = \left[\Delta P_t^{world}, \Delta Y_t^{world}, \Delta F_t^{world} \ \Delta Y_t^{Armenia} \right].$$

Where ΔP_t^{world} is the change in world commodity prices indicator, ΔY_t^{world} is the growth rate of an indicator of world economic activity, ΔF_t^{world} is the change in an indicator of international financial conditions, and $\Delta Y_t^{Armenia}$ is the growth rate in Armenia's non-agricultural real GDP.[5]

The reduced-form SVAR is:

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[3] The financial system in Armenia is dominated by a relatively fragmented banking sector with 89.5 percent of assets held by 22 commercial banks. Non-banking financial sector on the other hand is considered to be underdeveloped.

[4] Sims (1980), for instance, proposes the use of VAR models to capture the endogeneity of macroeconomic variables.

[5] The empirical analysis is conducted with "non-agricultural GDP" rather than with total GDP because of the high volatility of agribusiness in Armenia and great dependence of agriculture output on weather conditions. We do not believe this is affecting our analysis of transmission channels because, according to the business community testimony and trade data, exports of agribusiness products to Russia and the EU are more dependent of the availability of supply on the Armenian side than on demand conditions in trading partners.

$$Z_t = c + \sum_{j=1}^{p} B_t Z_{t-j} + u_t, \quad E(u_t u_t') = V$$

Where c is a constant and Z_t is the matrix of variables. The reduced-form residuals u_t are mapped into the structural shocks ε_t by the structural matrix A_0:

$$\varepsilon_t = A_0 u_t.$$

The inverse of the Choleski factor of the variance-covariance matrix V identifies structural shocks that are orthogonal to each other, i.e. $E(\varepsilon_t \varepsilon_t') = I$, where I is the identity matrix. The long-run effects of the structural shocks are given by: $Z_\infty = \Theta \varepsilon_t$. This is equivalent to assuming that the impact of structural shocks in Armenian non-agricultural GDP has zero effects on shocks in the world economy. In other words, under our *baseline* SVAR model the real growth rate of Armenian non-agricultural GDP is affected by world shocks, yet it does not have any influence on world economic activity.

B. Decomposition of Spillovers by Geographical Areas and Transmission Channels

To identify the contribution of different geographical areas, most empirical studies based on SVAR models estimate an *augmented* SVAR that results from adding to the *baseline* SVAR the growth rates of the GDP of key neighboring regions. A useful example is Adler and Sosa (2012), which analyzes the impact of Brazil and Mexico on other Latin American countries. In the case of Armenia, the *augmented* SVAR would include the real GDP growth of main trading partners, such as Russia, the EU and US. The identification of structural parameters in an *augmented SVAR* is relatively straightforward in most regions, such as in Latin America, given limited intra-regional trade and similar sensitivity to moves in international commodity prices (e.g., both Mexico and Brazil benefit from an increase in commodity prices). However, in the case of Armenia, there are several specificities that make it difficult to support the assumption that structural shocks are orthogonal to each other in an *augmented* SVAR. These include: (i) strong trade flows between the EU and Russia, and especially strong dependence of the Russian economy on growth in the EU; (ii) different impacts of an increase in commodity prices, and especially oil prices, in the EU and in Russia; and (iii) Armenia's relative isolation from oil price shocks.

To address these identification difficulties, this paper follows the approach of Bayoumi and Swiston (2009) to identifying the contribution of different geographical areas to the impact of world shocks on Armenian economic activity. Under this approach, the *baseline* SVAR is augmented *one at a time* with data on the real GDP growth of EU, Russia and US. The potential contribution c_g of the real GDP growth of a particular geographical area g is then calculated as:

$$c_g = r - r_g.$$

where g = Russia, the EU, and the US. The contribution of each geographical area is estimated as the difference between r, which is the impulse response of Armenian non-agriculture GDP growth to a change in world economic activity under the *baseline* SVAR, and r_g, which is the impulse response of Armenian non-agriculture GDP growth to world GDP growth under the *augmented* SVAR that includes as an exogenous variable the real GDP growth of the

geographical area *g*. The idea is that adding the exogenous variable to the SVAR leaves in r_g the part of the response that is not associated with the growth of the geographical area *g* (Figure 13).

