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SCUOLA DI DOTTORATO DI RICERCA IN
ECONOMIA E MANAGEMENT
CICLO XX

PUBLIC DEBT MANAGEMENT IN TRANSITION COUNTRIES

Direttore della Scuola: Ch.mo Prof. Guglielmo Weber

Supervisore: Prof. Luciano Greco

Dottoranda: Svitlana Moskalyuk

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Contents

Abstract

Public debt management (PDM) in transition and other emerging countries is more complex and crucial than in developed ones. In these economies, the choice of the financial structure of the public debt is key to warrant fiscal stability because of higher volatility of macroeconomic and financial conditions. In addition, public debt dynamics exacerbate the weight of fiscal risk as a source of macroeconomic instability. This work is a contribution to the analysis of these issues; in particular, it is focussed on the optimal PDM in the Former Soviet Union (FSU) countries, a relatively unexplored issue in the economic literature.

This Ph.D. thesis is composed by three papers, each one corresponding to a chapter. The first one presents a brief description of the economy and public debt structure of the FSU countries since their independence, while the last two provide the optimal debt structure of Armenia and Lithuania.

Break up of the Soviet Union put the FSU republics in front of a number of issues, which they had to solve on their own. Lack of significant own resources and loss of subsidies from the consolidated budget of the USSR necessitated foreign borrowings of financial resources. In the early years of the transition the republics borrowed from the international financial institutions mainly on concessional terms, thus, external debt increased to extremely high levels. Lately, the markets for debt securities expanded significantly in order to diversify the risks and to look for a different sources of finance. But these financial markets remain undeveloped, which causes extremely difficulties to collect data on debt composition. Chapter 1 is the first attempt to describes the public debt evolution in the FSU republics since their independence, thus, represents a unique contribution to the literature.

Chapter 2, relying on a stylized set of securities and on a simple econometric model of the Armenian economy, analyzes the optimal public debt composition, balancing fiscal and financial risks and costs. Considering several alternative macroeconomic shocks hitting the economy, I find that the balance of risks and costs underlying Armenian public debt can be improved by reducing foreign-currency denominated debt (both on concessional and commercial terms), and by increasing fixed-rate bonds. Also, the analysis clearly supports the introduction of real bonds.

Chapter 3 presents a model in which PDM stabilizes the debt ratio to minimize the risk that the budget deficit exceeds the 3% limit set by the EU Stability and Growth Pact, in face of different macroeconomic and financial shocks affecting Lithuanian economy in the context of a pegged exchange rate. To minimize debt risks and costs the estimated results suggest giving priority to fixed rate securities. The model introduces inflation-indexed bonds and describes the share necessary for potential gains to the government from their issuing.

Chapter 1

Public Debt in the Former Soviet Union countries

1.1 Introduction

Following the collapse of the USSR in the December of 1991, a group of 15 new independent countries has started the different paths of transition from closed command economy to other forms of economy organization. There was no common belief about optimal speed and deep of reforms. Some of them have managed to carry out swift liberalization and successfully pursue reforms, while others have achieved significantly less progress in reforming their economies. This chapter presents a brief description of the macroeconomic situation and overview of the structure and evolution of public debt[1] of the FSU countries: Baltic states, Russia and Western CIS, Caucasian states and Central-Asian states[2] since independence[3].

1.2 Caucasian Republics: Armenia, Azerbaijan, Georgia

Caucasian Republics group explains more geographic position. Azerbaijan possesses considerable energy resources. For Georgia restructuring the energy sector and

[1]Data was taken from the following official sources: IMF Country Reports, EBRD Transition reports and the Ministry of Finance (MOF) of the FSU countries annual reports.

[2]The EBRD provides a classification of transitional patterns of the FSU countries as a result of their geographical location, size, openness and similarities to each other can be distinguished: Baltic states, Russian Federation (RF) and Western CIS (Commonwealth of Independent States), Caucasian states, Central-Asian states.

[3]Above mentioned information on Armenia and Lithuania is presented in separate following chapters II and III.

finding energy supply alternatives to Russia remains a major challenge. Armenia is a member of the WTO from 2003 and its economic ties with Russia remain close.

1.2.1 Azerbaijan

Macroeconomic situation

Following the collapse of the USSR, Azerbaijan's economy suffered from serious political, military, economic and social imbalances reflected four major factors: (i) the military conflict with Armenia over the Nagorno-Karabakh reduced the national territory and produced a large number of refugees; (ii) traditional trade and financial links with FSU countries collapsed; (iii) the terms of trade deteriorated as suppliers from the FSU moved to world market pricing; (iv) fiscal deficits financed by CB money creation fueled macroeconomic instability.

Although Azerbaijan has started the independent government building and economic transformation process, it has inherited a lot of problems from the Soviet period. It was one of only two Soviet Republics which did not receive subsidies from the center (the other being Russia), and it ranked tenth in terms of living standards among the Soviet Republics.

At the beginning of 1990s the economy was characterized by real GDP drop of about 60%, sharp currency depreciation, high inflation (see Fig.1.1), which was largely fueled by production decline, rapid growth of the money supply, and unreformed financial institutions. Market mechanisms did not work normally. There was a deficit of food products in the county. The unstable internal political situation also made it difficult to launch economic reform, and made Azerbaijan unattractive to foreign investors.

In 1996 the economy has started its recovery led by investments in the oil fields which contributed to increases in the construction and service sectors.

The importance of the oil sector has grown substantially since the collapse of the planned economy. Following the signature of a major production sharing agreement between the government and foreign investors in 1994, there has been significant foreign interest in exploration and development of oil ad gas field, estimated at 7,0 billion barrels (0,6% of proven world oil reserves) and 48,4 trillion cubic feet (0,8% of proven world gas reserves), respectively. Thus, oil output started to increase in mid-1990s, to reach 0,3 million barrels per day in 2003, and reaching a maximum of 1,3 million barrels per day in 2010.

In 2009, oil GDP grew by 37% and accounted for 59% of total GDP. Non-oil growth remained at about 12%, driven mostly by strong non-tradable sectors activity, particularly construction, commerce, and communications. While the oil boom has created extraordinary opportunities for economic and social development, it is highly temporary in nature. Oil production is expected to peak in 2014. Trade

is declining with RF and FSU states, while is expanding with Turkey and the EU.

The Azerbaijani economy has withstood the impact of the world economic and financial crisis relatively well. The economy grew at 9,3% during 2009, driven by a pickup in oil production growth, as well as continued growth in services and agriculture. Inflation fell dramatically, from above 20% in 2008 to 1,5% in 2009, driven by falling international commodity prices, and lower domestic and external demand. The unemployment rate remained stable, and the poverty rate declined reflecting lower inflation and higher social spending.

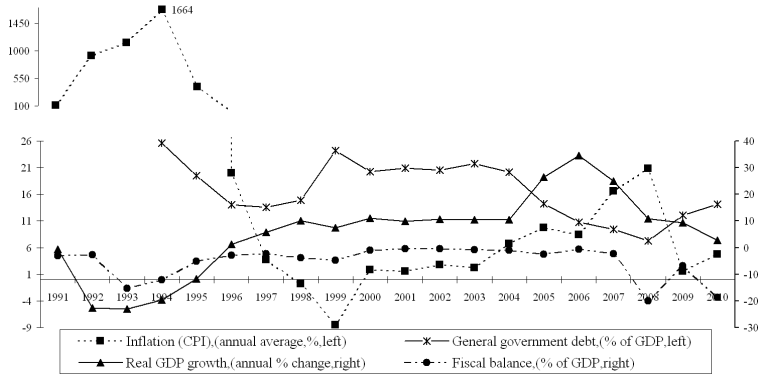

Figure 1.1: Main macroeconomic indicators of Azerbaijan: 1991 - 2010

Government debt

Domestic debt is close to zero, and external government and government-guaranteed debt is around 10% of GDP, with a significant portion on highly concessional terms with Kazakhstan, Turkmenistan, and Uzbekistan (see Fig.1.2).

Domestic debt

The GS market is relatively new and still developing. Its formation started in September 1996 with the issuance of short-term t-bills with an initial offering of 1-month bills with a yield-to-maturity of 31,18%. Since then, most auctions have been for 1-month bills, but 2-month bills have also been offered since June 1997.

T-bills, issued by the MOF to finance the state budget, are bought principally by commercial banks. Brokers-dealers[4] can bid for t-bills at auction. Private investors

[4]In 1999, there were 19 primary dealers, all of which are commercial banks licensed in Azerbaijan, including 2 foreign-owned banks. The CBA has so far chosen not to licence any nonbank financial institutions as primary dealers. Bids from domestic and foreign nonbanks must therefore be placed through banks.

can participate in the primary placement of t-bills or trade them on the secondary market only through a broker and must have a bank/broker account. T-bills are traded at the BSE[5] without limitations also for non-residents.

In 2004 the NBA began issuing short-term notes[6] to support its monetary policy operations. On the other hand, in that same year the MOF considerably reduced the issuance of t-bills. The latter change occurred in spite of the fact that the value of t-bills in the market exceeded, which, together with increased liquidity and the development of market infrastructure, had allowed the government to achieve substantial cost reductions in the service of the internal debt.

Currently, trades of the NBA notes on secondary market constitute 80% of the total transaction volume. Dealers cannot be designated as nominees. Trading and settlement processes are extremely cumbersome; as a result, nearly 2/3 of total GS transactions are not made through the BSE but by means of bilateral addressed transactions through brokers and public notaries.

GS can be issued in both dematerialized and physical form and must be registered in one of two existing registrars if the number of shareholders exceeds 20. At present, 99% of all GS are dematerialized in one of the three institutions that have a license to perform GS depository services: National Depository Center (NDC), the BSE, and another private sector organization. The NDC is the major GS depository[7].

Recently there also has been an increase in initial principal offerings by private sector firms. As a result, the securities market structure increased the share of the private corporate sector. The private corporate sector now accounts for nearly 40% of the total value of securities in the marketplace while the government sector represents the remaining 60%.

Securities are issued through competitive auctions managed by the BSE. Auctions are held periodically, volumes remain small. Thus, secondary market activity remains insignificant and no basis exists for conducting open market operations.

The government plans to increase the issuance of both t-bills and longer-term GS to further develop GS markets. The core elements for the good functioning of the

[5]In 2000, the Baku Stock Exchange was established by a group of shareholders drawn mainly from the banking sector with Turkish and British capital. The BSE renders a range of services to market participants - depositary, clearing and settlement, information services, consulting, and training. Any interested person who is duly authorized by the SCS (created in 1999, the State Committee on Securities has been establishing the key elements for the development of the GS market) to perform capital markets activities may purchase a seat in the trading floor of the BSE.

[6]Short-term NBA notes have a 28-day maturity. Both the notes and the t-bills are offered in the primary market through the regular weekly auctions held by the BSE. The NBA announces the issuance of notes in advance, and information is also made available at the BSE. The primary registrar of the notes is the SCS.

[7]It is a non-for-profit joint stock company totally owned by its regulator, the SCS. Deposit accounts at the NDC identify the final beneficiary. There are approximately 97000 accounts belonging to individuals, while 281 belong to legal entities.

securities market are in place now, and the securities market is expected to become one of the engines to facilitate foreign capital inflows to the country.

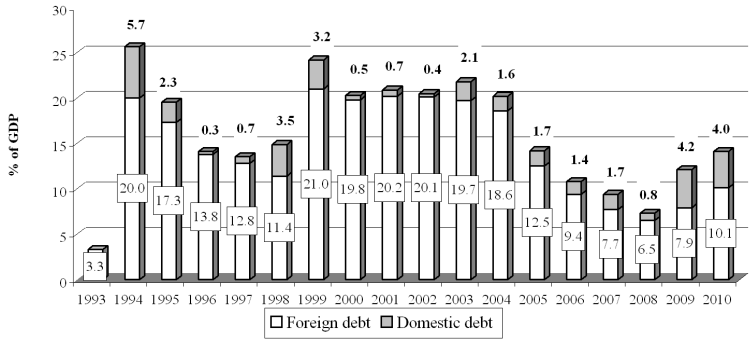

Figure 1.2: Public debt of Azerbaijan: structure and dynamics

External debt

Azerbaijan has reached an agreement on settling its debt to a Turkish company obtaining a judgement in Turkish courts that led to the seizure of three freighters and two aircraft operated by Azeri state-owned companies earlier in 2004, to force repayment of a state guaranteed debt.

External debt in percent of GDP has declined substantially since oil production took off in 2005, and remains low.

Since 2005, the government has been able to use its rapidly growing oil revenues to finance a large part of domestic investment projects, which reduced total external debt from 40% of GDP in 2004 to 20% in 2009. The government issued USD 500 million in Eurobonds in 2010.

1.2.2 Georgia

Macroeconomic situation

The vulnerabilities and policy challenges in the Georgian economy were closely linked to the transitional stage. In 1995 a national currency, Lari, was introduced (replacing the coupon, which was introduced in 1993), which was instrumental in bringing the inflation down to single digits and in maintaining a stable exchange rate of the Lari. Following the severe hyperinflation of 1993-94 (see Fig.1.3), the Lari exchange rate was an important signaling effects in Georgia and its stability was a key element in the government's reform strategy and the remonetization of the economy. The Lari

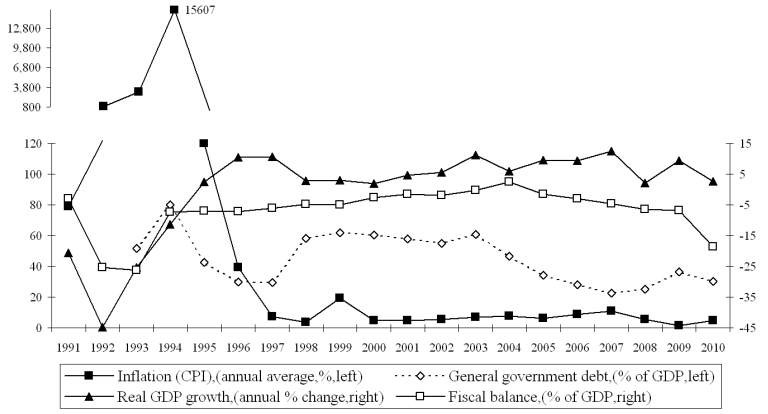

Figure 1.3: Main macroeconomic indicators of Georgia: 1991 - 2010

was pegged de facto to the USD between 1995 and 1998 and price stability helped to remonetized the economy, although monetization remained low and dollarization high. At the end of 1998, the Russian crisis and widespread public concern regarding domestic budgetary problems led to a sharp decline in the demand for Lari and growing pressure on the pegged exchange rate.

The agriculture, mining of manganese and copper, producing beverages, metals, machinery, aircraft and chemicals are the main economic activities. Areas of improvement include growth in the construction, banking services, and mining sectors, but reduced availability of external investment and the slowing regional economy are emerging risks. The country imports nearly all its needed supplies of natural gas and oil products. The energy shortages and gas supply interruptions were overcome by renovating hydropower plants and relying on gas imports from Azerbaijan.

The pace increased after the Rose revolution as a result of strong growth, restrained borrowing and fast repayment of energy debt to Turkmenistan. The fiscal position improved in the second part of 2000 and the exchange rate began to appreciate at the end of 2002.

Georgia became a member of the WTO in June 2000. Turkey became the largest importer of Georgian goods in 2000, and largest export market but exports to Russia were also strong. Russia's share of Georgia's exports dropped sharply in the wake of the Russian crisis.

Georgia sustained GDP growth of 10% in 2006-2007, based on foreign direct investment (FDI) and robust government spending. GDP growth slowed to 2% in 2008 following the conflict with Russia, and contracted by 5% in 2009 because of the global financial crisis.

Government debt

Georgia's public debt is mostly external (see Fig.1.4), includes all foreign loans and government guaranteed loans and can be classified as medium-and long-term debt. The largest creditors are the IMF and the WB. The largest bilateral creditor is Turkmenistan. The large share of foreign debt implies that this component dominates the debt dynamics. Improved economic conditions are expected to favor the development of the domestic t-bill market and reduce reliance of the government on NBG credit. The domestic market for GS consists of t-bill, loans from the NBG,

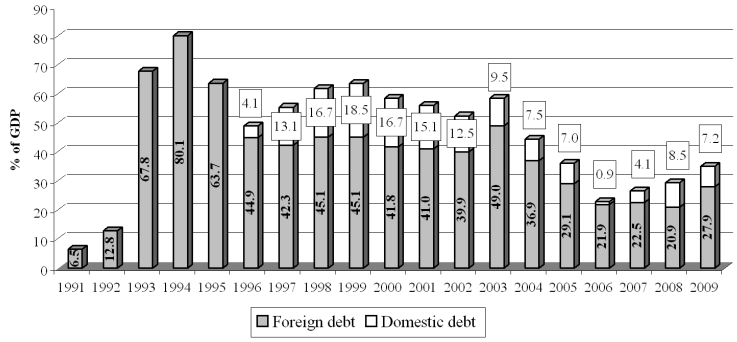

Figure 1.4: Public debt of Georgia: structure and dynamics

and historical debt from the Soviet era and remains limited. The only GS are t-bills, which are issued in small amounts in 28 and 91-day maturity, reflecting the general preference for highly liquid instrument. At present the only purchasers are the banks and in practice the secondary market does not function, partly because of the differential tax treatment afforded to the interest yield on traded GS (20% profits tax) compared with those held until final maturity (10% withholding tax). Currently, some developments in the t-bill market are remarkable as interest rates declined and market perceptions changed reflecting growing confidence.

Debt sustainability in Georgia depends to a significant extent on fiscal performance, in particular on efforts to improve tax collection. From 2004 through mid-2009, Georgia's private external debt increased rapidly, while public debt fell to low levels. This reflected a sharp increase in capital inflows, including loans and deposits from abroad, and a shift away from official to private forms of external financing.

Domestic debt

Primary t-bills auctions[8] were introduced in August 1997. Initially the maturity of the t-bills auctioned in the primary market was limited to 28-day bills only, but starting from November bills with 91-day maturity also became available. The NBG does not participate in the primary market and a secondary market is under development[9]. Despite the decline of annual inflation, the t-bill yield prevailing in the primary market has been very high and volatile (from 7,7% to 41%). While the volatility in the t-bill yield is related to a thin primary market and the authorities' lack of experience in this area, the yield level reflected the stance of fiscal policy.

T-bills accounted to 4% of all domestic financing in 1997. Concerns about the weak budgetary position and the Russia crisis had an adverse impact on market, and the authorities, unwilling to pay higher interest rates of 30-40%, reduced the incentives for a more substantial issue of t-bills. The entire stock was retired in December 1998[10], after a peak stock of outstanding bills had been reached in mid-1998. The auctions resumed in August 1999 but continued lack of confidence in fiscal policy limited sales, thus small amount offered was sold at below market rates. The government resorted to direct borrowing from the banking system, thereby undermining the t-bill market. In October, the 91-day t-bill was reintroduced, with an interest rate of 15,8%. In November, the continued weak fiscal position forced to educe issuance below announced levels and 91-day t-bills were discontinued.

Conditions improved in 2000, as the fiscal situation improved and the practice of direct borrowing was stopped. The t-bill market remains thin in 2001, thereby limiting the development of indirect monetary instruments. Interest rates have generally declined since 1999, reflecting the decline of inflation, although the Turkish crisis adversely affected rates at the beginning of 2001. T-bill yields edged downward from 12% in to 7% in 2000. They rose again in 2001, influenced by concerns surrounding events in Turkey as well as a weakening of the fiscal situation. As market sentiment improved, maturing t-bills have been rolled over smoothly and yields have fallen from 77% in 2003 to 23,2% in 2004.

[8]Participation in the primary auctions is limited to licensed commercial banks. About 4 banks participate in each auction although 11 banks presently licensed have participated at one time or another. Other interested buyers including non-residents can purchase t-bills through licensed banks. T-bills are auctioned in a dematerialized (book entry) form by the NBG and settlement is also handled by the NBG. The average frequency of primary auctions is once a month for the 28-day bills and twice a month for the 91-day bills.

[9]A t-bills secondary market existed before the Russia crisis, but it lacked a clear venue for bringing buyers and sellers together, contributing to its lack of development. During 2001, a small size of the primary market limited its development. The NBG supported its development by introducing in 2009 an electronic trading platform.

[10]Prior to the crisis, the outstanding stock was concentrated in 91-day maturity bills, most of these were owned by commercial banks, with around 10% owned by non-banks, including non-residents who held a small amount.

Georgia terminated its domestic debt program in mid 2000 when the interest rates reached double digit numbers and restared the program in 2009 with issuance of short-term t-bills. In 2009, t-bills were reintroduced as response to a market development need to provide the NBG with another monetary policy tool and allow the banks to diversify their portfolio to include an important class of risk-free assets. The cost of financing from this source was low. Government continues the issuance of t-bills in 2010 and plans to introduce 2-year t-notes.

External debt

Georgia cleared its arrears to Russia and ratified the agreement on the settlement of external debts and assets of the Soviet Union (known as the zero option agreement). From independence to 1994, Georgia accumulated 81% of GDP in external debt, following a civil war and economic collapse, much of it stemming from energy sector borrowing. About 45% of this debt was incurred as a result of unpaid gas imports from Turkmenistan during 1993-94.

The creditor composition of external debt has changed since the early years of independence, as financing from IFIs increased in the mid-1990s. The share of bilateral creditors in the total debt stock continues to decline, while the share of multilateral creditors increases. This change has resulted in an increase in the degree of concessionality. A significant part of this debt is related to credits from FSU countries (especially Russia and Turkmenistan) contracted mostly during the early 1990s to finance energy-related imports[11].

The rapid debt accumulation Georgia has sought to ease through a series of rescheduling[12] However, Georgia soon began to accumulate arrears on some of the rescheduled debt.

Most of the additional debt accumulated after 1994 reflected concessional lending by multilaterals, aimed at supporting efforts to promote macroeconomic stabilization and structural reform. In the context of macroeconomic adjustment and more limited borrowing, the pace of indebtedness slowed during late 1990s, although the debt continued to grow in absolute terms. By 1999, the debt stock rose but the ratio to GDP declined to 60%, following output growth. With little net borrowing, debt accumulation has slowed in 2002 (because of the large 1999 depreciation of the Lari following the Russian crisis, the ratio to GDP declined to 53%).

The nature of the debt problem in 2000 was not too different from the situation in 1994, despite concessional multilateral lending and bilateral debt rescheduling. The

[11]FSU countries accounted for 65% of total claims in 1994, but their share had come down to 31% by 2002. Claims by Paris Club creditors, excluding Russia, have been around 10% and have increased since 1994. In turn, the share of the IMF and the WB claims has risen since 1994.

[12]During 1995-98, Georgia negotiated 11 separate rescheduling agreements with its bilateral creditors, on the basis of a 4% interest rate and grace periods ranging from 2 to 5 years.

main vulnerability continued to be liquidity, as debt service obligations accounted for a high share of fiscal revenues and gross reserves. The liquidity problem reflected the short repayment period negotiated with Turkmenistan and slower than expected macroeconomic recovery.

In 2001 Georgia became the second CIS country after Russia to reach an agreement to reschedule principal payments falling due over the next two years[13] with the Paris Club creditors[14]. Although the agreement was based on Houston terms, which are classified as nonconcessional[15], the low interest rate and the long repayment period reduced the net present value of bilateral debt. Since the agreement, the rounds of negotiations were held with Turkmenistan[16]. Foreign debt remains a major issue and there is need to continue cooperation with the Paris Club to restructure concessional debt.

The year 2008 marked a shift in the debt management policy as the government tapped international markets with a USD500 million Eurobond issue. The global crisis changed radically the debt dynamics. Private inflows dried up as banks lost access to capital markets, but large fiscal and balance of payments needs, including banks' repayment obligations, were addressed by loans and grants from donors. In 2009, the external debt stock was less than USD3 billion, more than USD500 million above the 2008 level. The fiscal impact of the crisis and the related policy response imply a further increase in public debt in the next 2 years.

1.3 Baltic Republics: Lithuania, Estonia, Latvia

Baltic Republics, members of the World Trade Organization (WTO), have joined the European Union (EU) in May 2004. Monetary policy based on a fixed exchange rate of the national currencies against the Euro, following Euro adaption. Due to the global financial crisis in 2008, the Baltic republics had the world's worst economic declines in 2009.

[13]Creditors agreed to consider a further extension of the consolidation period. Maturity on bilateral and commercial debt falling due within this consolidation period is to be repaid over 20 years, with a 3-year grace period and a graduated repayment schedule. The interest rate on previously rescheduled debt is to be no higher than 4%.

[14]Participants were Austria, Georgia, Netherlands, Russia, Turkey, and the US.

[15]Nonconcessional external loans are defined as loans from lenders other than the IMF with a grant element of less than 35% of the value of the loan. The grant element is to be calculated by using currency-specific discount rates reported by the OECD. For maturity of less than 15 years, the grant element will be calculated based on six-month averages of commercial interest rates. For maturity longer than 15 years, the grant element will be calculated based on 10-year averages.

[16]Negotiations were focused on in-kind transactions, including contracts to service Turkmen aircraft, to reduce the debt.

1.3.1 Estonia

Macroeconomic situation

Since regaining independence in mid-1991, Estonia has moved swiftly and comprehensively in most areas of structural reform to support the transition to a market economy. In several policy areas reforms had been initiated earlier[17].

During 1991-1994, the main focus of structural reforms was on (i) completing the liberalization of prices, wages, and interest rates; (ii) fully liberalizing the exchange system and external trade; (iii) reforming tax policy and administration; (iv) privatizing state-owned enterprizes and promoting private sector development; (v) establishing the legal framework required for the functioning of a market economy; and (vi) restituting property or compensating the previous owners of real estate.

In mid-1992, the currency - Estonian kroon - became fully convertible for current and capital transactions within the context of a currency board arrangement[18] (first in 1992 to DM and than to Euro).

Estonia is a small open economy with stable economic growth. Its income depends mainly on exports. It has no external tariffs, very limited restrictions on international capital mobility and free trade agreements with all main trading partners. This transparent and liberal external policy framework has helped boosting Estonia's trade with Western countries after independence and has played an important role in attracting foreign investors. Coupled with the close cultural and geographical ties to the Nordic countries, the development led to deeper economic integration in the Baltic Sea region in the form of growing trade and cross-border investment activity. Growth prospects of economy are supported by strong export demand due to the favorable external environment, low real interest rates, increasing incomes and intensified EU funds inflow.

Estonia has transitioned effectively to a free market economy with strong ties to the West. The economy benefits from strong telecommunications and electronics sectors and is influenced by developments in Finland, Sweden - two major trading partners. By now, Estonia has one of the highest per capita income levels and is considered one of the most advanced transition economies in CEE and the Baltic region. It has a large share of the private sector in the economy, estimated at 70%, and is ranked favorable in indicators measuring progress in transition. The current account deficit remains high; however, the state budget is balanced, and public debt is low. During 2008 crisis the economy slowed dow (see Fig.1.5).

[17]For example, the first commercial banks were established already in 1988-89, and the central bank, the Bank of Estonia, was founded in 1989. The lifting of price controls began in 1989. The law on economic autonomy for the three Baltic states, passed by the Soviet Union's supreme court, became effective in 1990.

[18]The country entered ERM II in 2004, unilaterally maintaining its peg to the Euro with a CBA and is aiming at an early Euro adoption.

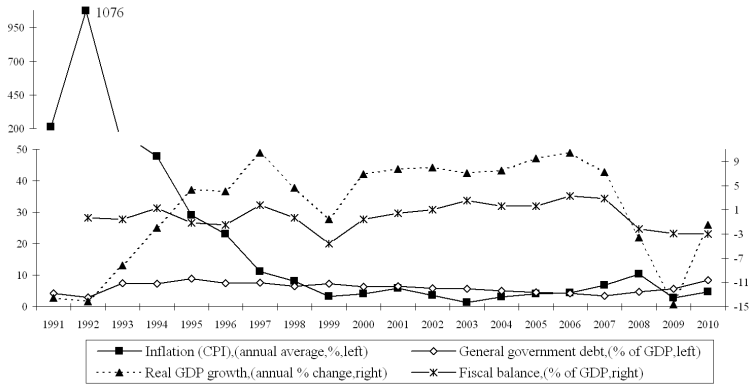

Figure 1.5: Main macroeconomic indicators of Estonia: 1991 - 2010

Government debt

The legal basis for debt management is established in the Organic Budget Law. Prudent fiscal policies during most of the transition period generated relatively small amounts of debt. The central government has almost no internal debt and its stock of external debt is currently less than 3% of GDP (see Fig.1.6). Local governments, however, have substantial domestic debt[19].

The only international bond Estonia has issued was fixed rate bond in 2002 with 5-year maturity and in EUR100 million. Currently Estonia doesn't have any bond issues at the market. The MOF has the right to determine modalities for managing the state's money, securities, and other financial assets, which include money in the treasury's two main accounts, as well as the pension reserve and Stabilization Reserve Fund.

Domestic debt

Public debt is very low in Estonia, so there are no debt sustainability concerns. Estonia's public deficit and debt remain among the lowest in the EU. This can be attributed to a large and timely fiscal effort, a favorable starting position, as well as strong budget institutions and prudent macroeconomic policies.

[19]One reason for this is that only the central government budget has been in surplus, while the revenues of local governments have remained lower than their expenditure (public debt is divided almost equally between the central and local governments). Secondly, the central government debt has decreased but the respective repayment decisions are not determined by the budget surplus of the current year but by the repayment terms of loans in the loan contract.

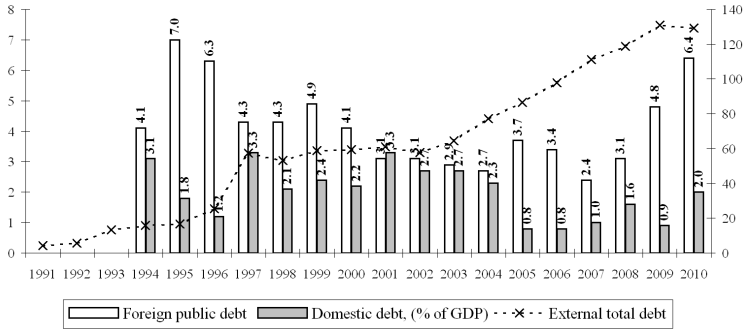

Figure 1.6: Public debt of Estonia: structure and dynamics

External debt

Estonia has been forced to borrow more in foreign currencies. About 70% of the central government debt is borrowed from abroad for investments and major acquisitions. According to loan contracts, the majority of loans have been granted in the past decade by IFI. Local government is small, it is difficult to get direct access to external funders and 90% of local governments' debt is loans from Estonian banks.

Estonia has attracted substantial FDI in recent years. During the early years of transition, FDI inflows were driven in part by the opportunities created by privatization. The consolidation and restructuring of the banking sector also attracted substantial foreign investment. Estonia represents as attractive destination for foreign investors, namely potential market growth in the region, low production costs, political and exchange rate stability, the absence of capital controls and the rapid pace of economic reforms. Estonia has also benefited from its geografical proximity to historical ties with Finland and Sweden as a bridge into the Baltic market. Finland and Sweden account for two thirds of the stock of FDI.

There is practically no market for GS. In n order to refinance more costly WB loans and to test the market sentiments towards Estonia, in 2002 the government issued the first and the only international fixed rate Euro-denominated bonds in EUR100 million with 5-year maturity for financing USD loans. The yield on that bond has been moving in line with the yields of government bonds issued by other European countries. Currently Estonia do not have any bond issues at the market

In Estonia, the creation of a sound government debt market supports the formation of private sector debt markets. GS yields can be used as reference rates for corporate bond issues, the pricing in the markets for commercial paper, etc. In addition, the infrastructure and the procedures established for the government debt market can be used as a model for private sector debt markets.

Total foreign debt, nearly all private, reached 85-90% of GDP in 2009, which is high compared to other fast-growing economies. About 90% of these GS are long-term bonds.

1.3.2 Latvia

Macroeconomic situation

The Russian crisis had a significant impact on the Latvian banking system and exposed vulnerabilities that had built up during the expansion period from 1996. But Latvia recovered from the Russian crisis, largely due to the government's budget stringency and a gradual reorientation of exports toward EU countries, lessening trade dependency on Russia.

Now 75% of exports is related to the EU markets, mainly machine building and wood processing sectors. Exports to the CIS countries determined by the export of agricultural, food and chemical products. 80% of FDI stock is from the EU states, 1/3 of them from the new EU states. Major investors are Estonia (21%), Sweden (18%), and Germany (9%). After rapid economic growth, when GDP increased by

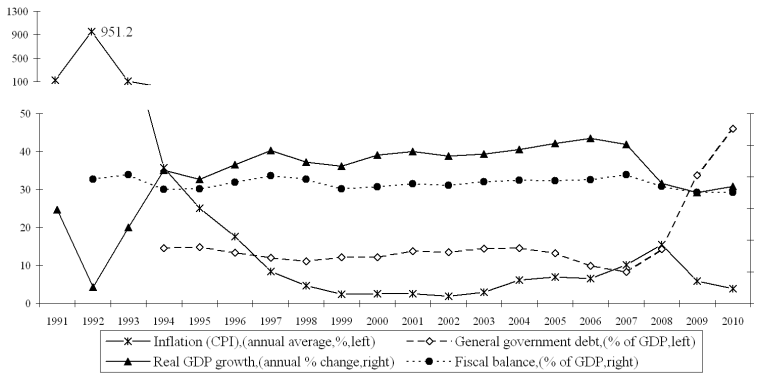

Figure 1.7: Main macroeconomic indicators of Latvia: 1991 - 2010

11% per year (see Fig.1.7), lasting several years, the economy entered a severe recession, consequently, GDP decreased by 18% in 2009, bringing Latvia's vulnerabilities to a head, as a result of the global financial crisis in 2008. Years of unsustainably high growth and large current account deficits have coalesced into a financial and balance of payments crisis.

Government debt

GS market regulation was adopted in 1997 and is currently being carried out by the Securities Market Commission[20], an independent agency, overseen by the MOF.

In Latvia, the general government is the major issuer of debt (see Fig.1.8). In contrast to Estonia, the Latvian government issued securities in excess of fiscal needs to help establish the domestic bond market and promote long term financing in domestic currency. Nonetheless, corporate issues are still dominant and issues by financial institutions continue to be insignificant as well. Public debt is very

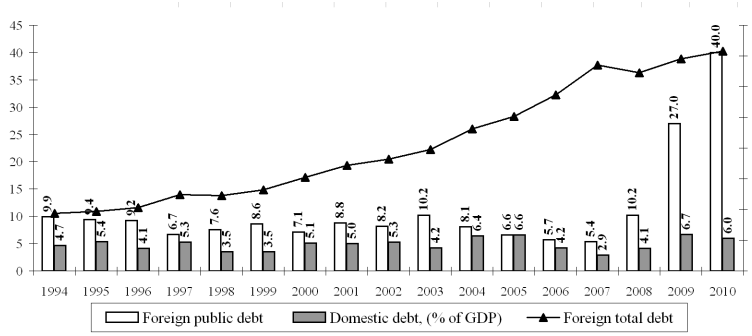

Figure 1.8: Public debt of Latvia: structure and dynamics

low and is expected to remain sustainable: while it increases in the near-term, it is projected to decrease by 2013. The much heavier external debt burden is mostly concentrated in the private sector with a significant share (40% of total external liabilities) owed to affiliated banks and companies of foreign enterprises operating in Latvia. Though the external debt to GDP increases marginally over the next two years, it is also declining as public external debt is repaid. Latvia's external debt remains vulnerable. Moreover, the low public debt level provides room to the government to absorb some (foreign and domestic) private liabilities, should this be unavoidable, without threatening fiscal sustainability.

Domestic debt

Both primary and secondary market activity was and remains dominated by government debt, although, the share of debt of financial institutions traded in the secondary market increased. About 95% of the trades in GS were conducted via

[20]The commission, which began operation in January 1998, is built on the Danish model. The chairman is proposed by the MOF and the Bank of Latvia and ratified by the parliament.

the over-the-counter market while the remaining 5% were traded via the stock exchange. Nonetheless, with the listing of GS at the Riga Stock Exchange in 1999, stock exchange trading has gained in importance.

In terms of maturity, about 19% of GS outstanding at end-2000 were short-term, while the remaining stock had a maturity between 1 and 10 years. Since early 2003, the maximum maturity for domestic currency bonds is 10 years.

External debt

Because of the slowing economy, public debt increases taking the external debt (with original maturity below one year including non-resident deposits at call) to around 130% of GDP in 2009, which is the highest among EU new member states.

A large share of Latvia's high external debt has a domestic debt counterpart, since it is owed to foreign parent banks and then on lent to Latvian households and corporations, whose debt service capacity is likely to suffer in the coming slowdown.

Latvia's loss of investor confidence is linked to global developments, though domestic banking problems have exacerbated this trend. The speed with which access to capital markets returns will depend in large part on global markets. Latvia has a strong track record in servicing its external debt. Latvia's access to private financial markets will likely be restored, particularly if international financial markets normalize, or if it is able to join the Euro area.

1.4 Central-Asian Republics: Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan, Tajikistan

Half of the region's countries are exporters of oil and gas (Kazakhstan, Turkmenistan, and Uzbekistan), while the others are importers (the Kyrgyz Republic, and Tajikistan). The economy was hit hard by the 1998 Asian-Russian shock, and the 2008 global financial economic crises had a profound impact on domestic economic development.

1.4.1 Kazakhstan

Macroeconomic situation

Kazakhstan saw its output collapse after independence. From 1996, the economy started to grow (see Fig.1.9). The initial recovery was based on the emerging oil industry. By 1997, macroeconomic stabilization was largely achieved, its domestic market became fairly liberalized and opened up to foreign competition, and the role of the state in the economy was reduced. The financing of the deficits didn't posed

major problems since Kazakhstan has benefited from large FDI inflows, mainly into the oil and gas sector[21]. As elsewhere in the region, and in the transition economies generally, poverty is a major concern. The non-oil economy decreased or stagnated for most of the decade, but started to grow from 2000 on to diversify the economy away from overdependence on the oil sector. In 1998 Kazakhstan was affected by

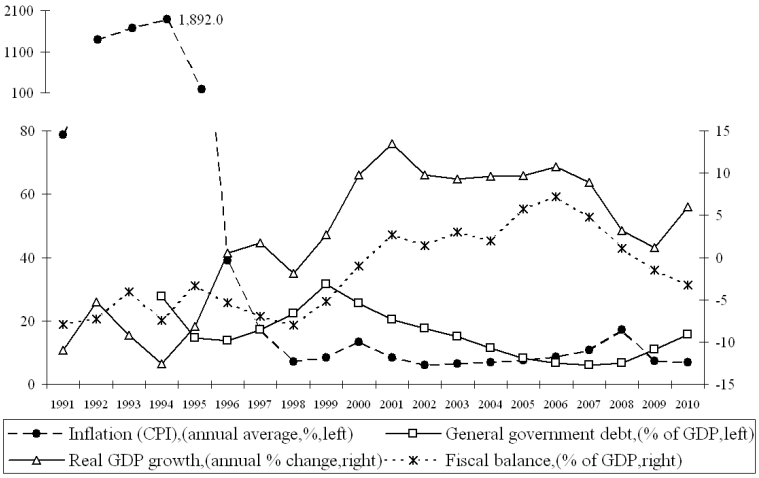

Figure 1.9: Main macroeconomic indicators of Kazakhstan: 1991 - 2010

four major shocks: (i) a fall in the prices of oil and other primary commodities, (ii)a sharp real depreciation of the Russian ruble, (iii) turmoil in emerging markets, and (iv) a severe drought. The crisis in Russian and Asian countries led financial market participants to revaluate their emerging market portfolios. As a result, the premium on Eurobonds issued by Kazakhstan jumped in the mid-1998 and Kazakh borrowers found themselves effectively cut-off from international financial markets.

Kazakhstan is relatively open economy, however, also displays the trade structure of a resource-dependent economy. While 78% of exports are accounted for by oil and other nonagricultural commodities, imports are dominated by consumer, investment and intermediate products which typically display more stable prices.

Country's geographical location in Central Asia opens up access to large markets in both the west (Europe) and the east (China and south-east Asia), thus enabling both expansion and diversification of export markets.

Kazakhstan enjoyed growth of 8% in 2002-2007 - thanks to its energy sector, economic reform, good harvests, and FDI. GDP growth slowed to 2,4% in 2008, and

[21]Kazakhstan possesses enormous fossil fuel reserves (oil and natural gas) and plentiful supplies of minerals and metals. Its reserves are second to only Russia's among the CIS countries. It also has a large agricultural sector featuring livestock and is a major grain producer in the CIS region.

turned negative in 2009, as a result of declines in oil and metals prices and problems in the banking sector following the global crisis.

Country continues to face significant challenges from the ongoing difficulties in the weak global backdrop. The financial system remains highly stressed. Nevertheless, Kazakhstan is better placed given its large official foreign currency assets and low public debt.

Government debt

Since Kazakhstan is a major oil producing and exporting country, the fiscal position is dependant on revenues from the oil and gas sector and is therefore volatile. Due to the rapid increase in the share of the oil sector in the economy, the oil price is the most important factor explaining the volatility of government revenues.

External debt is a component of state debt for external state loans and other debt obligations of the government, local executive authorities, and the NBK owed to nonresident creditors of Kazakhstan, while internal debt is a component of state debt for internal state loans and other debt obligations of the government, local executive authorities, and the NBK owed to resident creditors of Kazakhstan. Most of the stock of government debt is denominated in, or indexed to the USD.

Since the start of the transition and up to 1999, the government had accumulated a sizable stock of debt used to finance successive public deficits. Moreover, owing to the impact of two external shocks in 1998, the Russian crisis and the fall in price of oil and other commodities, net debt rose sharply to reach 31% of GDP at the end of 1999. Thanks to a recovery in the oil price and a phasing out of the effects of the Russian crisis, the fiscal position has improved remarkably.

At end-1999, 86% of total debt (78% of which foreign debt) was denominated in, or indexed to, a foreign currency, mostly the USD. Moreover, at the beginning of 2000, a large part of domestic debt was refinanced through an issue of a 7-year Eurobond. The average maturity of foreign debt was 9,8 years, while that of domestic debt was 4 years. In 2000, a large part of domestic debt, a special state bond issued to the pension funds was refinanced through a new Eurobond issue, and the government has gradually increased the issuance of government bonds with longer maturities and reduced the amount of short-term T-bill issues.

Now both the level and composition of net public debt are not a major source of fiscal vulnerability. Rapid GDP growth and the appreciation of the Tenge reduce the debt ratio. Public debt has been declining as % of GDP, and this trend is likely to continue as the government shifts to domestic financing. External debt, which is almost entirely private, would remain at a manageable level even if it faced multiple negative shock scenarios (see Fig.1.10).

