

# Monetary Policy Efficiency in the Economies of Central Asia\*

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## Abstract

*This study examines monetary policy efficiency in Central Asia by investigating the monetary transmission mechanism in the region's economies. To examine monetary policy efficiency, it is necessary to take into account factors that might impede the transmission, such as high levels of dollarization, weak financial sectors, underdeveloped capital markets, and low monetization of economies. Empirical findings confirm the importance of exchange rate pass-through in transition economies with high dollarization. The findings also provide an empirical case for deepening the local financial sectors to improve the efficiency of monetary policy and to improve resilience to external and other shocks.*

## 1. Introduction

Knowing the monetary transmission mechanism (MTM) is necessary for conducting an effective monetary policy. This study aims to contribute to our understanding of monetary policy effects in emerging market economies by investigating the transmission channels of monetary policy in three CIS economies in Central Asia – Kazakhstan, the Kyrgyz Republic, and Tajikistan. These countries share a common economic history, and have overcome a period of large macroeconomic instability and deep recession. The profound economic transformation which took place after these countries became independent, combined with liberalization of prices and trade, resulted in hyperinflation and large external imbalances in the first half of the 1990s. The final objective for the macroeconomic policy of the central banks in these states became price stabilization and external balance.<sup>1</sup> Their monetary authorities managed to achieve overall macroeconomic stability in the late 1990s. Since 2000, their economies have been characterized by single-digit inflation rates and positive economic growth. Macroeconomic stabilization has brought advances in their financial systems while at the same time a need for elaborate and efficient monetary policy.

The present study seeks to estimate the impact of monetary policy on the output growth and price levels in these economies. Three major channels of monetary policy transmission are the focus of this empirical investigation: the interest rate channel, exchange rate pass-through, and the credit channel.<sup>2</sup> These three channels

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<sup>1</sup> Gurgun, Snoek, Craig, and McHugh (1999) give a description of the economic development and monetary policy framework in the Central Asian states in the 1990s.

<sup>2</sup> In the present study, the credit channel is represented by the bank lending channel.

are considered in a vector autoregression (VAR) framework through investigation of the impulse response functions of prices and output to shocks in the policy variables. Exchange rate pass-through (ERPT) is found to be a strong channel of monetary policy transmission, while the interest rate does not prove to be an important monetary transmission channel. The results about the bank lending channel do not allow us to make a satisfactory conclusion. This finding can be explained by the fact that financial sectors in Central Asian economies remain weak and underdeveloped. An empirical investigation of the pass-through from the official rates of central banks to different market rates was performed by estimating an autoregressive distributed lag model (ARDL). Nearly complete pass-through has been established in most cases. The pass-through from interest rates to prices and output has, however, been found to be almost non-existent.

The empirical results testify to the limited ability of central bankers in the region to affect the real sector and prices due to ineffective functioning of major transmission channels. The findings confirm the general outcomes of previous studies on the MTM in transition economies, i.e., strong exchange rate pass-through and a weak interest rate channel.

The paper is organized as follows. Section 2 discusses the factors that potentially impede effective monetary policy in the Central Asian economies. Section 3 outlines the proposed methodology and describes the data. Section 4 presents the results. Section 5 investigates the completeness of the interest rate channel in the three economies and Section 6 presents the results. Section 7 concludes.

## **2. Barriers to Effective Monetary Policy in Central Asia**

This study is motivated by the literature on monetary policy transmission channels.<sup>3</sup> As monetary policy has gained importance in emerging market economies, there has been a growing interest in studying the transmission channels and their efficiency in the context of transition.<sup>4</sup>

Interest rate pass-through is the first transmission mechanism to be modeled, and is found to be a strong transmission channel in advanced economies. To maintain price stability, monetary authorities have to understand how fast and to what extent their policy instruments affect aggregate demand and inflation. Putting it simply, lower interest rates lead to an increase in aggregate demand, and therefore promote output growth. Besides including interest rates in a VAR framework to examine this channel, authors have also studied the first stage of interest rate pass-through – the transmission from policy rates to different market rates.<sup>5</sup>

Effective functioning of other transmission channels is related to interest rate pass-through. An increase in interest rates leads to an appreciation of the local currency, and thus affects ERPT. This will have an impact on output by affecting the competitiveness of domestic goods vis-à-vis foreign goods. The exchange rate channel has been found to be a major channel of monetary transmission in transition

<sup>3</sup> A comprehensive description of MTM functioning can be found in (Mishkin, 1996), who provides an exhaustive explanation of the existing transmission channels.

<sup>4</sup> Egert and MacDonald (2006) provide a summary of a large number of empirical studies on transmission channels in transition economies.

<sup>5</sup> See, for example, (Egert, MacDonald, 2006) and (Crespo-Cuaresma et al., 2004).

economies. Central Asian economies are small, open, and substantially affected by external shocks. For example, Kazakhstan's economy depends on its oil exports and has benefited from oil sector revenues.<sup>6</sup> Previous literature has found that exchange rate shocks in emerging market economies tend to feed into the aggregate price level faster than in advanced economies.<sup>7</sup> It is important to take into account the mechanism through which ERPT is put into effect in the context of transition. In most cases, central bankers have to affect the exchange rate directly, by conducting foreign exchange interventions.<sup>8</sup> This is directly related to the weak response of the value of the national currency to changes in interest rates, and the practically absent interest rate pass-through.

Recent economic developments, described by expansion of economic activity and advances in the banking sector, could have an impact on the credit channel of monetary policy transmission. The bank lending channel, which is a narrower representation of the credit channel, is related to the ability of second tier banks to provide finance to the private sector. An increase in available credit leads to an increase in aggregate demand and promotes economic activity.<sup>9</sup> Dabla-Norris and Floerkemeier (2006) argue that the effectiveness of this channel is related to the ability of economic agents to substitute loans available from banks with other sources of finance. The results of empirical studies on credit channel performance in transition economies vary from country to country.<sup>10</sup>

The functioning of the monetary policy transmission channels in the economies of Central Asia is heavily affected by several factors that should be taken into account when examining the effects of monetary policy and the monetary policy framework.

High levels of dollarization resulting from periods of high inflation and economic instability continue to characterize these countries (see *Figure B2* in Appendix B).<sup>11</sup> Ize and Levy Yeyati (2003) suggest that financial dollarization displays high persistence if the expected volatility of the inflation rate remains high in relation to the expected volatility of the real exchange rate, even after price stabilization has been achieved.<sup>12</sup> Significant inflows of foreign capital and remittances from

<sup>6</sup> Oil sector production accounts for about 30 percent of GDP and oil export revenues constitute more than 50 percent of total export revenues of the country. Some analysts and researchers have studied the problem of the Dutch disease in the Kazakh economy (see (Kutan, Wyzan, 2005).

<sup>7</sup> See, for example, (Calvo, Reinhart, 2002).

<sup>8</sup> More discussion on nominal anchors and exchange rate regimes in CIS economies can be found in (Keller, Richardson, 2003).

<sup>9</sup> Mishkin (1996) explains that expansionary monetary policy, which increases bank reserves and bank deposits, should increase the quantity of bank loans available.

<sup>10</sup> See (Hericourt, 2006), (Dabla-Norris, Floerkemeier, 2006), and (Egert, McDonald, 2006).

<sup>11</sup> Estimated dollarization indices (DIs) for the Central Asian economies are available from the study by Havrylyshyn and Beddies (2003), who calculate the DIs as the ratio of foreign currency denominated deposits to broad money. However, their estimates are only available up to 2001. Therefore, newly available data were used to calculate the DIs for the three economies.

<sup>12</sup> Horvath and Maino (2006) argue that dollarization will decline, reflecting agents' preference to switch from foreign currency when its purchasing power in terms of the domestic currency is no longer more stable than the purchasing power of the domestic currency. Therefore, an important driving force of dollarization is the expected volatility of the real exchange rate relative to the expected volatility of inflation.

abroad contribute to growing levels of currency substitution and asset dollarization.<sup>13</sup> Havrylyshyn and Beddies (2003) argue that in dollarized economies exchange rates are more volatile, money demand is unstable, and thus interest rates do not constitute an effective instrument of monetary policy. Therefore, currency substitution and dollarization can potentially affect the monetary transmission channels.<sup>14</sup> Horvath and Maino (2006) argue that ERPT grows stronger in the context of a highly dollarized economy.

The efficiency of monetary policy in Central Asian economies is also affected by the state of their financial sectors. Dabla-Norris and Floerkemeier (2006) claim that monetary policy transmission depends on the extent of financial intermediation, the size, concentration, and health of the banking system, and the development of capital markets. *Tables B2–B3* in *Appendix B* present selected financial indicators for a group of transition economies. The degree of monetization in the economies of Central Asia is lower than that in more advanced transition economies. Moreover, the size of the banking systems measured as the ratio of bank assets to GDP is smaller in these economies than in Central and Eastern Europe (CEE), including the Baltic countries. Other indicators, such as bank deposits to GDP and bank credit to the private sector, show that financial intermediation is still low and banks do not constitute an important source of financing of real activity. Though Kazakhstan has seen rapid credit growth over the recent period, its level of credit to the economy is still inferior to the economies in CEE. Large inflows of remittances from abroad might constitute an important financial source in the region, especially in Kyrgyzstan and Tajikistan.<sup>15</sup> In such a context the efficiency of the interest rate, bank lending, balance sheet, and asset price channels of monetary transmission can be seriously challenged. It is evident that dollarization together with underdeveloped financial sectors can pose a serious obstacle to the effective implementation of monetary policy decisions in the countries of Central Asia.