Figure 13: Bayoumi and SwistonApproach
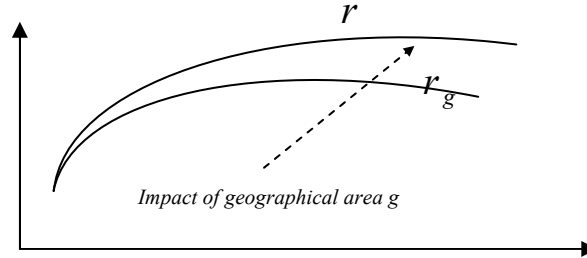
Source: Bayoumi and Swiston (2009)

This paper also uses the Bayoumi and Swiston (2009) approach to decompose the impact of world shocks on Armenian economic activity into the contribution of different transmission channels, including trade (exports), tourism net revenues, remittances net inflows and net external borrowing. To that end, the *baseline* SVAR will also be *augmented one at a time* with data on these transmission channels. As in the case of geographical areas, the potential contribution c_t of the real GDP growth of a particular transmission channel *t* is then calculated as:

$$c_t = r - r_t.$$

where t = trade, tourism, remittances, and external borrowing. The contribution of each transmission channel is estimated as the difference between *r,* which is the impulse response of Armenia non-agriculture GDP growth to a change in world economic activity under the *baseline* SVAR, and r_t, which is the impulse response of Armenia non-agriculture GDP growth to world GDP growth under the *augmented* SVAR that includes as an exogenous variable the time series of the transmission channel *t*.

The Bayoumi and Swistom (2009) approach has some caveats. It does not exclude the existence of other relevant geographical areas or transmission channels. In addition, it does not account for potential *collinearity* among the different geographical areas and transmission channels. This approach also implies that the sources of spillovers c_g and c_t are not necessarily required to sum up to the impulse response *r*. In other words, it should not be interpreted as a precise decomposition of the impulse response under the *baseline* SVAR. However, it is a useful technique to gauge the relative importance of major transmission channels and the impact of different geographical areas as part of the impact of global shocks.

C. Sectoral Analysis

This paper also aims to identify the Armenian economic sectors that are most affected by global and regional spillovers. To that end, the paper estimates three SVAR models, one each for industry, construction and services. These three *sectoral* SVAR models are similar to the *baseline* SVAR estimated for the whole economy. The main difference is that the three *sectoral*

baseline SVAR include the real GDP growth rates of the three sectors, ΔY_t^S (where s= services, construction and industry). To that end, and again drawing on Bayoumi and Swiston (2009), the paper develops three *sectoral augmented* SVAR models which will include *one at a time* the time series of transmission channels.

D. Data

Estimations are conducted using two sets of variables. The dataset contains real GDP (non-agricultural), real value added in services, construction and industry), and balance of payment statistics time series, including exports, tourism net revenues, remittances net inflows, and the net external borrowing by the private sector. The world and regional dataset includes an indicator of world economic activity (computed as the weighted average GDP of Armenia's trading partners, weighted by their shares in Armenian exports)[6], a world commodity price index (given by the IMF's crude oil prices index), and an indicator of international financial market conditions (given by the VIX, which measures investor risk aversion). It includes as well real GDP series for the EU, Russia and the U.S. Data are quarterly for 2000Q1 to 2014Q1. Armenian time series have been obtained from Central Bank of Armenia and National Statistical Service of Armenia. World and regional data have been taken from IMF, WB, and the Federal State Statistics Service of the Russian Federation, the U.S. Bureau of Economic Analysis, and Eurostat.

IV. ECONOMETRIC RESULTS

What is the overall impact of global shocks on Armenian economy?

To respond to this question, we estimate the *baseline* SVAR model by including in Z four variables: the change in the IMF crude oil prices index, the growth rate of weighted-average world GDP, the change in the VIX index and the growth rate of Armenia's real non-agricultural GDP. The estimation includes two lags, which according to Schwarz information criteria is the optimal lag length.