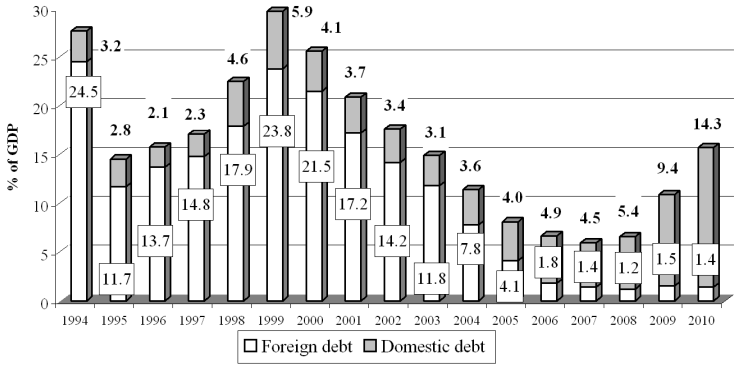

Figure 1.10: Public debt of Kazakhstan: structure and dynamics

Domestic debt

Domestic state debt is composed of short, medium-and long-term treasury GS; medium-and long-term indexed treasury GS; and long-term savings treasury GS.

First 3-months t-bills were issued in December 1995. The financial system in continued to deepen in 1997, when the government introduced t-bills with a maturity of 2 years and the trading volume continued to shift away from 3-month t-bills to those with longer maturities where the refinancing risk is smaller.

The public debt market is in stage of developing improving the operations of secondary market. Development of a deeper domestic debt market requires a more solid, domestically derived yield curve up to 7 to 10 years. To that end, the government considers an issuance schedule that comprises less frequent but larger auctions of more standard type of long-term bonds with a substantial proportion of fixed-income GS, the issuance schedule set for reasonable period of time in advance, and transparency to the market.

Domestic debt, amounting in 2010 to only 14% of GDP, is expected to increase as the government substitutes some foreign debt with domestic debt to support capital market developments.

External debt

The stock of external debt relative to GDP increased in 1997, but remained just above 20%. The single most important factor behind the increase in the external debt stock was the sovereign 5-year Eurobond issue, to finance the clearance of remaining pension arrears.

External debt ratios decline steadily on account of continued high economic growth, Tenge appreciation, and the projected amortization profile, particularly of

intra-company loans[22] in an environment of sustained high oil prices.

With the exception of the Eurobonds most of the foreign loans of the government are from international or official bilateral financial institutions[23]. Therefore, the refinancing risk is rather limited, and more than adequately covered by foreign assets of the government.

While the rapid accumulation of private sector foreign debt continues, external debt is expected to remain at a manageable level, given the large share of long-term and in large part comprised of intra-company loans, mainly in the oil, gas and mining sectors, without specified repayment schedules. Nevertheless, the level of private external debt (65% of GDP in 2009) remains high, and only part of it may have been used to finance the tradable sector.

1.4.2 Kyrgyzstan

Macroeconomic situation

Break up of the Soviet Union put the Kyrgyz Republic in front of a number of issues, which had to be solved on its own. Lack of significant own resources, loss of subsidies from the consolidated budget of the Soviet Union necessitated foreign borrowings of financial resources. The significant part of the resources was allocated on supporting the budget and the national currency. In this situation lack of a coordinated borrowing policy and weak foreign debt management based on lack of necessary experience in this sphere at the initial stages, led to the foreign debt growth from the zero level in 1992 up to about USD2 billion in 2006.

Kyrgyzstan experienced a dramatic contraction of economic activity and high levels of inflation (see Fig.1.11). Since 1992, the government has implemented a reform program aimed at creating a market economy. In the early years of the transition, the Som - Kyrgyz currency, introduced in 1993 replacing the Russian Ruble, experienced a high degree of volatility. The economy is heavily weighted toward gold export. Thus, Kyrgyzstan enjoys strong international support and Kumtor[24] is its largest FDI. A small, open transition Kyrgyz economy has been heavily dependent on gold and agriculture output (tobacco and cotton are exported in any quantity). First signs of macroeconomic stabilization appeared in 1994. This

[22]About one half of all external debt obligations in 2004 were intra-company loans, almost one quarter represented obligations of banks, about 10% were government or government-guaranteed obligations, and about 7% were trade credits.

[23]IBRD, Asian Development Bank, EBRD, Islamic Development Bank, Saudi Development Fund, Kuwait Fund, Abu Dhabi Fund, Japan Bank for International Cooperation, German government, Foreign commercial banks.

[24]The Kumtor Gold Company (owned two-thirds by the government and one-third by Canadian mining company) was established in 1992 to develop the gold mining. The gold deposit was itself discovered in 1978 and is now considered to be eighth largest in the world.

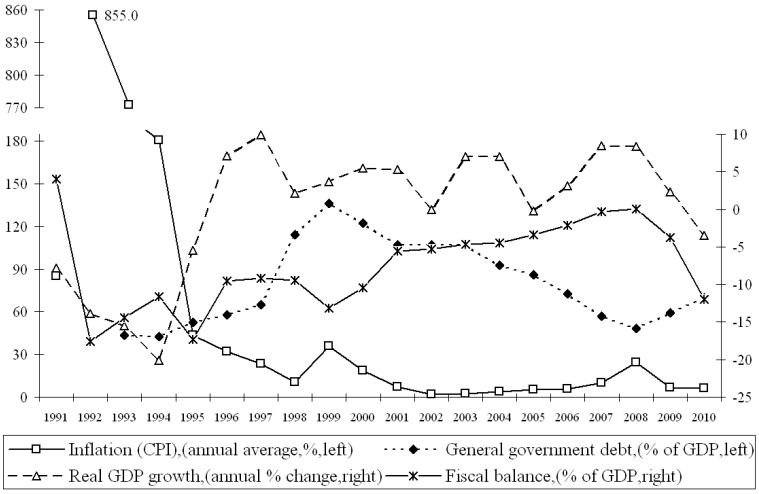

Figure 1.11: Main macroeconomic indicators of Kyrgyzstan: 1991 - 2010

return of positive real growth was primarily attributable to increases in agricultural production. The Kyrgyzstan was the first CIS country to be accepted into the WTO. Industrial exports include gold, mercury, uranium, natural gas, and electricity.

Nevertheless, it is among poorest CIS countries, it is among the more advanced transition economies in Central Asia in terms of market reforms, but weak state and corporate governance, legal uncertainty, and corruption impede the pace of development.

GDP grew 6% in 2007-2008, partly due to higher gold prices internationally. The 2008 global crisis hurt the economy mainly through trade and remittance channels. Russia and Kazakhstan remain key trading partners of the Kyrgyzstan and the main source of remittances. With these countries in recession, Kyrgyz GDP growth declined 1% in 2009 before recovering modestly in 2010. The rise in international commodity prices caused a sharp increase in Kyrgyz inflation to 13,6% in 2009 and a worsening of the external position.

Government debt

The Kyrgyzstan faces a potential vulnerability due to the high level of its public debt. Most public debt is externally held and foreign currency denominated and hence subject to exchange rate risk. The main reasons for the rapid accumulation of foreign debt include the relatively large borrowing for the Public Investment Program, the accumulation of a large stock of contingent liabilities through government guarantees of state-owned enterprizes borrowing and the 1998 Russian and 2008 global financial

crisis and the subsequent devaluation of the Som.

Public debt is allocated between domestic and external debt by reference to the residence of the creditor. Domestic debt is classified by Kyrgyz type of instrument. External debt is classified into concessional and nonconcessional debt. Multilateral debt is classified by the individual international organizations. Bilateral debt is classified by creditor country.

The public debt and assets department of the Ministry of Economy and Finance is responsible for debt management[25].

Realization of activities on reduction and efficient foreign debt management, as well as comprehensive restructuring of the Paris Club in 2002 and 2005 led to the improvement of debt indicators. Thus, correlation of foreign debt to GDP decreased from 112% in 2000 to 41% in 2008 (see Fig.1.12). However, the situation with public debt still remains unstable and in 2010 the debt reached 62% of GDP. The problem of debt instability locks economic reforms, carried out by the Kyrgyz government to further improve the system of state debt management and to get debt stability.

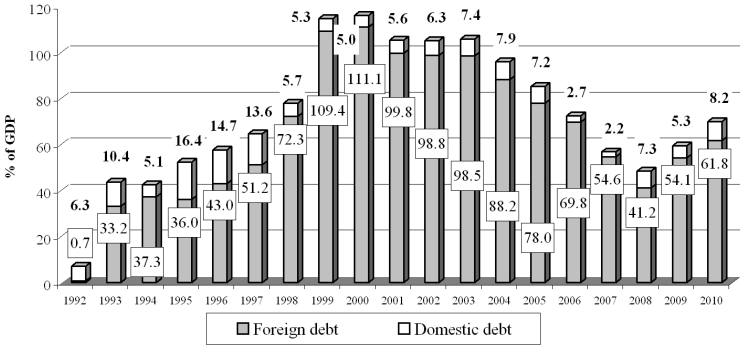

Figure 1.12: Public debt of Kyrgyzstan: structure and dynamics

Domestic debt

During the early years of transition and after the introducing of the som, the domestic financing of the budget deficit reflected almost entirely credit from the NBKR. In 1993 the government started to finance part of the budget through sales of t-bills. In 1997, the composition of the domestic component of the budget financing shifted further away from direct credit to t-bills, and in 1998, no direct credit from the CB

[25]It systematically monitors the stock, disbursements, principal and interest payments, both actual and falling due, on public debt. The National Bank of the Kyrgyz Republic (NBKR) collects information on external debt, including private sector debt, and external sector statistics.

has been granted. At the end of 1998, domestic public debt, excluding debt to the CB, was about 5,5% of GDP.

In 1996-1998 average interest rates on 3-month bills fluctuate from 18% to 143% due to the Russian crisis. The volume of newly sold t-bills of all maturities dropped during the first half of 1998. While the stock of outstanding GS rose rapidly in mid-1998. This sudden change in demand led to a virtual drying up of the domestic t-bill market, with new bill issues not even covering the redemption of maturing securities. After the outbreak of the Russian crisis, the 3-month interest rate climbed steadily to 116% in late 1998. The Russian debt moratorium created some doubts among holders of Kyrgyz GS as to whether the government would honor its T-bill obligations, requiring a substantional risk premium on such bills. At the peak of interest rates in early November 12-month bills yielded 87% compared to 100% for 6-month bills and 143% for 3-month bills.

Domestic debt consists of treasury paper, and foreign exchange-denominated loans. In spite of the absence of restrictions on sale of GS to foreigners, non-residents' holdings of Som-denominated government debt has been, and still is, very limited. Domestic debt is projected to increase and will play a more important role in financing the budget deficit. Domestic debt currently accounts for less than 7% of GDP and is held mainly by the NBKR. However, by 2028, domestic debt is projected to reach 40% of total public debt as domestic financial markets deepen.

External debt

External public debt continued to increase rapidly in 1996-1998, reflecting the need for external resources from the international community to finance large, albeit declining, fiscal deficits and the public investment program. Nevertheless, in 1998, the external debt stock was equivalent to 66% of GDP compared to virtual zero in 1991. The majority of this debt was on highly concessional[26] terms from IFIs.

As a result of fiscal laxity since independence, poor debt management and the shock from the 1998 Russian crisis, the external debt burden began to swell. These problems were compounded by the low and often negative rates of return of many of the investments financed by the external debt accumulation, thereby undermining the debt repayment capacity. As a consequence by the early 2000s the external debt had risen to the equivalent of the country's GDP, up from one-third of GDP in 1995. During 2000-05, the country achieved broad macroeconomic stability, and

[26]A debt is considered concessional if the grant element is at least 45 percent, calculated by using currency specific discount rates based on the Commercial Interest Reference Rates (CIRRs) published by the OECD. A lower grant element is considered only for new debt committed to replace old debt originally contracted at less favorable terms. The average of the CIRRs over the last 10 years is used for debts with a maturity of at least 15 years and the average CIRR of the preceding six months is used for shorter maturities.

prompted by a growing awareness of the problematic debt overhang, the authorities were able to stabilize the debt ratios, mainly through fiscal consolidation supported by enhanced coordination between the IFIs.

The Kyrgyzstan in 2002 and 2005 has had two debt restructuring agreements with the creditors of the Paris Club. The high level of external debt makes it critical to attract private investment, which, in turn, will allow to grow out of poverty.

All external debt is long term and is defined as public and publicly guaranteed debt to non-residents. There is also no breakdown of type of interest rate, as close to 100% of debt has a fixed interest rate. The government has neither debt swaps nor arrears. The private sector debt includes the Kumtor gold mine debt, amounting to about 10% of GDP in 2009[27].

1.4.3 Tajikistan

Macroeconomic situation

The beginnings of economic reform were seriously delayed strained by the continued civil wars since 1992 and repeated changes of political leadership. Thus, real output declined by more than half from 1991 to 1996 (see Fig.1.13). Moreover, this fall reflected a variety of other factors: (i) the break-up of the USSR including the collapse of inter-republican trade arrangements and elimination of grants from Moscow (40% of Tajik GDP); (ii) internal factors, most notably natural disasters - floods. After parliamentary elections held in 1995, the political environment began to improve. In 1996 the first comprehensive effort at economic reform was done. The national currency was introduced in 1995, replacing the Russian ruble.

Tajikistan is a small open economy with large share of imports from non-CIS countries, in GDP of 50%. Foreign exchange earnings are heavily dependant on aluminium and cotton production[28], which constitutes the bulk of industrial output. Agriculture is a key sector of Tajik economy. Industry consists only of a large aluminum plant, hydropower facilities, and small obsolete factories mostly in light industry and food processing. Tajikistan's economy significantly developed at the end of the pre-crisis period, which promoted important positive changes at the macroeconomic level. The country's economic development was driven to a

[27]The Kumtor debt was included in public debt as the state-owned KyrgyzAltyn owned 66% of the mine. Now the Kumtor gold mine is owned by Centerra company which is listed in the Toronto Stock Exchange and only 20% of its shares are held by KyrgyzAltyn.

[28]About 50% of the active population is employed in the cotton sector, and 35% of irrigated agricultural land is used for cotton. However, cotton accounts for around 4% of GDP and 13% of total exports it is the most important crop. But this sector has presented a steady decline in productivity and profitability, largely due to mismanagement, poor regulation and governance, excessive state interference, obsolete infrastructure and debt.

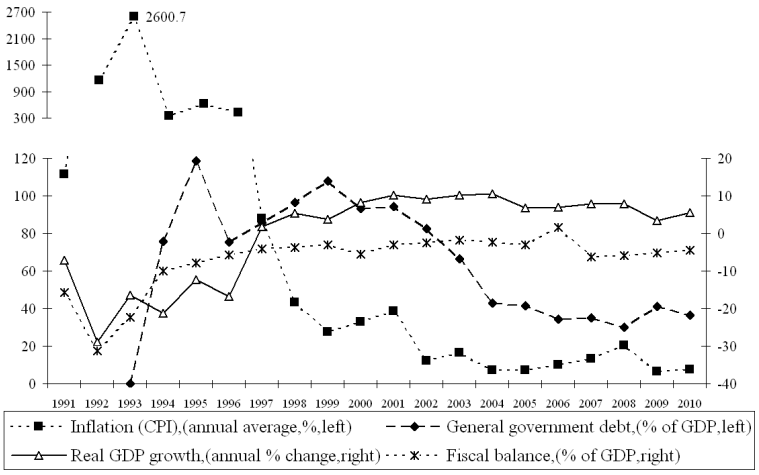

Figure 1.13: Main macroeconomic indicators of Tajikistan: 1991 - 2010

large extent by an increase in the daily internal demand due to the large volume of remittances from labor migrants.

Tajikistan was hit by severe external shocks in 2009. While the impact on growth was cushioned by supportive policies, the global crisis affected Tajikistan mainly via declining remittances[29]. Remittances and exports of aluminium and cotton have started to recover in 2010.

Tajikistan ranks among the poorest countries in the world and has one of the lowest per capita GDP among the FSU republics. Economic situation remains fragile due to uneven implementation of structural reforms, corruption, weak governance, unemployment, seasonal power shortages, and the external debt burden. Nevertheless, Tajikistan has experienced growth since 1997, reached 10,6% in 2004, but dropped below 8% in 2005-2008, as the effects of higher oil prices, lower prices for key export commodities and lower remittances. In 2009 GDP growth dropped to 3,4% as a result of the world recession.

[29]Because of an high unemployment nearly half of the labor force works abroad, primarily in Russia and Kazakhstan, supporting families through remittances. Due to the decline in the Russian economy, the opportunities weakened for employment of labor migrants, resulting in a decrease in remittances by 31,4%. This trend had an overall effect on private consumption and the level of the welfare since Tajikistan ranks first in the world in terms of dependency of its economy on remittances; the families with members who are labor migrants, cover about 35% of their expenses in this way. With around half of the labor force working outside of Tajikistan, the 31% fall in remittances in 2009 contributed to a decline in per-capita disposable income.

Government debt

Virtually most of the debt is government or government-guaranteed, and is denominated in USD. The debt accumulated in the years immediately after independence (see Fig.1.14), as Tajikistan ran significant arrears on trade payments, particularly to Russia and Uzbekistan, and accumulated debt balances on correspondent accounts with FSU countries. As most of the debt was contracted on short maturities, debt service due increased rapidly.

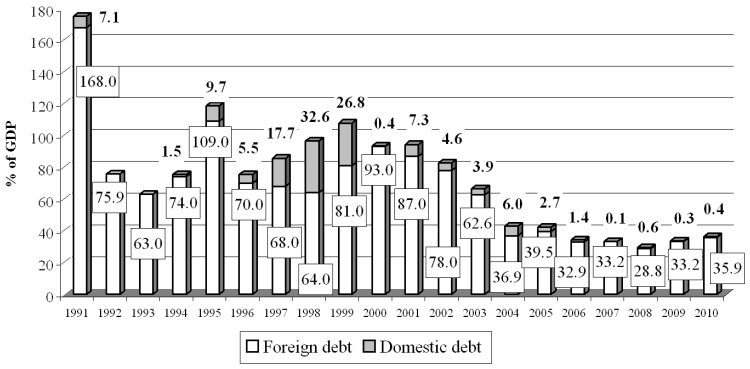

Figure 1.14: Public debt of Tajikistan: structure and dynamics

Domestic debt

The first t-bills auction was held in September 1998 with a small amount offered for sale. The t-bills market had developed slowly and only a very small amount of t-bills was issued. The main reasons for this limited growth of the t-bill market were low confidence in the government's ability to redeem the bills, weakness in the liquidity management by banks and the negative effect of the Russian crisis which coincided with the initiation of the t-bills market. Interest rate formation in the t-bill market, however, appears truly market determined as investors demand different volumes at different yield rates. The t-bill market rate rose trend wise since late 1998 with the exchange rate and price instability but has started to decline.

To broaden the range of financial instruments and to develop money market instruments, the MOF issued 28-day t-bills in 2005. The management of these securities is handled by the NBT, which acts as the MOF's agent. The Somoni bonds and deposits earn interest calculated by explicit margins over inflation.

Domestic debt constitutes only a negligible part of public debt, due to the fact that the general government budget ran continuous surpluses (excluding externally financed public investment program) in recent years. Domestic debt represents 3%

of total public debt in 2008 and mostly consists of non-tradable GS held by the NBT. Average t-bills yield has been fluctuating from 111,6% to 35,2% since issuing.

The NBT is strengthening its liquidity management tools. In 2009, the government started auctioning a small volume of t-bills for the first time with a view to developing a secondary market. As part of the cotton debt resolution, the government will issue around USD100 million t-bills with a 2% interest rate and a mandatory roll over at maturity.

External debt

In the early years of transition, against the backdrop of a chaotic political situation, civil conflict, poor governance and cessation of transfers from the central budget, the authorities had to import petroleum products, grain, and consumer staples, all at market prices. These imports relied initially on short-term suppliers' credits and subsequently on offsets through correspondent accounts in central banks of FSU states. As a result, external debt increased from zero at independence to 15% of GDP by end-1992. The explosive trend in debt accumulation continued and culminated in 2000, when external debt reached 130% of GDP.

Attempts to regularize the debt situation began in the mid-1990s but initially were only partly successful. In 1995, to arrest the build up of arrears under bilateral trade arrangements with CIS partners, the government announced that it would no longer guarantee payments by Tajik enterprizes.

In the late 1990s-early 2000s, Tajikistan conducted a series of debt rescheduling negotiations with its main bilateral creditors[30], which helped to improve its debt service profile, although the terms of rescheduling were not sufficiently concessional to stabilize the debt ratios. At the same time, the authorities started using external concessional loans to finance development projects and accumulated additional debt. Tajikistan has obtained large external trade credits on commercial terms, accumulated debt balances on correspondent accounts held with other FSU countries, and received significant external budgetary support.

Most of the debt comes from short-term credits and unsettled debit balances on correspondent accounts with other CIS-countries. In addition, Tajikistan received credits from neighboring countries (China, Pakistan and Turkey) and the US, to

[30]In 1995, Tajikistan reached a rescheduling agreement with Kazakhstan, in 1996 with Russia and Uzbekistan. Debt to Uzbekistan was the subject of protracted negotiations. The debt originated from trade credits and negative balances on correspondent accounts opened in the early 1990s in the CBs of both countries for offsets in trade-related payments. This debt was serviced by offsets with services provided by Tajik Rail for the transportation of Uzbek goods through the Tajik territory. After protracted negotiations, in 2005 both governments signed an agreement for debt payments. These agreements provided for a comprehensive restructuring of all debt at concessional interest rates.

finance the importation of grains and consumer goods. As most of the debt is short-term, debt service obligations are large, and, largely fell into arrears.

At end-2009, multilateral creditors accounted for two-thirds of the debt stock[31]. Uzbekistan is now the largest bilateral creditor, (after the 2004 debt reduction agreement with the RF) followed by the RF, the US, and Turkey[32]. Over half of external debt is denominated in SDR, 34% in USD, 7% in Euro, and in other currencies.

Most bilateral assistance is now provided in the form of grants. Almost all of external public debt is contracted on concessional[33] terms. Private external debt consists mainly of the cotton sector.

1.4.4 Turkmenistan

Macroeconomic situation

Turkmenistan is largely a desert country with intensive agriculture and sizeable gas and oil resources. One-half of its irrigated land is planted in cotton; it was the world's 10th-largest producer. Turkmenistan is under an authoritarian ex-Communist regime in power and a tribally based social structure.

Developments in real GDP are dominated by the contraction in the output of gas and cotton, Turkmenistan's two most important export items. Turkmenistan's energy sector is the cornerstone of its economy. The agricultural sector is the second most important sector, accounting for about 10% of GDP. The two major crops produced are cotton and wheat, both of which are grown and marketed under a state order system. Cotton is exported after processing into cotton fiber, while wheat is consumed domestically.

Turkmenistan has been engaged in a two-track economic development strategy. On the one hand, the country has borrowed extensively from western economies to finance the upgrading and development of the energy sector. On the other hand, agriculture has also benefited heavily from foreign lending, as new silos, imports of machinery and equipment, and upgrading of the agroindustrial base have been financed by foreign savings. While this development strategy has yielded an increased supply of oil and gas, and rapid growth in cotton and wheat production, it has also translated into growing fiscal deficits (see Fig.1.15). Turkmenistan's per capita gas reserves are among the highest in the world. The regional gas pipeline for the export of gas is controlled by the Russia, which has the world's largest gas reserves and

[31]Two largest multilateral creditors are the WB and the IMF.

[32]Other creditors include Kazakhstan, Turkmenistan, Iran, the Kyrgyz Republic and the EU.

[33]Concessional debt is defined as debt with a grant element equivalent of 35% or more. The grant element is calculated using the commercial interest reference rates (CIRRs) plus a margin. In general, the grant element is calculated as value of the loan minus present discounted value of future payments over the loan value.

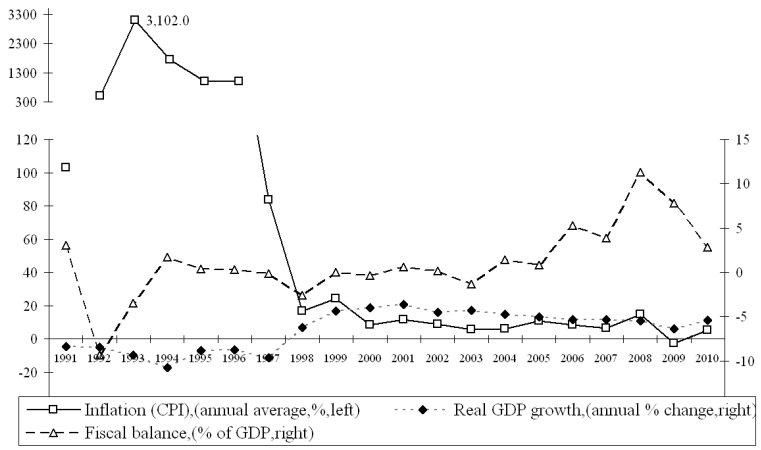

Figure 1.15: Main macroeconomic indicators of Turkmenistan: 1991 - 2010

considerable production capacity[34].

In late 90s, the economy was hit by a number of external shocks. Trends for overall economic activity in Turkmenistan are dominated by developments in the gas sector, which has traditionally generated the largest amounts of foreign exchange earnings for the economy and whose exports have been mainly to other FSU countries. From 1998-2005, Turkmenistan suffered from the lack of export routes for gas and from extensive external debt. Economic activity in the nongas sector grew rapidly with development of the oil sector.

Exports rose by 15% per year from 2003-2008, because of higher international oil and gas prices. Prospects in the future are discouraging because of poverty, corruption, poor educational system, government misuse of oil and gas revenues, limited privatization goals and unwillingness to adopt market-oriented reforms. In the past, economic statistics were state secrets, GDP and other figures often are subject to error.

The global recession slowed economy in 2009. However, Turkmenistan was less affected by the global financial crisis because limited inter-linkages with the global economy, substantial reserves, and a small external debt. The economy was affected by the crisis mainly through lower external demand for hydrocarbon exports, causing natural gas and oil production to fall.

[34]The alternative pipeline, which became operational in 1997, is to Iran to meet local demand in the northern part of the country, with no onward connections to other markets.

Domestic debt

The public investment and debt management process are fragmented. Rates and terms on t-bills continue to be set by the Ministry of Economy and Finance, with the rate set normally equal or close to the refinance rate. The T-bills are non transferable, non tradable and consequently no secondary market exists.

Since end-1995, the first t-bills with a maturity of one month have been issued at face value, but failed due to inadequate coordination.

The Ministry increased t-bill issues, at the end of 1997 and early 1998. However, as rates and terms continued to be set by the Ministry and there was no secondary market, t-bills did not play a role in monetary policy. T-bills were sold monthly, mostly to banks at the initiative of the Ministry.

Since August 1998, no new t-bills have been issued, which outstanding bills and accrued interest have been placed in frozen accounts that are expected to be repaid gradually to the t-bill holders.

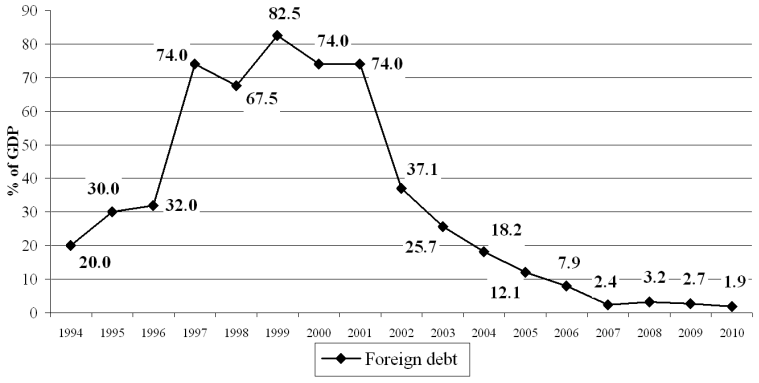

Figure 1.16: Public debt of Turkmenistan: structure and dynamics

External debt

Virtually all of foreign debt of Turkmenistan is owed by the public sector (see Fig.1.16), mostly by off-budget ministries and state enterprizes. All medium-and long-term foreign borrowing by the state entities is approved and guaranteed by the government. Turkmenistan's foreign borrowing has been exclusively on nonconcessional terms.

Loans are administered either by the CBT[35], in order to obtain most favorable

[35]Loans administered by the CB are of two kinds: those from IFIs (IBRD and EBRD loans), which are rather small and those received from commercial banks that manage the country's

terms by using its official guarantee, or most foreign borrowing takes place through the Vnesheconombank[36]. Loans typically have initial draw down periods of 1-3 years during which the project is established, followed by repayment periods of 5-8 years during which the loan is amortized in equal instalments.

In the first years of independence, public enterprizes borrowed heavily on relatively short maturities 2-3 years under government guarantees issued by ministries. As of mid-1996, the issuance of such guarantees was made subject to clearance by the Foreign Currency Committee and registration with the State Agency for Foreign Investment. Almost two-thirds of this increase was accounted for by loans to the agricultural sector, consisting mostly (90%) of short-term loans to the cotton sector.

1.4.5 Uzbekistan

Macroeconomic situation

Under the Soviet system, Uzbekistan's primary role was to produce cotton, fruits and vegetables, along with energy, gold mining, and the exploitation of other natural resources largely for export to other Soviet republics or CMEA countries.

After independence, agriculture remains the key sector of the Uzbek economy with an average share in GDP of 25%. About 60% of the population live in the rural areas, depending mostly on agriculture for their incomes and employment. Cotton (the white gold) is still the most important agriculture crop and foreign exchange earner, despite the increase on the production of wheat.

Although among the poorer Soviet Republics, Uzbekistan began the transition with relatively favorable initial condition. It was less deeply entrenched in the FSU's industrial-military complex than most of the other FSU countries. Since independence, cotton exports have increasingly shifted to western markets, including the US and Europe. In recent years, Uzbekistan has been the world's fifth largest cotton producer (with a world market share of 6%) and the second largest exporter (17% of world exports).

The production of the two major crops, cotton and wheat, has remained tightly controlled by the government with the objective of channeling resources out of agriculture and into other sectors of the economy. Cotton is of strategic importance to the nation and it cannot be grown on private plots of land. For the time being, Uzbekistan's agriculture is one of the most regulated among the transition countries.

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reserves (mostly loans to finance cotton production and the purchase of two aircrafts).

[36]Vnesheconombank, which is responsible for insuring and orderly access to international capital markets and for the timely servicing of public external debt. The loans in Vnesheconombank's portfolio are mainly related to development and investment projects in the energy and agricultural sector. All of the loans administrated by Vnesheconombank are taken on commercial terms and most of them are secured by a foreign guarantor, mainly export credit agencies.

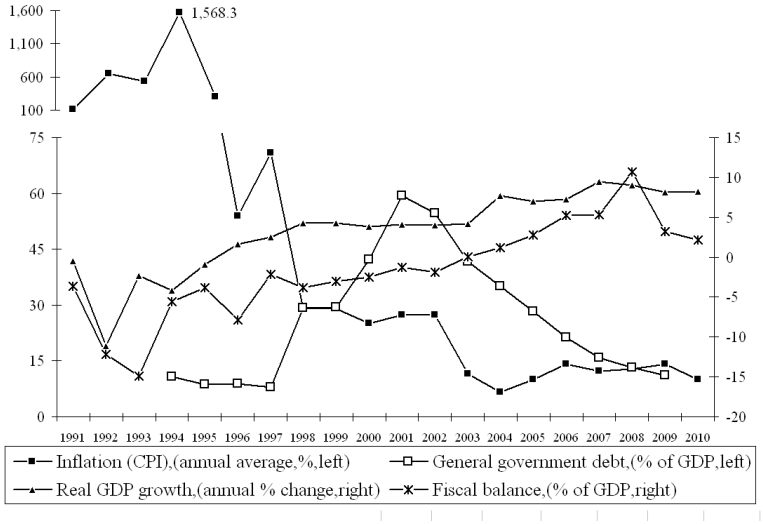

Figure 1.17: Main macroeconomic indicators of Uzbekistan: 1991 - 2010

Uzbekistan's output record since independence has been exceptional when compared to that of most other transition economies (see Fig.1.17). Its decline in official output between 1991 and 1997 was the lowest of any country of the FSU. Uzbekistan's transitional recession was mild not only relative to the FSU average, but even relative to the average of the Central European transition economies. This is true regardless of whether output is measured in calendar time or transition time.

Uzbekistan resumed moderate positive growth during 1996 and 1997. But, in 1998 and 1999 the economy experienced three shocks - the Russian crisis, a poor cotton harvest, and continuing decline in world cotton and gold prices.

Russian businesses show increased interest in Uzbekistan, especially in mining, telecom, oil and gas. Although growth slowed in 2009, Uzbekistan has seen few effects from the global economic downturn, primarily due to its relative isolation from the global financial markets.

Domestic debt

Financial markets are still in the early stages of development in Uzbekistan (see Fig.1.18). Until 1996, the only instruments available for the mobilization of savings were household saving accounts and term deposits at commercial banks.

In March 1996, 91-day t-bills were issued for the first time, and 182-day t-bills started to be issued one year later[37].

[37]These bonds have no coupon and are sold at a discount rate in auctions held once a month by

The CBU services t-bills as financial agent of the MOF. In 1997 there were 14 banks authorized to operate in the bond auctions as dealers on their own account and on behalf of their clients. A development of the secondary market created a degree of liquidity for these securities. Secondary market auctions are held by the RCE four times a week, and both maturities are traded in the same auction.

However, market penetration of T-bill is still limited, with only 25% of the outstanding stock (or less than 1% of GDP) being held by the nonbank public. This is due, inter alias, to (i) low yields compared to inflation and the high return on holding USD bank notes; (ii) the lack of permission for the banks to sell the bonds to the public outside the auction; and (iii) the nonexistence of repurchase agreement operations between banks and the public, based on t-bills in banks' portfolios.

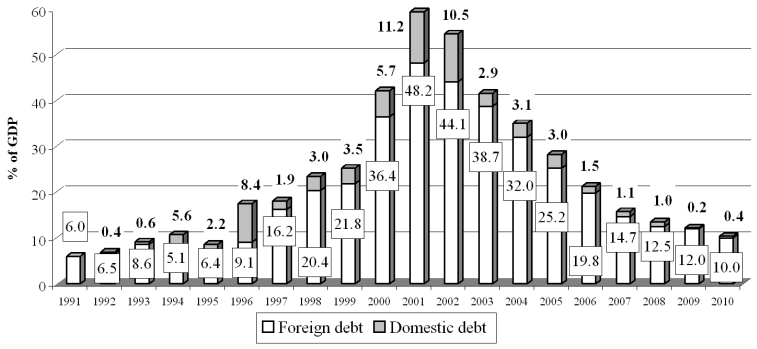

Figure 1.18: Public debt of Uzbekistan: structure and dynamics

External debt

External debt is continuing to decrease and reached in 2009 percentage point of 12%. The average maturity of the debt lengthened. Although debt owed to commercial banks grew rapidly, official bilateral debt continued to comprise the largest portion (46%) of the overall stock. In contrast, in 2009 debt to multilateral institutions and suppliers declined.

the Republican Currency Exchange (RCE).

1.5 Russia and Western CIS: the RF, Moldova, Ukraine, Belarus

Ukraine, after Russia, was the most important economy of the FSU. Moldova remains one of the poorest countries in Europe despite recent progress. Russia remains largest trading partner and energy supplier for these countries[38].

1.5.1 The Russian Federation

Macroeconomic situation

The central planned economy had existed in Russia for more than 70 years, consequently the transition to a free market system proved more difficult for Russia.

The economy underwent tremendous stress in the 1990s. In 1991 GDP dropped by one-sixth, and the budget deficit was one-fourth of GDP (see Fig.1.19).

Despite Soviet industry was one of the biggest in the world, it was very inefficient and expensive to support. Industry was heavily geared toward defence and heavy industrial products whose conversion to light industries would require much time. Plus the workforce wasn't prepared to work in a market environment.

As the first step toward a market economy, the price control was removed in 1992. However, this step also spurred inflation[39] and the government was constraint to print money to support the budget and to prevent failing factories from going bankrupt. As a result, the economy became increasingly dollarized as people lost faith in the Ruble. Inflationary pressure was exacerbated by the establishment of a Ruble zone when many of the FSU republics continued to issue and use Rubles and obtain credits from the CBR. In 1993 the government pulled out of the Ruble zone, reducing Russian influence over the FSU republics. Another element of economic reform was the privatization of industries. However, the process seemed to benefit solely the friends of those in power, who received large chunks of Russian industry for little. Russia's companies in the natural resource sector were sold at prices well below. From this process emerged the oligarchs[40].

[38]The energy sector is a key component of the Russian economy, accounting for about 17% of total value-added (oil and gas extraction account for 6% of GDP, energy-related transportation services and pipelines for 9% of GDP, and other fuels for 2% of GDP). Petrochemical, including crude oil, fuel oil, other oil products and natural gas, account for more than one-half of exports, and the energy sector contributes about a quarter of consolidated government revenues.

[39]almost 900% in 1992. By 1997, inflation had been brought down to around 15%. After the 1998 crisis, year-on-year inflation jumped again to over 100% in mid-1999, but then dropped to around 20% in 2000, and has declined slowly since then, with inflation in 2002 at 15%

[40]Individuals who, because of their political connections, came to control huge segments of the Russian economy.

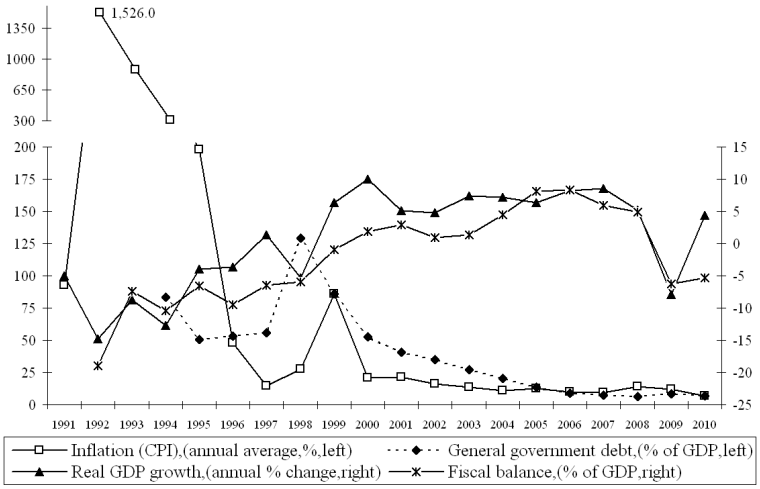

Figure 1.19: Main macroeconomic indicators of the Russian Federation: 1991 - 2010

Starved for cash, the use of barter has increased dramatically peaking at over 50% of sales in 1998. Moreover, debts between factories were enormous; though they were diligently recorded, there was little hope of eventual collection. Thus, workers went months without being paid.

The financial/Ruble crisis hit Russia on August 1998. It was exacerbated by the Asian financial crisis, which started in July 1997. Given the decline in world commodity prices Russia, heavily dependent on the export of raw materials (more than 80% of total export), was most severely hit. The result was a rapid and steep decline around 60% in the value of the Ruble, loss of foreign investment, delayed payments on sovereign and private debts, a breakdown of commercial transactions through the banking system, and the threat of runaway inflation. However, the primary cause of the Russian crisis was the result of non-payment of taxes by the energy and manufacturing industries.

The economy bounced back quickly from the 1998 crisis and enjoyed over 9 years of sustained growth averaging 7%. Household consumption and fixed capital investments both grew by 10% per year and replaced net exports as the main drivers of demand. Inflation and exchange rates stabilized due to a prudent fiscal policy. The balance of payments experienced twin surpluses until mid-2008 in the current and capital accounts, which accounted for the phenomenal growth of reserves.

The economy was one of the hardest hit by the 2008 global economic crisis by dual shocks - a collapse in oil prices and a sudden reversal of capital flows, which caused a crisis in its stock market. Real GDP contracted sharply, as Russia's investment boom came to an abrupt end. As a result, inflation pressures are easing.

Only in the late-2009 there were signs of recovery, bolstered by government anti-crisis policies, the 50% rise in oil prices, promotion of innovation and diversification of the economy away from oil and gas. In 2009 Russia was already the world's largest exporter of natural gas, the second exporter of oil, and the third exporter of steel and primary aluminum. Agriculture revived and has led to shifting from being a net grain importer to a net grain exporter.

Government debt

Regular reports on public debt and debt guarantees of the federal government are published[41]. Subnational debt, including the municipalities, is reported on a monthly basis[42].

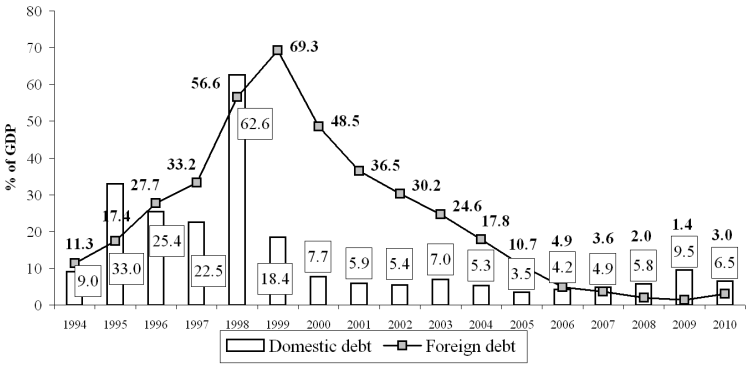

Figure 1.20: Public debt of the Russian Federation: structure and dynamics

Domestic debt

Structure of domestic government debt (se Fig. 1.20) is presented in primary and secondary GS market mainly by short-term t-bills and medium-and long-term bonds

[41]The MOF releases monthly and quarterly data on foreign debt and guarantees, classified by official creditor and type of debt to private creditors, and on domestic debt and guarantees, classified by debt instrument. The CBR publishes monthly data on general government debt held by non-residents and the foreign investment position held by the institutional sectors. At the end of each year, the MOF conducts an inventory of the public debt and reconciles differences.

[42]Debt policy is subject to continuous external scrutiny. The budget law establishes ceilings on domestic and foreign debts. Annual programs for domestic and foreign borrowings are approved with the budget. The government is also required to spell out all types of debt management operations planned for the budget year in the annual budget law. The government made public its medium-term debt management strategy for the first time in 2003, including projections of foreign and domestic debt and debt service until 2008.

(fixed and variable coupon)[43]. Moreover, nonmarket and saving bonds, short-term bank and budgetory loans, promisory notes and bank credits are available on the market.

Nonresident access to the market was not officially permitted until 1996, when a scheme was introduced to allow nonresidents to participate in the primary and secondary markets in the same way as residents and to keep all the Ruble proceeds.

A rapid build-up of short-term government debt obligations preceded the financial crisis of 1998. Interbank markets were active and the debt market - dominated by federal government debt instruments, including t-bills, floating rate Federal saving bonds, and medium-term foreign-currency bonds - was highly liquid. The Russian equity market was one of the best emerging market performers in 1997.

Since that time, the restructuring of t-bills and the paralysed state of the internal bond market was associated with a decline in domestic debt market. Following the halt in trading of t-bills in mid-1998, the CBR issued its own short-term paper. The amount of these CBR bills issued remained small, and as their legal status was the subject of debate with the Securities Commission, the issuance of new bills was halted in late 1998. After this restructuring, the ratio of domestic government debt to GDP fell from 28% in 1998 to 18,4% in 1999.

Internal government debt was roughly constant between 1999 and 2001 and increased in 2002. In 2002, the Russian financial markets were, for a second consecutive year, among the best performing in the world. Russian external debt trades at yields that were lower than those of other countries with similar credit ratings. In 2003, new issuance of domestic debt (OFZ-AD) increased significantly, but there was almost no net effect on outstanding internal debt, as the bulk of the OFZs issued in the rescheduling of the pre crisis GKOs fell due.

