



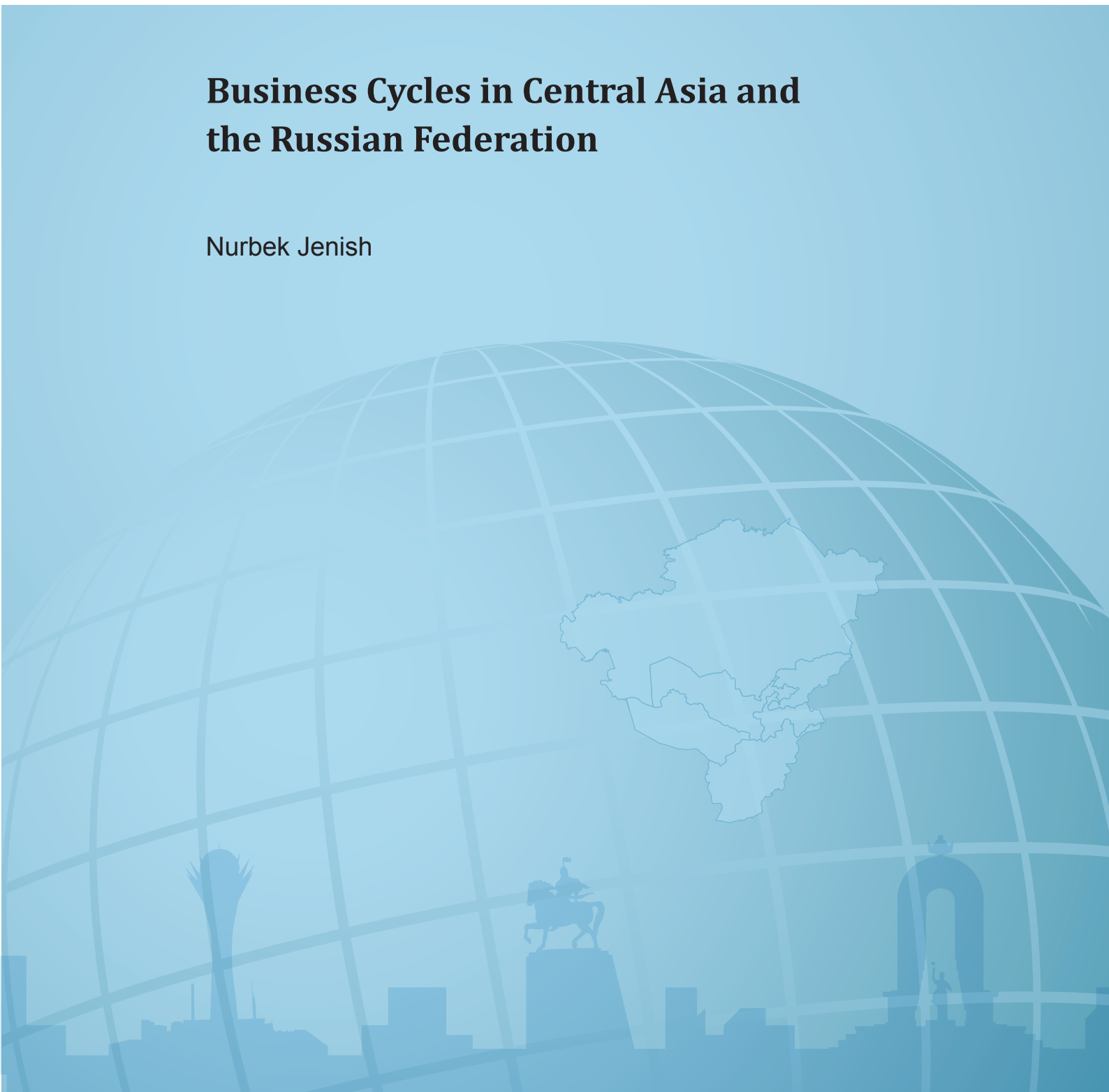
UNIVERSITY  
OF CENTRAL ASIA

GRADUATE SCHOOL OF DEVELOPMENT

Institute of Public Policy and Administration

# **Business Cycles in Central Asia and the Russian Federation**

Nurbek Jenish



**WORKING PAPER №15, 2013**





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INSTITUTE OF PUBLIC POLICY AND ADMINISTRATION

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### **Abstract**

The paper examines business cycle (BC) features of selected Central Asian (CA) countries – Kyrgyzstan, Kazakhstan and Tajikistan- and the Russian Federation, from the first quarter of 2000 through the fourth quarter of 2011. Key findings include the following: (i) Output fluctuations in these countries are more volatile than in developed countries; (ii) Unlike in the Russian Federation, the duration of business cycles in the CA countries is shorter compared to that of developed countries; (iii) With the exception of Kazakhstan, household consumption is more volatile than output; (iv) There is a mixed picture on the BC properties of other main macroeconomic variables in these countries; (v) In Kyrgyzstan and Tajikistan, monetary shocks matter for BC fluctuations; (vi) In Kyrgyzstan and Tajikistan, government expenditures are found to be procyclical, which may indicate the inefficiency of fiscal policy in stabilizing economy following negative shocks in these countries; (vii) Kyrgyz and Tajik BCs are not synchronized with either Russian or Kazakh BCs; (viii) Kazakh and Russian BCs are synchronized, indicating the increasing degree of economic integration between the countries, and (ix) With the exception of Tajikistan, there is a positive correlation between BCs in Kyrgyzstan and Kazakhstan with fluctuations in the global prices of their main export commodities: gold and oil.

### **Keywords**

business cycles, Kyrgyzstan, Kazakhstan, Tajikistan, Russian Federation

**JEL Codes:** E32

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### **About the author**

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The findings, interpretations and conclusions expressed in this paper are entirely those of the author and do not necessarily represent the view of the University of Central Asia

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## Acronyms

BC	Business Cycle
CA	Central Asian
CB	Central/National Bank
CIS	Commonwealth of Independent States
CIS STAT	Statistics Office of the Commonwealth of Independent States
CPI	Consumer Price Index
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
IFS	International Financial Statistics of the IMF
ILO	International Labour Organization
IMF	International Monetary Fund
IPPA, UCA	Institute of Public Policy and Administration, University of Central Asia
OECD	Organisation for Economic Co-operation and Development
REER	Real Effective Exchange Rate
SO	National Statistics Office
UK	United Kingdom
UN Comtrade	United Nations Commodity Trade Statistics Database
US	United States

## 1. Introduction

This paper provides business cycle (BC) facts for Kyrgyzstan, Kazakhstan and Tajikistan, and their important economic partner, the Russian Federation.<sup>1</sup> BCs are defined as periodic but irregular up-and-down movements in economic activity, measured by fluctuations in real Gross Domestic Product (GDP) or industrial output and other macroeconomic variables. The paper also attempts to provide answers to the following questions: What is the extent of BCs synchronization across countries? Is there increasing regional economic integration across countries? What are the nature of shocks that cause cyclical fluctuations in these countries? Are they similar?

Why is it important to study BC features of a country? First, BC facts help us understand what drives fluctuations in the economies of countries, such as supply or demand shocks. Establishing the nature of shocks can help decision-makers decide what the most appropriate policy is to smooth out cyclical fluctuations. Additionally, BC facts can also help decision-makers assess the role of fiscal and monetary policies in mitigating or aggravating aggregate fluctuations.

Section 2. includes a literature review. Section 3. provides a discussion of methodology and discusses data. Section 4. presents BC facts for our sample countries. Section 5. includes an examination of the extent of synchronization of business cycles across the countries and their dependence on external developments. Section 6. discusses conclusions and policy implications.

## 2. Literature Review

Following the seminal paper by Kydland and Prescott<sup>2</sup> that established the first set of “stylized facts” for developed countries, there has been an explosion in the literature devoted to the examination of the properties of BCs in both developed and developing countries.

The key findings of existing literature on BCs in industrialised countries can be summarized as follows (see Table A1):

- Real output and real exchange rate fluctuations have been persistent in recent years.
- The magnitude of output, consumption and net exports volatility is fairly similar. The volatility of real (private) consumption is slightly smaller than volatility of output for the majority of developed countries.
- Consumption, investment, employment, inflation and money velocity are generally procyclical.
- For the majority of countries, government expenditures are less volatile than output and are typically acyclical.
- Investments are, on average, more than two times more volatile than output.
- There is international co-movement in output, consumption and investment. However, output correlations are generally higher than consumption correlations.

<sup>1</sup> The author would like to thank Dr. Charles Becker for providing valuable comments and suggestions, and Anvar Muratkhonov for providing excellent research assistance.

<sup>2</sup> Finn E. Kydland and Edward C. Prescott, “Business Cycle: Real Facts and a Monetary Myth,” *Federal Reserve Bank of Minneapolis Quarterly Review* 14 no. 2, (1990): 3–18.