Table 3 shows the response of growth of Armenian real GDP (non-agricultural) to a structural one standard deviation (SDA) shock in the growth of world GDP and changes in both, the international oil prices index and VIX. According to the first column in Table 3, the effect of a crude oil shock on Armenian economic growth is immediate (just after the first quarter), reaching its peak in the second quarter and persistent throughout ten quarters. As a result of a one standard deviation (SDA) shock to oil prices, Armenian growth accelerates by 0.548 percentage points after the first quarter. The maximum impact is realized after the second quarter at 2.29 percentage points. The full effect after ten quarters is about 0.01. Figure 14 shows the

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[6] We believe that the weighted average of the GDP of Armenia's main trading partners is a good indicator to capture the influence of foreign developments in Armenian economy. For instance, the weight of exports to the EU in Armenia's total exports is around 33.4 percent, while the weight of EU GDP in total world GDP (based on IMF methodology) it is only 13.1 percent. Similarly, Russia's, USA's and China's weights in Armenia's exports stand at 22.6 percent, 6 percent and 4.7 percent respectively, while their shares in world GDP (based on IMF methodology) are only 2.9 percent,19.3 percent and 15.4 percent.

accumulated response to the shock in oil prices. This strong positive response seems counterintuitive. Given that Armenia is an oil-importing country, one would expect that an increase in oil prices should have an adverse impact on growth. However, this is more than offset by several factors: (i) the positive impact that an increase in oil prices produces on Russian growth, and therefore on Armenian remittances, exports and external borrowing originating in Russia; (ii) Armenia's relative isolation for a direct impact of changes in international oil prices, as explained before; and (iii) co-movement of oil and metal prices, which implies that increases in oil prices are usually associated with increases in Armenian's mining exports.

Table 3: Impulse response of growth of Armenian real GDP to a one standard deviation shock		
Crude Oil (C1)	World demand (C2)	Financial volatility (C3)
Q1 0.548	1.096	0.069
Q2 2.290	0.044	-0.760
Q3 1.555	1.914	0.027
Q4 0.753	0.815	0.171
Q5 -0.141	0.466	0.104
Q6 -0.262	-0.143	-0.035
Q7 -0.243	-0.094	-0.046
Q8 -0.092	-0.157	-0.038
Q9 -0.040	-0.035	-0.006
Q10 0.010	-0.027	-0.001

Figure 14: Cumulative Response of Armenian Real GDP Growth to one Structural SDA Shock
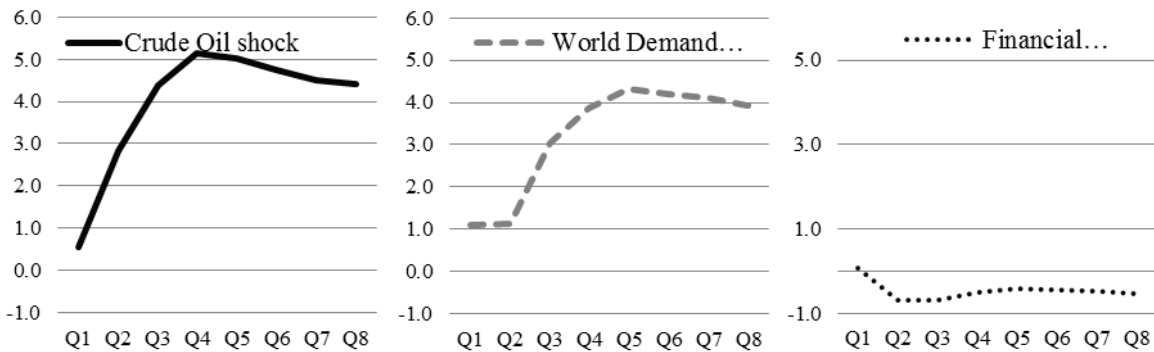
Source: Authors' estimates.