### 3. Proposed Methodology and Data Description

To empirically investigate the effects of monetary policy through policy-related variables on prices and output, a five-variable Vector Autoregression (VAR) model has been estimated. The present VAR system includes the following endogenous variables: real income ( $y$ ), price indices ( $p$ ), policy rates ( $r$ ), monetary aggregates ( $m$ ), and the nominal exchange rate to the U.S. dollar ( $x$ ). The world prices of oil, gold, and cotton are included as exogenous variables in the case of Kazakhstan, the Kyrgyz Republic, and Tajikistan, respectively. Moreover, the U.S. Federal Funds Rate is included as an exogenous variable to account for uncovered interest rate parity, and seasonal dummies are used to account for seasonality in the data.<sup>16</sup> All variables are transformed into natural logarithms except interest rates. The ADF test results show that all variables are non-stationary and I(1), except for interest rates. Therefore, first differences of these series are used in the VAR estimation.

<sup>13</sup> See *Table B1* in *Appendix B*.

<sup>14</sup> See (Baliño, Bennett, Borensztein, 1999) and (Sahay, Végh, 1995) for a discussion of dollarization and the conduct of monetary policy.

<sup>15</sup> Tajikistan has the one of the highest remittances to GDP ratios in the world according to IMF staff estimates.

<sup>16</sup> A more detailed description of the data is given in *Table A1* in *Appendix A*.

The following VAR model is estimated:

$$\Delta Y_t = A(L)\Delta Y_{t-1} + B(L)\Delta X_{t-1} + u_t \quad (1)$$

where  $Y$  is a vector of endogenous variables and  $X$  is a vector of exogenous variables.  $A(L)$  and  $B(L)$  correspond to the matrices of coefficients to be estimated, and  $u$  is a vector of impulses. Using VAR will also allow us to analyze the short dynamics based on variance decompositions and impulse response functions.

The following ordering is used in the estimation:

$$Y = \{y_b, p_b, r_b, m_t/c_b, x_t\}$$

Using alternative orderings showed that the results are robust to changes in the order of the variables. To capture the effect of shocks in available bank lending, a variable measuring credit volume is included in the VAR specification instead of the variable measuring money supply.<sup>17</sup>

Price indices are represented by the producer price and consumer price indices (PPI and CPI). Industrial production volume is measured in units of national currencies. Due to the unavailability of data on the volume of industrial production in the case of Kazakhstan, the industrial production index is used. Nominal exchange rates are measured as units of domestic currency per one U.S. dollar. Monetary aggregates are represented by two measures: money and broad money. An important difference between money and broad money is that the latter includes foreign currency deposits in local banks.

VAR estimation is a popular methodology for investigating monetary policy transmission mechanisms. Though it is an atheoretic approach, it can still give insights into the relationships between variables and shed light on the responsiveness of variables in the system to shocks to policy variables in the system. In the case of transition economies, VAR estimation is a useful methodological approach with good predictive power.<sup>18</sup>

#### 4. Empirical Results

The exchange rate transmission to prices and output is investigated by examining the impulse response functions of changes in producer price and consumer price inflation after a shock to a change in the nominal depreciation rate. The shock to nominal exchange rates is represented as a 1percent change in nominal depreciation. The impulse responses show the percentage changes in inflation rates and output growth. The period under investigation spans 24 months after the shock occurs.

<sup>17</sup> For example, Hericourt (2006) and Dabla-Norris and Floerkemeier (2006) include data for domestic credit in a VAR model instead of monetary aggregates to study the bank lending channel.

<sup>18</sup> Several authors have studied the problem of asymmetric monetary policy effects. For example, Cover (1992) found that in the U.S. economy, positive money supply shocks did not have effects on output, while negative shocks did. Garcia and Schaller (1999) find that the magnitude of the monetary policy effects depends also on whether there is a boom or a recession in a given economy. To account for this non-linearity in monetary policy effects empirically, a General Method of Moments (GMM) estimation might be employed. This discussion is, however, beyond the scope of the present study and offers an opportunity for further research.

The impulse response functions are shown in *Figure C1* in *Appendix C*. The results show that in Kyrgyzstan, inflation reacts rather strongly and statistically significantly to shocks in the depreciation rate. A one-percent change in the nominal exchange rate will lead to an almost 0.4 percent increase in PPI inflation and about a 0.12 percent change in CPI inflation after 2 to 3 months. Producer prices are more heavily affected by the exchange rate variation than consumer prices. After 3 months, inflation returns toward its original level but does not reach it even 24 months after the shock.

In Kazakhstan, inflation seems to be less sensitive to nominal depreciation rate shocks. The PPI reaches its highest peak after 3 months, at about 0.2 percent, while consumer price inflation does not increase by more than about 0.05 percent.

In Tajikistan, the behavior of producer prices and consumer prices does not differ substantially. Quantitatively, however, prices in Tajikistan are the most sensitive to changes in the rate of nominal depreciation. Inflation would rise by 0.4 percent if the nominal depreciation rate increased by 1 percent. The shock to exchange rates brings more volatility to the inflation rate.

The results obtained show that prices in the three economies exhibit different magnitudes of reaction to changes in the nominal rate of depreciation. In Kyrgyzstan and Tajikistan, nominal depreciation shocks had a significant effect on the price level. In Kazakhstan, the quantitative change in the price level is smaller than in neighboring countries. Its weaker exchange rate pass-through might be a consequence of a successful exchange rate stabilization policy. Indeed, though the countries report having floating exchange rate regimes, their central banks are very much concerned about the stability of exchange rates. This is reflected in their active policies to control the rate of depreciation of the domestic currencies.<sup>19</sup> Moreover, during the period observed, prices of certain items were still regulated in transition economies.<sup>20</sup>

Analysis of the effect of a shock to the nominal depreciation rate on output shows that increased exchange rate volatility leads to increased volatility in the output growth rate in all three economies (see *Figure C2* in *Appendix C*). Such a cyclical fluctuation of the impulse response function is somewhat unusual and difficult to interpret. The output growth rate varies within one percent, which is a relatively small pass-through from nominal depreciation of the local currency to the real sector.<sup>21</sup>

Analysis of the effects of unanticipated changes in the policy rate show that the interest instrument is still ineffective in Central Asian states.<sup>22</sup> A one-percent increase in the repo rate in Kyrgyzstan will lead to an increase in CPI inflation of less than 0.03 percent. This tiny effect dies out after 5 months. In Kazakhstan, the inflation rate rises by about 0.06 percent after a shock to the policy rate. In Tajikistan,

<sup>19</sup> See (Keller, Richardson, 2003).

<sup>20</sup> See (Sosic, Kraft, 2006).

<sup>21</sup> These results can probably be explained by the poor quality of industrial production as a proxy for real output. As Hericourt (2006) argues, industrial production offers only a partial view of the economy's productive abilities, and it exhibits more pronounced "procyclicality" and instability than GDP, for example.

<sup>22</sup> The figure with the impulse response functions of prices and output to a shock in the official interest rates is not presented in the *Appendix* due to insignificance of the effect. The results are available from the author upon request.

the policy rate has a tangible effect on the price level, as after a one-percent shock the inflation rate will decrease by 0.2 percent almost immediately after the shock. These results, however, do not allow for drawing satisfactory conclusions about the interest rate channel in the Central Asian states. The completeness of the interest rate transmission is analyzed in the next section.

To establish whether shocks to money represented by different aggregates have an impact on inflation rates and output, the impulse response functions of the CPI and the PPI, together with output, to shocks in the money growth rate were considered as well (see *Figures C3–C4* in *Appendix C*). Prices appear to be more sensitive to changes in money including foreign currency deposits in the cases of Kyrgyzstan and Kazakhstan.

The findings about the credit channel show that a shock to credit brings increased volatility in output growth. The cyclical behavior of output growth does not help establish results about the performance of the bank lending channel. The results are, however, statistically significant in Kyrgyzstan and Kazakhstan. Inflation does not change significantly in response to a positive shock to credit growth (see *Figures C5–C6* in the *Appendix C*).

The time span covered in the present analysis might be characterized by a structural change. Hence, it is necessary to check the robustness of the results over different sub-periods in the sample. Due to a short time period in the case of Tajikistan, testing for the stability of the system during different periods was not possible. In the cases of Kyrgyzstan and Kazakhstan, the sample was divided into two sub-samples: from the beginning of the sample until December 2000, and from January 2001 until the end of the sample. Starting from 2001 the economies are characterized by relatively stable inflation and exchange rates, and this allows us to examine whether a relatively stable context reinforces the effect of monetary policy.

Impulse response function analysis shows that prices reacted less to shocks to the nominal depreciation rate after stabilization had been achieved. There is no significant evolution in the interest rate or bank lending channel over the whole period.

## **5. More on the Interest Rate Channel**

The role of interest rate pass-through is crucial, since it represents a potentially important transmission channel, and because other channels of the MTM are related to the performance of this transmission mechanism. However, the results of the VAR estimation in the previous section have shown that the policy rate is not an effective tool for affecting aggregate demand in the economies of Central Asia. In this section, the pass-through from the official interest rates of central banks to other rates is examined.

Despite recent advancements in the regional banking systems, financial intermediation remains weak. This contributes to the weakness of the interest rate channel and, thus, ineffective credit, asset price, and balance sheet channels.<sup>23</sup> Moreover, monetary policy operations are very limited in scope and in their ability to affect economic activity.

