TOTAL PUBLIC DEBT SUSTAINABILITY: EMPIRICAL ASSESSMENT OF THE SOLVENCY ISSUE IN THE CASE OF THE KYRGYZ REPUBLIC

A Thesis
Presented to the MA Programme
of the OSCE Academy in Bishkek
in Partial Fulfillment of the Requirements for the Degree of

Master of Arts in Economic Governance and Development

by
Daniiar Moldokanov

September 2013

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ABSTRACT

This thesis analyses the total public debt of the Kyrgyz Republic in terms of solvency criterion. The recent development of total public debt to GDP ratios as well as sharp increase of fiscal deficit increases the attention of international investors to the issue of total public debt sustainability of the Kyrgyz Republic. Different methodologies in order to assess whether the country satisfies solvency criterion of the sustainability was implemented including fiscal reaction function, the debt stabilizing primary balance over/under-borrowing test and the stress test. The main finding of the paper is that total public debt to GDP ratio in the Kyrgyz Republic is sustainable in 2012, but the country still has the moderate risk of debt distress. The assessing methods all face the issue of uncertainty, therefore the probability of over/under-estimation of the results exists.

Key words: Public Debt Sustainability, Fiscal Reaction, Fiscal Solvency

Jell Classification: E62, F34, H63, O43, H54

ACKNOWLEDGEMENT

First and foremost, I would like to thank my parents and my sister for their support and encouragement throughout my study. Furthermore, I would like to express my gratitude to my supervisor Aibek Baibagyshuulu for the useful comments, remarks and engagement through the learning process of this master's thesis. I am also highly indebted to Radzhapov Bahadyrjon, who willingly shared his precious time and helped in doing the data collection. Finally, I would like to thank Indra Øverland for his constant support and his willingness to give me time to work on this thesis so generously.

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ACRONYMS

ADF	Augmented Dickey-Fuller (test)
CPI	Consumer price index
DSA	Debt sustainability analysis
EME	Emerging market economy
GDP	Gross domestic product
IMF	International Monetary Fund
LIC	Low income country
NBKR	National Bank of the Kyrgyz Republic
OECD	Organization for Economic Cooperation and Development
OSCE	Organization for Security and Cooperation in Europe
SA	Seasonally adjusted
SDRs	Special drawing rights
VECM	Vector Error Correction Model

I

INTRODUCTION

Chains of habit are too light to be felt
until they are too heavy to be broken.
—Warren Buffett

Public debt sustainability problem has been the issue of high importance and concern among economists around the globe. The high attention to the effect of high public debt on economic development goes back to the 18th century, when the problems of public debt accumulation appeared in England and France. Nowadays the issue has not lost its relevance. As it is recently discussed intensively in economic literature, the European sovereign debt crisis is having a significant and negative impact on global economic development. The high public debt problems in the periphery of the European Union are negatively affecting main partners of the union, and the overall financial stress on the financial market, that was caused by the debt crisis, is putting downward pressure on global economic growth. According to the October 2012 World Economic Outlook, public debt has reached significantly high points and based on historical analysis it might take many years to appreciably reduce it.[1]

Although the recent development in global economics articulates that the accumulation of high public debt has a negative effect on growth, it is out of the question that there are reasonable justifications to accumulate debt. Public debt might be used to fund government expenditures that contribute to economic and social objectives. For example the government expenditures on infrastructure or financing of public investment can increase the rate of interest of private capital, or the expenditures oriented towards preventing market failures such as public goods, overall improve infrastructure and socio-economic development. Higher spending on education or health care improves the human capital of a country. Accumulation of public debt is also used as a safeguard to limit the need in implementation of strict fiscal policy.

[1] IMF, "Global Prospects and Policies: Risks Related to High Public Debt Levels," in *World Economic Outlook: Coping with High Debt and Sluggish Growth,* World Economic and Financial Surveys, (October 2012), http://bit.ly/2EFizpW (22 December 2018).

It is important, however, to remember that public debt can easily become unsustainable due to exogenous determinants, and if that happens then the country will experience significantly negative economic consequences. To finance public debt, the government often has to implement strict fiscal policy which puts upward pressure on real interest rates and might negatively affect the gross domestic product (GDP) growth. It often appears that the economy at the time of implementation of required strict fiscal policy needs stimulation, and when the government cannot take the stimulating actions, a debt crisis ensues and the government is forced to default or inflate the debt away. Both options bring significant economic and welfare costs.

As has been mentioned by Adrian Penalver and Gregory Thwaites, in emerging market economies the issue of public debt sustainability has a comparatively faster impact on economic development than the same issue in developed countries, because key macroeconomic variables, that are considered as an exogenous variables, such as budget balance, GDP growth, inflation, domestic and foreign interest rates and the exchange rate are comparatively volatile, making it difficult to predict public debt solvency of a country with confidence. It is also important to take into consideration the fact that these macroeconomic variables are usually correlated. For example, negative shock in net export can slow GDP growth, provoke exchange rate depreciation and raise interest rates, all of which might negatively affect the debt position of a country.[2]

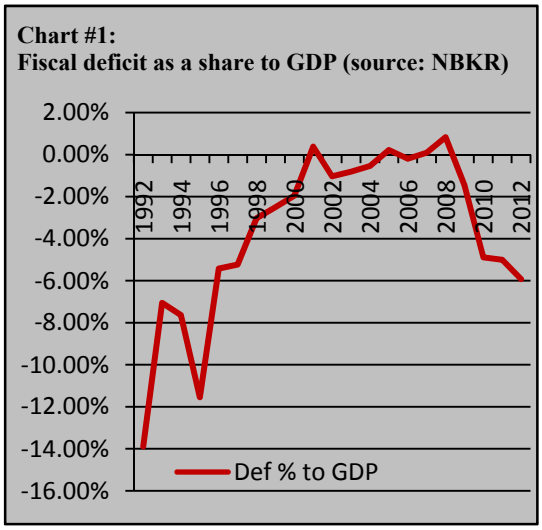
In the low income countries (LICs) the problem of public debt sustainability is even sharper than in emerging markets, due to the fact that these countries also have volatile macroeconomic indicators, that are hard to be predicted, and unlike to an emerging market economy (EME), a LIC has lower GDP growth and weak institutional development, making it not only hard to predict the behavior of debt but also hard to accumulate enough funds to finance the budget deficit, which makes LICs rely on external sources of funding like external debt and external aid.

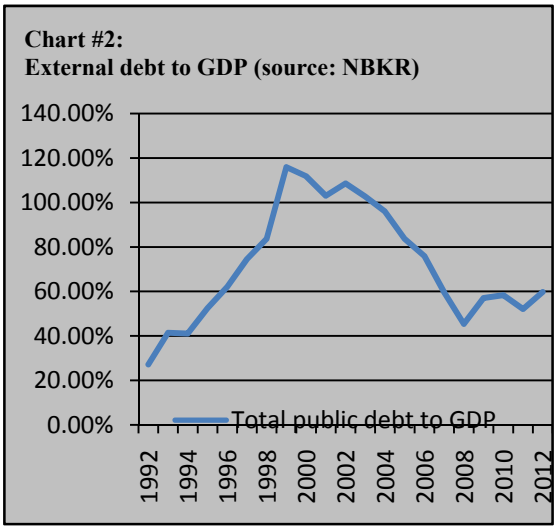
> "LICs differ in that their development needs are larger relative to their resource envelope; they rely to an important extent on external aid; they have a higher susceptibility to external and domestic shocks and more uncertain returns on public investments; narrow production and export bases, often concentrated in a limited number of primary commodities, for which prices are

[2] Adrian Penalver and Gregory Thwaites, "Fiscal Rules for Debt Sustainability in Emerging Markets: The Impact of Volatility and Default Risk," *The Bank of England*, (2006), https://bit.ly/2K8Q4U3 (23 May 2012).

determined in world markets; and a tendency to weaker policies and institutions, including in project implementation and debt management."[3]

The fact that the Kyrgyz Republic is considered to be under the LIC group with volatile exogenous macroeconomic indicators makes one conclude that the issue of public debt sustainability in the country is relevant. As it is written in the report of Dr. Manfred Stamer under the Euler Hermes country risk evaluation, the Kyrgyz Republic had two restructuring agreements with the Paris Club (first in 2003 and second in 2005) that contributed to the significant reduction of public debt to GDP ratio from 100% in 2003 to 45% in 2008. However, the fiscal deficit widened rapidly from the surplus of 0,83% to -4,89% to GDP in 2010 and external public debt increased from a low of 45% of GDP in 2008 to 58% in 2010.[4] Majorly, the increase in debt to GDP ratio since 2008 might be explained by the negative impact of the world





economic crisis in 2008 on the main macroeconomic variables of the country and by internal political instability which caused the increase in public borrowings to finance the development of infrastructure and deficits that were obtained because of the crisis. According to the Euler Hermes country risk evaluation, Kyrgyzstan was classified as a country with high risk in 2011.[5] The further behavior of fiscal deficit and debt in the country does not seem to reduce the concerns of economists about the public debt

[3] IMF, "Some Tools for Public Sector Debt Analysis: B. Debt sustainability Analysis," in *Guide for Compliers and Users: Public Sector Debt Statistics*, (2012), http://bit.ly/2Lv8RHk (22 December 2018).

[4] Manfred Stamer, "Country Review Kyrgyzstan," *Euler Hermes* (2011), https://bit.ly/2ludvcw (15 December 2012).

[5] Ibid.

sustainability. Since 2010 public deficit to GDP ratio increased from 4,89 to 5,93 % (see the Chart #1), and the ratio of public debt to GDP has also had increasing trend since 2008 and in 2012 it reached the level of 59,79% of GDP compared to 45,41% of GDP in 2008 (see Chart #2).

The described facts and high volatility of main macroeconomic variables makes one to conclude that it is out of the question that the issue of the external public debt sustainability needs to be analyzed in the case of the Kyrgyz Republic. Therefore this thesis aims to assess the issue of public debt sustainability in the case of Kyrgyzstan, and the main research question to be investigated is: whether the government of the Kyrgyz Republic is solvent or not and if it is solvent, what is the level of risk of having the debt sustainability problems? In order to assess the issue of sustainability some sub-questions need to be answered such as:

- Do the fiscal tools of the country react positively or negatively to the higher debt to GDP level?
- Does the current fiscal path satisfy long run solvency criterion of sustainability? If it does not, what is the debt stabilizing primary balance and can the government credibly commit to the stabilizing fiscal path without significant corrections such as debt relief or debt rescheduling?
- What is the benchmark debt to GDP ratio for the Kyrgyz Republic? Does the government over/under-borrow? If it over-borrows, is it economically and politically possible for the country to commit to the fiscal path in future that will bring debt to GDP level to the benchmark level?

Finding the right answer to these questions will evaluate country's capacity to fund its policy agenda and finance the resulting debt without excessively large changes that can compromise its macroeconomic stability. It will also help to determine future direction of the fiscal policy of the country and might lead one to make reasonable conclusion about possible future perspectives to development. The main limitations of this research are:

- The thesis only assesses the solvency criterion of the Kyrgyz Republic, since limited scope of the paper does not allow us to assess liquidity condition due to the fact that assessment of liquidity condition is extensional and requires a separate research.

- The investigation analyses the solvency criterion but does not analyze the liquidity condition in the assessment of debt sustainability of Kyrgyz Republic, due to the limited resources and scope of the thesis.
- The research does not take into account off-budget obligations of the country such as implicit and contingent liabilities due to the fact that estimation of those liabilities require a detailed forecasting that consumes time and resources, and the scope of the thesis does not allow to cover the issue.
- The data for the Kyrgyz Republic is not always available in consistent manner; in some cases the number of observations will not be enough, thus some estimates might be biased.
- This research has to deal with uncertainty. Therefore the number of stress tests will be applied in the paper in order to deal with uncertainty; however, the results that will be obtained based on the stress test in isolation are not going to give a determination of optimal borrowing path, but provide with valuable inputs for macroeconomic design and should be considered as a recommendation for future policy direction.

The methodological part of the thesis is based on the quarterly data from 2003 to 2012 obtained from the World Bank database, as well as the annual data from 1992 to 2017 obtained from the International Monetary Fund (IMF) database. Some data was obtained from the Ministry of Finance of the Kyrgyz Republic, the National statistics committee of the Kyrgyz Republic and from the bulletins of the National Bank of the Kyrgyz Republic. The main finding of the paper is that the Kyrgyz Republic is not experiencing debt sustainability problems for now; however, it has moderate risk of debt distress under the debt distress risk classification of the World Bank and IMF. It was also found that the historical, as well as current, fiscal policy track does not satisfy the long run solvency criterion, all other thing being equal.

The research for this thesis is organized as follows: in the second chapter the literature review is discussed. The chapter includes the discussion of key terms and definitions, overview of available methods to assess the solvency criterion, critical analysis of published material and gives justification to use the stress test. The third part of the thesis covers detailed discussion of methodological issues related to the assessment of solvency condition in the case of the Kyrgyz Republic and describes the obtained results and findings, including the estimation of fiscal reaction Function in the case of the Kyrgyz Republic, empirical assessment of debt stabilizing primary

balance, over/under-borrowing test, and a number of sensitivity tests. In the last chapter, one may find some concluding remarks and general recommendations. The thesis ends with appendixes, data attachments, and bibliography.

II

LITERATURE REVIEW

Due to the relevance of the public debt sustainability issue, one may find a large amount of literature related to the topic, in which researchers have highlighted different methodologies of public debt sustainability assessment. However, in common, there is no simple rule that can give a rigid determination of whether the debt accumulation is sustainable or not. Therefore, it is essential to understand all theoretical and practical nuances of public debt sustainability issue's assessment. This chapter tries to describe and critically analyze the most popular methodologies in order to bring some conclusions related to the methodological part of the thesis.

II.1. Main terms and concepts

Since this thesis focuses on the analysis of public debt sustainability, it is essential to define the main concepts and terms of the issue. According to the IMF's Guide for Compliers and Users, total gross public debt "consists of all liabilities that are debt instruments." It further states that

> "A debt instrument is defined as a financial claim that requires payment(s) of interest and/or principal by the debtor to the creditor at a date, or dates, in the future. The following instruments are debt instruments: Special drawing rights (SDRs); Currency and deposits; Debt securities; Loans; Insurance, pension, and standardized guarantee schemes; and Other accounts payable."[6]

In addition, researchers at the World Bank divide the public debt to external public and publicly guaranteed debt and domestic public and publicly guaranteed debt, where public and publicly guaranteed debt "…comprises obligations of public debtors, including the national government, political subdivisions (or an agency of either), and autonomous public bodies, and obligations of private debtors that are guaranteed for repayment by a public entity."[7] Generally speaking, public debt is obligations that are explicitly recognized as liabilities in the budgetary system.[8]

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[6] IMF, "Definitions and Accounting Principles: B. Definitions of Debt," in *Guide for Compliers and Users: Public Sector Debt Statistics*, (2012).