The total value of Ruble denominated public debt was 6,3% of GDP in 2002. Most of this debt was in the form of non-market instruments held by the CBR. The size of the Ruble denominated government bond market was 2% of GDP. In 2003 the MOF placed 15-year bonds at an average yield to maturity of 9,7%.

There are two types of instruments in the government bond market - t-bills (GKOs) and treasury notes (OFZs). The GKO/OFZ market is dominated by two large players: Sherbank and the State Pension Fund. The share of Sherbank in the longer-dated bond market segment is smaller and it is notably absent from the secondary market. All transactions between the State Pension Fund and the MOF are carried outside the market, at an average market price.

[43]Eurobond placements by the federal government began with the issuance in late 1996.

External debt

After the dissolution of the Soviet Union, the RF became its successor state, inheriting the bulk of its foreign assets and debt (USD65 billion at the end of 1991), and has pledged to meet its obligations. Russia has adopted a strategy that differentiates between RF debt, incurred after 1991, and the inherited debt of the Soviet Union.

Total gross external debt holds public[44] and private sector[45] debt. The general external public debt consists of federal (new Russian debt[46] and debt to the former USSR[47]) and local government[48]debt.

1.5.2 Ukraine

Macroeconomic situation

During the first three years following independence, Ukraine implemented inflationary policies which resulted in a sharp depreciation of the currency and in a rapid decline of the economy (see Fig.1.21). Demand for Ukrainian products declined in several important markets in Asia and output decline continued in 1997 and 1998, following the crisis in Russia.

Reform of the agriculture sector is considered a key milestone in the market-oriented transformation of the Ukrainian economy, both because of its relative size and its capacity to generate private activity.

Ukraine inherited a highly industrialized economy, heavily reliant on subsidies and excessively dependent on energy. Industry (mainly steel, chemicals, shipbuilding, coal, machine tools and weaponry) made up a relatively large share of output. As a result of the loss of transitional markets, manufacturing output fell sharply, declining by over 60% in the first 5 years of transition. Ukraine also possesses some 60% of the former USSR's bitumen and anthracite coal reserves, in addition to more modest reserves of natural gas and petroleum. Domestically produced coal is used intensively in domestic industries, such as steel. The coal sector is almost completely state owned. Ukraine is a major importer of energy, especially natural gas.

The dependence on Russia for energy supplies and the lack of structural reform have made the economy vulnerable to external shocks. The Ukrainian economy is

[44]short and long debt of general government, monetary authorities, banks and other sectors.

[45]short and long debt of banks and other sectors.

[46]Multilateral (IBRD, EBRD and others) and official creditors (including Paris club credits); foreign currency bonds (Eurobonds, issued by public subscription and Eurobonds related to GKO and London club debt restructuring, MOF foreign currency bonds); and GKO-OFZs.

[47]to official creditors (Paris club), to commercial creditors (London club), debt owed to former socialist countries, MOF foreign currency bonds, debt accumulated by the RF (to multilateral creditors, to official creditors, bonds).

[48]loans, foreign currency bonds (Eurobonds) and Ruble denominated bonds.

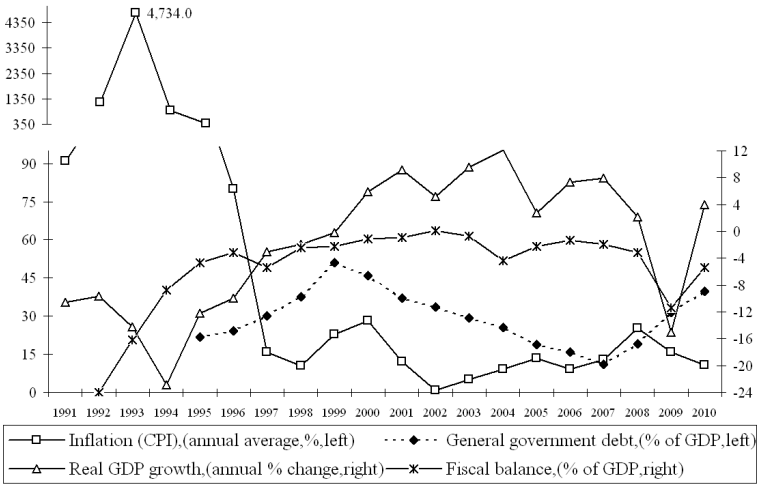

Figure 1.21: Main macroeconomic indicators of Ukraine: 1991 - 2010

relatively open and dependent on international trade. Russia remains the largest market for Ukrainian goods. A decline in net service demand, foreign investment, and worker's remittances from Russia also have a noticeable adverse impact on Ukraine's economy.

In 1996, Ukraine achieved macroeconomic stability and introduced national currency - the Hryvnia, which rate was initially informally pegged to the USD.

GDP growth exceeded 7% in 2006-2007, fueled by high global prices for steel and by strong domestic consumption, spurred by rising pensions and wages.

The global crisis hit Ukraine hard in 2008 and 2009. As a major steel exporter and borrower in international markets, Ukraine's economy was severely hit by the decline in demand for steel products and reduced access to capital markets. The drop in steel prices and Ukraine's exposure to the global crisis lowered growth in 2008 and the economy contracted more than 14% in 2009, among the worst economic performances in the world.

Government debt

External debt (see Fig.1.22) is classified by categories of creditors; domestic debt distinguishes between t-bills, classified by maturities, other state securities, and outstanding NBU loans[49].

[49]Debt data is reported by the STU to the MOF on gross terms. Information on public debt is published in a timely way. The State Debt Management Department of the MOF publishes monthly data on central government and guaranteed debt. Reports are placed on the web site 25

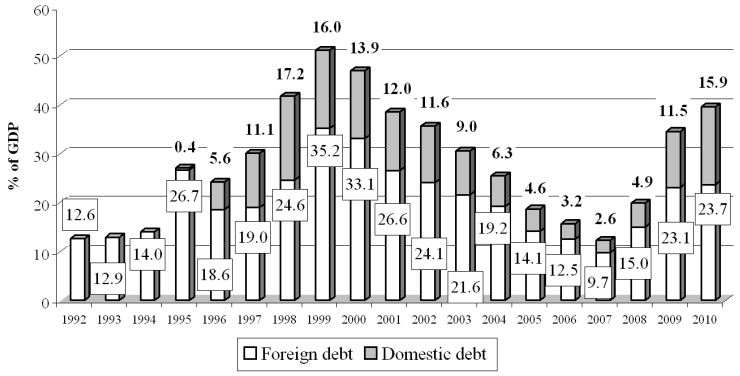

Figure 1.22: Public debt of Ukraine: structure and dynamics

Domestic debt

The t-bill market became active-especially in 1996, when foreign participation increased - allowing the government to finance the largest part of the deficit through t-bill sales. Over time, due to the increasing loss of confidence in transition economies, this instrument became less attractive and investors started to pull out or were interested only in hedged operations. This prompted Ukraine to seek access to international capital markets.

Ukraine floated its first Eurobond in August 1997 with one-year Eurobond issue at a 12% interest rate. Despite the instability in the international capital markets, Ukraine borrowed again in October although the amount was smaller and the terms were less favorable.

Creditors continued to enjoy unrestricted access to the t-bill market during 1997 and the amount borrowed from the t-bill market increased three-fold compared to 1996 and covered the major portion of budget financial needs. The bulk of the t-bills were bought by non residents. The MOF places t-bills in the primary market, through conducting multiple-maturity auctions on most days of the week. Receipts from the auctions were used to cover the daily cash needs of the budget. While the frequent auctions raised the necessary resources, they did not help promote an efficient market, participants had an incentive not make their best offer given the option to wait for subsequent auction.

The development of a secondary market was affected by the differential tax treatment of GS purchase in the primary and secondary markets. The MOF lengthened the maturity and the placement of 3-month bills was discontinued in 1997, while the

days after month-end.

threshold price below which investors' bids were rejected was increase. As a result, t-bill yields declined from 60% (for 12-month bills) in 1996 to 22% in 1997. In 1997, the MOF issued 9-and 12-month maturity t-bills denominated in Hryvnia.

The departure of investors from the t-bill market started in 1997. The MOF tried to promote investor participation, by raising yields to 60% and by issuing certain short-term maturities.

In 1998, activity in the t-bill market came to a halt[50] Creditors, concerned with the sustainability of the fiscal position, were reluctant to purchase t-bills, and the government had to rely on the NBU to cover budgetary needs. In early 1998, Ukraine borrowed three times from international capital markets but increasingly had to use the proceeds to repay obligations to t-bill holders and external creditors. In mid-1998, Ukraine lost its access to all external markets while debt payments created the liquidity crisis. In August 1998, the MOF negotiated with three major groups of creditors regarding a voluntary conversion of short-term instruments into long-term ones[51]. The GS markets were thin and fragmented and suffered from the financial crisis of 1998.

At the end of 2002, the face value of all domestic GS amounted to 5% of GDP. The market was divided between restructured bonds that were mainly held by the NBU and carry a real return of 3%; and t-bills with yield of 11%. The market was fragmented due to multiplicity of maturity dates (in 2002, 20 different maturities dates were offered for sale) and frequent auctions.

Ukraine re-entered the sovereign Eurobond market in 2003. Private foreign investors became dominant in the domestic currency GS market in 2004-2005.

Frequent auctions, which often failed to find buyers, left the primary yield curve with significant gaps. Until 2004, the MOF held weekly auctions with maturities being decided week by week and ranging from 3 to 24 months. Emphasis shifted towards 18-and 24-month maturities in 2004 and 3-year maturity in 2005. Due to low yields offered at the short end, the MOF could not find buyers for its papers in more than half of all auctions since 2003. The number of outstanding papers was large while each volume was low since none GS issuance was reopen. In 2003, the government issued 66 different papers. This fragmentation did not improve in 2004, even though two larger issues were placed. In an attempt to reduce such fragmentation, the MOF has moved to bi-weekly auctions in 2004 and issued only paper with a maturity of at least 9 months.

[50]The MOF started to announce the date of the auctions, the GS maturities, and the amount of cash it wished to raise during the following week, in advance in an effort to disseminate more information to the market. Nevertheless, activity remained depressed. Operations continued to be non transparent, maturities were often longer than what the market was prepared to buy, and the price was determined administratively.

[51]In 1998 the 3-year Eurobond at a 16% interest rate and a 2-year Eurobond with a 14,75% yield were issued.

Ukraine has not placed an international bond since 2007. The NBU has emerged as a major holder of t-bonds (over 60% of total stock). While the NBU does not participate in the primary t-bond auctions, it has been monetizing government bonds issued for bank recapitalization, in line with the 2009 anti-crisis law. In addition, it has been refinancing bonds purchased by state banks which recently have increased their presence in the t-bond market.

External debt

The public external debt position has strengthened since the 1998-99 crisis. Following the 1999 sovereign debt restructuring, primary budget surpluses and output growth have contributed to a steady decline in the public external debt in 2000-2003, from 33 to 22% of GDP. And given that all of public debt held by residents is denominated in domestic currency, Ukraine compares more favorably in terms of its foreign currency public external debt.

Between 2000 and 2002, Ukraine restructured its external debt with Paris Club and other bilateral creditors, most importantly Turkmenistan. The total debt restructuring operation covered about 9% of GDP. Debt restructuring together with the rapid economic growth and fiscal discipline combined to bring the public debt down from 67% of GDP in 1999 to 25% of GDP in 2004.

In 2007 Ukraine's total external debt, primary long-term, has increased to high levels, 58% of GDP, over 80% of which was owed by the private sector. This was mainly due to the sharp increase in foreign borrowing by banks and corporations.

External debt ratio increased sharply in 2008-09 as a result of the depreciation and the recession, making Ukraine vulnerable to confidence reversals and financial strains in other parts of Europe. Ukraine's total external debt was about 80% of GDP in 2009. Public external debt is projected to rise to 22% of GDP by end-2010.

1.5.3 Belarus

Macroeconomic situation

During the Soviet era, a large share of Belarus' industrial sector was in defence-related industries, and it developed a comparative advantage in human capital-intensive goods such as machinery and equipment. Among the FSU countries, Belarus was most reliant as a market[52].

Since independence, industrial enterprizes have had to deal not only with finding new markets and suppliers of raw materials, but also with the break up of traditional technological alliances with foreign companies. Belarus inherited a quite valuable

[52]Exports to other union republics represented almost 70%, mainly mineral fertilizers, transportation and agricultural equipment, clothing and consumer durables.

capital stock from the FSU, including assets in the automobile and tractor industries that remain competitive in the CIS market and chemical and oil processing industries that can compete in the European markets. The political and economic fortunes

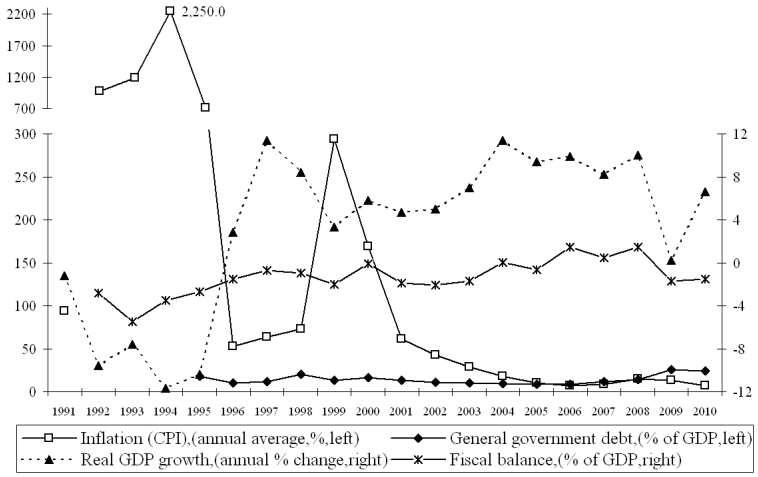

Figure 1.23: Main macroeconomic indicators of Belarus: 1991 - 2010

remains closely tied to Russia[53]. Given Belarus' relative openness and extreme dependence on Russian markets, economy slowed down after the Russian crisis.

In 2002, GDP growth averaged 9% (see Fig.1.23), reflecting improvements in labor productivity, reductions in energy intensity, a high level of investment and favorable developments in the terms of trade.

Belarus remains self-isolated from the West with limited structural reform since 1995. The economy is among the least reformed of the transition countries, predominantly state-owned and overwhelming with impediments to private sector. The government continues to control or intervene in most aspects of the economy developing a socially-oriented, market-based economic model.

The agriculture sector plays a key role in the economy, accounting for 15% of output and employment. Belarus has significant forest resources with total forest land covering 40% of the total area. By law, forests are property of the state.

Belarus achieved impressive economic growth in the past decade, averaging 7,5% per year. GDP growth reached 10% in 2008, despite the roadblocks of a tough, centrally directed economy with a high inflation. The poverty rate declined from 47% in

[53]Russia is Belarus' largest trading partner, accounting for 50% of exports and 63% of imports. Russia granted USD950 million in debt relief in 1997 and assumed USD2,5 billion of Soviet debt from Belarus. Belarus is highly dependent on energy imports from Russia, gas in particular, and receives large implicit import subsidies from Russia in the form of low prices for natural gas.

1999 to 6% in 2008. The economy was highly dollarized till the authorities devalued the rubel against the USD in 2009 and re-pegged against the basket consisting of the Russian ruble, the USD and the Euro, but exchange pressures persisted.

The 2008 global crisis, which produced a strong negative shock transmitted mainly via trade and exchange rate channels from the Russian economy, pushed the economy into recession.

Government debt

Belarus' foreign and public debt to GDP ratios among the lowest among the transition countries, while social spending and indicators of social well being have been maintained at a high level. The authorities therefore consider it prudent to borrow limited amounts to smooth the adjustment of the economy and to finance the energy savings program. In this, Belarus follows the successful experience of other transition countries that used additional borrowing to finance growth-promoting programs.

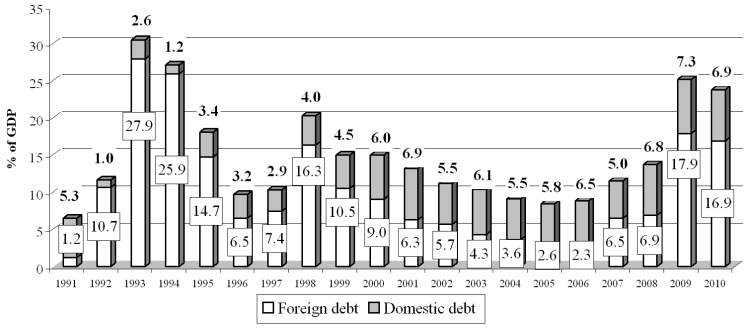

Figure 1.24: Public debt of Belarus: structure and dynamics

Domestic debt

While the external debt ratios remain moderate, the share of short-term debt is on rise. Such debt is generally on favorable terms but still raises roll-over risk.

GS issue during 1996 almost doubles in nominal terms compared to the year before and represented 0,7% of GDP[54]. As a result of an unsuccessful attempt in

[54]The NBB is the central depository of the GS. GS are bought by the NBB and 16 approved banks which then sell them to institutional investors or use the securities as collateral to secure financing from the NBB. Auctions are normally held twice a month. The limit for GS placement as a financing item is set in the law on budget for the current fiscal year. Expenditures related to issuing and servicing the securities are planned based on the inflation forecast and other parameters set in the main monetary policy framework adopted by the NBB.

1996 to place long-term GS, only short-term securities have been issued since then. The securities' maturity is usually 6 month (30% of total emission) or 9 months (70%). There is an active secondary market for GS in Minsk.

In 1997, there were seven auctions of short-term NBB securities with maturities ranging from 10 to 104 days. In September 1997, the NBB stopped issuing short-term securities and began to issue NBB promisory notes with a longer average maturity. These notes are considered by commercial banks as more liquid assets than short-term NBB securities and are traded in the secondary market.

Primary market yields on treasury securities were approximately equal to the refinance rate of the NBB. Banks and the SPF were the major buyers of treasury securities. Uncertainty over inflation and exchange rate depreciation, as well as the diversion of banks' resources to directed lending, led to increasing difficulties in placing treasury securities in the primary market in 1999. As a result, the NBB became an active participant in the primary market for treasury securities but had limited success reselling them in the secondary market.

The MOF can place its debt through a number of channels. Treasury securities can be sold through auctions carried out at the Belarus Currency and Stock Exchange, placed directly with investors on mutually agreed terms, sold to or through banks. Direct private placements of state securities are undertaken in order to raise funds quickly when an auction is not possible owing to lack of at least two participants, as required by the civil code. During 2001 and 2002 the government, when facing severe financial crunch and unable to sale more than just a fraction of its t-bill offering, resorted to directly placing its debt with investors to raise funds. The government has also placed securities, often denominated in foreign currencies, to cover its guarantees to banks on non performing loans.

The debt servicing capacity of Belarusian households is satisfactory, which reflects a relatively low level of household indebtedness. Household debt in terms of GDP (8,4% in 2007) is one of the lowest in Europe.

External debt

Belarus's main creditors are the IMF and Germany. In 1997, with the exception of arrears to Gazprom and some other temporary arrears, Belarus has been current on its debt obligations.

Nevertheless, in spite of the relatively low level of indebtedness, Belarus has been experiencing increasing difficulties in servicing its debt as it lacks foreign exchange, partly because a significant part of its export is in barter. In addition, Belarus has limited access to international markets.

1.5.4 Moldova

Macroeconomic situation

Output of Moldova dropped sharply by more than 50% between 1991 and 1994 and inflation soared, peaking at 2200% in 1992 (see Fig.1.25). Moldova was affected by a sharp deterioration in its terms of trade, the loss of traditional markets, and disruptions in payments. The adverse effects on output were compounded by droughts in 1992 and 1994 and an internal conflict in 1992 over the independence of the Transdnistria.

National currency, the Leu, introduced in 1993, shown remarkable stability until 1998 following the Russian crisis when Moldovan output declined further. The economy returned to growth in 2000 and has remained at 6% every year since, boosted by capital investment, and strong domestic demand driven by remittances.

Workers' remittances have become the single largest source of foreign exchange inflows after exports. Remittances have been more stable than other short-term capital inflows and continue to grow, while emigration remains important. Moldova's trade regime is quite liberal. Recently, two-thirds of trade has been with FSU. Moldova must import all of its energy from Russia and depends heavily on agricul-

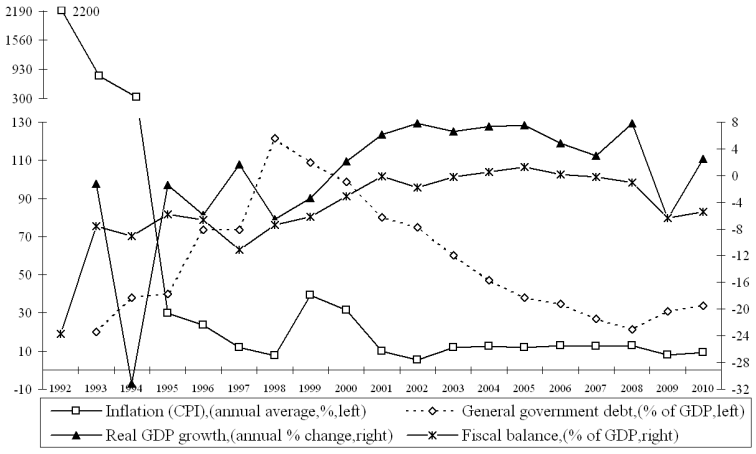

Figure 1.25: Main macroeconomic indicators of Moldova: 1991 - 2010

ture. Fertile soils have favored agricultural production, which currently accounts for about 50% of GDP. Nevertheless, Moldova remains one of the poorest countries in the region and since 2007 is classified as a low middle-income country.

Barter[55] continues to constitute an important, albeit declining, part of external

[55]Barter is pervasive throughout the countries of the FSU. The incentives for barter arise from

trade. Much of this reflects payments in kind for energy imports. The energy sector, mainly gas, is a major source of internal and external imbalances in the economy.

The global crisis has worsened macroeconomic outlook significantly since the 2008. In 2009, FDI came to a halt, domestic investment contracted sharply, and recession in the trading partners caused a severe decline in exports by 37% and remittances, contributing to a collapse in domestic demand. As a result, the economy went into a recession and external and fiscal financing gaps emerged. Key changes include a significantly lower GDP growth and inflation rate. Moldovan economic activity is recovering in 2010, but gas-related external debt remains a major concern.

Government debt

Moldova's debt situation has improved since 2007, mostly due to GDP growth. Debt is sustainable at present, but vulnerabilities remain. Public and publicly guaranteed debt is moderate at 31% of GDP in 2009 (see Fig. 1.26). The previously contemplated large loans from China and Russia did not materialize. The identified external debt of state-owned enterprizes amounts to only 0,4% of GDP and is treated as implicitly government-guaranteed.

Despite a significant reduction in the total debt stock following a series of bilateral rescheduling, the current level of indebtedness will continue to represent an important obstacle to growth and poverty reduction in Moldova.

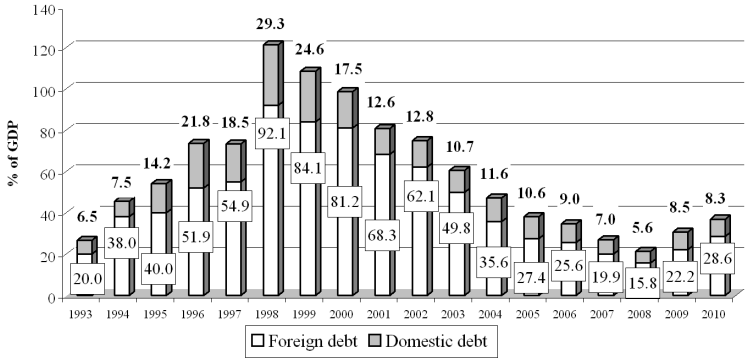

Figure 1.26: Public debt of Moldova: structure and dynamics

a number of considerations, such as the desire to maintain former trading relationships, enterprize employment and benefits, despite insufficient cash flow for operations and investment; and opportunities for personal gain through manipulation of prices and transactions in the shadow economy. Barter was also a legacy of the state planning system of the Soviet Union, with its administrative approach to the allocation of resources, and is thus a way of transacting business with which most enterprize managers are familiar.

Domestic debt

The main securities are money market instruments in the form of the direct interbank market, NBM certificates and MOF t-bills. The situation does likely not change with the securitization of government debt owed to the NBM, as those securities are short-term and are used primarily for monetary operations[56].

Leading up to the financial crisis in Asia , there was significant foreign participation in the longer maturities of the t-bill market. With the onset of the default on treasury securities by the Russian government in August 1998, the situation in Moldova deteriorated dramatically. The t-bill market, which had been eroding for most of the year, shrunk abruptly with both domestic and foreign holders of t-bills fleeing the market. The NBM responded to avoid a default by the MOF on maturing t-bills and credit to government rose rapidly.

There is a strong need for building a well structured government bond market. However, the government issued on certain occasions bonds with maturities up to 2 and 3 years, but the outstanding amount was very small and there is no secondary market activity in them. There have also been a handful of small corporate bond private placement issues. No other bond types are present in the market.

The infrastructure for the equities market is unnecessarily complex and there is a need to simplify it. Nearly all the securities are dematerialized, but there is no central register of ownership. This task is handled by 14 registrars.

Public domestic debt has remained steady at about 25% of total public debt, and is held primarily by the NBM. Domestic debt all short-term. Secondary market transactions in GS are also emerging although the market remains small and the trend is less apparent.

External debt

The large current account deficits have been financed mainly by debt accumulation, including borrowing from multilaterals, arrears to energy suppliers, sales of T-bills to nonresidents, issuance of Eurobonds, and other commercial borrowing. This has led to a rapid accumulation of external debt from zero at the time of independence to 55% of GDP in 1997.

[56]T-bills are auctioned weekly, mostly 91-day papers, though 182 and 364-day bills are also sold in small quantities in the form of zero-coupons obligations at a discount to face value. The outstanding stock is owned mainly by commercial banks, while the share of non-bank investors is low. NBM certificates are currently being offered to banks at pre-announced interest rates in 7-, 14-and 28-day maturities. There is no secondary trading in t-bills or NBM certificates. Due to liquidity overhang, both papers are primarily used as short-term investment vehicles, rather than a liquidity management tool. The t-bill market is the smallest followed by the interbank market, which is dominated by overnight and up to 14-day interbank loans.

In 1997 a USD75 million 5-year Eurobond was issued. The issue was heavily oversubscribed and was priced at LIBOR+3,4%. In 1996, parliament passed a laws on public debt and guarantees which stipulated that all external loans and guarantees must be proposed by the MOF and approved by parliament.

More than half of outstanding public debt is owed to multilateral institutions, including the IMF, the WB and the EBRD. Debt owed to bilateral official creditors represented 28% of total debt, including Russia, the US, the EU, Japan and Romania. Other official obligations amounted to Eurobonds and direct and publicly guaranteed credits from foreign banks.

Most borrowing is on concessional terms, either directly or through integrated loan arrangements that incorporate grants. Over the longer term, as Moldova becomes an IDA-IBRD blend country, borrowing will continue to be primarily from multilateral lenders, but will become less concessional.

Reflecting strong growth, total external debt burden has declined in recent years, helped by the shrinking public debt mostly owed to multilaterals and Paris Club[57]. In 2009 public debt was low without significant rollover risks. Initially, increases in debt largely reflected fairly long-term borrowing from multilateral and bilateral sources, recently there has been a switch to shorter-term commercial debt.

1.6 Conclusions

While Baltic Republics tried to become pure market economies as fast as possible and in 2004 have joined the EU, others have seen their further development in retaining close links with Russian Federation. The majority of the FSU countries is still at the beginning of this transformation.

Baltic states (Estonia, Latvia, Lithuania) performed a successful macro-and microeconomic path, joining the WTO and the EU; Russia and Western CIS (Belarus, Moldova, Ukraine) due their high degree of industrialization, performed relatively poorly in terms of industrial transition, with the quite good economic position of Russia (in the last decade) being explained mainly by huge trade surplus related to raw commodities export; Central-Asian states (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan) are featured by poor economic conditions (mainly due to 1998 Asian-Russian shock), and - in some cases - bad fiscal conditions; Caucasian states (Armenia, Azerbaijan, Georgia) economic performance has been quite good, though Armenia and Georgia have been negatively affected by the political instability of the region. The Fig. 13,14,15 and 16 depict some basic macroeconomic indicators of the FSU countries.

[57]Private external debt is growing, with loans associated with FDI becoming more important. Between 2004 and 2008, the external private debt increased from 33 to 40% of GDP, two-and-a-half times the size of the public external debt.

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
																				Estimate	*Projection*
Armenia																					
GDP	14.2	-7.4	-11.7	-41.8	-8.8	5.4	6.9	5.9	3.3	7.3	3.3	5.9	9.6	13.2	13.9	10.1	14.0	13.2	13.8	6.8	-12.9
GDP (in billions of drams)	na	na	na	63	4	187	522	661	804	955	987	1.031	1.176	1.362	1.624,6	1.907,9	2.244,0	2.656,0	3.149,0	3.650,0	3.757,0
Consumer prices	na	na	na	1.346,0	1.822,0	4.962,0	175,8	18,7	14,0	8,7	0,7	-0,8	3,2	1,2	4,7	7,0	0,6	2,9	4,4	9,0	3,0
Exchange rate (drams per US dollar)	na	na	na	226,2	9,1	288,7	405,9	414,0	490,8	504,9	535,1	539,5	555,1	573,4	578,8	533,5	457,8	416,0	342,1	304,1	na
General government balance	na	na	na	na	na	-16,5	-9,0	-8,5	-5,8	-4,9	-7,2	-6,4	-3,8	-0,4	-1,1	-1,8	-2,6	-2,8	-2,3	-1,4	-1,5
General government debt	na	na	na	na	na	30,9	29,7	34,3	39,8	39,5	44,4	46,8	44,6	45,7	40,9	51,5	39,7	34,3	20,5	20,0	na
External debt/GDP	na	na	na	na	na	30,9	30,1	33,6	41,7	41,0	47,1	45,0	42,8	43,2	63,7	52,2	38,0	32,2	23,9	na	na
Current account/GDP	na	na	na	na	na	-14,3	-16,0	-17,0	-18,2	-18,0	-22,1	-16,6	-14,5	-10,0	-6,3	-6,7	-4,5	-3,9	-1,8	-6,4	-12,5	-12,4
Azerbaijan																					
GDP	-4,4	-11,7	-0,7	-22,6	-23,1	-19,7	-11,8	0,8	6,0	10,0	11,0	6,2	6,5	8,1	11,2	10,2	24,3	30,5	23,4	10,8	5,0
GDP (in billions of manats)	na	na	na	0,005	0,031	0,37	2,1	2,7	3,2	3,4	3,8	4,7	5,3	6,1	7,1	8,5	12,5	18,7	26,9	38,0	35,5
Consumer prices	na	na	na	912,0	1.129,0	1.664,0	412,0	19,7	3,5	-0,8	-8,5	1,8	1,5	2,8	2,2	6,7	9,6	8,3	16,7	20,8	2,5
Exchange rate (manats per US dollar)	na	na	na	0,011	0,020	0,314	0,883	0,860	0,797	0,774	0,824	0,895	0,931	0,972	1,0	1,0	0,9	0,9	0,9	0,8	na
General government balance	na	na	na	2,7	-15,3	-11,2	-3,1	-2,4	-4,0	-3,9	-4,7	-0,6	-0,4	-0,5	-0,8	1,0	2,6	-0,2	2,4	25,5	9,2
General government debt	na	na	na	na	na	25,7	19,6	14,1	13,5	14,9	24,2	20,3	20,9	20,5	20,0	18,6	14,2	10,8	9,4	9,7	na
External debt/GDP	na	na	na	na	na	3,3	20,0	13,3	13,8	12,8	15,9	21,0	19,8	20,2	20,1	37,7	40,2	32,8	23,2	18,6	13,8	na
Current account/GDP	na	na	na	na	na	-10,2	-10,3	-13,2	-25,8	-23,1	-30,7	-13,1	-3,5	-0,9	-12,3	-27,8	-29,8	1,3	17,7	28,8	35,5	4,9
Georgia																					
GDP	-4,8	-12,4	-20,6	-44,8	-25,4	-11,4	2,4	10,5	10,6	2,9	3,0	1,9	4,7	5,5	11,1	5,9	9,6	9,4	12,4	2,1	-5,5
GDP (in millions of laris)	na	na	na	167.200	16	1.373	3.694	3.847	4.679	5.741	5.665	6.013	6.638	7.448	8.565,0	9.969,8	11.621,0	13.789,9	16.998,6	19.069,6	17.925,4
Consumer prices	na	na	na	887,4	3.125,4	15.606,5	162,7	39,4	7,1	3,6	19,2	4,1	4,6	5,7	4,9	5,7	8,4	9,2	9,3	10,0	1,2
Exchange rate (laris per US dollar)	na	na	na	226,2	0,02	1,1	1,3	1,3	1,3	1,4	2,0	2,0	2,1	2,2	2,1	1,9	1,8	1,8	1,7	1,5	na
General government balance	na	na	na	-25,4	-26,2	-7,4	-5,3	-7,3	-6,7	-5,4	-6,7	-4,0	-2,0	-2,0	-2,5	2,3	-1,5	-3,0	-4,2	-6,4	-9,4
General government debt	na	na	na	na	na	na	na	na	na	58,2	77,0	69,8	68,4	67,4	61,5	47,0	36,6	28,9	22,9	na	na
External debt/GDP	na	na	na	12,8	67,8	80,4	42,4	44,8	42,8	39,4	61,1	52,0	53,5	54,8	49,0	39,2	33,3	25,7	30,8	35,6	na
Current account/GDP	na	na	na	-33,5	-40,2	-22,3	-7,5	-9,1	-10,6	-8,9	-7,7	-4,5	-6,6	-5,8	-7,4	-8,3	-9,8	-13,7	-19,7	-22,7	-16,1

Figure 1.27: Macroeconomic situation: Caucasian states

Figure 1.28: Macroeconomic situation: Baltic states

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
																				Estimate	*Projection*
Estonia																					
GDP	8,1	-6,5	-13,6	-14,2	-8,8	-1,6	4,5	4,4	11,1	4,4	0,3	7,9	6,5	7,2	7,6	7,2	9,4	10,0	7,2	-3,6	-13,2
GDP (in billions of kroons)	na	na	na	13	23	31	43	56	69	78	82	93	104	117	136,4	151,5	175,0	207,0	244,5	251,5	219,0
Consumer prices	na	na	na	1.076,0	89,8	47,7	29,0	23,1	11,2	8,1	3,3	4,0	5,8	3,6	1,3	3,0	4,1	4,4	6,6	10,4	0,3
Exchange rate (kroons per US dollar)	na	na	na	12,1	13,2	13,0	11,5	12,0	13,9	14,1	14,7	17,0	17,5	16,6	13,9	12,6	12,4	12,5	11,4	10,7	na
General government balance	na	na	na	na	na	1,2	-1,2	-1,5	1,9	-0,3	-3,7	-0,6	0,3	1,5	1,7	1,6	1,6	2,3	2,6	-2,7	-3,0
General government debt	na	na	na	na	na	na	8,2	7,5	6,4	5,6	6,0	4,7	4,7	5,8	5,6	5,0	4,6	4,5	3,8	4,6	na
External debt/GDP	na	na	na	5,7	13,2	15,8	16,7	33,0	51,9	52,7	51,7	54,9	54,9	66,8	71,8	84,6	80,9	102,4	119,3	114,1	na
Current account/GDP	na	na	na	3,3	1,3	-6,9	-4,2	-8,6	-11,4	-8,6	-4,4	-5,4	-5,7	-10,2	-11,3	-11,4	-9,8	-17,0	-17,8	-9,5	2,7
Latvia																					
GDP	6,8	2,9	-10,4	-34,9	-14,9	2,2	-0,9	3,8	8,3	4,7	3,3	8,4	8,0	6,5	7,2	8,7	10,6	12,2	10,0	-4,6	-16,0
GDP (in millions of lats)	na	na	na	1.113	1.625	2.262	2.580	3.076	3.563	3.903	4.224	4.686	5.168	5.689	6.392,8	7.434,5	9.059,1	11.171,7	14.779,8	16.274,5	14.162,7
Consumer prices	na	na	na	951,2	109,2	35,9	25,0	17,6	8,4	4,7	2,4	2,6	2,5	1,9	2,9	6,2	6,7	6,5	10,1	15,4	3,6
Exchange rate (lats per US dollar)	na	na	na	na	0,7	0,6	0,5	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,6	0,5	0,6	0,6	0,5	0,5	na
General government balance	na	na	na	na	na	-3,9	-3,6	-1,7	0,7	-0,6	-4,9	-2,8	-2,1	-2,3	-1,6	-1,0	-0,4	-0,5	-0,4	-4,0	-10,0
General government debt	na	na	na	na	na	12,8	14,7	13,3	11,0	9,8	12,6	12,9	15,0	14,2	14,6	14,9	12,4	10,7	9,0	19,5	na
External debt/GDP	na	na	na	na	na	na	na	37,5	44,9	46,8	52,9	60,9	67,6	76,5	84,0	97,7	94,7	119,2	135,4	124,0	na
Current account/GDP	na	na	na	na	17,3	5,0	-0,3	-5,0	-5,6	-9,8	-9,1	-4,8	-7,6	-6,8	-8,2	-12,8	-12,4	-22,7	-22,3	-13,2	5,4
Lithuania																					
GDP	1,5	-5,0	-5,7	-21,3	-16,2	-9,8	3,3	4,7	7,0	7,3	-1,7	3,9	7,2	6,8	10,2	7,4	7,8	7,8	9,8	2,8	-18,4
GDP (in millions of litas)	na	na	na	3.406	11.590	16.904	25.568	32.290	39.378	44.377	43.359	45.848	48.563	51.948	56.959,4	62.697,9	72.060,4	82.792,8	98.699,1	111.189,8	94.541,6
Consumer prices	na	na	na	1.020,5	410,4	72,1	39,6	24,6	8,9	5,1	0,8	1,0	1,5	0,3	-1,1	1,2	2,7	3,8	5,7	11,0	4,2
Exchange rate (litas per US dollar)	na	na	na	na	4,3	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	3,7	3,1	2,8	2,7	2,8	2,5	2,4	na
General government balance	na	na	na	na	-5,3	-4,8	-4,2	-4,4	-1,1	-3,0	-5,6	-2,5	-2,0	-1,4	-1,3	-1,5	-0,5	-0,4	-1,0	-3,2	-9,0
General government debt	na	na	na	na	na	na	na	na	15,2	16,5	23,0	23,6	22,9	22,3	21,1	19,4	18,4	18,0	16,9	15,6	na
External debt/GDP	na	na	na	na	na	12,4	21,5	29,7	33,5	34,2	41,9	42,4	43,4	43,8	44,8	46,4	47,6	63,0	76,9	68,9	na
Current account/GDP	na	na	na	na	-3,2	-2,2	-9,6	-9,0	-10,0	-11,7	-11,0	-5,9	-4,7	-5,2	-6,9	-7,6	-6,9	-10,7	-14,5	-12,3	1,2

