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Effect of exchange rate policy on GDP and GDP components: The Kyrgyz Republic Case

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Abstract. *The choice of exchange rate regimes in the countries to take advantage of stabilization policies was quite difficult. After the breakdown of the USSR, the KR among the former member countries in the Central Asia was the first to introduce its national currency on 10th of May 1993. After that time, it has done several adjustments in the exchange rate policy to preserve the value of the som from external shocks. In the study, the effectiveness of the exchange rate policy on GDP and GDP components is examined by using the ARDL model by Pesaran et al. (2001). The estimation results show that the depreciation of som has positive significant short- and long-run effects on GDP growth. However, while it has insignificant effect on most of the GDP component variables in the short-run, it has negative significant long-run effect.*

Keywords: exchange rate regimes, som, external shocks, ARDL, GDP, GDP components, short-run effects, long-run effects.

JEL Classification: E00, E52, E69, F41.

1. Introduction

Since increasing level of financial and trade, integration the choice of appropriate and adjusted foreign exchange controls by countries is important in persisting of healthy financial and economic state. Within the last fifty decades, the change of foreign exchange controls by authorities was indicated for most of the countries. More than half of the International Monetary Fund (IMF) members replaced or tend to move to opposite foreign exchange controls form implemented one (IMF, 2014). Whether to move from fixed regime to floating is suitable in current dynamic financial and economic condition is large discussion of researchers and institutions.

Opinions are varied and opposite to each other, most studies on this issue starts with contemplation of foreign exchange controls theory (by most informally named conventional view) and declaring of contradicting empirical evidences. Although, most agrees that the choice of foreign exchange control is closely related with whether country is developed industrial economy, emerging market economy or less involved in world financial and economic system state. Some incline to view those industrial developed economies should practice floating regimes where others despite temporally benefit from fixed regimes will need to move to more free regimes (Mussa et al., 2000). Another groups assert opposite view, if one of them questions the generally accepted in classic theory effectiveness of floating regimes through analysis of empirical case (Fukao, 1990), others aggressively argue the coincidence of theory of foreign exchange controls and advocates fixed toward fixed regimes (Hausmann et al., 1999).

Beside other opinions on the relation of foreign exchange controls with other economic aggregates, there are also opinions, which explore and state the insignificance of the choice of foreign exchange regime to real economic growth to country (Rose, 2011). There are many studies made on other directions of issue of foreign exchange controls and its effect, but for the purpose of paper's efficiency, the range is limited.

The exchange rate movements or fluctuations affect economy of a country starting from the famous "interest rate parity". There is a difference in the interest rates of the countries due to the depreciation or the appreciation of the domestic currency. Investors want to gain high return (interest rate on assets) with low risk (risk premium). Interest rates do not only affect FDI, but also lending opportunities of governments and consumption behavior of the households. It can also affect the trade balance by its effect on the domestic exchange rates.

Being very vulnerable to the external financial, trade shocks, and the high contagion property of crises the validity of current foreign exchange regime is need to be reviewed. The number of foreign exchange regimes is practicing in it like transition economies as the Kyrgyz Republic (KR). The reason of that, despite the same level of economic stage, is obviously for most the fact of variety economic conditions, geographical trade concentration and other individual characteristics. The fact of not high level of foreign market, low and mostly inflow of capital and assets to the country, import orientation, comparatively fewer financial transaction and other economic characteristics defines its own path to manage foreign exchange. The frequent noticed in studies view of difference

of foreign exchange regimes between in empirical implementation and conventional wisdom raises necessity for Kyrgyz Republic authority to deviate from theory of exchange rate arrangement. The behavior of closest economic partners of the country and more important the recent gained partnership in "tight" economic union – Eurasian Economic Union which closes some doors and opens others, the members different economic level increments the real effectiveness of current foreign exchange regime. Examining the generally bad economic performance of the country especially in integration to global increasing financial and economic systems it comes the idea of, among other possible problems in economic administration, the irrelevance of current foreign exchange regime in Kyrgyz Republic.

The aim of the paper is to estimate the effect of exchange rate on GDP and GDP components by using interest rate parity and relative purchasing power parity identities. The theoretical backgrounds of the models are based on the behavioral equations like interest rate parity, intertemporal consumption behavior, etc. As a result of the estimation results, the effectiveness of the exchange rate in the short- and long-run will be discussed and then alternative policy variables will be proposed. In the next chapter, the general literature review will be discussed. Then the evolution of the exchange rate policy in the KR is discussed. The data sample variables and methodology will be discussed in detail. Lastly the model estimations are interpreted and as a result of the findings some policy implications are introduced.

2. Literature review

The differential condition in terms of economy, geographical trade concentration, level of industrialization or its potential development, monetary and fiscal policy design; and in terms of financial tightness to outside, intensity of capital and asset flow, development of financial market in the region are both became the source of evolution of variety kinds of foreign exchange controls. Depending on individual condition of country's economic, financial and even political factor except polar exchange, regimes fixed and floating many intermediate regimes were developed to current days. The classification of foreign exchange controls by IMF (2014), gives 10 categories dividing them into main four type *Hard peg, Soft peg, Floating regimes (market-determined markets) and Residuals*. In Ribnikar's (2004) study there is given 11 classification of regimes, except IMF classification author has added other scholars defined regimes as *Monetary Union, 'Truly' fixed exchange rate regime, Crawling peg or basket peg and Free or pure float* (as cited in IMF, 2004; Von Hagen and Zhou, 2002; Frankel, 1999; and Crockett 2003).Conceptual section, the classification of foreign exchange regimes will be covered closer and detailed. However, among scholars and practitioners it is well known that often country's responsible authority's officially declared foreign exchange regime *(de jure)* fairly differ from the way it manages foreign exchange *(de facto)*.

The view to the rational foreign exchange regime in speeding financial and economic globalization is shown in research of Mussa et al. (2000). According to Mussa et al. (2000), the main factor in determining foreign exchange regime is dependent on external

conditions, these economic, financial and there is cannot one specific regime classified as most effective for the country. Considering accelerating integration of financial and economic (especially monetary) systems, authors point, that in case of raising international capital and asset flow, despite the advantages of fixed and close to it kinds of regimes countries need to adopt float regime and there is tendency of. Mussa et al. (2000) states that is especially recommended for financially expanding countries, which are mostly emerging market economies. Floating regime as argue Mussa et al. (2000) more suitable in case when highly linked financial system and monetary policy country is at risk of larger external financial and trade shocks. For the most transition economies which are less developed the fixed (pegged) foreign exchange regime is best, implying appropriate policies by related right institutions supporting the exchange regime, noticed authors. However, in spite well-adjusted monetary and other policies to fixed foreign exchange regime from which country will benefit, the continuation of the regime cannot last for longer period in time of frequent external financial and trade shocks and raising globalization of them (Mussa et al., 2000). Finally, Mussa et al. (2000) bring out based the study, that in grouped economies as ASEAN there is importance to consider moving from one currency pegged regimes to major currencies (dollar, euro, yen) pegging to persist instability of one currency. This may be the case in integration to unified economy of Kyrgyz Republic as the member of Eurasian Economic Community (EurAsEC). As neither rubble nor tenge is being currency to peg for other members and all states is quite vulnerable to dollar. It makes member countries fragile in case if one of them will be affected by outside shock the contagion effect can harm others without strong instrument against it.

One part which foreign exchange control has economic effect is for the balance of payment of country. In the article of M. Fukao (Liberalization of Japan's Foreign Exchange Controls and Structural Changes in the Balance of Payment, 1990), author studies the total effect to the capital inflow and outflow and balance of payment in tight fixed foreign exchange controls in early period after World War Second and movement to the floating foreign exchange controls and its liberalization. As author compares, the replacement of fixed foreign exchange controls to floating exchange controls very significantly increased capital inflow and outflow. The foreign trade also has been enlarged due to liberalization of exchange controls and enhances the relation of the country to international monetary system and international trade. Besides these changes, the weakening of yen in short period raised foreign investment and export to USA. However, as author mentioned, along with strong changes due to the floating foreign exchange controls, which strengthened the economic relationship of the country with world and gave many positive outcomes, it raised the conventional problem of floating exchange controls comparing to fixed exchange controls is high fluctuation of exchange rate. M. Fukao comments it as follow: "even with both exchange controls and interventions, it is impossible to achieve simultaneously both the stabilization of exchange rates and a monetary policy that is independent of world financial and economic conditions".

The study of Hausmann, Gavin, Pages-Serra and Stein (1999), analyzed the floating exchange regime and fixed exchange regime based on theoretical claims of these theories

and empirical practice of them. As the case authors focused on Latin America countries in 1960-1999 periods. According to Hausmann, Gavin, Pages-Serra and Stein (1999), despite the literatures, which states beneficial properties of floating exchange regime in coping external trade and financial shocks and evidence of experience of European countries, Latin American states practice shows other if not opposite effect. Briefly, concerning interest rate because of highly volatile currency in floating exchange regime or other close regimes, the depreciation of domestic currency will lower the real value of domestic assets and deposits; thus, the only way to make more attractive the interest rate will be raised. In case of fixed exchange, regime stable exchange rate savers will be ensured and the real interest rate will be in lower level than other case, thus deepening financial market. As authors describes, this was the case in terms of interest rate in Latin America. Authors also argued the theoretical property of floating exchange regime, which supposed to have low inflation rate. As it was case in Latin America the states having floating exchange regime faced higher wage inflation. The quantitative analysis made in the study, shows that most Latin America countries after moving to more free exchange regime perceived higher inflation. The question of pro-cyclical monetary policy according to regression analysis made in the study of authors, is shows that fixed exchange regime has been proven as less pro-cyclical monetary policy, which is also contradictory to theories about exchange rate regimes. In addition, conclusion made in Hausmann, Gavin, Pages-Serra and Stein (1999) study, shows that countries practicing fixed exchange regime (often despite officially is floating exchange regime) in Latin America the domestic interest rate was more sovereign to foreign interest rate fluctuations.

On the other hand, differing conclusion made by Rose in his research (2011) arguing that foreign exchange controls do not have real significant effect on country's economic growth. According to study of author, the regressions estimated to identify the correlation between first inflation rate and foreign exchange regime practicing by country mainly fixed or floating show that generally in case of floating foreign exchange control has larger inflation but it not significant. Second determining relationship between economic growth and foreign exchange controls systems there was not found significant effect and difference of type of exchange rate system on major economic aggregates. Although author study consolidates with conventional view of that fixed and pegged foreign exchange controls are more protected against inflation he states that it mainly impacted by other factors as "precise measure of the exchange rate regime". And finally, Rose end up, summarizing that most studies and evidence are contradictory and there is no direct relationship between of type of foreign exchange rate regime and inflation, economic growth.