[7] World Bank, "International Debt Statistics: Metadata," https://bit.ly/2yycedB (1 May 2012).

[8] For more detailed information about public debt see: Definitions and accounting principles, Supra 6, Chapter 2.

The IMF provides us with the definition of debt sustainability: "Debt is sustainable when a borrower is expected to be able to continue servicing its debts without an unrealistically large correction to its income and expenditure balance."[9] And the World Bank in their *Guide to LIC Debt Sustainability Analysis* highlights additional condition for debt sustainability requirement, apart from the corrections to the budget, which says that debt is sustainable "when it can be serviced without resort to exceptional financing (such as debt relief)…".[10] These two definitions, provided by IMF and the World Bank, highlight the main idea of the sustainability condition which is the ability and capacity of the borrower to service the debt. It brings us to the discussion of the different methods of assessing the ability of the borrower to service the debt and important related issues. That discussion is most likely to provide us with fundamental specifics for developing the methodological part of the investigation.

II.2. Theoretical background: Assessment of the total public debt sustainability

The available literature does not come up with a simple rule that can help to determine whether the debt accumulation is sustainable or not. However, there are a number of approaches that ought to be used in assessing the issue of debt sustainability of a country. Based on literature, it is a good start to look at the government budget identity equation when analyzing the public debt sustainability. Basically the equation shows the linkage between government expenditures and government revenues. It is based on the elementary accounting principles, and thus contains all available determinants of fiscal policy of the government, making it very comfortable for investigators to analyze debt issues. The reader might observe later on that all the methods that was provided in the literature and would be discussed further in this thesis have their roots in the government budget identity equation. In this part of the research, various indicators that can be used to assess whether a particular debt accumulation is sustainable or not will be discussed.

II.2.1. When is public debt accumulation sustainable?

Many authors start their analysis with the solvency criterion which implies that a government is assumed to be solvent if it is projected to be able to accumulate enough

[9] Supra 3, 148.

[10] World Bank, "Basic Concepts of a DSA for Low-Income Countries: A. When is Public Debt Sustainable in LICs?," in *Guide to LIC Debt Sustainability Analysis: How to do a Debt Sustainability Analysis for Low-Income Countries*, (2006), https://bit.ly/2M6OmQp (1 December 2012).

future primary budget surpluses to be able to repay its outstanding debt; see for example Barro (1979)[11] and Christensen (2003).[12] In mathematical way of representation, it is said that the present discounted value of future fiscal revenues minus fiscal expenditures, not including the interest payment expenditures on the debt, must be at least equal to the value of existing stock of public debt.[13] However, Nouriel Roubini suggests that a theoretical criterion "solvency criterion from intertermporal budget constraint" for debt sustainability is not principally stringent because the budget constraint of a country imposes only very minor restrictions on the accumulation of a country's debt. As long as the discounted value of the country foreign debt is non-zero in the infinite limit, the country is solvent. This means only that the country cannot increase its debt faster than the real interest rate on this debt. The solvency constraint also implies that the stock of debt of the country can increase without limits as long as it does not increase faster than the real interest rate. If the real interest rate is greater than the rate of growth of an economy, solvency is consistent even with a debt to GDP ratio that grows continuously over time.[14]

A country could run very large primary deficits for a very long time if it could credibly commit to run primary surpluses in the long run to satisfy the condition that the discounted value of primary balances is at least equal to the initial public debt. But this does not seem to be realistic for some reasons. Such an action would require a very strict fiscal policy in the long run, whether it would be the immediate increase in taxes which will not guarantee that there will be positive primary budget because very high taxes might force tax evasion. While decrease in government expenditures might negatively affect the human capital development and cause unemployment, which in turn might lead to decrease of economic activity and even to a debt crisis in the country. IMF researchers have also indicated that the solvency criterion is not practical because "running large primary surpluses for a long period of time would be costly and politically very difficult".[15] So, researchers suggest that it is essential to

[11] Robert J. Barro, "On Determination of the Public Debt" *The Journal of Political Economy*, 87, № 5, part 1 (1979): 940-971.

[12] Jacob Christencen, "Domestic Debt Markets in Sub-Saharan Africa," *IMF Working Paper,* № 04/06, (2004). https://bit.ly/2tjUI86 (1 October 2012).

[13] Supra 3, 147.

[14] Nouriel Roubini, "Debt Sustainability: How to Assess Whether a Country is Insolvent," Stern School of Business, New York University, (2001). https://bit.ly/1lROEtv (10 September 2012).

[15] IMF, "Public Debt in Emerging Markets: Is It too High?," in *World Economic Outlook: Public Debt in Emerging Markets,* World Economic and Financial Surveys, (September 2003).

take into account the economically and politically realistic fiscal adjustment path of the country when analyzing the solvency criterion. Usually, the most convenient way to get more adequate information about fiscal adjustment path of the country is to use the national strategy of development reports that in most cases are prepared by the national authorities.

Most of the literature indicates that while analyzing the debt of the country one should see the debt as a ratio to the repayment capacity of the country. The indicator of the repayment capacity might be for instance GDP, fiscal balance or net export. All these variables (GDP, Export, government revenues) are to certain extend indicators of economic activity, but which of these indicators is best for implementation in accessing the issue of the debt sustainability? Taking the debt as the ratio of the government revenues seems to be logical, because the government revenues are the indicators of government capacity, but one can argue that in some cases the government can collect high revenues but also face high government expenditures which are in big proportion spent for unreasonably big size of the government apparatus and does not create additional capacity for economic development and does not contribute to higher government revenues in future. Taking the debt level as a share to the value of the export is also a good indicator, but what if the export is not a major contributor to the economic development of the country, and the export sizes are small while the economy itself has enough capacity to manage the debt? The GDP is always considered to be as an indicator of economic growth, but the growth of GDP does not necessarily state that the government is able to collect more revenues in order to cover expenditures. All these indicators have their own advantages and disadvantages, and in order to access the sustainability one can choose to use one of them depending on the country specifics, or can use all of them and make some conclusions.

The observed literature specifies that apart from solvency criterion the government should also satisfy liquidity condition. As the researchers from IMF articulated the government is assumed to be liquid if it has realistic ability to rollover its maturing debt obligations in an orderly manner.[16] The liquidity condition is very important, because even if the government is solvent it might not have sufficient assets and enough liquidity available to satisfy its maturing debt, and in that case

[16] Supra 3, 147.

when the government does not have the opportunity to rollover the maturing debt it simply faces sustainability problems. However, in this study the assessment of liquidity condition will not be investigated, due to the limited resources and scope of the thesis. As a matter of fact, the assessment of liquidity condition for the Kyrgyz Republic can become a very interesting and contributing continuation of the particular research, since it requires serious analysis and deep investigation of budgetary components.

II.2.2. Fiscal reactions function as a way to define compliance of the fiscal policy to the long run debt sustainability criteria

The assessment method has its start from government budget identity equation and goes to the analysis of fiscal tools' behavior effects on the main goals of the fiscal authorities (in our case it is attaining the debt sustainability). Basically the method suggests seeing the relationship between the variables that indicates fiscal policy tools such as government expenditures and taxes and debt to GDP ratio. The method is relatively new, however very popular around the researchers, see for example Bohn (1998),[17] Reinhard (2003),[18] and Roubini (2001).[19]

The key idea of the method is that the positive effect of public debt to GDP ratio on primary balance implies that fiscal policy is consistent with solvency criterion in the undetermined future. Generally speaking, it shows whether the government takes into account the increasing public debt to GDP levels and tries to adjust future fiscal policy to the way of reduction of deficits or creation of surpluses in order to comply with stabile debt to GDP levels in the future or not. Although the approach estimates the reaction of the government authorities on debt accumulation, the results of this method are not enough to make a rigid decision since it only says that according to the historical fiscal path of the observed country, on average, the government reacts appropriately or not appropriately to keep the debt to GDP level in compliance with the long run solvency criterion, but not taking into account the future strategic plans and possible future economic and political shocks. That is why the answers that will be provided by this approach should be analyzed further, taking into

[17] Henning Bohn, "The Behavior of U.S. Public Debt and Deficits," *Quarterly Journal of Economics*, 113, № 3 (1998): 949-963, https://bit.ly/2yqAWN3 (22 December 2018).
[18] Carmen Reinhart, Kenneth Rogoff, and Miguel Savastano, "Debt Intolerance," *Brookings Papers on Economic Activity*, Brookings Institution, 1-62, (2003). https://bit.ly/2K0mLDQ (10 April 2012).
[19] Supra 13.

consideration both economically and politically realistic fiscal adjustment paths of the observed country. The detailed technique of the implementation of this method is going to be discussed in the methodological part.

II.2.3. Another way to assess public debt sustainability: Debt stabilizing primary balance

One simple and very popular method around the researchers to assess the public debt sustainability can also be derived from the analysis of the basic government budget identity equation. The main idea is that fiscal path is sustainable if it brings to stable not growing public debt to GDP ratio. To understand whether the fiscal path is sustainable or not, one should calculate the primary budget balance that will allow achieving the stable debt to GDP level. Once such primary balance, called debt stabilizing primary balance, once calculated should be compared with the actual primary balance. If it is the case when actual primary balance is lower than the debt stabilizing primary balance, then one may consider that current fiscal policy leads to increasing not stabile public debt to GDP ratio, thus the current fiscal path is said to be not sustainable. The deviation between the actual and stabilizing primary balance shows the degree of future required or more recommended fiscal adjustment paths for the authorities to stabilize the public debt to GDP level. Therefore, by analyzing the capacity of the government and future economic development, one can make a conclusion whether it is economically and politically possible to commit to such a fiscal adjustment path. This method is very popular due to the fact that it is quite simple from theoretical point to see, for example Blanchard (1990),[20] Penalver (2006),[21] and Blanchard (1990).[22]

The approach is based on the future forecasting of the main macroeconomic variables and indicators: Stabilizing primary balance depends here mainly on debt to GDP ratio, therefore while analyzing and transferring the government budget identity in to a long run equation, which will consider the fiscal adjustment path, one needs to take into account such variables as GDP growth, real interest rate to closely find out the answer to the question about economic sustainability of the observed country. The

[20] O. Jean Blanchard, "Suggestions for a New Set of Fiscal Indicators," *OECD Economics Department Working Papers*, № 79, (1990).
[21] Supra 2.
[22] Supra 19.

detailed empirical description of the methodology will be observed later on in the third chapter of this thesis.

II.2.4. "Over-borrowing" test is the other way to assess sustainability

An alternative, or may be additional, option of debt sustainability issues' assessment may be to look whether the country "over-borrows." Roughly speaking, the method shows whether the government can afford the current level of debt, considering the discounted value of future government primary surpluses. The key idea of the approach is to look at the historical average of the country's primary balances and based on that make a projection of future primary balances. Once the future primary balances are estimated, the level of debt to GDP that the government can afford to itself can be derived, the so called benchmark level of public debt to GDP. It basically brings the present value of the estimated future primary surpluses. The next step is to divide the actual public debt to GDP ratio to the Benchmark level. The obtained result will indicate the degree of over-borrowing or under-borrowing. The received number that if greater than 1 indicates that the government over-borrows; the number smaller than 1 shows that government under-borrows. See Roubini (2001)[23] and Rao and McGrattan (1997).[24] This method of assessment looks similar to the previous method and also starts its analysis from the budget identity equation; however, the main difference of the "over-borrowing" method is that it does not provide with the debt stabilizing primary balance, but instead it shows the required debt level that the government should have based on its future primary balance capacity. Although the weakness of the "Over-borrowing" is that it makes an assumption that historical average is the best proxy for future primary balances, so if there is a case when the government in the past faced significantly large corrections or reforms in fiscal policy then the historical average will not be an adequate estimate for making further calculations. It is also important to take into account such variables as GDP growth and real interest rate due to the fact that the benchmark level of the debt is represented as a share to GDP. Often it is the case for LICs that it is hard to find the data on real interest rates in the consistent manner, due to the short time series observations for the main macroeconomic indicators. Therefore, in most of the cases it is required to find a

[23] Supra 11.

[24] Aiyagary S. Rao and Ellen R. McGrattan, "The Optimum Quantity of Debt," Federal Reserve Bank of Minneapolis, Research Department Staff Report 203. (1997). https://bit.ly/2JQ7u8s (10 October 2012).

proxy for unavailable variable. Nevertheless, one more weakness of the method is that if the future values of real interest rates and GDP growth turn out to be significantly different from the historical average values, then it will affect the over/under-borrowing ratio. The detailed empirical assessment of the method will be discussed in the third chapter.

II. 3. Critical analysis

The observed literature provides with several options for methods in order to assess the issue of the sustainability for the case of the Kyrgyz Republic: the method of fiscal reaction function, method of stabilizing primary balance and method of over/under-borrowing. However, it is essential to critically analyze the available methods in order to decide whether those methods are applicable for the case of the Kyrgyz Republic. Due to the fact that the Kyrgyz Republic is an LIC with significantly volatile macroeconomic indicators and high reliance on external aid, the assessment of the issue of the sustainability becomes not as stringent as for the developed countries. Generally this part will answer to the question: Which method is best appropriate to implement for the testing of solvency criterion in the case of the Kyrgyz Republic?

II.3.1. The most appropriate method for Kyrgyzstan

The method that implements the fiscal reaction function analysis has its own advantages. This way of assessment generally might indicate whether the government authorities react to the accumulation of the debt in a proper manner or not. It analyzes the historical data and provides with the coefficient of response of fiscal tools on increasing or decreasing of the debt. The method is generally very demanding and might be useful to understand the general fiscal policy of the observed country; moreover, the proper use of econometrics might help to indicate whether the fiscal policy of the country is pro-cyclical or counter-cyclical in terms of debt sustainability issue (simply it is enough to run a Granger Causality test, apart from estimating the coefficient of fiscal reaction). However, the method has its own disadvantages, too. This way of solvency assessment helps to assess the compliance of fiscal policy with the long run solvency criterion, while the method itself uses the historical data in order to assess the question. Therefore, it is not enough just to get the coefficient in order to make a more or less reasonable and justified conclusion, this method needs in

the further analysis that anyways will have to deal with future reasonable projection of fiscal path of the country, and uncertainty might become a significant barrier due to the highly volatile macroeconomic environment of the Kyrgyz Republic.