<sup>23</sup> The financial sectors remain small especially in Kyrgyzstan and Tajikistan. *Tables B2* and *B3* in *Appendix B* show several financial sector indicators.

The key questions about the interest rate pass-through in Kazakhstan, the Kyrgyz Republic, and Tajikistan that will be answered in this section are: (i) whether the pass-through from official rates to various market rates is complete, and (ii) how the reaction of market rates to changes in the key rate changes over time. For the purposes, of this investigation, the methodology proposed by Crespo-Cuaresma et al. (2004) is employed.

The data used is of monthly frequency and includes a range of interest rates.<sup>24</sup> Central banks' rates on refinancing operations and on repo operations are used as official rates in the investigation.<sup>25</sup> The graphical representations of the interest rate time series for the three economies are shown in *Appendix D*.

The higher and more volatile rates on bank loans could reflect the willingness of banks to hedge themselves against the risk of bad loans. Higher interest rates would also enable banks to make their payments on deposits. Underdeveloped financial systems and the local banks' limited capacity to borrow abroad make them find other ways to avoid credit risks.

The Crespo-Cuaresma et al. (2004) methodology consists in representing the relationship between the policy rate and a given market rate as an autoregressive distributed lag (ARDL) model such as

$$i_t^m = \alpha_0 + \sum_{j=1}^p \alpha_j i_{t-j}^m + \sum_{k=0}^q \beta_k i_{t-k}^p + \varepsilon_t \quad (2)$$

where  $i_t^m$  is the market interest rate,  $i_t^p$  is the policy rate, which in this study is represented by the official rates of the central banks, and  $\varepsilon_t$  is a white noise disturbance with constant variance  $\sigma_t$ . Equation (2) can be rewritten using the lag operator as

$$A(L)i_t^m = \alpha_0 + B(L)i_t^p + \varepsilon_t \quad (3)$$

where

$$A(L) = 1 - \sum_{j=1}^p \alpha_j L^j, \quad \text{and} \quad B(L) = \beta_0 + \sum_{k=0}^q \beta_k L^k$$

The long-run relationship implied by this parameterization is given by

$$i^m = \frac{\alpha_0}{A(1)} + \frac{B(1)}{A(1)} i^p \quad (4)$$

<sup>24</sup> The data description is given in *Table D1* in *Appendix D*. Data on interest rates with different maturities is not available for the whole period of investigation in Kyrgyzstan and Tajikistan.

<sup>25</sup> The choice of the refinancing rate as a main policy rate is not completely justifiable, as, in the context of transition economies, central banks' policies are mostly concerned with absorbing liquidity rather than providing it. Central bank deposit rates could constitute a more relevant interest rate for the purposes of the current study. Data on central bank deposit rates was not readily available at the time the study was conducted. Using refinancing and repo rates can still give important insights into the functioning of the interest rate channel. Central bank deposit rates can be used in prospective studies on the MTM in Central Asia.



The error correction (EC) representation of equation (2) can be written as

$$\Delta i_t^m = \delta_0 + \sum_{j=1}^{p-1} \mu_j \Delta i_{t-j}^m + \sum_{k=0}^q \kappa_k \Delta i_{t-k}^p + \gamma(i_{t-1}^m - \lambda i_{t-1}^p) + \varepsilon_t \quad (5)$$

where the term in brackets represents the long-run equilibrium. All the data series were subject to the unit root test through an ADF procedure. Due to the existence of a unit root in the autoregressive representation of some series included in the analysis,  $\gamma$  is interpreted as the speed of adjustment to the cointegration relationship given by equation (4).

To choose the lag length in the ARDL representation, certain selection criteria can be used. The most popular ones are the Schwarz Bayesian Criterion (SBC) and the Akaike Information Criterion (AIC). The more an identified model fits the data, the lower the AIC and SBC will be. As the fit of model improves, the AIC and SBC will approach  $-\infty$ . These criteria can be used to select the most appropriate model; one model is said to fit better than another model if the AIC or SBC for the first model is smaller than for the second model.<sup>26</sup>

To examine whether there is any change in the elasticity between different market rates and the official rate over the whole period, the time span is divided into the same sub-samples as in the VAR estimation in the previous sections.

## 6. Empirical Results: Interest Rate Pass-Through in the Central Asian Economies

*Table D2* in the *Appendix* gives the results of the estimation of the interest rate channel for the three countries. The results show estimators of the long-run multiplier and the speed of adjustment,  $\lambda$  and  $\gamma$ , respectively. The lag length of the ARDL models was chosen so that the Schwarz information criterion is minimized. All the estimations included an official rate and a given market rate. For each chosen specification, full interest rate pass-through, corresponding to the restriction  $\lambda = 1$ , was tested.

In the case of Kyrgyzstan, nearly complete pass-through is exhibited in the case of interbank money rates, i.e., an increase in the policy rate by 1 percent will lead to an increase in interbank rates by 0.99 percent. The average household deposit rates exhibit a close-to-complete pass-through coefficient. There is evidence of an overshooting effect of lending rates and lombard rates. This effect is rather significant. This could be explained by the overreaction of creditors to rising interest rates in the economy in order to hedge their credit risks in the face of uncertainty and underdeveloped financial markets.

<sup>26</sup> Koehler and Murphree (1988) study the identification abilities of both criteria, applying them to real time series in forecasting models. They found that the AIC and BIC indicate different results in choosing model orders in 27 percent of cases. The authors compare the accuracy of the cases where both criteria indicate the same results. They conclude that it is preferable to use the SIC, which leads to a lower order model for forecasting.

Another study by Neftci (1982) also showed that the AIC and SBC criteria can choose different order models. The reasons could be twofold. First, the Akaike procedure postulates a “reality” too complex to model, and proposes a model that is the best *pseudo* truth instead. Schwarz does not make such an assumption and usually would favor a lower dimensional model. Another reason that could explain the different results of the procedures is the multicollinearity problem. Schwarz’s criterion is quite sensitive to multicollinearity in small samples, and thus favors smaller dimensional models.

The second coefficient of interest,  $\gamma$ , constitutes the coefficient of adjustment of the given retail rate to deviations of the financial markets from equilibrium in the long run. The high statistical significance of the adjustment coefficients confirms that the error correction term belongs to the specification chosen. The diagnostic tests of the estimated residuals show no autocorrelation and homoskedasticity among the residuals. This is a sign of the robustness of the chosen specification.

To check how the pass-through has evolved over time, the period was divided into two sub-periods.<sup>27</sup> The recent period in Kyrgyzstan was characterized by a higher responsiveness of interbank market rates and average deposit rates to shocks in the policy rate. The reaction of the lombard rates has decreased somewhat. In the case of lending rates, the coefficient estimated shows that the lending rates would grow by more than 5 percent if the key rate is increased by 1 percent. This result would rather be evidence of no regular relationship between the official rates of the central bank and the lending rates charged by the second-tier banks.

In the case of Kazakhstan, all rates exhibit an overshooting effect in reaction to the changes in the policy rate. Average interest rates on loans by second-tier banks appear to be cointegrated with the central bank's rate if 1998 is excluded from the sample. This can be explained by the significant effect of the financial crisis in Russia on the economy of Kazakhstan after August 1998. Excluding the financial crisis period from the sample helps us to find the cointegration between different rates and the policy rate. The lending rate changes overshoot the changes in the policy rate almost twice. This might be caused by the desire of banks to hedge themselves against credit risks and to be able to pay interest to households on their deposit accounts.

Another explanation could be a greater integration of Kazakhstan into foreign financial markets, which would make local market rates more sensitive to external shocks. A high degree of dollarization, especially the rising amount of deposits and credits denominated in foreign currency, could also possibly affect the ability of the central bank to influence the domestic financial market rates. A robustness check illustrates that market rates still tend to overshoot the changes in the policy rate in the recent period. Just in the case of household deposits with maturity from 3 months to 1 year, the pass-through has declined and stands at 0.95 percent.

The estimated adjustment coefficients are statistically significant only in the case of lending rates. Moreover, when the period from 1996 to 2000 is examined, no cointegration can be found between the key rate and other rates in the economy.

The results for Tajikistan are rather contradictory, as no cointegration was established between the central bank's refinancing rate and the deposit and lending rates. This could be explained by the short time series, structural breaks in the data, and the general economic context in the country. The only rate cointegrated with the official rate is the money market rate. Not only is it cointegrated, but it also exhibits near complete pass-through, which holds also in the more recent period. The results obtained should be taken with caution and as being only suggestive, since the data available cover a relatively short period of time. Moreover, due to political unrest, the economy of Tajikistan was in distress for a longer period than its neigh-

<sup>27</sup> The results of the estimation over different sub-periods are available from the author upon request.

boring countries. This situation explains why financial sector development in this country lags behind that in other transition economies of the region.

## 7. Conclusions

This paper studies monetary policy transmission in the transition economies of Central Asia. Monetary policy should have gained more importance in these emerging market economies with recent advances and economic development in the region. However, there are certain factors that impede the effective conduct of monetary policy. A significant level of dollarization and financial sector underdevelopment can pose a serious obstacle to the functioning of the monetary transmission channels in these countries. It is important to take this framework into account when examining the monetary transmission channels in the countries of the region.

The present study has established that exchange rate pass-through is the strongest channel of the MTM in all three economies. The stabilization period brought a decline in the exchange rate channel, but this pass-through still represents the major factor affecting the price level. Empirical results show that changes in interest rates have little effect on prices or output, i.e., the interest rate channel has been weak.