3. Establishment of som, and exchange rate evolution in the KR

After the collapse of the USSR, the former members continued to use the ruble. By that time, the ruble zone was seen as well-behaved currency area (Pomfret, 1993). After a while it was seen that it was indeed unstable due to the facts: (i) the demand for ruble created a hyperinflation, (ii) former trade channels no more existed, (iii) there were

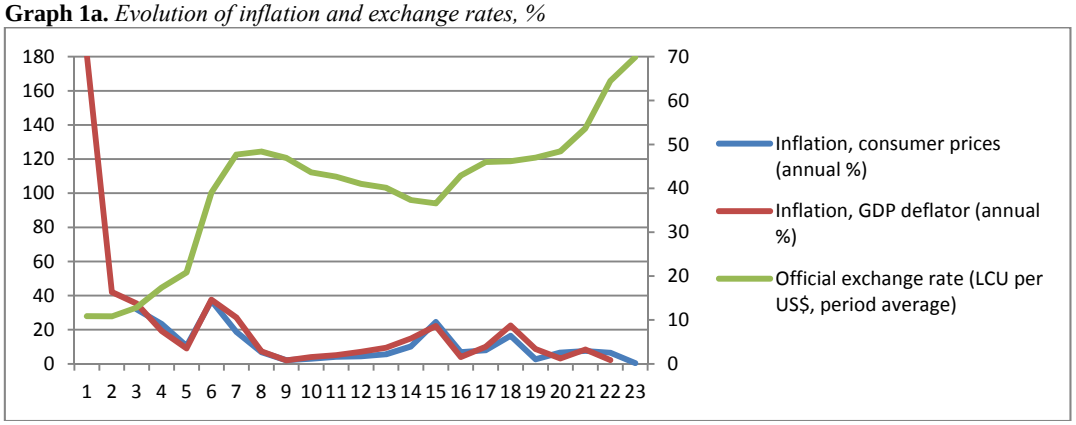
asymmetry in the local policies. Thus, the members had 2 choices: to make reforms in the existing monetary system to establish their own currencies.

Estonia was the first country to introduce its own currency kroon in June 1992. In the autumn of 1993, the Central Asian countries started to leave the ruble. Among the others Kyrgyzstan was the first to establish the som on 10th of May in 1993 (Pomfret, 2014). The starting exchange with respect to ruble was 1 som for 200 rubles, and to US dollar was 2 soms for 1 dollar (Olcott, 1997). International organizations like IMF and IDA gave away 23 million dollars, 39 million dollars by standby agreement, and a 60 million dollars respectively. Other developed countries lend to Kyrgyzstan of 70 million dollars (Pomfret, 2014).

However, the establishment of the domestic currency was not enough to solve trade problems with neighboring countries as they were not willing to accept the som in the inter-trade agreements.

The instability of the som when it is in first years was caused by high inflation expectations, and high demand for US dollar. By restrictive monetary policy and foreign exchange interventions, the government stabilized the domestic currency. When the exchange rate of dollar became 11.20, by 10.3% devaluation, the economic growth stayed stable. This stability ended in 1996 when the government emitted money to pay its debts. The effect on the exchange rate was the depreciation of som by 33% which in turn led to the inflation of 35%. Thus the confidence for the currency deteriorated.

Graph 1a. *Evolution of inflation and exchange rates, %*



Source: WB, WDI.

The next year the depreciation became 3.9%. On the other hand, in 1998 by the effects of external and internal factors like precipitation of liquidity of banking system and the financial crisis in Russia, the outflows of capital increased. To stop these NBKR made interventions through "Trading Informational Electronic System" but due to the insufficient level of gold reserves, it limited the liquidity of banking system.

When the Kazakh tenge and Russian ruble devalued on 5th of April 1999, the Kyrgyz goods lost the competitiveness which in turn led to the decrease of exports and increase of imports. The gradual actions of the NBKR devalued som by 40%. Also, the rise in the

exports of agricultural goods and the foreign currency inflow by the tourism season appreciated som. Again in 2000, the tourism season influenced som and to decrease the fluctuations in exchange rate the NBKR started new tool, SWAP operations to provide the slow overvaluation of the domestic currency to save the competitiveness of the domestic goods. In 2001, the som appreciated against dollar for the first time since it was introduced.

In 2002-2003, the som kept to appreciate. This is also fueled (fired) by positive balance of payments, and the set of the military base of the antiterrorist coalition, and the global devaluation of dollar. In 2004-2005, in addition to this export growth and inflow of capital appreciated the domestic currency. The appreciation continued till the end of 2007.

With the onset of the effect of the 2008 Financial Crisis the exchange rate became 1 dollar = 34.60 soms. In one year som depreciated and the exchange stayed 1 dollar = 44.24 soms in September of 2009. The appreciation affected manufacturing and agriculture sector negatively which finally destroyed the agricultural sector. This all-time deteriorated the trade balance and current account as well. The trade deficit was tried to eliminate by the remittances. The only positively affected sector was the textile sector in which Kyrgyzstan reexport the textile goods imported from China to Kazakhstan and Russia.

In summary, the exchange rate policy should have been used to increase the exports which in turn accelerate the capital inflow and employment, and thus the growth of the domestic production. Whereas the KR officially used managed floating exchange rate, the NBKR targeted certain level of foreign currency which led to the stable som. However, this decreases the circulation velocity of money which is very essential in the efficiency of the monetary policy by shrinkage of money.

4. Data sample

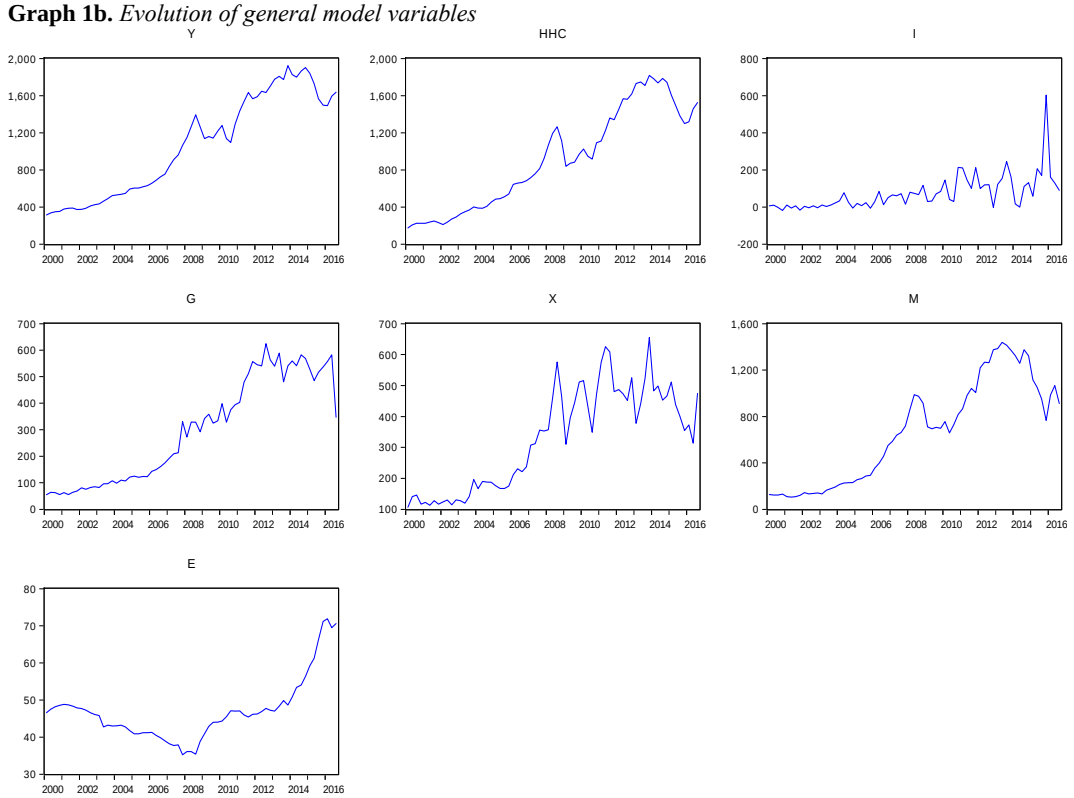
Y is current GDP in million US dollars, HHC is current household final consumption expenditure in million US dollars, GEXP is current government expenditure in million US dollars, X is current export of goods in (FoB) million US dollars, M is current import of goods in (FoB) million US dollars, I is current foreign direct investment in million US dollars, E is the exchange rate between Kyrgyzstani som and US dollar. Other variables and their descriptions are given in Table 1. The notation on the variables, Ln, is natural logarithm. The motivation to take natural logarithm is to decrease their variances or standard deviations. Rate and percentage variables are not transformed. All variables are seasonally adjusted by Census X13 and TRAMO/SETS (only I) and then the natural logarithm is taken except I. Some variables are converted from annual frequency to quarterly by using Chow-Lin interpolation method due to the no availability (absence) of the quarterly data (Chow and Lin, 1971). The data for Kyrgyzstan for 2000Q1-2016Q3 is collected from the websites of NBKR, National Statistical Committee of the KR, Interstate Statistical Committee of the CIS countries, and World Bank. Other used websites are of Fed Prime Rate and Investing.

Table 1. *Data source of variables and their descriptions*

Variable	Description	Transformation	Data Source
Y	current GDP in million US dollars	ln	Interstate Statistical Committee of the CIS
HHC	current household final consumption expenditure in million US dollars	Ln, Chow-Lin Interpolation	World Bank (WB)
I	current foreign direct investment in million US dollars	No	National Bank of the Kyrgyz Republic (NBKR)
G	current government expenditure in million US dollars	Ln	National Statistical Committee of the Kyrgyz Republic
X	current export of goods in (FoB) million US dollars	Ln	National Statistical Committee of the Kyrgyz Republic
M	current import of goods in (FoB) million US dollars	Ln	National Statistical Committee of the Kyrgyz Republic
E	exchange rate between Kyrgyzstani Som and US Dollar	Ln	NBKR
INTERESTDOM	interest rate of Som deposits, percent	No	NBKR
LIBOR6	US Dollar 6 month LIBOR Rate, percent	No	FedPrimeRate.com
INFKG	Inflation Rate of the KR, percentage change of CPI to the previous year's same quarter, 2010=100	No	National Statistical Committee of the Kyrgyz Republic
INFUS	US Inflation Rate, percentage change of CPI to the previous year's same period, 2010=100	No	Saint Louis Fed
DEBT	Current budget balance (Government Revenue-Government Expenditure) as a percentage of GDP	No	National Statistical Committee of the Kyrgyz Republic
INFPOILFAO	oil price inflation, 2010=100, % change with respect to the last year's same period	No	Food and Agriculture Organization of the UN (FAO)
INFPFOODFAO	food price inflation, 2010=100, % change with respect to the last year's same period	No	Food and Agriculture Organization of the UN (FAO)
YGAP	Difference between natural logarithms of Actual and Potential GDP values	No, Chow-Lin Interpolation for Potential GDP	National Statistical Committee of the Kyrgyz Republic
YWORLD	Current World GDP in million US dollars	Ln, Chow-Lin Interpolation	WB