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
																				Estimate	*Projection*
Kazakhstan																					
GDP	-0.4	-0.4	-11.0	-5.3	-9.2	-12.6	-8.2	0.5	1.7	-1.9	2.7	9.8	13.5	9.8	9.3	9.6	9.7	10.7	8.9	3.2	-1.3
GDP (in billions of tenges)	na	na	na	2	29	423	1.014	1.416	1.672	1.733	2.016	2.600	3.251	3.776	4.612.0	5.870.1	7.591.0	10.214.0	12.850.0	16.313.0	15.863.0
Consumer prices	na	na	na	1.381.0	1.662.3	1.892.0	176.3	39.1	17.4	7.1	8.3	13.2	8.4	5.9	6.4	6.9	7.6	8.6	10.8	17.2	7.2
Exchange rate (tenges per US dollar)	na	na	na	0.4	5.3	35.6	61.0	67.3	75.4	78.3	119.5	142.1	146.7	153.3	149.6	136.0	132.9	126.1	122.6	120.3	na
General government balance	na	na	na	-7.3	-4.1	-7.4	-3.4	-5.3	-7.0	-8.0	-5.2	-1.0	2.7	1.4	3.0	2.5	5.8	7.2	4.7	1.1	-2.0
General government debt	na	na	na	na	na	27.7	14.5	13.8	17.1	22.4	31.5	25.5	20.4	17.7	15.0	11.4	8.1	6.7	5.8	6.6	na
External debt/GDP	na	na	na	0.6	30.9	23.5	28.6	27.6	35.0	44.9	71.6	69.3	68.4	74.1	74.3	76.3	76.0	91.5	92.2	78.2	na
Current account/GDP	na	na	na	-25.0	-7.8	-7.6	-1.3	-3.6	-3.6	-5.5	-1.4	2.0	-6.3	-4.2	-0.9	1.1	-1.8	-2.3	-7.8	5.2	-2.1
Kyrgyz Republic																					
GDP	2.8	5.7	-7.9	-13.9	-15.5	-20.1	-5.4	7.1	9.9	2.1	3.7	5.4	5.3	0.0	7.0	7.0	-0.2	3.1	8.2	7.6	1.5
GDP (in millions of soms)	na	na	na	741	5.355	12.019	16.145	23.399	30.686	34.181	48.744	65.358	73.883	75.367	83.871.6	94.350.7	100.899.2	113.800.1	141.897.7	185.013.6	199.139.4
Consumer prices	na	na	na	855.0	772.4	180.7	43.5	31.9	23.4	10.5	35.9	18.7	6.9	2.0	3.1	4.1	4.3	5.6	10.2	24.5	7.6
Exchange rate (soms per US dollar)	na	na	na	1.0	6.1	10.8	10.8	12.8	17.4	20.8	39.0	47.7	48.3	46.9	43.7	42.6	41.0	40.2	37.3	36.6	na
General government balance	na	na	na	-14.4	-11.6	-17.3	-9.5	-9.2	-9.5	-12.7	-11.4	-5.6	-5.3	-4.7	-4.4	-4.4	-3.4	-2.5	-0.3	-0.1	-3.8
General government debt	na	na	na	34.3	31.4	45.7	60.9	68.4	110.7	134.3	113.3	107.3	107.3	106.9	92.9	85.9	72.5	56.8	48.6	na	na
External debt/GDP	na	na	na	26.2	68.7	58.8	56.5	74.2	90.2	131.8	124.4	109.6	111.1	103.3	95.2	85.5	77.9	69.3	45.7	na	na
Current account/GDP	na	na	na	-10.0	-7.6	-15.7	-23.3	-7.8	-22.2	-14.7	-5.7	-1.6	-3.1	1.7	4.9	2.8	-3.1	-0.2	-8.2	-7.9	
Tajikistan																					
GDP	-2.9	-1.6	-7.1	-29.0	-11.0	-18.9	-12.5	-4.4	1.7	5.3	3.7	8.3	10.2	9.1	10.2	10.6	6.7	7.0	7.8	7.9	2.0
GDP (in billions of somoni)	na	na	na	0.0006	0.007	0.018	0.1	0.3	0.6	1.0	1.3	1.8	2.5	3.3	4.8	6.2	7.2	9.3	12.8	17.6	19.5
Consumer prices	na	na	na	1.157.0	2.195.0	350.0	609.0	418.0	88.0	43.2	27.6	32.9	38.6	12.2	16.4	7.2	7.3	10.0	13.2	20.4	8.6
Exchange rate (somoni per US dollar)	na	na	na	0.002	0.01	0.02	0.10	0.29	0.56	0.78	1.24	1.83	2.38	2.78	3.1	3.0	3.1	3.3	3.4	3.4	na
General government balance	na	na	na	-31.2	-22.3	-10.1	-6.1	-5.8	-3.8	-3.8	-3.1	-5.6	-3.2	-2.5	-1.8	-2.4	-2.9	1.7	-6.2	-6.1	-8.9
General government debt	na	na	na	0.0	75.5	130.0	82.4	98.7	89.4	113.5	124.5	97.0	78.8	66.6	42.9	41.6	34.5	34.9	30.1	na	
External debt/GDP	na	na	na	73.2	93.8	130.0	82.4	98.7	89.4	113.5	124.5	97.0	84.0	83.8	56.5	51.5	42.7	40.9	47.0	na	
Current account/GDP	na	na	na	-29.7	-20.6	-15.2	-7.8	-4.0	-7.3	-0.9	-6.0	-5.0	-3.6	-1.3	-3.9	-2.7	-2.8	-8.6	-7.9	-11.2	
Turkmenistan																					
GDP	-6.9	2.0	-4.7	-5.3	-10.0	-17.3	-7.2	-6.7	-11.3	6.7	16.5	18.6	20.4	15.8	17.1	14.7	13.0	11.4	11.6	10.5	6.0
GDP (in billions of manats)	na	na	na	306	11	87	652	7.752	11.109	13.995	20.056	25.648	36.052	45.240	59.404.8	72.706.4	91.863.2	113.073.6	136.244.0	247.152.0	361.670.0
Consumer prices	na	na	na	493.0	3.102.0	1.748.0	1.005.3	992.4	83.7	16.8	24.2	8.3	11.6	8.8	5.6	5.9	10.7	10.5	8.6	12.0	5.5
Exchange rate (manats per US dollar)	na	na	na	226.2	1.018.0	41.7	207.7	3.499.8	4.534.3	5.130.1	8.169.4	8.478.6	9.827.9	10.097.5	10.033.5	10.375.0	11.015.2	10.881.9	10.690.0	13.041.5	na
General government balance	na	na	na	-9.4	-3.5	1.7	0.4	0.3	-0.2	-2.6	0.0	-0.3	0.6	0.2	-1.3	1.4	0.8	5.3	4.0	11.3	5.3
General government debt	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
External debt/GDP	na	na	na	na	na	20.0	17.5	30.2	55.3	67.5	82.5	72.2	50.8	37.1	25.7	18.2	12.1	7.7	na	na	na
Current account/GDP	na	na	na	na	na	4.0	0.7	0.1	-24.8	-34.3	-23.3	13.6	3.2	13.0	5.2	1.2	10.5	32.2	31.7	18.8	21.2
Uzbekistan																					
GDP	3.7	1.6	-0.5	-11.1	-2.3	-4.2	-0.9	1.6	2.5	4.3	4.3	3.8	4.1	3.1	4.2	7.7	7.0	7.3	9.5	9.0	7.0
GDP (in billions of sums)	na	na	na	444	5	65	303	559	977	1.416	2.129	3.256	4.925	7.450	9.837.8	12.261.0	15.923.4	20.759.3	28.186.2	36.839.4	44.351.7
Consumer prices	na	na	na	645.2	534.2	1.568.3	304.6	43.1	70.9	29.0	57.3	49.2	47.5	44.3	11.6	6.6	10.0	14.2	12.3	12.7	14.5
Exchange rate (sums per US dollar)	na	na	na	226.2	1.0	11.4	33.0	44.7	90.7	131.8	257.2	360.7	646.3	885.0	995.5	999.2	1.072.3	1.219.8	1.263.7	1.320.2	na
General government balance	na	na	na	-18.5	-18.3	-4.4	-4.1	-7.3	-2.2	-3.3	-2.6	-2.2	-2.1	-1.5	0.1	1.2	2.8	6.8	5.7	10.5	2.0
General government debt	na	na	na	na	na	na	na	10.0	11.0	12.7	11.8	16.6	24.3	22.4	41.6	35.1	28.2	21.3	15.8	13.1	na
External debt/GDP	na	na	na	17.3	22.0	21.9	19.5	19.1	25.9	30.1	58.1	48.9	56.2	50.6	43.7	37.3	31.3	22.1	16.7	13.4	na
Current account/GDP	na	na	na	-12.0	-8.4	2.1	-0.2	-7.8	-5.4	-0.9	-2.0	2.4	-1.5	3.0	5.9	7.0	7.4	9.1	7.3	12.8	7.8

Figure 1.29: Macroeconomic situation: Central Asian states

	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
																				Estimate	*Projection*
Belarus																					
GDP	8,0	-3,0	-1,2	-9,6	-7,6	-11,7	-10,4	2,8	11,4	8,4	3,3	5,8	4,7	5,0	7,0	11,4	9,4	9,9	8,2	10,0	-3,0
GDP (in billions of Belarussian roubles)	na	na	na	0,1	1	18	121	192	367	702	3.026	9.134	17.173	26.138	36.564,8	49.991,8	65.067,0	79.267,0	97.165,0	128.828,8	137.460,3
Consumer prices	na	na	na	970,3	1.190,2	2.221,0	709,3	52,7	63,9	72,9	293,7	168,6	61,1	42,5	28,4	18,1	10,3	7,0	8,4	14,9	13,2
Exchange rate (Belarussian rubles per US dollar)	na	na	na	0,02	0,3	3,7	11,5	13,2	26,0	46,1	249,3	876,8	1.390,0	1.790,9	2.051,3	2.160,3	2.153,8	2.144,6	2.146,0	2.136,7	na
General government balance	na	na	na	-2,0	-5,5	-3,5	-2,7	-1,5	-0,7	-1,0	-2,0	-0,1	-1,9	-1,8	-1,7	0,0	-0,7	1,4	0,4	1,4	0,0
General government debt	na	na	na	na	na	na	17,9	9,8	11,6	11,3	13,0	16,5	13,2	11,0	10,4	8,9	8,3	8,8	11,5	13,0	na
External debt/GDP	na	na	na	10,7	39,8	25,8	14,5	6,6	6,9	8,9	10,4	12,1	11,2	11,3	23,4	21,3	17,1	18,4	28,1	24,6	na
Current account/GDP	na	na	na	na	-11,9	-9,1	-4,3	-3,6	-6,1	-6,7	-1,6	-3,2	-3,2	-2,1	-2,4	-5,2	1,4	-3,9	-6,7	-8,4	-12,1
Moldova																					
GDP	8,5	-2,4	-17,5	-29,1	-1,2	-30,9	-1,4	-5,9	1,6	-6,5	-3,4	2,1	6,1	7,8	6,6	7,4	7,5	4,8	3,0	7,2	-8,5
GDP (in millions of lei)	na	na	na	192	1.821	4.737	6.480	7.798	8.917	9.122	12.322	16.020	19.052	22.556	27.618,9	32.032,0	37.651,9	44.754,0	53.430,0	62.840,0	57.517,1
Consumer prices	na	na	na	1.276,4	1.184,0	487,0	30,2	23,5	11,8	7,7	39,3	31,1	9,6	5,2	11,6	12,5	12,0	12,8	12,4	12,8	0,0
Exchange rate (lei per US dollar)	na	na	na	0,2	1,5	4,1	4,5	4,6	4,6	5,4	10,5	12,4	12,9	13,6	13,9	12,3	12,6	13,1	12,1	10,4	na
General government balance	na	na	na	-26,6	-7,5	-10,6	-6,7	-8,0	-10,5	-7,4	-6,2	-1,8	-0,3	-2,2	1,0	0,4	1,5	-0,3	-0,3	-1,0	-7,0
General government debt	na	na	na	na	na	5,7	7,4	57,1	63,7	108,5	103,3	91,7	78,4	73,1	58,9	46,0	34,7	34,2	28,5	21,4	na
External debt/GDP	na	na	na	1,3	20,4	53,1	46,3	62,8	66,6	85,4	127,6	133,6	113,1	109,2	97,5	72,5	69,6	74,3	76,3	67,9	na
Current account/GDP	na	na	na	-3,0	-14,5	-8,4	-8,0	-11,1	-14,2	-19,7	-5,8	-7,6	-1,7	-4,0	-6,6	-2,2	-8,1	-11,7	-15,2	-16,7	-9,0
Russian Federation																					
GDP	1,6	-3,0	-5,0	-14,8	-8,7	-12,7	-4,0	-3,6	1,4	-5,3	6,4	10,0	5,1	4,7	7,4	7,1	6,4	7,4	8,1	5,6	-8,5
GDP (in billions of roubles)	na	na	na	19	172	611	1.429	2.008	2.343	2.630	4.823	7.306	8.944	10.818	13.243,2	17.048,1	21.625,4	26.903,5	33.111,4	41.668,0	40.795,1
Consumer prices	na	na	na	1.526,0	875,0	311,4	197,7	47,8	14,7	27,6	86,1	20,8	21,6	15,7	13,6	11,0	12,5	9,8	9,1	14,1	12,3
Exchange rate (roubles per US dollar)	na	na	na	0,2	1,0	2,2	4,6	5,1	5,8	10,0	24,6	28,1	29,2	31,3	30,7	28,8	28,3	27,2	25,6	24,9	na
General government balance	na	na	na	-18,9	-7,3	-10,4	-6,6	-9,4	-8,5	-8,1	-3,1	3,2	2,7	0,6	1,3	4,5	8,1	8,4	6,0	4,8	-8,8
General government debt	na	na	na	na	na	47,8	46,3	49,0	57,2	81,9	90,0	62,5	48,2	41,4	27,0	20,4	13,5	9,0	7,3	6,5	na
External debt/GDP	na	na	na	na	na	3,6	6,4	36,7	44,6	70,4	90,3	61,6	49,3	44,1	43,1	36,1	33,6	31,7	36,4	28,8	na
Current account/GDP	na	na	na	na	na	2,8	2,2	2,8	0,0	0,1	12,6	18,0	11,1	8,4	8,2	10,1	11,1	9,6	5,9	6,1	3,1
Ukraine																					
GDP	4,0	-4,0	-10,6	-9,7	-14,2	-22,9	-12,2	-10,0	-3,0	-1,9	-0,2	5,9	9,2	5,2	9,6	12,1	2,7	7,3	7,9	2,1	-14,0
GDP (in billions of hryvnias)	na	na	na	0,05	1	12	55	82	93	103	130	170	204	226	267,3	345,1	441,5	544,2	720,7	949,9	920,0
Consumer prices	na	na	na	1.210,0	4.734,0	891,0	377,0	80,0	15,9	10,6	22,7	28,2	12,0	0,8	5,2	9,0	13,5	9,1	12,8	25,2	16,0
Exchange rate (hryvnias per US dollar)	na	na	na	0,002	0,05	0,3	1,5	1,8	1,9	2,4	4,1	5,4	5,4	5,3	5,3	5,3	5,1	5,1	5,1	5,3	na
General government balance	na	na	na	-24,0	-16,2	-8,7	-4,7	-3,2	-5,4	-2,5	-2,3	-1,1	-0,9	0,1	-0,7	-4,4	-2,3	-1,3	-2,0	-3,2	-11,4
General government debt	na	na	na	na	na	na	21,7	24,3	30,1	37,6	51,0	45,9	36,9	33,5	29,3	25,5	18,7	15,7	12,9	19,9	na
External debt/GDP	na	na	na	12,6	12,9	14,0	21,9	20,4	20,4	28,6	42,8	37,8	31,8	30,1	47,5	47,3	46,0	50,6	57,6	56,4	na
Current account/GDP	na	na	na	na	na	-3,2	-3,1	-2,7	-2,7	-3,1	5,2	4,7	3,7	7,5	5,8	10,5	2,9	-1,5	-4,1	-7,2	-0,8

Figure 1.30: Macroeconomic situation: Russia and Western CIS

Chapter 2

Optimal Public Debt Management in the Republic of Armenia

2.1 Introduction

Public debt management is more complex and crucial in transition and other emerging countries than in developed ones. In these economies, the choice of the financial structure of public debt is key to warrant fiscal stability because of higher volatility of macroeconomic and financial conditions. Also, public debt dynamics exacerbate the weight of fiscal risk as a source of macroeconomic instability. This work is a contribution to the analysis of these issues; in particular, I focus on optimal PDM in a FSU country, a relatively unexplored issue in the economic literature.

FSU countries followed differentiated transitional paths from central planning to market economy. The choice of the Republic of Armenia, belonging to the Caucasian region, is based on several theoretical and practical issues: Armenia is one of the few transition countries that has never practiced a fixed exchange rate regime after USSR break down (Poghosyan and Koenda, 2006), which makes relevant the exchange rate risk for the analysis of optimal debt management; no administrative restriction has been imposed on deposit rates, thus short-term interest rate is driven by market conditions. Moreover, the availability of high frequency data on foreign and domestic Armenian debt makes the analysis viable.

Armenia has experienced a rapid economic transformation since mid-1990s, though different shocks affected its macroeconomic situation: the adjustment of energy prices to world levels; the loss of transfers from USSR budget; the collapse of the payments system; the 1998 Russian crisis. As a consequence, poverty grew sharply and fiscal needs were initially covered by peculiar public liabilities such as expenditure arrears. Though macroeconomic situation is still affected by political instability

and trade imbalance, partially offset by international aid and grants[1] and huge foreign remittances[2], Armenia succeeded in implementing crucial economic reforms, such as introducing the Armenian Dram (ADM) as national currency in 1993 and joining the WTO in 2003. Macroeconomic policy also was successful: inflation was curbed by the half of 90s, thanks to inflation targeting; real GDP growth became positive by 1994; the trend of public debt to GDP ratio became downward sloping by 2002 (see Fig.2.1).

The global crisis in 2008 faced Armenia with a number of strong external shocks. Declines in the construction sector and remittances, particularly from Russia, are the main reasons for the downturn. In 2009 GDP growth declined 15% and inflation increased sharply to over 9%, reflecting a combination of exchange rate depreciation, a decline in international prices, and a drop in domestic demand. A gradual recovery has started in 2010, but downside risks are prevalent. Relying on the model

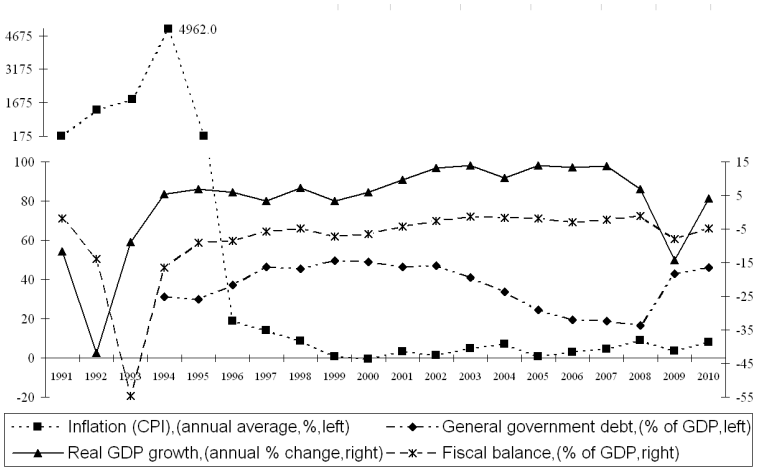

Figure 2.1: Macroeconomic conditions of the Republic of Armenia 1991-2010

developed by Giavazzi and Missale (2005), the main contribution of this paper is to investigate the optimal composition of Armenian public debt (in terms of maturity, currency denomination, and indexation), minimizing the probability of fiscal instability (namely, of undesired growth of debt-to-GDP ratio), and balancing risks and

[1]According to CBA annual report, in 2009, Armenian government received 0,5% of GDP (2,2% of total public revenues) in grants (see http://www.cba.am).

[2]Only 3 million of Armenians are resident in the Republic, another 6 to 8 million live and work abroad (for further details: http://www.armeniadiaspora.com/followup/population.html). According to the CBA Statistical Bulletin (for details: http://www.cba.am) Armenians transferred (mainly from Russia and including seasonal workers) ADM1575678 million in 2009, or 49,78% of GDP (total individual remittances inflows via the banking system).

cost minimization. As suggested by Giavazzi and Missale (2005), the optimal structure of public debt is a function of the expected return differentials between debt instruments[3], of the conditional variance of debt returns and of their covariances with the main macroeconomic and financial variables. To estimate the macroeconomic and financial risks associated to different public securities, I rely on a simple econometric model of the Armenian economy estimated with quarterly data for the period between the first quarter of 2000 to the last quarter of 2007[4]. Furthermore, I introduce a new additional variable, e.g. RF output gap, as ex Soviet Union countries experience quite significant dependence on the development of Russian economy.

The main results are that debt obligations in foreign currency have to be reduced, giving priority to fixed-rate and real-indexed long term securities, thus increasing the borrowing volume in the domestic market. This implies that Armenia should continue to focus on the development of GS domestic market.

The paper is structured as follows. In the remaining sections of Introduction, I provide an overview of the structure and evolution of Armenian public debt. Next section presents literature review on underlying economic theory with brief description, analysis of different models, empirical findings and states the importance of conducting of such an investigation for transition countries. The third section contains methodology and discusses the application of the Giavazzi and Missale (2005) model of optimal liability portfolio to the Armenian case. The fourth section presents and discusses the main results of the paper, namely the effects of several macroeconomic and financial shocks on the optimal structure of Armenian public debt. Finally, the fifth section presents conclusions and policy implications with possible areas for further research. In the appendixes, I present the estimation of the econometric model an the simulation of variances and covariances (Appendix I), and the data set sources (Appendix II).

2.1.1 Armenian public debt: stylized facts

After the collapse of the USSR in 1991, Russia took over all assets and liabilities of the Soviet Federation[5]. Therefore, most of the FSU countries (and Armenia among them) started their transition path with low debt-to-GDP ratios. While in early transition years, these countries faced high financial cost in issuing securities,

[3]As discussed in Section 2.1.1, I will consider four types of securities: T-bills, T-bonds, real-indexed bonds, and US dollar-denominated loans.

[4]Covariances and variances of relevant variables are estimated as the one-year cumulated impulse responses to shocks to inflation, output gap, exchange rate, T-bill interest rate, RF output gap and LIBOR.

[5]The "Zero agreement" relieved Armenia of any obligations related to the former USSR's public debt, in exchange for Armenia forgoing claims on any USSR foreign assets.

the situation quickly changed. For most of the FSU, adverse initial conditions of transition (basically related to the break down of former central planning and the cutoff of transfers from Moscow) and subsequent difficult economic and political conditions (the 1998 Russian crisis, internal and regional political instability, growth of energy prices, and so on) caused rapid debt accumulation.

FSU countries then benefitted of relatively easy international credit lines (both from multilateral financial institutions, and commercial banks) that, together with growth of exports and FDI, made possible real exchange appreciation notwithstanding large current account deficits. After almost two decades of transition, most of FSU countries still tend to have low debt-to-GDP ratios (except for Russia and some Central Asian countries). Most of the public debt issued by Armenia is denominated

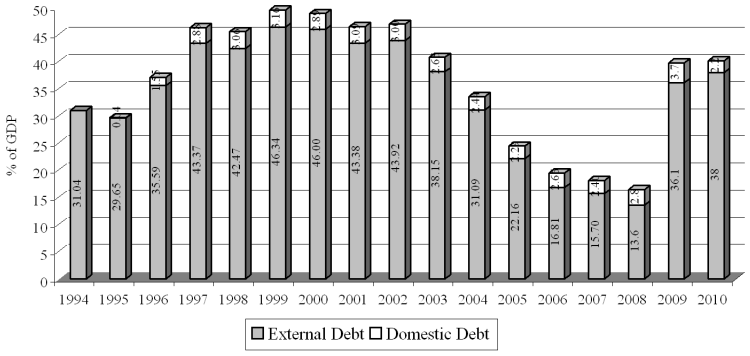

Figure 2.2: Armenian public debt: structure and dynamics

in foreign currencies. However, the domestic-currency denominated share is growing relatively fast (see Fig.2.2).[6]

Domestic-currency denominated debt

All ADM-denominated debt securities are currently non-indexed with various maturities. Fig.2.3 shows the composition of the domestic public debt, which includes liabilities of the Central Bank of Armenia (CBA). Armenia started auctions of GS on the domestic financial market in September 1995. One-month T-bills were first

[6]PDM is assigned to the Central Treasury , subordinated to the MOF. Within the Central Treasury, debt management is carried out by the Government Debt Management Department, including the External Debt Management Division, the Domestic Debt Management Division and the Treasury Direct Division. Treasury Direct, that is responsible for T-bills management, used to be supervised by the CBA at the outset of its mission in 1999 and passed under MOF control in 2001.

issued on the primary market[7]. In May 1996, the government began auctioning 3-and 6-months T-bills; in 1997, the maturity range was further expanded to 9-and 12-months with the share of longer maturities increasing steadily.

Interest rates were very high in 1990s (between 40-50% most of the time reaching 70% level at certain times). Till 2000 only T-bills were issued. Accordingly, debt

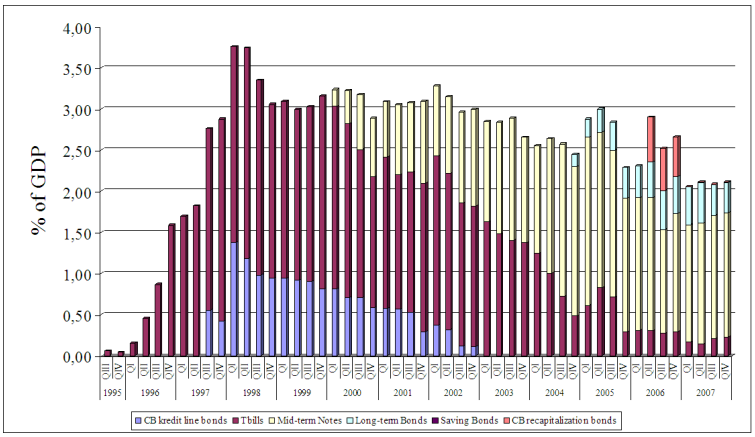

Figure 2.3: Domestic public debt: structure and dynamics

maturity was very short (ranging from 7 days to a year) and interest-rate cost was relatively high. Wider security market attracted an increasing number of nonresidents compressing average yield on T-bills (since April 1997) and pushing the share of ADM-denominated debt held by foreigners over half of the total by September 1997.

Building on growing confidence in securities issued by Armenia, the government has implemented, since 2000, a strategy aiming at: debt-maturity extension, cost reduction, and market transparency enhancement. Part of this strategy relied on issuing new types of securities: Medium-term coupon notes (MTCN)[8]; Long-term coupon bonds (LTCB)[9], with coupon based on a fixed interest rate and paid semi-annually; Saving coupon bonds (SCB)[10]. Upon the considered evolution of primary

[7]Treasury bills (T-bills) or Short-term T-bills are discount securities, issued in non-paper (electronic) form and accounted at the CBA.

[8]Issued, since March 2000, in non-paper form.

[9]MTCN from 15 months to 5 years and LTCB with a maturity period from 6 to 30 years were introduced in September 2004. In 2008, benchmark bonds of this type were issued with starting maturity of 3, 5, 10 and 20 years.

[10]SCB are non marketable securities issued since 2007 with maturity from 3 months to 25 years. SCB are allocated only through Treasury Direct System and sold exceptionally to individuals. Coupon is paid quarterly, semiannually or annually.

market, a secondary market of GS has recently started its operation.

In the analysis, I simplify the structure of existing government securities denominated in domestic currency as follows: T-bills (short-term and floating interest rate), including all T-bills; T-bonds (long-term and fixed interest rate), including all MTCN and LTCB. I will also consider R-bonds (long-term and real-indexed interest rate) that are currently not issued by Armenian Treasury.

Foreign-currency denominated debt

Since independence in 1991, the external public debt of Armenia[11] (i.e. denominated in foreign currencies and owned by foreign institutions, namely multilateral organizations, foreign governments, and commercial banks) has increased rapidly, often in the form of structural reforms credits provided to the government and the CBA by international financial organizations (multilateral loans) and public and private institutions of foreign countries (bilateral loans), as well as of credits provided against guarantee of the government and the CBA.

Most of Armenian external debt was issued on concessional terms (Fig.2.4), basically by multilateral institutions, typically: 7 to 10 years grace period (in which no repayment is owed by the Armenia); 25 to 40 years repayment period; low interest rate (usually, 0,75%). Though concessional debt is very convenient as regards its cost, it involves exchange-rate risk, given foreign-currency denomination (namely, SDR for loans granted by the IMF and the WB; EURO, USD, Ruble, and Yen for bilateral loans). As of 2007 the portion of concessional loans on total external public debt was 99,1%. In particular, loans provided by the WB and Germany increased. The WB is currently the largest lender to Armenia. The remaining (shrinking) share of Armenian external debt is bilateral and lent on non-concessional terms, mainly provided in USD through credit restructuring. Loans afforded by IBRD, EBRD, EU, RF and Turkmenistan were provided on non-concessional terms[12].

In the analysis, for the sake of tractability, I consider that external public debt (both concessional and non-concessional) is USD-denominated. Moreover, I assume that interest rate on non-concessional loans is given by the LIBOR rate plus 1%, and that interest rate on concessional loans is given by a fixed 1% rate.

[11]The structure of Armenian external public debt is similar to many emerging countries: high share of debt issued or guaranteed by public sector (private sector has less admittance to international financial capital markets); concessional terms dominate over commercial ones; long maturity (from 25 to 40 years).

[12]In 1999-2003 period, the Armenian government negotiated loans restructuring with Turkmenistan and Russia: the term of payment of the Turkmen loan was prolonged, with partial repayments in the form of goods (all external arrears to Turkmenistan were cleared through cash payments, the export of goods or deferrals by the creditors), while the Russian loans of USD94 million were repaid in 2002 by asset transfers to the RF (mainly, enterprizes property).

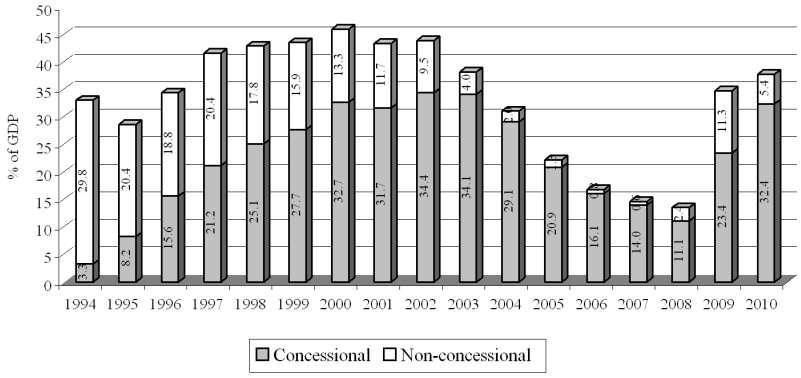

Figure 2.4: External public debt: structure and dynamics

2.2 Related Literature

2.2.1 Theories on PDM

Theories on PDM have emphasized a variety of goals over time, including macroeconomic stabilization, supporting monetary and fiscal policy, minimizing costs and risks of the debt portfolio, promoting financial development and efficient country's securities markets (see Missale, 1999 for an excellent survey).

In the traditional view (see Tobin, 1963), the primary objective of PDM is to support monetary and fiscal policies as a tool of macroeconomic stabilization, with minimization of interest costs coming secondary, and risk minimization playing no role at all. Lately there were suggested additional objectives, namely promoting well functioning GS markets and providing instruments for monetary and fiscal policy.

The study of Faraglia et al.(2008) proposes two distinct classes of indicators for the performance of PDM - tax-smoothing, based on implication from the tax-smoothing literature, and debt stabilization, based around the period by period budget constraint.

Faraglia compares structural similarities of debt stabilization vis-a-vis tax-smoothing to see whether PDM provides fiscal insurance against budget shocks so as to support optimal taxation or stabilize the debt ratio. The idea of looking at similarity of tax-smoothing and debt stabilization perspective of fiscal insurance dates back to theory of optimum taxation stating, that countries' debt management are less likely to suffer from the unexpected fiscal shocks.

Tax-smoothing perspective

In the optimal taxation literature there are a long discussion on the optimal tax composition and borrowing to finance government expenditures.

First contribution to this issue dates back to Ramsey (1927). His approach to optimal taxation is the solution to the problem of choosing optimal taxes and transfers given the following assumptions: only distortionary tax instruments are available, lump sum taxation is prohibited, only linear taxes are allowed, all activities of agents are observable. Mirrlees (1971) further characterizes the optimal income tax schedule when individual productivity is not observed by the planner and evaluate optimal trade-off of labor incentives and consumption insurance through use of a non-linear tax schedule, including lump-sum taxes[13].

In the literature on fiscal policy in general equilibrium under incomplete markets one of the first and key theories on public debt is considered Barro tax-smoothing model (1979). The main result is that budget deficit has the negative relationship with unanticipated changes in output but is positively correlated with expected increase in economic growth. Lately, Bohn (1990) kept focus on a stochastic version of Barro's model that is optimal tax and debt policy smooth taxes over time and states of nature. Bohn considered a model similar to Barro's adding some risky securities, such as stocks and foreign currency debt, in order to analyze the optimal debt structure as a hedge of budget against macroeconomic uncertainty.

A number of papers accepts that debt markets may be imperfect and provides optimal fiscal policy under complete markets by alternative policy instruments. Lucas and Stokey (1983) emphasize the role of contingent debt in smoothing taxes, that since then has become a key ingredient in most studies of optimal fiscal policy and PDM. By application of the Ramsey theory of optimal taxation to the study of optimal fiscal and monetary policies in a general equilibrium economy, they show that, in a model without capital, state-contingent returns on debt is an important feature of an optimal policy under complete markets and play a role in smoothing tax distortions across states of nature in a welfare-maximizing way.

Chari et al. (1994) extend this analysis to an economy with capital, thus investigating the quantitative properties of optimal fiscal policy in a standard business cycle model.

Aiyagari et al. (2002)[14] recasts the optimal taxation problem in an incomplete markets setting and show that the debt structure is a critical ingredient for determining the properties of optimal taxation. This analysis recovered a version of Barro's random walk tax-smoothing outcome, modifying a Lucas and Stokey's no capital economy to permit only risk-free debt.

[13]Werning (2001), Golosov et al.(2003) extends the static Mirrlees framework to dynamic settings.

[14]more recently Werning (2005)

Angeletos (2002), Buera and Nicolini (2004) independently worked on the same problem how to use debt management and obtained very similar results. The main insight is common - in a dynamic economy a Ramsey government may sustain state contingent debt with issuing non-contingent risk-free bonds only, by properly managed the debt maturity. The paper of Angeletos notices that long-term security can hedge the budget balance against fiscal shocks, therefore this is not possible if the government issues only short-term debt.

Farhi (2005) extends this line of research by introducing capital along with a more general asset structure, and studying capital taxation in addition to labor taxation. Optimal capital taxation can be decomposed into hedging role in incomplete market and intertemporal role in complete market.

All these approaches focus on fiscal policy in a neoclassical, stochastic production economy either under complete or incomplete markets.

Faraglia et al. (2008) analyze a Ramsey planner under complete[15] and incomplete markets[16] following the approach of Marcet and Scott (2007). The core of the paper is justification and implementation of the two tests induced by two different debt market structures and see how debt evolves in response to exogenous deficit and output growth shocks. Under complete markets, the debt has the same or less persistence than other endogenous variables in the economy including primary deficit/GDP ratio, growth, government expenditure and declines in response to increases in the fiscal deficit. Under incomplete markets the market value of debt shows more persistence than other variables and increases in response to a higher primary fiscal deficit.

Debt-to-GDP ratio stabilization perspective

There are different approaches used in the economic theory regarding the PDM in supporting fiscal policy. This section shows debt stabilization as the probability to achieve fiscal rule. Similar motivation in the role of debt management can be find in Goldfajn's (1998) endogenous (covariance-led) tax-smoothing model, Lloyd-Ellis and Zhu (2001), optimal debt structure derived by Giavazzi and Missale (2005), Borensztein and Mauro (2004).

Lloyd-Ellis and Zhu (2001) emphasize the role of fiscal shocks in affecting the variation in budget surplus rather than in the tax rates. They show that the impact of these shocks was absorbed by the government through risk-free borrowing and lending and, therefore, resulted in rising debt ratio. While Bohn argues that risk management help the government to reduce the short-term variations in the tax rates, Lloyd-Ellis and Zhu show that fiscal risk management help to reduce the

[15] there are available state-contingent securities

[16] government trades only with one-period risk-free bonds and cannot achieve full fiscal insurance

probability of high debt, enhancing the long-term stability of fiscal policy and thus improve welfare.

Goldfajn (1998) emphasizes the effects of both tax-smoothing motives and time-consistency problems (inflation rate fluctuations) in government's decision to manage its optimal public debt composition. The paper put in discussion the volatility of inflation, the debt level, the exchange rate and the correlation between government expenditures and inflation as important elements in the public debt composition.

Following Goldfajn, Giavazzi and Missale (2005) presented a model where PDM helps to stabilize the debt-to-GDP ratio along the trade-off between cost and risk minimization, thereby reducing the probability of a fiscal crisis. The paper derives the optimal composition of Brazilian public debt by looking at the relative impact of the risk of large interest payments due to unexpected changes in interest rates and/or in the exchange rate and cost of alternative debt securities on the probability of missing a well-defined stabilization target.

A simple numerical exercise by Borensztein and Mauro (2004) illustrates how GDP-indexed securities, whose return would be indexed to the real GDP growth rate, would help to stabilize debt ratios. Sovereigns and especially emerging economies very often suffer from many shocks. The analysis sustains that indexing debt instruments repayments to GDP outcomes would reduce the impact of these shocks, stabilize debt ratio and prevent some unpleasant dynamics or possible risk of default.

In the purely empirical analysis, Faraglia et al. (2008) focus on both optimal tax-smoothing and debt stabilization as possible motivations for government's interest in supporting fiscal policy potential of PDM and find little evidence that debt management has provided much support to fiscal policy. There are also little evidence of any relationship between differences in performance of PDM, namely tax-smoothing and debt stabilization perspective, connected to differences in public debt composition. This might happen because relative yields show minor variations in public debt structure and thus little effect on fiscal insurance. This empirical achievement can also explain why public debt managers traditionally choose objectives other than fiscal insurance for public debt issuance.

2.2.2 Theories on PDM in transition countries

The markets for debt securities in the emerging economies have expanded significantly. The main reasons for their development are the risk diversification away from banks and the need for a different source of finance for the economy. The composition of the public debt is more complex in emerging countries, because volatility in the macroeconomic environment is higher.

Thus, studies of performance of financial markets in emerging economies have intensified significantly, as these markets are less researched but provide a higher

average rate of return compared to the developed ones[17].

PDM in the FSU countries remains relatively less explored in the literature. That is why, topic of this paper is urgent and studying countries with similar starting conditions can help to receive more accurate and applicable results.

Dooley (2000), in his research on emerging countries, writes that minimizing public-debt service costs may prove inefficient because potential increase of fiscal risk related to the volatility and dynamics of outstanding debt, and ultimately a growth of default risk. According to Jeanne (2003) the currency composition of public debt is chosen to minimize the probability of default. The less credible monetary policy is, the more foreign currency-denominated debt will be issued.

Montiel (2005) provides an overview of important factors in determining the optimal debt composition and attempts to establish general guidelines for PDM in emerging economies. This analysis suggests that in order to retain market access and promote domestic financial market development, governments should finance themselves at market rates using a wide variety of financial securities. The optimal public debt composition involves a trade-off between raising the government's anti-inflationary credibility and reducing the vulnerability of its state budget to shocks.

The importance of risk management function is growing. Blommestein (2005) provides new risk management approach to debt sustainability that goes beyond the existing traditional literature simply focused on determining the primary deficit (surplus) and/or GDP growth rate that would keep the public debt at a certain level. The traditional approach analyzes in essence public debt sustainability in the absence of risk. The risk management approach, in contrast, shows that risk is minimized if a chosen debt instrument provides insurance against fluctuations in the primary budget balance, in the interest payments and the debt ratio due to uncertainty about output and inflation.

Recently, the PDM literature has focused on the optimal debt portfolio and macroeconomic stabilization in indebted countries, particularly in Latin America, Central and Eastern Europe (CEE).

Thus Izak (2003) argues the dominating opinion that the debt service cost depends on the variables that determine the debt dynamics: primary balance, outstanding debt level, economic growth and inflation. Therefore, the relationship between the debt costs and some explanatory variables has been studied in Czech Republic, Hungary, Poland and Slovakia. The results show that the impact of inflation and GDP growth is robust and has a statistically significant effect on borrowing costs, whereas the impact of fiscal variables primary fiscal balance is weak and insignificant and that of outstanding debt exhibits even a bad sign.

A key insight of Matalik and Slavik (2004) on PDM in the Czech Republic is

[17]For example the sovereign bond of the same maturity date can yield 2-5% in the US and 6-10% in the CIS countries.

that PDM represents one of the central areas of the fiscal and monetary policies, has the crucial impact not only on the financial market development, but also on the most important macroeconomic variables. In economies with less developed financial markets or in an earlier stage of transformation, a relatively consistent coordination of the monetary and fiscal policies targets with PDM targets is required.

As an integral part of transition process loans from different IFI occur, increasing in such a way their external debt. Several articles focus on the issues arising by growing external public debt in emerging economies. Thus, Gray and Woo (2000) point out that the external borrowing for emerging markets make sense if a government wishes to increase resources available to the economy, non accessible for private sector, but if a government is accessing international capital markets because it appears to be cheaper, make sure that all costs and risks have been taken into account. Governments should allow the domestic market to be accessed more cheaply than international capital market borrowings.

Giavazzi and Missale (2005) derive the optimal Brazilian debt composition by looking at the relative impact of the risk and cost of alternative debt instruments on the probability of missing the stabilization target.

Based on this literature investigation, I rely on the model developed by Giavazzi and Missale. The goal of my paper is to investigate the optimal debt composition (in terms of maturity, currency denomination and indexation), minimizing the probability of fiscal instability and balancing risks and cost minimization.

2.3 Optimal Public Debt Management Model

As argued, my focus in the assessment of optimal structure of public debt in Armenia. I rely on the technique developed by Giavazzi and Missale (2005), which is based on the minimization of the risk that shocks hitting the economy may determine a fiscal risk, say an increase (or lower reduction) of the public debt ratio above government projected level.

The optimal debt structure is estimated by evaluating the relative impact of the costs and risks of the different public debt instruments on the debt-to-GDP ratio.

I assume that the prevail debt management objective is to stabilize the debt ratio. Given my focus on the assessment of the optimal structure of public debt in Armenia I rely on technique developed by Giavazzi and Missale (2005) to illustrate that the choice of different debt instruments trades off the risk and expected costs of debt service.

In order to stabilize the debt ratio, B_t, the government decides to implement a fiscal adjustment, taking into account the realization of debt returns, output, inflation and the exchange rate. Consequence of a stabilization program is uncertain. As a result, a debt crisis cannot be prevented with certainty. When a debt crisis

arises, the debt ratio increases rapidly:

$$B_{t+1}^T - A_{t+1} + X > B_t \tag{2.1}$$

where B_{t+1}^T is the trend debt ratio[18], A_{t+1} is the expected fiscal adjustment, and X is the uncertain component of the fiscal adjustment (or external or internal shocks to the budget).

Debt accumulation $\Delta B_{t+1}^T = B_{t+1}^T - B_t$ is driven by:

$$\Delta B_{t+1}^T = I_{t+1}B_t + \Delta e_{t+1}B_t - S_{t+1}^T - (\Delta y_{t+1} + \pi_{t+1})B_t \tag{2.2}$$

where $I_{t+1}B_t$ are the nominal interest payments on outstanding amount of debt, e_{t+1} is the log of the nominal exchange rate, q is the share of foreign currency-denominated debt, S_{t+1}^T is the trend primary surplus, y_{t+1} is the log output and π_{t+1} is the rate of inflation.

Total interest payments $I_{t+1}B_t$ are equal to:

$$I_{t+1}B_t = i_{t+1}sB_t + (R_t^{US} + RP_t)qB_t + (R_t^I + \pi_{t+1})hB_t + R_t(1 - s - q - h)B_t \tag{2.3}$$

where s is the share of debt indexed to the (average) domestic interest rate i_t, R_t^{US} is the world USD interest rate, RP_t the risk premium[19] q is the share of foreign currency-denominated USD bonds, R_t^I is the real interest rate, h is the share of price-indexed debt and R_t is the nominal rate of return on nominal fixed-rate bonds.

The ratio of the trend surplus-to-GDP, S_{t+1}^T, depends on cyclical conditions and unanticipated rate of inflation:

$$S_{t+1}^T = E_t S_{t+1}^T + \eta_y(y_{t+1} - E_t y_{t+1}) + \eta_\pi(\pi_{t+1} - E_t\pi_{t+1}) \tag{2.4}$$

where E_t denotes expectation conditional on the available information at time t, η_y is the elasticity of the government budget (relative to GDP or output), η_π is the elasticity with respect to the price level, and $y = lnY_{t+1}$.

Hence, expression (2.4) captures the notion that S_{t+1}^T can be higher than expected because of output surprises and/or inflation surprises.

I consider a model which aims to determine shares of different debt instruments to minimize the probability that debt stabilization fails because of uncertainty in the fiscal adjustment (in terms of GDP) which I denote as X. The optimal debt portfolio (that is, the choice of debt denomination and indexation) is based on the

[18] this is the debt ratio that would persist in the period t+1 in the absence of the fiscal adjustments

[19] the return on USD denominated bonds $(R_t^{US} + RP_t)(1 + \Delta e_{t+1})$ has been approximated by $(R_t^{US} + RP_t)$

minimisation of the probability that the expected fiscal adjustment program fails:

$$Min\{E_t Prob[X > A_{t+1} - \Delta B^T_{t+1}]\} \tag{2.5}$$

subject to (2.2), (2.3) and (2.4).

The probability Pr of debt crisis is the integral of the probability density function $\phi(X)$ over the possible realizations of fiscal adjustment.

In order to identify the optimal debt structure, minimizing Pr, I derive the probability of debt instability with respect to the shares of debt instrument that I assume the government can issue, obtaining the first order conditions which are functions of $\phi(X)$ parameters.

Since $\phi(X)$ cannot be estimated, following Giavazzi and Missale (2005), I apply a linear approximation[20]. Under this assumption, $\phi(X)$ is completely identified by introducing the worst possible realization $\bar{X}$. The model could work having an estimate of $\bar{X}$. Otherwise I prefer to transform $\bar{X}$ in the probability Pr of a debt crisis as it is perceived by the government.

Thanks to these hypothesis the optimal values of debt-instrument shares can be calculated solving (2.5) with respect to s, q and h. These first-order conditions show also the trade-off between the risk and expected cost of debt service related to the choice of debt instruments.