The high degree of dollarization in these economies is a likely explanation for the findings of sizable ERPT and a weak interest rate channel. In heavily dollarized economies, the scope for an independent interest rate policy can be limited.<sup>28</sup> Central banks are constrained in their ability to control domestic interest rates, which appear to be influenced by interest rates on dollar denominated assets. The analysis of the completeness of the interest rate channel has, however, confirmed nearly complete pass-through from official rates to other interest rates. The limited real effects of interest rate policy are related to weak financial intermediation and the low sensitivity of economic agents to changes in the cost of borrowing.

The credit channel has proved to have a very small effect on prices, while a positive shock to credit growth would bring more volatility in output. The cyclical behavior in the output growth rate after a credit shock – it falls following the shock and recovers within the next few months – is difficult to interpret and thus should be considered with caution.

Shocks to the money supply appeared to have tangible effects on output and prices. Including foreign currency components in the definition of money can help to establish a stronger relationship between prices and money. Overall, the empirical analysis confirms previous studies' findings about monetary transmission in transition and developing economies with dominant exchange rate pass-through and a weak interest rate channel.

In terms of policy implications, this study shows the importance of further development of financial sectors in the Central Asian countries. Deeper financial markets, developed financial intermediation, and competition will promote the effectiveness of the interest rate and credit channels of monetary transmission. Maintaining the financial stability of the economy will restore the public's confidence in the local currency. Dollarization and currency substitution pose less risk of financial instability in a fundamentally stable economic environment.

<sup>28</sup> See (Horvath, Maino, 2006).

In terms of further research about the monetary transmission mechanisms and the efficiency of monetary policy instruments in the Central Asian region, a valuable extension of the present study could be to include the rate of crawl as a policy variable used by the central banks in the region. The rate of crawl is the rate at which central banks periodically adjust the exchange rate in response to changes in selected quantitative indicators. The exchange rate regimes in Central Asian economies are described as managed floating rates with no predetermined exchange rate path. Central bankers do, however, adjust the exchange rate whenever necessary to support the stability of the national currencies and to maintain competitiveness vis-à-vis their major trade partners. Including this new variable could contribute to the understanding of monetary policy developments and improve the interpretability of the empirical results.

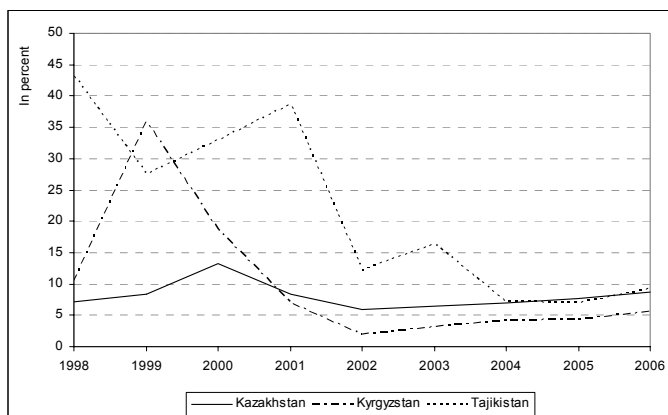
## APPENDIX A

TABLE A1 Data Description

Series	Time span	Number of obs.	Source
<b>Kyrgyzstan</b>			
Consumer Price Index ( <i>in percent</i> )	1995:9 till 2006:12	136	IMF
Producer Price Index ( <i>in percent</i> )	1995:9 till 2006:12	136	IMF
Monetary aggregates (money and broad money) ( <i>in mln soms</i> )	1995:9 till 2006:12	136	IMF
Credit ( <i>in mln soms</i> )	1996:1 till 2006:12	132	NBKR
Industrial Production ( <i>in mln soms</i> )	1995:9 till 2006:12	136	NSC
Rate on repo operations of the NBKR ( <i>in percent</i> )	1995:9 till 2006:12	136	Global Financial Data
Nominal exchange rate (som to US dollar) ( <i>in soms</i> )	1995:9 till 2006:12	136	IMF (official rate, stocks)
<b>Kazakhstan</b>			
Consumer Price Index ( <i>in percent</i> )	1995:1 till 2006:12	144	IMF
Producer Price Index ( <i>in percent</i> )	1995:1 till 2006:12	144	IMF
Monetary aggregates (money and broad money) ( <i>in mln tenge</i> )	1995:1 till 2006:12	144	IMF
Credit ( <i>in mln tenge</i> )	1996:1 till 2006:12	132	NBK
Industrial Production Index ( <i>in percent</i> )	1995:1 till 2006:12	144	Statistical Agency
Refinancing Rate of the National Bank	1995:1 till 2006:12	144	Global Financial Data
Nominal exchange rate (tenge to US dollar) ( <i>in tenge</i> )	1995:1 till 2006:12	144	IMF
<b>Tajikistan</b>			
Consumer Price Index ( <i>in percent</i> )	2000:1 till 2006:12	96	NBT
Producer price Index ( <i>in percent</i> )	2000:1 till 2006:12	96	NBT
Monetary aggregates (money and broad money) ( <i>in mln somoni</i> )	2000:1 till 2006:12	96	IMF
Credit ( <i>in thousand somoni</i> )	2000:1 till 2006:12	96	NBT
Industrial Production ( <i>mln somoni</i> )	2000:1 till 2006:12	96	State Statistical Committee
Official Rate of the NBT ( <i>in percent</i> )	2000:1 till 2006:12	96	NBT
<b>External Sector Variables</b>			
Oil price (US dollars per barrel)	1995:1 till 2006:1	144	Global Financial Data
Gold Price (US dollars per ounce)	1995:1 till 2006:12	144	Global Financial Data
Cotton Price Index (Year 2000 = 100)	2000:1 till 2006:12	96	UNCTAD Handbook of Statistics
Federal Funds Rate ( <i>in percent</i> )	1995:1 till 2006:12	144	Global Financial Data

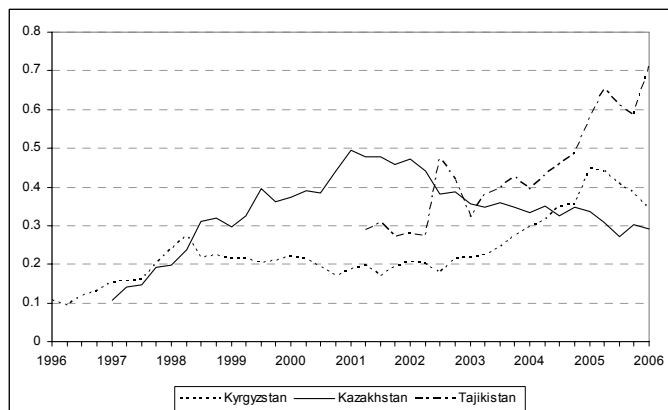
## APPENDIX B Inflation and Dollarization

**FIGURE B1 Inflation in Central Asia**



Source: EBRD Transition Report 2006.

**FIGURE B2 Dollarization Indices in Central Asia**

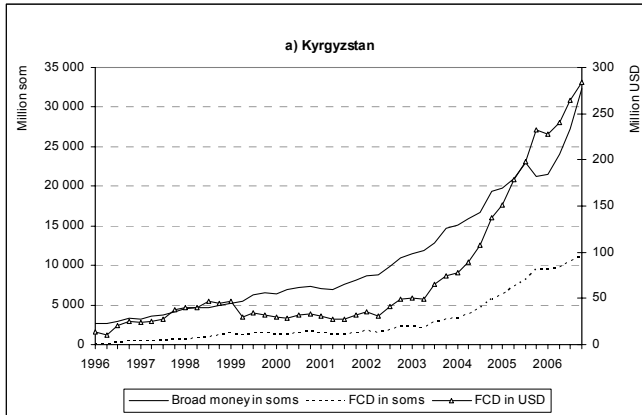


Notes. 1. Computations are done by the author (Dollarization Index (DI) = Foreign Currency Deposits (FCD) / Broad Money (M2))

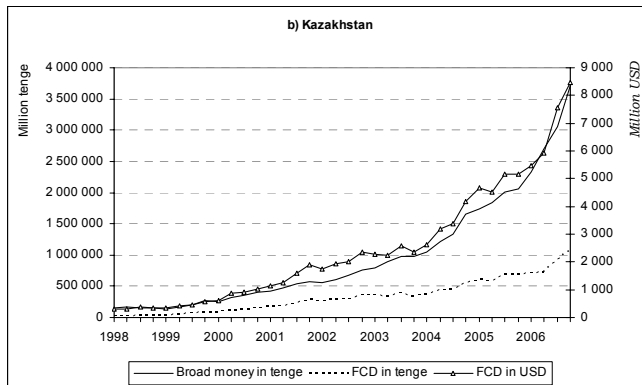
2. Data on deposits in Tajikistan are only available from 2002

Source: Data from national banks, IMF.