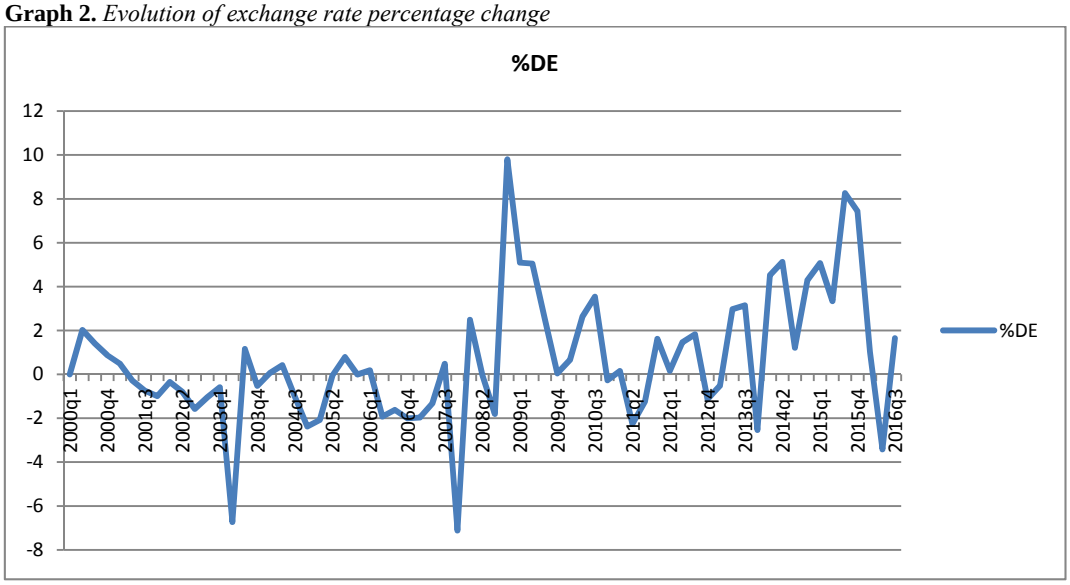
Ln: natural logarithm; Chow-Lin interpolation method to convert annual data to quarterly data.

Graph 1b. *Evolution of general model variables*



Now look at the graphs of the variables. Actually the behavior of GDP and Household Consumption is the same. This means household consumption is one of the important determinants of GDP. They both have upward trend which stagnated in 2008-2010 and decreased 2014-2015 due to the 2008 Global Financial Crisis and the Euro Asian Economic Union negotiations. This interpretation can be done for the government expenditures with more cyclical movements and it stagnated one more year, 2016. This is true for the components of trade as well. Export stagnated 2000-2003 and 2008-2010 and decreased after 2014 with high volatility and cyclical movements. Whereas Import is less volatile with few cyclical movements, its behavior is the same as of Export. Most volatile part of GDP is FDI in the macroeconomics literature. It is also the case in the graph. FDI becomes more volatile year by year after 2005 due to the political upheaval (Revolution and collapse of the Parliament). The exchange rate policy of the NBKR leads to the appreciation of som against US Dollars till 2008. After the crisis, the local currency depreciated in most of the periods till nowadays. The huge depreciations between 2008Q3 to Q4 and 2015 Q2 to Q3 were 9.80% and 8.257% respectively.

Graph 2. *Evolution of exchange rate percentage change*



Descriptive statistics show that while HHC, Grev, X, and M are normally distributed, others are non-normal. GDP is 1059143000 dollars on average.

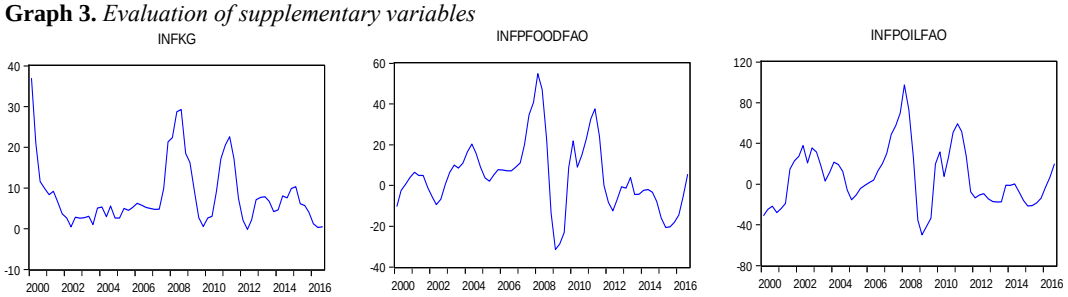
Table 2. *Summary statistics for general model variables*

	Y	HHC	I	G	X	M	E
Mean	1059.143	915.1358	73.96014	297.7765	328.3444	668.4145	46.93533
Median	1137.233	883.6431	50.10492	324.8545	353.3007	697.1608	46.14528
Maximum	1924.588	1818.685	603.1395	624.8133	655.3063	1438.731	71.92187
Minimum	313.4038	174.2846	-17.87281	54.97013	106.5397	104.2981	35.21141
Std.Dev.	540.2648	536.6728	94.11002	195.5821	163.1584	444.7940	8.332505
Jarque-Bera p-value	0.040896	0.066224	0.000000	0.030008	0.076532	0.070818	0.000000
Number of Observations	67	67	67	67	67	67	67

HHC is about 86.40% of GDP, which is the largest component of the GDP. Government expenditures take 28%. There is instability in the trade. The country suffers from trade deficit; that is to say on average import of goods is more than two fold than export of goods, about 2.036. Again the FDI is the most volatile variable with respect to its mean with little percentage, 7%.

Evolution of other variables used in the model of GDP components are given in Graph 3. CPI in the KR has flatter slope till 2007 and then exponential slope thereafter. In 2008 and 2010, it gets steeper with no cyclical components. As a result of all these, inflation (*INFKG*) is always positive. It has the highest values in 2000, 2008, and 2011 due to the effects of Russian crisis, 2008 Financial Crisis, and 2010 political tension in the country. World inflation has the same behavior as the inflation in the KR. Price of crude oil has the same behavior with more fluctuations and steep decrease after 2014.

Graph 3. *Evaluation of supplementary variables*



The World inflation (truly the inflation of food prices) and price of crude oil (fuel) feeds the domestic inflation. In summary, price inflation of World Food products, Oil products, tend to have similar behaviors. Since the US economy products huge volume of the World GDP by using oil products, and nearly 30% of World GDP is consumed by US citizens, then the prices in the US tend to move together with these two prices. GDP gap of the KR with always negative values has a fixed slope except it has the highest value in 2002Q3 with 72000 US dollars. The reason for this is the decrease of employment.

Government debt as a ratio of GDP is increasing after 2008 Financial Crisis. Due to the political upheaval in 2010, it decreased till 9.10% in 2012Q3. The inverse is the case in 2015Q2 with 9.4% budget surplus. However, it decreased thereafter. Interest rate for som deposits decreases steeply till the start of 2004, and continues to increase till 2016Q3 with 6.70%. While in 2008Q3-2009Q3, in which the world economies including the KR felt the 2008 Financial Crisis, it stayed rather constant, from 5.60% to 5.80%. In 2010 political upheaval, from the mid 2010 till end of 2010, it decreased from 4.90% to 4.50%. Afterwards it continues to increase gradually. US dollar 6 month LIBOR rate till 2004 (1.20%) and then steeply increased to 5.80% in 2007Q1. Then it decreased steeply till 2010 and got more fixed afterwards. The 9/11 Terrorist Attacks and 2008 Financial Crisis are the main factor. After 2010, the world becomes more peaceful and as a result World GDP started to increase.

The summary statistics are given in Tables 3 and 4.

Table 3. *Summary statistics for supplementary variables I*

	INTERESTDOM	LIBOR6	INFKG	INFUS	DEBT
Mean	6.152751	2.235603	8.182076	2.185665	-1.569870
Median	5.356569	1.344735	5.623795	2.046754	-0.814236
Maximum	19.60703	6.784434	36.90878	5.252946	9.374428
Minimum	3.470075	0.325788	-0.176940	-1.606843	-9.107639
Std.Dev.	3.183283	2.019985	7.734901	1.297894	2.863542
Jarque-Bera p-value	0.000000	0.007938	0.000000	0.384373	0.000432
Number of Observations	67	67	67	67	67

All variables except US, oil price, and food price inflation rates are non-normal. Domestic inflation rate based on 2010 (8.1821) is greater more than two fold (3.744) than the World inflation (2.185665). Oil and food price inflations are on average 6.89653 and 4.500767. While the country inflation rates are always positive, the price inflations have negative values till 50%. Therefore, the standard deviations of price inflations are very high relative to their means.

Table 4. *Summary statistics for supplementary variables II*

	INFPOILFAO	INFPFOODFAO	YGAP	YWORLD
Mean	6.896530	4.500767	-0.020455	14419345
Median	1.488568	3.967442	-0.017758	15097905
Maximum	97.56844	54.95025	-0.003695	19814901
Minimum	-49.92678	-31.38127	-0.071993	8324119.
Std.Dev.	29.56525	16.94377	0.013298	4105404.
Jarque-Bera p-value	0.072766	0.066903	0.000000	0.043916
Number of Observations	67	67	67	67

Government budget has a deficit of 1.57% of GDP due to the unavailability of tax system and natural resources. GDP is always below its potential. Deposit interest rates are 6.153% and US dollar 6 month LIBOR rate is 2.236%. As deposit interest rates are between 5.36% and 19.61%, and then this rate is not so high. It is important for both consumption and investment. However, as it is higher than the foreign interest rates, then there is a possibility of inward capital flow to gain from this return.

