EXPLAINING INFLATION IN GEORGIA: DO EXCHANGE RATE AND NOMINAL WAGE MATTER?

by

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Abstract

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This study investigates the behavior of inflation in Georgia in the post-stabilization period based on the long-run equilibrium models of three inter-related markets – foreign exchange, money and labor. It is the first attempt to look at the sensitivity of consumer prices to the changes of nominal wages and, respectively, evaluate the potential consequences of the high increases in nominal wages in the country during 2004-2006. The study also explains the opposite dynamics of inflation and the domestic exchange rate depreciation in Georgia in the last two years (2005-2006). By estimating a pass-through equation using the cointegrating framework, this paper finds that the exchange rate pass-through to prices is very strong related to the other determinants (money supply, nominal wages, and food prices) – in the short-run depreciation of the Georgian lari against US dollar by 1 percent leads to contemporaneous increase in CPI inflation by 0.28 percent. The long-run response of consumer prices to the exchange rate becomes much stronger (0.43 percent). Changes in nominal wages have significant effect on consumer prices as well – an increase in nominal wages by 1 percent leads to increase in the CPI inflation by 0.03 percent in the same month – making the predictions of the NBG experts about the risk of high future inflation (due to increase in nominal wages) reasonable.

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Chapter 1

INTRODUCTION

Efficient monetary policy is one of the major conditions for a transition economy to achieve economic stability. What is especially important for a transition country in terms of monetary policy is its ability to address issues associated with inflation since these issues affect the overall performance of the entire economy. The case of Georgia is a good example of this.

Georgia has been one of the most successful transition countries in fighting inflation, along with Armenia and Azerbaijan. It achieved a single digit inflation rate in 1996, while the other Former Soviet Union countries achieved this goal later, in 1998. In doing this, the National Bank of Georgia (NBG) passed several programs associated with monetary reform and stabilization of national currency. As a result, a hyperinflation of the 1993-1994 was successfully eliminated: Inflation decreased from 15,607 percent in 1994 to a single-digit value in 1997. However, down the road the NBG has faced some problems such as high dollarization of the national economy and very volatile demand for money. In addition, there were some seasonal effects especially rising consumer prices at the end of each year due to Christmas shopping, an increase in prices of fruits and vegetables. As a result of these fluctuations, the monthly inflation rate, for example, reached 12.2 percent in December of 1998, and – 8.2 percent in December 2000, while during these years the monthly increase in inflation rate in the country on average amounted to 1.30 and 0.85 percents respectively (Table A.1). In this study we are emphasizing impacts of two main determinants of price behavior – changes in the exchange rate and nominal wages. The reason for this is as follows.

First, the case of Georgia shows that in 1996-2005 price increases were accompanied by USD/GEL exchange rate depreciation and price decreases were associated with domestic currency appreciation (Figure 1.1, 1.2).

Figure 1.1 USD/GEL Exchange Rate Index, 1996-2006 (Dec.95 – 100)

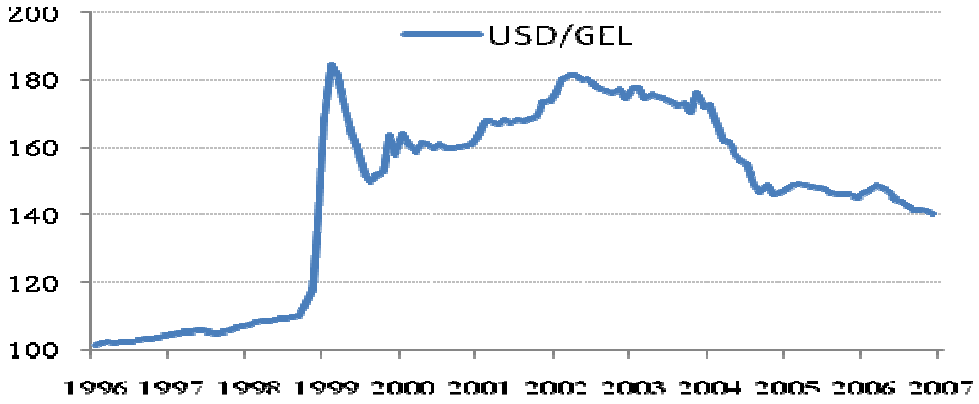
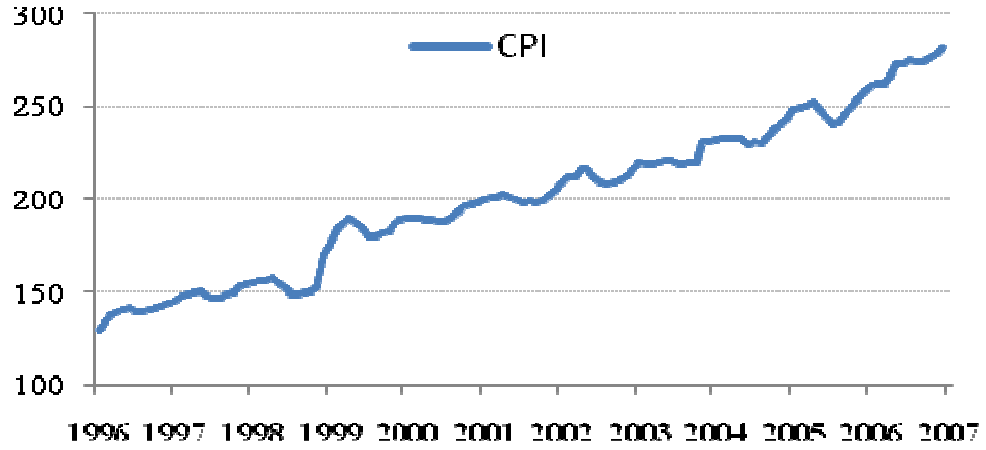


Figure 1.2 Consumer Price Indices, 1996-2006 (Dec.95 – 100)



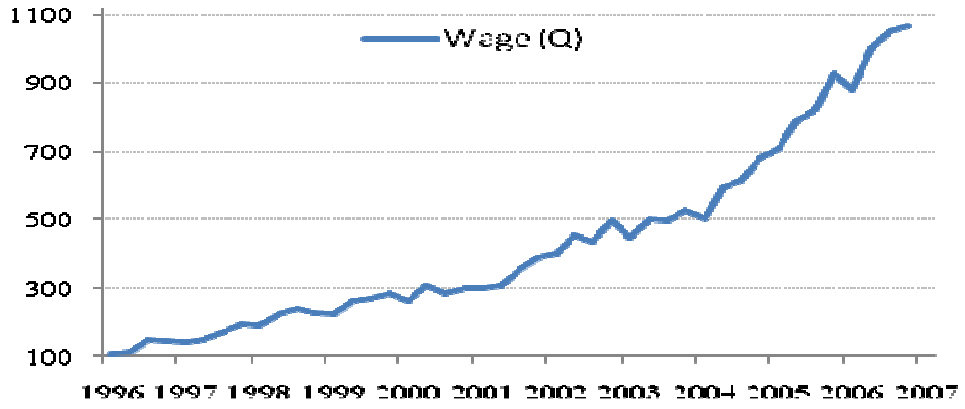
Literature review dedicated to the monetary transmission processes in the country during different financial crises, also suggests negative relationship between the exchange rate and inflation in Georgia since the very early years of transition.

However, during the 2005-2006 period prices have continued to change very rapidly while exchange rates were more or less stable. Moreover, after the first quarter of 2006 price increases were associated with domestic currency appreciation, contradicting the results of the existing works.

Second, some economists emphasize the importance of changes in nominal wages for the inflation rate in Georgia, but without support of empirical analyses. In fact, these two variables are highly correlated – the correlation coefficient is equal to 0.9785, indicating very strongly inter-related variation of these two variables.

In addition, estimation of nominal wage impacts becomes more important for the last years, when an increase in nominal wages in Georgia amounted to 27.4 percent y-o-y in 2005 and 22.9 percent y-o-y in 2006 (Figure 1.3).

Figure 1.3 Changes in Nominal Wage, 1996-2006 (Dec.95– 100)



Such a discrepancy allows the NBG experts to predict the risk of a higher future inflation in the country.

Based on the above discussion, it appears that changes in the exchange rate and nominal wages in Georgia along with seasonal price fluctuations are the major determinants of inflation in the country. These two stylized facts, mentioned above, is a big motivator to study the impacts of changes in exchange rate and nominal wages on the inflation rate in the country. This study is the first attempt to estimate the impulse response relationships of the above-mentioned variables on the inflation rate using the Vector Auto Regression approach. The following points are addressed:

- the consequences of the exchange rate fluctuations for the inflation rate in Georgia during last three years;

- the responsiveness of the inflation rate to changes in nominal wages: Is there any concern regarding higher future inflation rate due to higher nominal wages as suggested by the NBG experts;

- the consequences of Financial Crises in Russia in 1998-1999 for the inflation rate behavior in Georgia.

On the other hand, although the main focus of this study is on Georgia, nonetheless the obtained results can significantly contribute to the analysis of other Former Soviet Union countries and other economies in transition.

The remainder of the paper is organized as follows: section II provides chronological overview of inflation behavior in Georgia since the years of independence of the country. Section III summarizes the recent literature on the exchange rate and nominal wage pass-through effects to price changes for the countries with the different levels of development, for Georgia as well. Section IV outlines the theoretical background utilized to capture the relationship between consumer prices, exchange rate and nominal wages and section V presents

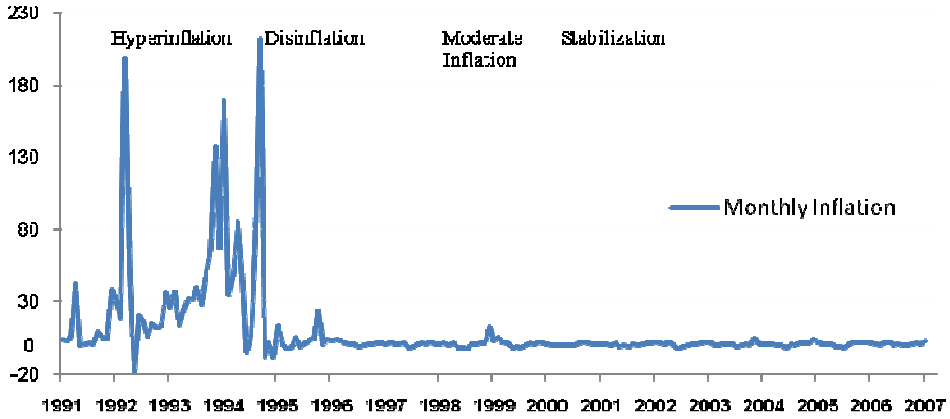
empirical model of identified relationship. Section VI describes statistical properties of the data. Section VII represents the results of empirical analyses and section VII concludes the study with some policy recommendations.

Chapter 2

GENERAL OVERVIEW

Chronologically inflation behavior in Georgia since its dependence in late 1991 can be divided into four periods (Figure 2.1). First, there was a period of very high inflation (15,607 percent), from 1992 to 1994, mostly due to the external shocks and currency crises. Then, introduction of several monetary reforms in the mid 1994, supported by the International Monetary Fund and the World Bank, produced disinflation period, when inflation rate in the country amounted to 7.3 percent per annum. Third, in the aftermath of the Financial Crises in Russia in 1998-1999, moderate disturbances in the price fluctuations in Georgia were observed, which eventually stabilized in 2001. This section will briefly review the development of Georgian economy in terms of price dynamics since the first years of independence.

Figure 2.1 Inflation in Georgia: percent per month, 1991-2007



Beginning from the early years of independence, the majority of Former Soviet Union countries inherited economies that were highly vulnerable to different external and internal shocks (trade shocks, fiscal imbalances, cash crises). The result was strong hyperinflation in these countries. The case of Georgia is a good example of this.