While the “stylized facts” for developed countries discussed in the literature are quite robust,<sup>3</sup> this is may not be true for those of developing countries. In fact, there is mixed evidence regarding the cyclical properties of main macroeconomic variables across developing countries.<sup>4</sup>

A recent paper by Male<sup>5</sup> documents empirical regularities for 32 developing countries in Latin America, Africa, North Africa, East Europe and Asia (see Tables A2 and A3). The common empirical regularities arising from this and the other papers (listed in footnote 4) examining developing countries can be summarized as follows:

- BCs are generally shorter and more volatile in developing countries, compared to those in the industrialized countries.
- Output is more volatile in developing countries than in developed countries.
- In developing countries, consumption is more volatile than output.
- Monetary aggregates, private consumption, investment and real wages are all generally procyclical.
- Real interest rates are more volatile in developing countries than those in developed countries.

Despite numerous studies of BCs in developing countries, there are few recent studies that examine countries in the Central Asian region, namely, Kyrgyzstan, Kazakhstan and Tajikistan. One exception is a paper by Benczúr and colleagues<sup>6</sup> that studies BC features in countries of the former Soviet Union. They use quarterly observations covering the period 1996-2004. However, the findings of the paper may be distorted because since the collapse of the Soviet Union, almost all the counties in their sample went through large-scale structural reforms. The cyclical properties of macroeconomic variables may therefore be substantially different from what they may be once the reforms are over. The Russian financial crisis years from 1998 to 1999 may also have caused some distortions in the results.

<sup>3</sup> See, for instance, Kydland and Prescott (1990); Pierre-Richard Agénor, C. John McDermott, and Eswar S. Prasad. “Macroeconomic Fluctuations in Developing Countries: Some Stylised Facts,” *World Bank Economic Review* 14 no. 2, (2000):251-285; David K. Backus and P.J. Kehoe, “International Evidence on the Historical Properties of Business Cycles.” *American Economic Review* 82, (1992): 864-888; and David K. Backus, P.J. Kehoe and Finn E. Kydland, “International Business Cycles: Theory and Evidence” in *Frontiers of Business Cycle Analysis*, ed. Thomas F. Cooley (Princeton: Princeton University Press, 1995), among others.

<sup>4</sup> See, for instance, see Agenor et al (2000); John Rand and Finn Tarp, “Business Cycles in Developing Countries: Are They Different?” *World Development* 30 no. 12, (2002): 2071-2088; Pablo Andrés Neumeyer and Fabrizio Perri, “Business Cycles in Emerging Economies: The Role of Interest Rates.” *Journal of Monetary Economics* 52, 2005: 345-380; and Mark Aguar and Gita Gopinath, “Emerging Market Business Cycles: The Cycle is the Trend.” *Journal of Political Economy* 115 no. 1, 2007: 69-102.

<sup>5</sup> Rachel Male, “Developing Country Business Cycles: Revisiting the Stylized Facts” *School of Economics and Finance Working Paper 663* (London: Queen Mary, University of London, 2010).

<sup>6</sup> Péter Benczúr, Emin Muradov and Attila Rátfai, “Cyclical Fluctuations in CIS Economies” *Journal of Business Cycle Measurement and Analysis* 3 no. 1, (2007): 121-135.

### 3. Methodology and Data

#### Methodology

Analysing BC properties of a variable requires examining the volatility and cross-correlation of the variable with a GDP, which is used as a measure of aggregate economic activity. To obtain volatilities and correlation coefficients, several steps are necessary. The first step is to take natural logarithms of times series, wherever possible. It is a standard practice in the real BC literature to assume that macroeconomic time series are multiplicatively separable. Taking natural logarithms would therefore render the variable additively separable. Moreover, taking logarithms also helps smooth out the series. The next step is to deseasonalise the data. One has to get rid of seasonal variation in the data in order not to contaminate the cycle. This is done using the Census Bureau's X-11 method. Once deseasonalised, the series are filtered (detrended) to extract the cyclical (stationary) and the trend (nonstationary) components. For that purpose, the Hodrick-Prescott (HP) detrending procedure was employed. Despite some drawbacks, the HP remains the most common choice in the real BC literature.<sup>7</sup>

The HP filter is designed to optimally extract a nonstationary component yielding a stationary cyclical component, which can be used by researchers to analyse BC. A (nonstationary) series  $y_t$  can be decomposed into cyclical component,  $c_t$ , and trend component,  $\tau_t$ :

$$y_t = c_t + \tau_t \text{ for } t=1, \dots, T$$

The trend component,  $\tau_t$ , is obtained by minimising

$$\sum_{t=1}^T (\ln c_t - \tau_t)^2 + \lambda \sum_{t=2}^T [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2$$

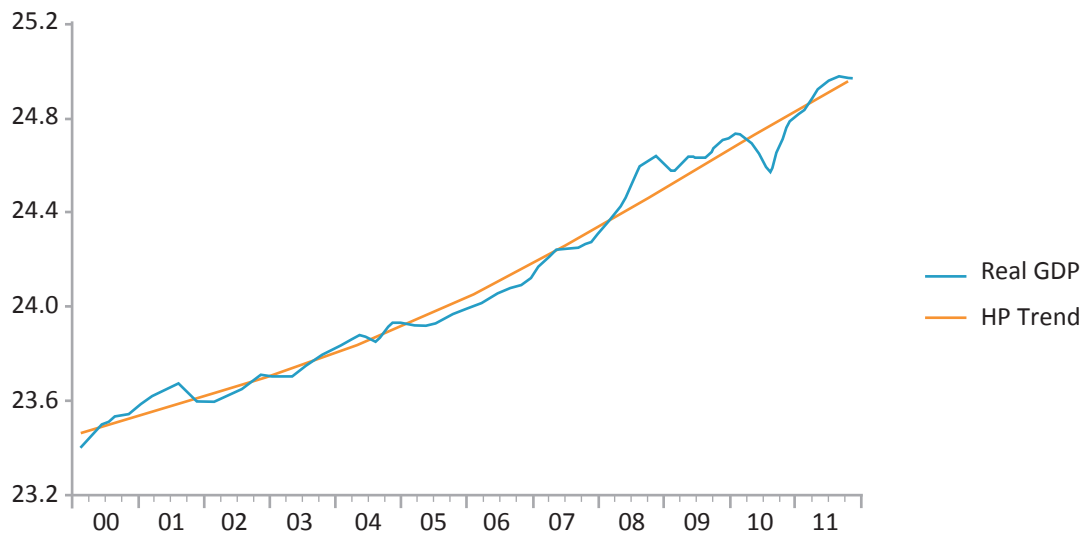
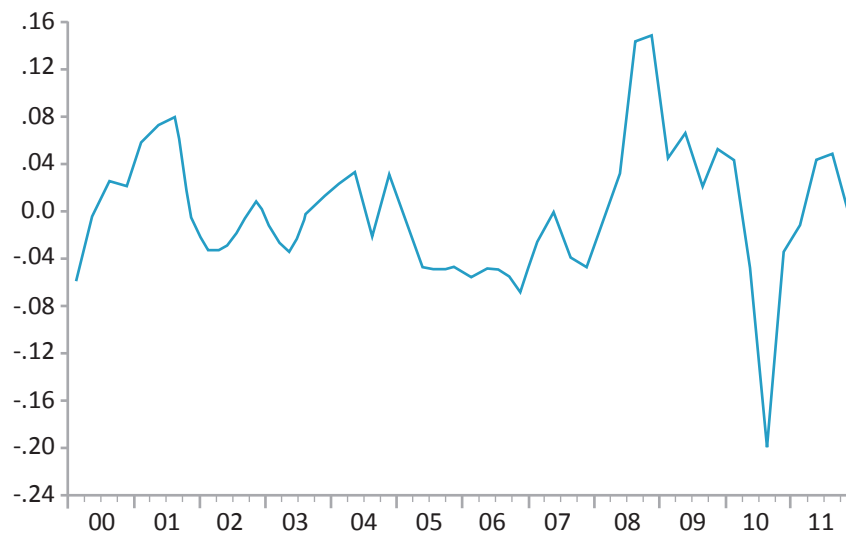
where  $\lambda$  is set equal to 1,600 for a quarterly series.<sup>8</sup> The cyclical part of a series, which is of main interest (Figure 2), is obtained by

$$Y_t = \frac{\ln c_t - \tau_t}{\tau_t}$$

Figure 1 depicts the deseasonalized logarithm of Kyrgyz real GDP series and the trend given by the HP filter. Figure 3 plots the cyclical part of the logarithm of Kyrgyz real GDP series.

