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DISSERTATION PAPER

DETERMINANTS OF INFLATION IN ROMANIA

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Abstract

Inflation rates in Countries in Central and Eastern Europe have strongly declined in recent years relative to the beginning of transition. By 2001, annual inflation rates reached single digits in all accession countries excepting Romania.

This paper reviews the inflation dynamics in Romania, aiming to shed new light on its determinants. The main findings are that relative price adjustment, inflation variability, wages, and exchange rate depreciation are the most important factors that explain the inflation dynamics. Money growth has no influence on inflationary pressures.

Inflation continues to be a major policy concern given the high risk of inflationary spikes and the country prospect to join the European Union.

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A. Introduction

The countries in Central and Eastern Europe (CEECs) are in process of rapid transformation. During the last twelve years, economies of these countries have experienced significant changes in economic structure and economic policies pursued. First of all, there is the ongoing process of transformation from the former planned economy toward a market economy. This process is currently progressed so far that the institutional structures in these countries are increasingly resembling those in other market economy.

All of the transition economies have seemingly stabilized their economies, built up the institutions required for the functioning of a modern market economy, privatized the greater part of their productive assets, restructured their industries and integrated into the global economy. They also have filed applications to become member of European Union. On 31 March 1998, accession negotiations were started with six applicant countries - Hungary, Poland, Estonia, the Czech Republic, Slovenia and Cyprus. On 13 October 1999, the Commission recommended Member States to open negotiations with Romania, the Slovak Republic, Latvia, Lithuania, Bulgaria and Malta.

The European Central Bank points out that: “Even though the fulfillment of the Maastricht convergence criteria – including price stability, the sustainability of public finance, exchange rate stability in the framework of participation in the exchange rate mechanism and the convergence of interest rate – is not mandatory for European

Union accession, accession countries should have macroeconomic programmes consistent with those prevailing in the Euro area in their policy agenda." (ECB, 2000, p 44). Inflation is extremely important according to the EU policy agenda: "Accession countries need to continue to implement monetary policies geared towards achieving and maintaining price stability and to support this process with prudent fiscal policies and adequate structural reforms". (ECB, 2000, p 49).

Thus, an important task for the policymakers in the accession countries is to lower the inflation rate and, at the same time, to rise output per capita to a level approaching EU average. In recent years, the inflation rate in accession countries has fallen drastically relative to the beginning of transition (from double or three digits in the earlier years of transition to single digits in 2001). Although all transition countries have made a substantial progress in lowering inflation over time, inflation continues to be an issue of key policy concern. This is due to persistent character of inflation rates and to the remaining risks of inflationary spikes. Moreover, as have been shown before, the inflation developments will be at the core of the assessment of convergence with the euro area, given the countries' prospects to join EU.

There is a general agreement that the costs of inflation go beyond the economic sphere toward the social and political life. Anticipated or unanticipated, inflation affects the behaviour of economic agents and the allocation of economic resources.

Anticipated inflation implies three types of costs. First, there are "shoe leather costs". Second, inflation implies that firms adjust their prices in line with inflation every time the benefits exceed the cost from this adjustment ("menu costs"). Third, the costs of inflation derive from a nominal base tax system generating sometimes a greater real fiscal burden. The first two situations imply costs for society because scarce resources are used for unproductive destinations. The third situation implies distortions introduced by inflation in the allocation process of economic resources.

When the inflation is not anticipated, three types of costs can arise. First, inflation distorts the capacity of price system to achieve an efficient allocation of resources in economy because the relative prices become hardly observable by economic agents. Second, financial resources and risks are redistributed in an undesirable fashion between debtors and creditors, between public and private sector, and between young and old peoples. Third, the incertitude the agents have to cope with and the resources used for this are greater when the inflation is greater.

Given the cost and “the sand effects” of inflation, there is a great agreement that price stability is the primary objective of monetary policy. Price stability means a situation with low and stable inflation (2 to 3 percent a year). A low positive level of inflation can have “lubrifiant effects” on economy given the nominal price and wage rigidity (because of imperfect information, and sticky or staggered price and wages), the lower bound of zero on nominal interest rate as an instrument of monetary policy, the adverse effects of deflation on financial system, and the errors in correctly measuring the price indexes.