Shocks to the transition economies came mostly from disruption of the existing trade relationships between the countries following the break-down of the Soviet Union. Production, energy consumption and trade were highly integrated within the Soviet economy, reflecting low input prices and high output levels. Trade to GDP ratio in Georgia, in 1990 amounted to 40 percent and the imports of energy – 80 percent of total available energy resources in the country. The interruption of terms of trade in the former Soviet Union in 1991 sharply reduced the volume of external trade within the system, causing an increase in input prices with decline in production levels in several countries. Prices of Georgia's key energy imports, such as natural gas and refined oil products, increased respectively by five- and twenty-seven-times y-o-y in 1992-1993. The output level in the country dropped first by 44.8 percent in 1992 and then by another 25.4 percent in 1993.

In addition, the collapse of the Soviet System negatively affected the fiscal discipline in Georgia. Relative to GDP, tax revenue decreased from 22.1 percent in 1991 to 8.2 percent in 1992 and to 2.0 percent in 1993, while the total expenditure to GDP ratio increased from 33.7 percent in 1991 to 35.6 and 35.9 percents respectively in 1992 and 1993. As a result, the overall fiscal deficit as a percentage of GDP increased from 3.4 percent in 1991 to 25.4 percent in 1992 and to 26.2 percent in 1993, producing the need for external loans and grants. Prices increased rapidly, but did not cause hyperinflation until the introduction of a new currency – coupon.

When Georgia was in the ruble zone, its monetary policy was controlled by the National Bank of Russia. However, by the end of 1992, Russia stopped supplying banknotes to the National Bank of Georgia following the introduction of a new national currency – coupon – which came in circulation in April, 1993. It created the explosive growth of the NBG's domestic lending to government, serving to finance budget deficit, agriculture and gaps of trade disturbances. In the mid 1993-1994, currency in circulation and domestic currency broad money increased by more than 152- and 130-times respectively. All the above-mentioned facts resulted in hyperinflation in Georgia. Inflation rate in the country in 1993-1994 reached 15,607 percent - second highest level after Turkmenistan among the Former Soviet Union countries.

The existing situation in Georgia in 1991-1994 caused the necessity for immediate intervention by foreign and domestic economic institutions to provide sustainable development of the country. Since the mid 1994 several reforms, supported by the International Monetary Fund and The World Bank, have been introduced including an introduction of a new, more stable currency (lari) into circulation, with focus on price stability. As a result, Georgia was able to stop hyperinflation spiral (when inflation rate amounted to 50-70 percent m-o-m) and after a long-period of decline in economic growth, managed to reach high rates of GDP growth. Annual inflation rate in 1995 amounted to only 53%, and 13.5 and 7.3 percent in 1996 and 1997 respectively. As for the economic growth, in 1995 GDP increased by 3.3 percent y-o-y, in 1996 – by 11.0 percent and in 1997 – by 10.8 percent.

In 1998 economic situation in Georgia deteriorated again due to civil conflicts, fiscal imbalances and currency crises, in its tern, caused by the Financial Crises in Russia – in one of the major trading partner of Georgia. Disturbances of terms of trade, and, therefore, the deterioration of trade balance in Georgia created gaps

between the supply and demand of foreign currency. Devaluation of Russian ruble in august of 1998, caused depreciation of local currencies in some other major partner countries of Georgia, which led to inflow of cheap goods from these countries and outflow of foreign capital from Georgia. The risk of high future price increases became very high. To defend the domestic currency and to support the programs of price stabilization in the country, the National Bank of Georgia tried to heavily intervene in the foreign exchange market, but the attempt appeared to be unsuccessful, and eventually NBG allowed the currency to continue to free float. Devaluation of lari led to some kind of equilibration in trade and stabilization of foreign exchange market, making the exchange rate stable and inflation low in the country. The mid of 1999 can be regarded as the end of currency crises in Georgia.

The Financial Crises in Turkey in November 2000 also created threat of future imbalances in the foreign exchange market as well as disturbances in the price changes in the country, but Georgia managed to keep price changes under control. Some small price fluctuations in the country were caused by several fiscal and seasonal patterns. Due to stable domestic currency, the price dynamics in Georgia during the last five years (2002-2006) has been determined mostly by the disturbances in the labour market (changes in nominal wages) and seasonal price fluctuations. The importance of these factors was also strong for the period of Financial Crises in the neighbor countries (Russia and Turkey). However, compared to the impacts of currency instability, the influence of seasonal patterns, as well as the effects of changes in nominal wages, seemed to be less significant. Currently, these effects are stronger due to increasing growth rate of these macro variables themselves: an increase in nominal wages in Georgia amounted to 24.5 percent y-o-y in 2004, 27.4 percent y-o-y in 2005 and 22.9 percent y-o-y in 2006. This study will estimate the importance of these impacts on the price behavior in Georgia and compare these effects to the impacts of the

other determinants of inflation in the country, such as the changes in exchange rate and money supply. However, before estimating the impacts of changes in nominal wages and exchange rate on the inflation behavior in Georgia, let's first summarize the existing literature on these relationships.

Chapter 3

LITERATURE REVIEW

Different features and associated welfares of inflation are highlighted in various literatures. Providing the theoretical frameworks, they study inflation behavior in the several groups of countries with the different levels of development. In this section we will try to summarize the results of the existing literature on the underlined relationship between consumer prices, exchange rate and nominal wage. First, we develop the general discussion about the price behavior in transition countries from the early years of independence. Then demonstrate the empirical findings of different papers about exchange rate and nominal wage impacts on price changes for developing countries, compare the results to the highly developed economies, and, finally, evaluate the existing studies for Georgia.

According to Koen and De Masi (1997), prices within the centrally planed economies were set administratively, with little regard for cost and demand considerations. After price liberalization, followed to the break-down of the Soviet System, most countries of the Former Soviet Union experienced sharp price increases. The cumulative increase in consumer prices during the first five years of independence amounted to 80 times in Latvia, 2,000 times in Russia, over 18,000 times in Kazakhstan, and over 86,000 times in Georgia. However, by the second half of 1996 hyperinflation was replaced by single-digit inflation rate, reaching on average less than one percent monthly inflation rate in most of them. The authors also claim that prices tended to converge across the transition countries, but the full convergence of the overall prices is expected only in the very long run.

Some interesting and important conclusions about inflation in Georgia and other transition countries were made by Ghosh (1997). The author evaluates potential benefits and costs of inflation, introducing the desirable level of inflation in transition economies. Ghosh regards the seignorage or inflation tax as the main benefit of high inflation in the country. Using the money demand function, the author estimates the expected level of inflation, at which the inflation tax revenue would be maximized. This expected level of inflation seems to be very high, at about 90 percent. However, the inflation tax revenue in Georgia was the lowest among the Former Soviet Union countries in the early years of transition. On the other hand negative impact on output growth is regarded by the author as the major cost. As pointed out in the paper, for the inflation rate below 10 percent, the effect of inflation on output growth rate is not visible. This effect becomes more visible above the 10 percent inflation rate - inflation above 40 percent level results in GDP growth being by 2 percentage points lower than for the countries with the inflation rate less than 10 percent. What determines this high and low level of inflation?

Different determinants of inflation are identified in the literature. Since our focus is on the two of them – exchange rate and nominal wages – we will deal with the papers, that evaluate effects of these factors.

Inflation behavior with respect to the exchange rate and nominal wages is well-studied for diverse groups of countries, developing and developed. The results are not clear cut. While analysis in developing counties suggests negative relationship between consumer price changes and the exchange rate, for some developed countries this is not the case.

The multi-country panel regression study conducted by Loungani and Swagel (2001) shows positive relationship between the exchange rate depreciation and the inflation rate in developing countries. The authors estimate this effect using a

panel of 53 developing countries: African countries – 16, Asian – 11, South American – 19, and Mediterranean – 7. The case of the developing counties with the floating exchange rate suggests that the impact of exchange rate depreciation on the price changes is positive and statistically significant.

The same result is obtained in a study estimating the relationship between the exchange rate and inflation separately for developing countries. In his article, Mwase (2006) shows negative exchange rate effect on inflation, which becomes stronger in the long-run compared to the short-run. Considerable attention was paid to the exchange rate impacts, as on of the leading factors, on inflation in the papers by Kuijs (1998), Callen and Chang (1999), Ubide (1997), Gelos (2005), Leigh and Rossi (2002), Hossain (2002), Sacerdoti and Xiao (2001), Khan and Schimmelpfennig (2006), that analysed inflation dynamics respectively for Nigeria, India, Mozambique, Brazil, Turkey, Bangladesh, Madagascar and Pakistan. The papers also suggest negative relationship between the exchange rate and inflation.

While the case of developing countries shows negative responsiveness of the price movements to the changes of the exchange rate, in the developed countries the result is different. A multi-country panel regression study, conducted by McCarthy (2000), suggests insignificant negative impact of the exchange rate changes on inflation for some developed countries, such as United Kingdom, Sweden and Switzerland, and the positive effect of the exchange rate changes on inflation for other developed countries (Japan and France).

As for the relationship between the nominal wages and inflation, the number of studies is fewer, especially with respect to empirical analyzes of individual countries. Analyzing the results of different studies that estimate the nominal wage effects on inflation for various countries Podkaminer (2002) suggests that based on these results the question of "whether rising nominal wages universally "cause" inflation, or rather rising prices universally "cause" higher wages cannot

be conclusively answered" (Podkaminer). Our study will try to address to this question again with respect to Georgia.

It is necessary to mention one more paper estimating the relationship of both, exchange rate and nominal wages, on the inflation rate in Turkey by Lim and Papi (1997). In their model, the long-run equilibrium level of domestic prices is assumed to be determined by aggregate demand and supply functions. The major findings of the paper are the strong response of the inflation to wage, money and the exchange rate that is a very important result for this study. The expected sign of wage impacts on the price movements is positive, while the expected sign for the exchange rate impacts is negative. Moreover, the effects of the exchange rate on the consumer price changes appear to be stronger (coefficients higher) than the effects of the nominal wages. We will use this model while identifying the price change equation, making some extensions to it.

One thing that can we add to this model is the inclusion of seasonal fluctuations in the equation of price changes. The authors don't use the effects of seasonal patterns since in Turkey inflation is in line with that of industrial countries and price changes occurs mainly through the changes in manufacturing sector. Agricultural prices are excluded from the total prices and, therefore, the effects of seasonal fluctuations are excluded from the model, too.

However, Kumah (2006) emphasizes the dominant role of seasonality in inflation behavior in transition countries, based on the case of Kyrgyz Republic. In his estimation of the inflation response to seasonal patterns, the seasonal coefficient becomes significant at even 1 percent significant level. It indicates the significant influence of seasonality on the consumer price changes in this country, and this framework can be applicable to other transition countries, too, like Georgia, where seasonal fluctuations of prices are pronounced. How does the given result correspond to Georgian and other transition countries' evidence?

Different predictions of price dynamics in Georgia are made in different papers. In some of them, mostly empirical, the dynamics of price changes totally corresponds to the changes in exchange rate, while in the reports made by different organizations no response of the price changes to the exchange rate is suggested. As for the nominal wage influences, there doesn't exist a single quantitative analysis about this relationship. Only a few predictions are made by the experts of the NBG.

A study conducted by Gigineishvili (2002) describes the monetary transmission in Georgia after the Russian Financial Crises. Transmission mechanism is realized through four main channels: through direct interest rate effect, through indirect interest rate effect, through credit and through the exchange rate effect. By employing econometric modeling techniques, the author develops his analysis of the latter channel, as the most important one for the transmission process of monetary policy, and therefore, for the process of price formation in the highly dollarized country, like Georgia, and investigates the short-run impacts of the determinants of inflation in the country in August 1998 – June 2001. The result of the study is that the short-run impact of the exchange rate changes on the price movements in Georgia during this period is higher than the effects of the seasonal fluctuations in the country, but lower than other affects, like the impact of world price level and persistence of domestic price inertia.