The next step is to use a structural macroeconomic model to investigate how the optimal debt portfolio depends on the type of shocks hitting the economy (demand, supply, exchange rate, international interest rate, etc.).

Following the analytical derivation of Giavazzi and Missale (2005), and the types of debt securities I considered (as discussed in previous section, the optimal shares

[20]The reason for this choice is that the triangular density function means that the higher value of X (worse cases realization) have less probability to happen.

of T-bills, $s*$, USD denominated LIBOR-indexed loans, $q*$, and Real-bonds, $h*$, are:

$$s* = \frac{\eta_y + B_t}{B_t}\frac{Cov(y_{t+1}i_{t+1})}{Var(i_{t+1})} + \frac{\eta_\pi + B_t}{B_t}\frac{Cov(\pi_{t+1}i_{t+1})}{Var(i_{t+1})} - q * \frac{Cov(e_{t+1}i_{t+1})}{Var(i_{t+1})} \quad (2.6)$$
$$-h * \frac{Cov(\pi_{t+1}i_{t+1})}{Var(i_{t+1})} + TP_t\frac{\sqrt{2P_r}}{1-\sqrt{2P_r}}\frac{E_t(A_{t+1} - \Delta B^T_{t+1})}{B_t Var(i_{t+1})}$$

$$q* = \frac{\eta_y + B_t}{B_t}\frac{Cov(y_{t+1}e_{t+1})}{Var(e_{t+1})} + \frac{\eta_\pi + B_t}{B_t}\frac{Cov(\pi_{t+1}e_{t+1})}{Var(e_{t+1})} - s * \frac{Cov(e_{t+1}i_{t+1})}{Var(e_{t+1})} \quad (2.7)$$
$$-h * \frac{Cov(\pi_{t+1}e_{t+1})}{Var(e_{t+1})} + FP_t\frac{\sqrt{2P_r}}{1-\sqrt{2P_r}}\frac{E_t(A_{t+1} - \Delta B^T_{t+1})}{B_t Var(e_{t+1})}$$

$$h* = \frac{\eta_y + B_t}{B_t}\frac{Cov(y_{t+1}\pi_{t+1})}{Var(\pi_{t+1})} + \frac{\eta_\pi + B_t}{B_t} - q * \frac{Cov(e_{t+1}\pi_{t+1})}{Var(\pi_{t+1})} \quad (2.8)$$
$$-s * \frac{Cov(\pi_{t+1}i_{t+1})}{Var(\pi_{t+1})} + IP_t\frac{\sqrt{2P_r}}{1-\sqrt{2P_r}}\frac{E_t(A_{t+1} - \Delta B^T_{t+1})}{B_t Var(\pi_{t+1})}$$

where $Var(.)$ and $Cov(.)$ - variances and covariances conditional on the information available at time t; $Cov(y,i)/Var(i), Cov(y,e)/Var(e), Cov(y,\pi)/Var(\pi)$ - covariances of output growth with all types of debt; $Cov(e,i)/Var(i), Cov(i,e)/Var(e)$, $Cov(e,\pi)/Var(\pi), Cov(i,\pi)/Var(\pi)$, $Cov(\pi,i)/Var(i), Cov(\pi,e)/Var(e)$ - the conditional covariances between the returns on the various debt instruments[21]; Pr - the probability of a debt crisis as perceived by the government (from 0 to 1); $E_t(A_{t+1} - \Delta B^T_{t+1})$ - function of the expected reduction in the debt-to-GDP ratio; B_t - the debt-to-GDP ratio; η_y - the elasticity of the government budget (relative to GDP) with respect to output; η_π - the elasticity of the budget with respect to the price level; TP_t, FP_t, IP_t - risk premia (the excess return of fixed-rate bonds relative to the instrument considered).

The optimal debt shares depend on risk and cost conditions.

- The first two terms of each equation provide insurance against the risk of variations in the primary budget and the debt ratio due to output and inflation uncertainty (first column "risk no hedge" in the debt composition table).

- Then the government chooses the debt composition which provides the best insurance against the risk of deflation and low growth. Risk minimization also depends on the conditional covariances between the returns on the various debt instruments (second column "risk" in the debt composition table).

- Cost minimization is considered in the last term. Debt stabilization thus

[21] positive covariance between the returns on two types of debt makes them substitutes in the government portfolio.

implies a trade off between risk and cost minimization (third column "risk plus cost" in the debt composition table):

- increases with the risk premia, the impact of the excess return on the optimal share depends on the marginal increase in Pr. The latter has been written as $E_t(A_{t+1} - \Delta B^T_{t+1})$ and Pr. Pr depends on the expected debt reduction.

- decreases with a greater variance of the return on a given debt instrument $Var(i), Var(e), Var(\pi)$ reducing the importance and the impact of interest cost differentials on its optimal share as much as it reduces the relevance of its hedging characteristics.

2.3.1 Fiscal stabilization and fiscal risk

The optimal debt structure depends on the sensitivity of the primary surplus to unexpected variations in output and inflation, η_y and η_π, on the reduction in the debt-to-GDP ratio, B_t, and on the probability of debt stabilization as perceived by the government, Pr.

Fiscal adjustment

Similar to the majority of Eastern European and FSU countries, one of the characteristics of the State Budget of Armenia is its certain dependency on external borrowings, in particular deficit financing, essentially depends on external loans and grants. Domestic savings in Armenia are forecast to grow over the next few years, which will enable to increase the share of the deficit financed from internal sources, while reducing the interest rates.

In the coming years, expenditure will still exceed revenues of the State Budget. In 2008 the share of State Budget expenditure in GDP is within the 23,3-23,9% compared to 20,1% in 2007 (growth of 3,2%).

There has been a tendency for growth in revenues from 17,2% in 2007 to 21,2 - 21,8% in 2008 (4% growth). This level of annual revenues will largely be driven by anticipated budget tax revenues, which constitute 90% of annual revenues over 2008-2010.

At the end of 2007 the debt ratio was 18,4% of GDP and the debt ratio should stabilize next year and in 2008 is forecasted to be around 18,1% of GDP. Therefore the expected debt reduction is assumed to be 0,3% of GDP.

In order to stabilize the debt ratio the government applies a fiscal correction A_{t+1} of the State Budget (reduces the expenditures or increases the revenues). In 2008 an expected revenue-based fiscal adjustment of Armenia is 0,8%,[22] thus the

[22] calculated as the proportion of the adjustment obtained from expenditure growth in comparison with the proportion gained from tax increases

expected debt reduction yields 1,1% of GDP.[23]

Probability of debt crisis

The probability density function, used to derive the optimal debt shares, cannot be estimated. Giavazzi-Missale takes a linear approximation of density function decreasing with X for $X > 0$; it implies that bad realizations of the fiscal adjustment are less likely to occur the greater is their size. The difference between the worst possible realization of the fiscal adjustment $\bar{X}$ and the expected change in the debt ratio after the fiscal correction, $A_{t+1} - E_t(\Delta B^T_{t+1})$ [24] is transformed in terms of the probability of a debt crisis as perceived by the government (the probability that the shock X exceeds the expected debt reduction) Fig.2.5. Then an assumed triangular

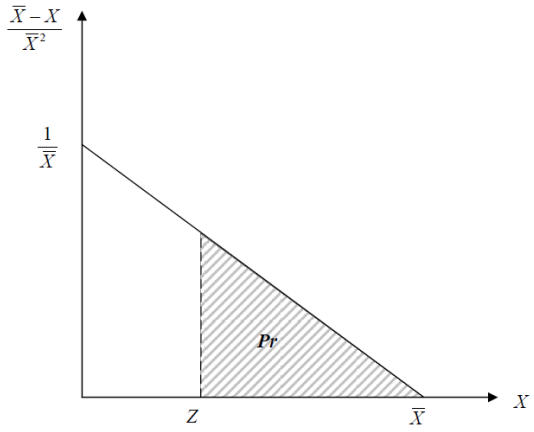

Figure 2.5: Fiscal instability risk.

probability density function could be rewritten as follows,

$$Pr[X > Z = A_{t+1} - E_t \Delta B^T_{t+1}] = \int_Z^{\bar{X}} \frac{\bar{X} - X}{\bar{X}^2} dX = \frac{(\bar{X} - Z)^2}{2\bar{X}^2} \tag{2.9}$$

where, $X > 0$ is the uncertain component of the fiscal adjustment, a shock to the budget after the fiscal adjustment or a debt increase ($B^T_{t+1} - A_{t+1} + X > B_t$) and $\bar{X}$ is the worst possible realization of the fiscal correction ($\bar{X} > A_{t+1} - \Delta B^T_{t+1}$).

[23]Function of the expected debt reduction $E_t(A_{t+1} - \Delta B^T_{t+1})$ is the difference between the expected fiscal adjustment and the debt accumulation. $\Delta B^T_{t+1} = (B^T_{t+1} - B_t)$ where B^T_{t+1} denotes the trend debt ratio, that is, the debt ratio in period t+1 in the absence of the fiscal correction

[24]$E_t(A_{t+1} - \Delta B^T_{t+1})$ is equal to $A_{t+1} - E_t(\Delta B^T_{t+1})$.

Replacing $A_{t+1} - E_t(\Delta B^T_{t+1})$ for Z in the density function yields:

$$Pr = \frac{(\bar{X} - A_{t+1} - E_t \Delta B^T_{t+1})^2}{2\bar{X}^2} \tag{2.10}$$

From this equation follows that:

$$\bar{X} = \frac{A_{t+1} - E_t(\Delta B^T_{t+1})}{1 - \sqrt{2Pr}} \tag{2.11}$$

In 2008 in Armenia the expected debt reduction yields 1,1% of GDP, then maximum negative shock to the budget, $\bar{X}$, equal to 1,2% of GDP. It follows that the probability Pr that the stabilization plan by government fails is set at 2% of GDP (see Fig.2.6).

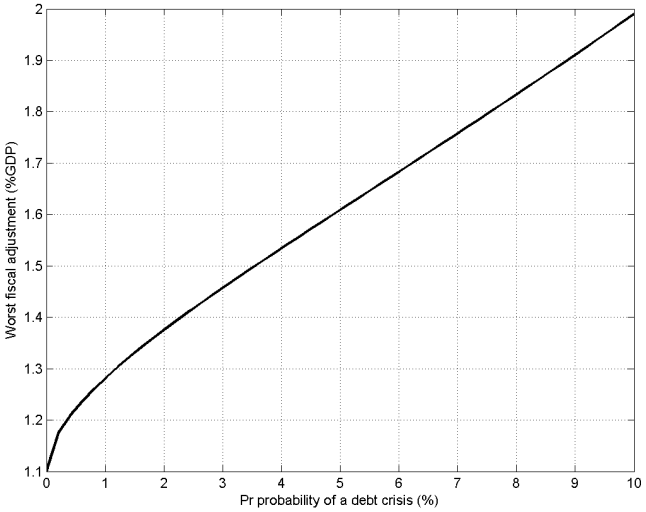

Figure 2.6: Relationship between the probability of a debt crisis as perceived by the government, Pr and maximum negative shock to the budget, $\bar{X}$.

Elasticity of the primary surplus

The empirical literature on this issue has been evolved by different authors[25]. Thus, different approaches have been developed to disentangle cyclical and structural components of government expenditure, (tax) revenues and balance[26].

The difficulties in explaining this indicator, the diversity of available methodologies, the ex-post revision of cyclically adjusted budget balances are among the principal factors that have hampered its widespread use.

There could be distinguished two methods to investigate the elasticity of the budget balance with respect to GDP and inflation: (1) The approach of the European Commission (EC): fiscal elasticities are estimated directly with respect to GDP and inflation, neglecting the intermediate effect on tax bases; (2) The OECD estimates revenues elasticities taking the output transmission mechanism into account[27]. Then the effect of the expansion of the tax base on revenue is estimated.

Although estimates used in the EU framework are those of the EC, other international institutions, such as OECD and IMF, regularly publish values for cyclically adjusted budget balances.

I estimate a measure of sensitivity of the Armenian budget balance in response to macroeconomic variables base on the EC approach. First, the macroeconomic variables driving the automatic component were chosen: nominal GDP[28] and CPI. Then, the revenue side of the government budget[29] was decomposed into tax income and duties; on the expenditure side[30] - into the current primary government expenditures, other benefits were not considered, as they are unrelated to the economic cycle. Finally, each government budget item that was supposed to include an automatic component (tax income and duties and current expenditures) was regressed directly on the GDP and the inflation [31] affecting the automatic components.

The overall elasticity of the budget balance with respect to (cyclical) economic activity is calculated as a difference between revenues and expenditures elasticities.

[25]For earlier attempts to estimate the response of the primary surplus to macroeconomic variables (GDP and inflation rate) see Bevilaqua and Werneck (1997), Persson at al. (1998), Van Den Noord (2000), Blanco and Herrera (2002), Ginebri et al. (2005), Braz (2006).

[26]The cyclical component of the government budget balance corresponds to the cyclical component of tax revenues and current primary expenditure

[27]linking different taxes to different tax bases, and not directly to GDP

[28]Due to the difficulty of defining the base and limited data base, tax levies and expenditures were regressed directly on nominal GDP.

[29]Budget revenues consist of revenues from tax income and duties, from non-tax and capital incomes; and grants

[30]Budget expenditures consist of current and capital expenditures, net lending and repayment of previous debts

[31]There was applied a joint estimation of elasticities with respect to both the inflation and the GDP, estimated by Ginebri et al. (2005) through regression analysis and thus providing new insights in such a research field.

OLS regression was run with the following specification:

$$lnA_t = \alpha + \eta_y lnY_t + \eta_\pi ln\Pi_t + \varepsilon_t \tag{2.12}$$

where A_t represents the specific category of the government budget deficit (in nominal terms, mln of Drams)[32], Π_t is the inflation rate (CPI), Y_t stands for nominal GDP (mln of Drams), η_y, η_π - elasticity of the government budget relative to the output and price level, ε_t is an error term.

Estimation results for the explanatory variables as the inflation and the GDP are presented in table below[33]:

	Coeff.	Std.Err.	t-ratio	$P > \|t\|$	$Adj.R^2$	DW
GDP elasticity						
Tax incomes	1,04	0,055	18,81	0,000	0,99	1,66
Current expenses	-0,89	0,392	-2,27	0,053		
Inflation rate elasticity						
Tax incomes	0,81	0,065	12,51	0,000	0,96	1,47
Current expenses	-1,09	0,651	-1,68	0,131		
Total balance η_y	0,23					
Total balance η_π	0,20					

Revenues and expenditures prove sensitive to changes in the inflation and to variations in the activity level. Increase in the GDP results in a greater increase in revenues. The findings show that a 1% growth in the output is associated with the increase of the primary surplus balance of 0,2% (as a % of GDP).

The effect of the unexpected inflation on the government budget (as % of GDP) estimates a budget improvement of 0,2% of GDP on a yearly basis for a 1% increase in the inflation rate.

Expected return differentials

Optimal public debt composition also depends on expected return differentials (or risk premia), TP_t, FP_t and IP_t, more precisely, on the excess return perceived by the government of fixed-rate bonds relative to the debt instrument considered.

Term risk premium:

$$TP_t = R_t - E_t i_{t+1} \tag{2.13}$$

[32]As our concern refers mainly to the central government borrowing requirement, the object of our estimation is the primary budget balance on a cash basis.

[33]The regression was run on one-year frequency data covering the period from 1994 to 2008. The coefficients are significant at 5% level of confidence for the revenue and 10% for expenditure. The total balance is the elasticity which measures the change of the government budget balance, as a % of GDP, for a 1% change in GDP and the inflation

The expected return differential between fixed-rate bonds and T-bills, TP_t, is the difference between the yield at auction of fixed-rate bonds, R_t and the expected average return on T-bills between time t and $t+1$, $E_t i_{t+1}$. At the end of December 2007 the average auction yield on fixed-rate bonds was 6,9%, the short-term interest rate expected for the end of December 2008 is 2,07%. The expected return differential, TP_t, can thus be set at 4,8%. Issuing T-bills is optimal until the uncertainty of the short-term interest rate raises the probability of failure as much as paying the term premium on fixed-rate bonds.

Foreign currency exchange-rate risk premium:

$$FP_t = R_t - R_t^{US} - E_t e_{t+1} \tag{2.14}$$

To estimate the expected return differential between fixed-rate bonds and dollar denominated bonds, FP_t, the yield on fixed-rate bonds, R_t of 6,9% must be compared to the interest rate for US federal funds rate, R_t^{US} of 4,5% (see the British Bankers' Association December 2007) and in the same period, the expected depreciation of exchange rate, $E_t e_{t+1}$ was 0,6%. The expected return differential, FP_t, can thus be estimated at around 1,8%. Foreign exchange-rate risk premium depends on the realization of the exchange rate.

Inflation rate risk premium:

$$IP_t = R_t - R_t^I - E_t \pi_{t+1} \tag{2.15}$$

The premium on price-linked bonds over fixed-rate bonds, IP_t, can be estimated as the difference between the interest rate on fixed-rate bonds and the (real) yield at issue of price-linked bonds augmented by the expected by the market between time t and t+1 inflation. With an interest rate of 6,9% on fixed-rate bonds, real interest rate for possible issued price-indexed bonds R_t^I estimated of 1,3% [34] while the expected average rate of inflation for 2007 $E_t \pi_{t+1}$ was settled around 4%. This implies an inflation risk premium of 1,5%.

2.4 The model of Armenian economy

The structural backward-looking model of the Armenian economy used to estimate the optimal debt composition is made of following six equations for: (i) the LIBOR; (ii) the exchange rate; (iii) the output gap; (iv) the inflation rate; (v) the short-term interest rate and; (vi) the RF output gap. The model, which is presented in Appendix I, is consistent with that proposed by Favero and Giavazzi, (2003) under

[34] this was calculated as the difference between the interest rate on T-bills at time t (5,7% in 2007) and the average rate of inflation in the same period of time (4,4% in 2007)

the hypothesis of "Ricardian fiscal policy"[35].

$$LIBOR_t = \mu_0 + \mu_1 LIBOR_{t-1} + \nu_{LIBOR_t} \quad (2.16)$$

$$e_t = \delta_0 + \delta_1 e_{t-1} + \delta_2(i_{t-2} - {i_{t-2}}^{US}) + \delta_3 {y_{t-1}}^{RF} + \delta_4 {Y_{t-1}}^{RF} + \nu_{e_t} \quad (2.17)$$

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \gamma_3 i_{t-2} + \gamma_4 LIBOR_{t-3} + \gamma_5 {y_{t-1}}^{RF} + \nu_{y_t} \quad (2.18)$$

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 y_{t-1} + \alpha_3(e_{t-3} - e_{t-5}) + \alpha_4 {y_{t-2}}^{RF} + \nu_{\pi_t} \quad (2.19)$$

$$i_t = \rho i_{t-1} + (1-\rho)[\beta_0 + \beta_1(\pi_{t-3} - \pi^T) + \beta_2 i_{t-1}^{US} + \beta_3 \Delta e_{t-2}] + \nu_{i_t} \quad (2.20)$$

$$y_t^{RF} = \kappa_0 + \kappa_1 y_{t-1}^{RF} + \kappa_2 y_{t-2}^{RF} + \kappa_3 LIBOR_{t-1} + \nu_{y_t^{RF}} \quad (2.21)$$

The model is estimated on quarterly data for the period 2000:01-2007:04. Then, the impulse response function was used in order to describe the dynamic behaviors of the whole system with respect to unit shocks in the residuals of the time series. There are considered six types of shocks: a supply shock (in the inflation equation), a demand shock (in the Armenian output gap equation), an exchange rate shock, a shock to the LIBOR, an interest rate shock and a shock to the Russian output gap.

I compute impulse responses of the interest rate, LIBOR, the exchange rate, inflation, Armenian and Russian output gap from the distribution of each type of shock. The cumulated responses are then used to estimate the ratios of conditional covariances relative to conditional variances which are presented in Table 2.

The optimal debt composition that stabilizes the debt ratio against shocks is reported in Tables 3 and 4. Column 1 reports the debt composition that stabilizes the debt ratio against variations in output and inflation, in the case we abstract from hedging against variations in debt returns. Column 2 shows optimal debt structure for risk minimization when the role of each debt instrument in hedging against the returns of the other instruments is considered. In Column 3, the debt instruments are constrained to be non-negative. In Column 4 and 5 only costs are taking into consideration. Then in Column 6 and 7 both risk and cost considerations are introduced into the analysis. Finally, Column 8 and 9 present optimal debt composition assuming that all foreign debt is on the concessional terms.

2.4.1 LIBOR shocks

First section of the Table 3 shows the debt composition that stabilizes the debt ratio against shocks to the LIBOR.

The shares of T-bills and dollar denominated bonds are negative, reflecting the strong negative covariances of their returns with output growth that are shown in

[35] A simple model of the Brazilian economy was estimated to obtain the threshold beyond which the economy might fall into a bad equilibrium, analyze the dynamics of the main variables in the bad equilibrium and investigate the effectiveness of monetary policy in controlling inflation in 3 different fiscal environments: a mildly Ricardian, a strong Ricardian, and exogenous.

Table 2. LIBOR shocks lead to unexpected exchange rate depreciation. The interest rate and the exchange rate negatively co-varies with output and inflation. It follows that real-indexed should be issued in amounts exceeding the total debt so as to insulate the budget from unexpected output contractions.

The government should issue real bonds, hold both T-bills and foreign assets for optimal risk minimization and in case of non negative constraint.

When cost consideration is presented in the analysis the optimal debt composition clearly moves towards short term indexation leaving second place for the fixed rate bonds. But the role of price-indexed debt returns is optimal considering both risk and cost minimization and in case of concessional debt.

2.4.2 Supply shocks

Second section shows the optimal debt composition that stabilizes the debt ratio against shocks to the inflation equation.

Both dollar denominated and price-indexed bonds provide insurance against variations in the primary surplus and in the debt ratio due to lower than expected inflation and output growth. Dollar denominated and price-indexed bonds are good hedges against lower than expected inflation, moreover, they provide insurance against budget risk, since their returns are positively correlated with output (see Table 2). Since supply shocks lead to a negative covariance of output with the T-bills, they provide limited insurance against budget risk while they offer a good insurance against inflation uncertainty. The same optimal debt composition is presented for the risk and cost minimization and for the external concessional debt. The absence of fixed-rate bonds in the optimal composition of debt can be partially explained by the strong complementarity between real-indexed and dollar denominated bonds which comes up because of the exchange rate appreciation that follows an inflation shock.

When we consider the risk of variations in debt returns along with budget risk and debt-ratio uncertainty, the optimal composition for risk minimization consists a small share of dollar denominated and fixed-rate bonds, a big share of price-indexed bonds. The share of T-bills is still negative since such bonds are close substitutes for price-indexed bonds. Finally, fixed-rate bonds appear to play a small role in risk minimization.

When the optimal shares are constrained to be non-negative, there is a strong case for price-indexation except the case of cost minimization where the optimal debt ratio moves towards T-bills and fixed-rate bonds leaving no role for the price-indexed and small share of dollar denominated debt.

2.4.3 Demand shocks

Section Demand shocks shows the debt composition that stabilizes the debt ratio against shocks to the output gap equation.

The shares of dollar denominated and price-indexed bonds are positive and exceed several times the total debt; such bonds offer a valuable policy against fluctuations in the primary surplus and the debt-to-GDP ratio. Since the demand shocks lead to an appreciation of the exchange rate, the return on dollar denominated bonds is positively correlated with both output and inflation. This explains the large positive share of dollar denominated and price-indexed.

The risk minimizing debt structure calls for issuing large amounts of T-bills and real-indexed bonds considering, along with budget and debt-ratio uncertainty, the role of each debt instrument in hedging against variations in the returns of other debt instruments.

The optimal debt structure changes when cost minimization is considered: all types of bonds should be issued with the priority to T-bills and dollar denominated bons as a second best.

Optimal debt composition does not change in the case cost minimization is considered along with risk insurance and all foreign debt is on concessional terms: both T-bills and price-indexed bonds should be issued if large holdings of foreign assets were feasible. If we restrict the shares to be non-negative the risk minimization clearly favors real-indexed bonds over T-bills.

2.4.4 Exchange rate shocks

The public debt composition that stabilizes the debt ratio against exchange rate shock (shock to the exchange rate equation) reports that the real debt is optimal for risk minimizing against variations in the primary surplus and the debt ratio.

When the role of each debt instrument in hedging against the returns of the other instruments is considered along with budget and debt-ratio uncertainty, large amounts of real and small amount of fixed rate bonds should be issued as an optimal choice. The optimal composition of the public debt does not change when cost is considered along with risk hedging and all foreign debt is considered concessional.

The optimal debt structure changes when only costs are taking into consideration: big amount of fixed bonds and small amount of T-bills should be issued.

When the debt shares are constrained to be non-negative price indexation again clearly emerges as the optimal choice.

2.4.5 Interest rate shocks

Interest rate shock results from interest rate fluctuations in the market. The interest rate fluctuations determine fluctuations in servicing costs of the floating interest rate debt portfolio. As the floating (short-term) interest rate is lower than the fixed interest (long-term) rate, the bigger share of floating interest debt reduces the debt servicing costs, however, exposes it to a greater interest rate risk.

Estimation of the interest rate shock and the debt portfolio share is an important parameter. In the Table 3 there is presented the public debt composition that stabilizes the debt ratio against interest rate shock (shock to the interest rate equation).

The shares of dollar denominated bonds and real-indexed bonds are optimal for minimizing the risk of variations in the debt-to-GDP ratio and the primary balance.

When the role of each debt instrument in hedging against the returns of the other instruments is considered real and fixed-rate bonds are two optimal choices, holding their best positions in case of non-negativity constraint, risk and cost consideration and for concessional debt.

The optimal debt composition changes once cost minimization is considered - fixed -rate are preferred over dollar denominated bonds.

2.4.6 Russian Federation Gap Shock

Armenia has remained in close economic ties with Russia. Still Russia continues to be the second leading trading partner of Armenia (as reports Armenian statistical service, in 2008 Russia acquired 20% of total export and 16% of total import). Another very important component is that most remittances to Armenia (70% and in US dollars) are sent from Russia, and are correlated with Russian GDP growth.

This fact has some substantial macroeconomic effects like appreciation of the exchange rate, nevertheless, the current account has not worsened but export may have been negatively affected. Russian output gap shock results from fluctuations in the gross domestic product of the Russian Federation.

Under this shock issuing the real-index bonds is the first choice and T-bills as an alternative choice because such bonds offer a valuable policy against fluctuations in the primary surplus and the debt ratio. When costs are consider in the analysis the main role plays fixed rate bonds and T-bills like a second choice.

2.4.7 Concessional external debt

In our research we have made an assumption that all external debt both concessional and non-concessional is US dollar denominated debt on non-concessional terms based on LIBOR + 1% interest rate. This is based mainly on the consideration that even

if concessional debt has very low interest rate it does not mean that it does not induce any costs for the Armenian government.

Further in this section, we present the public debt structure under the consideration that all external public debt of the Republic of Armenia is US dollar denominated debt on concessional terms based on 1% interest rate. As of 2007 the portion of concessional loans in total external public debt was 99,1%. Though concessional terms are very convenient as regards cost of public debt, also this form of external debt involves exchange-rate risk, given foreign-currency denomination (mainly SDR[36] for concessional debt).

In this case foreign currency exchange-rate risk premium is:

$FP_t = R_t$ - 1% - $E_t e_{t+1}$

To estimate the expected return differential between fixed-rate bonds and dollar denominated bonds the yield on fixed-rate bonds of 6,9% must be compared to the interest rate for concessional debt of 1%, and in the same period, the expected depreciation of ADM per US dollar exchange rate of 0,6%. The expected return differential can thus be estimated at around 5,3%.

The results are shown in the last two columns of the tables. In the case all Armenian external debt is concessional and under all types of shocks, the empirical evidence suggest that foreign currency denominated debt should be further reduced and substituted by the issuance of the debt indexed to the price level and fixed rate debt.

2.5 Conclusions

In this paper I construct a model of optimal debt management of the Republic of Armenia, in terms of public securities (maturity, currency denomination, and indexation), as driven by the task to minimize the probability of fiscal instability (namely, of undesired growth of debt-to-GDP ratio), trading off risk and cost minimization tasks. Results, obtained from the analysis of structural model of Armenian economy whether and how the optimal public debt composition depends on shocks hitting the economy, suggest six solutions relative to six types of shocks.

While fixed-rate bonds play no role in the case of supply and Russian output gap shocks, they are a worse alternative to price-indexed bonds for exchange rate and LIBOR shock. In order to improve the situation in domestic financial markets,

[36]Special Drawing Rights (SDRs)- are defined in terms of a basket of major currencies used in international trade and finance. In 2006-2010, the currencies in the basket are the US dollar, the euro, the Japanese yen, and the pound sterling. The exact amounts of each currency in the basket, and their approximate contributions to the value of SDR are USD - 0.6320(44%), Euro - 0.4100(34%), Yen - 18.4(11%), Sterling - 0.0903(11%). Based on this composition we consider all concessional debt like US dollar denominated debt

borrowing externally gradually has to be phased out by borrowing in the domestic market. In order to reduce an interest rate risk, volatility of debt servicing costs and to facilitate planning and forecasting of cash flows required for execution of state liabilities, better to give the priority to the borrowings at a fixed interest rate.

Issuance of debt indexed to the short-term interest rate should be avoided if LIBOR and interest rate shocks prevail while T-bills are a worse alternative to price-indexed bonds in the case of Russian output gap and demand shocks (the conditional variance of the short-term interest rate is low and short-term interest rate is positively correlated with unanticipated output and inflation). Although their role is limited in the case of exchange rate shocks and supply shocks.[37]

Considering foreign currency denominated debt, there comes out to be a small role for dollar denominated bonds in case of supply shocks, (note that even if the conditional variance of the exchange rate is not very low the exchange rate is positively correlated with unanticipated output and inflation which means that variations in the primary budget could be hedged by dollar denominated debt). Exposure to exchange rate risk should be avoided in case of LIBOR and exchange rate shocks.[38]

Whether price-indexed bonds should be issued depends on the type of shocks hitting the economy of Armenia. The best hedge against exchange rate and supply shocks consistently provide real-indexed bonds (the conditional variance of the inflation rate is low and inflation rate is positively correlated with unanticipated output), they play an important role in insurance against LIBOR shock although their role is limited in the case of demand and Russian output gap shocks[39].

In Table 4 there is presented the optimal public debt composition, if we abstract from the introduction of currently non issued real-indexed debt on the domestic market of government securities of the Republic of Armenia. In this case the empirical evidence advises to issue fixed-rate bonds rather dollar denominated debt while the share of T-bills should be further reduced.

The foreign currency denominated debt should be substituted by the real-indexed debt in case all Armenian external debt is on concessional terms.

[37]Floating-rate debt is optimal when $Cov(y,i)/Var(i)$ and $Cov(i,\pi)/Var(i)$ is positive. This allows the government to pay less interests when output and inflation are unexpectedly low. Lower output growth tends to increase the debt ratio, instruments with returns correlated to nominal output growth help to stabilize the debt ratio. The case for indexation weakens as $Var(i)$ increases, thus producing unnecessary fluctuations in interest payments.

[38]Dollar denominated debt is optimal when $Cov(y,e)/Var(e)$ and $Cov(e,\pi)/Var(e)$ is positive. If the exchange rate appreciated at times of unexpectedly low output (an unlikely event) cyclical variations in the government budget could be hedged by dollar denominated debt. To the extent that exchange rate depreciation is associated with inflation, foreign currency debt helps to stabilize the debt ratio. Exposure to exchange-rate risk becomes less attractive as $Var(e)$ increases.

[39]Price-indexed debt is optimal when $Cov(y,\pi)/Var(\pi)$ is positive or even zero, lower interest payments on price-indexed debt provide an insurance against the cyclical deficit due to unexpected slowdowns in economic activity.

2.6 Appendix I: Structural model estimation

The structural model applied in the simulation exercises in order to obtain the impulse responses to different shocks (LIBOR, supply, demand, exchange rate, interest rate and Russian output gap shocks) hitting the economy of the Republic of Armenia is composed by the following six equations for: (1) the LIBOR; (2) the exchange rate; (3) the Armenian output gap; (4) the inflation rate; (5) the interest rate for T-bills; (6) the Russian output gap:

$$LIBOR_t = \mu_0 + \mu_1 LIBOR_{t-1} + \nu_{LIBOR_t} \tag{2.22}$$

$$e_t = \delta_0 + \delta_1 e_{t-1} + \delta_2(i_{t-2} - {i_{t-2}}^{US}) + \delta_3 {y_{t-1}}^{RF} + \delta_4 {Y_{t-1}}^{RF} + \nu_{e_t} \tag{2.23}$$

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \gamma_3 i_{t-2} + \gamma_4 LIBOR_{t-3} + \gamma_5 {y_{t-1}}^{RF} + \nu_{y_t} \tag{2.24}$$

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 y_{t-1} + \alpha_3(e_{t-3} - e_{t-5}) + \alpha_4 {y_{t-2}}^{RF} + \nu_{\pi_t} \tag{2.25}$$

$$i_t = \rho i_{t-1} + (1-\rho)[\beta_0 + \beta_1(\pi_{t-3} - \pi^T) + \beta_2 i_{t-1}^{US} + \beta_3 \Delta e_{t-2}] + \nu_{i_t} \tag{2.26}$$

$$y_t^{RF} = \kappa_0 + \kappa_1 y_{t-1}^{RF} + \kappa_2 y_{t-2}^{RF} + \kappa_3 LIBOR_{t-1} + \nu_{y_t^{RF}} \tag{2.27}$$

where, $LIBOR_t$ is the London Inter-Bank Offered Rate, e_t – the change of the exchange rate, i_t – the interest rate for T-bills, i_t^{US} – the US federal funds rate, y_t – Armenian output gap, π_t – the inflation rate, π^T - the CBA inflation target, y_t^{RF} – the Russian output gap, ${Y_{t-1}}^{RF}$ – GDP of the Russian Federation.

This nine-variable model includes the five domestic variables together with the four world variables: GDP, CPI, CPI target, IR, ER, and wLIBOR rate, wIR, wGDP, wGDPgap.

All the financial variables series are constructed by using the last available observation, using quarterly frequency or were converted into quarterly terms from daily, weekly, monthly terms. All data were taken from official sources, except for the output gap, which was calculated as the difference between actual and potential GDP, using HP-filter.

Public debt composition is not available and undeveloped financial market of most FSU countries causes extremely difficulties to collect high-frequency data. Data on the composition of the public debt: Domestic and External by debt instruments, interest rate and maturity of GS are taken from the website of the MOF of the RA, and directly contacting Shushanik Mkrtchyan - Head of Domestic PDM Division and Heghine Karapetyan - Head of External Debt Division.

Each equation of the model was estimated considering the largest available sample: 2000:01 - 2007:04 of the financial variables. Because of short period of time 2000 - 2007 the use of quarterly data is necessary to obtain reasonably precise estimates of the covariances. All the equations have been estimated by OLS[40].

[40]If we find that autocorrelation occurs within the panels from one time period to another we can use Cochrane-Orcutt transforation to deal with autocorrelation in the residuals (Gujarati, 1995).

LIBOR equation

$$LIBOR_t = \mu_0 + \mu_1 LIBOR_{t-1} + \nu_{LIBOR_t} \tag{2.28}$$

where, $LIBOR_t$ is the London Inter-Bank Offered Rate.

Results for the LIBOR equation:

$\mu 0$	$\mu 1$
$0,007$	$0,758$
$(0,004)$	$(0,102)$

I have thus assumed that LIBOR only depends positively on growth. The empirical evidence shows that one of the main determinants of LIBOR is international factor, specifically US Federal Funds Rate (see Fig.2.7). Note, that foreign interest rates are allowed to affect domestic interest rates, but not viceversa. LIBOR is just one of the elements determining the cost of the Armenian public debt. In 2001 the LIBOR decreased, and it has had a positive effect on the service of external debt of the Republic of Armenia.

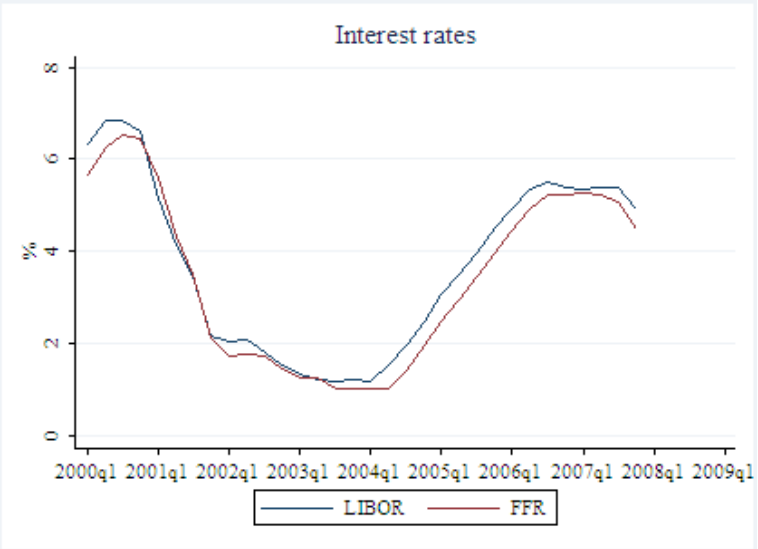

Figure 2.7: LIBOR and US Federal Funds Rate

Exchange rate equation

$$e_t = \delta_0 + \delta_1 e_{t-1} + \delta_2(i_{t-2} - {i_{t-2}}^{US}) + \delta_3 {y_{t-1}}^{RF} + \delta_4 {Y_{t-1}}^{RF} + \nu_{e_t} \tag{2.29}$$

where, e_t – the change of the exchange rate (exchange rate ADM per USD is the logarithm of the ADM/USD exchange rate), i_t – interest rate for T-bills, i_t^{US} – US federal funds rate, y_t^{RF} - Russian output gap, ${Y_{t-1}}^{RF}$ - GDP of Russia.

Results for the Exchange rate equation:

$\delta 0$	$\delta 1$	$\delta 2$	$\delta 3$	$\delta 4$
$3,674$	$0,774$	$-0,484$	$-0,308$	$-0,172$
$(1,042)$	$(0,081)$	$(0,200)$	$(0,141)$	$(0,044)$

The change in the exchange rate depends on the interest rate differential (domestic interest rate minus US Federal Funds rate). The coefficient is negative: a 1% increase in the domestic interest rate appreciates the exchange rate by 0,484%. The external debt of Armenia consist of loans provided in different currencies, changes of shares of currencies and exchange rate fluctuations (see Fig.2.8) have their direct effect on the level of external debt of Armenia.

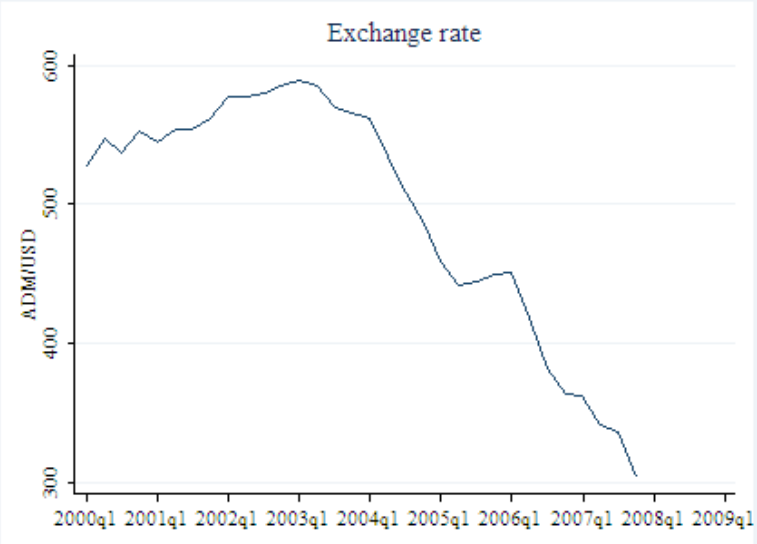

Figure 2.8: ADM/USD exchange rate

Output Gap equation

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 y_{t-2} + \gamma_3 i_{t-2} + \gamma_4 LIBOR_{t-3} + \gamma_5 {y_{t-1}}^{RF} + \nu_{y_t} \qquad (2.30)$$

where y_t – output gap, i_t – interest rate for T-bills, $LIBOR_t$ – London Inter-Bank Offered Rate, y_t^{RF} – Russian output gap.

Results for the Output Gap equation:

$\gamma 0$	$\gamma 1$	$\gamma 2$	$\gamma 3$	$\gamma 4$	$\gamma 5$
$-0,016$	$0,596$	$-0,404$	$-0,305$	$1,172$	$0,440$
$(0,011)$	$(0,181)$	$(0,120)$	$(0,105)$	$(0,442)$	$(0,165)$

The GDP or output gap is determined as the difference between real GDP $\log y_t$ and trend of real GDP $\log \widehat{y}_t$. For that reason the potential GDP for Armenia was estimated using a Hodrick-Prescott filter. This procedure is the commonly used in statistical literature to determine trend components in macroeconomic series. The calculation gives us also a negative number which is known as a expansionary gap and indicates an economy in recession (positive number or recessionary gap indicates an economy in expansion) (see Fig.2.9).

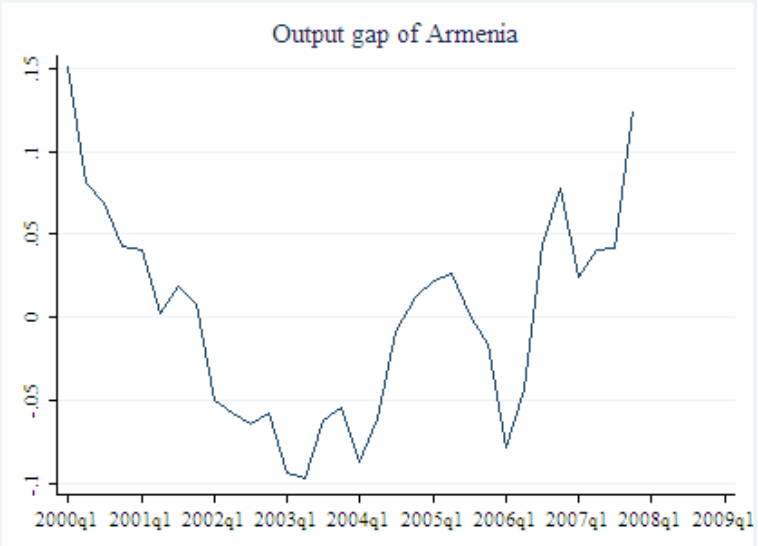

Figure 2.9: Armenian Output Gap

Inflation equation

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 y_t + \alpha_3 (e_{t-3} - e_{t-5}) + \alpha_4 {y_{t-2}}^{RF} + \nu_{\pi_t} \tag{2.31}$$

where, y_t – output gap, e_t – exchange rate, π_t – inflation, y_t^{RF} – Russian output gap.