<sup>7</sup> See Robert G. King and Sergio T. Rebelo, "Low Frequency Filtering and Real Business Cycles" *Journal of Economic Dynamics and Control* 17 no. 1-2, (1993): 207-231; and Timothy F. Cogley and James M. Nason, "Effects of the Hodrick-Prescott Filter on Trend and Difference Stationary Time Series: Implications for Business Cycle Research" *Journal of Economic Dynamics and Control* 19 no. 1-2, (1995): 253-278 for more detailed discussion of the shortcomings of the HP filter. An alternative detrending procedure also used in the literature is the band-pass (BP) filter developed in Marianne Baxter and Robert G. King, «Measuring Business Cycles: Approximate Band-Pass Filters for Economic Time Series» *Review of Economics and Statistics* 81 no. 4, (1999): 575-593. See Rand and Tarp (2002) for a discussion of the relative advantages of the BP filter vis-à-vis the HP.

<sup>8</sup> Choosing an optimal value for  $\lambda$  has caused much controversy in the literature. However, Hodrick and Prescott, amongst others, find this value to be reasonable for quarterly time series. They showed little change in results when  $\lambda$  was changed by a factor of four to 400 or 6,400.

**Figure 1. Kyrgyz real GDP and its trend given by HP filter****Figure 2. Percentage deviations of the Kyrgyz real GDP from its trend given by the HP filter**

Having deseasonalised and detrended the series, one obtains their cyclical components. In what follows, all references to the variables refer to their cyclical components. All the subsequent statistical analysis is carried out with their cyclical parts. The analysis concentrates on the examination of statistical features of series, namely, volatility, persistence and cross-correlations.<sup>9</sup>

Absolute volatility clarifies the magnitude of fluctuations of the variables of interest. It is defined as the standard deviation of the series and is given by

$$\sigma_Y = \sqrt{\sum_{t=1}^T \frac{(Y_t - \bar{Y})^2}{T-1}}, \text{ where } \bar{Y} \text{ is the mean of the variable } Y.$$

<sup>9</sup> Deseasonalising, detrending and all other statistical analysis in the paper were performed in E-views.

Relative volatility is measured as the ratio of the standard deviation of the series and standard deviation of (detrended) real GDP. If relative volatility equals one, it implies that the variable has the same cyclical amplitude as the aggregate business cycle, which is proxied by real GDP; whereas relative volatility greater than one means that the variable has greater cyclical amplitude than the aggregate business cycle. Degree of persistence is captured by the first order autoregressive coefficient in the series. The Ljung-Box portmanteau (Q) test statistics measures the significance of persistence. If  $Q$ -statistics has  $p$ -value greater than the significance level<sup>10</sup> then it implies that there is little or no persistence in the cyclical component of the variable.

The extent of co-movement of the variables,  $Y_t$  and  $X_t$ , is measured by the magnitude of the (cross-) correlation coefficient

$$\rho(i) = \frac{\frac{1}{T} \sum_{t=1}^T (Y_t - \bar{Y})(X_t - \bar{X})}{\sigma_Y \sigma_X}, \quad i = 0, \pm 1, \pm 2, \dots,$$

where variables with bars denote their respective means.

Variables are defined to be a) procyclical if they move in the same direction – the contemporaneous correlation coefficient,  $\rho(0)$ , is positive; b) countercyclical if they move in the opposite direction - negative contemporaneous correlation coefficient, and c) acyclical if they are uncorrelated if  $\rho(0)=0$ .

The cross-correlation coefficient also indicates whether the macroeconomic series leads, lags or is synchronous with the business cycle. Series  $Y_t$  is considered to (i) lead the cycle by  $i$  periods if the largest cross-correlation coefficient,  $\rho(i)$ , arises for a negative  $i$ ; (ii) be synchronous with the cycle if the largest cross-correlation coefficient arises at  $i=0$ , and (iii) lag the cycle by  $i$  periods if the maximum cross-correlation arises for a positive  $i$ .

## Data

The data for the countries under consideration - Kyrgyzstan, Tajikistan, Kazakhstan and the Russian Federation - are quarterly and cover the period from the first quarter of 2000 through the fourth quarter of 2011.<sup>11</sup> The data come mainly from national statistics offices and national/central banks, as well as from databases of international financial institutions (Table 1). With the sole exception of Tajikistan, the quarterly data for almost all macroeconomic series are available for the other countries. Data on (realized) quarterly foreign direct investments (FDI), household consumption and monetary aggregate M1 are not available and therefore cross-correlation of these variables with the aggregate business cycle in Tajikistan is not examined.

<sup>10</sup> 5 % significance level is most frequently used.

<sup>11</sup> Pre-2000 years are not considered since (i) During that period the countries underwent large-scale structural reforms; (ii) There are missing data, and (iii) Including 1998-1999 is not desirable since this was the time of the Russian financial crisis.

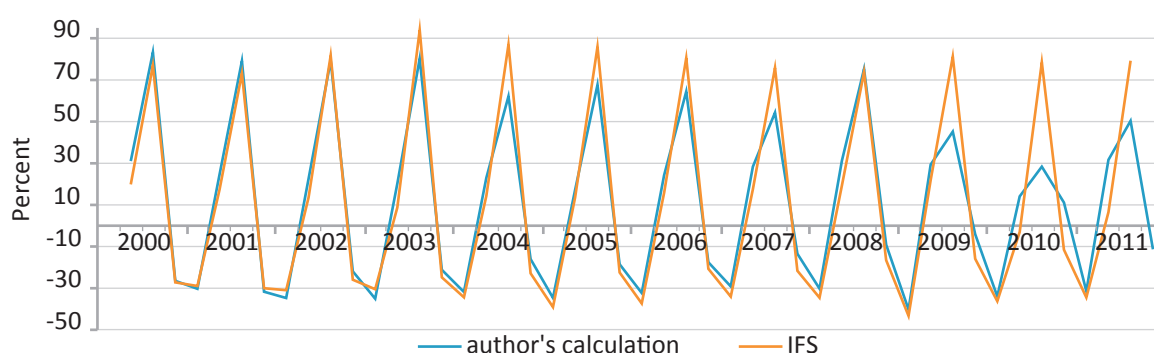
Table 1. Data sources

	Kazakhstan	Kyrgyzstan	Tajikistan	Russian Federation
Nominal GDP	SO	CB	CIS STAT	SO
Nominal exchange rate	CB	CB	CB	CB
Real effective exchange rate	CB	CB	CB	IFS
Remittances	n/a	CB	Russian CB	n/a
Government expenditures	IFS	SO	CB	CB
Consumption	IFS	SO	-	IFS
Foreign Direct Investment (FDI)	CB	CB	-	CB
M1	CB	CB	-	-
M2	CB	CB	CIS STAT	CB
Gross fixed capital formation	CIS STAT	CB	SO	CIS STAT
Export	CB	CB	SO	CB
Import	CB	CB	SO	CB
CPI	CB	CB and SO	CB	CB
Employment	IFS	IFS	SO	IFS and ILO

Notes: CB: Central/National Bank; SO: National Statistics Office; IFS: International Financial Statistics of the International Monetary Fund; ILO: International Labour Organisation; CIS STAT: Statistics Office of the Commonwealth of Independent States; n/a: not applicable; "-": unavailable data

To generate the cyclical component of variables, a number of transformations are made. First, nominal GDP and its components, government expenditure, consumption, export, import and investment (as proxied by gross fixed capital formation) are deflated by the consumer price index (CPI) to obtain constant price measures of these variables.<sup>12</sup> For all the countries, their respective first quarter 2000 CPI series are used as a base year CPI. In the case of Kyrgyzstan, Figure 3. shows that GDP growth rates obtained by deflating nominal GDP series are not different from the actual ones.<sup>13</sup> Inflation is defined as the rate of change in the CPI. Increases in the values of nominal and real effective exchange rates correspond to nominal and real depreciation of currency, respectively. Finally, the variables are transformed into natural logarithm form, and statistical analysis is carried out.

Figure 3. Real GDP growth in Kyrgyzstan



<sup>12</sup> Quarterly real GDP series are not reported for most of the countries under consideration. Moreover, quarterly GDP deflator series are generally not available in these countries. The SO of the Russian Federation publishes quarterly real GDP series, which are used in this paper.

<sup>13</sup> I have conducted similar exercises for Kazakhstan and Tajikistan. The comparison showed that there is not much difference between officially reported and the calculated figures.