Another study, dedicated to the inflation behavior in Georgia, is due to Maliszewski (2003), who estimated the impacts of various determinants on the consumer price changes in the country in 1995-2002. According to the model, developed by the author, impact of the exchange rate on inflation in the country significantly fall only behind the changes in the food prices, while the effects of changes in the oil prices and the seasonal fluctuations in the country become rather lower.

This study, like the previous one, suggests crucial role of the exchange rate in price formation process in Georgia. However, in the "Quarterly Inflation Review" by the NBG, it is suggested that the price movements in the country were not caused by the exchange rate changes. According to the review, in the last quarters of 2006 high increase in consumer prices was observed while the exchange rate of lari was relatively stable. This report also provides information about the high increase (27.4 percent annually) in nominal wages that creates (in the authors' opinion) significant risk of high future inflation. That is why we will try, first, to clarify the influence of changes in the exchange rate on inflation, and second, to quantitatively test predictions of the Georgian experts.

One more study estimating the relationship between these three inter-related variables was conducted by Grigorian, Khachatryan and Sargsyan (2004), where they identify effects of each variable (consumer price, exchange rate and nominal wages) on the other ones. By studying three inter-related markets (foreign exchange, money and labor), the authors analyze dynamic effects of the exchange rate and wages on prices in Armenia. Their estimation showed higher responsiveness of inflation to the exchange rate than to nominal wage. An important finding of this study is that in the long-run wages are more sensitive to movements in prices than the prices to changes in wages. In the short-run, there are no significant impacts of wage on prices. As for the relationship between the exchange rate and inflation, the paper suggests a negative correlation, both in the short-run and long-run.

As the paper suggests the result for one of the transition countries, it may be applicable to other transition countries, but for the ones where interventions by Central Bank in the foreign exchange market becomes a major policy tool. In our opinion, the case of Georgia is a bit different from the one in Armenia. The ethnic wars developed in the country in the very early years of independence

caused fiscal and different economic imbalances, which finally reflected into the different background of price changes in Georgia rather than in Armenia.

So, based on the evidence from transition and non-transition countries, the relationship between the changes in the exchange rate and inflation is negative what we will check for Georgia and evaluate also for the other transition countries. What about the relationship between the nominal wages and inflation, it is less clear. Our research will provide one more attempt to clarify the latter relationship.

Chapter 4

THEORETICAL FRAMEWORK

This section investigates the long-run relationship between consumer prices, exchange rate, nominal wages, together with the money supply, any deviation from which can be interpreted as the deviation from the steady-state with influencing from the short-run dynamics. That is why the exogenous variables, affecting the long-run steady-state, are including into the cointegration equations introduced below.

The long-run equilibrium level of domestic prices is assumed to be determined by aggregate demand and supply functions. "Aggregate demand increases if real money balances rise and/or competitiveness improves (i.e., if domestic prices in foreign currency terms decline relative to foreign prices of competing exports) and aggregate supply declines if real wages and/or imported input prices increase" (Lim and Papi, 1997). So, the balance of aggregate demand, y^d, and supply, y^s, looks like:

$$y^d\left(\frac{M}{P}, \frac{P_X^*}{PE}; \varepsilon_d\right) = y^s\left(\frac{W}{P}, \frac{P_r^*}{PE}; \varepsilon_s\right)$$

P – Domestic price level;

W – Nominal wages;

E – The exchange rate;

M – Money;

And exogenously determined:

P_x^* – the price of exports;

P_r^* – imported input prices;

ε_d and ε_s – random demand and supply shocks.

After solving for the price level (P), we get the following long-run price equation:

$$\mathbf{p = \alpha_0 + \alpha_1 e + \alpha_2 m + \alpha_3 w + \alpha_4 px^* + \alpha_5 p_r^* + \varepsilon_p} \qquad (1)$$

Where, α_0 denotes the constant, α_1, α_2, α_3, α_4, α_5 – the coefficients of endogenous and exogenous variables, and ε_p – the residual, which is normally distributed with zero mean and constant variance. All the variables (p, e, m, w, p_x^* and p_r^*) are represented in the logarithmic form estimating the percentage change effects of each variable.

The long-run equilibrium on the exchange market can be represented as:

$$\mathbf{e = \beta_0 + \beta_1 p - \beta_2 p^* - \beta_3 tot + \beta_4 ydev + \varepsilon_e} \qquad \mathbf{(2)}$$

e – (the logarithm of) nominal exchange rate (expressed in lari per U.S. dollar);

p – (the logarithm of) domestic price level measured by the consumer price index;

And exogenously determined:

p* - (the logarithm of) foreign (U.S.) price level;

tot – term of trade index;

ydev – the real GDP's deviation from its potential level.

β_0 denotes the constant, β_1, β_2, β_3, β_4 – the coefficients of endogenous and exogenous variables, and ε_e – the residual, which is normally distributed with zero mean and constant variance.

The equation represents the theoretical model of Purchasing Power Parity, corrected for the transition countries by adding the deviation of GDP from its potential level (ydev) and terms of trade (tot). The inclusion of the last variable in the equation is consistent with the theoretical suggestion that an improvement in relative prices of exports and imports in the long run would result in an appreciation of the nominal exchange rate. As the equation (1) shows the relationship between prize (p) and nominal wages (w), equation (2) can be considered as well as the relationship (indirect) between the exchange rate (e) and nominal wages.

The long-run equilibrium in the labor market can be represented as

$$\mathbf{w = \gamma_0 + \gamma_1 p + \gamma_2 ydev + \varepsilon_w} \qquad (3)$$

Where, w is (the logarithmic form of) nominal wage. The variable ydev – the real GDP's deviation from its potential level – in equation (3) is exogenously determined. Also, γ_0 denotes the constant, γ_1, γ_2 – the coefficients of endogenous and exogenous variables, and ε_w – the residual, which is normally distributed with zero mean and constant variance.

The simple representation introduced in the given model states that the nominal wage is a function of the price level and a measure of deviation of real GDP from its potential level. The right-hand side of the equation (3) can also be interpreted as the term of productivity shocks: "any wage pressures beyond the underlying productivity gains will be passed through by firms in the form of higher prices." (Grigorian, Khachatryan and Sargsyan, 2004).

Similarly to the previous equation, this equation (3) also shows the relationship (indirect) between nominal wages and the exchange rate.

At the same time, in the long-run, money supply, as well, responds to the shocks in the above inter-related variables, and vice versa. The long-run equilibrium in the money market can be expressed as:

$$\mathbf{m = \varphi_0 + \varphi_1 p + \varphi_2 y - \varphi_3 i + \varepsilon_m} \qquad (4)$$

Exogenously determined:

y – (the logarithm of) real GDP;

i – the average nominal rate of time deposits.

In equation (4), φ_0 denotes the constant, φ_1, φ_2, φ_3 – the coefficients of endogenous and exogenous variables, and ε_m – the residual, which is normally distributed with zero mean and constant variance.

This equation states that the equilibrium on the money market requires the supply to be equal to the demand for money. The model states that nominal money balances held by the agents are a function of the price level, income, and the opportunity cost of holding money (i.e., the nominal interest rate).

Using the above-specified identification of long-run relationship between consumer prices, exchange rate, nominal wages and money supply, we will estimate responsiveness of price dynamics to its determinants, the methodology of which is introduced in the next section.

Chapter 5

METHODOLOGY

The impacts of shocks in exchange rates and nominal wages on the consumer prices in the country will be estimated using the Variance Autoregressive (VAR) analysis and the analysis of impulse response functions, by constructing a structural form VAR with consumer price index (CPI), exchange rate, nominal wages and money supply, as inter-dependent endogenous variables that, in tern, depend on some other exogenous variables (introduced in equation 1,2,3,4,) and the lagged values of each endogenous variable.[1]

In general structural VAR with respect to our variables is:

$$\begin{bmatrix} 1 & \phi_{12} & \phi_{13} & \phi_{14} \\ \phi_{21} & 1 & \phi_{23} & \phi_{24} \\ \phi_{31} & \phi_{32} & 1 & \phi_{34} \\ \phi_{41} & \phi_{42} & \phi_{43} & 1 \end{bmatrix} \begin{bmatrix} p_t \\ e_t \\ w_t \\ m_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \end{bmatrix} + \begin{bmatrix} \theta_{11} & \theta_{12} & \theta_{13} & \theta_{14} \\ \theta_{21} & \theta_{22} & \theta_{23} & \theta_{24} \\ \theta_{31} & \theta_{32} & \theta_{33} & \theta_{34} \\ \theta_{41} & \theta_{42} & \theta_{43} & \theta_{44} \end{bmatrix} \begin{bmatrix} p_{t-1} \\ e_{t-1} \\ w_{t-1} \\ m_{t-1} \end{bmatrix} +$$

$$\mathbf{B} \qquad \mathbf{Z_t} \qquad \mathbf{\Gamma_0} \qquad \mathbf{\Gamma_1} \qquad \mathbf{Z_{t-1}}$$

[1] Consequent test (Granger Causality Wald Test) suggest the inclusion lagged values of consumer prices, the exchange rate, nominal wage and money supply in the equations of endogenous variables.

$$+\begin{bmatrix} \tau_{11} & \tau_{12} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \tau_{23} & \tau_{24} & \tau_{25} & 0 & 0 \\ 0 & 0 & 0 & 0 & \tau_{35} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \tau_{46} & \tau_{47} \end{bmatrix} \begin{bmatrix} p_x^* \\ p_r^* \\ p^* \\ tot \\ ydev \\ y \\ i \end{bmatrix} + \begin{bmatrix} \upsilon_{pt} \\ \upsilon_{et} \\ \upsilon_{wt} \\ \upsilon_{mt} \end{bmatrix}$$

$\mathbf{\Phi}$ $\mathbf{D_t}$ $\boldsymbol{\varepsilon_t}$

For simplicity, we show only the one lagged values of the endogenous variables, however, in the process of analyses, it is possible that more lag length will be introduced. The matrix representation of the model (together with the exogenous variables) is:

$$\mathbf{BZ_t = \Gamma_0 + \Gamma_1 Z_{t-1} + \Phi D_t + \varepsilon_t}$$

Where, t indicates the time and t = 1...T; i indicates lag length and i = 1…k; B is the matrix of contemporaneous response of each dependent variable to changes in other endogenous variables. Z_t – the vector of jointly dependent endogenous variables (CPI, exchange rate, wage and money supply), Z_{t-i} the vector of the lagged values of endogenous variables, D_t – the vector of exogenous variables, Γ_1 and Φ the matrixes of coefficients (Γ_1 the matrix of coefficients of the lagged values of endogenous variables and Φ the matrix of coefficients of exogenous variables), Γ_0 – the vector of constant and ν_t the vector of error terms. Each error term is normally distributed with zero mean and constant variance. All the variables are presented in logarithmic form in order to capture the percentage change effects.

In our model, we include all the exogenous variables given in theoretical model along with seasonal dummies and dummy to capture the consequences of the

Financial Crises of Russia. The importance of seasonality in inflation behavior is emphasized in the works by Kumah (2006), who studied this issue for Kyrgyz Republic. Furthermore, in order to avoid the endogeneity problem, we assume all coefficients of endogenous variables, in the function of the exogenous variables on endogenous variables ($D_t = f(Z_t)$), to be zero. This is a starting point of our analysis. Due to this assumption our model will show the direct impact of the exchange rate on inflation as well as the impact of nominal wages on inflation.