One more problem is that for a good econometric analysis it is required to have a number of observations, not less than 32. And generally the more observations there are in the analysis the more reliable estimate will be received. This also might become a limitation for the method in the case of the Kyrgyz Republic, since the country is relatively young and it is hard to find time consistent data for some variables. Due to the disadvantages of the method and some issues related to country specific of the Kyrgyz Republic, it might be not enough to assess the solvency criterion by using this method.

The method that suggests debt stabilizing primary balance is also useful and logical is easy to implement for the case of the Kyrgyz Republic because it does not require big statistical time coverage. The method of calculation of the debt stabilizing primary balance is not difficult. This method might provide useful information about future direction of fiscal policy. However, the implementation of the method itself without further reasonable fiscal path analysis of the country will not answer the question of the country's solvency. The method only suggests what stabilizing primary balance should country accumulate in order to fulfill solvency criterion, but whether the country can credibly commit to such a fiscal path or not is the further analysis of the main macroeconomic indicators of the country, that are, as it has already been mentioned, very volatile in the case of the Kyrgyz Republic, since the economy of the country is vulnerable to external shocks and highly dependent on the external aid. So, in order to implement this method and get reasonable conclusions it is most likely that one will face the uncertainty problem here, as well as with the fiscal reaction function method.

While talking about over/under-borrowing method of solvency criterion's assessment, it is clearly seen that the main advantage of the method is that it allows to the fiscal authorities to understand what level of public debt to GDP they should keep in order to be able to satisfy the solvency criterion of the country, assuming that the recent fiscal path of the country will not significantly change from the historical fiscal path. This method might be very useful for those countries where the fiscal policy has not been or is unlikely to be changed significantly; therefore, the historical fiscal path for those countries might be the best proxy for the future fiscal indicators. However,

the Kyrgyz Republic is a country where the political and economic reforms take place in average with the frequency one reform per five years including the tax code and customs code reforms. Therefore, the results of this method will not give us the rigid determination of solvency situation of the Kyrgyzstan's fiscal policy. So, in this case, further analysis is required too.

As a matter of fact it is hard to choose between those methods, due to the fact that each of them only provides some hints for further analysis of the solvency criterion of the country. The generic characteristic of those methods is that all are based on the analysis of the basic fiscal budget identity equation. So, it is clear that the analysis of the fiscal solvency of the Kyrgyz Republic will start from the detailed discussion of basic budget identity equation. All of these discussed methods are in need of further analysis, and moreover, taking into account economic specifics of the Kyrgyz Republic, none of the methods will provide us with the rigid answer to the question whether the Kyrgyz Republic is solvent or not. However each of these methods allows analyzing the solvency situation of the Kyrgyz Republic from different angles. Thus, I believe that implementation of each method for the case of Kyrgyzstan and joint analysis of overall results will give us a clear notion about the Kyrgyz Republic's debt sustainability from the point of solvency criterion.

II.3.2 Off-budget obligations

As it was defined earlier, the discussed methods of solvency assessment are based on analysis of obligations that are explicitly recognized as liabilities in the public budget of the observed country. However, some of the researchers indicate the relevance of off-budget obligations of the government in the assessment of the sustainability issue. For example, researchers from IMF have found that budget obligations of the government are only a fraction of all potential government's obligations, so that the recognition of off-budget obligations can significantly alter a government's debt position.[25]

According to the analysis of the literature, off-budget obligations consist majorly from two main categories. First, government has to face implicit commitments to fight market failures in the future. The volume of such implicit liabilities mainly depends on many factors including the infrastructural and institutional development of the country, demography and human capital

[25] Supra 12, 126.

accumulation (such as healthcare and education), industrialization processes and economic growth. Second, a government faces some obligations that might occur only in some specific cases like emergency situation in financial sector, when it is essential to bailout some industries, or the case of deposit insurance and other different guarantees. The problem with the off-budget obligations is that they might significantly affect the debt position of the country, but it is hard to estimate them, due to the fact that they are implicit and deal with long run projections, which is very uncertain in the case of low income countries. The estimation of such off-budgetary obligations of government is important and very resource- as well as time-consuming task since it requires detailed long run forecasting. Due to the limited scope of this research, I have to leave this issue for further investigation and include the issue of off-budget obligations as another limitation of this thesis.

II.3.3. Dealing with uncertainty

One common problem with all three methods is that they all have to deal with an uncertainty issue. And in the context of volatile macroeconomic indicators of the Kyrgyz Republic, the issue of uncertainty becomes sharper. The relevance of uncertainty on fiscal sustainability has been discussed in details by Gavin (1996) for the Latin American countries.[26] One way to deal with the uncertainty is to run a series of stress tests. The stress tests have been widely used by the World Bank and IMF researchers in assessing the debt sustainability.[27] The assessment is majorly compares the path of debt burden indicators (in our case public debt to GDP level) in a baseline scenario and alternative scenarios and in the number of sensitivity tests with the threshold public debt to GDP level. The baseline scenario is based on the macroeconomic projection of future fiscal path of the country. Alternative scenarios are projected scenarios that indicate possible economic development of the country. Sensitivity analysis or stress test is the analysis which shows how debt burden reacts to some shocks in the case of different unexpected shocks in the main macroeconomic variables.

[26] Michael Gavin et al., "Managing Fiscal Policy in Latin America and the Caribbean: Volatility, Procyclicality, and Limited Creditworthiness," Inter-American Development Bank, *Working Paper* № 326, (1996), https://bit.ly/2IgWo6X (9 August 2012).

[27] Supra 9.

The debt sustainability analysis under the joint World Bank and IMF framework categorizes countries consistent with the countries' probability of a debt sustainability problem into four groups:

- Low risk. Country is said to have a low risk of debt sustainability problems when debt indicators are well below the threshold level. In the alternative scenarios and stress test, the debt indicators still do not reach the benchmark level in a dashingly rate.
- Moderate risk. Country is in moderate risk of debt distress when the baseline scenario does not exceed the benchmark level, while the alternative scenarios and stress test causes significant rise in the debt to GDP ratios.
- High risk. Debt to GDP ratio in the baseline scenario exceeds the threshold level.
- Country has problems with debt sustainability. Current debt to GDP level exceeds the benchmark level.

The main object for the stress test will be the budget identity equation, since each of three methods starts its analysis from it. The conclusions that will be driven from the stress test might help us to reduce the uncertainty and will provide results for making some reasonable conclusions. However, uncertainty is always uncertainty, therefore still there is a probability to overestimate or underestimate the solvency condition of the country.

III

EMPIRICAL ASSESSMENT OF PUBLIC DEBT SUSTAINABILITY IN THE KYRGYZ REPUBLIC

This part of the investigation aims to assess the issue of public debt sustainability in the case of the Kyrgyz Republic by implementing methods that are described in the literature review. The detailed description of methodology and analysis of results can be found in this chapter. Generally speaking, the results of the chapter will provide us with core information that will answer the research questions and sub questions, and will conclude with some remarks and recommendations.

III.1. Budget identity equation

The budget identity equitation will serve as a core starting point in the assessment, due to the fact that all the observed literature suggests the methodologies that are based on the analysis of this equation. The budget identity (1) indicates that the stock of public debt at the beginning of period $t + 1$ (B_{t+1}) results from the inherited debt, B_t, and the overall balance of period t (F_t) is added:[28]

$$B_{t+1} = B_t + F_t . \qquad (1)$$

From (F_t) it is possible to separate the government expenditures on paying interest on the debt and other expenditures and revenues:

$$B_{t+1} = (1 + r_t)\, B_t + E_t - R_t$$

$$B_{t+1} = (1 + r_t)\, B_t - P_t, \qquad (2)$$

Where E_t is the government expenditures apart from interest payments on debt at a period t, R_t is the revenues of the government at the period t, and r is the interest rate on the debt. P_t is the primary balance = ($R_t - E_t$). From here we can already rewrite (2) in terms of ratios to GDP in order to be able to analyze the public debt in ratio to resource capacity of the country:

[28] Supra 10.

$$\frac{B_{t+1} * Y_{t+1}}{Y_{t+1} * Y_t} = (1 + r) * \frac{B_t}{Y_t} - \frac{P_t}{Y_t}$$

$$(1 + g)b_{t+1} = (1 + r_t)b_t - p_t \qquad (3)$$

Where Y_t is the GDP value and g is the GDP growth rate, b_t is the current debt level as a share of GDP, p_t is the primary balance as a share of GDP. Now the budget identity equation is ready to be used in assessment of solvency of the Kyrgyz Republic.

III. 2. The fiscal reactions function in the case of Kyrgyz Republic

As it was discussed in the second chapter, one of the tools to assess the solvency position of a country is to look at the fiscal reaction function. Thus, taking into account the derived budget identity and the observed literature the fiscal reaction function to be estimated for the case of Kyrgyz Republic is as follows:

$$p_t = \alpha_0 + \rho b_{t-i} + \beta_g X_{g,t} + e_t \qquad (4)$$

Where p_t is the primary balance of the Kyrgyz Republic in the period t, α_0 is the intercept, b_{t-i} is the public debt to GDP ratio of Kyrgyzstan in the time t - i (t is the current period, i is the number of lags), $X_{g,t}$ indicates matrix of macroeconomic variables that can affect the primary balance of the Kyrgyz Republic such as inflation, business cycles, exchange rate and political and economic shocks. The role of $X_{g,t}$ is very significant because it will reduce omitted variable bias in the estimated results; however the estimated coefficients β_g is not in the major interest of the research. The core attention in the analysis will be given to the coefficient ρ under the b_{t-i} which will show the reaction of the fiscal tools on the debt accumulation. The fiscal reaction function itself has not been estimated for the Kyrgyz Republic.

In the real world there are not many countries that can physically commit to the path of debt accumulation without further appropriate fiscal reaction to stabilize the debt to GDP ratio due to the control of the international financial markets; however, the Kyrgyz Republic is among the LICs and fiscal policy in these countries is pro-cyclical rather than counter-cyclical, probably because of that reason there were already two debt restructuring agreements with the Paris Club due to the fact that the total public debt to GDP ratios was found to be non-sustainable in 2003 and 2005.

Therefore, we are expected to obtain a negative sign for the coefficient ρ in the case of Kyrgyzstan indicating that fiscal policy of the Kyrgyz Republic goes without compliance to long run solvency criterion. But it still will be interesting to see the speed of adjustment of the fiscal authorities to the accumulated debt. For estimation of the fiscal reaction function for the Kyrgyz Republic the Vector Error Correction statistical method was used in order to see the speed of adjustment of the fiscal authorities to debt accumulation as well as short run reaction of the primary balance to the debt accumulation.

III.2.1. Data description and arrangements

The quarterly data starting from 1995 first quarter ending in 2012 fourth quarter was collected from the Bulletins of the NBRK, the Reports of the Ministry of Finance of the Kyrgyz Republic on the State Budget Execution, and from the data base of the NBKR. In compliance with the observed methods and in the spirit of Bohn (1998), the collected data needs to be modified. For instance, there is no data on primary fiscal balance and on total Public Debt for the Kyrgyz Republic. The best indicator of business cycles is the output gap, most of the researchers use this indicator in order to see the business fluctuations, see for instance Bohn (1998).[29] However, there is no data for business cycles for the Kyrgyz Republic. Due to these issues, the variables were calculated based on the data set provided by the listed sources (to see the methodology of calculations go for Appendix A).

Apart from these major transformations in the data, it is important to get rid of seasonal shocks on the data. Time series data observed at quarterly and monthly frequencies often exhibits cyclical movements that recur every month or quarter. Seasonal adjustment refers to the process of removing these cyclical seasonal movements from a series and extracting the underlying trend component of the series. This is for getting rid of seasonal shocks, which could appear in each of our variables. Omitting of the seasonal shocks might lead us to underestimated or overestimated results, which would consider our point estimates to be biased.

Before using an estimated equation for statistical inference (*e.g.* hypothesis tests and forecasting), because usually the time series data might be correlated with the lagged values and this usually brings to the biased point estimates, usually, resear-

[29] Supra 15.

chers use the Durbin-Watson statistics, which is a test for first-order serial correlation. More formally, the DW statistic measures the linear association between adjacent residuals from a regression model. The DW is a test of the hypothesis ρ=0 in the following specification:

$$u_t = \rho u_{t-1} + e_t$$

Where u_t indicates residuals of the main equation in the period t, and e_t is the error term. If there is no serial correlation, the DW statistic will be around 2. The DW statistic will fall below 2 if there is positive serial correlation (in the worst case, it will be near zero). If there is negative correlation, the statistic will lie somewhere between 2 and 4. In our test of residuals we got the results: The estimated DW statistics shows the positive correlation (see Table #1).

Table #1: Durbin-Watson statistics

DependentVariable: PBSA
Method: LeastSquares
Sample: 1995:1 2012:4
Includedobservations: 72

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBTSA	-0.019290	0.005432	-3.551331	0.0007
OUTPUTGSA	0.089325	0.066441	1.344419	0.1834
CPISA	0.007189	0.007563	0.950570	0.3453
EXRSA	0.000399	0.001547	0.257977	0.7972
DUMMY	0.019137	0.020467	0.935005	0.3532
C	-0.656701	0.759513	-0.864635	0.3904
R-squared	0.509227	Meandependentvar		4.01E-05
Adjusted R-squared	0.472047	S.D. dependentvar		0.099291
S.E. ofregression	0.072145	Akaikeinfocriterion		-2.340616
Sumsquaredresid	0.343525	Schwarzcriterion		-2.150894
Loglikelihood	90.26219	F-statistic		13.69632
Durbin-Watsonstat	1.247431	Prob(F-statistic)		0.000000

Table #2: Testing $u_t = \rho u_{t-1} + e_t$1

Dependent Variable: RESID1
Method: Least Squares
Sample(adjusted): 1995:2 2012:4
Included observations: 71 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID2	0.369498	0.113628	3.251809	0.0018
C	-0.001182	0.007776	-0.151959	0.8797
R-squared	0.132885	Meandependentvar		-0.000635
Adjusted R-squared	0.120319	S.D. dependentvar		0.069843
S.E. ofregression	0.065507	Akaikeinfocriterion		-2.585568
Sumsquaredresid	0.296087	Schwarzcriterion		-2.521830
Loglikelihood	93.78766	F-statistic		10.57426
Durbin-Watsonstat	1.930578	Prob(F-statistic)		0.001776

Now, in order to get the coefficient of serial correlation and see whether it is significant or not, we will estimate $u_t = \rho u_{t-1} + e_t$ for our case. The rejection rule for the serial correlation is:

if the coefficient is significant, than we reject the null hypothesis.

H_0 states that there is no autocorrelation problem,

H_1 states that there is an autocorrelation problem.