## 4. Business Cycles in Central Asia and the Russian Federation: Empirical Results

### Persistence

Persistence of main macroeconomic variables (measured by the first order autocorrelation coefficient) is presented in Table 2. Significant output (real GDP) persistence can be observed in the Russian Federation, Kyrgyzstan and Tajikistan. However, in the latter two countries, the magnitude of the persistence is substantially lower compared to that of Russia. The persistence of Russia's GDP is similar to developed countries. Surprisingly, output persistence in Kazakhstan is even smaller than in Kyrgyzstan and Tajikistan. A key empirical feature of business cycles in industrialised countries is the significant persistence in output fluctuations. Though Kazakhstan is not considered an industrialised country, it is more developed than Kyrgyzstan and Tajikistan. Therefore, one would expect the magnitude of persistence of Kazakh output fluctuations to be, at least higher than in Kyrgyzstan and Tajikistan.<sup>14</sup>

There is significant persistence of remittances' fluctuations in Kyrgyzstan and Tajikistan. The economies of these countries are heavily reliant on migrant remittances. In 2011, remittances constituted more than 30 % and 50 % of GDP in Kyrgyzstan and Tajikistan respectively. The magnitude of remittances fluctuations is higher in Tajikistan than in Kyrgyzstan. One possible explanation for this observed difference is the difference in the sectors that migrant workers engage in. The majority of migrant workers from both Kyrgyzstan and Tajikistan work in the Russian Federation. It is argued that the migrants from Kyrgyzstan are typically employed by the services sector in Russia, while Tajik workers are mostly in construction. In general, construction sector is more sensitive than the services sector to changes in economic conditions, so the extent of remittance fluctuations persistence is greater in Tajikistan.

The persistence of real exchange rate fluctuations in industrialised countries is significant. All four countries being assessed also exhibit significant real exchange rate fluctuations, though the magnitude of this persistence is slightly lower than that of developed countries. For instance, the average autocorrelation coefficient at lag one for the United States (US), the United Kingdom (UK) and Japan is 0.84. It is 0.7 for the countries in our sample.

There is some price persistence over the sampling period, except for Kazakhstan, which is characterised by the first autocorrelation coefficient for CPI series. This is indicative of existing price rigidities (stickiness) in the countries.<sup>15</sup> Again, the magnitude of price persistence in these countries is smaller than that of the developed countries. For instance, the average price persistence for the US, UK and Japan is 0.92, while for Kyrgyzstan, Tajikistan and Russia it is 0.33. It would be also interesting to see how labour markets adjust to changing economic environment by examining cyclical properties of real wages in these countries. However, existing official wage statistics, at least in Kyrgyzstan and Tajikistan, are not suitable for such analysis, as they do not take into account wages paid in the informal sector or income of self-employed people. Moreover, in what follows,

<sup>14</sup> After correcting for the influence of oil prices.

<sup>15</sup> This may be partially due to policy inconsistency and may imply policy lurching and imported inflation.

cyclical properties of employment are not analysed since the official labour statistics, at least in Kyrgyzstan and Tajikistan, are not reliable.

Finally, our sample countries show significant real exchange rate persistence similar to industrialised economies. Again, the magnitude of Real Effective Exchange Rate (REER) persistence is slightly smaller in our countries than in developed countries.

With the exception of the Russian Federation, the duration of BCs (measured by persistence of real GDP fluctuations) is shorter in our sample economies compared to that of developed countries. This is generally in line with the findings in the existing literature that BCs in developing countries are shorter than those in developed ones.

**Table 2. Persistence of main macroeconomic variables**

Country	Real GDP	Cons'n	Gov. exp.	M1	M2	REER	NER	Export	Import	Remit's	Inv't	FDI	CPI	Empl't
Kyrgyzstan	0.57	0.49	0.20*	0.79	0.82	0.78	0.82	0.29	0.67	0.57	0.27	0.12*	0.38	0.87
Kazakhstan	0.36	0.19*	0.45	0.80	0.84	0.67	0.83	0.65	0.65	-	0.38	0.15*	0.19*	0.44
Russia	0.88	0.82	-0.08*	-	0.84	0.61	0.75	0.71	0.73	-	0.83	-	0.30	0.50
Tajikistan	0.54	-	0.34	-	0.78	0.73	0.74	0.32	0.32	0.73	0.28*	-	0.32	0.45

Notes: \*: not significant  $p > 0.05$ ; "-": unavailable data

## Volatility

The magnitude of fluctuations of the macroeconomic variables of interest is presented in Table 3. If we compare absolute volatility of real GDP in our sample countries with the corresponding figures for the developed countries reported in Table A1, one can note that volatility of output (real GDP) is substantially higher than corresponding figures for developed countries. This is in line with some stylised BC facts for developing countries: BCs are more volatile in developing countries than in industrialised economies. One explanation for excessive volatility in developing countries includes three key observations:<sup>16</sup> (i) Developing countries are more vulnerable to external shocks; (ii) They may be subject to greater domestic shocks, for instance, arising from policy failures, and (iii) Developing countries do not have well developed and functioning financial markets that would allow them to diversify risks and they may not possess the ability to carry out macroeconomic stabilisation policy. In the context of our sample countries, the Russian Federation has the lowest volatility of output at 0.03. Surprisingly, Kazakhstan, with its “more developed” economy than Kyrgyzstan and Tajikistan, exhibits the highest output volatility.<sup>17</sup>

<sup>16</sup> Norman V. Loayza, Romain Rancière, Luis Servén, and Jaume Ventura, “Macroeconomic Volatility and Welfare in Developing Countries: An Introduction” *The World Bank Economic Review* 21 no. 3, (2007): 343–357.

<sup>17</sup> One has to consider that the economy of Kazakhstan has a mineral orientation.

**Table 3. Absolute volatility (measured as standard deviation)<sup>18</sup>**

Country	Real GDP	Cons'n	Gov. exp.	M1	M2	REER	NER	Export	Import	Remit's	Inv't	FDI	CPI	Emp't
Kyrgyzstan	0.06	0.09	0.08	0.06	0.07	0.05	0.04	0.14	0.12	0.36	0.17	0.48	0.02	0.01
Kazakhstan	0.10	0.06	0.08	0.08	0.09	0.04	0.05	0.15	0.08	-	0.12	0.23	0.01	0.01
Russia	0.03	0.03	0.10	-	0.08	0.04	0.06	0.11	0.09	-	0.08	-	0.01	0.01
Tajikistan	0.06	-	0.15	-	0.20	0.04	0.06	0.16	0.14	0.17	0.24	-	0.03	0.01

Notes: "-": unavailable data

In recent years, remittances in Kyrgyzstan were twice as volatile than those in Tajikistan. One can also observe that volatilities of prices (based on CPI) in our sample economies are of the same magnitude as those for developed countries (Table A1), which is indicative of more or less stable inflation control policy during the last decade. Among our countries, Kyrgyzstan has the highest household consumption volatility. There may be two possible explanations. First, the financial system in Kyrgyzstan is less developed than that of Kazakhstan and the Russian Federation. As a result, households have more limited access to bank loans as they face higher interest rates. Despite a large number of microfinance institutions in Kyrgyzstan, the effective annual interest rate charged by micro-credit and finance entities can be as high as 60 %. These factors prevent households from obtaining loans at reasonable rates that would otherwise allow them to smooth consumption during difficult times. Second, high volatility of consumption can also be due to high volatility of remittances in Kyrgyzstan (which constitute more than 30 % of GDP), which are primarily used for consumption. The lower volatility of consumption in Kazakhstan may reflect stabilisation policy efforts and the presence and active use of the stabilisation fund.

Relative volatilities, which are defined as a ratio of absolute volatility of a macroeconomic variable to absolute volatility of real GDP, are reported in Table 4. In Kyrgyzstan, consumption is one and half times more volatile than output. This may be attributable to a lack of consumption smoothing over the course of the BC in the country. In the Russian Federation, consumption is almost as volatile as output, whereas in Kazakhstan, consumption is 40% less volatile than output. From the stylised BC facts, we know that consumption in developed countries is on average 50% less volatile than output. In that regard, cyclical properties of consumption in Kazakhstan resemble those of developed countries.

With the exception of Kazakhstan, government expenditures in the four countries are more volatile than output: in Kyrgyzstan, they are 40 % more volatile than output; in the Russian Federation and Tajikistan, government expenditures are more than three and two times more volatile than output, respectively. The observed excessive volatility in these countries may suggest that rather than helping smooth BC fluctuations, the government may actually aggravate them.

<sup>18</sup> In Tajikistan and Kyrgyzstan, agriculture and petty trade are relatively large shares of the economy. These sectors may be prone to measurement error and are not usually estimated carefully on a quarterly or even annual basis. If this is the case, then volatility of output and consumption in these countries may actually be lower.