Results for Inflation equation:

$\alpha 0$	$\alpha 1$	$\alpha 2$	$\alpha 3$	$\alpha 4$
$0,014$	$0,745$	$0,173$	$0,126$	$-0,218$
$(0,006)$	$(0,132)$	$(0,070)$	$(0,063)$	$(0,106)$

Trying to determine the sources of inflation in small open economies, this research suggests that the USD exchange rate is considered as an additional important determinant of inflation in Armenia. Inflation depends positively on growth (the effect of activity on prices), positively on exchange rate depreciation and negatively on Russian output gap. Armenia has reached a low inflation thanks to inflation targeting regime, little exchange rate intervention, tight fiscal policy. Main inflationary risks in 2009 are large foreign exchange inflows (remittances, FDI, aid, real estate) see Fig.2.10.

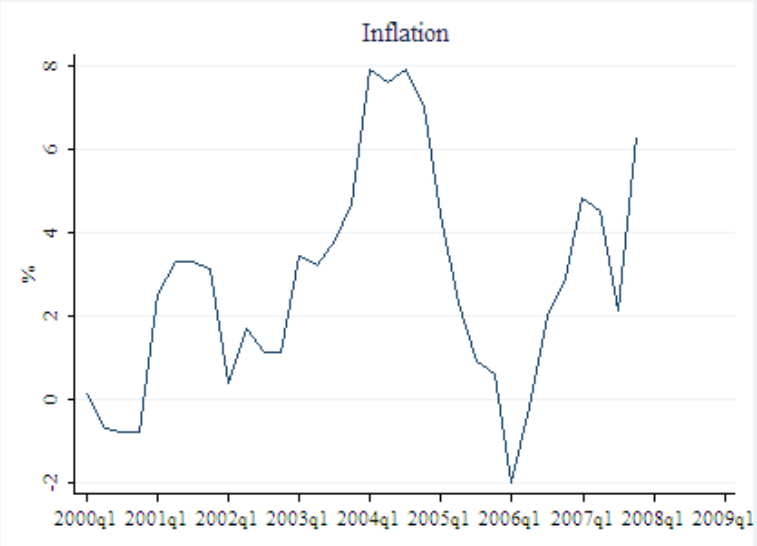

Figure 2.10: Inflation rate

Interest rate for T-bills equation

$$i_t = \rho i_{t-1} + (1-\rho)[\beta_0 + \beta_1(\pi_{t-3} - \pi^T) + \beta_2 i_t^{US} + \beta_3 \Delta e_{t-2}] + \nu_{i_t} \tag{2.32}$$

where, i_t – short-term interest rate, e_t – exchange rate (there is added to the Taylor Rule one more argument, such as the realized change in the exchange rate), π_t – inflation, π^T – CBA inflation target settled at 3% level, i_t^{US} – US federal funds rate

Results for the Interest rate for T-bills equation:

ρ	β_0	β_1	β_2	β_3
$0,916$	$0,125$	$1,833$	$6,619$	$2,143$
$(0,055)$	$(0,010)$	$(0,106)$	$(0,230)$	$(0,123)$

β_1, β_3 measure how the CBA reacts to deviations of inflation from the target and to deviations in the exchange rate. The exchange rate depreciation affects inflation. This induces the CB to increase the interest rate, which further raises the debt service costs. In 2005 the CBA shifted its policy objective from monetary to inflation targeting that appears to be successful in stabilizing inflation and GDP growth, see Fig.2.11.

Figure 2.11: The interest rates on T-bills

Russian output gap equation

$$y_t^{RF} = \kappa_0 + \kappa_1 y_{t-1}^{RF} + \kappa_2 y_{t-2}^{RF} + \kappa_3 LIBOR_{t-1} + \nu_{y_t^{RF}} \tag{2.33}$$

where, y_t^{RF} – Russian output gap, $LIBOR_t$ – London Inter-Bank Offered Rate

Results for the Russian output gap equation:

κ_0	κ_1	κ_2	κ_3
$-0,030$	$0,828$	$-0,374$	$0,851$
$(0,011)$	$(0,177)$	$(0,139)$	$(0,282)$

κ_1 and κ_2 measure the output gap auto-correlation. An expansionary (positive number) output gap indicates the Russian economy in recession. A recessionary (negative number) gap indicates an economy in expansion (see Fig.2.12).

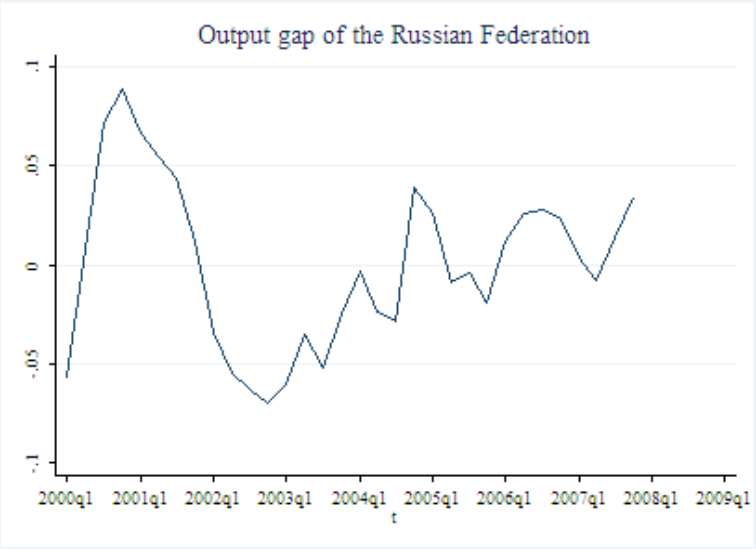

Figure 2.12: Output gap of the Russian Federation

Estimation results

Table 1. The estimated quarterly model, sample $2000:01-2007:04$

	Coeff.	Std.Err.	t-ratio	$P>\|t\|$	$Adj.R^2$	DW
LIBOR equation						
μ_0	0,007	0,004	1,53	0,137	0,65	1,96
μ_1	0,758	0,102	7,39	0,000		
Exchange rate equation						
δ_0	3,674	1,042	3,52	0,002	0,98	1,44
δ_1	0,774	0,081	9,53	0,000		
δ_2	-0,484	0,200	-2,42	0,023		
δ_3	-0,308	0,141	-2,18	0,039		
δ_4	-0,172	0,044	-3,93	0,001		
Output gap equation						
γ_0	-0,016	0,011	-1,51	0,144	0,76	1,57
γ_1	0,596	0,181	3,29	0,003		
γ_2	-0,404	0,120	-3,36	0,003		
γ_3	1,172	0,442	2,65	0,014		
γ_4	0,440	0,165	2,67	0,014		
Inflation equation						
α_0	0,014	0,006	2,58	0,018	0,62	1,94
α_1	0,745	0,132	5,64	0,000		
α_2	0,173	0,070	2,47	0,022		
α_3	0,126	0,063	2,01	0,058		
α_4	-0,218	0,106	-2,05	0,053		
Interest rate for T-bills equation						
ρ	0,916	0,055	16,71	0,000	0,96	1,46
β_0	0,125	0,010	-1,10	0,283		
β_1	1,833	0,106	1,46	0,157		
β_2	6,619	0,230	2,41	0,024		
β_3	2,143	0,123	1,47	0,155		
Russian output gap equation						
κ_0	-0,030	0,011	-2,81	0,009	0,77	1,96
κ_1	0,828	0,177	4,68	0,000		
κ_2	-0,374	0,139	-2,69	0,012		
κ_3	0,851	0,282	3,01	0,006		

Simulation of IRF, variances and covariances, and results

A MATLAB program has been used in order to explore the behavior of LIBOR, exchange rate, output gap, inflation, short-term interest rate and Russian output gap equations under LIBOR, supply, demand, exchange rate, interest rate and Russian output gap shocks.

Impulse response functions (IRF)

Impulse response functions analysis is widely used in the empirical literature to uncover the dynamic relationship between different macroeconomic variables[41].

The shock amplitude was taken as one standard deviation of the variables LIBOR, inflation (for supply shock), output gap (for demand shock), exchange rate, interest rate and Russian output gap.

The variables inflation rate, short-term interest rate, exchange rate, output gap, LIBOR, RF output gap depend on values in the past. External variables are not considered in the program (US federal funds rate, Russian GDP).

Fig.2.13 summarizes the outputs generated by the different shocks. The econometric model constructed to obtain these impulse responses shows stability because all impulse responses go to zero which means that the system reaches a steady state.

[41]Impulse responses measure the time profile of the effect of a shock, or an impulse, on the (expected) future values of a variable, Mitchell (2000).

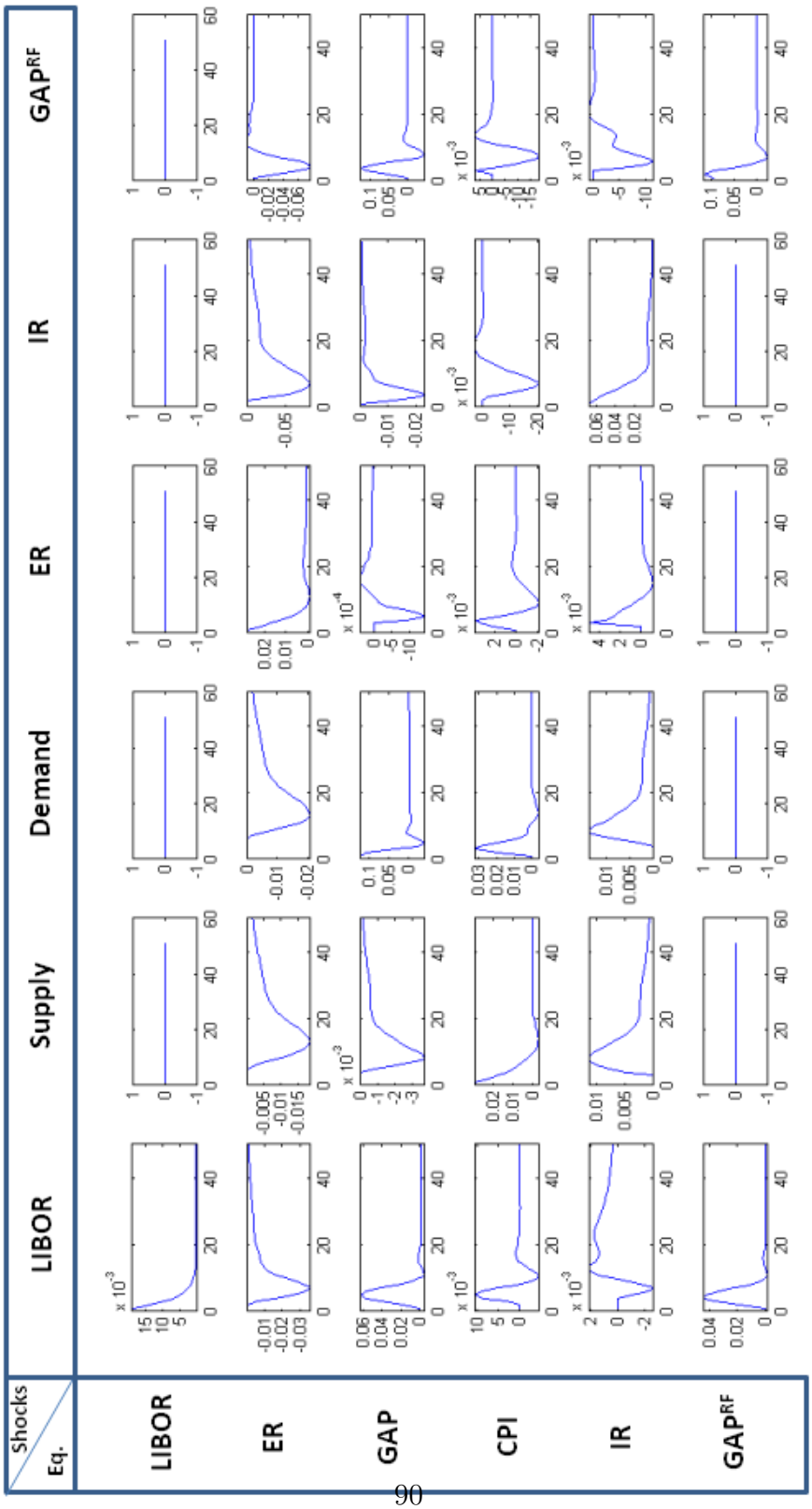

Figure 2.13: Impulse responses for a shock to LIBOR, inflation, Armenian output gap, exchange rate, interest rate, and Russian output gap equations (Notes: Deviation Mean).

Variances and Covariances

There is use an estimate of the variance - covariance matrix from one-period ahead forecast in order to identify the impact of structural shocks. The conditional covariances are estimated running the model under six types of shocks considered in the economy. The conditional variances and covariances are computed using the functions $var()$ and $cov()$ for time values from $t = 0$ to the 50th quarter.

The results of estimated conditional variances and covariances for different shocks are shown in Table 2. Positive covariance between the returns on two types of debt makes them substitutes in the government portfolio.

Table 2. Structural Model - Covariances and Variances

	$LIBOR$ *shock*	*Supply shock*	*Demand shock*	ER *shock*	IR *shock*	GAP^{RF} *shock*
$Cov(y,i)/Var(i)$	$-8,677$	$-0,342$	$-0,598$	$-0,203$	$-0,364$	$0,239$
$Cov(y,e)/Var(e)$	$-1,732$	$0,186$	$0,632$	$-0,018$	$0,203$	$-0,541$
$Cov(y,\pi)/Var(\pi)$	$5,402$	$0,072$	$3,740$	$-0,151$	$0,597$	$0,343$
$Cov(i,\pi)/Var(i)$	$-0,416$	$0,009$	$-0,692$	$0,435$	$-0,194$	$0,703$
$Cov(e,\pi)/Var(e)$	$-0,098$	$0,442$	$0,520$	$0,117$	$0,257$	$0,321$
$Cov(e,\pi)/Var(\pi)$	$-1,163$	$0,563$	$0,119$	$1,540$	$3,287$	$1,211$
$Cov(i,e)/Var(i)$	$4,811$	$-0,891$	$-0,511$	$2,426$	$-0,033$	$0,290$
$Cov(i,e)/Var(e)$	$0,113$	$-0,316$	$-0,237$	$0,163$	$-0,012$	$0,016$
$Cov(i,\pi)/Var(\pi)$	$-0,115$	$0,004$	$-0,073$	$0,386$	$-0,913$	$0,150$
$Var(\pi)$	$0,177$	$1,704$	$1,256$	$0,618$	$0,565$	$0,812$
$Var(e)$	$2,089$	$2,168$	$0,287$	$8,137$	$7,225$	$3,064$
$Var(i)$	$0,049$	$0,769$	$0,133$	$0,548$	$2,654$	$0,173$

Notes: Variances are multiplied by 100^2.

Results

Table 3. Optimal Debt Composition

	Risk no hed	Risk	Risk no neg	Cost	Cost no neg	Risk+C	Risk+C no neg	Conc	Conc noneg
LIBOR Shock									
s	-9,71	-1,30	0	3,14	0,78	1,83	-5,34	1,50	-5,34
q	-1,95	-1,30	0	-0,33	0	-1,63	0	-1,57	0
h	6,83	5,17	1,00	0,10	0,22	5,27	6,34	5,31	6,34
f	5,83	-1,56	0	-1,91	0	-4,47	0	-4,24	0
Supply Shock									
s	-0,36	-0,27	0	0,17	0,10	-0,10	0,00	-0,06	0
q	0,67	0,10	0	0,08	0	0,18	-0,34	0,24	-0,34
h	1,14	1,07	1,14	-0,03	0	1,05	1,34	1,02	1,34
f	-0,45	0,10	-0,14	0,79	0,90	-0,13	0	-0,19	0
Demand Shock									
s	-1,37	1,73	-0,40	0,70	0,70	2,43	-0,08	2,52	-0,08
q	1,23	-1,13	0	0,24	0,30	-0,89	0	-0,68	0
h	5,05	5,31	1,40	0,04	0	5,35	1,08	5,34	1,08
f	-3,91	-4,92	0	0,02	0	-5,90	0	-6,17	0
Exchange rate Shock									
s	0,24	-0,25	0	0,21	0,13	-0,04	0	-0,07	0
q	0,10	-0,04	0	-0,03	0	0,00	0	-0,02	0
h	0,90	0,94	0,90	0,00	0	0,94	0,93	0,94	0,93
f	-0,25	0,35	0,10	0,82	0,87	0,10	0,07	0,15	0,07
Interest rate Shock									
s	-0,59	-0,06	0	-1,36	0	-0,05	0	-0,05	0
q	0,49	-0,04	0	1,91	0,00	0,05	0	-0,05	0
h	1,70	0,15	0,17	-7,47	0	0,15	0,17	0,15	0,17
f	-0,59	0,95	0,83	7,92	1,00	0,85	0,83	0,95	0,83
Russian Gap Shock									
s	1,00	-0,75	0	0,47	0,42	-0,27	0	-0,27	0
q	-0,24	-1,18	0	0,02	0	-1,15	0	-1,12	0
h	1,43	2,97	1,43	-0,07	0	2,89	1,00	2,85	1,00
f	-1,19	-0,04	-0,43	0,58	0,58	-0,46	0	-0,46	0

The optimal debt composition is obtained from equations (6)-(8).

Notes: s – T-bills, q – US dollar-denominated LIBOR-indexed loans, h – Real bonds, f – Fixed rate bonds.

Table 4. Optimal Debt Composition - No real-indexed bonds

	Risk no hed	Risk	Risk no neg	Cost	Cost no neg	Risk+C	Risk+C no neg	Conc	Conc noneg
LIBOR Shock									
s	-9,71	-0,67	0	3,14	1,00	2,47	-8,21	2,15	-8,24
q	-1,95	-1,88	0	-0,33	0	-2,22	0	-2,16	0
h	12,66	3,55	1,00	-1,80	0	0,75	9,21	1,01	9,24
Supply Shock									
s	-0,36	0,11	0	0,15	0,10	-0,48	0	-0,51	0
q	0,67	0,67	0,62	0,06	0	0,83	0,67	0,86	0,67
f	0,69	0,21	0,38	0,79	0,90	0,65	0,33	0,64	0,33
Demand Shock									
s	-1,37	0,85	0,52	0,68	0,70	0,16	-0,08	0,07	-0,11
q	1,23	-0,67	0	-0,26	0	-1,28	0	-1,48	0
h	1,15	0,82	0,48	0,57	0,30	2,12	1,08	2,41	1,11
Exchange rate Shock									
s	0,24	-0,02	0	0,21	0,13	0,19	0,38	-0,16	0
q	0,10	-0,11	0	-0,03	0	-0,08	0	-0,09	0
h	0,65	1,13	1,00	0,82	0,87	0,88	0,62	1,25	1,00
Interest rate Shock									
s	-0,59	-0,06	0	0,03	0,03	-0,06	0	-0,05	0
q	0,49	-0,04	0	0,00	0,00	-0,05	0	-0,05	0
h	1,11	1,10	1,00	0,97	0,97	1,11	1,00	1,11	1,00
Russian Gap Shock									
s	1,00	1,07	0,97	0,42	0,42	1,50	1,00	1,08	0,93
q	-0,24	-0,26	0	0,00	0	-0,25	0	-0,24	0
h	0,24	0,18	0,03	0,58	0,58	-0,24	0	0,15	0,07

The optimal debt composition is obtained from equations (6)-(8).

Notes: s – T-bills, q – US dollar-denominated LIBOR-indexed loans, h – Real bonds, f – fixed rate bonds.

2.7 Appendix II: Data

Variable	Measure	Source	Period
GDP of Armenia	nominal and real, cumulative, in million of USD, ADM	MOF of Armenia, www.mfe.am	1991-2010
GDP growth rate of Armenia	% growth	MOF of Armenia www.mfe.am	1991-2010
Inflation rate[42]	% change to the same period of the previous year	CBA, annual statistics www.cba.am	1991-2010
Government budget balance	% of GDP	MOF of Armenia, www.mfe.am	1991-2010
Russian GDP	in current prices, cumulative, in million of USD, Rubles	National Bank of Russia, www.cbr.ru	2000-2007
USD Federal Funds Rate	in %, monthly average	Board of Governors of the Federal Reserve System, www.federalreserve.gov	2000-2007
Exchange rate ADM per USD	sale, end of period	CBA, www.cba.am	1991-2010
LIBOR	for 6-month USD deposit rate	British Bankers' Association www.bba.org.uk	2000-2007
T-bills interest rate	in%, quarterly average	CBA, www.cba.am	1991-2010
Domestic and External debt instruments	in millions of ADM, USD, % of GDP	CBA, www.cba.am	1991-2010

The inflation rate, the interest rates and the output gap have not been multiplied by 100. The exchange rate, T-bills interest rate, LIBOR, USD Federal Funds Rate are converted into quarterly terms from monthly.

Chapter 3

Optimal Public Debt Management in the Republic of Lithuania

3.1 Introduction

Since 1991, FSU countries have started independent sovereign borrowing policies. Their creation and further improvement was one of the necessary steps at the beginning of these countries' economic transition. The transitional countries often face high levels of public debt and debt interest payments absorb a large share of the state budget. PDM plays an important role in debt and deficit stabilization and thus helps to insure fiscal sustainability. Although the applied model is very simple, this work is a contribution to the analysis of these issues and, in particular, optimal PDM in the FSU countries, a relatively unexplored theme in the literature.

Optimal public debt structure differs from country to country and also it may vary over time. The choice of Lithuania is based on several factors: Lithuania practices a fixed exchange rate regime and has been successful in its transition from centrally planned to market economy, while previous chapter 2 derives the Armenian optimal public debt composition under floating exchange rate regime and weak transition economy.

The Lithuanian economy began its stabilization in 2000 (see Fig.3.1), characterized by progressive integration of labor, capital markets, and growing trade with the Euro area. Growing domestic consumption and increased investment have furthered recovery. Privatization of the large, state-owned utilities, particularly in the energy sector, was also undertaken.

Trade has been increasingly oriented toward the West, however, trade with its CEE neighbors, and Russia in particular, accounts for a growing percentage of total trade. Foreign government and business support have helped in the transition from

the command economy to a market economy. The share of the total export[1] to the EU states amounts 61% and to CIS countries - 24%.

In 2008, as a consequence of the global financial crisis, the Lithuanian economy was damaged. National GDP, which was growing on average by 8% per year from 2004 to 2008, driven by exports and domestic demand, in 2008-2009 declined by 2,2%. Fast growing inflation, in 2008 around 11,1%, makes it impossible for Lithuania to switch to the Euro in the near future. The level of the public debt in 2009 increased to 29,6% of GDP and in 2011, according to the IMF estimation, will reach 40% of GDP level. This work presents simple structural, forecasting and VAR

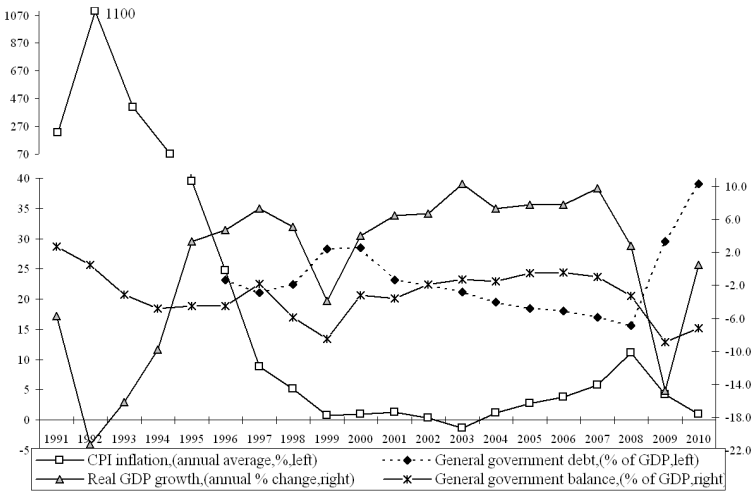

Figure 3.1: Main macroeconomic indicators of the Republic of Lithuania: 1991-2010

models, under different macroeconomic and financial shocks, i.e. external shocks (Euribor, RF, EU output gap) and domestic (supply, demand, short-term interest rate) shocks to real returns and output growth, in which debt management stabilizes the deficit-to-GDP ratio to ensure debt sustainability, balancing risks and costs minimization. This is accomplished by managing the optimal debt composition which minimize the risk that the deficit-to-GDP ratio exceeds the 3% limit set by the Stability and Growth Pact (SGP) and how fixed exchange rate regime may affect the correlations of the interest rate with output and inflation and thus the optimal choice of debt instruments.

As an underlying model I used empirical study by Missale (2000), who was interested in developed economies. I applied his approach for the Lithuanian case. The optimal structure of public debt is a function of the expected return differen-

[1]Main exports are mineral and chemical products in the global markets.

tials between debt instruments, the conditional variance of debt returns and their covariances with output growth and inflation. I estimate the optimal composition of public debt that would support deficit stabilization in Lithuania introducing Russian and the EU output gap variables, as Lithuania shows significant dependence on the development of the Russian economy.

The evidence suggests that inflation-indexed bonds have a positive role for deficit stabilization. T-bills have to be reduced, giving priority to fixed-rate long term securities. The real exchange rate is subject to fluctuate. Though Eurobonds are very convenient relative to a broad international market, it does involve exchange rate risk given foreign-currency denomination and the instability of the Lithuanian economy.

The paper is structured as follows. In the remaining subsections of the Introduction, an overview of the structure and evolution of the Lithuanian general government debt is provided. The next section describes the monetary policy of Lithuania with a brief literature review, on a choice of the exchange rate regime. The third section contains methodology and discusses the application of the Missale (2000) model of optimal debt portfolio to the Lithuanian case. The fourth section provides an empirical estimation of the optimal structure of Lithuanian government debt under several macroeconomic shocks. Finally, the fifth section presents conclusions and policy implications with possible areas for further research. In the appendixes, I present the estimation of covariances and variances by three different methods: the structural model (Appendix I), forecasting regression (Appendix II) and VAR (Appendix III). I conclude with the data set sources (Appendix IV).

3.1.1 Lithuanian public debt: stylized facts

With the dissolution of the Soviet Union, the allocation and settlement of its external assets and liabilities has become an important issue that affected the access to both public and private (FDI) foreign capital[2].

Lithuania recognized external debt contracted prior to independence for enterprises located within Lithuania to Soviet banks for the provision of goods and services that had been purchased centrally, and passed these on to enterprises.

Government's borrowing in financial and capital markets includes issuance of GS of the Republic of Lithuania on behalf of the State in domestic and foreign financial markets and borrowing from commercial banks.

Since the government is borrowing in Litas and foreign currencies, total public debt[3] is divided into domestic and external debt. Most of the government debt

[2]In Lithuania PDM, administration, and accounting are executed by the MOF.

[3]Before 2004, general government debt was classified into direct and contingent (government contingent debt includes liabilities of guarantee institutions established by the government of Lithuania, to credit institutions under guarantee agreements), and its classification into domestic

issued by Lithuania is denominated in foreign currencies, mainly in the Euro and its share is growing fast (see Fig.3.2). Positive economic developments, membership

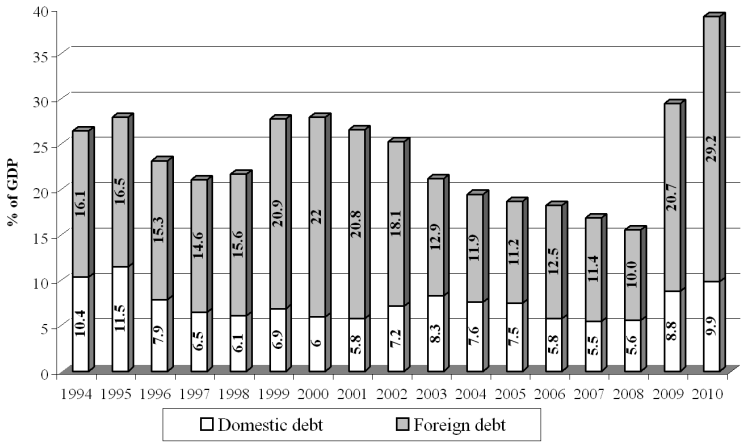

Figure 3.2: General government debt of Lithuania: structure and dynamics

in the EU and NATO and strengthened foreign investors' interest and confidence in the Lithuania's debt instruments. Additional impetus in buying Lithuanian's GS was provided by the removal, since the accession to the EU, of the requirement to maintain provisions for holding GS of the country (zero risk weighting[4]), and by trading GS in NewEuroMTS [5].

Domestic-currency denominated debt

The Lithuanian government borrows in the domestic market by issuing Treasury Bills (T-bills - short-term GS, the maturity of which at the time of issue does not exceed one year) and coupon bonds (long-term liabilities, the maturity of which is

and foreign was based on the currency of the loan.

[4]GS of non-EU countries are attributed to the category of higher risk; therefore, banks who have bought such GS are obliged to maintain corresponding provisions

[5]The electronic trading system of Euro-denominated GS of the states that have became EU member since 2004, the nominal value of which is not lower than EUR1billion (or else the country has to commit to re-open the issue and built it up to this level in a 6-months). Lithuania was the third (after Poland and Hungary) to have its GS traded through this system. Currently, there are 27 market makers, who are required to quote selling and buying prices for the bonds listed in the system. Participation in the system keeps minimum bid/offer spread (the difference between the buying and selling prices of 10-year GS must not exceed 25 cents). This arrangement aims the integration into the EU capital market; ensures trade transparency, GS comparability and liquidity that allows to reduce borrowing costs in the primary market

longer than one year) sold by auction and, taking short-and long-term loans. In addition, a number of saving notes[6] and special purpose bonds[7] are issued in the national currency (see Fig.3.3). All GS denominated in Litas are issued in a book-

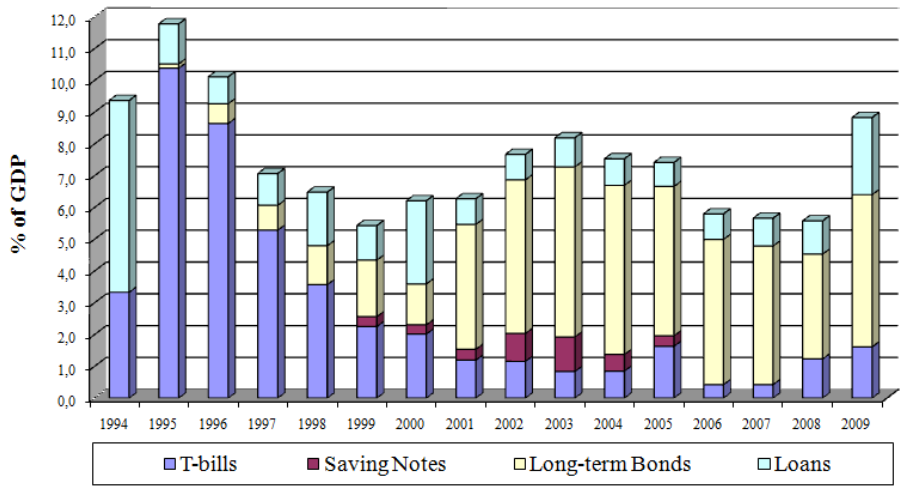

Figure 3.3: General government Domestic debt of Lithuania: structure and dynamics

entry form. The title is evidenced by relevant records in personal securities accounts. GS acquired in the primary market are exempted from corporate income, personal income or VAT.

The Lithuanian domestic security market started in 1994 with issuing on the auction[8] first 1-and 3-month maturity T-bills with a maximum interest rate fixed

[6]Saving notes (deposits), issued through the network of commercial banks and financial brokerage companies, are offered for sale in the primary market to natural persons in order to encourage them to invest their funds and provide an opportunity to invest a smaller amount than in case of GS sold in auctions. They can be redeemed before maturity date without losing interest due. In 1999 short- and in 2001 long-term deposits were launched in market with enormous popularity

[7]GS are issued under special legislation without auctions for the purpose of execution of certain state property liabilities, restructuring of banks, settlements with creditors. These securities are not subject to secondary marketing

[8]Since 1999, auctions have been open for those national and foreign banks and brokerage companies which have signed an agreement with the Lithuanian Bank and meet the requirements set: auction participants must acquire at least 1% of the total GS sold by auction during a quarter and announce the yield rate for buying and selling of the most recent issue. Notices about GS issues and schedules are published by the MOF in its bulletin and on the web site. Currently 7 dealers, all of which are resident, have signed agreement. The auctions are organized by the Bank of Lithuania in accordance with the agreement concluded by the Bank and the MOF.

by the government at 35%. Since then, the yield has fluctuated in the range of 39-5%. In 1995 the MOF introduced T-bills with 6-and 12-month maturities.

The share of short-term liabilities continually decreased. To reduce the re-financing risk, since 1999, the government has increased the issues of long-term debt instruments with great success among investors. Their maturity was extended from 2 to 11 years.

Foreign-currency denominated debt

Initially, Lithuania undertook minimal external debt obligations of its own. Further, the government, state enterprises and the private sector increased access to foreign credits, starting with loans from multilateral institutions, establishing credit lines with Western export credit agencies and introducing Eurobonds in financial markets.

Fig.3.4 shows the composition of the foreign public debt, which includes short-term GS, long-term bonds (with a maturity period from 1 to 10 years) and loans[9]. The GS traded externally has changed several times the currency denomination.

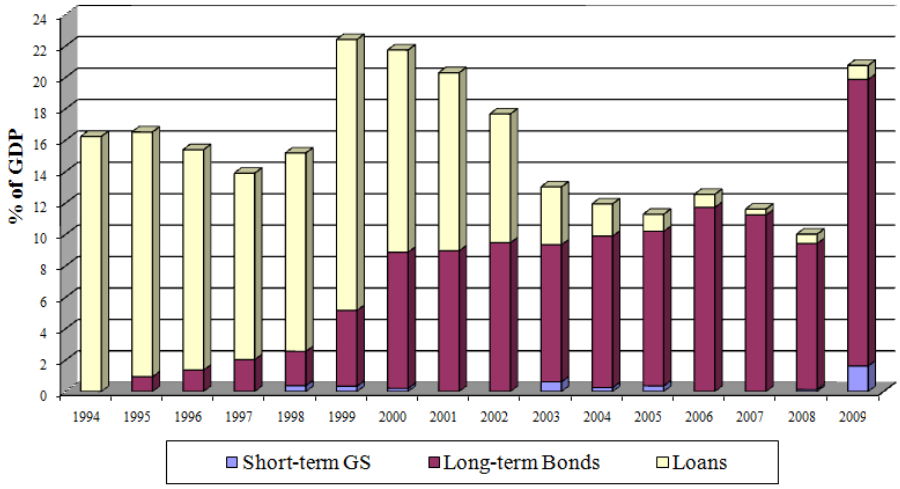

Figure 3.4: General government Foreign debt of Lithuania: structure and dynamics

The first sovereign issue of GS denominated in US-dollars was held in 1995-1997. In 1998, the currency denomination was changed to Deutsche Mark.

[9]Foreign loans include loans from international development organizations and foreign governments, and State guarantees (loans granted by foreign lenders and Lithuanian commercial banks in foreign currency, from 2003 on no new State guaranteed on loans were issued).

The structure of the foreign debt by currency was transformed after joining the ERM-II[10]. After the pegging to Euro, seeking to protect the foreign debt from exchange rate fluctuations, government borrowings in Euro increased and still the major currency for borrowing in international finance markets remains the Euro.

During 1996-1997, the Ministry focused more on international borrowing in the Eurobond market, a move that was tempered due to increasing rates. Thus, Eurobond has been the main GS instrument for borrowing in foreign capital markets since 1999. Since then their maturity was extended from 2 to 11 years.

The Euro-denominated GS have been listed in stock exchanges in Frankfurt and Luxemburg. Secondary markets for these Eurobonds are operating by the rules set by these stock exchange.

Lithuania is a member of several IFI, like the IMF, EBRD and the WB. Most of the loans were undertaken for public investments and structural reforms. The largest loans were received from the IMF, the WB. Currently, the IBRD is the largest lender to Lithuania. Since 2007, the loan category has decreased as a result of the implementation of the provision to decrease a share of loans in order to reduce exchange rate fluctuation risk and cut expenditures on interests.

3.2 Monetary policy

3.2.1 Fixed exchange rate regime

Exchange rate arrangements vary according to the degree of flexibility in establishing the exchange rate from rigid forms - Currency Boards (CBs) or domestic currency pegging, to free floating.

Exchange rate regimes in CEE countries are analyzed according to their stages of development - stabilization, transition, preparation for the Eurozone[11]. A fixed exchange rate system is preferable for these countries, and for those introducing new currencies, because this system imposes discipline on the authorities, provide credibility, price stability and have advantages for small, open economies which find independent monetary policy difficult to sustain.

[10]The Litas was included in the European Exchange Rate Mechanism II on 28 June 2004 undertaking an unilateral commitment to maintain the fixed exchange rate regime of Litas against Euro at the central parity.

[11]In the early 90s during the macroeconomic stabilization, "pegging" the domestic currency to another one was the most common option. In the late 90s, countries moved towards either flexible or rigid currency regimes. Changes in monetary policies in new EU member states have been induced by the need to align to requirements imposed by the EU. Often a proposal for a fixed exchange rate system comes together with a macro stabilization package, which includes the monetary policy that supports a fixed exchange rate, balanced budget, foreign economic assistance.

The first CB were established by British colonies in the 19th century and became widespread in the 20th century. CB were out of fashion for a long time because of the advantages of central banking. After the collapse of communist regimes, interest in CB revived. Several countries implemented this monetary regime[12] in order to achieve credibility for new or crisis shaken monetary arrangements[13].

From 1991 to 1994, Lithuania adopted a flexible exchange rate system, but in 1994, the Litas was pegged to the US dollar due to little trust in the emerging monetary system, fear of high exchange rate fluctuations, desire to attract FDI.

Initially the EU institutions had doubts about the suitability of a CB for the EU accession process. As a result, in 1997, the Bank of Lithuania explored the option of introducing an element of exchange rate flexibility by gradually relaxing the rules of the CB. The Asian-Russian crisis of 1998 forced Lithuanian institutions to reinforce the commitment to the CB.

In 1999, given increasing trade with the EU, the Bank of Lithuania announced its intention to re-peg the Litas from the US dollar to the Euro. The modalities and timing of the re-pegging were made public in advance to reduce uncertainty[14].

In 2000 the EU confirmed that fixed exchange rate regimes can be sustainable in small and open economies and that CBs may constitute an appropriate unilateral commitment within ERM-II. This decision sent the signal that a Euro-based CBs would be a feasible exchange rate regime in the run-up to the EU.

In 2002 the Litas was smoothly re-pegged to the Euro at a rate of 3.4528 to 1 and is not expected to change until the Euro adoption. The link to the Euro has helped Lithuania to reach close economic integration with the EU.

In contrast to European Central Bank[15], Hanke (2009)[16], strongly maintains that, when all countries are experiencing the pain of a world economic crisis, in Lithuania, the pain is mitigated by the CB system. Things would even be worse if Lithuania had any other type of exchange-rate regime.

The abandonment of the CB now would result in increasing CPI, a loss of stability

[12]Exchanging the domestic currency to a certain foreign monetary unit has to be made by a fixed rate. The central bank entrusts its "traditional" functions to a CB, which can be an entity within the bank and takes on some of the bank's functions

[13]Thus from 1992 to 1997, given the combination of structural and external factors, Estonia, Lithuania, Latvia, Bosnia and Herzegovina, and Bulgaria preferred the rigid form of exchange rate regimes, and established CB systems of running monetary policy. Certain transition economies, Czech Republic in 1997, Slovakia in 1998, Poland in 2000, Serbia in 2006, adopted more flexible exchange rate arrangements, and accepted inflation targeting to reduce inflationary expectations

[14]Lithuania was the first country in the FSU where a CB was discussed among the public and government officials

[15]In 2010 Lithuania suffered a deeper economic slump than the rest of the EU because tight Euro pegs too early in the convergence cycle led to asset bubbles.

[16]Steve H. Hanke served as State Counselor and an adviser to the Lithuanian government and helped the Prime Minister of Lithuania to install a CB in 1994

and credibility. Therefore, the return to a flexible exchange rate may be impossible because of the high social and economic costs.

3.2.2 Calculating of the real exchange rate

As Lithuania practices a fixed exchange rate regime, the model does not consider an exchange rate. But, doest this mean that the exchange rate cannot eventually depreciate or appreciate? Different rates of inflation in different economic sectors definitely influence the developments in the real exchange rate.

In the literature, there are two different ways of its calculating:

- first defines the real exchange rate as the ratio between prices on traded and non-traded goods. This definition captures the efficiency of allocation of resources in the country. However, the problems of the classification of statistical information regarding the traded and non-traded goods makes the calculation of the real exchange rate virtually impossible.

- second, as a ratio of domestic to foreign price levels, multiplied by the nominal exchange rate. It is much easier to calculate it by applying inflation differentials according to the chosen indices between countries.

The real Litas/Euro exchange rate is calculated as:

$$s = e\frac{p}{p^f} \tag{3.1}$$

where e is nominal Litas/Euro exchange rate, p is domestic price level (CPI inflation of Lithuania) and p^f is foreign price level (CPI inflation of the EU-15[17]).

Fig.3.5 illustrates the developments in real Litas/Euro exchange rate after the introduction of the CB based on the CPI inflation in Lithuania and the EU-15. The real exchange rate tends to fluctuate. In late 2006 it increased and in early 2009 it declined sharply following easing of tensions in global financial markets. The important issue of sustainability of the fixed rate at its present level came out. Floating exchange rate enables market to determine this equilibrium[18], however this is not possible, since Lithuania is already a member of ERM-II and has to keep its currency fixed at least two years prior to the Euro adoption.

The real exchange rate tends to fluctuate following easing of tensions in global financial markets but remains sustainable.

The increasing risk of significant economic downturn in Lithuania in the face of the global financial crisis, deteriorating public finances and the increasing risk in

[17]The EU-15: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

[18]As Maeiulis (2005) mentioned that it could have been useful to float the currency before joining ERM-II and allow the exchange rate self-adjust towards equilibrium

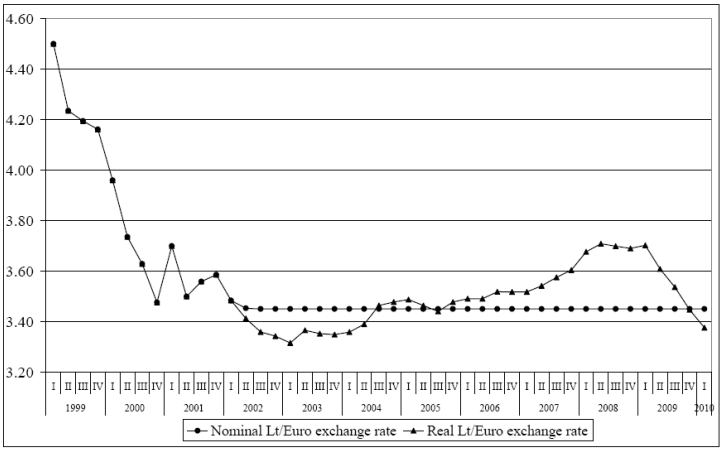

Figure 3.5: Nominal and Real Litas/Euro Exchange Rates

external sector forces investors to quit the Lithuanian security market.