5. Empirical methodology

When ordinary least squares (OLS) is estimated, the series are assumed to be stationary, which means their means and variances are constant over time. On the other hand, Nelson and Plosser (1982) argue that most macroeconomic variables are non-stationary or have a unit root; that is to say their means and variances depend on time. These kinds of series or variables have random shocks and therefore follow a random walk. This can cause serious problems like serial correlation (in residuals) and spurious regression, in which variables seem to have a significant relationship indeed they do not have due to the existence of seasonality, time trend, and structural break(s). So, we should use stationary variables to avoid all these problems. One of the ways to detect a unit root in time series is Augmented Dickey Fuller (ADF) unit root test (for AR(p) process):

$$\Delta y_t = \delta x'_t + \alpha y_{t-1} + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ... + \beta_p \Delta y_{t-p} + v_t \quad (1)$$

Where x'_t are optional exogenous variables that include a constant or constant and time trend, v_t is a White Noise process; Δ is a 1st difference operator. In this test, zero hypotheses is

$$\begin{aligned} &H_0 : \alpha = 1 \text{ (the series has a unit root)} \\ &H_1 : \alpha < 1 \text{ (the series is stationary (around a constant or/and trend))} \end{aligned} \quad (2)$$

The 2nd unit root test is of the Phillips Peron (PP). PP Test uses non-augmented Dickey Fuller equation, $\Delta y_t = \alpha y_{t-1} + \delta x'_t + \varepsilon_t$, and modifies the t-value of α so that serial correlation does not influence the asymptotic distribution of the test statistic;

$$\tilde{t}_\alpha = t_\alpha \left(\frac{\gamma_0}{f_0} \right)^{1/2} - \frac{T(f_0 - \gamma_0) se(\hat{\alpha})}{2 f_0^{1/2} s} \quad (3)$$

where $\hat{\alpha}$ is the estimate, and t_α is the t-value of α, $se(\hat{\alpha})$ is coefficient standard error, and s is the standard error of the test regression. Also, γ_0 is a consistent estimate of the error variance computed as $\frac{(T-k)s^2}{T}$. Lastly, f_0 is an estimator of the residual spectrum at frequency zero. Here zero hypothesis is the same as the zero hypothesis in ADF unit root test.

On the other hand, the potential weakness of the ADF and PP unit root tests is their misdetection of structural breaks in the series and as a result the wrong decision rule; that is to say they may fail to reject the H_0 (the series has unit root) if the series has structural break. The series that are stationary around a structural break in level seems to be first difference stationary. To solve this kind of problem, Perron (1989) advices to include exogenous structural break in the ADF Unit Root Test. After this breakthrough, Zivot and Andrews (1992) and Perron (1997) proposed to add the structural break "endogenously". If the date of the structural break is unknown, it is appropriate to use the model proposed by Perron and Vogelsang (1992). To detect the "endogenous" structural break, the model of Perron-Vogelsang (1992) is more successful than that of Zivot and Andrews (1992). Both tests do not need a priori information about the date of the structural breaks.

Clemente-Montanes-Reyes (1998) bases their studies on Perron-Vogelsang (1992). Their test allows two structural breaks in the mean of the series. The test is as the following:

$$\begin{aligned} H_0 &: y_t = y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DTB_{2t} + u_t \\ H_1 &: y_t = \mu + d_1 DU_{1t} + d_2 DU_{2t} + e_t \end{aligned} \tag{4}$$

where DTB_{it} is a pulse variable equal to 1 if $t=TB_i+1$ and 0 otherwise. In addition, $DU_{it}= 1$ if $t > TB_i$ ($i = 1, 2$) and 0 otherwise. TB_1 and TB_2 represents the time periods when the mean is being modified. Now, suppose that $TB_i = \lambda_i T$ ($i = 1, 2$) where $0 < \lambda_i < 1$ and $\lambda_2 > \lambda_1$.

If the two breaks belong to the innovational outlier, which allows for a gradual shift in the mean of the series, we can test the H_0 (the series has a unit root with structural break(s)) against H_1 (the series is stationary with break(s)):

$$y_t = \mu + \rho y_{t-1} + \delta_1 DTB_{1t} + \delta_2 DTB_{2t} + d_1 DU_{1t} + d_2 DU_{2t} + \sum_{i=1}^{k} c_i \Delta y_{t-i} + e_t \tag{5}$$

In this regression, the minimum value of the simulated t-ratio is obtained and this can be used for testing if $\rho = 1$ for all break time combinations (Clemente et al., 1998).

If the shifts are better described as additive outliers (which captures a sudden change in the mean of a series), the H_0 can be tested through a two-step procedure: (1) eliminate the deterministic part of the variable by estimating the following model:

$$y_t = \mu + d_1 DU_{1t} + d_2 DU_{2t} + \tilde{y}_t \tag{6}$$

(2) take residuals in the previous model and estimate the following by assuming ρ = 1:

$$\tilde{y}_t = \sum_{i=0}^{k} \omega_{1i} DTB_{1t-i} + \sum_{i=0}^{k} \omega_{2i} DTB_{2t-i} + \rho \tilde{y}_{t-i} + \sum_{i=1}^{k} c_i \Delta \tilde{y}_{t-i} + e_t \tag{7}$$

the dummy variable DTB_{it} is included in the model to make sure that $\min t_{\hat{\rho}}^{AO}(\lambda_1, \lambda_2)$ converges to the distribution (Clemente et al., 1998):

$$\min\ t_{\hat{\rho}}^{IO}(\lambda_1, \lambda_2) \to \inf_{\lambda=\Lambda} \frac{H}{[\lambda_1(\lambda_2 - \lambda_1)(1-\lambda_2)]^{1/2} K^{1/2}} \tag{8}$$

The critical values are provided by Perron and Vogelsang (1992), as they do not follow the standard "Dickey-Fuller" distribution (Baum, 2001).

Bu using Perron's (1989) approach, Zivot and Andrews (1992) uses three separate regressions to detect structural breaks:

$$\Delta y_t = c + \alpha y_{t-1} + \beta t + \gamma DU_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \tag{9}$$

$$\Delta y_t = c + \alpha y_{t-1} + \beta t + \theta DT_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \tag{10}$$

$$\Delta y_t = c + \alpha y_{t-1} + \beta t + \gamma DU_t + \theta DT_t + \sum_{j=1}^{k} d_j \Delta y_{t-j} + \varepsilon_t \tag{11}$$

Where in (9) the models allows for one-time change in the intercept of the dependent variable, in (10) it allows for one-time change in the trend of the dependent variable, and in (11) it allows for both the change in the intercept and the trend of the dependent variable. In addition here DU_t is a dummy variable that takes 1 at the break date (TB) of the intercept, and DT_t is a dummy variable that takes 1 at the break date (TB) of the trend of the dependent variable:

$$DU_t = \begin{Bmatrix} 1.....if\ \ t > TB \\ 0.....otherwise \end{Bmatrix} \text{ and } DT_t = \begin{Bmatrix} t - TB.....if\ \ t > TB \\ 0.....otherwise \end{Bmatrix} \tag{12}$$

In all of the models, the hypotheses are

$$\begin{aligned} &H_0 : \alpha = 0 \text{ (the series has a unit root)} \\ &H_1 : \alpha < 0 \text{ (the series is stationary around a structural break)} \end{aligned} \tag{13}$$

The method takes every point of time as a potential break date and among all available break points it chooses the break date that minimizes the t-statistic for $\hat{\alpha} = 1$ where $\hat{\alpha} = \alpha - 1$. When there are end points, the test statistic diverges to infinity (Zivot and Andrews, 1992).

If we compare the tests of Clemente et al. (1998) and Zivot-Andrews (1992), there are researches that say to identify the "endogenous" structural break(s), the Clemente et al. is more successful (Shrestha and Chowdhury, 2005). According to Baum (2004), if the estimates of the Clemente-Montanes-Reyes unit root tests provide evidence of significant additive or innovational outliers in the time series, the results derived from ADF and PP tests are doubtful, as this is evidence that the model excluding structural breaks has misspecification problem. On the other hand, if the results of the Clemente-Montanes-Reyes unit root tests show no evidence of two significant breaks in the series, the results from the Perron–Vogelsang unit root tests are considered. If both of them do not show the significant results then the method of Zivot-Andrews should be used. If all these tests show no evidence of a structural break (s), the ADF and PP tests can be considered.

In our analysis, at first Clemente at al. (1998) test is conducted, then is it does not give significant results Perron-Vogelsang test is considered. Simultaneously the Zivot-Andrews test results are calculated. The significant dates are included in the necessary models by using dummy variables. Then to check the degree of integration, the conventional unit root tests are calculated.

The models are separated into two parts:

(i) General model for the equality of the aggregate demand and output; that is to say the equilibrium identity for the goods market $Y = AE$ where $AE = HHC + I + G + (X - M)$. The first function becomes

$$\ln Y = f(\ln HHC, I, \ln G, \ln X, \ln M, \ln E) \tag{14}$$

(ii) The behavioral models for the components of GDP, interest rate and inflation. In all these models exchange rate is an exogenous monetary variable changed with respect to the domestic and international shocks. It has direct and indirect effects on the level of the dependent variables. First of all, the interest rate parity should be introduced as it is necessary in most of the behavioral equations. To start with

$$i^d = f(i^f, \pi^d, \pi^f, \ debt, \ln E) \tag{15}$$

$$\pi^d = f(\pi^{oil}, \pi^{food}, Y^{gap}, i^d, \ln E) \tag{16}$$

More appropriate variable seems to be the interest rate for credit as it stimulates private consumption (wedding expenditures, mortgage, and cars) and investment (for agriculture, and running own business). In (16), π^d domestic inflation (in the KR) are caused by oil (fuel) prices, and overall food prices due to the large part of CPI consists of consumer goods. Both prices affect it positively. Output gap, Y^{gap}, is negatively correlated with prices according to Aggregate Demand curve in macroeconomics course books. Last two variables come from the equation (15).

In (15), the interest rate for som deposits (i^d) is assumed to be used for savings and credit in the KR. US Dollar 6 months LIBOR (i^f) is assumed to be perfect substitute for the interest bearing domestic assets (som deposits). The relationship among domestic interest

rates (i^d), foreign interest rates (i^f), and the nominal exchange rate (lnE) can be explained by using interest rate parity condition. It says that if there is no arbitrage return, investors become indifferent between foreign currency deposits (US Dollar 6 month LIBOR) in the foreign country (the USA) and domestic currency deposits (interest rate of som deposits) in the domestic economy (the KR). Two assumptions needed are: (i) capital is mobile across borders, (ii) perfect substitutability of som deposits and US deposits. There are two different forms of the interest rate parity: (i) uncovered interest rate parity in which the assets are exposed to the exchange rate fluctuations, (ii) covered interest rate parity in which the uncertainty in the exchange rate is offset or covered by a forward sale (swap). The uncovered interest rate parity can be written as

$$(1+i^d)=\frac{E^e_{t+k}}{E_t}(1+i^f) \tag{17}$$

Here i^d is the interest rate on som deposits, i^f is the LIBOR rate, E_t is the current exchange rate of som and US dollar, and E^e_{t+k} is the expected future exchange rate at time t+k. (21) can be written in natural logarithms as

$$\begin{aligned} i^d &= i^f + (\ln E^e_{t+k} - \ln E_t) = i^f + \%\Delta E^e_{t+k} \\ i^d &= i^f - \%\Delta (E^e_{t+k})^{-1} \end{aligned} \tag{18}$$

where $\%\Delta E^e_{t+k}$ is the expected depreciation rate of som against US dollar, and $\%\Delta (E^e_{t+k})^{-1}$ is the expected appreciation of som against US dollar (Salvatore, 2013). So if som depreciates 0.6753% point (the average value obtained from the actual data) against US dollar, c.p., then foreigners come to get interest return from som deposits. Since som deposits (6.1528%) have a higher return than a US Dollar 6 month LIBOR (2.2356%), investors would sell American assets and buy Kyrgyz assets. Thus, som will be expected to depreciate as the demand for som increases, and US Dollar will be expected to appreciate as the demand for US Dollar decreases; that is to say a shortfall in return of US Dollar 6 month LIBOR must be offset by some gain from depreciation of som against US dollar. Conversely, any excess return from US Dollar 6 month LIBOR must be offset by some loss from the appreciation of the som against US dollar (Salvatore, 2013). Secondly, as the return of foreign asset (US Dollar 6 month LIBOR) increases, c.p., som appreciates against dollar as investors sell Kyrgyz assets and buy American assets. Thus, the return of domestic assets will remain constant if the percentage appreciation of som equals the percentage increase in the return of foreign assets. Otherwise, if the initial change is less than the latter then domestic interest rates will also increase.