The VAR in standard form can be derived in the following way:

$$\mathbf{Z_t = B^{-1}\Gamma_0 + B^{-1}\Gamma_1 Z_{t-1} + B^{-1}\Phi D_t + B^{-1}\varepsilon_t}$$

If we further denote $B^{-1}\Gamma_0$ by A_0, $B^{-1}\Gamma_1$ by A_1, $B^{-1}\Phi$ by C and $B^{-1}\varepsilon t$ by e_t we will end up with the following reduced-form model:

$$\mathbf{Z_t = A_0 + A_1 Z_{t-1} + CD_t + e_t}$$

And in case of more than one lang length, the reduced-form VAR is:

$$\mathbf{Z_t = A_0 + \sum_{i=1}^{k} A_i Z_{t-i} + CD_t + e_t}$$

However, estimation of the reduced form VAR doesn't allow us to retrieve the coefficients of the structural model. The solution to this problem is to impose some explicit restrictions on the coefficients of the matrix B, assuming the same kind of dynamics in short-run as in long-run,

$$\mathbf{p = f\ (e,\ m,\ w,\ p_x^*,\ p_r^*,\ \varepsilon_p)}$$

$$\mathbf{e = g\ (p,\ p^*,\ tot,\ \ ydev,\ \varepsilon_e)}$$

$$\mathbf{w = h\ (p,\ ydev,\ \varepsilon_w)}$$

$$\mathbf{m = z\ (p,\ y,\ i,\ \varepsilon_m)}$$

or, on the other word, the existence of no contemporaneous effects of

- nominal wages and money supply on exchange rate;
- exchange rate and money supply on nominal wages;
- exchange rate and nominal wages on money supply.

Thus, we set $\phi_{23} = \phi_{24} = \phi_{32} = \phi_{34} = \phi_{42} = \phi_{43} = 0$, making our model

$$\begin{bmatrix} 1 & \phi_{12} & \phi_{13} & \phi_{14} \\ \phi_{21} & 1 & 0 & 0 \\ \phi_{31} & 0 & 1 & 0 \\ \phi_{41} & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} p_t \\ e_t \\ w_t \\ m_t \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \\ \alpha_{30} \\ \alpha_{40} \end{bmatrix} + \begin{bmatrix} \theta_{11} & \theta_{12} & \theta_{13} & \theta_{14} \\ \theta_{21} & \theta_{22} & \theta_{23} & \theta_{24} \\ \theta_{31} & \theta_{32} & \theta_{33} & \theta_{34} \\ \theta_{41} & \theta_{42} & \theta_{43} & \theta_{44} \end{bmatrix} \begin{bmatrix} p_{t-1} \\ e_{t-1} \\ w_{t-1} \\ m_{t-1} \end{bmatrix} +$$

$$+ \begin{bmatrix} \tau_{11} & \tau_{12} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & \tau_{23} & \tau_{24} & \tau_{25} & 0 & 0 \\ 0 & 0 & 0 & 0 & \tau_{35} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & \tau_{46} & \tau_{47} \end{bmatrix} \begin{bmatrix} p_x^* \\ p_r^* \\ p^* \\ tot \\ ydev \\ y \\ i \end{bmatrix} + \begin{bmatrix} \upsilon_{pt} \\ \upsilon_{et} \\ \upsilon_{wt} \\ \upsilon_{mt} \end{bmatrix}$$

Finally, the equation of reduced-form VAR can be transformed into a reduced-form error-correction model by taking the first differences:

$$\mathbf{\Delta Z_t = A_0 + \sum_{i=1}^{k-1} \Omega_i\, \Delta Z_{t-i} + \Theta Z_{t-1} + C D_t + \omega_t}$$

Where,

$$\Omega_i = -\sum_{j=i+1}^{k} A_j \qquad \text{and} \quad \Theta = \sum_{i=1}^{k} A_i - I$$

This model will allow us to estimate the long-run effects amongst our inter-related variables. As well, before estimating VAR, it is necessary to check all series (CPI, exchange rate, nominal wages and money supply) for unit root or whether or not they are integrated of order one (or at least of the same order). This will give us some evidence for co-integration to find the long-run relationship amongst the variables of interest.

Chapter 6

DATA

This study is based on monthly data of all above-mentioned variables except nominal wages during 1996 - 2006, obtained from the databases of the National Bank of Georgia and the Georgian State Department of Statistics. The brief description of the data is presented in the table below:

Table 6.1 Data description

Variable	Number of observations (Monthly)	Mean	Std. Dev.	Min	Max	Source
Consumer Price Index	132	200.77	40.71	129.80	281.20	NBG
USD/GEL Exchange Rate	132	1.80	0.33	1.25	2.27	NBG
Nominal Wage	132	113.64	70.67	28.01	281.00	GSDS
Nominal Wage_End	132	111.17	70.03	21.38	281.00	Self Calculated
Money Supply (M2)	132	481633.10	311306.20	147969.00	1392849.00	NBG
Food Price	132	101.75	58.58	20.31	234.48	GSDS
EPI (Laspeyres)	132	187.12	55.54	99.20	308.00	GSDS
EPI (Paasche)	132	155.93	58.80	20.60	440.50	GSDS
EPI (Fisher)	132	168.70	48.77	45.80	331.40	GSDS
IPI (Laspeyres)	132	195.84	92.39	75.70	428.20	GSDS
IPI (Paasche)	132	102.63	27.43	39.90	179.80	GSDS
IPI (Fisher)	132	140.28	49.54	56.80	263.90	GSDS

The data of average monthly nominal wages are given quarterly. In order to insure data consistency without sacrificing the number of observations, we use the monthly growth rates of the associated, correlated variable to the nominal wages, such as deposits in foreign currency, recalculate the monthly series of this variable and proceed the estimation. Quarterly calculated average monthly values of nominal wages appear to be highly correlated to the quarterly values of deposits in

foreign currency in Georgia (the correlation coefficient is equal to 0.9909). The high correlation of nominal wages and deposits (denominated in foreign currency) is the result of faint hope to the domestic currency in the country. Therefore, an increase in foreign deposits is associated with increase in nominal wages in Georgia. Consequently, it allows us to recalculate the monthly values of nominal wages using the monthly growth rates of foreign deposits during 1996-2006 period. However, in order to check the reasonability of our self-calculation, we also assume that the variation of monthly average wages within a quarter is insignificant, spread the data of monthly nominal wages over the whole quarter, lead the estimation, and compare the results to the ones, obtained with the self-calculated data.

In addition to the four inter-related variables, we also include in our model some other exogenous variables, such as money aggregates, export and imported input price indexes, and seasonal patterns (the price changes of food). We expect the effects of these factors to be significant.

During recent years, the Central Banks of various developing countries have used some mechanisms of monetary policy to stabilize prices. Georgia, one of the transition countries, introduced such a mechanism in the very early years independence, when hyperinflation was a major issue. In order to estimate consequences of the monetary policy for the price changes, in this study we use money aggregate M2 – broad money.

The use of export and import price indexes in our model, along with seasonal patterns, can be explained by the structure of consumer basket in the country, which, based on COICOP, is decomposed into 12 big groups of commodities (see Table 6-2).

Table 6.2 The structure of Consumer Price Index

Code	Group	Weight
00	Total	1.0000
01	Food and non-alcoholic drinks	0.4263
02	Alcoholic drinks, tobacco	0.0621
03	Cloths and foot-wear	0.0497
04	Residential house, water, electricity gas and other means of heating	0.0875
05	Furniture, family items and accessories, house/apartment repair/maintance	0.0319
06	Health Care	0.0730
07	Transport	0.1135
08	Communications	0.0433
09	Leisure, entertainment, culture	0.0308
10	Education	0.0296
11	Hotels, cafes, restaurants	0.0291
12	Other goods and services	0.0231

Food items represent the largest part of the consumer basket (41.2 percent). Agricultural products account for a sizable share in food, emphasizing the dependence of the consumer price index on seasonal patterns. Our model incorporates seasonality via dummy variable.

At the same time, the share of tradable goods (mostly imported inputs) in the consumer basket is quite large, making import and export price movements important. To take account of the responsiveness of price changes in the country on these indexes, we include in our model the monthly data of foreign trade price indexes, self-calculated using the Fisher formula which represents the geometrical mean of the Laspeyres and Paasche indexes:

$$I_P^F = \left[I_P^L * I_P^P\right]^{1/2} = \left[\frac{\Sigma(p_1 q_0)}{\Sigma(p_0 q_0)} * \frac{\Sigma(p_1 q_1)}{\Sigma(p_0 q_1)}\right]^{1/2}$$

Where:

I_P^F - Price index according to the Fisher formula

I_P^L - Price index according to the Laspeyres formula

I_P^P - Price index according to the Paasche formula

p_1 - Price in the current period

p_0 - Price in the base period

q_1 - Quantity in the current period

q_0 - Quantity in the base period

The equation (3) represents the rule of Purchasing Power Parity (PPP), which holds poorly for the developing countries. The correction is made by adding the variables, like terms of trade and deviation of the real GDP from its potential level.

Chapter 7

EMPIRICAL RESULTS

In this study, two econometric techniques were used to establish the existence of the long run cointegration relationship amongst three inter-related variables and to study whether or not nominal wages and the exchange rate matter for inflation in Georgia: Engel-Granger methodology and Johansen approach.

The result of Augmented Dickey-Fuller unit root (stationarity) test (Engel-Granger methodology), introduced in Table 7.1, suggests that all the endogenous variables – CPI, nominal wages, exchange rate and money supply – are integrated of order one, i.e., I(1).

Table 7.1 Augmented Dickey-Fuller Tests for a Unit Root

	Level		First Difference	
	Lag	**Test statistic**	**Lag**	**Test statistic**
p	5	-0.554	4	-7.636**
e	1	-2.062	0	-5.876**
m	0	0.383	0	-11.778**
w	0	-0.837	0	-12.635**
w_e	0	-1.467	0	-12.975**
r	1	-4.835**		
r_e	1	-4.888**		

* significant at 5%; ** significant at 1%

As the Table 7.1 shows, both, quarterly calculated average monthly nominal wage (w) and self-calculated (using the monthly growth rates of deposits in foreign

currency) average monthly nominal wages (w_e), are I(1). In this section we first, introduce the results of cointegration estimation obtained with the self-calculated data, then, in order to check the reasonability of our data construction of monthly nominal wages, we will conduct the same estimation with the data provided by the Georgian State Department of Statistics and compare the given results.

I. Results with self-calculated average monthly nominal wages

The lag-order selection statistics suggested the existence of nine lags in our estimation. Running OLS using the endogenous variables (consumer price, exchange rate, money supply and nominal wage) and testing the residuals (r_e) for unit root, we detected that residuals were stationary (Table 7.1), implying the existence of the cointegration relationship between these inter-related variables.

The same result was obtained using the Johansen approach (Table7.2).

Table 7.2 Johansen Tests For Cointegration

Null Hypothesis	**Alternative Hypothesis**		**95% Critical Value**
λ_{trace} *tests*		λ_{trace} *value*	
r = 0	r>0	53.7950	47.21
r ≤ 1	r>1	21.8396*	29.68
r ≤ 2	r>2	11.8085	15.41
r ≤ 3	r>3	3.4438	3.76
λ_{max} *tests*		λ_{max} *value*	
r = 0	r=1	31.9554	27.07
r = 1	r=2	10.0310	20.97
r = 2	r=3	8.3648	14.07
r = 3	r=4	3.4438	3.76

The test suggested the existence of a unique cointegrating vector and, therefore, the existence of the long-run relationship amongst the changes in consumer prices, nominal wages, the exchange rate and money supply. Normalizing the

cointegrating vector with respect to price, exchange rate, money supply and nominal wages respectively, we obtained the following long-run relationships:

Table 7.3Coitegration Analysis of the Full Model

Vector	A	B	C	D
β:				
p	1	-2.3081	-2.8565	12.2767
	.	(0.2210)**	(0.4647)**	(2.7578)**
e	-0.4333	1	1.2376	-5.3190
	(0.0374)**	.	(0.1112)**	(1.0719)**
m	-0.3501	0.8080	1	-4.2978
	(0.0535)**	(0.0758)**	.	(0.7618)**
w	0.0815	-0.1880	-0.2327	1
	(0.053)	(0.1219)	(0.1271)***	.

* significant at 5%; ** significant at 1%;*** significant at 10%

The exchange rate coefficient is the highest in the long-run equation of consumer prices (vector A). The signs of all the coefficients (except the nominal wages) are fully consistent to the theory.