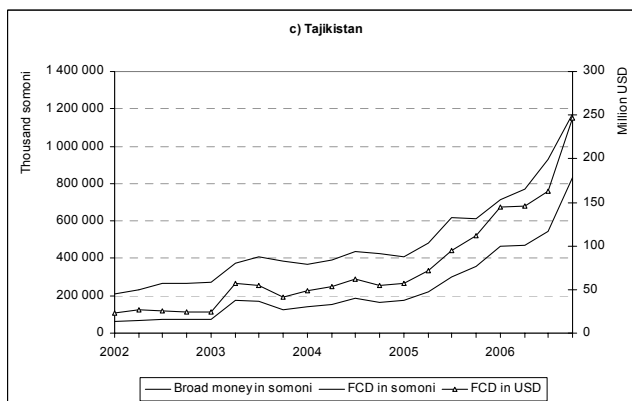
**FIGURE B3 Foreign Currency Deposits Measured in local Currencies and U.S. Dollars**



Source: National Bank of the Kyrgyz Republic



Source: National Bank of Kazakhstan



Source: National Bank of Tajikistan

**TABLE B1 Capital Inflows in Central Asia**

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Remittances* (mln. USD)										
Kazakhstan	60	72	64	122	171	205	147	166	178	187
Kyrgyzstan	3	25	18	9	11	37	78	189	322	481
Tajikistan	...	...	...	...	...	79	146	252	467	1019
FDI** (mln. USD)										
Kazakhstan	1 320	1 143	1 468	1 278	2 861	2 164	2 213	5 436	2 123	6 630
Kyrgyzstan	83	87	38	-7	-1	5	46	132	43	182
Tajikistan	18	25	21	24	10	36	32	272	55	66

Source: \* IMF Migration and Remittances Factbook, 2008.

\*\* EBRD Transition Report, 2006: Finance in Transition

**TABLE B2 Selected Financial Indicators**

	M2/GDP	Bank assets/ /GDP	Bank deposits/ /GDP	Bank credit to private sector
Kazakhstan	26.6	63.3	25.6	26.7
Kyrgyzstan	21.3	51.3	9.2	6.2
Tajikistan	7.0	20.7	8.9	12.9
Armenia	16.4	20.2	10.7	8.2
Azerbaijan	18.0	26.8	12.7	9.1
Estonia	29.5	112.6	44.8	60.0
Latvia	23.1	123.2	36.7	60.1
Czech Rep.	69.8*	99.0***	56.0***	36.0**
Hungary	49.9*	80.0***	34.0***	50.0**
Poland	44.0*	61.0***	34.0***	29.0**

Other sources: \* IFS, World Bank Financial Indicators

\*\* EBRD Transition Report 2007 (data for 2005)

\*\*\* National Banks

Notes. Figures are taken from Dabla-Norris and Floerke (2006) with data for 2005 if not specified otherwise.

**TABLE B3 Credit Growth in Selected Transition Economies**

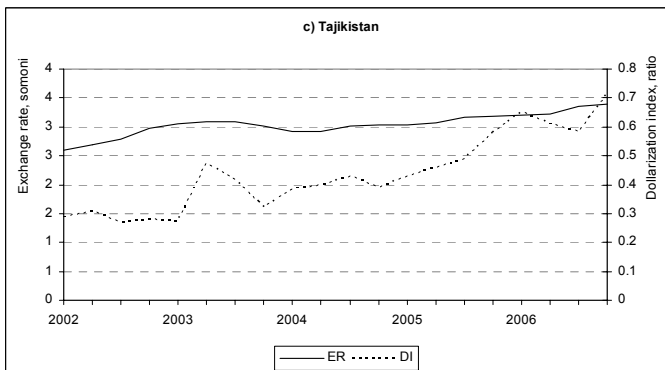
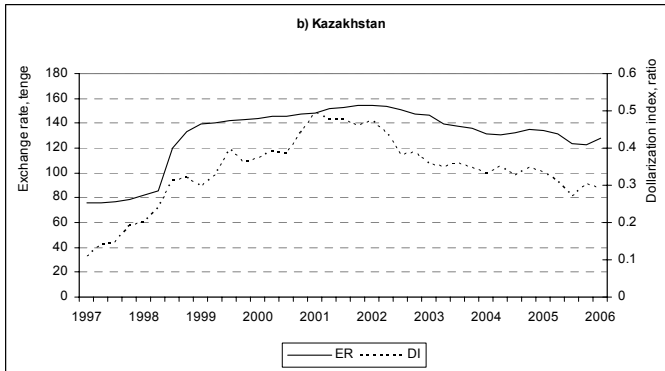
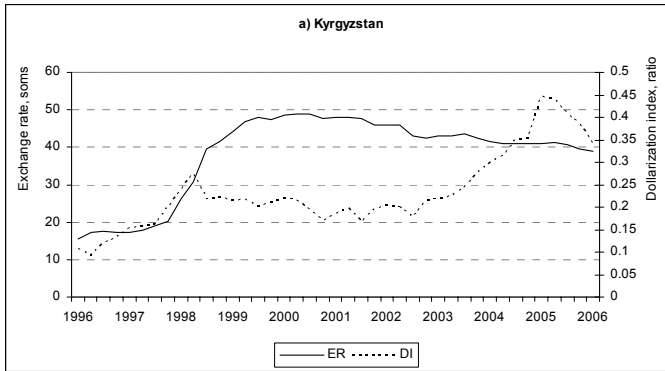
	Credit growth Average 2001–05	Credit to GDP	
		2001	2005
Kazakhstan	56.9	16.8	38.1
Kyrgyz Republic	26.7	3.8	7.8
Tajikistan*	18.1	-	17.8
Armenia	13.8	7.8	8.6
Azerbaijan	33.8	5.0	9.1
Bulgaria	41.0	14.9	45.0
Czech Republic	1.7	39.6	36.6
Romania	42.5	7.7	11.7
Russia	43.6	16.5	26.0
Ukraine	47.7	12.9	33.6

Source: IMF Staff Report, 2006

\* Author's estimation



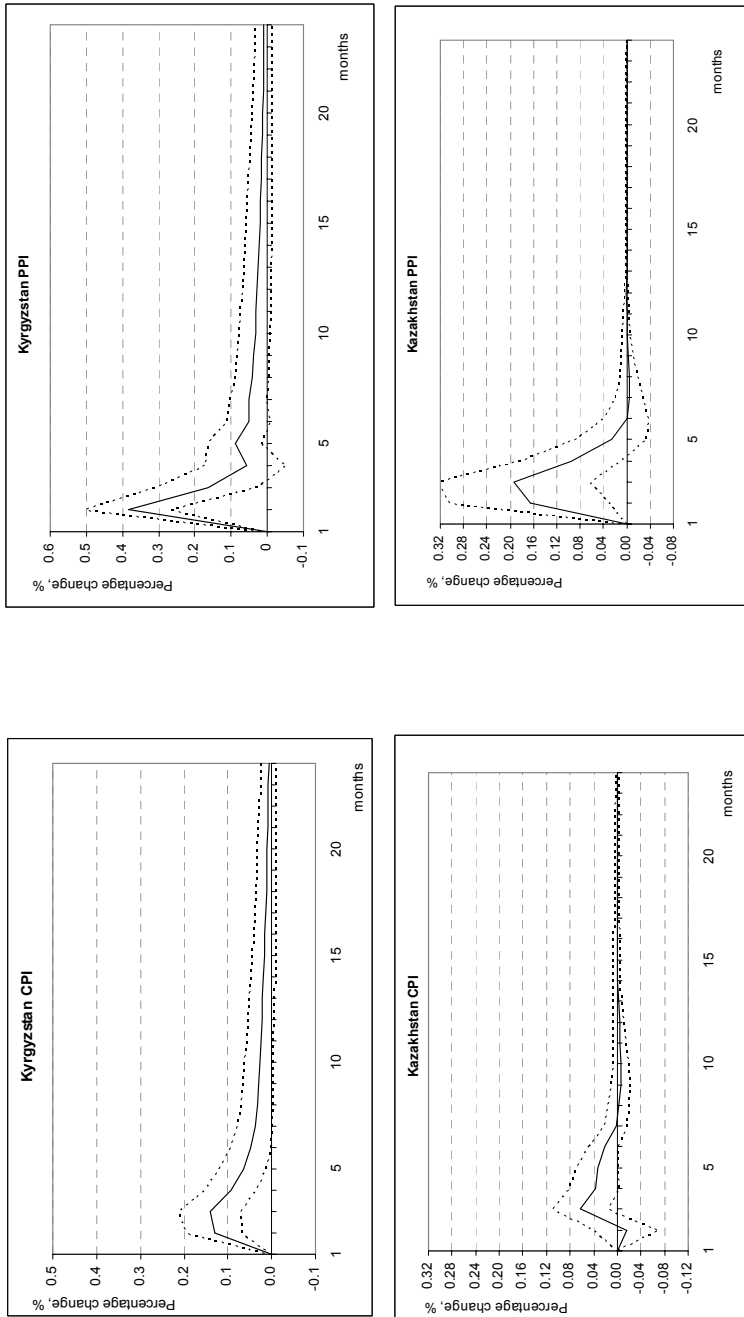
**FIGURE B4 Foreign Exchange Rate (National Currency/USD) and Dollarization Index**