This study examines the recent developments in inflation and its key determinants in Romania. The paper analyses the relative impact of monetary, labour, and foreign exchange sectors, emphasizing the role played by relative price adjustments and administrative price decisions. The interaction of inflation with these variables is empirically examined in the context of the vector autorregresion model (VAR), in which cointegration relationships are used to derive deviation of the variables from their steady-state levels as potentially inflationary pressures. The main findings are that inflation in Romania was largely due to the relative price adjustment process, excess wages relative to their long run level of equilibrium, and exchange rate depreciations. The monetary sector appears not to have exerted an important influence on inflation in Romania.

The paper is organized as follows. Section B presents an overview of main sources of inflation in transition economies. Section C discusses some theoretical aspects related to the equilibria in the money and labour market, and to the relative price adjustments in transition economies. Section D presents the recent evolution of prices in Romania and the modelling framework, rendering useful information about key determinants of inflation in this country. Section E concludes the paper, pointing out some policy implication of the inflationary process in Romania.

B. Sources of Inflation in Transition Countries

In most countries, the management of monetary parameters (inflation included here) is the responsibility of the central bank as content of monetary policy. The central bank has large prerogative in pursuing price stability as the primary objective of monetary policy. While it is generally accepted that the long-run effect of monetary policy is to be found in the movements of prices and not of real output, there are important short-term links between the real and monetary spheres (especially in transition economies).

Given the moderate and persistent character of inflation in transition countries, it is particular important to better understand the extend to which inflation is a demand driven phenomenon so that the policies aimed at limiting discretionary demand can be used to bring down inflation and stabilize the economy. On the other hand, is it also important to find out the role that supply-side of economy has in maintaining inflation at a moderate level. Understanding the forces underlying inflation can help policymakers become better prepared for full membership in the EU and also allow them to design credible policies before they establish any formal link to the euro.

There are several possible causes of inflation in an open economy, and no single cause is adequate to explain the data. Therefore, models of inflation that attempt to encompass several theories have a better chance of empirical success.

Studies of inflation in transition economies have generally focused on a combination of supply or cost-push pressures, demand-pull factors, and structural changes or rigidities. The key cost push elements identified were wages and currency depreciations. Demand pull factors have often been related to monetary expansion to finance fiscal deficits, or caused by large, nonsterilized capital inflows. Finally, structural factors have included price deregulations and general supply-and demand-induced relative price changes, which have had an inflationary impact in the presence of downward nominal rigidities.

Monetary influences on inflation in transition countries. In mature market economies, the stance of monetary policy is typically represented by the policy interest rate. In a relatively closed economy, the main channels through witch monetary policy affect inflation are aggregate demand and expectations. In a relative open economy, additional channels are (in order of speed) a (very fast) direct exchange rate channel for the transmission of monetary policy to inflation via the price of imports, a real exchange rate effect on aggregate demand via the relative price of foreign and relative goods, and the impact of the exchange rate on the price of domestically produced via the price of imported intermediate inputs and wages.

In transition countries, the policy channels relied on by central banks in mature market economy can be rendered less effective, given the situation of monetary institution, including capital markets and the banking system. In the state sectors, firms have continued to run loses that have been sometimes covered by government subsidies, sometimes by loans from banks and sometimes by other enterprises (arrears). The growing indebtedness and payments arrears have had their counterparts in the monetary sectors, commercial banks in these countries facing a number of problems. The existence of large problem loans had led monetary authorities to maintain high spreads between lending and borrowing rates so as to boost banks' profits and thus their ability to build up their reserves. The weaknesses of the credit market has been exacerbating by the fact that capital markets have not provided a viable substitution. Owing the highly interest inelastic lending policies of banks burdened by non-performing loans, a long period of time the principal instruments of monetary policy was the direct instruments. The interest-rate-based monetary policy and the utilization of indirect instruments (open market operations) started been used in the last years approaching these countries by the monetary policy pursued by the central banks in industrialized countries and EU, but the transmission mechanism of monetary policy was complicated by the underdevelopment of financial markets.