In 2009, in order to finance the government deficit and attract more investors, the Lithuanian government issued long-term Euro-and USD-denominated bonds at rather high primary yields (9,4% and 6,8%, respectively). Though Eurobonds are very convenient as regards the wider international market, they do involve exchange-rate risk, given the foreign-currency denomination and instability of Lithuanian economy. Moreover, pressure on fiscal policy is growing: as of 2009 the portion of Eurobonds was 17,7% of GDP with a total external public debt of 20,9% GDP (total government public debt was 29,8% of GDP). However, the domestic-currency denominated share in 2009 grew to 8,9% of GDP (5,6% of GDP in 2008).

Fig.3.6 shows the dynamic of spread on the Eurobond issue over the yield on Litas-denominated Bonds. The risk premium over Bonds on the Eurobonds has started to increase following the crisis in financial markets which commenced in August 2007 but its value keeps on low level.

3.3 Model and methodology

As it was mentioned above, this paper focuses on deriving the optimal composition of Lithuanian government debt (in terms of maturity, currency denomination and indexation) relying on the model developed by Missale (2000) for OECD economies, which is based on management of the public debt to minimize the risk that the deficit-to-GDP ratio exceeds the 3% limit of the Stability and Growth Pact (SGP). Careful choice of debt instrument is needed to control interest payments and hedge

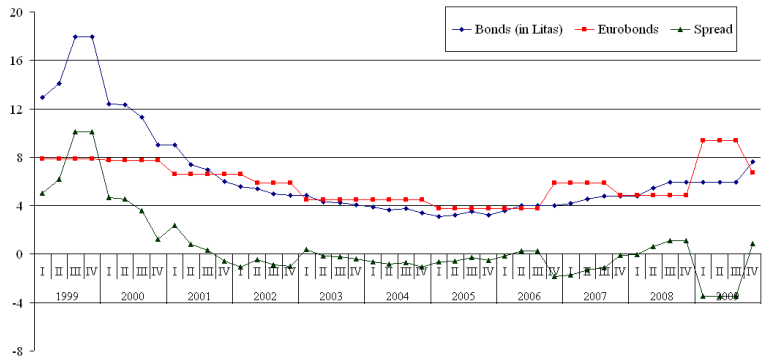

Figure 3.6: Dynamics of the weighted average yield (%) on Litas-denominated Bonds and Eurobonds in 1999-2009. Spread on Eurobonds over Litas-denominated Bonds

against inflation and output shocks to the budget so as to stabilize the deficit-to-GDP ratio. This allows to derive the optimal debt structure as a function of the stochastic relations between output, inflation and the interest rate.

Next it is demonstrated how the optimal debt structure that stabilizes the deficit-to-GDP ratio is determined by the Lithuanian monetary regime. The effect of the monetary policy on public debt management depends on the conditional covariances between output, inflation and interest rate.

This paper formalizes the idea that the SGP[19] takes deficit stabilization as an interesting objective of public debt management. In the model the government trades off the cost of exceeding the 3% deficit limit against the costs of fiscal adjustment. The debt composition which is optimal for deficit stabilization depends on the monetary regime, the domestic and external shocks and the size of such shocks.

The government wants to maintain the deficit-to-GDP ratio, G_{t+1}, below the 3% limit, D^T. In order to reach this goal the government controls the deterministic component of the state budget and decides to implement the fiscal adjustment (rel-

[19]The SGP is an agreement between the 16 members of the EU that take part in the Eurozone, to facilitate and maintain the stability of the EMU. It consists of fiscal monitoring of members by the EC and the Council of Ministers and, after multiples warnings, sanctions against offending members. Member states adopting the Euro have to meet the Maastricht convergence criteria, and the SGP ensures that they continue to observe them. The actual criteria that member states must respect are the following: Inflation must not be more than 1,5% higher than the average of the 3 lowest inflation member states; Annual government deficit must not exceed 3% of GDP at the end of the preceding fiscal year; The ratio of gross public debt to GDP must not exceed 60% at the end of the preceding fiscal year; Applicant countries should have joined the ERM-II under the EMS for 2 consecutive years and should not have devalued its currency during the period; The nominal long-term interest rate must not be more than 2% points higher than in the 3 lowest inflation member states.

ative to GDP), A_{t+1} , facing a trade off between the cost of the adjustment and the probability of incurring in the penalties of the SGP. However, since the outcome of the correction is uncertain (and the fiscal adjustment is costly), because the budget is subject to a shock, X, which occur after taxes and spending have been set, the government loss function is given by the following equation

$$L_{t+1} = \frac{1}{2}A_{t+1}^2 + Kp \tag{3.2}$$

where K is the fixed cost of failure due to the loos of reputation and the penalty for breaking the SGP, p, the probability of exceeding the deficit limit, is equal to

$$p = Prob[X + G_{t+1} - A_{t+1} > D^T] = Prob[X > D^T + A_{t+1} - G_{t+1}] \tag{3.3}$$

Substituting equation (3.3) in (3.2) yields the government loss function

$$L_{t+1} = \frac{1}{2}A_{t+1}^2 + \int_{D^T + A_{t+1} - G_{t+1}}^{\infty} K\phi(X)dX \tag{3.4}$$

where first term represents the cost of the fiscal adjustment while the second term is the expected cost (penalties) of exceeding the deficit limit[20]; G_{t+1} is the deficit-to-GDP ratio in the absence of government intervention[21], $\phi(X)$ is probability density function of the shock to the budget, X, after the fiscal adjustment.

The public debt structure is important since it determines the interest payments of debt servicing which affect the trend component of the state budget deficit together with cyclical effects and inflation rate:

$$G_{t+1} = g_t - \eta_y y_{t+1} - \eta_\pi \pi_{t+1} + I_{t+1}B_t \tag{3.5}$$

where g_t is the deterministic component of the budget deficit, y_{t+1} is the growth rate of output, π_{t+1} is the inflation rate, η_y and $\eta_\pi$is the elasticity of the government budget with respect to the output and the price level respectively, B_t denotes the debt-to-GDP ratio, $I_{t+1}B_t$ are the nominal interest payments relative to GDP.

[20]The fixed cost, K times the probability that the shock to the budget, X, exceeds the deficit ceiling augmented by the planned surplus; i.e. the probability that $X > D^T + A_{t+1} - G_{t+1}$

[21]Agenor and Montiel (1999) survey the theoretical literature and conclude that fiscal adjustment in the transition countries is crucial for gaining macroeconomic stability. Excessive fiscal deficits may lead to inflation, balance of payments difficulties, external debt crises, and high real interest rates, outcomes that tend to be negatively correlated with economic growth

The interest payments, $I_{t+1}B_t$, on the outstanding public debt depend on the interest rates and on the composition of the public debt as determined in the previous period of time and play a key role in the choice of the debt instruments maturity.

The interest payments in period $t+1$ are equal to:

$$I_{t+1}B_t = i_{t+1}sB_t + (R_t^I + \pi_{t+1})hB_t + R_t(1-s-h)B_t \tag{3.6}$$

where, s is the share of debt indexed to the domestic floating interest rate and h is the share of inflation-indexed debt, i_{t+1} is the average short-term interest rate and R_t denotes the nominal rate of return on fixed-rate bonds, R_t^I is the real interest rate known at the time of issuance.

3.3.1 The choice of debt instruments

The state budget is affected by output growth and inflation, while an increase in the interest rates leads to higher interest payments on short-term and floating GS. The debt structure, which stabilizes the deficit-to-GDP ratio, thus depends on the stochastic relations between output growth, inflation and the interest rate. The choice of debt maturity and indexation is a function of the stochastic relations between output, inflation and interest rate. Deriving first the fiscal correction, A_{t+1}, next it is possible to choose the debt instruments.

The government goal is to decide the fiscal adjustment, A_{t+1}, to minimize the loss function (3.3) before knowing the outcome of the government's efforts, X, taking into account output, inflation, the interest rate and the interest payments on public debt. Deriving (3.3) with respect to A_{t+1}, yields the first order condition (FOC)

$$A_{t+1}^* = K\phi(D^T + A_{t+1}^* - G_{t+1}) \tag{3.7}$$

where A_{t+1}^* defines the optimal adjustment which is an increasing function of the trend component of the deficit and the deficit ceiling. It follows from the assumption that the probability density function of X, $\phi(X)$, decreases the greater is the shock size ($X > 0$) and the cost, K, is high relative to the trend component of the deficit, thus the optimal fiscal correction implies an expected deficit below the 3% deficit limit, i.e. $A_{t+1}^* > G_{t+1} - D^T$, and the limit is exceeded for bad shocks $X > 0$.

Now, the government can choose the debt denomination, indexation and maturity. Substituting A_{t+1}^* in the loss function (3.3) and taking expectations conditional on the information at time t, we obtain the expected loss at the time when the government decides the debt structure. The government chooses s and h to minimize the expectation of the government loss function:

$$E_t L_{t+1} = E_t[\frac{1}{2}A_{t+1}^{*2} + \int_{D^T + A_{t+1} - G_{t+1}}^{\infty} K\phi(X)dX] \tag{3.8}$$

subject to (3.5) and (3.6).

Deriving (3.8) with respect to s and h yields

$$E_t K\phi(D^T + A_{t+1}^* - G_{t+1})[i_{t+1} - R_t] = 0 \tag{3.9}$$
$$E_t K\phi(D^T + A_{t+1}^* - G_{t+1})[R_t^I + \pi_{t+1} - R_t] = 0 \tag{3.10}$$

The FOCs (3.9), (3.10) have a simple explanation: they demonstrate that the public debt composition is optimal only if interest costs of debt instruments are uncorrelated with the fiscal adjustment. Therefore, the government cannot modify the debt composition; e.g. substitute fixed-rate bonds for short-term and vice versa, so as to reduce the fiscal correction needed to keep the deficit within the 3% limit.

Then in the FOC (3.9) the difference between the interest cost of short-term T-bills, i_{t+1}, and fixed-rate bonds, R_t, is equal to the difference between the average short-term interest rate between time t and t+1, i_{t+1}, and its value as expected at time t, $E_t i_{t+1}$, minus the term premium on fixed-rate bonds, TP_t:

$$i_{t+1} - R_t = i_{t+1} - E_t i_{t+1} - TP_t \tag{3.11}$$

In the FOC (3.10) the difference between the interest payment on real bonds, $R_t^I + \pi_{t+1}$, and fixed-rate bonds, R_t, is equal to the difference between the average inflation rate between time t and t+1, π_{t+1}, and its value as expected at time t, $E_t\pi_{t+1}$, minus the inflation risk premium which is relevant to the government, IP_t:

$$R_t^I + \pi_{t+1} - R_t = \pi_{t+1} - E_t\pi_{t+1} - IP_t \tag{3.12}$$

The return differentials (3.11) and (3.12) allow to rewrite the FOCs (3.9), (3.10) as follows

$$E_t K\phi(D^T + A_{t+1}^* - G_{t+1})(i_{t+1} - E_t i_{t+1}) = TP_t E_t K\phi(D^T + A_{t+1}^* - G_{t+1}) \tag{3.13}$$
$$E_t K\phi(D^T + A_{t+1}^* - G_{t+1})(\pi_{t+1} - E_t\pi_{t+1}) = IP_t E_t K\phi(D^T + A_{t+1}^* - G_{t+1}) \tag{3.14}$$

To obtain an explicit solution for the optimal shares of debt instruments here must be specified the probability density function, $\phi(X)$, which cannot be estimated.

Thus, a linear approximation of fiscal rule A^*_{t+1} was taken.

Substituting equations (3.5) and (3.6) in the FOC (3.13), (3.14) yields the optimal shares of T-bills, s^* and price-indexed debt, h^* which minimize the expected loss function:

$$s^* = \frac{\eta_y}{B_t}\frac{Cov(y_{t+1}i_{t+1})}{Var(i_{t+1})} + \frac{\eta_\pi}{B_t}\frac{Cov(\pi_{t+1}i_{t+1})}{Var(i_{t+1})} - h^*\frac{Cov(\pi_{t+1}i_{t+1})}{Var(i_{t+1})} + TP_t\frac{E_t(D^T + A^*_{t+1} - G_{t+1})}{B_t Var(i_{t+1})} \quad (3.15)$$

$$h^* = \frac{\eta_y}{B_t}\frac{Cov(y_{t+1}\pi_{t+1})}{Var(\pi_{t+1})} + \frac{\eta_\pi}{B_t} - s^*\frac{Cov(\pi_{t+1}i_{t+1})}{Var(\pi_{t+1})} + IP_t\frac{E_t(D^T + A^*_{t+1} - G_{t+1})}{B_t Var(\pi_{t+1})} \quad (3.16)$$

where $Var(.)$ and $Cov(.)$ – variances and covariances conditional on the information available at time $t+1$; $Cov(y,i)/Var(i), Cov(y,\pi)/Var(\pi)$ – covariances of output growth with T-bills and Real Bonds; $Cov(i,\pi)/Var(\pi)$, $Cov(\pi,i)/Var(i)$ – the conditional covariances between the returns on debt instruments; $E_t(A_{t+1})$ – expected fiscal adjustment; B_t – the debt-to-GDP ratio; η_y and η_π – the elasticity of the government budget with respect to the output growth the price level (in % of GDP); TP_t – term premium and IP_t – inflation risk premium.

The optimal debt composition depend on risk and cost considerations. By the first and second terms in equations (3.13) and (3.14) is captures risk minimization when a debt instrument provides hedge against fluctuations in the primary budget and the debt ratio due to output and inflation uncertainty and when the conditional variances of its returns is low. By the third and fourth terms is captured risk minimization which also depends on the conditional covariances between the returns on the various debt instruments. By the last term is captured cost minimization.

3.3.2 Expected return differentials

Optimal debt composition, mainly cost minimization, depends on expected return differentials/risk premia, TP_t, IP_t, more precisely, on the excess return perceived by the government of fixed-rate bonds relative to the debt instrument considered.

$$TP_t = R_t - E_t i_{t+1} \quad (3.17)$$

$$IP_t = R_t - R^I_t - E_t\pi_{t+1} \quad (3.18)$$

TP_t - Term risk premium (or the expected return differential between fixed-rate bonds and T-bills) is the difference between the yield at auction of fixed-rate bonds, R_t and the expected average return on T-bills between time t and $t+1$, $E_t i_{t+1}$.

IP_t - Inflation risk premium (or the premium on price-linked bonds over fixed-rate bonds) can be estimated as the difference between the interest rate on fixed-rate bonds, R_t and the (real) yield at issue of price-linked bonds, R^I_t augmented by the

expected inflation between time t and $t+1$, $E_t\pi_{t+1}$.

3.4 Estimation the optimal debt composition

Three main debt instruments: T-bills (floating rate notes), fixed-rate bonds (mid- and long-term bonds denominated in domestic currency, Litas, and Eurobonds) and anticipated inflation-indexed bonds (real bonds) were used to obtain the optimal structure of the Lithuanian debt. Eurobonds were not considered as a foreign currency denominated debt as these instruments have been issued by Lithuanian government under fixed-exchange rate monetary regime since 2002. The issue of long-term domestic bonds has been gradually suspended giving priority to Eurobonds.

The optimal debt composition depends on:

the reduction in the debt-to-GDP ratio, B_t. Domestic general public debt in Lithuania was 27,8% of GDP in 2009;

$E_t(A_{t+1})$ - expected fiscal adjustment. As mentioned in the IMF country report (2009), in 2010, a sizeable adjustment of 7,3% of GDP will be implemented in the original and supplementary budgets. The consolidation is largely expenditure-based in line with international experience of successful fiscal adjustments Current spending allocations are adjusted downward given the backdrop of deflation, investments are protected by utilizing front-loaded EU funds to replace domestically funded-capital projects and wage cuts are targeted at higher-paid civil servants. The adjustment has also permanently raised various tax rates and broadened the VAT base to protect the revenue base;

the sensitivity of the primary surplus to unexpected variations in output growth and inflation, η_y and η_π. The overall cyclical sensitivity of the budget balance to the economic cycle can be measured by the elasticity of the government deficit with respect to the output. It is defined as the difference between the cyclical sensitivity of the 4 categories of taxes (corporate tax, personal tax, indirect tax and social security contributions) and the one expenditure item (current expenditure), weighted by their respective shares in GDP. This measures the change of the budget balance for a 1% change in GDP and is equal to average 0,42 for the new EU members and a tentative 0,30 for the elasticity with respect to the price level[22];

expected return differentials, TP_t and IP_t, more precisely, on the excess return perceived by the government of fixed-rate bonds relative to the debt instrument considered. Term risk premium, TP_t, was set at 1,70%: at the end of 2009 the average auction yield on fixed-rate bonds was 7,63%, the interest rate on T-bills expected for 2010 is 5,93%. Inflation risk premium, IP_t, at 0,75%: with an interest rate of 7,63% on fixed-rate bonds, real interest rate for possible issued price-indexed bonds,

[22]See Source: OECD Economic Outlook database and OECD estimates

R_t^I, estimated of 4,58% (this coefficient was calculated as the difference between the interest rate on T-bills at time t (5,98% in 2009) and the average rate of inflation in the same period of time (1,4% in 2009) while the expected average rate of inflation for 2010, $E_t\pi_{t+1}$, was settled around 2,3%;

conditional variance of debt returns and of their covariances with output, inflation, short-term interest rate.

The relevant covariances were estimated with quarterly data for the period from 2000:01 to 2009:04 with three alternative methods. The first one relies on a structural model of the Lithuanian economy. These policy implications strongly depend on the correct specification of the structural model of the economy. Thus, it is important to verify whether they continue to hold under different estimation methods. That is why three different methods for the estimation of the optimal debt composition is presented. The second approach approximates the unanticipated components of the relevant variables using the residuals of forecasting regressions. The third technique is vector autoregression (VAR) method.

3.4.1 Structural model

A simple structure model used to estimate the optimal composition of the Lithuanian public debt is made by six equations for the Euribor, the RF output gap, the EU output gap, the Lithuanian output gap, the inflation rate and the short-term interest rate (see Appendix I):

$$i_t^{Euribor} = \mu_0 + \mu_1 i_{t-1}^{Euribor} + \nu_{i_t^{Euribor}} \tag{3.19}$$

$$y_t^{RF} = \kappa_0 + \kappa_1 y_{t-1}^{RF} + \kappa_2 y_{t-2}^{RF} + \nu_{y_t^{RF}} \tag{3.20}$$

$$y_t^{EU} = \delta_0 + \delta_1 y_{t-1}^{EU} + \delta_2 y_{t-2}^{EU} + \delta_3 i_{t-1}^{euribor} + \nu_{y_t^{EU}} \tag{3.21}$$

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 i_{t-1} + \gamma_3 i_{t-1}^{Euribor} + \gamma_4 y_{t-1}^{EU} + \gamma_5 y_{t-3}^{RF} + \nu_{y_t} \tag{3.22}$$

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 y_{t-1} + \alpha_3 y_{t-1}^{RF} + \alpha_4 i_{t-3}^{euribor} + \nu_{\pi_t} \tag{3.23}$$

$$i_t = \rho(i_{t-3}^{Euribor} + Pe_t) + (1-\rho)[\beta_0 + \beta_1 i_{t-1} + \beta_2(\pi_{t-1} - \pi^T)] + \nu_{i_t} \tag{3.24}$$

All the equations in the model have been estimated by OLS. I consider six types of shocks: a supply shock (in the inflation equation), a demand shock (in the output gap equation), a short-term interest rate shock, an Euribor shock, a shock to the RF output gap and a shock to the EU output gap.

The unanticipated components of the short-term interest rate, inflation and output growth are estimated as the cumulated impulse responses of these variables to different domestic (supply, demand and short-term interest rate) and external (Euribor, RF and EU output gap) shocks. The shock amplitude was taken as one standard deviation of the variable. Fig.3.13 summarises the outputs generated by the different shocks.

The RF and the EU are the main trading partners of the Baltic countries. Lithuania imports the most from the RF, mainly crude oil. Given their dominance of trade in Lithuania, the RF and the EU are key determinants of economic activity in the region. However, spillovers from these trading partners would not only affect one Baltic country directly but may also have significant indirect effects on the other Baltic countries because of high intra-regional trade.

The impulse-response functions show that shocks from the EU exert significant effects on the growth rate of Lithuania. Shock from the EU growth rate leads to an immediate jump in Lithuania's GDP growth rate but Lithuania's GDP response to a shock from the RF occurs with decline. The imprecision of the RF's effects may be due to the fact that the RF exports oil: an increase in the international price of oil is likely to lead to a faster pace of economic activity in Russia while conversely having an adverse effect on the oil-importing Lithuania.

Then, the cumulative responses are used to estimate the ratios of conditional covariances relative to conditional variances which are shown in Table 2. The covariance of short-term interest rate and output growth is negative for all types of shock (except Euribor): unexpected increase in interest rate is associated with significant reductions in output growth. The conditional covariance between inflation and output is positive, (negative and small in case of supply shock). The effect on the conditional covariance of inflation and the interest rate depends on the monetary regime. This coefficient is high for all types of shock (except domestic and external interest rate). This evidence is consistent with monetary regimes where monetary authorities have a concern for output stabilization and/or interest rate smoothing. This evidence is also consistent with a fixed exchange rate regime when the interest rate reaction of the leader country is weaker than that needed to fully stabilize domestic inflation[23].

The optimal debt structure that stabilizes the deficit-to-GDP ratio against macroeconomic shocks is reported in Table 3. Column 1 reports the debt composition that stabilizes the debt ratio against variations in output and inflation, in the case we abstract from hedging against variations in debt returns. Column 2 shows optimal debt structure for risk minimization when the role of each debt instrument hedging against the returns of other instruments is considered. In Columns 3, 5 and 7 the debt instruments are limited to the non-negative. Column 4 reports optimal structure of the public debt considering only debt cost. Column 6 presents an optimal debt composition when, besides risks, debt costs are taken into consideration. In Column 8, real bonds are not considered in the analysis.

Supply Shock The optimal debt composition that stabilizes the deficit-to-GDP ratio against supply shocks, i.e. against shocks to the inflation equation is as follows: T-bills are optimal in absence of real bonds and provide insurance against variations

[23]see Bacchiocchi and Missale (2005) for deeper explanation

in the primary surplus and in the debt ratio due to lower than expected inflation and output growth. Fixed-rate bonds appear to play an important role in all the cases except for minimizing the risk of variations in the primary surplus and the debt ratio. Real bonds take second best position.

Demand Shock The debt composition that stabilizes the deficit ratio against demand shocks, i.e. against shocks to the output gap equation remains the same as for supply shock, only when the real bonds are not issued, then T-bills are optimal.

Short-term interest rate shock The public debt composition that stabilizes the deficit ratio against interest rate shock (shock to the interest rate equation) shows that it would be optimal to hold T-bills and fund this position with other instruments, namely real and fixed-rate bonds.

Euribor Shock The public debt composition that stabilizes the deficit ratio against external interest rate shock (shock to the Euribor equation) reports that issuing T-bills is optimal in all cases. Real bonds also play an important role. Fixed-rate bonds provide limited insurance against budget risk and would be optimal for cost minimization.

RF output gap Shock The public debt composition that stabilizes the deficit ratio against RF output gap shock (shock to the RF output gap equation) gives absolute priority to fixed-rate bonds, limited role for real bonds and denies issuing of T-bills.

EU output gap Shock The public debt composition that stabilizes the deficit ratio against RF output gap shock (shock to the RF output gap equation) shows that T-bills are optimal choice in the case the real bonds are not issued in the financial market. Real bonds are optimal solution for all the cases, leaving limited role for the fixed-rate bonds.

Results from the structural model suggest that a large share of the Lithuanian debt should be indexed to the price level or on a fixed rate basis. Price-indexed bonds and fixed rate bonds appear to provide good insurance against all types of shocks. Although, the role of real bonds in case of supply and the Russian output gap shocks is limited. These bonds are optimal, when the role of each debt instrument in hedging against the returns of the other instruments is considered and in case debt costs are taken into consideration.

T-bills should be avoided if domestic interest rate shocks prevail and are optimal under Euribor shock. In the case of demand and supply shocks, these GS are an optimal solution in the absence of the real bonds and a worse alternative to price indexation against variations in output and inflation.

While fixed-rate bonds are the best instruments to cope with supply, interest rate and RF output gap shocks when real bonds are absent, they play no role in the case of demand and supply shock against variations in output and inflation.

3.4.2 Forecasting regression

In this section the optimal debt composition for deficit smoothing is obtained by estimating the conditional covariances of public debt returns, output and inflation using the residuals of forecasting equations.

The ratios of conditional covariances and variances of relevant variables can be obtained in two steps. First, the regressions of output growth, CPI inflation, and the short-term interest rate are run separately on one lag of each variable and take the residuals as an estimate of the unanticipated component of the dependent variable. Second, the ratio of the conditional covariance between, for example, output growth and inflation to the variance of inflation is estimated as the coefficients of the regression of the residuals of output growth on the residuals of inflation obtained in the first stage.

The estimated coefficients, shown in Table 7, allow the derivation of the optimal debt composition. The correlation coefficient between the short-term interest rate and output growth is negative. This finding is consistent with the results obtained from the structural model: unexpected increases of the interest rate on T-bills appear to be connected with significant reduction in output growth. The covariance between short-term interest rate and unexpected inflation is negative and statistically significant: high interest rate puts a curb on inflation. The correlation between output and inflation is positive and significant; this is evidence of a preference for output stabilization and interest rate smoothing in the conduct of monetary policy.

The optimal debt composition that would support the deficit-to-GDP ratio stabilization is presented in Table 8. Column 1 reports the shares of debt instruments which are optimal for risk minimization, when all bonds had the same expected return. Column 2 performs the same using only the covariance/variance ratios that are statistically significant. These two columns show that, for the risk minimization, all the debt should be indexed to the price level. The government should hold T-bills and fund this position with fixed-rate bonds. The negative and large share of T-bills reflects the negative covariance between output and the interest rate: a large exposure to floating rates makes the budget vulnerable to high interest rates.

The share of fixed-rate debt is used to fund the long position in T-bills. If the share of T-bills is constrained to be non- negative as in Column 3, then such bonds should not be issued. Columns 4 and 5 show that fixed-rate bonds are optimal choice for cost minimization and in the absence of real bonds. Real bonds appear the optimal choice for risk minimization providing insurance against lower than expected inflation. Almost the whole debt in all cases should be indexed to the price level, except when real bonds are not being taken into consideration, there is strong position for fixed-rate bonds. The fact that price indexed debt have been issued only in a few countries and often in limited amounts, can be explained by the cost of introducing such bonds in the financial markets or by their illiquidity.

Therefore, the results obtained from forecasting regressions strengthen the previous conclusion: fixed rate bonds should be preferred to short-term debt instruments and the introduction of real bonds, the share of which is correspondingly large, could provide potential gains to the Lithuanian government.

3.4.3 VAR method

In this section I use a simple vector autoregression (VAR) framework for the Lithuanian economy to capture the links among variables, namely, Euribor, RF GDP, EU GDP, Lithuanian GDP, CPI inflation rate and short-term interest rate. All the variables in the system are treated as endogenous. Variables Russian GDP, Lithuanian GDP and EU GDP are set in natural logarithms.

Then many of the VAR diagnostics are applied by STATA commands:

- *Varsoc* is used to select the lag order. One lag-length is optimal to built this model according to Akaike's information criterion and Schwarz's Bayesian information criterion

- *Varstable* checks the eigenvalue condition for stability, which is needed to interpret the Impulse Response Function. The constructed VAR model is stable, namely, all the eigenvalues in absolute terms lie inside the unit circle (see Fig.14 in Appendix III), then, the empirical inference is possible.

- *Vargranger* determines the joint significance of lagged observations of the variables in a regression. The Granger causality test results are collected in Table. One would reject the null hypothesis that lnGDP does not Granger cause inf. On the other hand, either Euribor or lnRus appear to have incremental forecasting power for inf.

Once all coefficients of the panel VAR are estimated, I compute the impulse response functions (IRFs) of the estimated 6-variable VAR model.

But, I would like a pure, structural shock that happens independently from shocks to other variables. One way to do this: insist that the shocks are orthogonal. In order to compute the orthogonal IRFs I use Cholesky decomposition. The assumption behind Cholesky decomposition is that series listed earlier in the VAR order impact the others variables contemporaneously, while series listed later in the VAR order impact those listed earlier. Consequently, variables listed earlier in the VAR order are considered to be more exogenous.

Granger causality tests between the endogenous variables measure the forecasting ability of the actual and past values of a given variable, to predict another variable evolution and help to determine the order of shocks orthogonalization. Consequently, the more exogenous variable will be placed at the top of the VAR.

According to the results obtained from Granger causality tests, inflation rate, short-term interest rate and Lithuanian GDP are the more exogenous variables in the model. Otherwise, the more endogenous variables are unambiguously Euribor, Russian GDP and EU GDP. I retain for the Cholesky decomposition the following order: inflation rate, short-term interest rate, Lithuanian GDP, Euribor, RF GDP and EU GDP.

I use the orthogonalized impulse-response functions (OIRFs) that Stata provides us to watch the structural impulse response functions.

Figures 3.15-3.20 reproduce the impulse responses of Euribor, inflation, interest rate, Lithuanian GDP, EU GDP and RF GDP to interest rate, inflation, Lithuanian GDP, Euribor, EU GDP and RF GDP shocks with the size of the shocks equivalent to a one standard deviation of the respective variable. The OIRFs are shown for the first 8 quarters. The centered lines in each figure give the estimated impulse responses of each variable to a positive shock. The upper and lower grey areas give a 95% confidence interval.

The OIRF recursively identifies the structural shocks by using the Choleski decomposition of the covariance matrix, which yields a unique lower triangular matrix. I use Stata command *vce* to obtain the variance-covariance matrix of the estimator and the estimator itself to calculate conditional variances and covariances, presented in Table 9 to derive optimal debt portfolio, reported in Table 11.

The results show that short-term public debt instruments are optimal when the interest rate and thus interest payments are positively correlated with unanticipated inflation and output growth, that is in the case of Supply shock and external shocks.

The covariance between the output and the interest rate is always negative. In this case a long maturity fixed-rate debt insulates the budget from interest rate shocks, thus avoiding higher than expected interest payments at times of cyclical downturns, that in the case of Demand and IR shocks.

But in a flexible inflation targeting, because of the weaker reaction of the interest rate to inflationary pressure, this correlation is diminished. It is optimal for the government to pay lower interests at times when output growth and inflation rate are lower than expected and the primary deficit is unexpectedly high.

The conditional covariance between output and inflation is uncertain because it depends on both demand and supply shocks and by the correlation induced by monetary policy. Contemporaneous shocks leads to a positive covariance. In a flexible inflation targeting such a covariance is negative while in a strict inflation targeting is positive.

The optimal share of price-indexed debt instruments increases with the covariance between output and inflation. When this covariance is positive real bonds provide an insurance against unexpected slowdowns in economic activity, that is in the case of Supply, Euribor and RF GDP shocks.

3.5 Conclusions

In this chapter I construct a model of Lithuanian optimal debt composition, in terms of maturity, currency denomination, and indexation, as driven by the goal of minimizing the risk that the deficit-to-GDP ratio exceeds the 3% limit of the SGP, trading risk and cost minimization. Results were obtained by three different econometric methods taking into account fixed monetary policy and different shocks hitting the Lithuanian economy.

As an underlying model, I used empirical studies by Missale (2000), which looked at developed countries. Most studies have been done on developed economies but only few on transition countries. That is why I applied his approach for transitional countries, and in particular Lithuania.

Based on the results achieved it could be concluded that deriving the optimal debt structure in transition economies external shocks do matter. The real exchange rate tends to fluctuate following easing of tensions in global financial markets but remains sustainable. The risk premium over Bonds on the Eurobonds has started to increase following the crisis in financial markets which commenced in August 2007 but its value keeps on low level.

Short-term debt should be avoided if domestic shocks prevail and is optimal under external shock. While fixed-rate bonds are the best instruments to cope with domestic shocks the real bonds are optimal insurance against external shocks. The estimated optimal share of real bonds is so large that this evidence has to be taken as indicative of the potential gains that government of Lithuania could obtain if they issued such bonds. Indexation to CPI inflation, naturally, provides insurance against lower-than-expected inflation. However, introducing real bonds into the Lithuanian security market would be costly because of a high premium for the insurance and for the illiquidity of the market.

As a final remark, it should be outlined that the three methods used by me are not perfect and results are slightly different following different econometrical methods. Due to the short history of transition countries, most of which proclaimed their existence in 1991-1993, I had no possibility to use long period data. Another drawback that has to be pointed out is the difficulty to find good instrumental variables to run instrumental estimations. Hopefully, further research studies would be able to overcome these problems.

For further research I would suggest to consider an investigation of the impact of political factors on the optimal public debt composition in transition countries. It would be interesting to apply the model for another FSU countries from different clusters and compare the results.

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[IMF] International Monetary Fund, Country reports.

[EBRD] European Bank for Reconstruction and Development, Transition reports.

[Ministry] Ministry of Finance of the FSU countries.

3.6 Appendix I: Structural model estimation

The structural model applied in the simulation exercise to obtain the impulse responses to different shocks (Euribor, supply, demand, interest rate, RF output gap and EU output gap shocks) hitting the Lithuanian economy is composed by following six equations for: (1) the Euribor; (2) the RF output gap; (3) the EU output gap; (4) the Lithuanian output gap; (5) the inflation (for aggregate supply); (6) the interest rate for T-bills:

$$i_t^{Euribor} = \mu_0 + \mu_1 i_{t-1}^{Euribor} + \nu_{i_t^{Euribor}} \tag{3.25}$$

$$y_t^{RF} = \kappa_0 + \kappa_1 y_{t-1}^{RF} + \kappa_2 y_{t-2}^{RF} + \nu_{y_t^{RF}} \tag{3.26}$$

$$y_t^{EU} = \delta_0 + \delta_1 y_{t-1}^{EU} + \delta_2 y_{t-2}^{EU} + \delta_3 i_{t-1}^{euribor} + \nu_{y_t^{EU}} \tag{3.27}$$

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 i_{t-1} + \gamma_3 i_{t-1}^{Euribor} + \gamma_4 y_{t-1}^{EU} + \gamma_5 y_{t-3}^{RF} + \nu_{y_t} \tag{3.28}$$

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 y_{t-1} + \alpha_3 y_{t-1}^{RF} + \alpha_4 i_{t-3}^{euribor} + \nu_{\pi_t} \tag{3.29}$$

$$i_t = \rho(i_{t-3}^{Euribor} + Pe_t) + (1-\rho)[\beta_0 + \beta_1 i_{t-1} + \beta_2(\pi_{t-1} - \pi^T)] + \nu_{i_t} \tag{3.30}$$

where, $i_t^{Euribor}$ is the Euro Interbank Offered Rate, i_t – short-term interest rate for T-bills, π_t – CPI inflation rate, y_t – Lithuanian output gap, y_t^{RF} - RF output gap, y_t^{EU} - EU-15[24] output gap (to simplify, the EU output gap, is used in the text), Pe_t is currency risk premium (obtained as a difference between interest rate on long-term fixed rate bonds denominated in Litas and interest rate on Eurobonds denominated in Euro) is very small and once is omitted doesn't influence the results obtained[25], π^T is the Bank of Lithuania inflation target, calculated as the difference between actual and potential inflation rate using HP-filter; ν_{π_t} is an i.i.d. supply shock, ν_{y_t} is an i.i.d. demand shock, ν_{i_t} is an i.i.d. short-term interest rate shock, $\nu_{i_t^{Euribor}}$ is an i.i.d. Euribor shock, $\nu_{y_t^{RF}}$ is an i.i.d. RF output gap shock and $\nu_{y_t^{EU}}$ is an i.i.d. EU output gap shock with mean zero and variance equal to $\sigma_{2\nu}$.

All data were taken from official sources, except for the GDP/output gap, which was estimated as the difference between real GDP $\log y_t$ and trend of real GDP $\log \widehat{y}_t$. For that reason the potential GDP was estimated using a Hodrick-Prescott filter (HP-filter).

[24]EU-15 was the number of member countries in the European Union prior to the accession of ten candidate countries on 1 May 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom (Source: OECD definition)

[25]Risk premium factor is another approach for debt valuation that is popular among practitioners. Fisher (1959) considered a credit spread as a compensation for various risks in a linear relationship. By risk premium Fisher implied the difference between the market yield on a bond and a corresponding risk free interest rate

This seven-variable model includes four domestic variables: GDP gap, CPI inflation, CPI inflation target, IR together with three world variables: wEuribor, wGDP gap of the EU, wGDP gap of the RF.

Each equation of the model was estimated by OLS considering the largest available sample: 2000 - 2009 of the financial variables. Because of short period of time, the use of quarterly data is necessary to obtain reasonably precise estimates of the covariances and variances.

All information on the public debt composition was obtained from the general government debt reports of the MOF of the Republic of Lithuania.

EURIBOR equation

$$i_t^{Euribor} = \mu_0 + \mu_1 i_{t-1}^{Euribor} + \nu_{i_t^{Euribor}} \tag{3.31}$$

Results for the EURIBOR equation:

	μ_0	μ_1
$coeff.$	$0,800$	$0,747$
$std.err.$	$(0,282)$	$(0,094)$

I have assumed that Euribor only depends positively on growth. Euribor is allowed to affect domestic Lithuanian interest rates, but not viceversa and is just one of the elements determining the cost of the Lithuanian public debt.

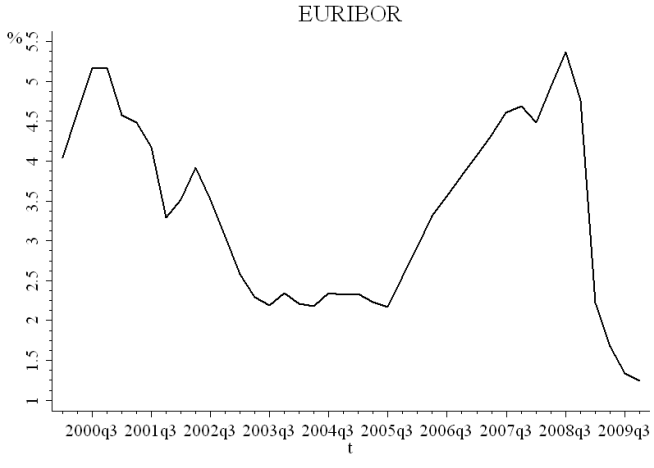

Figure 3.7: Euro Interbank Offered Rate (Euribor)

Russian Federation output gap equation

$$y_t^{RF} = \kappa_0 + \kappa_1 y_{t-1}^{RF} + \kappa_2 y_{t-2}^{RF} + \nu_{y_t^{RF}} \tag{3.32}$$

Results for the Russian Federation output gap equation:

	κ_0	κ_1	κ_2
$coeff.$	$-0,002$	$1,110$	$-0,289$
$std.err.$	$(0,008)$	$(0,160)$	$(0,161)$

κ_1 and κ_2 measure the output gap auto-correlation. An expansionary (positive number) output gap indicates the Russian economy in recession. A recessionary (negative number) gap indicates an economy in expansion.

Figure 3.8: Russian output gap

EU output gap equation

$$y_t^{EU} = \delta_0 + \delta_1 y_{t-1}^{EU} + \delta_2 y_{t-2}^{EU} + \delta_3 i_{t-1}^{euribor} + \nu_{y_t^{EU}} \tag{3.33}$$

Results for the EU output gap equation:

	δ_0	δ_1	δ_2	δ_3
$coeff.$	$-0,015$	$1,074$	$-0,324$	$0,368$
$std.err.$	$(0,004)$	$(0,117)$	$(0,120)$	$(0,073)$

The change in the EU output gap depends on the domestic interest rate, i.e. Euribor. The coefficient is positive: a 1% increase in the Euribor increase the EU output gap by 0,368%.

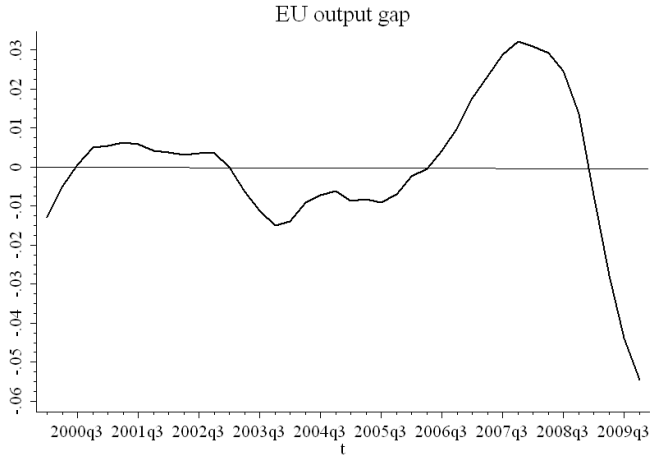

Figure 3.9: EU output gap

Lithuanian output gap equation

$$y_t = \gamma_0 + \gamma_1 y_{t-1} + \gamma_2 i_{t-1} + \gamma_3 i_{t-1}^{Euribor} + \gamma_4 y_{t-1}^{EU} + \gamma_5 y_{t-3}^{RF} + \nu_{y_t} \tag{3.34}$$

Results for the Lithuanian output gap equation:

	γ_0	γ_1	γ_2	γ_3	γ_4	γ_5
$coeff.$	$-0,029$	$0,520$	$-0,640$	$1,545$	$1,300$	$-0,071$
$std.err.$	$(0,010)$	$(0,098)$	$(0,142)$	$(0,384)$	$(0,356)$	$(0,026)$

γ_1 measures output gap auto-correlation, while the impact of the short-term interest rate depends on the parameter γ_2. Strong dependence of the domestic output gap on the EU output gap and Euribor can be explained by Lithuanian membership in the EU. Finally, ν_{y_t} is an i.i.d. demand shock with mean zero and variance equal to $\sigma_{2\nu}$.

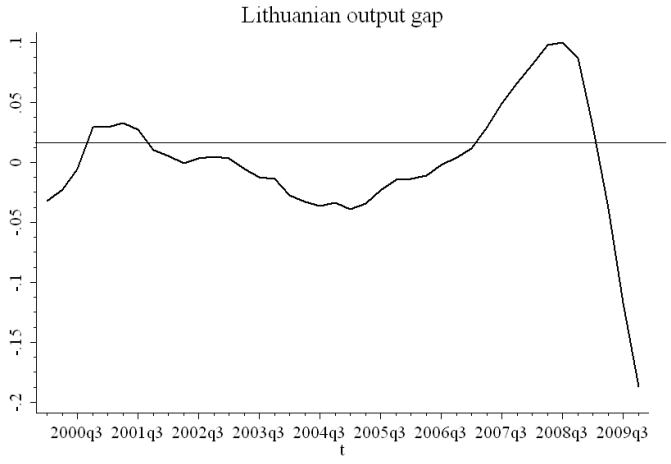

Figure 3.10: Output gap of Lithuania

Inflation equation

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 y_{t-1} + \alpha_3 y_{t-1}^{RF} + \alpha_4 i_{t-3}^{euribor} + \nu_{\pi_t} \tag{3.35}$$

Results for Inflation equation:

	α_0	α_1	α_2	α_3	α_4
$coeff.$	$0,029$	$0,848$	$0,169$	$-0,729$	$0,044$
$std.err.$	$(0,007)$	$(0,064)$	$(0,066)$	$(0,219)$	$(0,022)$

The supply side of the Lithuanian economy implies backward looking Phillips curve behavior in that, current inflation depends on lagged inflation. α_2 measures the impact of the domestic output gap on inflation; α_3 and α_4 evaluate the affect of the external shocks, i.e. Russian output gap and Euribor. Joining the EU has led to greater sensitivity of the Lithuanian inflation to the Euribor. Significant dependence of the domestic inflation on Russian output gap can be explained by still strong trade relations.