When domestic inflation rises, then som loses its purchasing power then it will depreciate against dollar. Thus, the interest rates on som deposits will increase. The relationship between inflation and interest rates can be seen from the relative purchasing power parity:

$$\%\Delta E_{t+k} = \pi^{d}_{t+k} - \pi^{f}_{t+k} \tag{19}$$

where $\%\Delta E_{t+k}$ is the percentage depreciation of som against US dollar in the future period (t+k), π^{d}_{t+k} is the inflation rate for the KR, and π^{f}_{t+k} is the inflation rate for the US. In the long-run equilibrium, $\%\Delta E^{e}_{t+k} = \%\Delta E_{t+k}$ (20)

should be the case; that is to say the expected depreciation rate should be accurately foreseen then by using (22), (23) and (24) we can write

$$i^{d}_{t} - i^{f}_{t} = \pi^{d}_{t+k} - \pi^{f}_{t+k} \text{ then } i^{d}_{t} - \pi^{d}_{t+k} = i^{f}_{t} - \pi^{f}_{t+k} \tag{21}$$

This condition is known as the real interest rate parity (Sorensen and Jacobsen, 2010). Again when domestic inflation increases, by (23) the som depreciates against the US dollar; that is to say loses its purchasing power, and by (25) the interest rates on som deposits will increase to keep the right side fixed. Similarly when the interest rate in the US increases, the US dollar depreciates against the som, and US Dollar 6 month LIBOR rate increases to keep the left side fixed. Lastly, if the government borrows too much debt, then it can make repress the Central Bank to print money. Thus, the domestic inflation goes up, the nominal interest goes up as well to protect the falling real value of the assets.

$$\ln HHC = f(\ln Y, i^{d}, \ln E) \tag{22}$$

According to the Keynes' Absolute Income Hypothesis, GDP or income is a long-run determinant of the private household consumption. It has positive effect on the consumption. Furthermore, interest rates (for som deposits) can have negative effect on the consumption due to the substitution effect between saving and consumption, and positive effect on the consumption due to the income effect, in which lenders get higher income and borrowers get lower income (Corugedo, 2004). In summary, a higher interest rate influences the level of financial wealth which includes variables like capital stock and housing capital, and labor income (human capital) negatively. Thus it leads to a decrease in the consumption expenditure (Sorensen and Witta-Jaconsen, 2010). The exchange rate has a negative effect on the consumption by the way its effect on import prices and domestic prices (by inflation rate and/or inflation), and by its effect on the domestic interest rate by interest rate parity. While stabilization policy variables or nominal variables like nominal exchange rate are assumed to effect the consumption in the short-run and "neutral" in the long-run, they can affect the consumption in the long-run by the expectations channel from the interest rates channel.

$$I = f(\ln Y, i^{d}, \ln E) \tag{23}$$

As income or GDP affects the private consumption, it affects the private investment or FDI in the long run. Countries with high income are seen as the safe places for the FDI due to the low level of corruption and political instability, and high level of infrastructure. As interest rate is an opportunity cost for investment, it is assumed to have a negative

effect. The effect of the exchange rate is ambiguous; that is to say while an increase in nominal exchange rate may have positive effect on the investment by increase in the competitiveness of domestic goods and as a result of increasing production in the exporting firms it encourages an additional FDI, it may hamper FDI by increasing the interest rates through interest rate parity.

Government expenditure is assumed as the exogenous variable, so it will not take part in the first and second type models. Nowadays, consumers can make choice between domestic and foreign goods by trade. Improvement of trade gives them more choices of bundles to choose from. One of the components of the trade is export of goods and services. The determinants of export can be written as the following

$$\ln X = f(\ln Y^{world}, Y^{gap}, i^{d}, \ln E) \tag{24}$$

Demand for export goods has a positive income effect proxied by foreign buyers (World GDP) and a negative price effect by the appreciation of som against US dollar. When the som depreciates against US dollar, then the domestic goods become cheaper and foreign goods become more expansive. So the foreign and domestic consumers prefer the domestic goods. When foreign customers' get richer, they will demand more domestic goods and when the domestic currency appreciates against the foreign currency, the local goods loose the competitiveness (the domestic goods become more expensive compared to the foreign goods). Domestic output gap measured by the difference between actual and potential GDP negatively affects export capacity (Goldstein and Mohsin, 1985).

$$\ln M = f(\ln Y, i^{d}, \ln E) \tag{25}$$

When the income of the domestic economy increases, the citizens become wealthier and they differentiate their consumption by buying more foreign goods and services. Appreciation of the local currency positively affects the demand for foreign goods as the domestic goods become more expensive compared to the foreign goods. Interest rate (and inflation) influences trade variables by the interest parity condition. A country that has a higher interest rate (by the higher inflation rate) will suffer from the depreciation of local currency against foreign currency. So whereas the depreciation will increase the exports by making domestic goods cheaper compared to the foreign goods, it will decrease the imports.

The models can be shown by using the general function: $Y = f(IndVars)$ (26)

where Y and $IndVars$ is the relevant dependent variable and vector of regressors in the equations from (14), (15), (16), and (22)-(25). The coefficients are in the form of elasticities and semi- elasticities.

Since OLS has some problems as explained above, the autoregressive distributed lag (ARDL) model will be estimated. It has several advantages over other techniques:

(i) It can be applied to the variables with mixed order of integration (Pesaran and Pesaran, 1997).
(ii) In this model, sufficient number of lags is estimated to capture the dynamic framework.

(iii) The error correction model (unrestricted ECM) could be obtained from ARDL. Pesaran et al. (2001) calls it "conditional ECM". It integrates short-run adjustments with long-run equilibrium without losing long-run information.
(iv) It can be applied to the small sample estimations so is superior to that of Johansen and Juselius's cointegration technique (Pesaran and Shin, 1999).
(v) Endogeneity is no longer a problem.
(vi) Pesaran and Shin (1999) optimal lags in ARDL removes the problem related with serial correlation and endogeneity.

ARDL framework for the function above is

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{q_m} \delta_i^m \Delta IndVars^m{}_{t-j} + \lambda_0 Y_{t-1} + \lambda_m IndVars^m{}_{t-1} + \varepsilon_t \quad (27)$$

where β_0 is a constant and ε_t is a well-behaved white noise process, Y is the dependent variable, and $IndVars^m$ is the list of independent variables. While α and δ corresponds to short-run coefficients, λ_m, for the regressor m, corresponds to the long-run coefficients.

The ARDL model testing starts with the bounds test where H_0 ($\lambda_0 = \lambda_m = 0$) (there is no long-run relationship between Y and the independent variables) against H_1 ($\lambda_0 \neq \lambda_m \neq 0$) (there exists a long-run relationship between Y and the independent variables). Since we do not F-statistic values for mixed integration degree of variables, F-statistics value is not compared to conventional F-statistic values rather compared to values calculated by Pesaran et al. (2001). There are two bound values: upper and lower. If F-statistic is lower than the lower bound value then all variables are I(0) and cointegration does not exist. If it is greater than the upper bound value then there is cointegration between Y and the independent variables. If it is between the lower and upper values then the test is inconclusive (Pesaran and Pesaran, 1997).

To choose optimal lags for Y and the independent variables the ARDL estimates $(p+1)^k$ and $(q+1)^l{}_m$ for Y and the independent variables respectively number of regressions where p and l_m are maximum number of lags (there is a lag for each independent variables) (here 1). The optimal lag length is selected by Akaike Information Criterion (AIC) and Schwarz Information Criterion (SC). While AIC selects maximum relevant lag length, SC selects the smallest possible lag length. Since the abundance of the observations, we use AIC in our analysis.

After the ARDL is estimated, the unrestricted ECM can be estimated as the following:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{q_m} \delta_i^m \Delta IndVars^m{}_{t-j} + \theta ECT_{t-1} + \varepsilon_t \quad (28)$$

The coefficient of lagged error correction model θ is the speed of adjustment to long-run equilibrium. By using this value, the half-life (the time in which half of the derivations from long-run equilibrium is corrected): $t_{1/2}=\ln(0.5)/\theta=0.693/\theta$. The long-run multipliers can be calculated as $-(\lambda_m/\lambda_0)$ for each regressor m.

Lastly, diagnostic tests for the residuals from the ARDL and stability test are conducted. These are Breusch-Godfrey Serial Correlation LM Test, Breusch-Pagan-Godfrey Heteroskedasticity Test, Jarque-Bera Normality Test, and Ramsey RESET functional form misspecification Test. As a result of these, we will decide whether the model estimates are reliable or not.