Global demand shocks also have a significant effect on Armenian economic growth. As illustrated by the second column of Table 3, a SDA shock of 0.42 to global demand growth leads to a 1.096 percentage point increase in Armenian economic growth after the first quarter. Although the initial impact of global demand shocks is small, its effects accumulate over time. After two years, Armenian's accumulated response to a change in world demand growth is 3.9 percentage points (Figure 14). This reflects the spillovers through trade, remittance, tourism, and FDI, and bank linkages, from stronger (or weaker) growth in the EU and Russia, which are Armenia's key trading partners and main sources of remittances and FDI. Financial uncertainty shocks only have a modest effect on Armenian economic growth. The third column of Table 3 shows that the immediate effect is almost zero but the impact gradually becomes noticeable over time. Following a SDA shock to VIX index, Armenia's real GDP growth is affected negatively and decelerates by -0.076 after the second quarter. The accumulated effect stabilizes around -0.5 (Figure 14). This is an expected result given Armenia's low level of global financial integration.

What are the geographical areas through which global shocks affect Armenian economy?

To identify the contribution of different geographical areas to the impact of global shocks, we estimate an *augmented* SVAR by including, *one at time*, the growth rates of Russian, EU and US real GDP. Then we estimate the different contributions, c_g, which are shown in Figure 15. As explained before, the contributions derived from each geographical area should not be interpreted as a *precise* decomposition of the impulse response under the baseline SVAR, but they can be used to assess their relative importance. Results indicate that in the short-term, (i.e. two quarters) the contributions of the EU and Russian growth rates to Armenia's GDP growth (non-agricultural) are relatively similar in size. This could be interpreted as follows: the impact of one SDA shock (i.e. 0.42 percentage points) to global demand on Armenian economic growth after first quarter could be split, into a 36 percent due to the EU and 64 percentage point to Russia, with negligible impact from other trading partners. Over a period of 8 quarters, Russia's contribution to a global demand shocks is considerable larger, accounting for almost 70 percent (or 2.7 percentage points) of spillovers from global demand shocks, while the EU only accounts for 21 percent (or 0.8 percentage points) and the US for only 3 percent (0.1 percentage point).

Figure 15: Decomposition of Spillovers by Main Trading Partners:
Cumulative Response of Armenian GDP Growth to a World Demand Shock
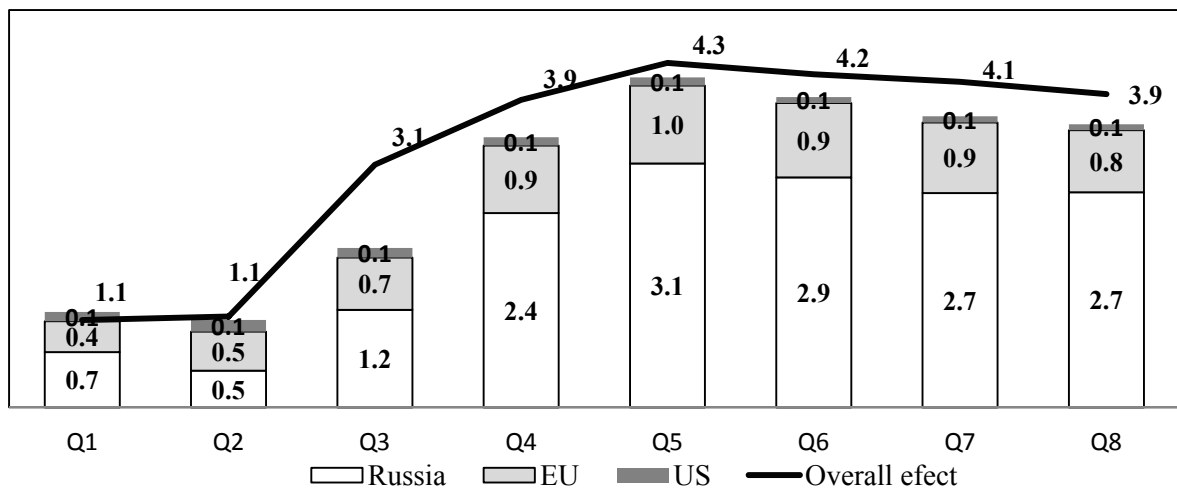
Source: Authors' calculations.

What were the transmission channels through which global shocks impact Armenia?