According to the obtained results we do have the autocorrelation problem. As it was expected, we obtained positive serial correlation which is statistically significant (see Table #2). *t*-Statistics is 3,25 which indicates that ρ is statistically significant under the 1% confidence level. This makes us to believe that the using of simple ordinary

least squares model is not appropriate for our case. Apart from analyzing the short term effect as well as long run adjustment to equilibrium, the Vector Error Correction Model (VECM) allows taking into account the effect of lagged values of the variables, and this automatically allows us to deal with the problem of autocorrelation.

III.2.2. Estimation of fiscal reaction function by the means of the VECM

As it was discussed earlier, the method of estimation of the fiscal reaction function is going to be the VECM. The justification for this is that we are interested not only in the obtaining the short run coefficient ρ, but also would like to see the speed of adjustment of the fiscal authorities to the shock in the debt to GDP level. Apart from this, the main equation to be estimated has the serial correlation problem, while the vector models allow taking into account the impact of the lagged values of the variables and by that removes the serial correlation problem.

The VECM provides a simple means of explaining or predicting the values of a set of economic variables at any given point in time. This model is a basic, strong statistical forecasting and inference procedure, which can be applied to co-integrated time series data. The VECM method of estimation avoids making potentially specious restrictions on the model. In addition, it lets us to take into account empirical abnormalities in the data and shows the channels through which the different policy variables operates as well as shows the speed of adjustment of the dependent variable to the long run equilibrium after the shocks in independent variables. The VECM is commonly used for forecasting systems of interrelated or co-integrated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VECM approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.[30]

The main requirement for VECM is that the data should be co-integrated. The data is said to be co-integrated if there is some vector of coefficients that forms the stationary linear combination of the data. Roughly speaking, co-integration shows long run equilibrium between the variables.[31] In order to see whether the components of our main equation are co-integrated, the Johansen cointegration test was

[30] Bruce E. Hansen, "Chapter 18: Multivariate Time Series," in *Econometrics* (Wisconsin: University of Wisconsin, 2013), 285.
[31] Ibid, 288.

implemented.

The main hypothesis of the Johansen cointegration test is that there no cointegrating equations exist. While the alternative hypothesis is that there is/are number of cointegrating equations. As it can be seen from the Table #3 of results, test for long run relationship indicates one cointegrating equations at 5% significance level. These results justify our choice to use the VECM model, due to the fact that the test indicates the existence of long run equilibrium in the data.

Table #3: Johansen Cointegration test

Sample: 1995:1 2012:4				
Includedobservations: 67				
Test assumption: Linear deterministic trend in the data				
Series: PBSA DEBTSA				
Exogenous series: DBUSCYCLSA DCPISA DDEXRSA DUMMY				
Lagsinterval: 1 to 2, 3 to 4				
	Likelihood	5 Percent	1 Percent	Hypothesized
Eigenvalue	Ratio	CriticalValue	CriticalValue	No. of CE(s)
0.479676	55.64361	25.32	30.45	None **
0.162386	11.87227	12.25	16.26	Atmost 1
*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. test indicates 1 cointegrating equation(s) at 5% significance level				
UnnormalizedCointegratingCoefficients:				
PBSA	DEBTSA	@TREND(95:2)		
4.204334	0.016364	0.008251		
-3.901817	-0.186366	-0.011712		
Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)				
PBSA	DEBTSA	@TREND(95:2)	C	
1.000000	0.003892	0.001963	-0.111658	
	(0.00616)	(0.00045)		
Loglikelihood	155.6542			

Since exogenous variables are not included to the cointegration equation they need to be tested for unit root problem. The macroeconomic data is often non-stationary or have means, variances and covariances that change over time. Non-stationary behaviors can include trends in the data, cyclicality in the time span, random walks or different mixtures of the three. Usually, non-stationary data are unpredictable and cannot be used in the modeling. The point estimates obtained based on non-stationary time series may be biased in that they may show a relationship between two variables where the relationship does not truly exist. For obtaining consistent, reliable results, the non-stationary data needs to be transformed into stationary data. Unlike the non-stationary data that has a variance in variable and a non-constant mean or mean that returns to a long-run mean over time, the stationary process reverts around a constant mean and has a constant variance that is independent from time. In order to test the data for stationarity the Augmented Dickey-Fuller unit root test (ADF) was used. This test is based on the following three regression forms:

- Random walk: $\Delta Y_t = \varphi Y_{t-1} + u_t$ it simply indicates that change in variable at time t will be equal to its previous period with the coefficient φ value plus

stochastic disturbance u_t with zero mean and variance equaled to δ^2 that is often called white noise.

- Drifted random walk: $\Delta Y_t = c + \varphi Y_{t-1} + u_t$ is when apart from white noise the variable has some constant intercept or drift, which is indicated in the equation as *c*.
- Random walk with drift and deterministic trend: $\Delta Y_t = c + \varphi Y_{t-1} + \beta t + u_t$ this happens when the data on top of drifted random walk has a time deterministic trend βt.[32]

In order to check whether the data has unit root (non-stationary) it is required to test it for all three equations. The main hypotheses to be tested are as follows:

H_0: $\varphi = 0$

H_1: $\varphi \neq 0$

And the rejection rule is:

If t* > ADF critical value, we fail to reject null hypothesis, i.e., unit root exists.

If t* < ADF critical value, we reject null hypothesis, i.e., unit root does not exist.

Where t* is t-statistics for the coefficient φ.

As it was expected, the macroeconomic variables that are used in the main regression are non-stationary; for example, it turned out that the CPI index for the Kyrgyz Republic has a random walk in its series; exchange rate also turned out to have a random walk as well as drifted random walk with the deterministic trend; and finally business cycles turned out to have a drifted random walk in its series. Therefore, to get rid of the unit root, the first difference was taken for CPI and business cycles, while the second difference was taken for the exchange rate, due to the reason that exchange rate did not become stationary after taking the first difference. For more detailed information about the results of the ADF unit root test see appendix B.

Now when all preliminary work has been done, we can go to the discussion of the fiscal reaction function's estimation in the case of Kyrgyzstan by the means of VECM. The VECM transforms the main equation (4) that was planned to be estimated to the following form:

$$\Delta y_t = \alpha_0 + \varphi\tau y_{t-1} + \sum_{i=1}^{n} \rho_i \Delta y_{t-i} + \beta \Delta X_t + \varepsilon_t \qquad (5)$$

[32] Bruce E. Hansen, "Chapter 17: Univariate Time Series," in *Econometrics* (Wisconsin: University of Wisconsin, 2013), 275.

where Δy_t indicates the matrix of all dependent variables taken as the first difference in the period t. In our case, these variables are: D(PBSA) is the seasonally adjusted primary balance of the Kyrgyz Republic; D(DEBTSA) is the seasonally adjusted total public debt to GDP level of the Kyrgyz Republic; α_0 is a specific intercept; φ is a coefficient which shows the speed of adjustment of the dependent variables to the long run equilibrium after a certain shock in the independent variables, at some point it might be interpreted as a coefficient of long run relationship; τ is the error correction term of matrix y_{t-1}; ρ_i is the matrix of short run coefficients of the lagged values of independent variables taken as the first difference, *i* denotes number of lags; β is the matrix of coefficients under the matrix of exogenous variables such as: D(BUSCYCLSA): seasonally adjusted business cycles of Kyrgyzstan; D(CPISA): seasonally adjusted CPI index of the Kyrgyz Republic; D(EXRSA): seasonally adjusted Exchange rate KGS per 1 USD; DUMMY: Dummy variable for political and economic shocks; and ε_t is the error term with zero mean and constant variances.

The estimated VECM (see Table #16) shows us that the speed of adjustment φ of the PBSA to the change in total public debt to GDP ratio in the case of the Kyrgyz Republic is (-0.027130). This simply implies that primary balance of the Kyrgyz Republic adjusts to the long run equilibrium point with the speed 2.7130% per quarter. The coefficient φ is statistically significant under the 99% confidence level since p-value is (-0.00303). Thus we can conclude that there is a long run negative relation between Primary balance as a share to GDP and total debt to GDP level in Kyrgyzstan. The correction term coefficient τ is also statistically significant under the 99% confidence level p-value equals to (-0.01249), which implies the existence of the long run relationship between the variables. The short run coefficient ρ under the D(DEBTSA(-1) which indicates the negative effect of total public debt to GDP ratio taken as the first difference on D(PBSA) primary balance of Kyrgyzstan taken as the first difference in the given period is also statistically significant under the 99% confidence level, p-value is less than 1 % and equals to 0.5%.

R-squared indicates that explanatory variables explain variation in primary balance to 68%. Our model, however, shows that the coefficients under the external variables such as CPI index, business cycles, exchange rate and dummy variable for economic and political shocks turned out to be insignificant in explaining the dependent variable.

Table #16: VECM estimated output 1		
Sample(adjusted): 1996:2 2012:4		
Included observations: 67 after adjusting endpoints		
Standard errors & t-statistics in parentheses		
CointegratingEq:	CointEq1φ	
PBSA(-1)	1.000000	
DEBTSA(-1)	-0.027130	
SE	(0.00908)	
t-statistics	(-2.98795)	
p-value	(-0,00303)	
C	0.088822	
ErrorCorrection:	D(PBSA)	D(DEBTSA)
CointEq1τ	-0.352023	1.546804
SE	(0.06632)	(0.66644)
t-statistics	(-5.30805)	(2.32098)
p-value	(-0,01249)	0.28713
D(PBSA(-1))	-0.591012	-2.146626
SE	(0.10522)	(1.05740)
t-statistics	(-5.61674)	(-2.03009)
D(PBSA(-2))	-0.567723	-2.077131
SE	(0.09232)	(0.92778)
t-statistics	(-6.14920)	(-2.23882)
D(PBSA(-3))	-0.604440	-0.743655
SE	(0.10108)	(1.01577)
t-statistics	(-5.97981)	(-0.73211)
D(PBSA(-4))	-0.166479	1.559814
SE	(0.08744)	(0.87874)
t-statistics	(-1.90382)	(1.77505)
D(DEBTSA(-1))	-0.025728	0.109982
SE	(0.01156)	(0.11618)
t-statistics	(-2.22549)	(0.94669)
p-value	(-0,00519)	
D(DEBTSA(-2))	-0.002263	-0.341043
SE	(0.00997)	(0.10023)
t-statistics	(-0.22689)	(-3.40271)
D(DEBTSA(-3))	0.007379	0.074254
SE	(0.00902)	(0.09062)
t-statistics	(0.81833)	(0.81940)
D(DEBTSA(-4))	0.004265	0.138413
SE	(0.00861)	(0.08651)
t-statistics	(0.49549)	(1.60003)
C	0.006386	-0.164329
SE	(0.00645)	(0.06482)
t-statistics	(0.98999)	(-2.53510)
DBUSCYCLSA	-0.000520	1.081130
SE	(0.02446)	(0.24584)
t-statistics	(-0.02124)	(4.39769)
DCPISA	-1.72E-05	-0.031810
SE	(0.00324)	(0.03259)
t-statistics	(-0.00530)	(-0.97598)
DDEXRSA	-0.000772	0.026734
SE	(0.00235)	(0.02366)
t-statistics	(-0.32794)	(1.12975)
DUMMY	0.006728	0.062634
SE	(0.00837)	(0.08411)
t-statistics	(0.80391)	(0.74469)

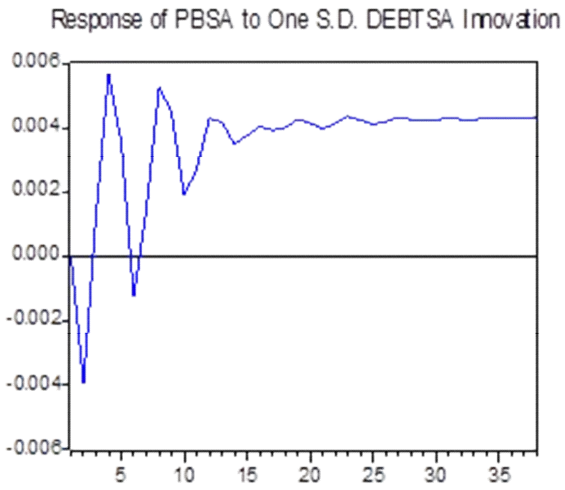
Generally speaking our model shows that the fiscal authorities do not react in the compliance with the long run solvency criterion, primary balance as a share to GDP of the Kyrgyz Republic decreases in short run as well as in long run with the increase of total public debt to GDP ratio. On top of it, the speed of adjustment shows that primary balance of the Kyrgyz Republic taken

R-squared	0.685657	0.768252
Adj. R-squared	0.608554	0.711408
Sum sq. residuals	0.040845	4.124725
S.E. equation	0.027761	0.278971
Loglikelihood	152.9203	-1.681157
Akaike AIC	-4.146875	0.468094
Schwarz SC	-3.686193	0.928776
Meandependent	0.000171	-0.169062
S.D. dependent	0.044371	0.519299
Determinant Residual Covariance		3.63E-05
Log Likelihood		152.3470
Akaike Information Criteria		-3.652150
Schwarz Criteria		-2.664975

as a share to GDP comes to the equilibrium point with the speed equal to 2.7% per quarter. Thus it might be concluded that if there is a significant shock in the debt to GDP ratio in the Kyrgyz Republic, primary balance might be stabilized approximately in 37 quarters or 9 years.

A shock to one variable not only directly affects this variable, but is also transmitted to all of the other endogenous variables through the dynamic (lag) structure of the VECM. An impulse response function

Chart #9



traces the effect of a one-time shock to one of the innovations on current and future values of the endogenous variables. The impulse response function was tested in order to strengthen our results (see Chart #9).

The impulse response function shows us that one innovation to standard deviation of the total public debt as a share to GDP leads to the significant fluctuations in the first 15 periods, and then starts to adjust to the stable level, and finally starting from 20th to 35th period it is not significantly deviated, which says that the response of primary balance starts becoming insignificant. Thus the impulse response shows us that the effect of debt to GDP ratio accumulation in general longs for 30–35 quarters.

As told by Idris and Cheong: "Correlation does not necessarily imply causation in any meaningful sense of that word. The econometric graveyard is full of magnificent correlations that are simply spurious or meaningless."[33] In order to check whether there is a cause effect relationship between the independent and dependent variables we run the granger causality test. Simply the test is bivariate regressions of:

$$\begin{cases} y_t = a_0 + a_1 y_{t-1} + \cdots + a_n y_{t-n} + \beta_1 x_{t-1} + \cdots + \beta_n x_{t-n} + \varepsilon_t \ {}_{34} \\ x_t = a_0 + a_1 x_{t-1} + \cdots + a_n x_{t-n} + \beta_1 y_{t-1} + \cdots + \beta_n y_{t-n} + \epsilon_t \end{cases}$$

This test simply shows whether we can predict one variable by having information about the other variable, i.e. if DEBT SA granger causes the PBSA, then

[33] Quoted in H. Goudarzi, "Empirical Analysis of the Impact of Foreign Institutional Investment on the Indian Stock Market Volatility during World Financial Crisis 2008-09," *International Journal of Economics and Finance* 3, № 3, (August 2011): 214-226.