Fiscal policy influences on inflation. While monetary policy, at least measures by real interest rates, has been tight, the same cannot be said for the trend in fiscal policy. Monetary policy has had to bear the brunt of the stabilization effort while governments have been relatively unwilling to make unpopular decision to reduce fiscal deficits, these deficits being a potentially source of inflation (Brada, Kutan 1999).

Exchange rate impact on inflation in transition countries. The economies of transition countries are highly open and integrated into a global financial system with few restrictions of capital flows. These countries maintain a wide diversity of exchange rate regimes, from currency board arrangements (e.g. Bulgaria, Estonia) to floating regimes (Czech Republic and Poland since April 2000), while Hungary still pursue a pre-announced crawling peg exchange rate regime. The great openness and the fragile financial systems have exposed these countries to volatile capital flows and have complicated the conduct of monetary policy. For countries with fixed exchange rates or pre-announced crawling peg exchange rates, the high interest rates led to significant inflows of short-term capital. In order to avoid inflationary pressures from the inflows of foreign capital, central banks have engaged in sometimes-massive sterilization. Not only has this sterilization been costly for the central banks, but it also has not been entirely successful, so that targets for monetary growth have often been exceeded, and interest rate have remain high in order to prevent sudden outflows of foreign capital. The use of exchange rate as a nominal anchor for monetary policy in order to bring down effective inflation and inflation expectation was not a riskless and costless strategy.

Judging the impact of openness of transition countries implies also taking into account the Balassa-Samuelson effect on inflation. Most of Central Europe's transition economies have experienced a very rapid productivity growth, especially in their industrial sector. Productivity growth in the open or traded goods sector is usually higher relative to that of the closed or non-traded goods sector. Given that wages tend to be roughly the same across sectors, faster productivity growth in the tradable sector pushes up wages in all sectors. This in turn increases the relative prices of non-tradable goods. In fact, if productivity growth in one country is higher than in the other, the inflation will be higher in the former. That is the main reason why the CPI based real exchange rate is likely to appreciate in the long run. The Balassa-Samuelson theory recalls into question the well-known purchasing power theory (PPP). Provided that the law of one price, or commodity arbitrage, does hold in the long term, a relation can be established between the variation of nominal exchange rate and that of price level, so as the real exchange rate should be stationary. If international prices exercise an upward pull on domestic prices to reestablish purchasing power parity, an under-evaluation of exchange rate and inflationary pressures result.

Wage influences. Because of poor governance and great power of the unions in bargaining, nominal wages have grown more rapidly than that the CPI, so that real wage grown steadily for a long period of time. On the other hand, productivity gains have been alleged to be lower than the gains in real wage. So, a potentially wage-pull inflation has been arose.

Relative prices adjustments and their impact on inflation in transition countries. The relation between inflation and relative price variability can be of particular interest in the context of transition economies. The transition from plan to market implied a comprehensive price reforms. A characteristic of transition economies is that their relative prices were badly distorted. Relative prices have undergone dramatic realignments in the wake of price liberalization, removal (or sharp reduction) of subsidies and unification of exchange rates. Those realignments have substantially increased the variability of inflation rates of individual groups of commodities comprising the consumer price index. The prices having to do with government and municipal services, utilities, and energy were not fully liberalized during the initial price liberalization. Instead, government either froze these prices or adopted a program of phased liberalization, in which controlled prices were increased in ad-hoc manner until they reached equilibrium, and then decontrolled, or were increased on a formula so that they outpaced inflation, moving to equilibrium at a controlled pace. Such a price setting pattern leads to the persistence of inflation because some of the items in the CPI basket have to go at rates that exceeded inflation rate.

Empirical studies of inflation in transition economies have been typically done in an ad hoc fashion, examining the long run equilibrium relationship between variables and deriving short run implications on inflation of the disequilibria in these variables.