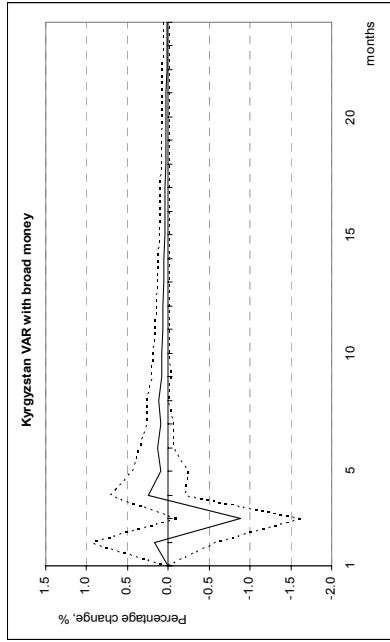
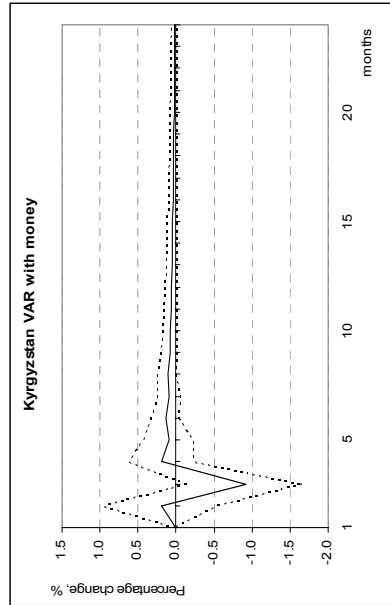
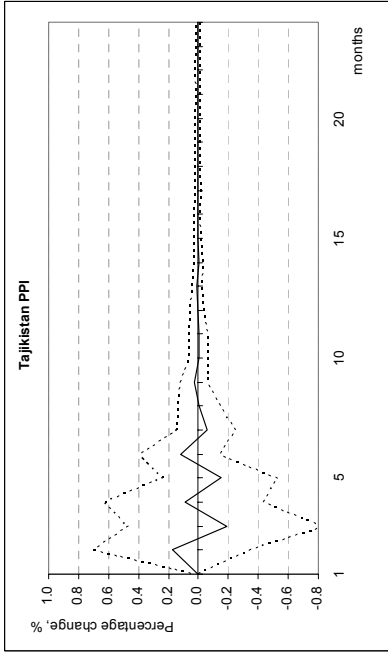
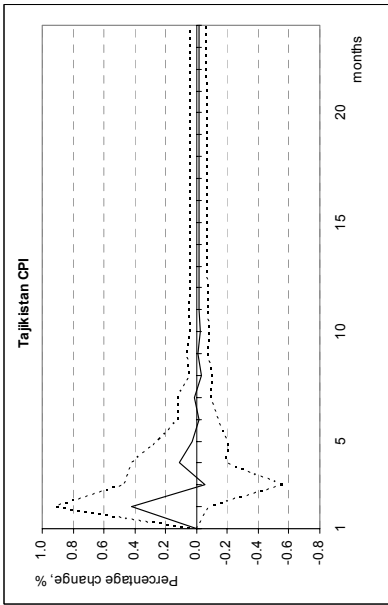


## APPENDIX C

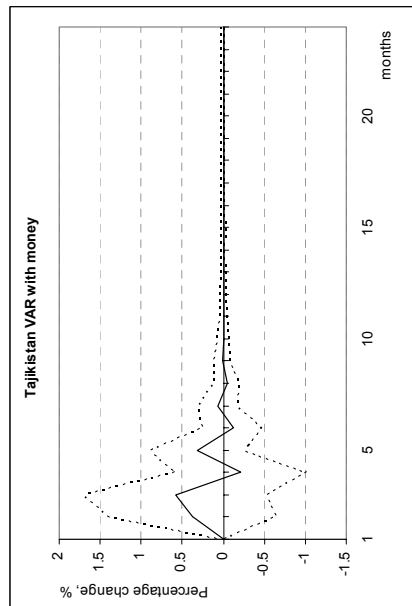
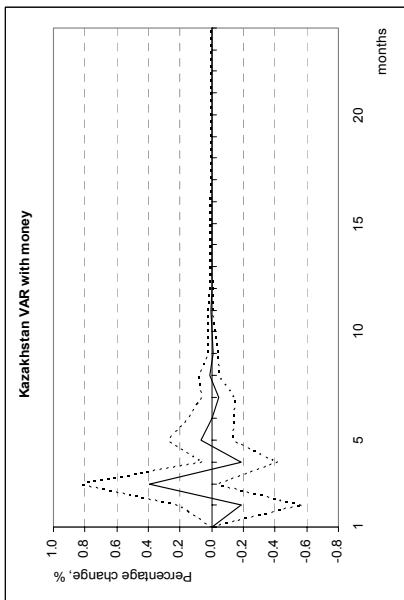
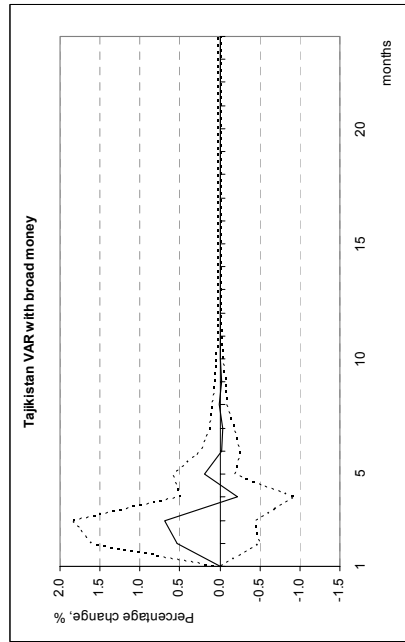
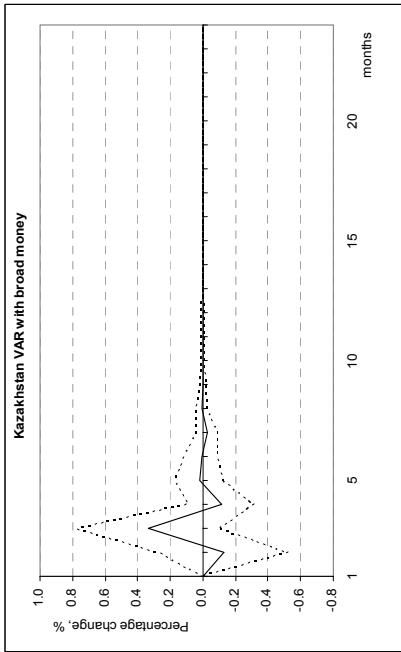
### VAR Estimation Results

FIGURE C1 Response of Inflation Rate to One Percentage Change in Nominal Depreciation Rate