[34] Supra 23, 288.

there are some information in total public debt that could predict the behavior of primary balance. The main hypothesis of the test is that the Y does not granger causes X. If the p-value is less than 10%, we reject the main hypothesis.

Table #17: Granger Causality test

Pairwise Granger Causality Tests
Sample: 1995:1 2012:4
Lags: 4

NullHypothesis:	Obs	F-Statistic	Probability
DEBTSA does not Granger Cause DPBSA	67	7.02348	0.00011
DPBSA does not Granger Cause DEBTSA		3.65491	0.01009

The results of Granger causality test indicates that the total public debt of the Kyrgyz Republic does granger cause primary balance (see Table #17). The p-value is much less than 10% and equals to 0.01% which is very significant. However, the test shows us that primary balance also granger causes total public debt to GDP ratio in Kyrgyzstan. It is logically, due to the fact that these variables are closely related, thus for example, it is clear that negative primary balances as a share to GDP is most likely to increase the debt to GDP level, because the deficits are usually covered by borrowings. But the most interesting detail here is that the granger causality effect of total public debt as a share to GDP is much more significant: p-value of DEBTSA = 0.001 versus p-value of PBSA = 1%. The obtained results support our main finding by showing the direction of the relationship, thus we can say that there is a fiscal causal relationship to the debt accumulation.

Now, according to the results of the VECM, the impulse response test and Granger causality test, it is clear that the fiscal authorities do not react in compliance with the long run solvency criterion in the case of Kyrgyz Republic. This might be explained by the fact that Kyrgyzstan is a LIC and its development needs are much higher than the capacity of revenue accumulation, which makes the fiscal policy of the Kyrgyz Republic pro-cyclical rather than counter-cyclical in terms of debt management. The results are most likely to interpret the real situation in Kyrgyzstan; however, one might wonder how come this country is able to allow itself the constant increase of debt to GDP level with no proper reaction of the fiscal authorities in order to stabilize the debt to GDP level? The answer is simple. Historically, Kyrgyzstan already had two debt restructuring and debt rescheduling agreements with the Paris Club, apart from this, Kyrgyzstan is a receiver of international aid. All these factors at certain extent allow keeping fiscal track of the country unchanged in terms of constant public deficits without debt crises.

But this does not mean that Kyrgyzstan may afford such fiscal path constantly. We know that fiscal authorities of Kyrgyzstan cannot allow generating a fiscal primary surplus in order to stabilize the debt to GDP level, all other things being equal. If the fiscal policy development is not significantly different from its historical path, fiscal authorities are unlikely to be able to stabilize the debt to GDP level in case of shock in the total public debt to GDP level. Moreover it might take 9 years to smooth the effect of that shock, but it does not mean that the debt to GDP level in Kyrgyzstan has sustainability problems yet. It is now interesting to see whether current fiscal primary balance is sustainable or not. Thus, the next part of the chapter will discuss debt stabilizing primary balance and will compare it with the current fiscal primary balance.

III.3. Calculation of debt stabilizing primary balance for the Kyrgyz Republic

Now, when we know how fiscal authorities react to the debt accumulation, it is interesting to see the debt stabilizing primary balance and compare it with the actual primary balance, in order to see whether the current primary balance is sustainable or not. As usual we start our analysis from budget identity that were transformed and represented in terms of share to GDP (equation 3).

$$(1 + g_t)b_t = (1 + r)b_{t-1} - p_{t-1} \quad (3)$$

As the theory implies, debt stabilizing primary balance from equation 3 that stabilize debt to GDP ratio, which is b_t, is represented by $\overline{p_{t-1}} = b_{t-1}(r - g)$, where r is the interest rate on debt payment, g is the nominal GDP growth rate. Once $\overline{p_{(t-1)}}$ is calculated, we will compare it with the actual p_{t-1}. If debt stabilizing primary balance is greater than actual primary balance, we consider that the current fiscal policy brings increasing debt to GDP ratio and therefore the fiscal path is assumed to be not sustainable. The difference between those balances indicates the degree of fiscal adjustment that is needed to stabilize debt to GDP level. Then, further analysis may be needed to analyze whether the future development of the country allows committing to fiscal adjustment path.

In order to start calculation of the debt stabilizing primary balance it is required to have all the data collected. The data is available for all the components of the equation except for interest rate r on debt. But it is not a big issue since we have

all the components of equation with one unknown parameter. Assuming that the (1+r) is the unknown parameter, equation 3 can be rewritten as follows:

$$(1 + r) = p_t + \frac{(1+g)b_t}{b_{t-1}}$$

The calculations are based on the annual data for 2011 and 2012 that were obtained from the National Statistics Committee of the Kyrgyz Republic, Bulletins of the National Bank of the Kyrgyz Republic (NBKR) and from the reports of the Ministry of Finance on budget execution. After those calculations, we obtained all the data and are ready to derive the debt stabilizing primary balance of the Kyrgyzstan for 2011. We found out that debt stabilizing primary balance in 2011 is -4.8156499% from Nominal GDP, while the actual primary balance was equal to -4.0380180% from nominal GDP, which is less than the debt stabilizing primary balance. This simply implies that in 2011 fiscal authorities were able to exceed the debt stabilizing primary balance. The debt to GDP ratios confirms this conclusion, due to the fact that at 2012 debt to GDP ratio has been reduced from 53.8440695% from GDP to 51.4931148%. The general conclusion from here is that fiscal authorities were able to commit to debt stabilizing primary balance in 2011, which says that fiscal policy of 2011 was in compliance with sustainable debt to GDP level for 2012.

Since the data for 2012 is already available, the assumption that interest rate for total public debt will not change, and taking into consideration the macroeconomic projection from Sustainable Development Strategy of the Kyrgyz Republic for the periods from 2013–2017[35] that the nominal GDP growth rate for 2013 will be equal to 13%, it is possible to predict the debt level for 2013 and derive debt stabilizing primary balance for 2012 and compare it with the actual level of primary balance at that period. It turned out that holding the assumption about interest rate on debt and considering the nominal GDP growth rate for 2013 equal to 7.6%, predicted total public debt level expected to be 56.2127482% of GDP. While the debt to GDP ratio stabilizing primary balance is expected to be -2.1568559% to nominal GDP.

According to the data from budget execution reports of the Ministry of Finance of the Kyrgyz Republic, the actual primary balance in 2012 equals to

[35] Government of the Kyrgyz Republic. "Strategiya Ustoichivogo Razvitiya Kyrgyzskoy Respublikina Period 2013 – 2017 gody [Sustainable Development Strategy of the Kyrgyz Republic for the Period of 2013 – 2017]," Roadmap project, Framework document, (2012).

-6.897904989195%. Thus, if the nominal GDP growth rate in Kyrgyzstan will be 7.6% in 2013 and the interest rate on debt is unchanged, the fiscal path in 2012 cannot be considered as sustainable. The degree of fiscal adjustment is equal to 4.741049062630% of GDP. The main question here is whether the Kyrgyz Republic can credibly commit to the fiscal adjustment path. The answer has already been provided in earlier in the estimation of fiscal reaction function; however it is not enough since the future development of the country has not been yet assessed. Thus further analysis is needed in order to make some conclusions, and the analysis will be provided after the stress test. The next part of the chapter will try to assess the question whether the government of Kyrgyzstan over-borrows or under-borrows in order to cover the development needs?

III.4. Does the public sector of Kyrgyzstan over-borrow?

Since the debt stabilizing primary balance was assessed and calculated for Kyrgyzstan it is now interesting to see, whether the government over-borrowed in 2012. As it was described in the second chapter, the main idea is to derive benchmark level of debt to GDP level by forecasting the future primary balances of the country using the historical average of country's fiscal path. The main assumption of the method is that future fiscal path of the country is not going to be significantly changed from its historical path. The formula for benchmark debt to GDP was constructed with minor corrections based on the works of Roubini (2001),[36] Terrones and Xavier (2003)[37] as follows:

$$\overline{b}_t = \int_t^{t+n} p_{t+n} - (r_{t+n} - g_{t+n}) * b_t \qquad (6)$$

Where $\overline{b}_t$ is the benchmark total debt to GDP ratio of the Kyrgyz Republic at year *t*; p_{t+1} is future primary balance taken as a historical average percentage change of it multiplied to the current primary balance at time *t+n*; r_{t+n} is the interest rate in the Kyrgyz Republic at the period *t+n*; g_{t+n} is the GDP growth rate of the Kyrgyz Republic at the period *t+n*; and b_t is the total public debt to GDP ratio of the Kyrgyz Republic at the time t. The annual data for using this method was collected from

[36] Supra 17.

[37] Marco Terrones and Xavier Debrun, "Assessing Fiscal Sustainability: Danta and Econometrics Methods," in *World Economic Outlook: Public Debt in Emerging Markets,* World Economic and Financial Surveys, IMF (September 2003).

National statistics committee and from the reports of Ministry of Finance of the Kyrgyz Republic. Since the data on interest rate has a variety we chose the interest rate on Government Treasury Bills, because it shows the approximate cost of borrowing money for government. The interest rate and growth rate are also unknown parameters, thus we took the historical average of growth rate for those variables too.
The estimated results shows us that the benchmark total public debt to GDP ratio in the case of the Kyrgyz republic for 2012 equals to 100.3% to GDP against actual level in 2012 51.5% to GDP. This simply implies that the Kyrgyz Republic is far enough from over-borrowing and has 51.7% as a "safeguard" debt to GDP ratio accumulation. However, it is essential to remember that the main assumption here is that the future development of the fiscal path of the country and the development of main macroeconomic indicators are taken as the historical average value. Thus it is projection, and considering the fact that Kyrgyzstan is the low income country with highly volatile macroeconomic indicators and with the high frequency of reforms in fiscal sector, we have uncertainty issue here. So the obtained results are not enough to make a reasonable conclusion about the sustainability of the total public debt to GDP ratio in the country. Therefore, the next part of the chapter is going to assess stress tests for the case of Kyrgyz Republic in order to deal with uncertainty and come up with reasonable analysis.

III. 5. Stress test for the case of Kyrgyzstan

Previous statistical framework still was not able to answer our question, whether the total public debt of Kyrgyz Republic is sustainable or not. Moreover the analysis indicates that in order to assess the issue it is essential to deal with uncertainty. One way to deal with it is to run series of stress tests. The stress tests have been widely used by World Bank and IMF researchers in assessing the debt sustainability.[38] The assessment majorly compares the path of debt burden indicators (in our case public debt to GDP level) in a baseline scenario and alternative scenarios and in the number of sensitivity tests with the threshold public debt to GDP level. The baseline scenario is based on the macroeconomic projection of future economic development of the country. Alternative scenarios show two possible economic development tracks of the country. Sensitivity analysis or stress test is the analysis which shows how debt

[38] Supra, 20.

burden reacts to some shocks in the case of different unexpected shocks in the main macroeconomic variables.

The main object for the stress test will be the budget identity equation, since from budget identity equation it is possible to derive the expected debt level. Therefore the equation to be stressed and used to construct the baseline and alternative scenarios is going to be derived from familiar budget identity equation (3). From equitation (3), after making general transformation, we obtain:

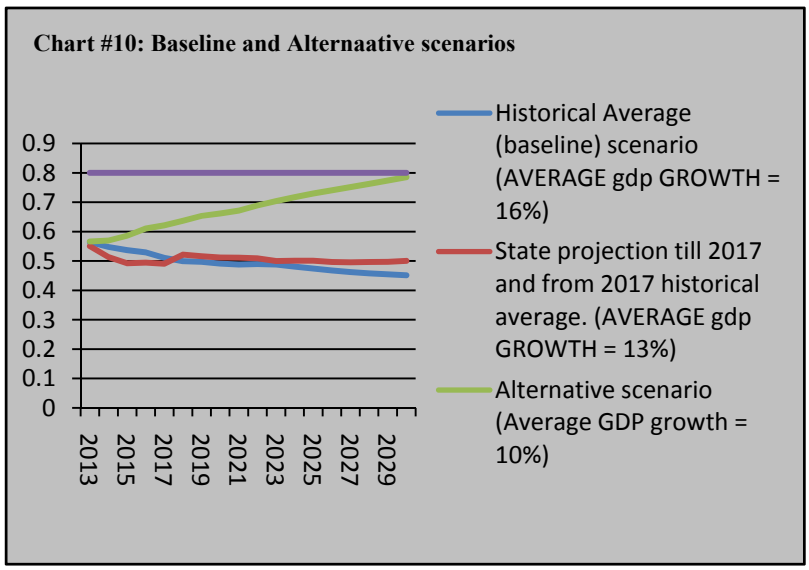
$$b_t = \frac{(1+r)b_{t-1} - p_{t-1}}{(1+g_t)} \qquad (7)$$

The most difficult part in running the stress test is the construction of scenarios. The researchers from World Bank and IMF were making a huge macroeconomic forecasting to construct the baseline scenario and alternative scenarios. In this work, due to the lack of resources it was not possible to do the same long run macroeconomic projection. Instead of doing the detailed macroeconomic projections, the historical average of the right part of equation was taken as the base line scenario, and based on that, the left part b_t was calculated. It turned out that in the case of historical average scenario the average nominal GDP growth is equal to 16%, primary balance is equal to -0.4% of GDP, interest rate is equal to 13.4% on average for the period from 2013 to 2030. As for one of the alternative scenarios the projected data from strategic development of Kyrgyzstan was obtained till 2017, for the right part of the equation (7), and based on that data, the left part of equation was calculated, further projection was made based on the moving average method. Average nominal GDP growth in this case turned out to be equal to 13%, average primary balance found to be -1% from GDP and the interest rate equal to 11%. Finally, the second alternative scenario of economic development was calculated by taking as an assumption that the average nominal GDP growth is going to be 10%, primary balance at average projected to be -3% of GDP since it was to be the case of pessimistic economic development scenario and the lowest trend of primary balance track was taken in to account. The interest rate was projected to be equal to 7%.