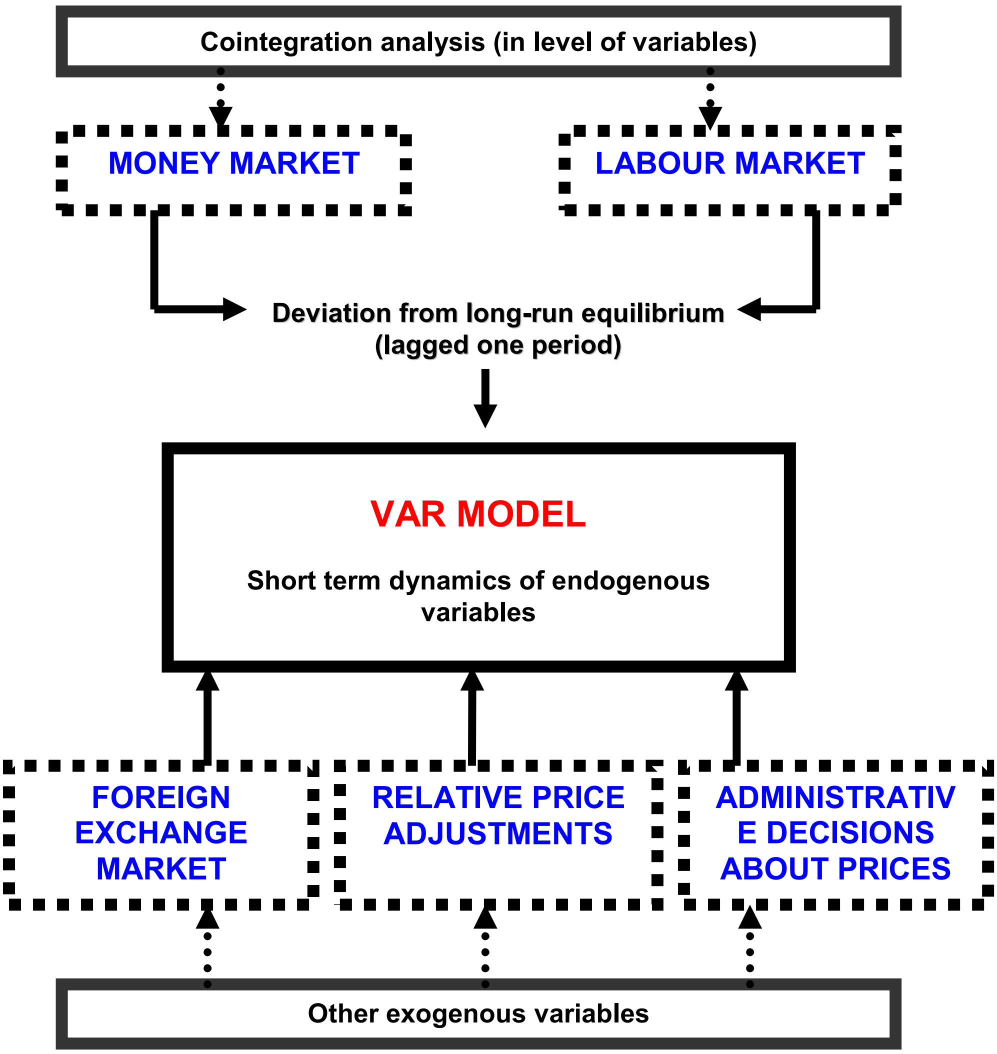
Coorey, Mecagny and Offeredal (1996, 1997) have realized a comprehensive study on **inflation in transition economy**, with a special attention paid to the role of relative price adjustments. They found that the money and wage increases are the most important determinants of inflation and that there is a considerable degree of inflation inertia (elastic ties range from 0.2 to 0.4). on the other hand, real exchange rate changes were found to be less significant. The effects of relative price adjustments were found to be larger at higher level of inflation and in the initial stages of inflation.

We also quote other recent studies on inflation for transition economy which emphasize the role of wages and real exchange rate in determining inflation in these countries: Pujol and Griffits (1996) for Poland, van Elkan (1996) for Hungary, Dayal-Gulati (1996) for Hungary, Laursen (1998) for The Czech Republic), Brada and Kutan (1999) for Poland and Hungary, Rother (2000) for Albania, Moore (2000) for Romania, Dibooglu and Kutan (2001) for Hungary and Poland, Beaumont (2001) for Hungary, Tzanninis (2001) for Czech Republic, Golinelli and Orsi (2001) for Czech Republic, Hungary and Poland, Kuijs (2002) for Slovakia.