6. Empirical results and discussion

6.1. Unit root test with structural breaks

Table 5. *Clemente-Montano-Reyes Unit Root Test Results*

Variable	(rho-1) (t-statistic) – optimal break point(s)	Variable	(rho-1) (t-statistic) – optimal break point(s)
lny	-3.347 – 2005Q4, 2010Q2 (IO) -3.401 – 2006Q2, 2011Q3 (AO) -2.955 – 2005Q4 (IO) -3.044 – 2008Q4 (AO)	*libor6*	-6.404 – 2004Q2, 2007Q3 (IO)** -0.131 – 2005Q1, 2008Q1 (AO) -3.67 – 2010Q2 (AO)**
lnhhc	-3.381 – 2001Q4, 2010Q4 (IO) -3.205 – 2006Q2, 2011Q4 (AO) -2.822 – 2001Q4 (IO) -2.58 – 2006Q2 (AO)	*infkg*	-3.886 – 2007Q1, 2008Q4 (IO) -4.039 – 2008Q1, 2008Q3 (AO) -1.685 – 2008Q1 (IO) -3.688 – 2007Q4 (AO)**
I	-8.968 – 2010Q2, 2015Q3 (IO)** -2.989 – 2007Q2, 2015Q1 (AO) -2.378 – 2010Q1 (AO)	*infus*	-5.372 – 2004Q2, 2008Q2 (IO) -1.105 – 2004Q3, 2008Q1 (AO) -4.496 – 2008Q2 (IO) -1.224 – 2008Q1 (AO)
lnG	-3.278 – 2001Q2, 2005Q3 (IO) -3.326 – 2006Q1, 2010Q1 (AO) -3.278 – 2005Q3 (IO) -3.265 – 2007Q1 (AO)	*debt*	-5.632 – 2009Q4, 2013Q1 (IO)** -0.778 – 2009Q4, 2013Q1 (AO) -5.793 – 2009Q2 (AO)**
lnx	-4.152 – 2003Q1, 2006Q3 (IO) -5.042 – 2004Q1, 2007Q2 (AO) -3.32 – 2005Q3 (IO) -4.542 – 2006Q2 (AO)**	*infpoilfao*	-3.661 – 2006Q4, 2007Q4 (IO) -1.776 – 2007Q3, 2012Q2 (AO) -3.212 – 2007Q4 (IO) -1.364 – 2007Q3 (AO)
lnm	-4.545 – 2002Q4, 2005Q3 (IO) -3.086 – 2004Q2, 2007Q1 (AO) -2.155 – 2002Q4 (IO) -2.483 – 2007Q1 (AO)	*infpfoodfao*	-2.487 – 2007Q4, 2011Q1 (IO) -0.89 – 2007Q3, 2012Q4 (AO) -2.394 – 2007Q4 (IO) -0.477 – 2007Q3 (AO)
lne	-2.251 – 2008Q2, 2013Q4 (IO) -2.415 – 2007Q2, 2014Q3 (AO) -1.802 – 2013Q4 (IO) -2.033 – 2014Q3 (AO)	*ygap*	-4.226 – 2001Q3, 2002Q3 (IO) -1.488 – 2002Q2, 2003Q4 (AO) -6.424 – 2003Q1 (IO)** -0.971 – 2001Q3 (AO)
interestdom	-4.874 – 2000Q4, 2008Q1 (IO) 0.066 – 2002Q3, 2008Q1 (AO) -2.071 – 2000Q4 (IO) -2.382 – 2014Q3 (AO)	*lnyworld*	-2.78 – 2005Q4, 2011Q2 (IO) -2.78 – 2005Q4, 2011Q2 (AO) -2.198 – 2009Q1 (IO) -2.765 – 2008Q3 (AO)

Critical Values (5% significance level): (İ) for Two Breaks, IO = -5.49, AO = -5.49, (ii) for One Break, IO = -4.27, AO = -3.56.

As we explained before, firstly we should run the unit root with structural break(s) by Clemente et al. (1998). Table 5 shows that for the general model variables only FDI and export have significant break dates at 2012Q2, 2015Q3 in innovational model, and 2006Q2 in Additive Outlier Model respectively.

Table 6. *Zivot-Andrews unit root test results*

Variable	Break Type	Minimum t-statistic – optimal break point(s)	variable	Break Type	Minimum t-statistic – optimal break point(s)
lny	Intercept Trend Both	-3.131 – 2014Q1 -3.69 – 2013Q1 -3.649 – 2012Q4	*libor6*	Intercept Trend Both	-4.105 – 2008Q4 -3.191 – 2006Q2 -4.19 – 2008Q4
lnhhc	Intercept Trend Both	-3.076 – 2014Q1 -3.598 – 2008Q2 -3.561 – 2007Q3	*infkg*	Intercept Trend Both	-4.96 – 2007Q3** -4.095 – 2008Q3 -5.075 – 2007Q3*
I	Intercept Trend Both	-7.161 – 2010Q4*** -7.032 – 2005Q3*** -7.451 – 2014Q1***	*infus*	Intercept Trend Both	-5.256 – 2008Q4** -4.498 – 2006Q2*** -5.408 – 2008Q4**
lngexp	Intercept Trend Both	-1.115 – 2013Q3 -3.239 – 2012Q2 -3.212 – 2011Q2	*debt*	Intercept Trend Both	-4.207 – 2013Q1 -3.541 – 2012Q1 -4.205 – 2010Q1
lnx	Intercept Trend Both	-3.884 – 2014Q1 -4.394 – 2011Q2 -4.774 – 2007Q1	*infpoilfao*	Intercept Trend Both	-4.901 – 2011Q3** -4.681 – 2007Q3** -4.876 – 2008Q3*
lnm	Intercept Trend Both	-1.79 – 2013Q4 -2.67 – 2008Q2 -2.705 – 2006Q1	*infpfoodfao*	Intercept Trend Both	-6.094 – 2011Q3 *** -6.279 – 2007Q4*** -6.452 – 2008Q3***
lne	Intercept Trend Both	-1.511 – 2014Q1 -2.78 – 2007Q3 -2.587 – 2006Q2	*ygap*	Intercept Trend Both	-4.416 – 2004Q1 -3.967 – 2007Q2 -5.718 – 2003Q3***
interestdom	Intercept Trend Both	-7.172 – 2009Q4*** -6.474 – 2014Q1*** -6.635 – 2014Q1***	*lnyworld*	Intercept Trend Both	-2.736 – 2014Q1 -3.869 – 2010Q2 -3.827 – 2010Q1

Critical Value: (i) Intercept: For 1% = -5.34, for 5% = -4.80, for 10% = -4.58, (ii) Trend: for 1% = -4.93, for 5% = -4.42, for 10% = -4.11, (iii) Both: for 1% = -5.57, for 5% = -5.08, for 10% = -4.82.
* 10% significant, ** 5% significant, *** 1% significant.

In the Zivot-Andrews test, only FDI have significant structural breaks in the mean at 2005Q3 and 2014Q1, Q4. The break dates are given for other (behavioral) variables in Tables 5 and 6. Oil price and World GDP have no breaks. In summary to catch the structural breaks, the Clemente et al. and Perron-Vogelsang tests are more successful than the Zivot-Andrews test, which is consistent with the anticipation of Shrestha and Chowdhury (2005). The break dates are controlled in the models by using the dummy variables in Table 7.

Table 7. *Dummy variables*

Dummy Variable	Variable	Dummy Variable	Variable
dumi, dumi2	I	duminfus	INFUS
dunlnx	LNX	dumdebt	DEBT
duminterestdom	INTERESTDOM	dumygap	YGAP
dumlibor6	LIBOR6	duminfpoilfao	INFPOILFAO
duminfkg	INFKG	duminfpfoodfao	INFPFOODFAO

6.2. ADF unit root test results

In ADF test, FDI, US Dollar 8 Month LIBOR rate, price inflations, and domestic output gap are level stationary, I(0) (ADF and PP unit root test results are given in the Appendix). Others are first difference stationary, I(1). In the PP test, FDI, interest rate of som deposits, domestic inflation, and budget balance are level stationary. Others are first difference stationary. Therefore, the ARDL models can be estimated. Dummy variables in Table 7 are included as fixed regressors. The models are selected by AIC. The top three models for the general model for (14) are as follows:

Table 8. *Top three general models by information criteria*

	Information Criterion		
Model	AIC	SC (BIC)	HQ
ARDL(6,1,3,0,4,1,1)	-4.565620	-3.700508	-4.226574
ARDL(1,1,1,0,1,1,3)	-4.555237	-3.914319	-4.302747
ARDL(3,1,1,1,2,1,1)	-4.447623	-3.806705	-4.195133

While according to the AIC, the best is ARDL(6,1,3,0,4,1,1), the ARDL(1,1,1,0,1,1,3) is better in other information criteria. The other is poor model. The ARDL Bounds Test Results for these are given in the Table 9.

Table 9. *ARDL bounds test for top three general models (LNY)*

Model Dependent Variable: LNY	F-Statistic, k, significance
ARDL(6,1,3,0,4,1,1)	5.432, k=6***
ARDL(1,1,1,0,1,1,3)	4.095, k=6**
ARDL(3,1,1,1,2,1,1)	4.9723, k=6***

* 10% significant, ** 5% significant, *** 1% significant.

First and third models have significant Bounds Test at 1% level, and the middle model's is significant at 5% level. Thus, H_0 Hypotheses of no long-run relationship between GDP and its components and exchange rate is rejected. So there is a long run relationship. The long-run model for top three models and diagnostic test results are given in the Table 10.

Table 10. *Top 3 general models, long-run coefficients*

	ARDL(6,1,3,0,4,1,1)		ARDL(1,1,1,0,1,1,3)		ARDL(3,1,1,1,2,1,1)	
Variable	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
LNHHC	0.302514	0.0006	0.475539	0.0003	0.279222	0.1123
I	-0.000481	0.0013	0.000020	0.8922	-0.000137	0.5217
LNGEXP	0.109448	0.0699	0.182065	0.0096	-0.145015	0.2609
LNX	0.262737	0.0000	0.142123	0.0256	0.352354	0.0001
LNM	0.174594	0.0224	0.239768	0.0304	0.355582	0.0698
LNE	0.443298	0.0000	0.527507	0.0054	0.425872	0.0000
DUMLNX	-0.056926	0.1973	-0.101551	0.0957	-0.095906	0.3014
DUMI	-0.062360	0.0609	-0.035116	0.4155	-0.059977	0.3837
DUMI2	0.004039	0.8810	0.044920	0.2396	0.023602	0.6838
C			-1.196790	0.3175		
@TREND			-0.011564	0.0323		
Diagnostic Tests	Serial Correlation: 0.8254 (0.3636) Heteroskedasticity: 22.101 (0.63) Normality: 1.318 (0.52) Functional Form: 1.89 (0.178)		Serial Correlation: 0.49 (0.4841) Heteroskedasticity: 7.3032 (0.4841) Normality: 3.26 (0.196) Functional Form: 0.4145 (0.521)		Serial Correlation: 0.0136 (0.9073) Heteroskedasticity: 13.95 (0.7867) Normality: 3.3546 (0.187) Functional Form: 0.606 (0.4405)	

In the first model, all variables except government expenditures are significant at 1% level. Government spending is also significant if the right tail is considered. Only the coefficient of FDI is not consistent with the economic theory. When FDI increases by 10 million dollars, c.p., GDP decreases by 0.481%. This sign is due to the low correlation between FDI and GDP in the KR, and the marginal efficiency of the capitals are low. Some infrastructure investments are needed to take the benefit from new capital inflow as Harrod-Domar-Singer Model proposed. When the household consumption increases by 10%, c.p., GDP increases by 3%. This rate is somewhat lower than the marginal propensity to consume for the developing country. The top three items in the government spending for the KR are: (i) Education (27.31%), (ii) Social Protection (22.98%), (iii) Economic Affairs (20.42%), and (iv) Health (13.97%). Three items except Economic Affairs are the structural policy variables as they have effect on GDP in the long-run.