II. Results with quarterly calculated average monthly nominal wages

Let's compare the previous results to the ones, obtained using the quarterly calculated nominal wages (provided by the Georgian State Department of Statistics). The lag-order selection statistics suggest the existence of nine lags in our estimation. Running OLS using consumer price, exchange rate, money supply and nominal wage and testing the residuals (r) for unit root, we also got the residuals (r) of the given regressions to be stationary (Table 7.1), stating the existence of the cointegration relationship between these inter-related variables.

The same result was obtained using the Johansen cointegration test (Table 7.4).

Table 7.4 Johansen Tests For Cointegration

Null Hypothesis	Alternative Hypothesis		95% Critical Value
λ_{trace} *tests*		λ_{trace} *value*	
r = 0	r>0	56.7035	47.21
r ≤ 1	r>1	23.0604*	29.68
r ≤ 2	r>2	12.2711	15.41
r ≤ 3	r>3	5.9106	3.76
λ_{max} *tests*		λ_{max} *value*	
r = 0	r=1	33.6431	27.07
r = 1	r=2	10.7893	20.97
r = 2	r=3	6.3605	14.07
r = 3	r=4	5.9106	3.76

The test showed the existence of a unique cointegrating vector and, therefore, the existence of the long-run relationship amongst changes in consumer prices, nominal wages, the exchange rate and money supply. Normalizing the cointegration vector with respect to price, exchange rate, money supply and nominal wages respectively, we obtained the following long-run response relationships:

Table 7.5 Coitegration Analysis of the Full Model

Vector	A	B	C	D
β:				
p	1	-2.2247	-2.5428	8.1007
	.	(0.2345)**	(0.4256)**	(1.8043)**
e	-0.4495	1	1.1430	-3.6412
	(0.0426)**	.	(0.1007)**	(0.6974)**
m	-0.3933	0.8749	1	-3.1857
	(0.0611)**	(0.0795)**	.	(0.5013)**
w	0.1234	-0.2746	-0.3139	1
	(0.0613)*	(0.1304)*	(0.1188)**	.

* significant at 5%; ** significant at 1%;*** significant at 10%

The coefficients of cointegration vectors given in Table 7.5 appear to have the same signs as in the previous estimation (Table 7.3). Moreover, the differences between these long-run coefficients are inconspicuous, allowing us to estimate the short-run and long-run impacts of price determinants using the self-calculated data of nominal wages. The difference between these two estimations is only in the significance level of coefficients of nominal wages in the price and exchange rate equation. In the estimation based on the self-calculated data of nominal wages, the coefficients of this variable become less significant (p-value equal to 0.124 and 0.123 respectively in the price and exchange rate equation).

Error-Correction Model For Inflation

The error-correction model of CPI inflation includes nine lags of inflation and nine lagged and current values of changes in the log of exchange rate, nominal wages and money supply. In the short-run estimation there are included also the impacts of the other (exogenous) explanatory variables, affecting deviation of the long-run equilibrium level of domestic prices from the steady-state.

The Error-Correction model for inflation can be written as follows:

$$\Delta p_t = 0.0080 + 0.0561\,(-0.8775 + p_{t-1} - 0.4332e_{t-1} - 0.3501m_{t-1} + 0.0815w_{t-1}) - 0.3812\Delta p_{t-5} - 0.2699\Delta p_{t-7} - 0.0776\Delta w_{t-2} - 0.0539\Delta w_{t-8} + 0.2394\Delta e_{t-2} + 0.1054\Delta m_{t-4} + 0.0774\Delta m_{t-5} + \varepsilon_{pt}$$

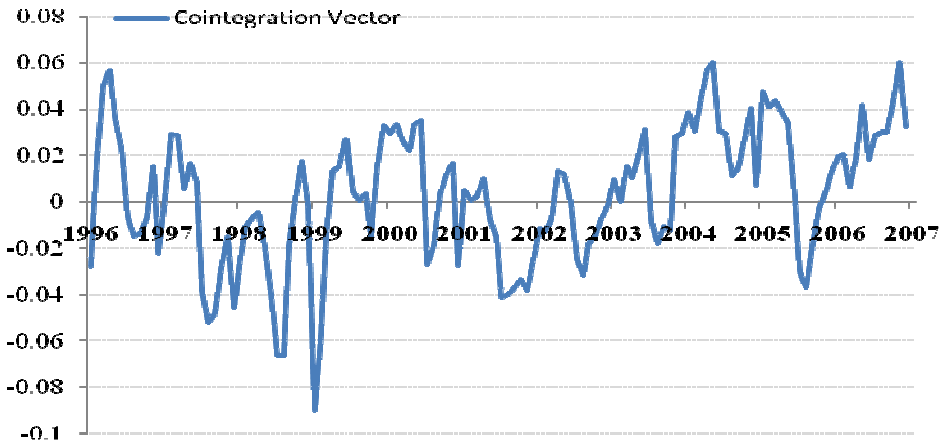
The equation shows that consumer prices in Georgia are strongly responded to the exchange rate changes – in the long-run, depreciation of the Georgian lari against US dollar by 1 percent leads to 0.43 percent of CPI inflation.

$$p_t = 0.8775 + 0.4332\ e_t + 0.\ 3501\ m_t - 0.0815\ w_t$$

Changes in money supply have also strong and significant effect (similar to the exchange rate impacts) on the consumer prices. The coefficient of impacts of nominal wages is negative (inconsistent to the theory), the reason of which may be several problems applied in our estimation: data imperfection, related to the absence of appropriate techniques to calculate monthly data for some determinants of price changes, like nominal wages, EPI and IPI and very short period of development of the country after its independence, providing a small number of observations to be included in our estimation.

The coefficient (speed of adjustment) in front of cointegration relationship is not significant at the conventional 10 percent level, implying that prices do not adjust to its long-run equilibrium, which is a function of the exchange rate, nominal wages and money supply. The graph 7.1 plots the cointegration vector of inflation.

Graph 7.1 The Structure Of Error-Correction Term



It is clear from the graph that the highest deviation from the long-run equilibrium was observed after the devaluation of domestic currency following to the Financial Crises in Russia.

Short-run dynamics of consumer prices are also strong and significant. In the OLS estimation of consumer prices the first differences of nonstationary (at 1 percent significance level) exogenous variables (food prices, EPI and IPI) are included together with the dummy variable of seasonal patterns and Russian Financial Crises.

$$\Delta P_t = -0.0153 - 0.3812\,\Delta p_{t-5} - 0.2699\,\Delta p_{t-7} + 0.0290\,\Delta w_t -$$
$$(0.0168) \quad (0.12339) \quad (0.1150) \quad (0.0132)$$

$$- 0.0776\,\Delta w_{t-2} + 0.2830\,\Delta e_t + 0.2394\,\Delta e_{t-2} + 0.0621\,\Delta m_t +$$
$$(0.0233) \quad (0.0377) \quad (0.0833) \quad (0.0203)$$

$$+ 0.1054\,\Delta m_{t-4} + 0.0774\,\Delta m_{t-5} + 0.0056\,\Delta IPI + 0.0039 EPI +$$
$$(0.0360) \quad (0.0378) \quad (0.0082) \quad (0.0033)$$

$$+ 0.0088\,\Delta Food + 0.1088\,ECM_t - 0.0083\,SUMMER +$$
$$(0.0030) \quad (0.0368) \quad (0.0027)$$

$$+ 0.0075\,D\,(1998\text{-}1999)$$

$$(0.0033)$$

R2 = 0.5924 Sample: 1996.12 - 2006.12

DW (10, 131) = 2.0337 Number of observations: 131

F (9,121) = 19.54

Diagnostic Statistics for the Single-Equation Inflation Model

ARCH 1-5 test	$\chi 2(1\text{-}9)$	=	16.919	[0.0500]
hetero test	$\chi 2(4)$	=	5.25	[0.2627]
serial correlation test	F(9,112)	=	1.281	[0.2551]
DW test	d(10,131)	=	2.033667	

The model appears to be well-specified with no rejections of this tests. The table suggests that the residuals are homoscedastic, serially uncorrelated and the absence of ARCH effects. The high value of R^2=0.5924 states that the model fits the data well.

The lagged values of inflation are included in the final specification of short-run dynamics, indicating that inflation persistence is very high.

Contemporaneous effects of domestic currency depreciation also appear to be the strongest among the short-run determinants of price changes in Georgia. Domestic currency depreciation against US dollar by 1 percent leads to an increase in the CPI inflation by 0.28 percent in the same month. This impact remains at most the same also in the two month; changes in money supply affect inflation rate much weaker. As for the nominal wages, the sign of the coefficient of contemporaneous effect is positive (consistent to the theory) – an increase in nominal wages by 1 percent leads to an increase in the CPI inflation by 0.03 percent in the same month. But, the response relationship of consumer prices to the nominal wages becomes negative in two month. One more point may be mentioned related to this relationship. High increases in nominal wages in the country during the last three-four years were associated to the unprecedentedly high salary growth in public administration and defense. For instance, 27.4% (annual) growth rate of nominal wages in the country in 2005 was fully caused by 80.8% (annual) growth rate of salaries in the public sector of the economy.

Increase in government expenditure, in its term, could have become the reason of increase in different taxes, which could have decreased aggregate demand and, therefore, decreased prices in the country. Up to this point, the negative impact of nominal wages on the price dynamics in certain period of time may be reasonable, but not true.

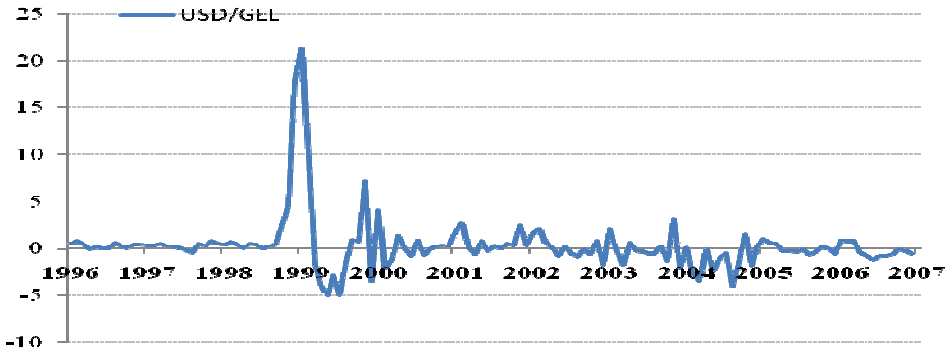
In addition, there are some other exogenous variables (equation (1)) that affect inflation dynamics in the country in the short-run. All the coefficients of exogenous variables (except of the EPI and IPI) are significant. The higher (but insignificant) coefficient of price changes of imported goods, compared to the price changes of exported ones, corresponds to real situation: Georgia is less export-oriented country and respectively changes in the prices of the exported goods have a small influence on the CPI inflation than changes in the prices of the imported ones.

As mentioned previously, agricultural products account for a sizable share of the food in consumer basket, justifying the dependence of the consumer price index on seasonal patterns. We included in our model prices of some seasonally dependent goods (foods). The model also incorporates dummy variable to capture seasonal patterns. The results of estimation suggest that an increase in food prices by 1 percent causes an increase in consumer prices respectively by 0.01 percent in the same month. At the same time, the coefficient of the summer dummy variable suggests that the logarithm of price falls by 0.01 percent during summer months, which is equivalent to approximately 1 percent decline. We also incorporate in our final specification of short-run dynamics of consumer prices the dummy variable for the period of Financial Crises in Russia, which states the reliance of consumer price changes on the tendencies developed in this period of time.

Hence, summarizing the results of our estimation it is possible to answer the question formulated just even in the title: Do exchange rate and nominal wage matter, while explaining inflation in Georgia? The estimation results show that nominal wages and the exchange rate affect the consumer prices in the country in the short-run as well as in the long-run. However, if changes in the exchange rates have the strongest influence on the price changes and these changes were pretty stable in previous three years, then why the consumer prices continued to increase much more rapidly now?