**Table 4. Relative volatility**

Country	Cons'n	Gov. exp.	M1	M2	REER	NER	Export	Import	Remit's	Inv't	FDI	CPI	Emp't
Kyrgyzstan	1.5	1.4	1.1	1.3	0.8	0.7	2.5	2.1	6.2	2.9	8.4	0.4	0.2
Kazakhstan	0.6	0.8	0.8	0.9	0.4	0.5	1.5	0.8	n/a	1.2	2.4	0.1	0.1
Russia	1.1	3.4	-	2.6	1.5	2.2	3.7	3.0	n/a	2.7	-	0.3	0.4
Tajikistan	-	2.5	-	3.3	0.7	1.0	2.7	2.3	2.8	4.0	-	0.4	0.1

Notes: "-": unavailable data

With the exception of Russia, both nominal and real exchange rates showed lower volatility than output. This is due to the fact that all of the CA economies studied follow *de facto* managed exchange rate regime and enjoyed relative price stability in the last decade. In the case of Russia, excessive volatility of nominal exchange rate (which led to high real exchange rate volatility) may be attributable to huge amounts of capital inflows and outflows in recent years. This may also partially explain the higher relative volatility of monetary aggregate M2 in Russia compared to Kyrgyzstan and Tajikistan. Average relative export and import volatilities in our sample countries were 2.6 and 2.1, respectively. These figures are similar to corresponding average figures for the US, UK and Japan, which were 2.1 and 2.6.

The existing stylised facts for developing countries suggest that volatility of investment should be larger than that of output in developing countries. Investment volatility in our countries is in line with these facts. One can note that FDIs are 8.4 times more volatile in Kyrgyzstan than output. This is primarily a consequence of the 2005 and 2010 events, when the country went through socio-political disturbances that led to leadership change and disrupted economic activity.

### Cross-correlations with real GDP

This section examines the degree of co-movement of the macroeconomic variable of interest with aggregate cycle (measured as the cyclical part of real GDP). The extent of co-movement is measured by the correlation coefficient between the variable and the real GDP (see methodology section). Table 5 presents the correlation results for the four countries.

#### Consumption and investment

The correlation coefficients of household consumption with the real GDP in Kyrgyzstan, Kazakhstan and the Russian Federation are positive. This means that consumption in these countries is procyclical. In Kyrgyzstan, consumption leads the cycle by 2 periods (or six months), whereas in Kazakhstan and Russia it lags the cycle by three and six months, respectively. Roughly speaking, these numbers may suggest that a reduction in private consumption precedes a downturn in economic activity in Kyrgyzstan, whereas in Kazakhstan and Russia, private consumption follows the aggregate cycle. The strong procyclicality of private consumption is found for the majority of developed and developing countries. Investment is procyclical in Kazakhstan and Tajikistan and Russia, while in Kyrgyzstan it is acyclical.

### Government expenditure

In Kazakhstan, government expenditure is acyclical. In contrast, government expenditure is strongly procyclical in Kyrgyzstan, the Russian Federation and Tajikistan. In both countries, government expenditures lag the cycle; in Kyrgyzstan by six months, and in Tajikistan by three months. It is widely argued that for a fiscal policy to have a stabilising effect it should be countercyclical. If government expenditure is procyclical it can exacerbate business cycle fluctuations. For instance, if economy goes into recession, contractionary fiscal policy may lead to even deeper economic recession. Conversely, during economic booms expansionary fiscal policy may lead to overheating of an economy.<sup>19</sup> The procyclicality of government expenditure in Kyrgyzstan and Tajikistan may be attributable to (i) (relatively) limited government revenue administration capacity. Revenue collections are (very) sensitive to economic conditions in these countries; (ii) (relatively) high budget deficits in recent years that prevent countries to further increase budget deficit to follow expansionary fiscal policy during economic downturns, and (iii) the absence of an abundant natural resource base, e.g. oil, and as a consequence, an absence of stabilisation funds where extra revenues associated with natural resources can be saved and utilised during bad times. Therefore, the governments in Kyrgyzstan and Tajikistan should address their revenue administration policies so as not to reinforce business cycle fluctuations. In the Russian Federation, stabilisation fund resources have been rarely used to counter economic downturns on the grounds that they may trigger inflation increase.

### Monetary aggregates and prices

In addition to fiscal policy, monetary policy is an important tool for macroeconomic stabilisation. It is therefore important to examine whether or not changes in money supply (represented by monetary aggregates M1 and M2) actually cause output fluctuations in our sample countries.

The results of cross-correlation tests suggest that money supply in our countries were strongly procyclical with output, leading cycles in Kyrgyzstan and Tajikistan and coinciding with the cycle in Kazakhstan and Russia. In the case of the latter three countries, changes in money are transmitted fairly quickly to economic activity (within three months). In Kyrgyzstan, monetary innovations are transmitted within one year.

To this end, a series of Granger causality<sup>20</sup> tests were undertaken for cyclical components of monetary aggregates and output. The test results (Table A4) suggest that changes in money supply in Kyrgyzstan and Tajikistan can help to predict the direction of cyclical fluctuations in the country. In the case of Kazakhstan, neither real GDP nor monetary aggregates have been found to Granger cause each other. In the Russian Federation, real GDP Granger causes monetary aggregate M2, whereas there is no reverse causality. This suggests that money is influenced by, and does not influence, output.

<sup>19</sup> Provided that economy is close to its full-employment level.

<sup>20</sup> Granger causality has a different meaning than the standard causality concept in economics/econometrics: a variable X is said to Granger cause variable Y if the past realisations of X help to predict current realisation of Y.

Table 5. Cross-correlations with real GDP. “+”: procyclical, “-”: countercyclical.

Country	Cons'n	Gov.exp.	M1	M2	REER	NER	Export	Import	Remit's	Inv't	FDI	CPI	Empl't
Kyrgyzstan	0.5	0.4	0.6	0.6	0.4	-0.5	0.7	0.6	-0.5		0.6	0.5	-0.4
	leads the cycle by 2 periods	lags the cycle by 2 periods	leads the cycle by 4 periods	leads the cycle by 4 periods	coincidental with the cycle	leads the cycle by 4 periods	coincidental with the cycle	leads the cycle by 2 periods	lags the cycle by 1 period	acyclical	coincidental with the cycle	leads the cycle by 4 periods	lags the cycle by 5 periods
Kazakhstan	0.4			0.3	0.4	-0.3		0.3	n/a	0.3			
	lags the cycle by 1 period	acyclical	acyclical	coincidental with the cycle	lags the cycle by 2 periods	lags the cycle by 1 period	acyclical	lags the cycle by 3 periods	n/a	lags the cycle by 5 periods	acyclical	acyclical	acyclical
Tajikistan	-	0.5	-	0.6	0.5	0.74	-0.5	0.3	0.7	0.6	-	-0.4	
	-	lags the cycle by 1 period	-	leads the cycle by 1 period	lags the cycle by 2 periods	acyclical	lags the cycle by 2 periods	leads the cycle by 1 period	leads the cycle by 1 period	coincidental with the cycle	-	lags the cycle by 2 periods	acyclical
Russia	0.8	0.3	-	0.9	0.4	-0.8	0.7	0.8	n/a	0.9	-	0.4	0.6
	lags the cycle by 2 periods	lags the cycle by 5 periods	-	coincidental with the cycle	coincidental with the cycle	coincidental with the cycle	coincidental with the cycle	lags the cycle by 1 period	n/a	lags the cycle by 1 period	-	lags the cycle by 2 periods	coincidental with the cycle

Notes: n/a: not applicable; “-”: unavailable data. For macroeconomic variables found to be acyclical, correlation coefficients are not reported.

Based on the examination of cross-correlations and results of Granger causality tests, one can conclude that monetary shocks do matter for business cycle fluctuations, at least in Kyrgyzstan and Tajikistan. Further, one can observe that prices (as proxied by CPI) are strongly procyclical in Kyrgyzstan and Russia and countercyclical in Tajikistan. It is argued that if both prices and inflation are procyclical then BCs are driven by demand shocks. If fluctuations are due to supply side shocks then both prices and inflation should be countercyclical. Therefore, it is plausible that BCs in Kyrgyzstan and the Russian Federation are driven by demand shocks, whereas those in Tajikistan are driven by supply shocks. There is no clear cut picture for Kazakhstan since prices are found to be acyclical.<sup>21</sup>

### Remittances

Migrant remittances in Tajikistan are strongly procyclical and lead the cycle by one quarter. This is not surprising as remittances recently constituted more than 50 % of GDP in Tajikistan. Therefore, the degree of economic activity and aggregate fluctuations are heavily dependent on the dynamics of remittances in Tajikistan.

In Kyrgyzstan, remittances also constitute a substantial share of GDP; over 30 % in 2011. However, they are countercyclical and lag the cycle by three months. A possible explanation for this is that following deteriorating economic conditions, migrant workers remit more money back home to help their families mitigate the negative consequences of recession. Conversely, during good times, migrant workers reduce the amount of money they remit home.

## 5. Synchronization of Central Asian Business Cycles and their Dependence on External Developments

The final objectives of this paper are (i) to assess whether BCs in our sample countries are synchronised, and (ii) to examine what other external factors may affect cyclical fluctuations in the countries.

To examine the degree of BCs synchronisation, correlation was computed between (cyclical parts of) real GDPs. The BCs across countries are said to be synchronised if the correlation is positive. The higher the value of correlation coefficient, the stronger the synchronisation is. The results of the analysis are summarized in Table 6.