To identify the contribution of different transmission channels to the impact of a global demand shock on Armenia's GDP growth, we estimate the *augmented* SVAR including *one at a time* data on trade, tourism, remittances and external borrowing, as exogenous variables in separate SVAR runs. The results in Figure 16 show that both remittances and external borrowing account for the largest shares of the total impact of global GDP shocks. The two channels are responsible for the transmission of 28 percent and 31 percent, respectively, of the spillovers from global GDP shocks, while exports and tourism have smaller contributions, in the range of 10 percent. This could be interpreted as follows: a SDA shock of 0.42 to global demand growth leads to a

1.1 percentage point increase in Armenian economic growth after the first quarter. The accumulated effect of a one SDA shock to global demand on Armenian economic growth stabilizes around 3.9 percentage points after the 8 quarters. Remittances would explain 28 percent of the impact (1.1 percentage points out of the 3.9 percentage points) while external borrowing would explain 31 percent (1.2 percentage points out of 3.9 percentage points). Exports and tourism would account for only 10 percent of the total impact (0.4 percentage points each). The impact of remittances and external borrowing are particularly important over the longer terms, after one year or beyond.

**Figure 16: Decomposition of Spillovers by Transmission Channels:
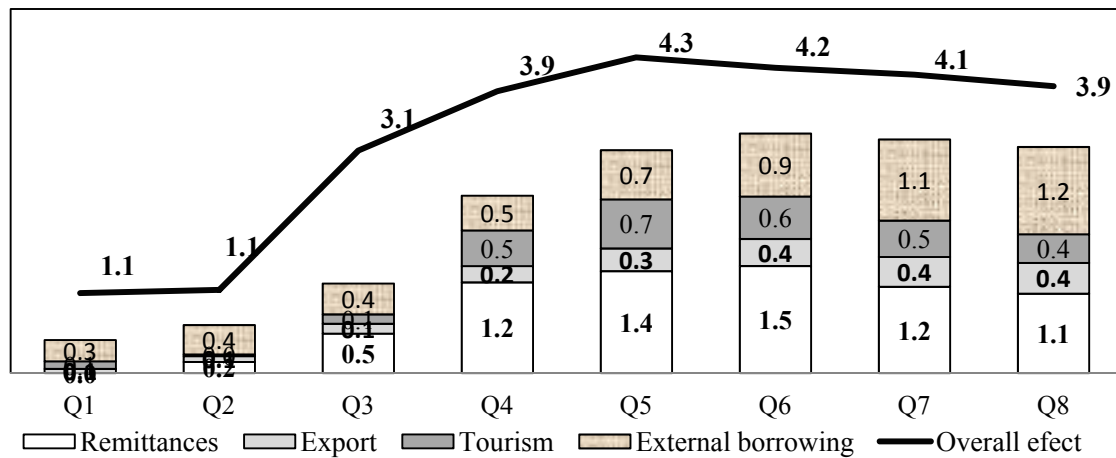Cumulative Response of Armenian GDP Growth to a World Demand Shock**

Source: Authors' calculations.

What are the Armenian economic activities that are affected the most by global and regional spillovers?

Not all of the Armenian non-agriculture sectors are affected in the same magnitude and time horizon by global shocks. Empirical results, obtained from estimating *sectoral baseline* SVAR models for each non-agricultural sector, show that the sector that is affected the most is construction (Figure 17), followed by services and then by industry. Moreover, empirical results show that transmission channels operate in different ways depending on economic sectors. Regarding services, the empirical results show that remittances and external borrowing are the major contributors to the impact of global demand shocks. External borrowing and remittances explain about 54 percent and 21 percent respectively of the impact of global demand shocks in the growth rate of services value added. The contributions of exports and tourism revenues are relatively small. This could be the result of the expected large influence that remittances and external borrowing would have on households' disposable income. In particular, external borrowing is likely to support consumer income through higher bank financing (as part of banks' external borrowing take the form of loans with IFIs that are onlent to firms and individuals).