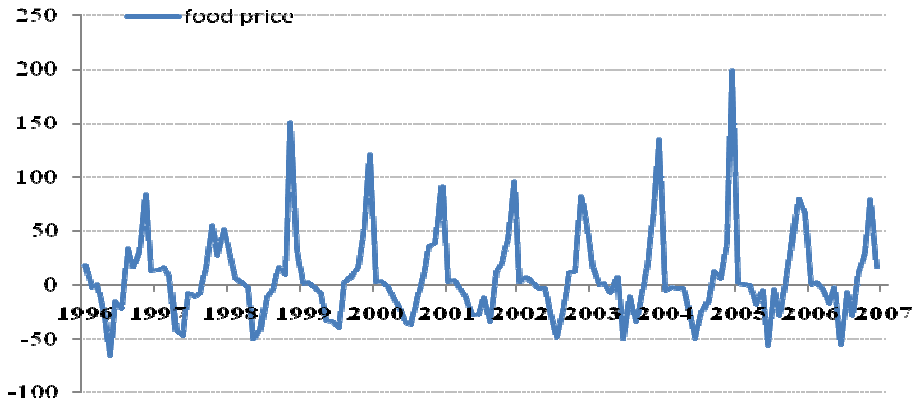
First, it is not only the dependence of prices on the exchange rate changes, but also the rates of changes in other affecting variable itself. As shown on the graphs, monthly percentage changes of exchange rate are much smaller than monthly percentage changes of food and vegetable price (Graph 7-2).

Graph 7.2 Changes in Exchange Rate, 1996-2006 (monthly)



The most noticeable changes in the exchange rates occurred in 1998-1999, during the Financial Crises in Russia, when at the end of 1998 the exchange rate depreciation was 21 percent m-o-m. On the other hand, in the winter months during 1996-2006 the food prices increased by more than 100 percent m-o-m, which, instead of lower influence of this determinant on the CPI inflation, makes the effects of these variables (foods) more obvious.

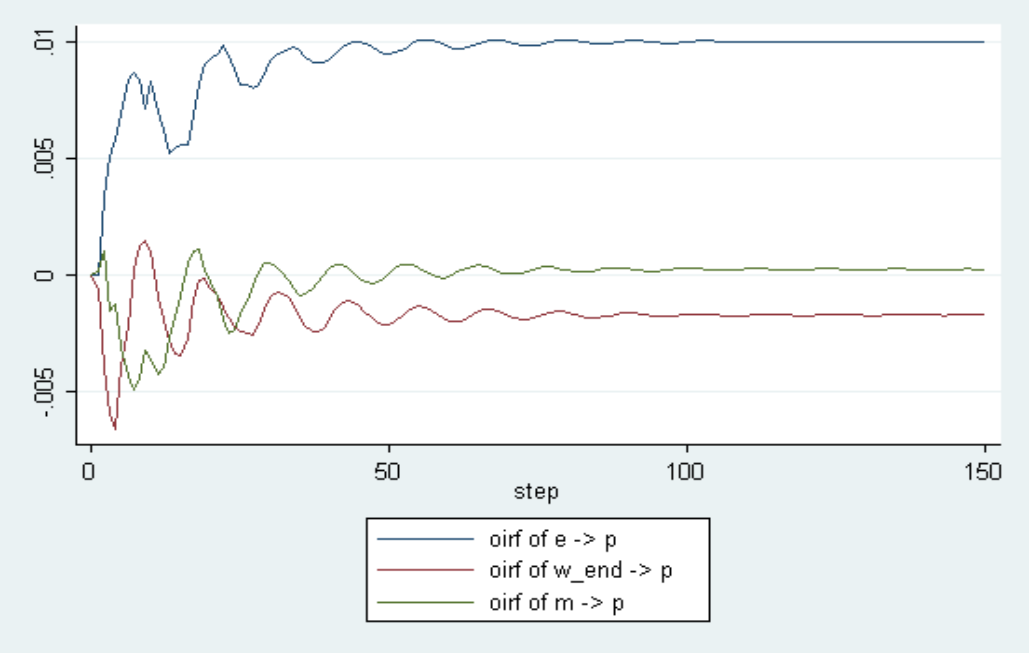
Graph 7.3 Changes in Food and Vegetable Prices, 1996-2006 (monthly)



Monthly changes in other variables such as, money supply and export and import goods' prices during the reported period (1996-2006) were very low (amounting maximum to 5 percent). That is why we emphasize in our analyses significance of changes in the exchange rate and prices of food. However, changes in these other variables also affect consumer price changes increasing the inflation rate in the country.

Second, we should not forget the consequences of the Financial Crises in Russia in 1998-1999, which became a major external shock that affected inflation in Georgia through the exchange rate fluctuations. As a result, the GEL/USD exchange rate increased by 21 percent in 1999, causing, along with some domestic factors, an increase in the inflation rate by about 12 percent. However, these effects did not last for only short period of time. If we look at the long run response of consumer prices to shocks in the exchange rate, nominal wages and money supply, we see that the impact of one standard deviation shock in the exchange rate exchange increases for the long period of time, becoming constant after about 8-9 years (Table A.3).

Graph 7.4 Impulse-response Relationship of Exchange Rate Depreciation and CPI



So, faster depreciation of Georgian currency during 1998-1999 can be also considered also as one of the main factors of rapid increase in consumer prices. As for the forecast error variance of consumer prices during the given forecast horizon, the proportion of the variance of the error made in forecasting this variable comes mostly due to shock in the exchange rate (Table A-4). Also, as it was predicted, own shocks explain the variance of the error made in forecasting this variable most at short forecast horizon (2-3 years), then these proportions decreases (Figure A.2).

Chapter 8

CONCLUSIONS

This study is the first attempt to look at the sensitivity of consumer prices to the changes of nominal wages in Georgia. Using the long-run equilibrium models of three inter-related markets – foreign exchange, money and labor – structural analysis of VAR cointegration framework has been applied, making an important contribution for this country, as well as for other transition economies. Focusing on the post-stabilization period of Georgia (1996-2006), long-run and short-run dynamics of inflation have been estimated, also including the exogenous variables (food price, EPI and IPI), affecting the long-run steady-state of consumer prices. During the estimation processes the paper has faced several problems: data imperfection (quarterly calculated average monthly nominal wages), combined with the necessity to use the monthly data in the estimation processes, which made us to pass appropriate assumptions in our model.

Despite these problems, our estimation provides many useful conclusions for Georgia. The paper found that the short-run dynamics of consumer prices, as well as the long-run, are strongly affected by the exchange rate changes – in the short-run depreciation of the Georgian lari against US dollar by 1 percent leads to contemporaneous increase in CPI inflation by 0.28 percent. The long-run response of consumer prices to the exchange rate becomes much stronger (0.43 percent). However, these impacts do not determine the behavior of inflation in the country yet. The main point is not only the dependence of consumer prices on determinants, but also the rates of changes in the affecting variable itself. Instead of the weakest response of inflation to the changes in relative prices of food (an increase in food prices by 1 percent causes an increase in consumer

prices respectively by 0.01 percent in the same month), the highest variation of this variable through the year fully determines the dynamics of price changes in the country.

Changes in nominal wages also have significant impact on inflation dynamics in Georgia, making the predictions of the NBG experts about high future inflation reasonable – an increase in nominal wages by 1 percent leads to increase in CPI inflation by 0.03 percent in the same month. However, these impacts become negative in the long-run, which may be the result of different data problems mentioned above.

The higher coefficient of price changes of imported goods, compared to the price changes of exported ones, corresponds to real situation: Georgia is less export-oriented country and respectively the changes in the prices of the exported goods have a smaller influence on the CPI inflation. However, both coefficients are statistically insignificant. We also incorporate in our model the seasonal dummy and the dummy variable for Russian Financial Crises to control our estimation for these patterns. The result is significant reliance of consumer price dynamics on these kinds of fluctuations in the economy.

As we have mentioned above response of price changes to nominal wages is one of the weakest in the country amongst the inflation determinants, however, the fact of high increase in this variable itself in the last two years (by 27.4 percent y-o-y in 2005 and 22.9 percent y-o-y in 2006) suggests the importance of nominal wages in explaining inflation in Georgia. High growth of nominal wages during the reported period, in its tern, was associated with an unprecedentendly high growth rate of salaries in the public sector of the economy (80.8 percent y-o-y in 2005 and 117.4 percent y-o-y). Excluding state non-market sector, there was negligible deviation in the average country nominal wages. Our finding may

become one more policy implication for price settings in this sector of the economy.

Chapter 9

SUGGESTIONS AND LIMITATIONS

Several limitations were attended in our study:

First, there should be mentioned a very short period of development of Georgia, making it impossible to control our estimation for different draw-backs (external and internal), reigned in this short period of time. Estimation inflation behavior in the country, it is impossible to care for trade shocks, fiscal imbalances and cash crises, associated with the break-dawn of the Soviet System, also shocks due to Financial Crises in Russia, or in Turkey, or imbalances associated to the Rose Revolution. Controlling the estimation for all these disturbances will decrease already limited set of series.

Limitations may be addressed also to the assumptions in the specified model of short-run dynamics of consumer price changes. Different assumptions of the contemporaneous effects in the short-run equations, rather than the same as in the long-run, may provide better and more consistent results.

Finally, the limitations may be addressed to the model itself. Identifying the long-run relationship of consumer prices with the exchange rate, nominal wages and money supply, as well as the short-run relationship of inflation with these and other (exogenous) variables, using the different equations (rather than ours), will provide inclusion of other endogenous or exogenous variables, which will probably introduce the better results.

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APPENDIX

Table A-1. Dynamics of CPI, Exchange Rate and Nominal Wages, 1996-2006

	Dynamics			Changes (%) Over Previous Period			Index (December 1995 = 100)		
	CPI*	GEL/USD Nominal Exchange Rate	Nominal Wage	CPI	GEL/USD Nominal Exchange Rate	Nominal Wage	CPI	GEL/USD Nominal Exchange Rate	Nominal Wage
December,1995	-	1.2396	-	-	-	-	100	100	100
1996									
January	102.6	1.2453	21.38	2.60	0.46	3.0	129.8	100.5	103.0
February	106.4	1.2548	24.68	3.70	0.76	15.4	134.5	101.2	115.4
March	109.4	1.2602	28.01	2.82	0.43	13.5	138.4	101.7	113.5
April	110.7	1.2581	33.10	1.19	-0.17	18.2	140.0	101.5	118.2
May	111.1	1.2596	27.95	0.36	0.12	-15.6	140.6	101.6	84.4
June	112.0	1.2596	29.66	0.81	0.00	6.1	141.7	101.6	106.1
July	110.4	1.2598	32.25	-1.43	0.02	8.7	139.9	101.6	108.7
August	110.5	1.2672	34.04	0.05	0.59	5.5	139.9	102.2	105.5
September	111.0	1.2697	38.90	0.49	0.20	14.3	140.6	102.4	114.3
October	111.5	1.2700	37.06	0.43	0.02	-4.7	141.2	102.5	95.3
November	112.7	1.2749	41.65	1.08	0.39	12.4	142.7	102.8	112.4
December	113.8	1.2803	37.87	0.99	0.42	-9.1	144.0	103.3	90.9
1997									
January	100.8	1.2846	35.45	0.80	0.34	-6.4	145.1	103.6	93.6
February	102.9	1.2884	34.47	2.08	0.30	-2.8	148.1	103.9	97.2
March	103.6	1.2943	37.23	0.68	0.46	8.0	149.2	104.4	108.0
April	103.9	1.2971	36.01	0.29	0.22	-3.3	149.6	104.6	96.7
May	105.0	1.2996	34.93	1.06	0.19	-3.0	151.2	104.8	97.0
June	103.0	1.3000	39.54	-1.90	0.03	13.2	148.3	104.9	113.2
July	102.0	1.2973	36.61	-0.97	-0.21	-7.4	146.9	104.7	92.6
August	102.1	1.2907	42.29	0.10	-0.51	15.5	147.0	104.1	115.5
September	103.3	1.2970	45.40	1.18	0.49	7.3	148.7	104.6	107.3
October	104.1	1.3000	51.40	0.77	0.23	13.2	149.9	104.9	113.2
November	106.5	1.3097	52.39	2.31	0.75	1.9	153.4	105.7	101.9
December	107.3	1.3158	51.14	0.75	0.47	-2.4	154.4	106.1	97.6
1998									
January	100.3	1.3210	47.77	0.30	0.40	-6.6	154.9	106.6	93.4
February	101.4	1.3293	49.31	1.10	0.63	3.2	156.6	107.2	103.2
March	101.4	1.3341	50.30	0.02	0.36	2.0	156.6	107.6	102.0