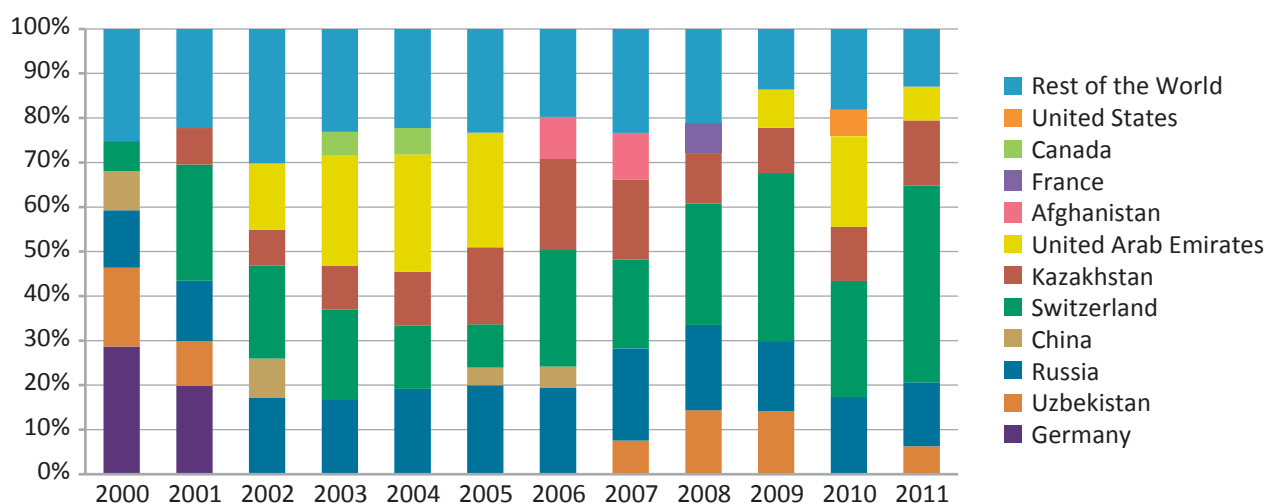
**Table 6. Synchronisation of Business Cycles**

Country	Kazakhstan	Russian Federation
Kyrgyzstan	No synchronisation	No synchronisation
Kazakhstan	-	Synchronised, correlation=0.3
Tajikistan	No synchronisation	No synchronisation

<sup>21</sup> In part this may reflect more sophisticated monetary policy but it is also possible that there is more error in Kazakh prices because of underestimation of housing price inflation, which is especially important there.

Despite the Russian Federation and Kazakhstan being the main economic partners of Kyrgyzstan, its BCs are not synchronised with either Russian nor Kazakh BCs. This may be due to the disruptive socio-political events of 2005 and 2010 and the large share of informal economy in Kyrgyzstan.<sup>22</sup> In terms of trade relations between countries, neither Russia nor Kazakhstan has been a major destination of Kyrgyz exports (Figure 4).<sup>23</sup> At the same time, the Kyrgyz market is relatively tiny for Kazakhstan and the Russian Federation in order to affect the economies of these countries. In 2000, the share of Kyrgyz exports to Russia stood at 12.9 % of total exports, with unmanufactured tobacco (5 % of total exports) being the largest export item to the Russian Federation. In 2011, the share of exports to Russia remained almost the same and constituted 14.4 % of total exports. The largest export item to Russia in that year was textile products, which accounted for 2.4 % of total exports. More or less the same picture can be observed for trade between Kyrgyzstan and Kazakhstan. In 2000, exports to Kazakhstan made up 6.6 % of total exports, whereas in 2011, they increased to 14.6 %. In 2011, the main export product to Kazakhstan was electrical energy.<sup>24</sup> Furthermore, the amount of FDIs from both the Russian Federation and Kazakhstan to Kyrgyzstan has been moderate.<sup>25</sup>

Figure 4. Main Export Partners of Kyrgyzstan



Source: UN Comtrade database.

Tajikistan's business cycles also appear to be non-synchronized with either Russian or Kazakh business cycles. This is surprising since the economy of Tajikistan, as discussed above, heavily depends on remittances of migrant workers in the Russian Federation, who in turn depend on developments in the Russian economy. As for Tajik exports to Russia, trade volume decreased from 37.4 % in 2000 to 8.1 % in 2011 (Figure 5). Tajik exports to Kazakhstan still constitute a small share of total exports, though there was an increase in the corresponding figure from 0.8 % in 2000 to 4.4 % in 2011.

<sup>22</sup> According to some estimates, the informal economy may constitute over 40 % of GDP.

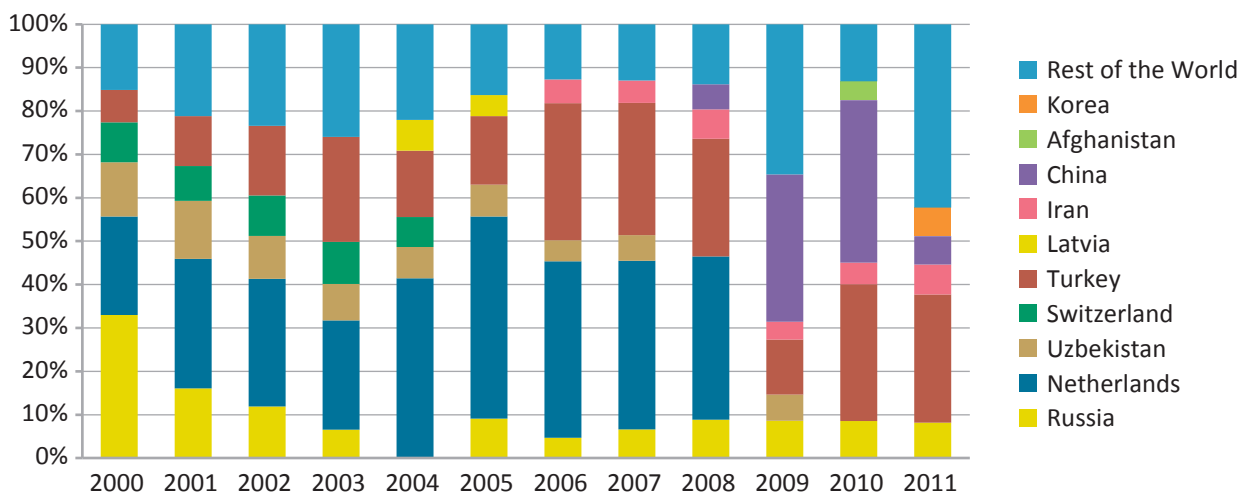
<sup>23</sup> Ignoring the informal trade in Chinese re-exports.

<sup>24</sup> The underlying rationale behind the increased trade in electricity may not only be due to economic reasons. As a result, trade in electricity between these two countries may not be influenced solely by economic developments in Kazakhstan.

<sup>25</sup> During the given period, FDI flows were substantially affected by the political situation in Kyrgyzstan, as well as the political relationship between the countries.

Small trade (export) turnover between Kyrgyzstan and Tajikistan with both Russia and Kazakhstan partly explain non-synchronisation between business cycles in these countries.

**Figure 5. Main Export Partners of Tajikistan**



Source: UN Comtrade database.

There is quite a strong synchronization between Russian and Kazakh BCs. The list of potential factors behind the observed synchronisation may include, but is not limited to: (i) geographical location of the countries, and hence large (cross-border) trade (Figures 6 and 7); (ii) long-standing interdependencies of production facilities in the countries; and (iii) relatively large FDI flows between countries.