As regards construction, results show that remittances are the major contributors to the impact of global shocks. This could be the result of the significant role that remittances played to finance the construction boom that Armenia experienced in the pre-crisis years. Remittances explain

almost 30 percent of the impact of global demand shocks in construction activity. External borrowing is also an important contributing factor, accounting for 27 percent of the total impact. Only 5.7 percent of the impact of external demand shocks in construction growth is transmitted through exports of goods and services.

The industry sector shows weak reactions to changes in world GDP. The main contributing factor seems to be external borrowing, which accounts for 25 percent of the total impact, followed by exports and remittances. Export shocks do not seem to play a major role in transmitting the impact of global growth into Armenian industry. This could be explained by the dominance of supply shocks over demand shocks in Armenian export-oriented industries, especially mining. The growth of mining output in Armenia, which is one of the driving forces of Armenian exports and industry, seems to depend more on the international prices of metals and minerals than on the growth of world demand.

Figure 17: Decomposition of Spillovers by Transmission Channels:
Cumulative Response of Sector Growth to a World Demand Shock
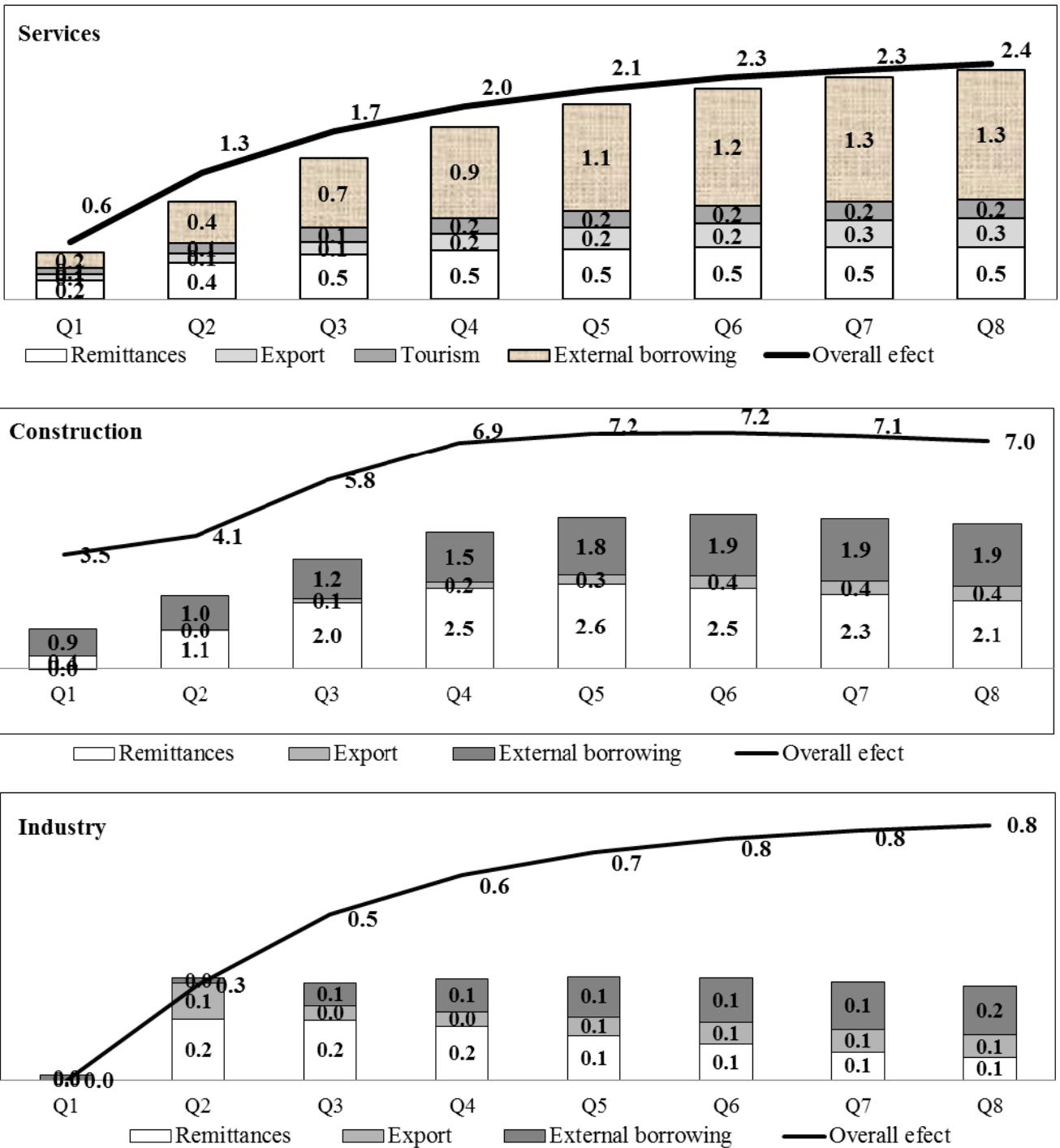
Source: Authors' calculations.