April	102.4	1.3350	53.66	0.94	0.07	6.7	158.1	107.7	106.7
May	100.7	1.3419	57.63	-1.65	0.52	7.4	155.5	108.3	107.4
June	98.7	1.3475	59.60	-1.97	0.42	3.4	152.5	108.7	103.4
July	96.4	1.3471	66.98	-2.33	-0.03	12.4	148.8	108.7	112.4
August	96.6	1.3497	68.34	0.21	0.19	2.0	149.2	108.9	102.0
September	96.7	1.3552	63.40	0.12	0.41	-7.2	149.4	109.3	92.8
October	97.7	1.3887	54.17	0.96	2.47	-14.6	150.8	112.0	85.4
November	98.7	1.4513	51.29	1.07	4.51	-5.3	152.4	117.1	94.7
December	110.7	1.7104	60.10	12.17	17.85	17.2	170.9	138.0	117.2
1999									
January	102.6	2.0746	52.00	2.60	21.29	-13.5	175.4	167.4	86.5
February	107.8	2.2710	61.60	5.02	9.47	18.4	184.2	183.2	118.4
March	109.8	2.2304	58.70	1.90	-1.79	-4.7	187.7	179.9	95.3
April	111.2	2.1371	60.46	1.28	-4.18	3.0	190.0	172.4	103.0
May	109.4	2.0306	63.61	-1.62	-4.98	5.2	186.9	163.8	105.2
June	107.8	1.9719	68.70	-1.43	-2.89	8.0	184.3	159.1	108.0
July	105.5	1.8739	65.78	-2.13	-4.97	-4.2	180.3	151.2	95.8
August	105.5	1.8462	69.93	-0.01	-1.48	6.3	180.3	148.9	106.3
September	106.5	1.8637	70.60	0.96	0.95	1.0	182.1	150.3	101.0
October	107.1	1.8777	71.47	0.50	0.75	1.2	183.0	151.5	101.2
November	109.6	2.0123	77.49	2.35	7.17	8.4	187.3	162.3	108.4
December	110.9	1.9417	75.30	1.19	-3.51	-2.8	189.5	156.6	97.2
2000									
January	100.4	2.0208	68.34	0.40	4.07	-9.2	190.3	163.0	90.8
February	100.2	1.9772	68.51	-0.20	-2.16	0.3	189.9	159.5	100.3
March	100.1	1.9549	68.90	-0.14	-1.13	0.6	189.7	157.7	100.6
April	99.8	1.9820	71.62	-0.23	1.39	3.9	189.2	159.9	103.9
May	99.7	1.9806	79.16	-0.13	-0.07	10.5	189.0	159.8	110.5
June	99.5	1.9639	80.90	-0.25	-0.84	2.2	188.5	158.4	102.2
July	99.2	1.9795	64.91	-0.25	0.79	-19.8	188.0	159.7	80.2
August	100.4	1.9657	70.10	1.21	-0.70	8.0	190.3	158.6	108.0
September	102.2	1.9643	75.10	1.79	-0.07	7.1	193.8	158.5	107.1
October	103.5	1.9686	82.36	1.23	0.22	9.7	196.1	158.8	109.7
November	104.1	1.9746	84.17	0.62	0.30	2.2	197.2	159.3	102.2
December	104.6	1.9783	78.80	0.48	0.19	-6.4	198.3	159.6	93.6
2001									
January	100.7	2.0107	75.98	0.70	1.64	-3.6	199.7	162.2	96.4
February	101.3	2.0636	74.70	0.60	2.63	-1.7	200.9	166.5	98.3
March	101.3	2.0651	78.60	0.00	0.07	5.2	200.9	166.6	105.2
April	102.3	2.0511	75.69	0.99	-0.68	-3.7	202.9	165.5	96.3
May	101.3	2.0654	76.14	-0.98	0.70	0.6	200.9	166.6	100.6
June	100.9	2.0600	81.10	-0.39	-0.26	6.5	200.1	166.2	106.5
July	100.2	2.0655	82.60	-0.69	0.27	1.8	198.7	166.6	101.8
August	100.5	2.0647	89.59	0.30	-0.04	8.5	199.2	166.6	108.5

September	99.9	2.0739	93.10	-0.60	0.45	3.9	198.1	167.3	103.9
October	100.6	2.0804	99.36	0.70	0.31	6.7	199.4	167.8	106.7
November	102.0	2.1305	95.86	1.39	2.41	-3.5	202.2	171.9	96.5
December	103.4	2.1367	102.80	1.38	0.29	7.2	205.1	172.4	107.2
2002									
January	102.0	2.1713	100.71	2.00	1.62	-2.0	209.2	175.2	98.0
February	103.2	2.2156	102.08	1.18	2.04	1.4	211.6	178.7	101.4
March	103.6	2.2293	105.80	0.39	0.62	3.6	212.4	179.8	103.6
April	105.4	2.2310	114.87	1.76	0.08	8.6	216.2	180.0	108.6
May	105.4	2.2133	111.54	0.03	-0.79	-2.9	216.2	178.5	97.1
June	103.0	2.2162	119.50	-2.32	0.13	7.1	211.2	178.8	107.1
July	101.9	2.2035	110.69	-1.07	-0.57	-7.4	208.9	177.8	92.6
August	101.7	2.1827	113.82	-0.15	-0.94	2.8	208.6	176.1	102.8
September	102.1	2.1790	114.70	0.39	-0.17	0.8	209.4	175.8	100.8
October	102.5	2.1652	119.87	0.39	-0.63	4.5	210.3	174.7	104.5
November	103.6	2.1814	126.83	1.07	0.75	5.8	212.5	176.0	105.8
December	105.4	2.1454	130.80	1.72	-1.65	3.1	216.2	173.1	103.1
2003									
January	102.1	2.1885	115.05	2.09	2.01	-12.0	220.7	176.6	88.0
February	101.6	2.1860	117.19	-0.52	-0.12	1.9	219.5	176.3	101.9
March	101.6	2.1483	117.50	0.04	-1.72	0.3	219.6	173.3	100.3
April	102.1	2.1604	124.06	0.50	0.57	5.6	220.7	174.3	105.6
May	102.3	2.1539	129.21	0.22	-0.30	4.1	221.2	173.8	104.1
June	102.4	2.1465	131.30	0.06	-0.35	1.6	221.3	173.2	101.6
July	101.5	2.1346	117.95	-0.89	-0.55	-10.2	219.4	172.2	89.8
August	101.4	2.1226	124.68	-0.12	-0.56	5.7	219.1	171.2	105.7
September	101.9	2.1271	130.30	0.53	0.21	4.5	220.3	171.6	104.5
October	101.9	2.0986	141.61	-0.01	-1.34	8.7	220.2	169.3	108.7
November	106.8	2.1648	139.67	4.81	3.16	-1.4	230.8	174.6	98.6
December	107.0	2.1194	139.10	0.16	-2.10	-0.4	231.2	171.0	99.6
2004									
January	100.4	2.1207	131.90	0.41	0.06	-5.2	232.2	171.1	94.8
February	100.9	2.0636	125.68	0.44	-2.69	-4.7	233.2	166.5	95.3
March	101.0	1.9925	131.80	0.10	-3.45	4.9	233.4	160.7	104.9
April	100.8	1.9906	148.46	-0.18	-0.10	12.6	233.0	160.6	112.6
May	100.8	1.9413	161.76	0.04	-2.48	9.0	233.1	156.6	109.0
June	99.2	1.9200	157.00	-1.58	-1.10	-2.9	229.4	154.9	97.1
July	100.1	1.9090	167.09	0.80	-0.58	6.4	231.3	154.0	106.4
August	99.5	1.8321	158.18	-0.60	-4.03	-5.3	230.2	147.8	94.7
September	101.0	1.8040	161.20	1.50	-1.53	1.9	233.6	145.5	101.9
October	102.6	1.8317	169.70	1.60	1.54	5.3	237.4	147.8	105.3
November	103.9	1.7973	171.57	1.26	-1.88	1.1	240.4	145.0	101.1
December	107.5	1.7992	179.50	3.47	0.10	4.6	243.5	145.1	104.6
2005									

January	102.1	1.8172	176.47	2.09	1.00	-1.7	248.5	146.6	98.3
February	102.4	1.8279	181.55	0.32	0.59	2.9	249.3	147.5	102.9
March	103.0	1.8366	186.80	0.60	0.48	2.9	250.8	148.2	102.9
April	103.5	1.8309	205.89	0.42	-0.32	10.2	251.8	147.7	110.2
May	102.1	1.8256	208.96	-1.30	-0.29	1.5	248.6	147.3	101.5
June	100.6	1.8186	208.40	-1.40	-0.38	-0.3	245.0	146.7	99.7
July	98.6	1.8158	200.76	-1.94	-0.15	-3.7	240.3	146.5	96.3
August	99.2	1.8021	209.34	0.56	-0.75	4.3	241.6	145.4	104.3
September	101.1	1.7959	216.70	1.94	-0.35	3.5	246.3	144.9	103.5
October	102.9	1.7977	247.34	1.73	0.10	14.1	250.4	145.0	114.1
November	104.3	1.7966	250.96	1.35	-0.06	1.5	253.8	144.9	101.5
December	106.2	1.7865	244.00	1.84	-0.56	-2.8	258.5	144.1	97.2
2006									
January	101.2	1.8018	223.54	1.19	0.85	-8.4	261.6	145.4	91.6
February	101.4	1.8146	230.74	0.18	0.71	3.2	262.1	146.4	103.2
March	101.5	1.8279	231.01	0.09	0.73	0.1	262.3	147.5	100.1
April	103.3	1.8206	261.35	1.80	-0.40	13.1	267.0	146.9	113.1
May	105.8	1.8064	258.21	2.42	-0.78	-1.2	273.5	145.7	98.8
June	105.6	1.7831	263.63	-0.17	-1.29	2.1	273.0	143.8	102.1
July	106.4	1.7690	258.02	0.79	-0.79	-2.1	275.2	142.7	97.9
August	106.0	1.7540	269.03	-0.42	-0.85	4.3	274.0	141.5	104.3
September	106.0	1.7427	276.41	-0.01	-0.64	2.7	274.0	140.6	102.7
October	106.8	1.7405	264.44	0.76	-0.12	-4.3	276.0	140.4	95.7
November	107.9	1.7346	277.69	0.99	-0.34	5.0	278.8	139.9	105.0
December	108.8	1.7242	281.00	0.86	-0.60	1.2	281.2	139.1	101.2