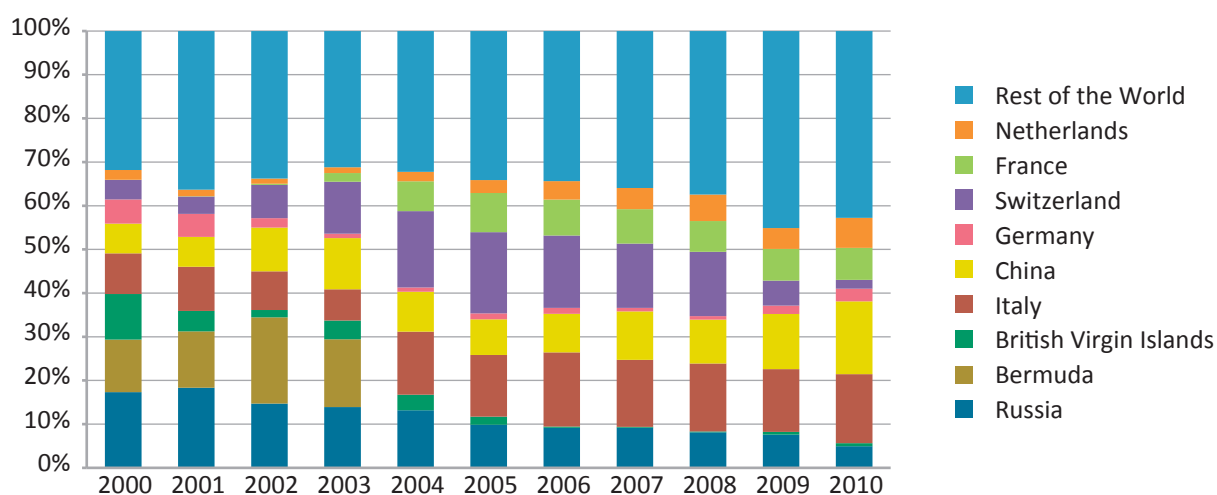
Finally, let us turn to the examination of other external factors that could have affected economic fluctuations in our sample countries. In particular, whether or not fluctuations of global prices of the countries' main export commodities affect the cyclicity of their economies. The main export items considered are: for Kyrgyzstan, gold; for Tajikistan, aluminum; and oil for the Russian Federation and Kazakhstan. Table 7 reports the correlation results. One can observe that with the exception of Tajikistan, there is a strong positive correlation between main export commodity price fluctuations and business cycles in Kyrgyzstan, Kazakhstan and Russia. For the latter two countries, the correlation is contemporaneous.

**Table 7. Correlation of Global Price Fluctuations of Main Export Commodities with Business Cycles**

Business Cycles in	Gold	Oil	Aluminum
Kyrgyzstan	0.5 Gold prices lead the cycle by 4 periods	-	-
Kazakhstan	-	0.3 Coincidental with the cycle	-

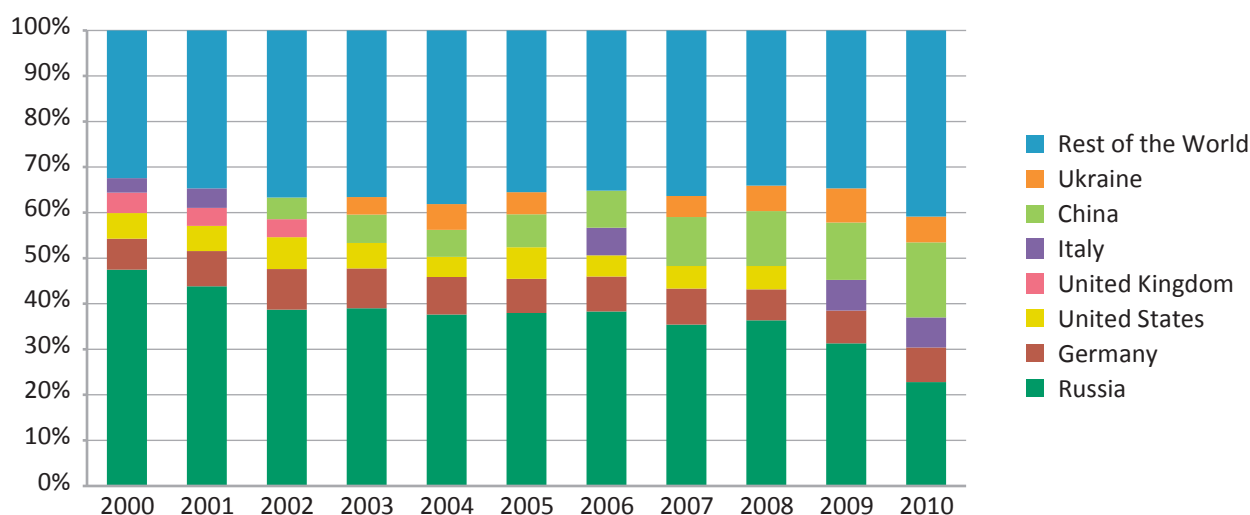
Business Cycles in	Gold	Oil	Aluminum
Tajikistan	-	-	-0.5 Aluminum prices lag the cycle by 2 periods
Russia	-	0.7 Coincidental with the cycle	-

Figure 6. Main Export Partners of Kazakhstan<sup>26</sup>



Source: UN Comtrade database.

Figure 7. Main Import Partners of Kazakhstan



Source: UN Comtrade database.

<sup>26</sup> Trade with Bermuda and the British Virgin Islands represented offshore operations in oil and oil products.

## 6. Conclusions and Policy Implications

This paper examined BC features of three CA countries, Kyrgyzstan, Kazakhstan and Tajikistan, and the Russian Federation from first quarter of 2000 through fourth quarter of 2011. The findings can be summarized as follows:

- Unlike in the Russian Federation, the duration of BC in the CA countries is shorter compared to that of developed countries.
- All four countries show significant real exchange rate persistence, which is similar to industrialised countries' BC properties of real exchange rate.
- Volatility of output in all four countries is significantly higher than in developed countries.
- Household consumption is more volatile than output in Kyrgyzstan and the Russian Federation, and it is less volatile than output in Kazakhstan.
- Household consumption is procyclical in the Russian Federation, Kyrgyzstan and Kazakhstan.
- Government expenditures are procyclical in Kyrgyzstan, Tajikistan and the Russian Federation, and it is acyclical in Kazakhstan. It is widely argued that for a fiscal policy to have a stabilising effect it should be countercyclical. Procyclical government expenditure can exacerbate BC fluctuations. Therefore, the governments in Kyrgyzstan and Tajikistan should address their revenue administration policies so as not to reinforce business cycle fluctuations.
- Based on the examination of cross-correlations and results of Granger causality tests, one can conclude that monetary shocks do matter for business cycle fluctuations in Kyrgyzstan and Tajikistan.
- Based on the examination of cyclical properties of prices, it is plausible to conclude that business cycles in Kyrgyzstan and the Russian Federation are driven by demand shocks, and in Tajikistan by supply shocks. There is no clear picture for Kazakhstan since prices are found to be acyclical.
- Migrant remittances are found to be strongly procyclical in Tajikistan, and, surprisingly, countercyclical in Kyrgyzstan.
- Despite the Russian Federation and Kazakhstan being the main economic partners of the Kyrgyz Republic, there is no synchronisation between Kyrgyz BCs with either Russian or Kazakh business cycles.
- Tajikistan's business cycles also appear to be non-synchronised with Russian and Kazakh BCs. This is surprising since the economy of Tajikistan heavily depends on remittances of its migrant workers in the Russian Federation.
- There is synchronisation between Russian and Kazakh BCs. This is indicative of increasing integration of economies of these countries.
- With the exception of Tajikistan, there is a strong positive correlation between price fluctuations of main export commodities of the countries and their BCs. In Kyrgyzstan, aggregate fluctuations are positively correlated with changes in global gold prices, whereas in Kazakhstan and the Russian Federation their BCs are positively correlated with changes in global prices for oil.



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## Annexes

Table A1. Properties of business cycles in OECD economies

Country	Standard Deviation (%)		Ratio Standard Deviation to that of y						Autocorr. y		Correlation with Output					
	y	nx	c	x	g	n	z	y	c	x	g	nx	n	z		
Australia	1.5	1.2	0.7	2.8	1.3	0.3	1.0	0.6	0.4	0.7	0.2	0	0.1	1.0		
Austria	1.3	1.2	1.1	2.9	0.4	1.2	0.8	0.6	0.7	0.8	-0.2	-0.5	0.6	0.7		
Canada	1.5	0.8	0.9	2.8	0.8	0.9	0.7	0.8	0.8	0.5	-0.2	-0.3	0.7	0.8		
France	0.9	0.8	1.0	3.0	0.7	0.6	0.8	0.8	0.6	0.8	0.3	-0.3	0.8	1.0		
Germany	1.5	0.8	0.9	2.9	0.8	0.6	0.8	0.7	0.7	0.8	0.3	-0.1	0.6	0.9		
Italy	1.7	1.3	0.8	2	0.4	0.4	0.9	0.9	0.8	0.9	0	-0.7	0	1.0		
Japan	1.4	0.9	1.1	2.4	0.8	0.4	0.9	0.8	0.8	0.9	0	-0.2	0.6	1.0		
Switzerland	1.9	1.3	0.7	2.3	0.5	0.7	0.7	0.9	0.8	0.8	0.3	-0.7	0.8	0.9		
UK	1.6	1.2	1.2	2.3	0.7	0.7	0.9	0.6	0.7	0.6	0.1	-0.2	0.5	0.9		
US	1.9	0.5	0.8	3.3	0.8	0.6	0.7	0.9	0.8	0.9	0.1	-0.4	0.9	1.0		
Europe	1.0	0.5	0.8	2.1	0.5	0.9	1.0	0.8	0.8	0.9	0.1	-0.3	0.3	0.9		

Source: Backus, Kehoe and Kydland (1995, p. 334; Table 11.1)

Notes: y: real output; c: real consumption; x: real fixed investment; g: real government purchases; nx: ratio of net exports to output, both at current prices; n: civilian employment; z: Solow residual.