Only Economic Affairs, in which the expenditures on different sectors in the economy are included, has short-run effect. The healthier the citizens, the more intensive they have to take education and thus contribute to the domestic production. As Economic Affairs for mostly agriculture sector increases, the export of goods increases, and thus GDP increases. Import has unexpected positive sign. This can be because of the major part of the imported items are consumption goods (about 60%). Export increases GDP as usual. Lastly as the som depreciates against US dollar by 1%, c.p., GDP increases by 0.4433%. The depreciation of domestic currency indeed increases the competitiveness of domestic goods with respect to the foreign goods. So as a result of an increase in the export and decrease in the import, trade balance improves and GDP increases.

In the 2nd model, FDI coefficient is positive but insignificant. Others are significant and have signs as anticipated. In the last model consumption, FDI, and government spending are insignificant. The rest two models are poor with regard to the significance of the coefficients. The diagnostic test results are desirable in all models. The residuals are normally distributed with homeskedastic variances, and do not follow serial correlation. Moreover, there is no functional form misspecification in the models. Thus, the coefficients are reliable and can be used in the policy implications.

The error correction models for top three general models are given in the Table 11.

Table 11. *Top 3 general models, error correction model*

ARDL(6,1,3,0,4,1,1)		ARDL(1,1,1,0,1,1,3)		ARDL(3,1,1,1,2,1,1)	
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
D(LNY(-1))	0.310822***	D(LNHHC)	0.287049***	D(LNY(-1))	0.154230*
D(LNY(-2))	-0.163938*	D(I)	0.000061	D(LNY(-2))	-0.139544*
D(LNY(-3))	0.307074***	D(LNGEXP)	0.072556**	D(LNHHC)	0.267943***
D(LNY(-4))	-0.001126	D(LNX)	0.119188***	D(I)	0.000045
D(LNY(-5))	0.132222*	D(LNM)	-0.003747	D(LNGEXP)	0.042493
D(LNHHC)	0.263167***	D(LNE)	-0.471811***	D(LNX)	0.116502***
D(I)	-0.000009	D(LNE(-1))	-0.362667*	D(LNX(-1))	-0.044418
D(I(-1))	0.000027	D(LNE(-2))	0.254918**	D(LNM)	0.036142
D(I(-2))	0.000124***	D(DUMLNX)	-0.040470	D(LNE)	-0.549622***
D(LNGEXP)	0.060232*	D(DUMI)	-0.013994	D(DUMLNX)	-0.026369
D(LNX)	0.125844***	D(DUMI2)	0.017901	D(DUMI)	-0.016490
D(LNX(-1))	-0.082340**	D(@TREND())	-0.004608**	D(DUMI2)	0.006489
D(LNX(-2))	0.068609**	CointEq(-1)	-0.398516***	CointEq(-1)	-0.274941***
D(LNX(-3))	-0.058962*				
D(LNM)	-0.001855				
D(LNE)	-0.414609**				
D(DUMLNX)	-0.031327				
D(DUMI)	-0.034318*				
D(DUMI2)	0.002223				
CointEq(-1)	-0.550323***				
Cointeq = LNY - (0.3025*LNHHC -0.0005*I + 0.1094*LNGEXP + 0.2627 *LNX + 0.1746*LNM +0.4433*LNE - 0.0569*DUMLNX -0.0624*DUMI + 0.0040*DUMI2)		Cointeq = LNY-(0.4755*LNHHC + 0.0000*I +0.1821*LNGEXP +0.1421*LNX + 0.2398*LNM + 0.5275*LNE -0.1016*DUMLNX -0.0351*DUMI +0.0449*DUMI2 -1.1968 - 0.0116*@TREND)		Cointeq = LNY - (0.2792*LNHHC -0.0001*I - 0.1450*LNGEXP + 0.3524 *LNX + 0.3556*LNM + 0.4259*LNE - 0.0959*DUMLNX - 0.0600*DUMI + 0.0236*DUMI2)	

* 10% significant, ** 5% significant, *** 1% significant.

Error correction term coefficients are significant and negative in all models. The highest speed of adjustment is of the first model, -0.550323, meaning that about 55.0323% of disequilibria in the short-run is eliminated in one quarter. Consumption, export, and

exchange rate have a short-run effect on GDP. FDI, government spending, and import do not affect GDP in the short-run. This can be because of the poor correlation between FDI and GDP, most of the items in government spending have long run effect, and consumers prefer domestic goods to foreign goods. To take the advantage of these variables, the General Government Expenditure should be used to stabilize the domestic institutions by Legislative and Executive Affairs, to raise the public budget and to make stabilization policies more effective by Financial and Fiscal Affairs, and to stimulate capital inflows by General Research.

The models for GDP components start with the model for the interest rate parity and relative purchasing power parity. The ARDL Bounds Test results for all models are demonstrated in the Table 12.

Table 12. *ARDL bounds test for models of GDP components*

Dependent Variable and Model	F-Statistic, k, significance
Interestdom: ARDL(1,0,4,0,1,4)	13.46374, k=5***
lnfkg: ARDL(6,0,6,6,5,5)	7.038748, k=5***
lnHHC: ARDL(2,7,3,5)	7.18 k=3***
I: ARDL(12,12,12,12)	15.63, k=3***
lnX: ARDL(1,0,0,0,0)	5.205, k=4***
lnM: ARDL(1,9,9,9)	6.942204 k=3***

* 10% significant, ** 5% significant, *** 1% significant.

All Bounds Tests are significant at 1% level. So there is a long run relationship between the relevant dependent and independent variables for each behavioral model. The models for INTERESTDOM (interest parity model), INFKG (relative purchasing power parity), and LNHHC (Intertemporal Consumption Model) are as follows:

Table 13. *Effect of exchange rate on GDP components I, long-run coefficients*

INTERESTDOM		INFKG		LNHHC	
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
LIBOR6	0.293170**	INFPOILFAO	-0.047596	LNY	1.170837***
INFKG	0.252546***	INFPFOODFAO	0.435061***	INTERESTDOM	0.020702
INFUS	0.052214	YGAP	-107.538081	LNE	-0.323689***
DEBT	0.244218***	INTERESTDOM	1.685445***	DUMINTERESTDOM	0.000395
LNE	8.737877***	LNE	-10.994323**		
DUMINTERESTDOM	0.299733	DUMINFKG	3.089099		
DUMLIBOR6	0.732750	DUMINFPOILFAO	-2.761283		
DUMINFKG	-0.930212	DUMINFPFOODFAO	5.604509***		
DUMINFUS	0.200251	DUMYGAP	2.824367		
DUMDEBT	0.833826	DUMINTERESTDOM	0.120076		
C	-32.850474***	C	35.859209**		
@TREND	0.065967***				
Diagnostic Tests					
Serial Correlation: 0.262337 (0.6085) Heteroskedasticity: 14.09536 (0.8655) Normality: 3.63773 (0.16221) Functional Form: 3.92125 (0.0546)		Serial Correlation: 0.909434 (0.3403) Heteroskedasticity: 39.82315 (0.3889) Normality: 0.46864 (0.79111) Functional Form: 0.47272 (0.4993)		Serial Correlation: 0.41 (0.523) Heteroskedasticity: 17.943 (0.6526) Normality: 0.22557 (0.8933) Functional Form: 2.07 (0.1584)	

* 10% significant, ** 5% significant, *** 1% significant.

In the first equation, US 6 Month LIBOR increases by 1% point, c.p., the interest rate on SOm deposits increases by 0.2972% point. This is caused by the appreciation of som against the US Dollar due to the increasing demand for US Dollar and decreasing demand for the som. The signs of coefficients on domestic inflation (INFKG) and exchange rate are found as anticipated. When the prices in the domestic economy rises, the som loses its

purchasing power so it will depreciate against US Dollar, in turn this will increase the interest rates on som deposits. When Kyrgyz government seeks for the resources of the NBKR to pay its debt, the domestic inflation will rise, which in turn increases the domestic interest rates as well as interest rates on SOM deposits. The prices in the US economy does not have significant effect.

In the second model, whereas the world food prices feeds the domestic inflation, the world oil prices does not have significant effect. Furthermore, when domestic interest rates increases, c.p., the domestic currency need to depreciate to satisfy the interest rate parity. Then the domestic prices should rise to keep the real purchasing power of the domestic currency.

In the 3rd model, domestic interest does not have significant effect on private consumption. Maybe credit interest rates can be used instead of deposit interest rates. Exchange rate depreciation is supposed to have positive effect as increasing the competitiveness of domestic goods; it will increase the exports and decreases imports. When GDP increases by 1%, c.p., private consumption increases by 1.171% which is not consistent with the consumer behavior as consumers do not consume all their disposable income rather they keep some part for future consumption. Diagnostic results show that the residuals in three models are normally distributed, have fixed variance, and do not follow autocorrelation. Lastly, the models are truly specified.

The short-run coefficients are given in the Table 14.

Table 14. *Effect of exchange rate on GDP components I, error correction model, overall effects*

INTERESTDOM		INFKG		LNHHC	
Variable	Overall Effect	Variable	Overall Effect	Variable	Overall Effect
D(LIBOR6)	0.061505**	D(INFKG)	0.646247***	D(LNHHC)	0.295286**
D(INFKG)	0.020527**	D(INFPOILFAO)	-0.03658	D(LNY)	0.194091**
D(INFUS)	0.010954	D(INFPFOODFAO)	0.175734**	D(INTERESTDOM)	0.017522**
D(DEBT)	0.025270**	D(YGAP)	-72.0136***	D(LNE)	-1.2547*
D(LNE)	1.015757**	D(INTERESTDOM)	1.937028**	D(DUMINTERESTDOM)	0.000170
D(DUMINTERESTDOM)	0.062882	D(LNE)	5.027999**	CointEq(-1)	-0.430792***
D(DUMLIBOR6)	0.153725	D(DUMINFKG)	2.373938		
D(DUMINFKG)	-0.195151	D(DUMINFPOILFAO)	-2.122015		
D(DUMINFUS)	0.042011	D(DUMINFPFOODFAO)	4.307004***		
D(DUMDEBT)	0.174930	D(DUMYGAP)	2.170495		
D(@TREND())	0.013839***	D(DUMINTERESTDOM)	0.092277		
CointEq(-1)	-0.209792***	CointEq(-1)	-0.768489***		

* 10% significant, ** 5% significant, *** 1% significant.

The coefficients are the sum of the significant lags of the relevant variables, and the p-value is the average p-value of those variables. In overall, in the interest rate parity, only US inflation does not have short-run effect on interest rate on som deposits. Other variables have significant and expected effect as in the long-run model. Coefficient of error correction term is negative and significant meaning that there is a long-run link from the regressors to the deposit interest rate, and about 20.9792% of the disequilibria in the short-run is cancelled in one quarter. Half-life is -0.693/(-0.209792)=3.3033 quarters, about 298 days. The time needed to eliminate 50% of the disequilibria is about 298 days.