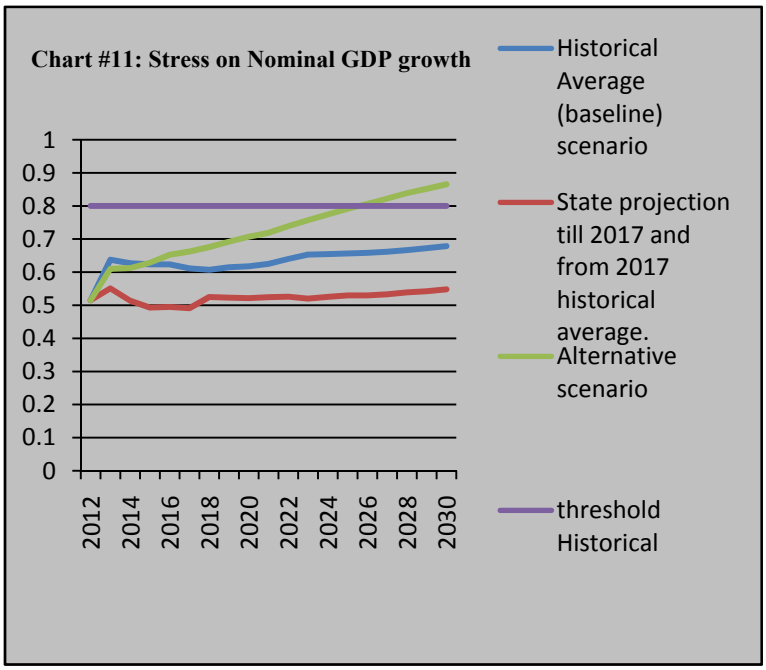
One more issue with the stress test is to indicate the threshold total public debt to GDP ratios. If we consider the historical development of public debt to GDP ratios, one may notice that the ratio at 2003 was 81% when the debt was found to be not

sustainable and the first debt rescheduling program with Paris Club took place. This could be one threshold indicator.

The stress test itself is the forecasting, thus as one may already have noticed, it contains a lot of assumptions. Thus the results of stress test cannot be interpreted as the rigid determination of sustainability, but can be used as a possible indicator of debt distress risk.



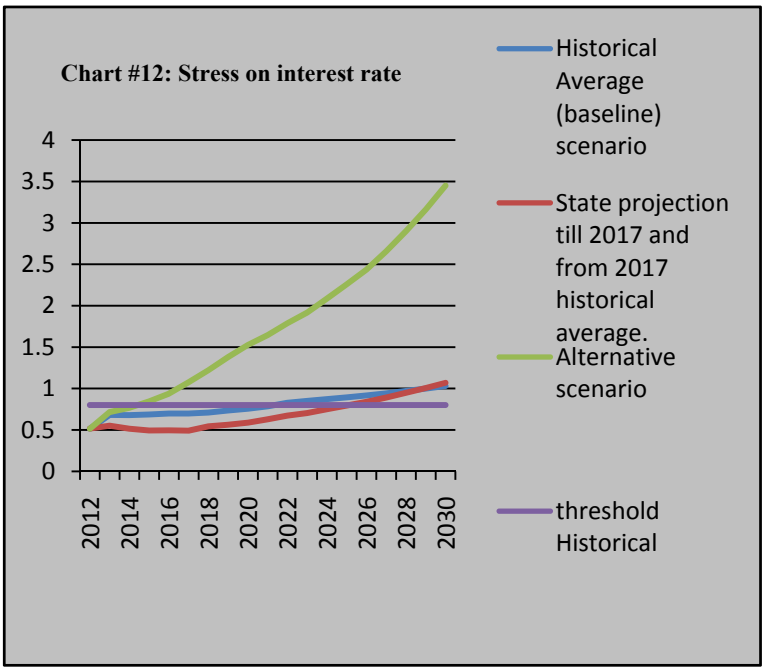
According to our constructed scenarios it turned out that in all the scenarios, the total public debt to GDP ratios are well below from the threshold indicator except for the worst development trend scenario (see Chart #10). The alternative pessimistic scenario indicates that total debt to GDP ratio is getting close to the historical threshold and shows that in 2030 the debt to GDP ratio might reach 78.5%, all other things being equal.



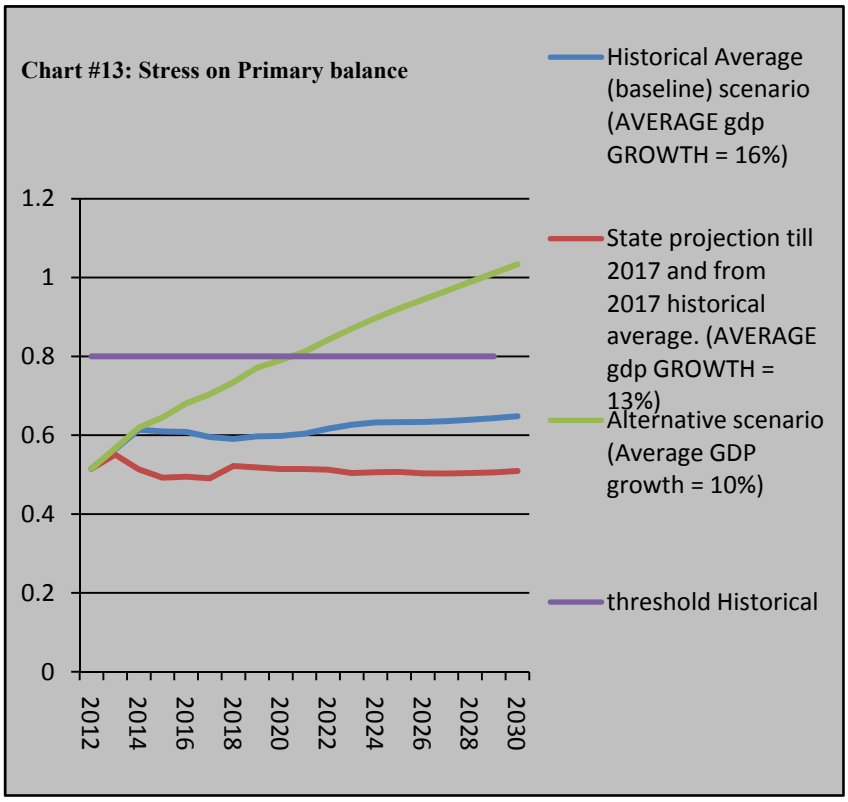
Now when the scenarios are ready, we implement the sensitivity analysis, simply by playing with the GDP growth, since it is considered to measure the capacity of the country to pay its debt, interest rate since it indicates the increasing or decreasing of costs of borrowing and with the

primary balance as a share to GDP since it is the source of debt financing (if its positive) and source of debt accumulation (if it is negative). Note: while stressing one of the variables of the equation, all other variables are assumed to be constant.

Thus we have chosen historically the worst case of nominal GDP growth that is equal to 2% and implemented it to each scenario. It turned out that the negative shock to nominal GDP growth leads to sensible increase of debt to GDP ratio in the pessimistic scenario: the baseline scenario and the state projection scenario turned out to be still well below the historical threshold, and the worst case alternative scenario indicates significant increase of debt to GDP ratio and exceeds the threshold (see Chart #11). This may indicate that the shock to the GDP growth might lead to the debt distress in the case of worst case scenario. Thus it is recommended to try to keep the nominal GDP growth rate stabile if the country is likely to be found in the worst development scenario.



The stress on interest rate was chosen as the highest historical level that was equal to 39%. The shock indicates that in the case of all scenarios, debt to GDP ratios exceed the threshold, ceteribus paribus (see Chart #12). From this test it might be concluded that all other things being equal, the increase in interest rate might lead to the fast accumulation of the debt to GDP ratio in any listed scenarios. This happens because with the increase of interest rate the cost of borrowing for public sector increases, and this increases the pressure to the fiscal primary balance thus increasing the future debt to GDP ratios in next periods. Therefore one may conclude that debt to GDP ratio is very sensitive to the shocks in the interest rate. The recommendation from this conclusion is to keep the interest rate in a stable position no meter in which of the possible scenarios of development the country finds itself.



Finally the stress on fiscal primary balance was chosen as the highest historical primary deficit that was 6.7% as a share to GDP. The shock on primary balance indicates that debt to GDP ratio, all other things being equal, exceeds threshold only in the case of worst development scenario (see Chart #13). Considering this results one may come to the conclusion that if the country finds itself in the worst development scenario, keeping the stabile primary balance might be required in order to avoid debt distress. In this case, the fiscal policy would have to become pro-cyclical rather than counter-cyclical, this means that in the case of the pessimistic scenario, the government would have to reduce its expenditures and/or raise taxes, which might lead to the further worsening of the situation, all other things holding constant.

The results of the stress test indicates that under the baseline and government projection scenarios total public debt to GDP ratios are well below the threshold, which says that the Kyrgyz Republic does not have sustainability problems and for now can be said to be solvent. However, in the worst development case scenario and in the case of number of sensitivity tests, the total public debt to GDP levels of Kyrgyzstan might significantly exceed the threshold. In compliance with the joint World Bank and IMF framework,[39] the results indicate that the Kyrgyz Republic is under the moderate risk of total public debt distress, all other things being equal.

[39] Ibid.

III. 6. Summary of the main findings

The empirical assessment of debt sustainability issue in the Kyrgyz Republic shows different results. The empirical estimation of the fiscal reaction function in the case of the Kyrgyz Republic brought us to the conclusion that, in general, fiscal authorities of Kyrgyzstan cannot allow generating a fiscal primary surplus in order to stabilize the debt to GDP level, all other things being equal. It simply says that if the fiscal policy development will not significantly be different from its historical path, fiscal authorities are unlikely to be able to stabilize debt to GDP level in case of a shock in total public debt to GDP level. Moreover the adjustment period was found to be 9 years, which implies that if the government faces high levels of debt to GDP ratio, it might take 9 years to fiscal authorities in order to adjust future fiscal track to those shocks. The general conclusion from the estimation of fiscal reaction function is that fiscal authorities do not act in compliance with the long run solvency criterion. But it is essential to remember that the obtained results are based on historical data, while the coefficient interpreted as an indicator of long run solvency criterion, thus deals with uncertainty issue. The stress test was able to fulfill this analysis and indicates that the result is appropriate for the case of pessimistic development scenario, thus if the country's future economic track will be close to this scenario, the fiscal policy is considered to be not in compliance with the long run solvency criterion, all other things being equal.

While the results of debt stabilizing primary balance indicated that in 2013 all other things being equal, the difference between actual and debt stabilizing primary balance was found to be –4.7% to GDP. This indicates that the results of fiscal policy in 2012 cannot be considered as sustainable and brings to the increasing debt to GDP ratios, and that the primary balance should be decreased by 4.7% in order to stabilize the debt to GDP ratio. The main question from this finding is: Can Kyrgyzstan credibly commit itself to the debt stabilizing fiscal adjustment in the future? From the results of stress test one may make a conclusion that if the country finds itself in a pessimistic economic development scenario, it is unlikely that the fiscal authorities could commit to the debt stabilizing fiscal path, because in that scenario the debt to GDP ratio in the long run exceeds the debt burden indicative threshold.

The over/under-borrowing test, however, shows us interesting results: The Kyrgyz Republic is far enough from over-borrowing and has 51.7% as a "safeguard"

debt to GDP ratio accumulation. Despite of the obtained results, it will be wrong to say that the total public debt to GDP ratio in Kyrgyzstan is sustainable, due to the fact that the main assumption of the test is that future economic development and fiscal policy will not differ from historical average. Thus the results of over-borrowing are not clear yet, due to the fact that future development of the country as well as future fiscal policy of Kyrgyzstan is uncertain. The stress test confirms this result in the cases of baseline and government projection scenario. However, it also rejects them in the case of pessimistic scenario. In order to deal with the issue of uncertainty, the stress test was implemented for the case of the Kyrgyz Republic. The results of the stress test at certain point confirmed the results of under/over-borrowing test, the current debt to GDP ratio is well below from threshold. It implies that in the historical average scenario of economic development, the debt to GDP level is sustainable and well below from the threshold if there are no shocks on macroeconomic variables. However the sensitivity test shows the other possible scenarios. It was found that the total public debt to GDP level in Kyrgyzstan is very sensitive to the shocks in interest rate even in the case of historical development of the country.

The overall result indicated that the Kyrgyz Republic does not have a debt sustainability problem in the current period, and though the baseline scenario does not reach the debt burden threshold, it was found that the country is under the moderate risk of debt distress.

IV

CONCLUSIONS

In this thesis, the issue of debt sustainability for the Kyrgyz Republic was assessed. The recent development indicated the increase of total public debt to GDP ratio from 47% to 51% in 2012, and the fiscal deficit also indicated significant increase, making the question of the sustainability relevant in the case of Kyrgyzstan. The main research question was whether the public sector of Kyrgyz Republic is solvent. In order to find the answer to this question some sub questions were pose, as well:

- Do the fiscal tools of the country react positively or negatively to the higher debt to GDP level?
- Does the current fiscal path satisfy long run solvency criterion of sustainability? If it does not, what is the debt stabilizing primary balance and can the government credibly commit to the stabilizing fiscal path without significant corrections such as debt relief or debt rescheduling?
- What is the benchmark debt to GDP ratio for the Kyrgyz Republic? Does the government over/under-borrows? If it over-borrows, is it economically and politically possible for the country to commit to the fiscal path in future that will bring debt to GDP level to the benchmark level?

In order to assess these questions, a number of empirical approaches were implemented in this thesis. The main findings are that the fiscal tools of the country react negatively to the higher debt to GDP level, which says that, all other thing being equal, the fiscal path of the country is not going in compliance with the long run solvency criterion. Moreover, the fiscal reaction function found that on average, it takes nine years in order to adjust fiscal tools to the shock of the increasing debt to GDP ratio, which indicates that fiscal authorities are not flexible enough in order to stabilize shocks in debt to GDP ratio.

The debt stabilizing primary balance analysis confirmed that the fiscal path is not going in compliance with the long run solvency criterion, and indicated that the primary balance in 2012 will lead to increasing debt to GDP ratios in 2013. The fiscal adjustment was found to be 4.7% to nominal GDP. The over/under-borrowing test, however, indicated that the Kyrgyz Republic does not exceed the benchmark total

public debt to GDP ratio in 2012, assuming that the future economic and fiscal development of the country is not going to be different from the historical average. But the fact that future development and future fiscal path of the country is uncertain due to the high volatility of main macroeconomic indicators, the results need to be tested for sensitivity analysis.

While the first three methods of debt analysis provided us with uncertain results, the stress test indicated that the Kyrgyz Republic is under the *moderate risk of total public debt distress*. The alternative scenario and sensitivity analysis showed that debt to GDP ratio exceeds the threshold level. Assuming that the average GDP growth rate in the period from 2013 to 2030 will be 10%, all other things being equal, it was found that the debt to GDP ratio might become close to the historical threshold, while the baseline and the government projection scenarios indicate that debt to GDP level is well below the threshold.