V. CONCLUSION

Using a SVAR model, this paper examines the size, geographical sources and transmission channels of global and regional shocks to Armenian economy. Results show that the impact of global demand shocks is sizeable and long-lasting. The impact is mainly transmitted through the Russian and EU economies, two of the world's geographical areas with the strongest trade, tourism, remittances and financial linkages with Armenia. These two regions account for 70 and 21 percent of the total impact respectively. Russia is important in transforming the negative impact of an increase in oil prices into a positive event in Armenia. This is because the negative impact that higher oil prices may have on the Armenian oil bill are more than offset by the positive effect that the oil price surges usually have on Russian growth rate, and therefore on Armenia's remittances, exports, financing, and economic growth. Our analysis also shows that remittances and external borrowing are the main transmission channels of spillovers from global shocks to Armenian economy, explaining 28 and 31 percent of total impact respectively, while the role of exports and tourism remains low. Consistently, services and construction, which are the two sectors that depend the most on remittances and external borrowing, are the most affected by global shocks.

Our analysis also provides useful insights on the potential impact of ongoing and expected global and regional developments on the Armenian economy. Some *global developments,* such as the normalization of monetary policies in advanced economies and the ensuing tightening in global financial conditions, would be somewhat mitigated, given Armenia's still relatively large access to external borrowing on concessional terms, the low international integration of Armenian banks, and the still low level of external portfolio investment. A change in international oil prices is not expected to have a direct impact on Armenia economy either, given Armenia's relative high level of gasification and the use of medium-term gas price agreements with Russia. However, our paper shows that these developments would affect Armenia *indirectly* via trading partners. For instance, the recent decline in commodity prices (especially oil prices), which is translating into lower growth for Russia, is affecting negatively Armenia, via lower remittances and exports. A tightening in global financial conditions could hinder Russia's access to international funding, and thereby affect Armenia. A delayed recovery in EU may also affect Armenia.

As regards the *policy response*, the Armenian authorities should consider the following options:

(i)   *On a preparatory basis, before the shock hits*, the authorities should focus on building and preserving macroeconomic buffers, including moderate levels of public deficit and debt, and a relatively high level of international reserves. This would help Armenia to tap external borrowing from donors and preserve current access to market In addition, the authorities should focus on improving the business climate and improving the country' openness and connectivity, to attract foreign direct investment and promote export-oriented activities. This could help ensure a higher degree of economic diversification, and, eventually a reduction of the country's dependence on remittances, especially from Russia.

(ii)   *In the short-term, once a shock has hit*, the Armenian authorities' room for maneuver could be limited, yet not negligible. In the context of comfortable buffers, the authorities should be able to implement a moderate fiscal stimulus and monetary easing.

At the same time, they could allow for exchange rate flexibility, which could operate as a shock absorber. While using existing reserves buffers to mitigate excessive exchange rate volatility, in the face of Armenia's high level of dollarization. Simultaneously, the authorities should focus on accelerating structural reforms to increase growth and diversify export destinations and products.

(iii)   Over the medium term, once the effects of the shock have waned, the authorities should focus their efforts on rebuilding buffers, by adopting a fiscal consolidation strategy and a plan to rebuild the stock of international reserves, while continuing with the implementation of structural reforms.

Annex I: Brief Review of Literature on Spillovers

The assessment of economic spillovers from global shocks and across countries is an area of considerable interest. The questions addressed in our paper have been studied by a wide range of authors for different countries.