Conversely to the long-run model, all variables except oil prices affect the domestic prices in the short-run positively. When the domestic production increases, there is abundance of goods and services in the domestic economy, the prices tend to decrease which is consistent with the AD relationship. When som depreciates against dollar, c.p., domestic interest rates increase which in turn increases the domestic prices. In summary, only global Food prices the domestic prices both in short- and long-run due to the high ratio of agricultural products in the nation's economy. So the signaling systems for the future fluctuations of World Food Prices and their effect on domestic consumer's utility through hampering the purchasing power of their incomes should be analyzed and the appropriate models like ALPS (alert for price spike) of the UN model should be derived. Oil prices have neither short- nor long-run effects as most of the imported products are consumption goods rather intermediate raw materials. The adjustment mechanism works and really fast. Half-life is 81 days.

In the 3rd model, exchange rate depreciation has negative effect both in short- and long-run as it hampers consumption expenditures by making foreign goods more expensive relative to the domestic goods. This doe not only decrease GDP in the short-run but only continue to decrease GDP by decreasing imports and consumption expenditures. Income is also short run determinant of the household consumption with marginal propensity rate of about 20%; that is to say consumer use only 20% of their income in the short-run and save the rest to take advantage of the increasing opportunity cost of savings by deposit interest rates. However, interest rates does not affect private consumption in the long-run as the domestic households are pessimistic about the situation of the economy due to the political tensions in every 5 years and corruption.

The rest behavioral models are exhibited in the Table 15.

Table 15. *Effect of exchange rate on GDP components II, long-run*

I		LNX		LNM	
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
LNY	208.372177***	LNYWORLD	1.513162***	LNY	1.612468***
INTERESTDOM	14.958141*	YGAP	-51.734517*	INTERESTDOM	-0.052235
LNE	-338.524196***	INTERESTDOM	0.517667**	LNE	-1.052490***
DUMI3	71.437936*	LNE	-6.076333***	DUMINTERESTDOM	0.147488
DUMINTERESTDOM	-22.101379	DUMLNX	0.775541		
		DUMYGAP	-0.234811		
		DUMINTERESTDOM	-0.638185		
Diagnostic Tests					
Serial Correlation: 0.4525 (0.5012) Heteroskedasticity: 12.5664 (0.1277) Normality: 3.73551 (0.1545) Functional Form: 0.4347 (0.5125)		Serial Correlation: 2.47 (0.1161) Heteroskedasticity: 22.872 (0.1535) Normality: 0.189 (0.91) Functional Form: 0.1972 (0.66)		Serial Correlation: 0.00452 (0.9464) Heteroskedasticity: 22.487 (0.8358) Normality: 4.1868 (0.1233) Functional Form: 1.608 (0.215)	

* 10% significant, ** 5% significant, *** 1% significant.

When the economy or the market size of the KR increases, c.p., the environment in the domestic economy improves to provide the safe place for new capital inflow. Every 1% increase in GDP leads to 2083722 dollars increase of FDI. When som depreciates, c.p., by interest rate parity the domestic interest rates increase and in turn this hampers new capital inflows by increasing the opportunity cost.

In the 2nd and 3rd models, exchange rate depreciation has expected effect on import of goods and unexpected effect on the export. When som depreciates with respect to the US

dollar domestic goods get cheaper and foreign goods get more expensive. So it should increase the demand for the domestic goods and decrease the demand for foreign goods. The economic activity improvement abroad increases the demand for the Kyrgyz goods and their sale. The interest rate decays the purchasing power of the domestic currency, which in turn increases the competitiveness of the domestic goods, and their sale. When GDP of the KR increases, the Kyrgyz citizens become richer which in turn this leads them to differentiate their preferences by purchasing more foreign goods and services.

The ECMs are given in Table 16. Since the lag lengths are very long, we should look at the overall coefficients.

Table 16. *Effect of exchange rate on GDP components II, error correction model, overall effects*

I		LNX		LNM	
Variable	Overall Effect	Variable	Overall Effect	Variable	Overall Effect
D(I)	64.10**	D(LNX)	-2.75138**	D(LNY)	-0.09513**
D(LNY)	-330.817**	D(LNYWORLD)	7.040654***	D(INTERESTDOM)	-0.10292**
D(INTERESTDOM)	-107.029**	D(YGAP)	14.24177*	D(LNE)	-1.53194*
D(LNE)	1782.825**	D(INTERESTDOM)	0.632903**	D(DUMINTERESTDOM)	0.044438
D(DUMI3)	307.416493**	D(LNE)	2.533886**	CointEq(-1)	-0.301302***
D(DUMINTERESTDOM)	-95.108131**	D(DUMLNX)	0.159418		
CointEq(-1)	-4.303267*	D(DUMYGAP)	-0.048267		
		D(DUMINTERESTDOM)	-0.131184		
		CointEq(-1)	-0.205558***		

* 10% significant, ** 5% significant, *** 1% significant.

In the FDI model, GDP has unexpected negative effect on FDI. Other variables' signs are calculated as anticipated. Interest rate increases the opportunity cost of investment which discourages FDI. Whereas it has no effect in the long-run, it has effect on FDI in the short-run. Depreciation of som increases the competitiveness of the domestic products. So by the improvement in the exports volume and increasing the employment and production in exporting sectors it causes new capitals flow to these sectors. By interrelationship between exchange rate and interest rate, both improve the export of goods in the short-run. In the last equation, GDP negatively influences imports, which is nonsense. When interest rates rises, the consumers prefer to delay their consumption (substitution effect) by keeping their financial wealth in the deposits accounts, which in turn leads to the fall for the demand of foreign goods. The coefficients of error correction terms are all negative and significant which justifies the existence of long-run relationship from the control variables to the dependent variables. The speed of adjustment is between 20% and 30%, which give the half lives of 303 and 207 days respectively. The diagnostic results are desirable. The residuals are well-behaved, so the estimates are reliable.

7. Conclusion

The evolution of the exchange rate regimes are rather complex. There were periods when some fixed exchange rate regimes dominated, and in last years most countries use floating exchange rate regime because of the deep financial sectors over the world.

To decrease the effect of the external shocks like remittances, food and oil price fluctuations, and exchange rate policies of the trade partners, the exchange rate policy plays a major rule to stimulate GDP and its components.

On the other hand, the most literatures state that effectiveness of foreign exchange regime in economy of the country depends on tightness with world financial market and trade. The literatures reviewed converges in idea of moving toward more floating foreign exchange regime if the country increasing its integration in global financial market and economy. Which is case in the Kyrgyz Republic, the joint to integrated economic union EAEU should theoretically increase the country international financial and economic activities. Therefore, it is recommended to update or change existing Foreign Exchange regime of the country to more floating one.

In the paper the behavioral equations for the KR for period 2000Q1-2016Q3 are analyzed. The models include the interest rate parity and relative purchasing power parity, and the behavioral equations for the GDP components. Models are estimated by using the ARDL model by Pesaran et al. They are divided into two categories; the model for the GDP in general and the models for the GDP components.

As a result of model estimations, exchange rate has short- and long-run effects on the GDP growth. An increase in the exchange rate increases the growth in the long-run. The speed of adjustment is normal. Furthermore, it influences GDP components mostly in the long-run. It negatively contributes to all of the component variables. The speed of adjustment is not very high. The diagnostic results show that the residuals obtained from the models are well-behaved. The negative effect long-run effect of depreciation of som says that we should be careful to use the exchange rate policy. In this case, the attention of the policymaker should be more focused on inflation, money supply and other variables like overnight interest rates. However, there is still sensible reason for raising question to update or replace current official Foreign Exchange regime of the country.

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Appendix

ADF and PP Unit Root Test Results

	ADF Unit Root Test Results (Schwarz Info Criterion, Max.Lag=10)					
	Level (ADF Test Statistics and p-values in parentheses)			1st Difference (ADF Test Statistics and p-values in parentheses)		
	None	Constant	Constant and Trend	None	Constant	Constant and Trend
lny	2.056	-1.421	-1.237	-4.937***	-5.54***	-5.743***
lnhhc	1.813	-1.41	-1.571	-5.254***	-5.727***	-5.793***
l	-2.282**	-4.843***	-7.021***			
lngexp	2.393	-1.755	0.763	-2.6542***	-10.558***	-10.961***
lnx	0.936	-1.6453	-2.355	-8.544***	-8.602***	-6.77***
lnm	2.081	-1.426	-0.104	-6.169***	-6.56***	-6.767***
lne	1.141	0.69	0.204	-5.395***	-5.52***	-6.364***
interestdom	-0.9451	-2.422	-3.733**	-5.4745***	-5.2544***	-4.7103***
libor6	-2.526**	-3.2848**	-4.1845***			
infkg	-2.2004**	-3.161**	-3.2115*			
infus	-1.3375	-2.4957	-3.08	-8.0411***	-8.0434***	-7.9734***
debt	-1.34	-1.844	-5.5356***	-9.85***	-9.785***	-9.8142***
infpoilfao	-4.14931***	-4.360356***	-4.392***			
infpfoodfao	-4.91***	-5.1865***	-5.26413***			
ygap	-2.7357***	-3.5677***	-5.518***			
lnyworld	2.44	-1.82	-0.3166	-2.768***	-3.7977***	-4.6963***
	PP Test Results (Newey-West Automatic using Bartlett Kernel)					
	Level (PP Test Statistics and p-values in parentheses)			1st Difference (PP Test Statistics and p-values in parentheses)		
	None	Constant	Constant and Trend	None	Constant	Constant and Trend
lny	2.90	-1.773	-0.332	-4.993***	-5.4982***	-5.571***
lnhhc	2.66	-2.028	-0.97	-5.254***	-5.681***	-5.646***
l	-3.26***	-4.733***	-7.228***			
lngexp	1.80	-1.851	0.523	-9.80***	-10.48***	-10.94***
lnx	2.173	-1.513	-2.344	-8.595***	-9.96***	-13.0625***
lnm	1.682	-1.364	-0.464	-6.297***	-6.6183***	-6.795***
lne	1.17	0.723	-0.1574	-5.637***	-5.754***	-6.388***
interestdom	-3.493***	-6.7061***	-9.017***			
libor6	-2.17**	-2.2105	-2.083	-3.747***	-3.83***	-4.036**
infkg	-3.497***	-4.3158***	-4.2448***			
infus	-1.7215*	-3.068**	-3.472**			
debt	-4.3458***	-5.316***	-5.844***			
infpoilfao	-2.84553***	-2.576*	-2.615511	-4.665322***	-4.62555***	-4.57***
infpfoodfao	-2.35244**	-2.4817	-2.5927	-3.74013***	-3.6975***	-3.6222**
ygap	-1.3654	-2.50342	-2.76616	-2.9744***	-2.951**	-3.3806*
lnyworld	3.3001	-1.1444	-0.944	-2.2376**	-2.9566**	-3.074

* 10% significant, ** 5% significant, *** 1% significant.