The sensitivity analysis, however, showed that in case of shock to interest rate, total public debt to GDP levels might exceed the threshold significantly in all scenarios, holding all other factors equal. This indicates high level of sensitivity of total public debt to GDP ratio in the Kyrgyz Republic. The sensitivity test also showed that in the low development case alternative scenario, the shock to nominal GDP growth and to the fiscal primary balance might lead to situations when total public debt to GDP ratio exceeds the threshold.

Apart from defining the country risk of debt distress, sensitivity analysis provides us with the information based on which it is possible to come up with some recommendations for public authorities. Since the stress test showed the high sensitivity of total public debt to GDP ratio on shocks to the interest rates, the public sector should pay high attention to the development track of interest rate. The main recommendation will be to adjust fiscal and monetary policy in order to prevent interest rate from increasing. Apart from this, sensitivity analysis showed that in the case of average nominal GDP growth equaled to 10% per year, the shock to GDP growth might lead to debt distress as well as shock on primary balance. Thus, the recommendation for authorities might be to keep stimulating the economy by the means of monetary policy and to increase primary balance once the country is found to be under the pessimistic scenario of development, holding all other things equal. The decreasing of the shadow market of economy is also required, since the businesses that will go out from shadow market can significantly contribute to

primary balance, thus might increase the debt to GDP level that the country can sustain. Decrease of government apparatus and reorganization of it in terms of liquidation of overlapping, making it more effective might also contribute to the improvement of primary balance.

According to the obtained analysis and results, it is now seen that the probability of solvency problem exists in the case of the Kyrgyz Republic. Unfortunately there is no method that will give a rigid determination of public debt sustainability, therefore the conclusions are made based on the projections and still there is a probability for mistake. Nevertheless, I believe that the results can be useful for fiscal policy issues and can give some reasonable conclusions to the fiscal authorities.

Further contribution to this research can be to assess the liquidity condition of the country since it is also an important indicator of debt distress risk. The Kyrgyz Republic may look solvent, but there might turn out in future that the country will not have enough liquidity in order to satisfy the financial obligations. It is also going to be interesting to try to assess the off-budget obligations of the country, due to the fact that it will allow to see how the country is vulnerable to the emergency situations. The future development of this research is to increase the quality of the stress test by making detailed macroeconomic projections not only based on the historical development trends, and by decreasing the number of assumptions in the stress test. These will be the main directions of development of this research in the coming future.

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APPENDIX A: Data transformation

The data on Primary Fiscal Balance (FB) as a share to GDP is not available in the data sources; therefore we were forced to derive them using the following formula which was based on the accounting principles described in Guide on Debt Statistics for Compliers and Users:[40]

$$\frac{PB_t}{GDP_t} = \frac{FB_t - \ Expenditures\ on\ interest\ payment\ on\ public\ debt_t}{GDP_t}$$

Where $\frac{PB_t}{GDP_t}$ indicates primary fiscal balance as a share to nominal GDP in the period t, FB_t indicates fiscal balance of the country in the period t. The data for Expenditures on interest payment on total public debt was obtained from Reports of Ministry of Finance of Kyrgyz Republic on Budget execution, and the data on FB and nominal GDP was taken from National Statistics Committee of Kyrgyz Republic.

The data on total public debt was not available too; therefore the variable was derived, based on Guide to LIC DSA issued by IMF and World Bank:[41]

$$\frac{Total\ Public\ Debt_t}{GDP_t} = \frac{PPG_t^{domestic} + \ PPG_t^{External}}{GDP_t}$$

Where $PPG_t^{domestic}$ indicates Public and Publicly Guaranteed domestic debt in the period t and $PPG_t^{External}$ indicates Public and Publicly Guaranteed external debt in the period t respectively. The data for $PPG_t^{domestic}$ and $PPG_t^{External}$ of Kyrgyz Republic was obtained from Reports of Ministry of Finance of Kyrgyz Republic on Budget execution.

The best indicator for business cycles is considered to be output gap; however, there is no data available on that variable and, therefore, the proxy for business cycles were calculated based on the assumption that deviation of economic growth from the average growth rate will be an appropriate estimate for business' activity fluctuations.

[40] Supra 6.
[41] Supra 20, 5.

$$BAF_t = \frac{GDP_t^{Actual} - GDP_{t-1}^{Actual}}{GDP_{t-1}^{Actual}} - \frac{\sum_{t=0}^{i}(GDP_t^{Actual} - GDP_{t-1}^{Actual}) / GDP_{t-1}^{Actual}}{t}$$

Where $\frac{GDP_t^{Actual} - GDP_{t-1}^{Actual}}{GDP_{t-1}^{Actual}}$ indicates nominal GDP growth rate of Kyrgyz Republic for the period t, while $\frac{\sum_{t=0}^{i}(GDP_t^{Actual} - GDP_{t-1}^{Actual}) / GDP_{t-1}^{Actual}}{t}$ shows average growth rate of Kyrgyzstan's Nominal GDP.

APPENDIX B: Augmented Dickey Fuller test for Unit Root

Testing CPISA (Seasonally adjusted Consumer Price Index) for Unit Root

The unit root test for drifted random walk indicates that seasonally adjusted CPI for the Kyrgyz Republic is stationary under the 5% critical value: t* is equal to -3.462118 and is < then ADF critical value under the 95% confidence level which is equal to -2.9048 (see Table #4).

Table #4: Drifted Random Walk for Seasonally adjusted CPI

ADF TestStatistic	-3.462118	1% CriticalValue*		-3.5297
		5% CriticalValue		-2.9048
		10% CriticalValue		-2.5896
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation Method: Least Squares				
DependentVariable: D(CPISA)				
Sample(adjusted): 1996:2 2012:4				
Included observations: 67 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPISA(-1)	-0.597752	0.172655	-3.462118	0.0010
D(CPISA(-1))	-0.150114	0.170071	-0.882655	0.3809
D(CPISA(-2))	0.108651	0.161925	0.670995	0.5048
D(CPISA(-3))	0.074325	0.155165	0.479008	0.6336
D(CPISA(-4))	0.007795	0.118977	0.065514	0.9480
C	60.30732	17.43696	3.458592	0.0010
R-squared	0.406023	Meandependentvar		-0.044158
Adjusted R-squared	0.357336	S.D. dependentvar		1.398744
S.E. ofregression	1.121322	Akaikeinfocriterion		3.152179
Sumsquaredresid	76.69910	Schwarzcriterion		3.349614
Loglikelihood	-99.59799	F-statistic		8.339500
Durbin-Watsonstat	2.053424	Prob(F-statistic)		0.000005

The unit root test for drifted random walk with the trend indicates that seasonally adjusted CPI for the Kyrgyz Republic is stationary under the 5% critical value: t* is equal to -3.505350 and is < ADF critical value under the 95% confidence level which is equal to -3.4769 (see Table #5).

Table #5: Drifted Random Walk with trend

ADF Test Statistic	-3.505350	1% CriticalValue*		-4.0990
		5% CriticalValue		-3.4769
		10% CriticalValue		-3.1657
*MacKinnon critical values for rejection of hypothesis of a unit root.				
Augmented Dickey-Fuller Test Equation Method: Least Squares				
Dependent Variable: D(CPISA)				
Date: 03/31/13 Time: 21:07				
Sample(adjusted): 1996:2 2012:4				
Included observations: 67 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPISA(-1)	-0.676081	0.192871	-3.505350	0.0009
D(CPISA(-1))	-0.088568	0.183069	-0.483796	0.6303
D(CPISA(-2))	0.154440	0.169668	0.910250	0.3663
D(CPISA(-3))	0.110969	0.160436	0.691668	0.4918
D(CPISA(-4))	0.029806	0.121533	0.245255	0.8071
C	68.49409	19.61411	3.492083	0.0009
@TREND(1995:1)	-0.007259	0.007924	-0.916097	0.3633
R-squared	0.414216	Meandependentvar		-0.044158
Adjusted R-squared	0.355638	S.D. dependentvar		1.398744
S.E. of regression	1.122802	Akaikeinfocriterion		3.168139
Sum squared resid	75.64109	Schwarzcriterion		3.398480
Log likelihood	-99.13266	F-statistic		7.071140
Durbin-Watson stat	2.054822	Prob(F-statistic)		0.000010

The unit root test for random walk indicates that seasonally adjusted CPI for the Kyrgyz Republic is non-stationary under the 10% critical value: t* is equal to -0.424805 and is > then ADF critical value under the 90% confidence level which is equal to -1.6183 (see Table #6).

Since seasonally adjusted CPI has random walk in its series it is essential to make it stationary. That is why the first difference for SA CPI was taken. The unit root test for random walk indicates that seasonally adjusted CPI taken as a first difference for the Kyrgyz Republic is stationary under the 1% critical value: t* is equal to -6.401073 and is < then ADF critical value under the 99% confidence level which is equal to -2.5968 (see Table #7). Chart #3 shows the seasonally adjusted CPI in the case of the Kyrgyz Republic. To see the effect of taking the first difference see Chart #4.

Table #6: Random Walk for Seasonally adjusted CPI

ADF TestStatistic	-0.424805	1% CriticalValue*		-2.5973
		5% CriticalValue		-1.9452
		10% CriticalValue		-1.6183
Augmented Dickey-Fuller Test Equation Method: Least Squares				
Dependent Variable: D(CPISA)				
Sample (adjusted): 1996:2 2012:4				
Included observations: 67 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPISA(-1)	-0.000627	0.001477	-0.424805	0.6724
D(CPISA(-1))	-0.584940	0.124246	-4.707900	0.0000
D(CPISA(-2))	-0.207807	0.144925	-1.433895	0.1566
D(CPISA(-3))	-0.193385	0.145884	-1.325608	0.1898
D(CPISA(-4))	-0.131939	0.121397	-1.086838	0.2813
R-squared	0.289546	Mean dependent var		-0.044158
Adjusted R-squared	0.243710	S.D. dependentvar		1.398744
S.E. of regression	1.216417	Akaike info criterion		3.301391
Loglikelihood	-105.5966	F-statistic		6.317033
Durbin-Watsonstat	1.998964	Prob (F-statistic)		0.000249

Table #7: Random Walk for Seasonally adjusted CPI taken as the first difference

ADF TestStatistic	-6.401073	1% CriticalValue*		-2.5968
		5% CriticalValue		-1.9452
		10% CriticalValue		-1.6183
DependentVariable: D(CPISA,2)				
Sample(adjusted): 1996:1 2012:4				
Included observations: 68 after adjusting endpoints				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPISA(-1))	-1.898422	0.296579	-6.401073	0.0000
D(CPISA(-1),2)	0.314958	0.230718	1.365117	0.1769
D(CPISA(-2),2)	0.133655	0.119872	1.114978	0.2690
R-squared	0.774757	Meandependentvar		0.020332
Adjusted R^2	0.767827	S.D. dependentvar		2.521505
S.E. ofregression	1.214971	Akaikeinfocriterion		3.270433
Sumsquaredresid	95.95009	Schwarzcriterion		3.368352
Loglikelihood	-108.1947	F-statistic		111.7887
Durbin-Watsonstat	1.978552	Prob(F-statistic)		0.000000

Chart #3: SA CPI

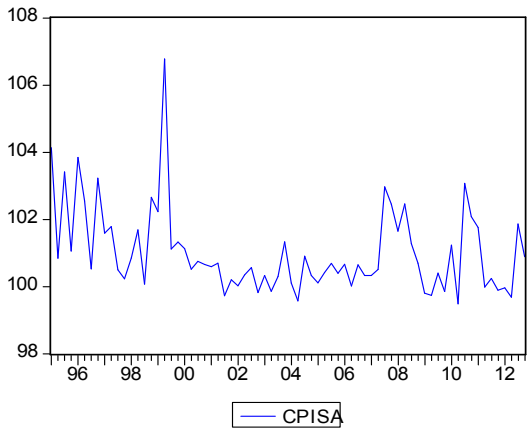
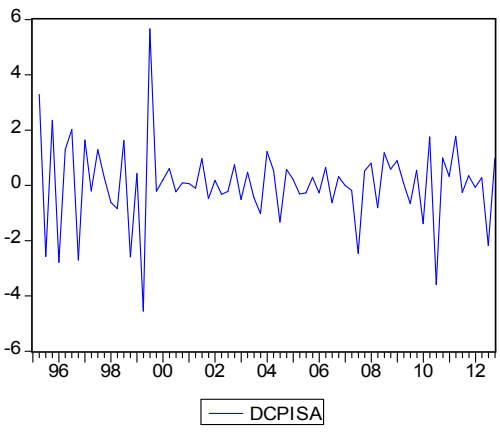


Chart #4 SA CPI as 1 difference



Testing BusCyclSA (Seasonally adjusted Business cycles) for Unit Root.

The unit root test for drifted random walk indicates that seasonally adjusted BusCyclSA for Kyrgyz Republic is non-stationary under the 10% critical value: t* is equal to -2.241113 and is > then ADF critical value under the 90% confidence level which is equal to -2.5896 (see Table #8).

Table #8: Drifted Random Walk for seasonally adjusted business cycles

ADF TestStatistic	-2.241113	1% CriticalValue*	-3.5297
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-2.9048
		10% CriticalValue	-2.5896
Augmented Dickey-Fuller Test Equation Method: Least Squares			
DependentVariable: D(BusCyclSA)			
Sample(adjusted): 1996:2 2012:4			
Included observations: 67 after adjusting endpoints			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BusCyclSA (-1)	-0.465659	0.20778	-2.241113	0.0287
D(BusCyclSA (-1))	-0.568589	0.21625	-2.629211	0.0108
D(BusCyclSA (-2))	-0.382350	0.20912	-1.828374	0.0724
D(BusCyclSA (-3))	-0.197780	0.18326	-1.079232	0.2847
D(BusCyclSA (-4))	0.123389	0.13095	0.942245	0.3498
C	-0.003443	0.01560	-0.220651	0.8261
R-squared	0.566487	Meandependentvar		0.0022
Adjusted R-squared	0.530953	S.D. dependentvar		0.1862
S.E. ofregression	0.127586	Akaikeinfocriterion		-1.194
Sumsquaredresid	0.992976	Schwarzcriterion		-0.997
Loglikelihood	46.02445	F-statistic		15.942
Durbin-Watsonstat	1.982693	Prob(F-statistic)		0.0000

The unit root test for drifted random walk with the trend indicates that seasonally adjusted Business Cycles for Kyrgyz Republic is stationary under the 10% critical value: t* is equal to -3.214875 and is < ADF critical value under the 90% confidence level which is equal to -4.0990 (see Table #9).