Table A.2 Dynamics of Money Aggregates, 1996-2006

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	End of period; Thous. of GEL											
Money Supply (M3)												
1996	179130	182352	189595	192856	192301	206454	217762	224605	236775	235788	238310	256272
1997	243176	235842	245808	269449	265731	271649	293446	321827	335369	340918	348010	373042
1998	360168	360730	360100	373550	382300	387331	395021	400250	350516	325596	301997	368544
1999	407691	424972	403499	393459	406620	412787	417086	438084	442741	456577	442696	444563
2000	435223	438487	448593	459791	475212	480316	526416	555408	573757	583254	589600	618229
2001	586636	580587	595128	601722	608427	635102	653046	684395	688388	709106	704326	732445
2002	741063	751849	763448	764324	756675	773970	787373	812403	805142	803685	830343	870222
2003	885177	900948	893165	920236	935817	933594	987081	1037299	1062130	1076712	1057537	1068850
2004	1092703	1095957	1131583	1112748	1188718	1196800	1268681	1284762	1334850	1355725	1381493	1521573
2005	1443563	1484314	1512412	1601587	1599309	1643988	1697075	1781527	1824447	1883967	1921281	1924919
2006	1956061	1986757	2023117	2187069	2185567	2307293	2346359	2397622	2448024	2468322	2524549	2689887
Money Supply (M2)												
1996	149344	147969	150571	159069	163770	176181	188960	194209	202038	198290	196162	217952
1997	204375	198114	205068	218372	216193	215563	236258	255768	264456	262691	268286	295211
1998	274307	272108	269700	278447	280172	281710	291125	294238	252170	228784	210335	261137
1999	275327	268188	254089	257195	263252	257955	272894	284803	287994	306215	279651	286136
2000	272035	274880	284063	283051	279868	280678	313145	325065	326988	336439	337334	382069
2001	345017	343040	345167	347291	352497	362502	383386	391908	384437	391500	397910	403839
2002	401134	407300	406329	409786	412393	405126	416481	431042	420826	429934	434912	462398
2003	449558	457238	448274	463945	460599	450672	482733	504174	504982	525660	514012	527559
2004	513561	544126	552862	546482	571697	597948	627454	677741	716231	718157	736892	847169
2005	787580	809440	818036	861120	847809	894495	921353	972659	987143	1018412	1043039	1071039
2006	1055535	1057217	1092520	1147523	1158490	1258674	1255728	1260433	1279668	1247729	1242778	1392849
of which: Money outside Banks												
1996	120334	118178	120109	123182	126115	130455	143048	152609	157669	155338	152845	176757
1997	160429	157952	158293	171313	166394	168656	184063	194839	202402	205783	209252	239865
1998	214698	210889	211903	219934	221633	220948	233783	230482	198909	183671	168835	212194
1999	226883	220654	206905	212914	214659	211627	226296	240103	240913	259114	234348	243997
2000	227532	225112	233645	241233	231068	234337	256822	262908	269116	266667	267861	314981
2001	290253	290543	294918	297770	297558	300509	322334	330428	321782	330360	330480	348850
2002	344638	352034	346286	347516	346736	345150	351043	362621	355732	359237	365916	390791
2003	365057	376396	372834	390263	382292	374885	398085	416449	411735	434622	430534	441536
2004	416333	422559	436985	436871	451380	470243	480329	510526	541940	539512	542182	615993
2005	577768	601686	613121	644084	628246	640135	668163	686582	689614	702863	688231	736284
2006	685795	692108	712598	717900	715217	733341	749754	756053	776625	758866	743278	827357
Deposits in National Currency												
1996	29010	29791	30462	35887	37655	45726	45912	41600	44369	42952	43317	41195
1997	43946	40162	46775	47059	49799	46907	52195	60929	62054	56908	59034	55346
1998	59609	61219	57797	58513	58539	60762	57342	63756	53261	45113	41500	48943
1999	48444	47534	47184	44281	48593	46328	46598	44700	47081	47101	45303	42139

2000	44503	49769	50418	41819	48800	46341	56323	62157	57872	69772	69473	67088
2001	54765	52497	50249	49521	54939	61993	61052	61481	62656	61140	67430	54989
2002	56438	55209	59950	62102	65608	59897	65357	68330	65007	70556	68912	71563
2003	84468	80807	75384	73617	78232	75677	84570	87628	93152	90871	83342	85959
2004	96745	120949	115601	109437	119885	127221	146540	166493	173541	177681	193787	230356
2005	208766	206969	204225	216340	219076	253766	252823	285774	297004	315086	354117	334552
2006	369333	364778	379698	429180	442825	525086	505497	503938	502672	488260	498978	565143
Deposits in Foreign Currency												
1996	29786	34383	39024	33787	28531	30273	28802	30396	34737	37498	42148	38320
1997	38801	37728	40740	51077	49538	56086	57188	66059	70913	78227	79724	77831
1998	85861	88622	90400	95103	102128	105621	103896	106012	98346	96812	91662	107407
1999	132364	156784	149410	136264	143368	154832	144192	153281	154747	150362	163045	158427
2000	163188	163607	164530	176740	195344	199638	213270	230343	246769	246815	252266	236160
2001	241618	237547	249961	254431	255930	272600	269660	292487	303951	317606	306416	328606
2002	339929	344549	357119	354538	344282	368844	370892	381362	384316	373751	395431	407825
2003	435618	443711	444891	456291	475218	482922	504348	533125	557149	551051	543526	541291
2004	579142	551830	578721	566266	617021	598852	641227	607020	618619	637567	644600	674405
2005	655983	674874	694376	740467	751501	749493	775722	808868	837303	865555	878242	853880
2006	900526	929540	930597	1039547	1027077	1048619	1090631	1137189	1168356	1220593	1281770	1297038

Figure A.1 Impulse-Response Relationships of Endogenous Variables

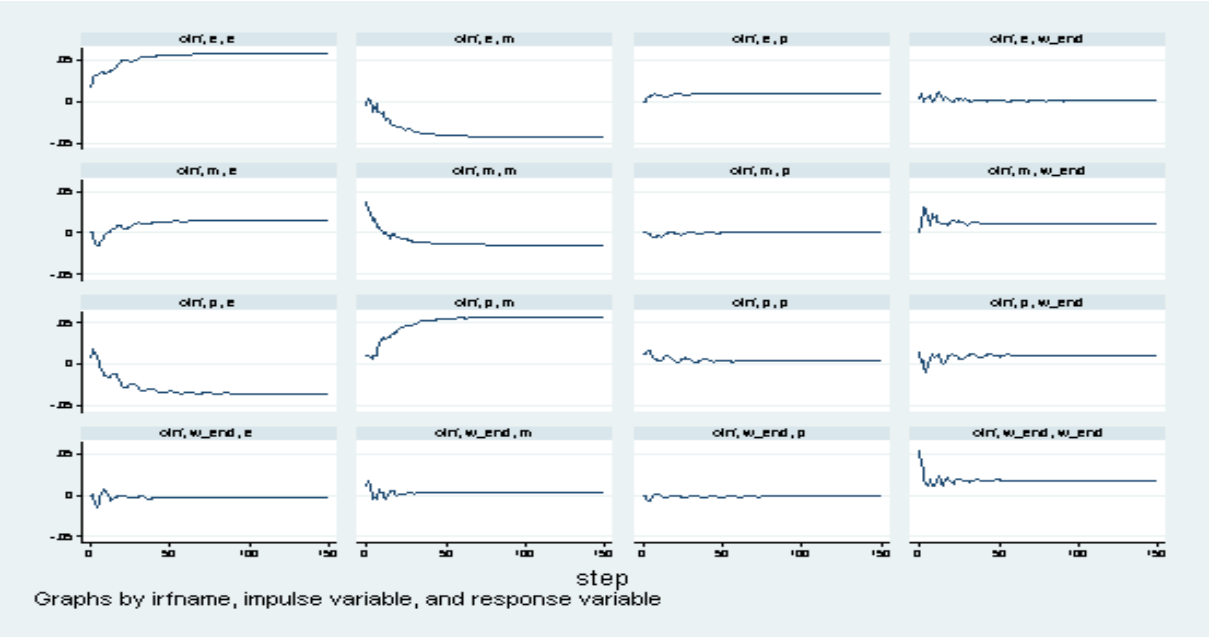

Table A.3 Response of Inflation

Horizon	CPI	Exchange rate	Nominal Wage	Money Supply
0	0.011768	0	0	0
12	0.006973	0.006219	-0.001912	-0.003975
24	0.005155	0.008795	-0.002218	-0.002373
36	0.004457	0.009306	-0.00224	-0.000828
48	0.004048	0.00957	-0.002104	-0.000337
60	0.003839	0.009755	-0.001993	-0.000083
72	0.003705	0.009849	-0.001917	0.000059
84	0.003615	0.009899	-0.001858	0.000139
96	0.003552	0.009929	-0.001817	0.000181
108	0.003507	0.009948	-0.00179	0.000202
120	0.003477	0.00996	-0.001772	0.000213
132	0.003456	0.009968	-0.001761	0.000219

Figure A.2 Variance-Decompositions for Endogenous Variables

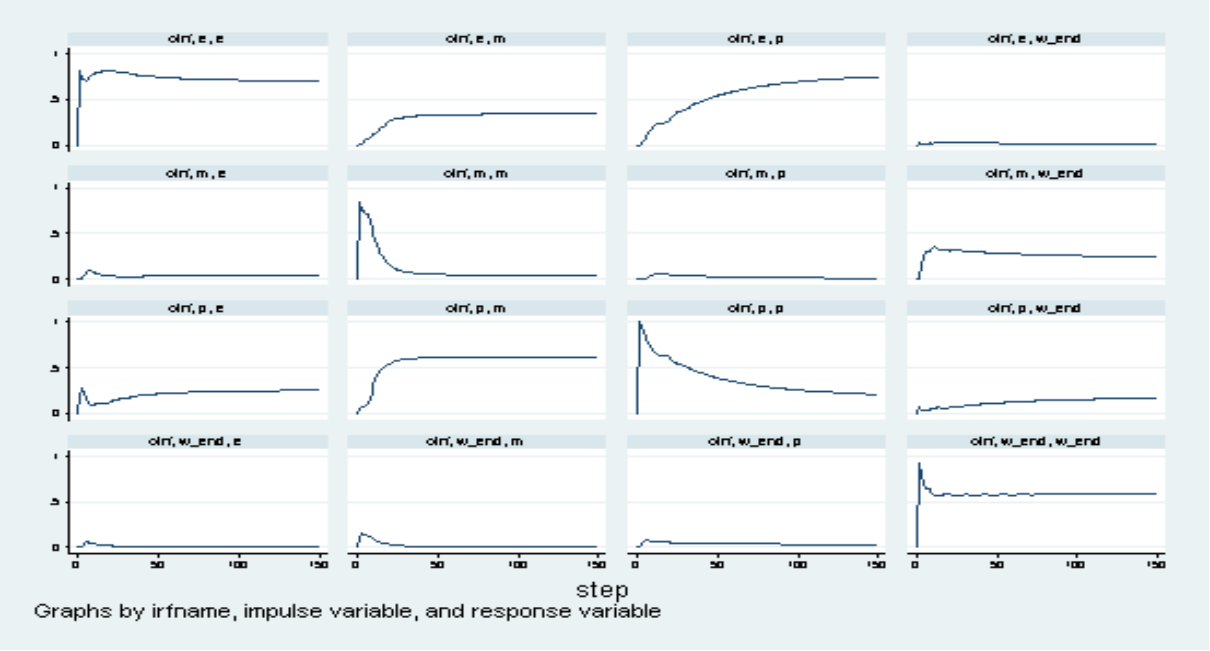

Table A.4 Variance-Decompositions for Endogenous Variables

Horizon	CPI	Exchange rate	Nominal Wage	Money Supply
0	0	0	0	0
12	0.645874	0.237651	0.058823	0.057651
24	0.552118	0.350623	0.050303	0.046956
36	0.463302	0.4555	0.044715	0.036483
48	0.395383	0.534343	0.041481	0.028792
60	0.34634	0.590936	0.039049	0.023675
72	0.310249	0.632423	0.037243	0.020085
84	0.282988	0.663703	0.035864	0.017445
96	0.261846	0.687939	0.034788	0.015427
108	0.245044	0.707191	0.033928	0.013837
120	0.231403	0.722818	0.033228	0.012551
132	0.220121	0.735741	0.032648	0.01149