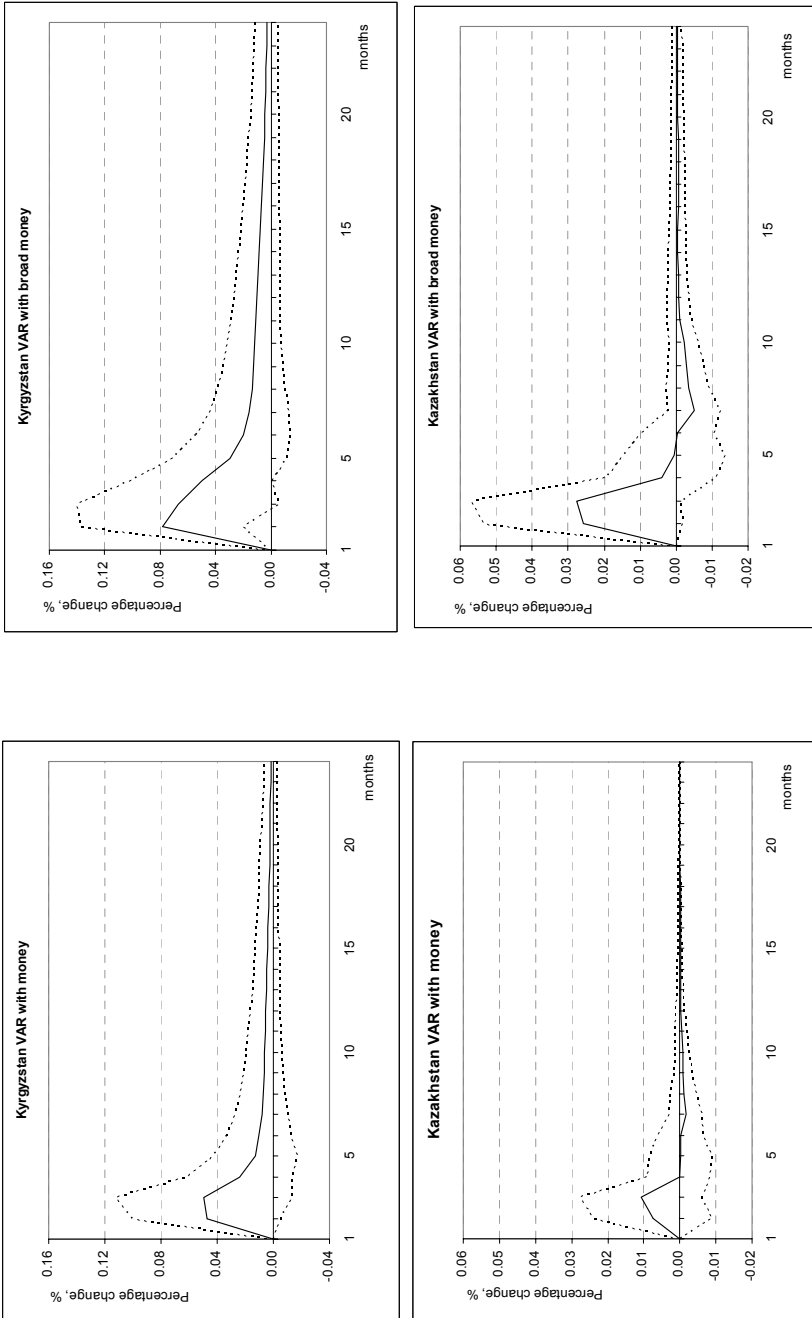


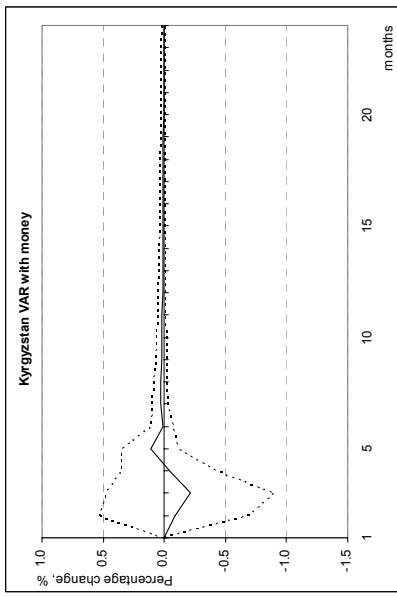
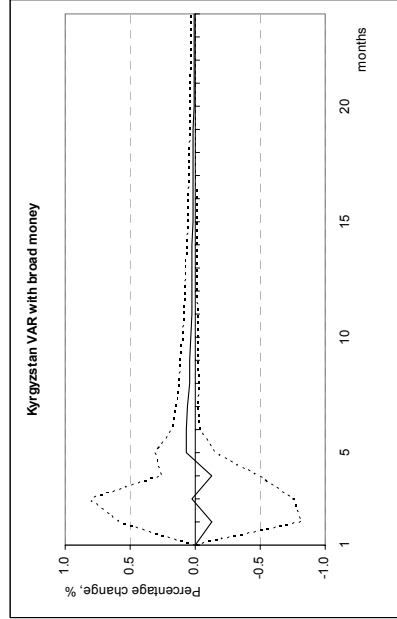
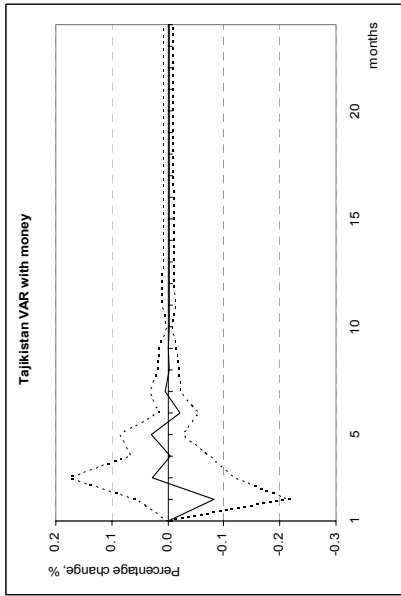
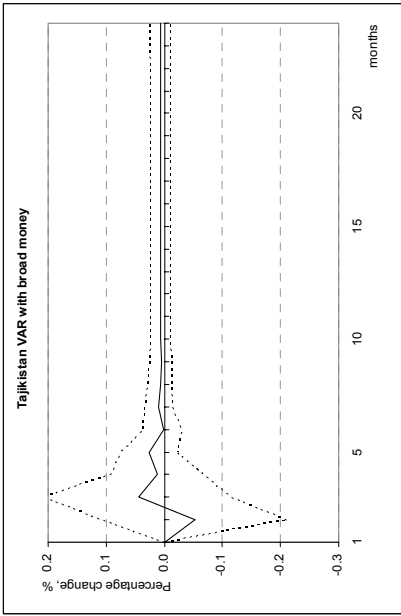


**FIGURE C2 Response of Output Growth Rate to One Percentage Change in Nominal Depreciation Rate**

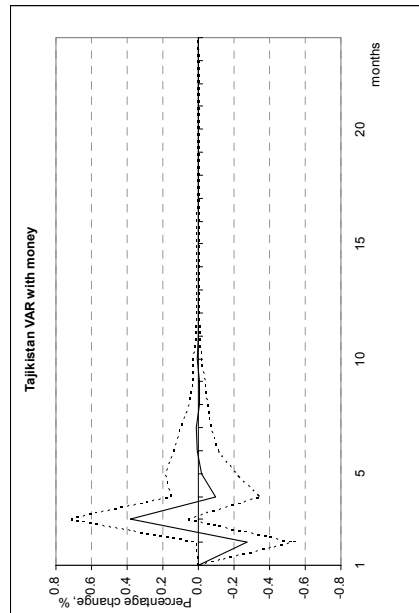
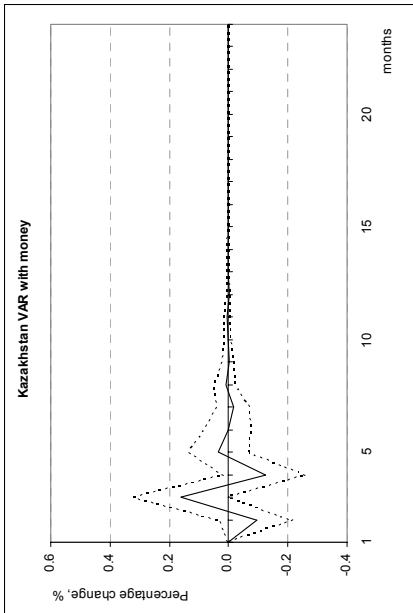
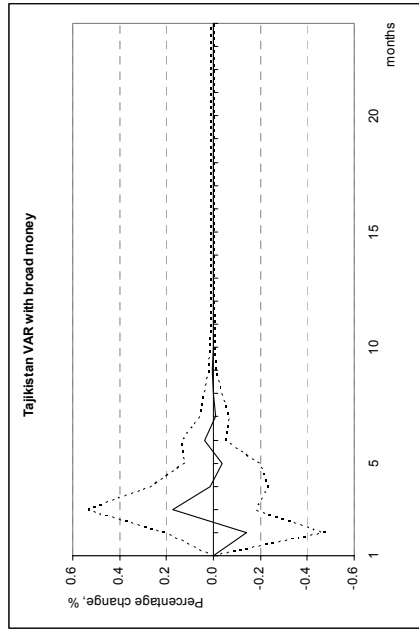
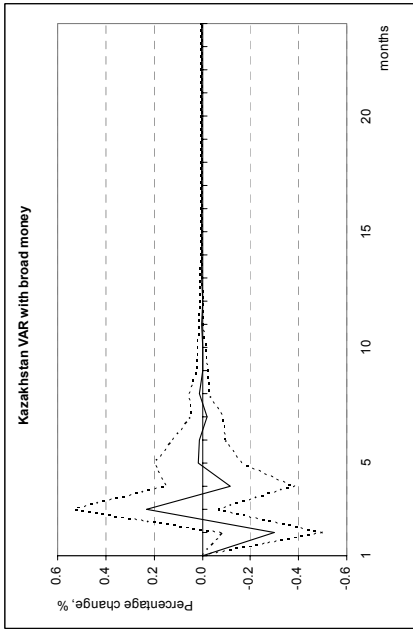


**FIGURE C3 Response of CPI Inflation to Changes in Money Growth Rate**

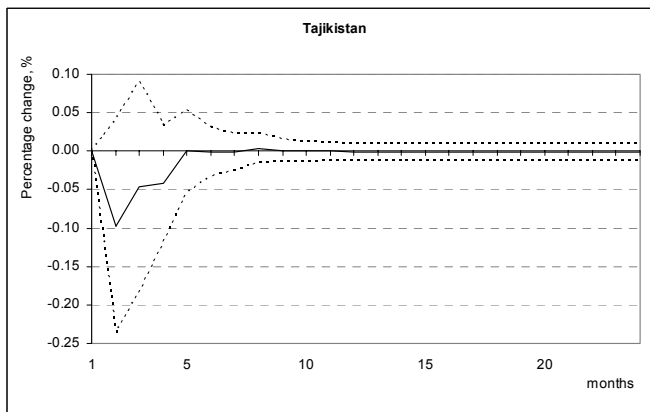
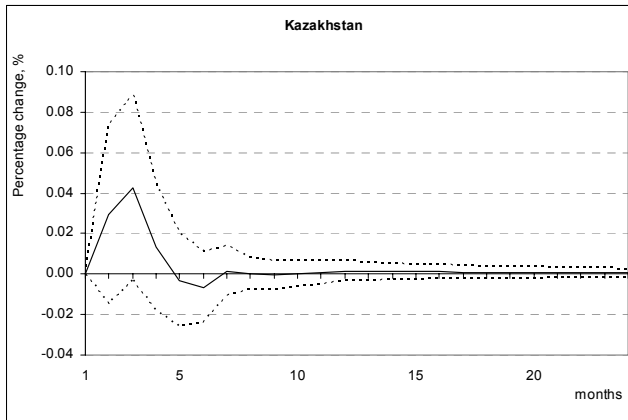
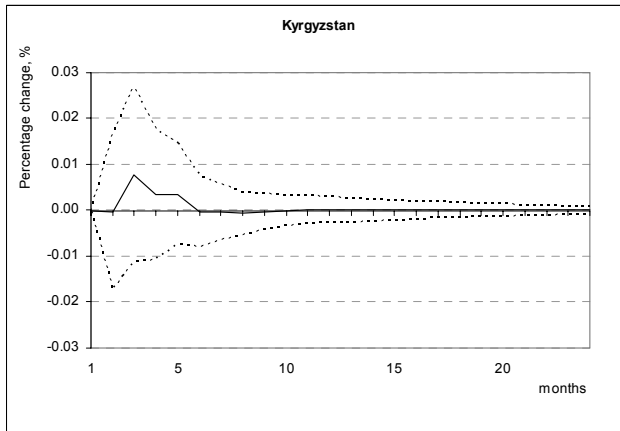