Table #9: Drifted Random Walk with trend

ADF TestStatistic	-3.214875	1% CriticalValue	-4.0990
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-3.4769
		10% CriticalValue	-3.1657
Augmented Dickey-Fuller Test Equation Method: Least Squares			
DependentVariable: D(BusCyclSA)			
Sample(adjusted): 1996:2 2012:4			
Included observations: 67 after adjusting endpoints			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BusCyclSA (-1)	-0.852038	0.265030	-3.214875	0.0021
D(BusCyclSA (-1))	-0.269154	0.248467	-1.083256	0.2830
D(BusCyclSA (-2))	-0.180931	0.221605	-0.816456	0.4175
D(BusCyclSA (-3))	-0.085899	0.184394	-0.465843	0.6430
D(BusCyclSA (-4))	0.159291	0.127847	1.245950	0.2176
C	0.084881	0.042219	2.010488	0.0489
@TREND(1995:1)	-0.002315	0.001033	-2.240581	0.0288
R-squared	0.599959	Meandependentvar		0.0022
Adjusted R-squared	0.559954	S.D. dependentvar		0.1862
S.E. ofregression	0.123579	Akaikeinfocriterion		-1.2452
Sumsquaredresid	0.916309	Schwarzcriterion		-1.0121
Loglikelihood	48.71629	F-statistic		14.997
Durbin-Watsonstat	1.973886	Prob(F-statistic)		0.0000

The unit root test for random walk indicates that seasonally adjusted Business Cycles for Kyrgyz Republic is stationary under the 5% critical value: t* is equal to -2.262017 and is < then ADF critical value under the 95% confidence level which is equal to -2.5973 (see Table# 10).The Augmented Dickey-Fuller test shows that data on seasonally adjusted Business cycles in the case of Kyrgyz republic has drifted random walk in its levels. That is why the first difference for seasonally adjusted Business cycles was taken.

The unit root test for drifted random walk indicates that seasonally adjusted Business cycles taken as a first difference for Kyrgyz Republic is stationary under the 1% critical value: t* is equal to -5.197568 and is < then ADF critical value under the 99% confidence level which is equal to -3.5312 (see Table #11).

Chart #5 shows the seasonally adjusted Business cycles in the case of Kyrgyz Republic. To see the effect of taking the first difference see Chart #6.

Table #10: Random Walk for Seasonally adjusted business cycles

ADF TestStatistic	-2.262017	1% CriticalValue	-2.5973
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-1.9452
		10% CriticalValue	-1.6183
DependentVariable: D(BusCyclSA)			
Sample(adjusted): 1996:2 2012:4			
Included observations: 67 after adjusting endpoints			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BusCyclSA (-1)	-0.466332	0.206158	-2.262017	0.0272
D(BusCyclSA (-1))	-0.566922	0.214462	-2.643463	0.0104
D(BusCyclSA (-2))	-0.381172	0.207442	-1.837485	0.0709
D(BusCyclSA (-3))	-0.197296	0.181835	-1.085024	0.2821
D(BusCyclSA (-4))	0.123274	0.129943	0.948683	0.3465
R-squared	0.566141	Meandependentvar		0.00226
Adjusted R-squared	0.538150	S.D. dependentvar		0.18629
S.E. ofregression	0.126604	Akaikeinfocriterion		-1.2238
Sumsquaredresid	0.993769	Schwarzcriterion		-1.0592
Loglikelihood	45.99772	F-statistic		20.225
Durbin-Watsonstat	1.982907	Prob(F-statistic)		0.00000

Table #11: Drifted Random Walk for Seasonally adjusted BC

ADF TestStatistic	-5.197568	1% CriticalValue*	-3.5312
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-2.9055
		10% CriticalValue	-2.5899
DependentVariable: D(BusCyclSA ,2)			
Sample(adjusted): 1996:3 2012:4			
Included observations: 66 after adjusting endpoints			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(BusCyclSA (-1))	-3.287568	0.632521	-5.197568	0.0000
D(BusCyclSA (-1),2)	1.321833	0.564786	2.340416	0.0226
D(BusCyclSA (-2),2)	0.605201	0.434917	1.391532	0.1692
D(BusCyclSA (-3),2)	0.151325	0.282188	0.536255	0.5938
D(BusCyclSA (-4),2)	0.099348	0.131852	0.753484	0.4541
C	-0.004578	0.016405	-0.279067	0.7812
R-squared	0.846707	Meandependentvar		0.0066
Adjusted R-squared	0.833932	S.D. dependentvar		0.3265
S.E. ofregression	0.133083	Akaikeinfocriterion		-1.1091
Sumsquaredresid	1.062664	Schwarzcriterion		-0.9101
Loglikelihood	42.60296	F-statistic		66.281
Durbin-Watsonstat	1.919843	Prob(F-statistic)		0.0000

Chart #5: Business cycles

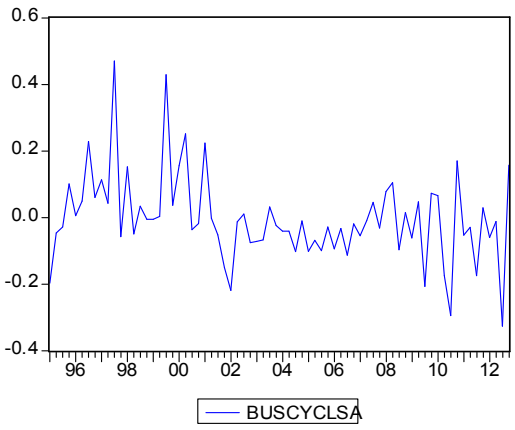
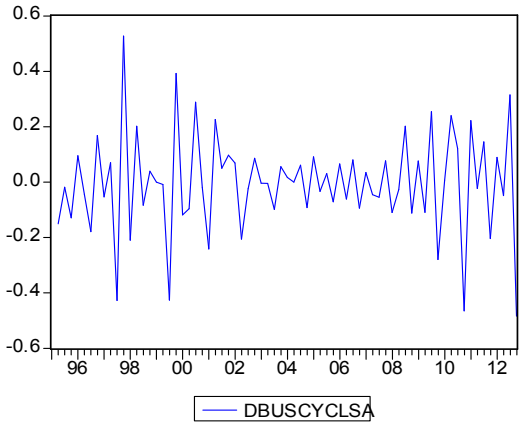


Chart #6: Business cycles taken as a 1 difference



Testing EXRSA (Seasonally adjusted Exchange rate KGS per 1 USD) for Unit Root

The unit root test for drifted random walk indicates that seasonally adjusted Exchange rate KGS per 1 USD for the Kyrgyz Republic is stationary under the 10% critical value: t* is equal to -2.687924 and is < the ADF critical value under the 90% confidence level which is equal to -2.5896 (see Table #12).

Table #12: Drifted Random Walk for SA Exchange rate

ADF TestStatistic	-2.687924	1% CriticalValue*	-3.5297
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-2.9048
		10% CriticalValue	-2.5896
Augmented Dickey-Fuller Test Equation Method: Least Squares			
DependentVariable: D(EXRSA)			
Sample(adjusted): 1996:2 2012:4			
Included observations: 67 after adjusting endpoints			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXRSA(-1)	-0.047497	0.017671	-2.687924	0.0093
D(EXRSA(-1))	0.300597	0.122538	2.453084	0.0170
D(EXRSA(-2))	0.313444	0.128401	2.441139	0.0176
D(EXRSA(-3))	0.031471	0.128757	0.244425	0.8077
D(EXRSA(-4))	-0.091646	0.121558	-0.753933	0.4538
C	2.071048	0.716605	2.890084	0.0053
R-squared	0.383591	Meandependentvar		0.53503
Adjusted R-squared	0.333066	S.D. dependentvar		1.83925
S.E. ofregression	1.502046	Akaikeinfocriterion		3.73681
Sumsquaredresid	137.6246	Schwarzcriterion		3.93425
Loglikelihood	-119.1834	F-statistic		7.59206
Durbin-Watsonstat	2.003980	Prob(F-statistic)		0.00001

The unit root test for drifted random walk with the trend indicates that seasonally adjusted Exchange rate KGS per 1 USD for the Kyrgyz Republic is non-stationary under the 10% critical value: t* is equal to -2.312640 and is > ADF critical value under the 90% confidence level which is equal to -3.1657 (see Table #13).

Table #13: Drifted Random Walk with trend

ADF TestStatistic	-2.312640	1% CriticalValue*	-4.0990
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-3.4769
		10% CriticalValue	-3.1657
Augmented Dickey-Fuller Test Equation Method: Least Squares			
DependentVariable: D(EXRSA)			
Sample(adjusted): 1996:2 2012:4			
Included observations: 67 after adjusting endpoints			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXRSA(-1)	-0.053010	0.022922	-2.312640	0.0242
D(EXRSA(-1))	0.301729	0.123441	2.444313	0.0175
D(EXRSA(-2))	0.315445	0.129416	2.437454	0.0178
D(EXRSA(-3))	0.038468	0.130959	0.293744	0.7700
D(EXRSA(-4))	-0.081608	0.125213	-0.651753	0.5170
C	2.084953	0.722596	2.885364	0.0054
@TREND(1995:1)	0.004969	0.013023	0.381568	0.7041
R-squared	0.385084	Meandependentvar		0.5350
Adjusted R-squared	0.323592	S.D. dependentvar		1.8392
S.E. ofregression	1.512677	Akaikeinfocriterion		3.7642
Sumsquaredresid	137.2914	Schwarzcriterion		3.9945
Loglikelihood	-119.1022	F-statistic		6.2623
Durbin-Watsonstat	2.000464	Prob(F-statistic)		0.0000

The unit root test for random walk indicates that seasonally adjusted Exchange rate KGS per 1 USD for the Kyrgyz Republic is non-stationary under the 10% critical value: t* is equal to -0.312804 and is > ADF critical value under the 90% confidence level which is equal to -1.6183 (see Table #14).

The ADF test shows that data on seasonally adjusted Exchange rate KGS per 1 USD in the case of Kyrgyz republic has random walk as well as drifted random walk in its levels. That is why the first difference for seasonally adjusted business cycles was taken. However, even taken as the first difference, the variable still has the problem

of drifted random walk in its series. So in order to get read of the unit root the second difference was taken for the series of Exchange rate KGS per 1 USD for the case of Kyrgyzstan.

Table #14: Random Walk

ADF TestStatistic	0.312804	1% CriticalValue*	-2.5973
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-1.9452
		10% CriticalValue	-1.6183
Augmented Dickey-Fuller Test Equation Method: Least Squares			
DependentVariable: D(EXRSA)			
Sample(adjusted): 1996:2 2012:4			
Included observations: 67 after adjusting endpoints			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXRSA(-1)	0.001606	0.005135	0.312804	0.7555
D(EXRSA(-1))	0.371056	0.127010	2.921476	0.0049
D(EXRSA(-2))	0.339544	0.135465	2.506516	0.0148
D(EXRSA(-3))	0.018246	0.136092	0.134073	0.8938
D(EXRSA(-4))	-0.114317	0.128296	-0.891046	0.3763
R-squared	0.299188	Meandependentvar		0.53503
Adjusted R-squared	0.253974	S.D. dependentvar		1.83925
S.E. ofregression	1.588615	Akaikeinfocriterion		3.83529
Sumsquaredresid	156.4692	Schwarzcriterion		3.99982
Loglikelihood	-123.4825	F-statistic		6.61720
Durbin-Watsonstat	1.985588	Prob(F-statistic)		0.00016

The unit root test for drifted random walk with deterministic trend indicates that seasonally adjusted EXRSA taken as the second difference for the Kyrgyz Republic is stationary under the 1% critical value: t* is equal to -4.840061 and is < ADF critical value under the 99% confidence level which is equal to -4.1035 (see Table #15).

Chart #7 shows the seasonally adjusted business cycles in the case of the Kyrgyz Republic. To see the effect of taking the first difference see Chart #8.

Table #15: Drifted Random Walk with trend

ADF TestStatistic	-4.840061	1% CriticalValue*	-4.1035
*MacKinnon critical values for rejection of hypothesis of a unit root.		5% CriticalValue	-3.4790
		10% CriticalValue	-3.1669
Augmented Dickey-Fuller Test Equation			
DependentVariable: D(EXRSA,3)			
Method: LeastSquares			
Date: 04/01/13 Time: 19:12			
Sample(adjusted): 1996:4 2012:4			
Included observations: 65 after adjusting endpoints			

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXRSA(-1),2)	-2.109768	0.435897	-4.840061	0.0000
D(EXRSA(-1),3)	0.576279	0.381750	1.509573	0.1366
D(EXRSA(-2),3)	0.453346	0.314826	1.439988	0.1552
D(EXRSA(-3),3)	0.364613	0.235247	1.549914	0.1266
D(EXRSA(-4),3)	0.160224	0.130071	1.231822	0.2230
C	0.009471	0.488165	0.019402	0.9846
@TREND(1995:1)	-0.001030	0.011280	-0.091297	0.9276
R-squared	0.745999	Meandependentvar		-0.0153
Adjusted R-squared	0.719723	S.D. dependentvar		3.22178
S.E. ofregression	1.705649	Akaikeinfocriterion		4.00720
Sumsquaredresid	168.7358	Schwarzcriterion		4.24137
Loglikelihood	-123.2343	F-statistic		28.3909
Durbin-Watsonstat	2.046719	Prob(F-statistic)		0.00000

Chart #7: Exchange rate

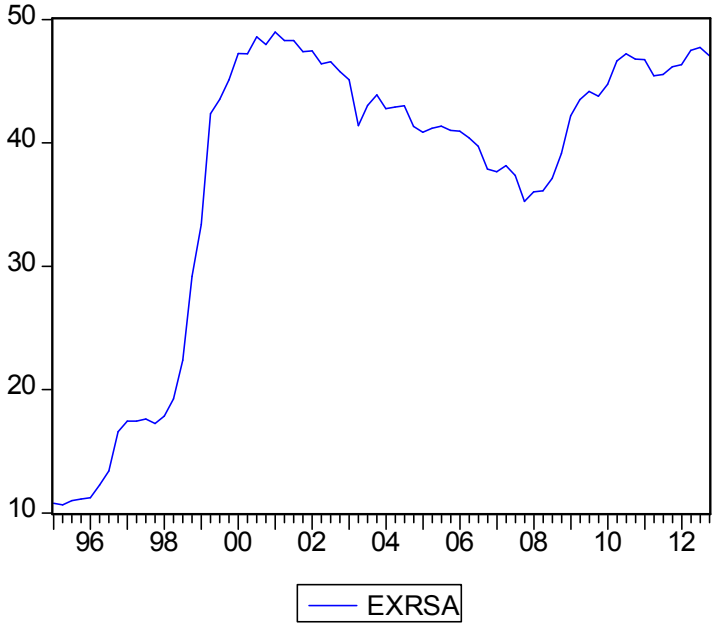


Chart #8: Exchange rate as a first difference