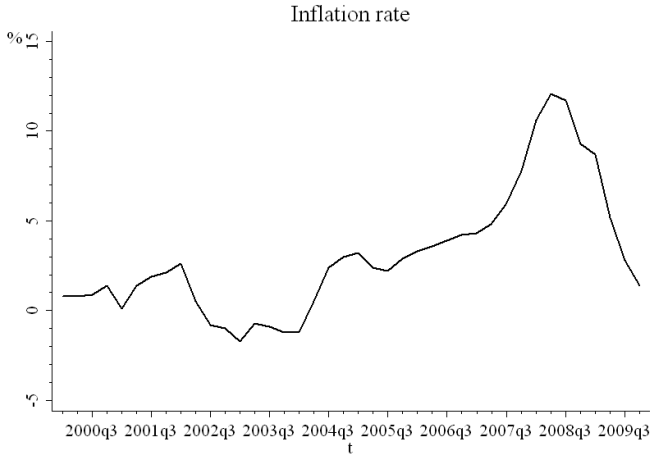

Figure 3.11: Inflation rate of Lithuania

Interest rate equation under fixed exchange rate regime

Introducing a fixed exchange rate regime, the Central Bank has to maintain parity by pegging the domestic interest rate to the interest rate of the leader country augmented by a currency risk premium.

The Central Bank loss function denotes:

$$L^{FE} = E_t(\pi_{t+1} - \pi^T)^2 + \lambda E_t y_{t+1}^2 + \varepsilon(i_t - i_t^* - Pe_t)^2 \tag{3.36}$$

where λ – the weight to output stabilization, i_t^* – the interest rate of the leader country and ε – the weight of maintaining the fixed exchange rate.

Assuming that fixed exchange rate does not affect Lithuanian domestic demand, the interest rate rule yields:

$$i_t = \rho(i_{t-3}^{Euribor} + Pe_t) + (1-\rho)[\beta_0 + \beta_1 i_{t-1} + \beta_2(\pi_{t-1} - \pi^T)] + \nu_{i_t} \tag{3.37}$$

Results for the Short-term Interest rate equation:

	ρ	β_0	β_1	β_2
$coeff.$	$0,623$	$-0,011$	$1,414$	$0,529$
$std.err.$	$(0,101)$	$(0,003)$	$(0,079)$	$(0,034)$

β_1, β_3 measure how the Central Bank of Lithuania reacts to deviations of inflation rate from the target and ρ captures the extent of the domestic interest-rate pegging to the Euribor.

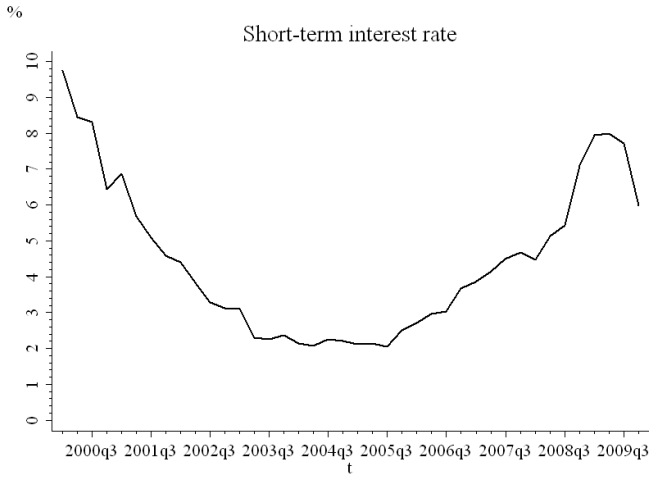

Figure 3.12: Short-term interest rate of Lithuania

Table. 1. The Structural model: Estimated Coefficients

	Coeff.	Std.Err.	t-ratio	$P > \|t\|$	$Adj.R^2$	DW
Output gap equation						
γ_0	-0,029	0,010	-2,96	0,006	0,96	1,75
γ_1	0,520	0,098	5,33	0,000		
γ_2	-0,640	0,142	-4,49	0,000		
γ_3	1,545	0,384	4,02	0,000		
γ_4	1,300	0,356	3,65	0,001		
γ_5	-0,071	0,026	-2,70	0,011		
Inflation equation						
α_0	0,029	0,007	3,90	0,000	0,91	1,20
α_1	0,848	0,064	13,25	0,000		
α_2	0,169	0,066	2,55	0,016		
α_3	-0,729	0,219	-3,33	0,002		
α_4	0,044	0,022	2,06	0,048		
Short-term interest rate equation						
ρ	0,623	0,101	4,68	0,000	0,95	1,76
β_0	-0,011	0,003	-1,68	0,103		
β_1	1,414	0,079	6,75	0,000		
β_2	0,529	0,034	5,92	0,000		
EURIBOR equation						
μ_0	0,800	0,282	2,83	0,007	0,62	1,78
μ_1	0,747	0,094	7,98	0,000		
Russian output gap equation						
κ_0	-0,002	0,008	-0,18	0,858	0,71	2,11
κ_1	1,110	0,160	6,94	0,000		
κ_2	-0,289	0,161	-1,79	0,082		
EU output gap equation						
δ_0	-0,015	0,004	-3,71	0,001	0,91	2,02
δ_1	1,074	0,117	9,21	0,000		
δ_2	-0,324	0,120	-2,71	0,010		
δ_3	0,368	0,073	5,00	0,000		

Note: Almost all estimated coefficients in Table 1 are significant at 5% significance level, except κ_2 which is significant at 8,2% significance level.

Simulation of IRF, variances and covariances

Impulse responses function - IRF

A MATLAB program was used to explore the behavior of Euribor, output gaps, inflation, short-term interest rate equations under domestic and external shocks. IRF analysis is widely used in the empirical literature to uncover the dynamic relationship between different macroeconomic variables. The shock amplitude was taken as one standard deviation of the variable that indicates type of the shock.

Figure 3.13 shows the outputs generated by the different shocks. The econometric model constructed to obtain these impulse responses shows stability because all IRF go to zero which means that the system reaches a steady state.

Variances and Covariances

There was used an estimate of the variance - covariance matrix from one-period ahead forecast in order to identify the impact of structural shocks on the model. The conditional covariances and variances are estimated running the model under six types of shocks considered in the Lithuanian economy.

The results are shown in Table 2. Positive covariance between the returns on two types of debt makes them substitutes in the government portfolio.

Table 2. Structural model: Covariances and Variances

	$SupplyShock$	$DemandShock$	$IRShock$
$Cov(y,i)/Var(i)$	$-0,948$	$-0,738$	$-1,445$
$Cov(y,\pi)/Var(\pi)$	$-0,227$	$0,569$	$0,574$
$Cov(i,\pi)/Var(i)$	$2,071$	$2,066$	$0,161$
$Cov(i,\pi)/Var(\pi)$	$0,381$	$0,298$	$0,218$
$Var(\pi)$	$0,714$	$0,200$	$0,053$
$Var(i)$	$0,131$	$0,029$	$0,072$
	$EuriborShock$	$RFgapShock$	$EUgapShock$
$Cov(y,i)/Var(i)$	$2,651$	$-3,433$	$-0,665$
$Cov(y,\pi)/Var(\pi)$	$-3,251$	$-0,842$	$0,628$
$Cov(i,\pi)/Var(i)$	$-0,196$	$2,064$	$2,150$
$Cov(i,\pi)/Var(\pi)$	$-1,799$	$0,297$	$0,331$
$Var(\pi)$	$0,010$	$0,165$	$0,498$
$Var(i)$	$0,090$	$0,024$	$0,077$

Notes: Variances are multiplied by 10^2.

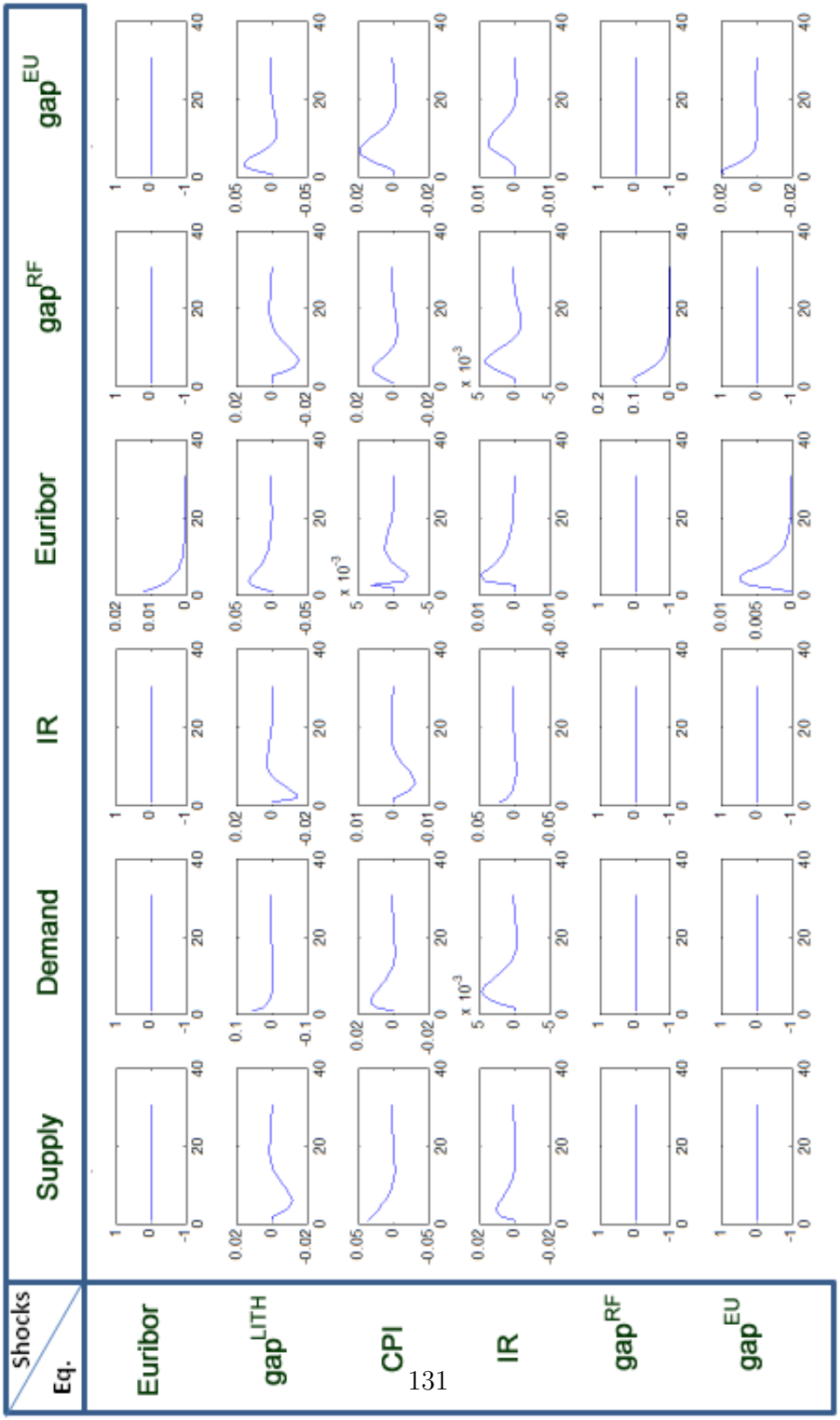

Figure 3.13: Impulse responses for a shock to inflation, Lithuanian output gap, short-term interest rate, Euribor, RF output gap and EU output gap equations (Notes: Deviation mean)

Table 3. Structural model: Optimal Debt Composition

	Risk no hedge	Risk	Risk no neg	Cost	Cost no neg	Risk+Cost	Risk+Cost no neg	No real
Supply Shock								
s	0,87	-3,24	0	-1,09	0	-4,43	0	0,87
h	0,75	1,98	0,25	0,56	0,14	2,59	0,90	0
f	-0,62	2,25	0,75	1,53	0,86	2,84	0,10	0,13
Demand Shock								
s	1,17	-7,17	0	-0,19	0	-7,36	0	1,17
h	1,90	4,04	0,42	0,10	0,04	4,13	1,94	0
f	-2,06	4,13	0,58	1,09	0,96	4,23	-0,94	-0,17
Interest rate Shock								
s	-1,91	-2,30	0	0,03	0,03	-2,26	0	-1,91
h	1,91	2,41	1,91	0,004	0	2,41	1,92	0
f	1,00	0,89	-0,91	0,967	0,97	0,85	-0,92	2,91
EURIBOR Shock								
s	3,60	4,47	0,52	0,06	0	4,53	0,54	3,60
h	-3,60	4,44	0,48	0,11	0,00	4,55	0,46	0
f	1,00	-7,91	0	0,82	1,00	-8,08	0	-2,60
RF output gap Shock								
s	-2,71	-6,31	0	-0,13	0	-6,44	0	-2,71
h	-0,13	1,74	-0,13	0,07	0,03	1,81	-0,10	0
f	3,84	5,57	1,13	1,06	0,97	5,63	1,10	3,71
EU output gap Shock								
s	1,36	-10,05	0	-0,61	0	-10,65	0	1,36
h	1,98	5,31	1,98	0,30	0,10	5,61	2,08	0
f	-2,35	5,74	-0,98	1,31	0,90	6,05	-1,08	-0,36

Notes: The optimal debt composition is obtained from equations (5)and (6); s - T-bills, h - Real bonds, f - Fixed rate bonds.

3.7 Appendix II: Forecasting regression estimation

In this approach, the conditional covariances of the short-term interest rate, output growth and CPI inflation are estimated as the residuals of forecasting equations in their first lag run on quarterly data for the time period from 2000:Q1 to 2009:Q4.

The conditional correlation coefficients are obtained in two steps. First, there were run regressions of output growth, inflation, and short-term interest rate separately on one lag of each variable[26] and taken the residuals as an estimate of the unanticipated components of the above mentioned variables[27].

Second, the correlation coefficients are obtained as the coefficients of the regression of the residuals of output growth/interest rate on the residuals of the CPI inflation obtained in the first stage[28] (see results in Table 4).

Table 4. Covariances and Variances

$Cov(y,i)/Var(i)$	$-0,517$ $(0,067)$	$Cov(i,\pi)/Var(i)$	$-0,529$ $(0,034)$
$Cov(y,\pi)/Var(\pi)$	$1,100$ $(0,000)$	$Cov(i,\pi)/Var(\pi)$	$-0,115$ $(0,201)$
$Var(i)$	$0,037$	$Var(\pi)$	$0,157$

Notes: Variances are multiplied by 1000. P-values in parenthesis. The conditional covariance between short-term interest rate and inflation is not statistically significant; between short-term interest rate and output growth is significant at 10%.

The estimated coefficients allow me to derive the optimal debt compositions.

Table 5. Optimal Debt Composition

	Risk	Risk signif.	Risk no neg	Cost	Cost no neg	Risk+Cost significant	Risk+Cost no neg	No real
s	-1,31	-1,30	0	-0,04	0	-0,13	-1,11	-1,31
h	2,11	2,15	2,66	0,03	0,02	2,71	2,11	0
f	0,20	0,16	-1,66	1	0,98	-1,57	0	2,31

[26] *STATA command: reg out.gr.Lith out.gr.Lith.L1; reg inf inf.L1; reg IR IR.L1.*

[27] *STATA command: predict resout.gr.Lith,res; predict resinf,res; predict resIR,res.*

[28] *STATA command: reg resout.gr.Lith resIR; reg resinf resIR; reg resIR resinf*
the ratio of the conditional covariance between, output growth/interest rate and CPI inflation to the variance of CPI inflation, $Cov(y,\pi)/Var(\pi)$ and $Cov(i,\pi)/Var(\pi)$); and as the coefficients of the regression of the residuals of output growth/CPI inflation on the residuals of the interest rate(the ratio of the conditional covariance between, output growth/CPI inflation and interest rate the variance of interest rate, $Cov(y,i)/Var(i)$ and $Cov(i,\pi)/Var(i)$).

3.8 Appendix III: VAR estimation

By using VAR approach, the complex relationship between macroeconomic indicators of Lithuania, the RF and the EU is considered. VAR treats all variables in the system (CPI inflation rate, Lithuanian GDP, the EU GDP, short-term interest rate, Euribor and the RF GDP) as endogenous.

With help of different VAR diagnostics, namely STATA commands like *varsoc*, *varstable* (see results in Fig.3.14 and 3.15) and *vargranger* (see results in Fig.3.16), I constructed VAR regression of all variables together on one lag of each variable:

$$\pi_t = \alpha_0 + \alpha_1\pi_{t-1} + \alpha_2 y_{t-1} + \alpha_3 y^{EU}_{t-1} + \alpha_4 i_{t-1} + \alpha_5 i^{euribor}_{t-1} + \alpha_6 y^{RF}_{t-1} + \nu_{\pi_t} \quad (3.38)$$

$$y_t = \gamma_0 + \gamma_1\pi_{t-1} + \gamma_2 y_{t-1} + \gamma_3 y^{EU}_{t-1} + \gamma_4 i_{t-1} + \gamma_5 i^{euribor}_{t-1} + \gamma_6 y^{RF}_{t-1} + \nu_{y_t} \quad (3.39)$$

$$y^{EU}_t = \delta_0 + \delta_1\pi_{t-1} + \delta_2 y_{t-1} + \delta_3 y^{EU}_{t-1} + \delta_4 i_{t-1} + \delta_5 i^{euribor}_{t-1} + \delta_6 y^{RF}_{t-1} + \nu_{y^{EU}_t} \quad (3.40)$$

$$i_t = \beta_0 + \beta_1\pi_{t-1} + \beta_2 y_{t-1} + \beta_3 y^{EU}_{t-1} + \beta_4 i_{t-1} + \beta_5 i^{euribor}_{t-1} + \beta_6 y^{RF}_{t-1} + \nu_{i_t} \quad (3.41)$$

$$i^{Euribor}_t = \mu_0 + \mu_1\pi_{t-1} + \mu_2 y_{t-1} + \mu_3 y^{EU}_{t-1} + \mu_4 i_{t-1} + \mu_5 i^{euribor}_{t-1} + \mu_6 y^{RF}_{t-1} + \nu_{i^{Euribor}_t} \quad (3.42)$$

$$y^{RF}_t = \kappa_0 + \kappa_1\pi_{t-1} + \kappa_2 y_{t-1} + \kappa_3 y^{EU}_{t-1} + \kappa_4 i_{t-1} + \kappa_5 i^{euribor}_{t-1} + \kappa_6 y^{RF}_{t-1} + \nu_{y^{RF}_t} \quad (3.43)$$

Then the estimated coefficients, see Figure 3.17, were applied to run the orthogonalized impulse-response functions (see Fig.18-23), which describe the reaction of one variable to the innovations in another one in the system.

Finally, there were taken the conditional variances and covariances, see Table 6, to derive optimal debt portfolio which is reported in Table 11.

Table 6. VAR model: Covariances and Variances

	$SupplyShock$	$DemandShock$	$IRShock$
$Cov(y,i)/Var(i)$	$0,389$	$-0,697$	$-5,377$
$Cov(y,\pi)/Var(\pi)$	$2,078$	$-0,678$	$-0,440$
$Cov(i,\pi)/Var(i)$	$-0,117$	$-0,013$	$-0,455$
$Cov(i,\pi)/Var(\pi)$	$-0,282$	$-0,032$	$-1,098$
$Var(\pi)$	$0,148$	$0,140$	$0,046$
$Var(i)$	$0,357$	$0,338$	$0,110$
	$EuriborShock$	$RFGDPShock$	$EUGDPShock$
$Cov(y,i)/Var(i)$	$2,807$	$1,409$	$2,933$
$Cov(y,\pi)/Var(\pi)$	$1,035$	$0,336$	$-0,976$
$Cov(i,\pi)/Var(i)$	$-0,110$	$-0,052$	$0,047$
$Cov(i,\pi)/Var(\pi)$	$-0,265$	$-0,125$	$0,115$
$Var(\pi)$	$0,044$	$0,088$	$0,208$
$Var(i)$	$0,107$	$0,213$	$0,501$

Notes: Variances are multiplied by 10^3, Euribor and EU GDP shocks by 100^2.

```
. varstable

   Eigenvalue stability condition
  +---------------------------------------+
  |        Eigenvalue         |   Modulus   |
  |---------------------------+-------------|
  |   .9193682 +  .3154287i   |   .971974   |
  |   .9193682 -  .3154287i   |   .971974   |
  |   .9611437                |   .961144   |
  |   .8688786                |   .868879   |
  |   .6112236 + .07741237i   |   .616106   |
  |   .6112236 - .07741237i   |   .616106   |
  +---------------------------------------+
   All the eigenvalues lie inside the unit circle.
   VAR satisfies stability condition.
```

Figure 3.14: Eigenvalue stability condition

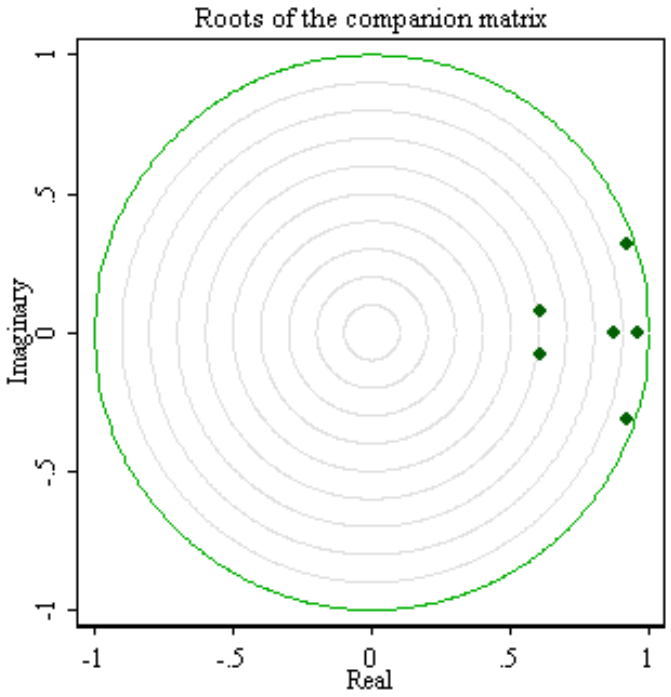

Figure 3.15: The eigenvalues of the companion matrix

```
. vargranger

  Granger causality Wald tests
  +-------------------------------------------------------------------------+
  |          Equation           Excluded |   chi2     df Prob > chi2 |
  |-------------------------------------+-----------------------------|
  |               inf                ir |   .6094     1    0.435     |
  |               inf             lngdp |  7.5997     1    0.006     |
  |               inf           euribor |  1.9534     1    0.162     |
  |               inf             lnRus |  .20931     1    0.647     |
  |               inf              lnEU |  9.3364     1    0.002     |
  |               inf               ALL |  29.329     5    0.000     |
  |-------------------------------------+-----------------------------|
  |                ir               inf |   3.231     1    0.072     |
  |                ir             lngdp |  5.7269     1    0.017     |
  |                ir           euribor |  6.2833     1    0.012     |
  |                ir             lnRus |  .40193     1    0.526     |
  |                ir              lnEU |  3.6366     1    0.057     |
  |                ir               ALL |  52.769     5    0.000     |
  |-------------------------------------+-----------------------------|
  |             lngdp               inf |  1.1233     1    0.289     |
  |             lngdp                ir |  .38164     1    0.537     |
  |             lngdp           euribor |  5.5167     1    0.019     |
  |             lngdp             lnRus |  .04271     1    0.836     |
  |             lngdp              lnEU |  59.377     1    0.000     |
  |             lngdp               ALL |  226.33     5    0.000     |
  |-------------------------------------+-----------------------------|
  |           euribor               inf |  3.5098     1    0.061     |
  |           euribor                ir |    8.29     1    0.004     |
  |           euribor             lngdp |  29.156     1    0.000     |
  |           euribor             lnRus |  1.5551     1    0.212     |
  |           euribor              lnEU |  18.161     1    0.000     |
  |           euribor               ALL |  32.701     5    0.000     |
  |-------------------------------------+-----------------------------|
  |             lnRus               inf |  1.0704     1    0.301     |
  |             lnRus                ir |   6.056     1    0.014     |
  |             lnRus             lngdp |   10.06     1    0.002     |
  |             lnRus           euribor |   3.823     1    0.051     |
  |             lnRus              lnEU |  12.853     1    0.000     |
  |             lnRus               ALL |  13.506     5    0.019     |
  |-------------------------------------+-----------------------------|
  |              lnEU               inf |  1.3712     1    0.242     |
  |              lnEU                ir |  3.9819     1    0.046     |
  |              lnEU             lngdp |  66.281     1    0.000     |
  |              lnEU           euribor |  .00904     1    0.924     |
  |              lnEU             lnRus |  5.8574     1    0.016     |
  |              lnEU               ALL |  147.23     5    0.000     |
  +-------------------------------------------------------------------------+
```

Figure 3.16: Granger causality test

```
Sample:  2000q2 - 2009q4                        No. of obs      =        39
Log likelihood =   843.889                      AIC             = -41.12251
FPE            =  5.70e-26                      HQIC            = -40.47973
Det(Sigma_ml)  =  6.46e-27                      SBIC            = -39.33098

Equation           Parms      RMSE     R-sq      chi2     P>chi2
------------------------------------------------------------------
inf                    7     .010324   0.9304   521.5658   0.0000
ir                     7     .004327   0.9618   981.7568   0.0000
lngdp                  7     .010183   0.9992   46933.75   0.0000
euribor                7     .004296   0.8885   310.8012   0.0000
lnRus                  7     .051031   0.9904    4012.98   0.0000
lnEU                   7     .003554   0.9989   34003.66   0.0000
------------------------------------------------------------------------------
                 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+------------------------------------------------------------------
inf      inf L1. |   .8120845   .1102681     7.36   0.000     .5959629    1.028206
          ir L1. |   .1073073   .1374604     0.78   0.435      -.16211    .3767247
       lngdp L1. |  -.1872493   .0679236    -2.76   0.006    -.3203772   -.0541215
     euribor L1. |   .3229136   .2310441     1.40   0.162    -.1299244    .7757517
       lnRus L1. |   -.010565   .0230924    -0.46   0.647    -.0558253    .0346953
        lnEU L1. |   .7228583   .2365724     3.06   0.002      .259185    1.186532
           _cons |  -9.681206   3.119742    -3.10   0.002    -15.79579   -3.566625
-----------------+------------------------------------------------------------------
ir       inf L1. |   .0830655   .0462114     1.80   0.072    -.0075072    .1736383
          ir L1. |    .717005   .0576072    12.45   0.000     .6040969    .8299131
       lngdp L1. |   .0681209   .0284656     2.39   0.017     .0123294    .1239125
     euribor L1. |   .2427107   .0968265     2.51   0.012     .0529342    .4324871
       lnRus L1. |  -.0061354   .0096776    -0.63   0.526    -.0251032    .0128324
        lnEU L1. |  -.1890653   .0991433    -1.91   0.057    -.3833826    .0052521
           _cons |   2.458573   1.307429     1.88   0.060    -.1039407    5.021087
-----------------+------------------------------------------------------------------
lngdp    inf L1. |   .1152662   .1087577     1.06   0.289    -.0978949    .3284273
          ir L1. |   .0837552   .1355774     0.62   0.537    -.1819716    .3494821
       lngdp L1. |   .4184161   .0669932     6.25   0.000     .2871119    .5497203
     euribor L1. |   .5352357   .2278792     2.35   0.019     .0886007    .9818708
       lnRus L1. |   .0047071   .0227761     0.21   0.836    -.0399332    .0493475
        lnEU L1. |   1.797966   .2333318     7.71   0.000     1.340644    2.255288
       _    cons |  -23.32369   3.077007    -7.58   0.000    -29.35452   -17.29287
-----------------+------------------------------------------------------------------
euribor  inf L1. |   .0859603   .0458834     1.87   0.061    -.0039695    .1758901
          ir L1. |   .1646875   .0571983     2.88   0.004     .0525809    .2767941
       lngdp L1. |  -.1526119   .0282635    -5.40   0.000    -.2080074   -.0972164
     euribor L1. |   .6300984   .0961392     6.55   0.000     .4416691    .8185277
       lnRus L1. |   .0119825   .0096089     1.25   0.212    -.0068507    .0308157
        lnEU L1. |   .4195039   .0984395     4.26   0.000     .2265659    .6124418
           _cons |  -5.415748   1.298148    -4.17   0.000    -7.960071   -2.871426
-----------------+------------------------------------------------------------------
lnRus    inf L1. |   .5639064   .5450493     1.03   0.301    -.5043705    1.632183
          ir L1. |   1.672077   .6794589     2.46   0.014     .3403615    3.003792
       lngdp L1. |  -1.064892   .3357426    -3.17   0.002    -1.722935   -.4068483
     euribor L1. |  -2.232968   1.142038    -1.96   0.051    -4.471321    .0053856
       lnRus L1. |   .8027707   .1141446     7.03   0.000     .5790514     1.02649
        lnEU L1. |   4.192367   1.169364     3.59   0.000     1.900456    6.484279
           _cons |  -54.48971   15.42071    -3.53   0.000    -84.71375   -24.26568
-----------------+------------------------------------------------------------------
lnEU     inf L1. |  -.0444458   .0379566    -1.17   0.242    -.1188394    .0299478
          ir L1. |   .0944194   .0473168     2.00   0.046     .0016802    .1871585
       lngdp L1. |  -.1903493   .0233807    -8.14   0.000    -.2361747   -.1445239
     euribor L1. |  -.0075614   .0795302    -0.10   0.924    -.1634378     .148315
      ln Rus L1. |    .019238   .0079489     2.42   0.016     .0036584    .0348176
        lnEU L1. |   1.510831   .0814332    18.55   0.000     1.351225    1.670437
           _cons |  -6.609466   1.073881    -6.15   0.000    -8.714233   -4.504698
------------------------------------------------------------------------------
```


Figure 3.17: The estimated VAR model coefficients

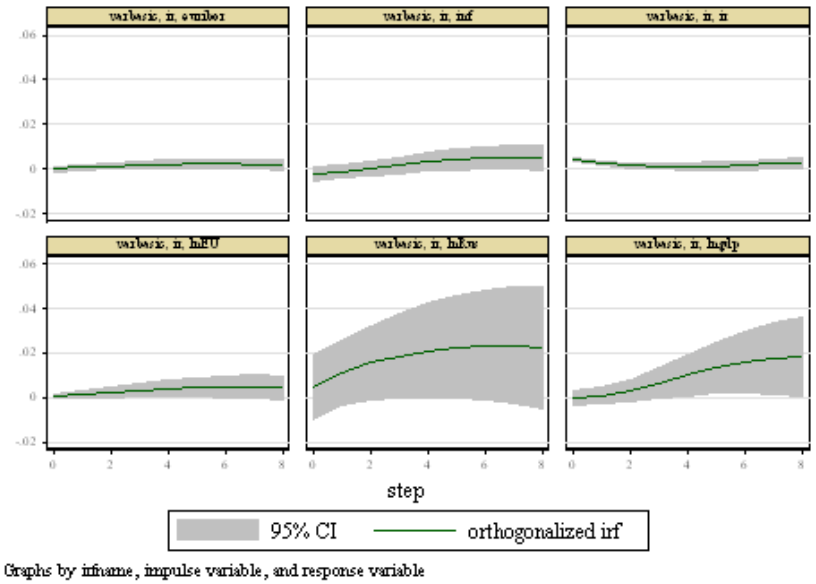

Figure 3.18: Impulse responses for a shock to short-term interest rate

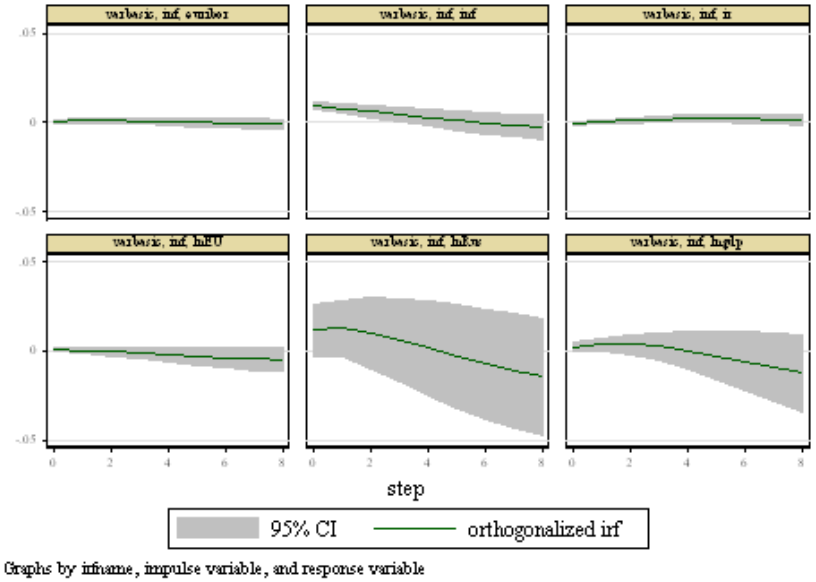

Figure 3.19: Impulse responses for a shock to inflation rate

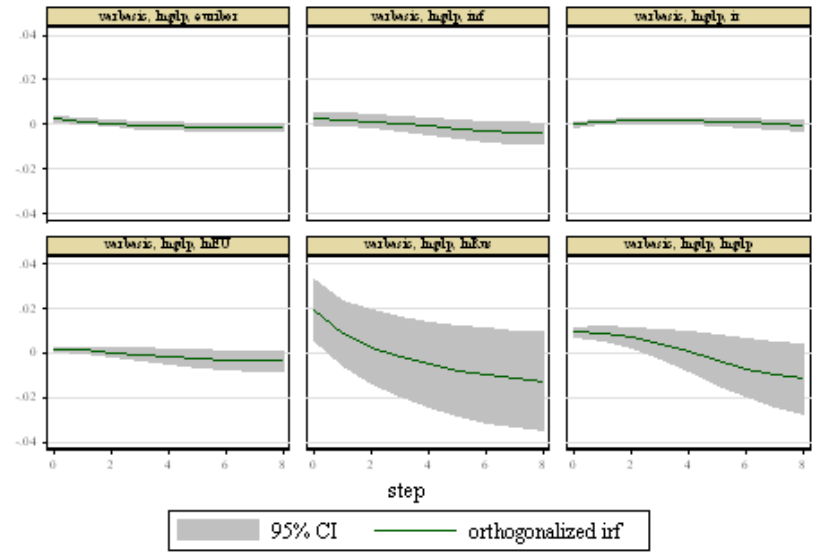

Figure 3.20: Impulse responses for a shock to Lithuanian GDP

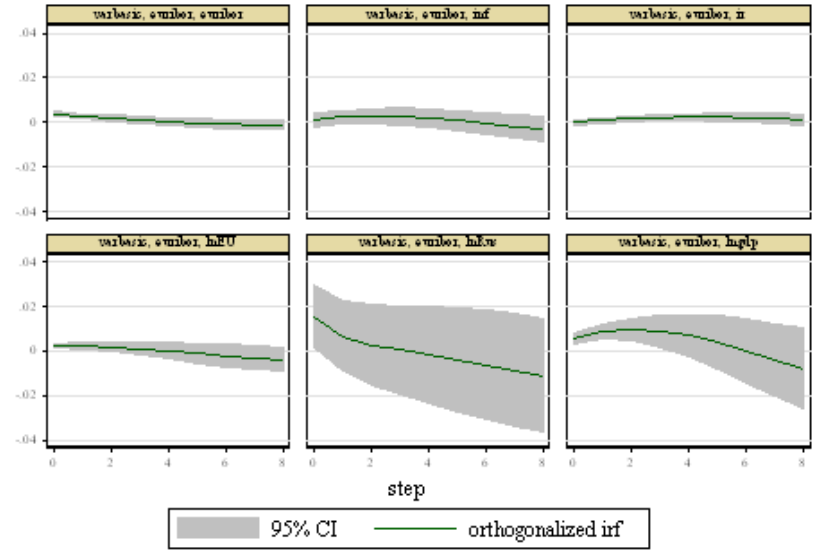

Figure 3.21: Impulse responses for a shock to Euribor

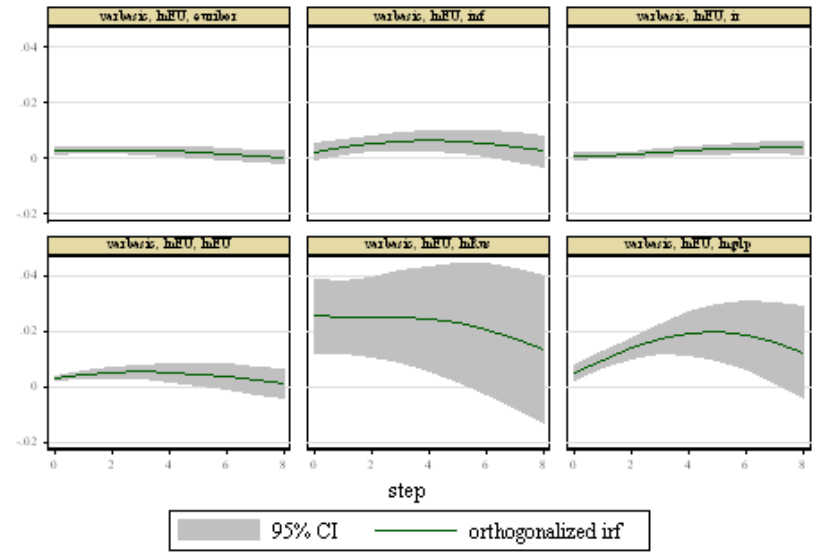

Figure 3.22: Impulse responses for a shock to EU GDP

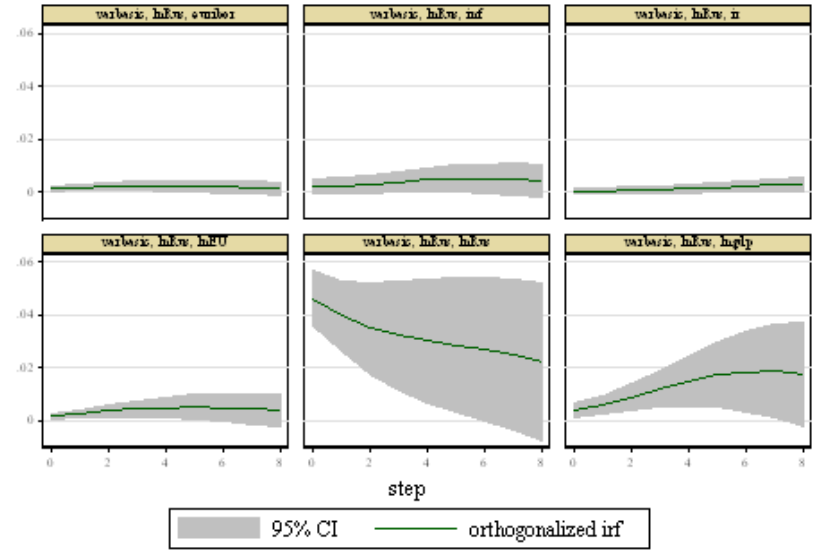

Figure 3.23: Impulse responses for a shock to Russian GDP

Table 11. VAR model: Optimal Debt Composition

	Risk no hedge	Risk	Risk no neg	Cost	Cost no neg	Risk+Cost	Risk+Cost no neg	No real risk no hedge
Supply Shock								
s	0,43	0,94	-2,39	0,17	0,16	1,11	-2,42	0,43
h	4,07	4,33	3,39	0,08	0	4,41	3,42	0
f	-3,50	-4,27	0	0,75	0,84	-4,53	0	0,57
Demand Shock								
s	-1,02	-1,02	0	0,15	0,15	-0,85	0	-1,02
h	0,10	0,07	0,10	0,03	0	0,10	0,13	0
f	1,91	1,95	0,90	0,81	0,85	1,75	0,87	2,02
Interest rate Shock								
s	-8,23	-8,02	0	0,11	0	-7,97	0	-8,23
h	0,45	-8,58	0	0,13	0,01	-8,52	0	0
f	8,78	17,60	1,00	0,76	0,99	17,49	1,00	9,23
EURIBOR Shock								
s	3,92	4,33	3,63	0,05	0,05	4,38	3,68	3,92
h	2,57	3,72	-2,63	0,02	0	3,74	-2,68	0
f	-5,49	-7,05	0	0,92	0,95	-7,12	0	-2,92
RF GDP Growth Shock								
s	1,97	2,06	1,92	0,10	0,1	2,17	2,02	1,97
h	1,56	1,82	-0,92	0,03	0	1,85	-1,02	0
f	-2,53	-2,88	0	0,87	0,90	-3,02	0	-0,97
EU GDP growth Shock								
s	4,27	4,31	1,00	0,23	0,23	4,54	1,00	4,27
h	-0,32	-0,82	0	0,01	0	-0,80	0	0
f	-2,95	-2,49	0	0,76	0,77	-2,74	0	-3,27

Notes: The optimal debt composition is obtained from equations (5)and (6); s - T-bills, h - Real bonds, f - Fixed rate bonds.

3.9 Appendix IV: Data

Variable	Measure	Source	Period
Real Gross Domestic Product (GDP) of Lithuania	current prices, cumulative, mln. of Litas and Euro	Ministry of Finance of the Republic of Lithuania: www.minfin.lt	1991-2010
GDP of the EU-15	current prices, cumulative, mln. of Euro	Eurostat: www.ec.europa.eu	2000-2009
Inflation rate (growth rate of the Consumer Price Index)	cumulative, in % change with respect to the same period of the previous year	Ministry of Finance of the Republic of Lithuania: www.minfin.lt	1991-2010
Inflation of the EU-15	cumulative, in % change with respect to the same period of the previous year	Eurostat: www.ec.europa.eu	2000-2009
Russian GDP	current prices, cumulative, mln. of Rubles and Euro	National bank of Russia: www.cbr.ru	2000-2009
Budget balance	in % of GDP	Central Bank of the Republic of Lithuania: www.cbl.lt	1991-2010
Domestic public debt by debt instruments	mln. of Litas, Euro and % of GDP	Ministry of Finance of the Republic of Lithuania: www.minfin.lt	1991-2010
Interest rate of Lithuanian GS	%, all securities	Ministry of Finance ofepublic of Lithuania: www.minfin.lt	2000-2009
External public debt by debt instruments	mln. of Litas, Euro and % of GDP	Ministry of Finance of the Republic of Lithuania: www.minfin.lt	1991-2010
Euribor for 12-month Euro deposit rate	%, converted into quarterly terms from monthly	Eurostat: www.ec.europa.eu	2000-2009

Note: All the financial variables series are constructed by using the last available observation. The inflation rate, the interest rates and the output gaps have not been multiplied by 100.

Chapter 4

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Finally, I would like to express my enormous encouragement to all "PhD student-mothers" do not give up, it is possible to raise kids and enjoy research. I encourage all "extracomunitari" like myself do not get upset and be proud of your nation.