Except for the ratio of net exports to output, statistics refer to logarithms of variables. Data are quarterly from the OECD's Quarterly National Accounts, except employment which is from the OECD's Main Economic Indicators. The sample period is 1970:1 to 1990:2

Table A2. Volatility (measured as percentage standard deviation)

Region	Country	Output	CPI	BM	GEX	EXP	IMP	RPC	RGFCF	NEER	REER
	US	2.9	1.3	1.6	3.2	7.2	6.1	1.5	5.2	4.9	4.5
	UK	2.6	2.0	8.4	...	5.4	6.1	1.9	4.5	4.4	5.1
	Japan	3.7	1.8	1.7	...	7.2	11.8	1.6	3.9	7.3	7.5
North Africa	Israel	4.3	26.2	49.9	89.4	6.5	10.6	20.2	19.9	19.9	7.2
	Jordan	8.2	3.7	3.3	16.3	16.3	11.8	13.3	19.7	3.3	3.2
	Morocco	2.9	1.7	2.5	6.8	14.7	10.5	5.3	16.3	2.5	1.9
	Tunisia	3.5	0.7	3.0	13.8	13.9	10.3	2.4	9.0	3.4	...
Latin America	Argentina	9.6	56.6	42.2	8.3	12.5	22.9	6.0	14.5	...	...
	Barbados	4.3	3.5	3.3	7.1	16.5	8.9	9.3	...	...	...
	Brazil	3.3	59.6	56.8	61.1	10.4	13.1	6.4	8.4	...	...
	Chile	8.3	7.1	5.8	94.1	17.2	17.3	7.7	23.6	6.5	2.1
	Colombia	3.1	4.8	4.0	6.7	11.0	13.1	2.3	14.6	6.8	6.8
	Mexico	3.6	37.1	11.4	14.5	11.4	16.5	5.9	8.1	...	...
	Peru	8.5	79.1	42.6	34.4	13.2	19.9	...	12.7	...	...
	Trinidad	5.9	2.4	3.9	...	18.7	17.9	19.0	36.8	7.0	6.9
	Uruguay	5.4	47.8	41.3	20.3	16.2	17.5	13.9	19.1	14.0	9.2
Asia	Bangladesh	4.4	1.5	3.6	...	10.8	13.9	2.5	2.8	...	...
	Hong Kong	3.8	1.9	2.4	9.4	7.0	7.9	2.5	7.4	3.9	4.0
	India	2.6	3.9	5.8	8.5	7.5	11.4	4.7	...	...	...
	Korea, South	5.1	3.4	6.9	12.2	9.4	13.7	3.7	9.7	...	...
	Malaysia	6.7	2.1	3.2	10.1	10.4	11.6	7.6	23.2	5.2	5.2
	Pakistan	4.2	3.2	3.6	13.2	13.5	12.2	...	11.7	4.3	4.3
	Philippines	18.0	7.1	3.9	11.2	11.5	11.6	8.0	12.3	6.9	6.1
	Turkey	4.0	38.8	9.6	33.3	12.3	14.1	4.6	9.6	...	...

Region	Country	Output	CPI	BM	GEX	EXP	IMP	RPC	RGFCF	NEER	REER
East Europe	Hungary	4.7	2.6	4.5	7.9	7.1	7.3	2.6	3.2	4.5	3.9
	Lithuania	14.5	23.3	10	7.5	10.6	11.6	5.7	11.3	...	...
	Macedonia	6.7	15.1	13.4	...	8.4	11.2	...	...	34.2	8.9
	Romania	8.3	19.1	11.6	24.7	15.0	13.9	6.6	8.6	...	12.5
	Slovak Republic	2.7	2.1	2.5	6.3	10.8	9.7	2.4	10.7	4.7	3.5
	Slovenia	2.4	4.1	7.6	3.6	9.9	8.9	1.5	4.3	...	...

Source: Male (2010, p. 14; Table 4(a))

**Table A3. Relative volatility**

Region	Country	CPI	BM	GEX	EXP	IMP	RPC	RGFCF	NEER	REER
	US	0.5	0.6	1.1	2.4	2.1	0.5	1.8	1.7	1.5
	UK	0.8	3.3	...	2.1	2.4	0.7	1.8	1.7	2.0
	Japan	0.5	0.5	...	1.9	3.2	0.4	1.1	2.0	2.0
North Africa	Israel	6.1	11.5	20.7	1.5	2.4	4.7	4.6	4.6	1.7
	Jordan	0.5	0.4	2.0	2.0	1.5	1.6	2.4	0.4	0.4
	Morocco	0.6	0.9	2.4	5.1	3.7	1.8	5.7	0.9	0.7
	Tunisia	0.2	0.9	3.9	3.9	2.9	0.7	2.5	1.0	...
	Argentina	5.9	4.4	0.9	1.3	2.4	0.6	1.5	...	...
Latin America	Barbados	0.8	0.8	1.7	3.8	2.1	2.2	...	...	...
	Brazil	18	17.1	18.4	3.1	4.0	1.9	2.5	...	...
	Chile	0.9	0.7	11.3	2.1	2.1	0.9	2.8	0.8	0.3
	Colombia	1.6	1.3	2.2	3.6	4.3	0.7	4.7	2.2	2.2
	Mexico	10.3	3.2	4.0	3.2	4.6	1.6	2.3	...	...
	Peru	9.3	5.0	4.0	1.6	2.3	...	1.5	...	...
	Trinidad	0.4	0.7	...	3.2	3.0	3.2	6.3	1.2	1.2
	Uruguay	8.8	7.6	3.7	3.0	3.2	2.6	3.5	2.6	1.7

Region	Country	CPI	BM	GEX	EXP	IMP	RPC	RGFCF	NEER	REER
Asia	Bangladesh	0.4	0.8	...	2.5	3.2	0.6	0.7	...	...
	Hong Kong	0.5	0.6	2.5	1.9	2.1	0.7	2.0	1.0	1.1
	India	1.5	2.2	3.3	2.9	4.4	1.8	...	...	...
	Korea, South	0.7	1.3	2.4	1.8	2.7	0.7	1.9	...	...
	Malaysia	0.3	0.5	1.5	1.5	1.7	1.1	3.5	0.8	0.8
	Pakistan	0.8	0.9	3.2	3.2	2.9	...	2.8	1.0	1.0
	Philippines	0.4	0.2	0.6	0.6	0.7	0.4	0.7	0.4	0.3
	Turkey	9.7	2.4	8.3	3.1	3.5	1.1	2.4	...	...
	Hungary	0.6	1.0	1.7	1.5	1.6	0.6	0.7	1.0	0.8
	Lithuania	1.6	0.7	0.5	0.7	0.8	0.4	0.8	...	...
East Europe	Macedonia	2.2	2.0	...	1.3	1.7	...	...	5.1	1.3
	Romania	2.3	1.4	3.0	1.8	1.7	0.8	1.0	...	1.5
	Slovak Republic	0.8	0.9	2.3	4.0	3.6	0.9	3.9	1.7	1.3
	Slovenia	1.7	3.2	1.5	4.1	3.7	0.6	1.8	...	...

Source: Male (2010, p. 16; Table 5 (a))

Notes: Output: real manufacturing or industrial production; CPI: consumer price index; BM: broad money; GEX: real government expenditure; EXP: real exports of goods and services; IMP: real imports of goods and services; RPC: real private consumption; RGFCF: real gross fixed capital formation (investment); NEER: nominal effective exchange rate; REER: real effective exchange rate.

Table A4. Granger causality between money supply cycle and real GDP cycle

Country	Granger causality of cyclical part of M1 on cyclical part of real GDP			Granger causality of cyclical part of M2 on cyclical part of real GDP			Granger causality of cyclical part of real GDP on cyclical part of M1			Granger causality of cyclical part of real GDP on cyclical part of M2		
	Lag 2	Lag 4	Lag 6	Lag 2	Lag 4	Lag 6	Lag 2	Lag 4	Lag 6	Lag 2	Lag 4	Lag 6
Kyrgyzstan	Does not Granger Cause	Grange Cause	Grange Cause	Does not Granger Cause	Grange Cause	Grange Cause	Grange Cause	Does not Granger Cause	Does not Granger Cause	Grange Cause	Does not Granger Cause	Does not Granger Cause
Kazakhstan	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause
Tajikistan	-	-	-	Grange Cause	Does not Granger Cause	Does not Granger Cause	-	-	-	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause
Russia	-	-	-	Does not Granger Cause	Does not Granger Cause	Does not Granger Cause	-	-	-	Grange Cause	Grange Cause	Grange Cause

Notes: "-": unavailable data.

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