**FIGURE C4 Response of Output Growth Rate to Shocks in Money Growth Rate (VAR with CPI)**

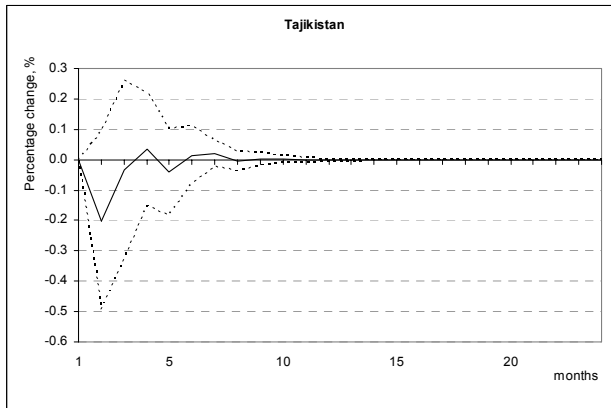
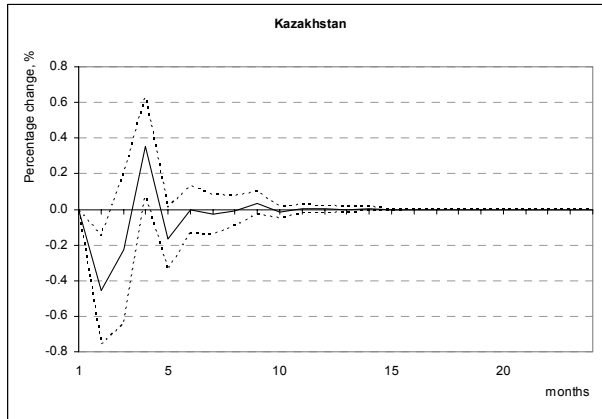
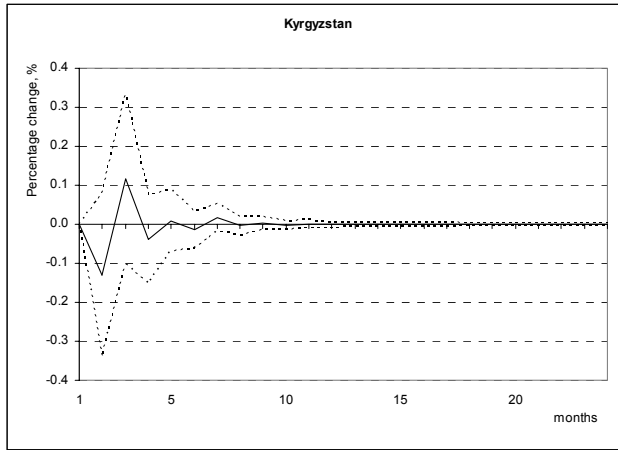


**FIGURE C5 Response of Inflation to Shocks in Credit Growth**





**FIGURE C6 Response of Output Growth Rate to Shocks in Credit Growth**

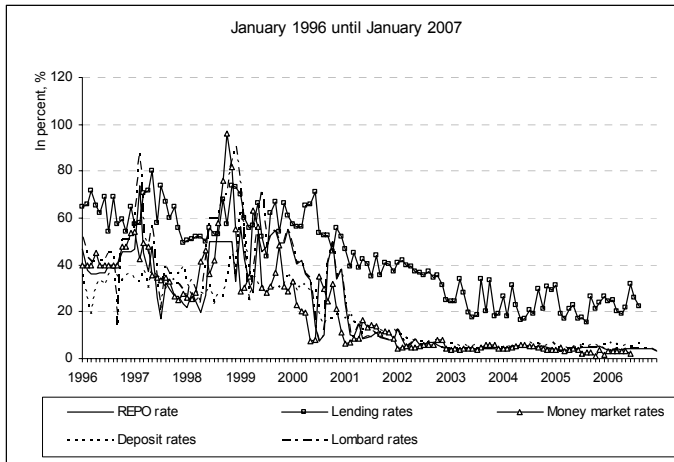


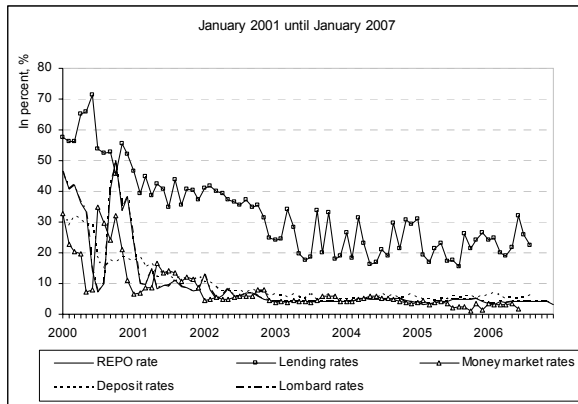
## APPENDIX D Interest Rates in Central Asia

TABLE D1 Data on Interest Rates

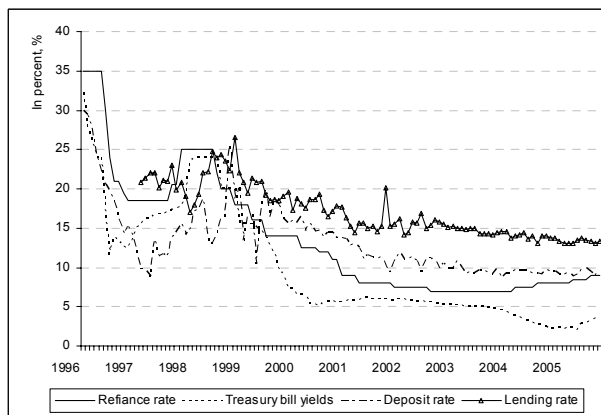
Series	Time span	Number of obs.	Source
<b>Kyrgyzstan</b>			
Repo rate of the NBKR	1996:1 till 2006:12	132	Global Financial Data
Money market rate	1996:1 till 2006:12	132	IMF
Deposit rate	1996:1 till 2006:12	132	IMF
Lending rate	1996:1 till 2006:12	132 </td <td>IMF</td>	IMF
Lombard rate	1996:1 till 2006:12	132	IMF
<b>Kazakhstan</b>			
Refinance rate of the NBK	1996:1 till 2006:12	132	Global Financial Data
Household deposit rate (< 1 year)	1996:1 till 2006:12	132	NBK
Household deposit rate (> 1 year)	1996:1 till 2006:12	132	NBK
Lending rate	1996:1 till 2006:12	132	NBK
<b>Tajikistan</b>			
Refinance rate of NBT	1997:7 till 2007:3	117	NBT
Deposit rate	1997:7 till 2007:3	117	NBT
Lending rate	1997:7 till 2007:3	117	NBT
Interbank money market rate	1997:7 till 2007:3	117	NBT

FIGURE D1 Interest Rates Behavior in Kyrgyzstan

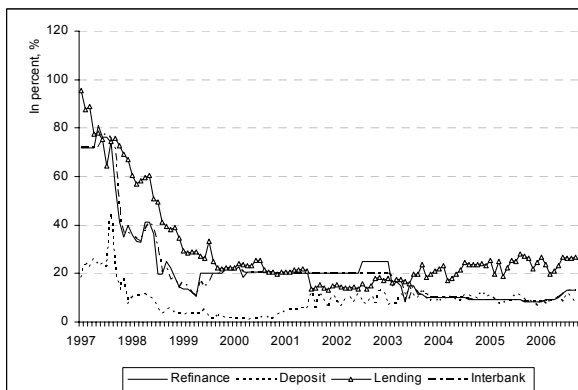




**FIGURE D2 Interest Rates Behavior in Kazakhstan**



**FIGURE D3 Interest Rates Behavior in Tajikistan**



**TABLE D2 Long-run Responses and Adjustment Coefficients  
in the Three Economies**

$$\text{Specification estimated: } \Delta i_t^m = \delta_0 + \sum_{j=1}^{p-1} \mu_j \Delta i_{t-j}^m + \sum_{k=0}^q \kappa_k \Delta i_{t-k}^p + \gamma(i_{t-1}^m - \lambda i_{t-1}^p) + \varepsilon_t$$

	$\lambda$	$\sigma_\lambda$	$\gamma$	$\sigma_\gamma$	$(p,q)$
<b>Kyrgyz Republic</b>					
Interbank Money Market	0.99***	0.05	-0.25***	0.07	(2,0)
Deposit Rates	0.83***	0.04	-0.28***	0.05	(1,2)
Lending Rates	1.62***	0.17	-0.11***	0.03	(2,0)
Lombard Rates	1.16***	0.04	-0.49***	0.08	(1,0)
<b>Kazakhstan</b>					
Deposit Rates (average)	1.44***	0.26	-0.01	0.02	(1,4)
Household Deposit Rate (3 months – 1 year)	1.33***	0.08	-0.05	0.08	(1,4)
Household Deposit Rate (1 – 5 years)	1.70***	0.17	-0.04	0.03	(1,0)
Lending Rates (average)	1.92***	0.16	-0.06***	0.02	(4,3)
<b>Tajikistan</b>					
Interbank Rates (average)	0.98***	0.01	-0.43***	0.08	(2,2)

Notes. \*\*\*, \*\* and \* stand for statistical significance at 1, 5 and 10 percent critical level, respectively.

No cointegration has been found between the refinancing rate of the Bank of Tajikistan and deposit and lending rates.

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