Categorization of global shocks

A categorization of shocks is important in order to identify shocks in a systemic way. It is useful to distinguish between the *source* of shock and the *transmission channels* through which shocks operate. As regards the sources, shocks are usually associated with a combination of circumstances that are difficult to disentangle. Some studies, such as Chowla, Quaglietti and Rachel (2014) have proposed a categorization of global shocks as:

- *World demand shocks*. These shocks are associated with a rise or a decline in spending and confidence in the global economy. They include changes in the fiscal plans of major countries or geographical areas, as well as changes in the level of confidence of firms and households and their appetite to spend, hire, invest, and borrow.

- *World supply/price shocks.* These shocks originate in the production sector of the global economy and affect the global supply and prices of goods and services. For example, an unexpected fall in the supply of a commodity that is traded globally would likely trigger a rise in its price.

- *World financial shocks.* These occur in the global financial system, such as increased stress in the international banking system or financial markets. They might relate, among other things, to changes in risk premium, driven by investors' decisions to reassess their perceptions of a certain asset class, including holdings of foreign exchange. Categorization of financial shocks is supported by much of the theoretical literature: several studies have highlighted the importance of financial frictions in driving business cycle fluctuations[7], while others emphasize that financial crises have particularly large effects on output. According to Reinhart and Rogoff (2009), financial crises are associated with larger output losses and slower recoveries than more "conventional" recessions (such as those driven by central banks actively raising interest rates to dampen demand). Hills, Thomas and Dimsdale (2010) argue that the recent UK recession had a defining characteristic that the financial sector was both the source and propagator of the crisis. Given this, it is logical to capture the role of financial shocks separately to more traditional demand and supply shocks.

Econometric studies on spillovers form global shocks

A Bayesian Vector Autoregression (BVAR) model presented by Österholm and Zettelmeyer (2007) examined the effect of external shocks to output fluctuations in Latin America. They found that 50 to 60 percent of the variation in Latin American GDP growth was accounted for by external shocks. Conditional forecasts for a variety of external scenarios suggested that Latin

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[7]Kiyotaki and Moore (1997) and Bernanke, Gertler and Gilchrist (1998) introduce credit and financial frictions to the analysis of the business cycle.

American growth was robust to moderate declines in commodity prices and U.S. or world growth, but sensitive to more extreme shocks, particularly a combined external slowdown and tightening of world financial conditions.

Bayoumi and Swiston (2009) examined linkages across North America by estimating the size of spillovers from the major regions of the world (the U.S., Euro area, Japan, and the rest of the world) to Canada and Mexico, and decomposed the impact of these spillovers into trade, commodity price, and financial market channels. For Canada, a 1 percent shock to U.S. real GDP shifts Canadian real GDP by some 0.75 percentage point in the same direction, with financial spillovers more important than trade in recent decades.

De Bock, Florea, and Toujas-Bernaté (2010) examined the economic and financial linkages between Morocco, Tunisia and their European partners using an SVAR. For Tunisia, exports and tourism appeared to be the major transmission channels. In Morocco, exports, remittances and tourism played relatively equal roles.

Adler and Sosa (2012) studied the importance of Brazil's influence on its neighboring economies, documenting trade linkages over the last two decades and quantifying spillover effects in a VAR setting. While trade linkages with Brazil were significant for the Southern Cone countries (Argentina, Bolivia, Chile, Paraguay, and Uruguay), they were very weak for others.

Dabla-Norris, Espinoza, and Jahan (2012) investigated linkages between low-income countries (LICs) and a narrow group of "Emerging Market leaders". The paper employed both VAR methodologies and dynamic panel regressions to estimate spillovers from the EM leaders to LICs. For commodity-exporting LICs in sub-Saharan Africa and the Middle East, terms of trade shocks and demand from the emerging market leaders were the main channels of transmission of foreign shocks.

Finally, Chowla, Quaglietti and Rachel (2014) presented model-based estimates that suggested that world shocks (demand, supply and financial) have driven around two thirds of the weakness in UK output since 2007.

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