C. Theoretical considerations

This study presents an econometric model of inflation and its determinants in Romania. The model examines the structure of various markets from which inflation is usually assumed to originate (money, labour and exchange rate market). Two long-run equilibria are specified for money, respective labour market. Then the model is set up containing the two error correction terms and other key variables for inflation (relative price adjustments, administrative decisions, inflation variability). We use this approach because the deviation of inflation from its long-run equilibrium level does not always reflect disequilibria only, but also cyclical or temporary factors.

Figure 1. The basic scheme of empirical analysis



The objective is to derive the determinants of inflation by examining each market individually, and subsequently find how disequilibria in these markets affect inflation when cyclical or temporary factors are also taken into account.

C.1 The long run equilibrium on the money market

According to quantity theory of money, in the long-run inflation is a monetary phenomenon. Consequently, long run price homogeneity is assumed, while money is suppose to be neutral in the long run. In the short-run, the relationship between money and inflation is a much controversial one. In order to derive and measure inflationary pressures arising from monetary sector of economy, we need to analyse the long run relationship between money, output and its opportunity cost. So a demand relation for real balances is derived, excess money balances being expected to affect inflation positively.

Standard theory of money demand predicts that money may be demanded for at least two reasons. On the one hand money is held for transaction purposes (to smooth differences between income and expenditures streams). On the other hand holding money is part of the optimal portfolio selection. The long run demand for money can be specified in the following form (Ericsson 1998):

$$M^d / P = f(Y, R)$$

where M^d is nominal money demand, P is the price level, Y is a scale variable (the real GDP), and R is a vector of returns on various assets. The transaction motive of holding money is represented by Y, while R is used for portfolio choice variables. The function $f(\cdot)$ is increasing in Y, decreasing in those elements of R associated with assets excluded from M, and increasing in those assets included in M. A log-linear form of the money demand is specified as:

$$m^d - p = \beta + \beta_y y + \beta_{ri} r^i + \beta_{ro} r^o + \beta_\pi \pi$$

where lower cases m, p, y indicates logarithms of M, P, and Y, while the r^i is the rate of return on money itself (expressed in level), r^o is the rate of return on assets outside of money (expressed in level), and π is the inflation rate (as measure of the opportunity costs of holding money relative to real assets). The coefficient β_y represents the income elasticity of the demand for money and it should show a positive sign because the transaction demand for money increases when income (real GDP) increases. It takes value of 0.5 according to Baumol-Tobin theory of money demand, and should equal unity corresponding to the quantity theory. In empirical investigations using broad monetary aggregates there are often found values that exceed unity (explained by other factors that are not explicitly modelled, like financial innovation). The coefficient β_{ri} reflects the semi-elasticity of money with respect to return on money itself (r^i) and must be positive ($\beta_{ri} \geq 0$). The coefficient β_{ro} reflects the semi-elasticity of money with respect to return on assets outside of money (r^o) and should be negative ($\beta_{ro} \leq 0$). The coefficient β_π should be negative because goods are substitute to money ($\beta_\pi \leq 0$).

C.2 The long run equilibrium on the labour market

We will make the assumption that the labour and product market are imperfectly competitive. In this framework, we can discuss explicitly how wages and prices are set. The imperfect market assumption implies that wages are set either through collective bargaining between unions and employers or as the result of employer strategies, while firms have also power to chose the price the goods will be sell for.

With bargaining negotiations, unions, on behalf of their members, are concerned with real wage. Given the fact that the negotiations take place on the basis of expectations about the price level that will prevail over the period of the wage contract, the bargained real wage depend on a multitude of factors, the rate of unemployment being of particular interest. However, the most important thing is the effective real wage (real wage implied by the existing aggregate price level).

Under perfect competitions, the profit maximization condition requires the real wage to be equal to the marginal productivity of labour, and marginal cost to be equal to exogenous price. Under imperfect competition, profit maximization implies that marginal cost is mark-up to form the price (endogenous variable). The same time, labour productivity is also marked-up to form the real wage. Empirical evidence suggests that the mark-up on labour productivity is not a constant, but declines as employment rises.

The simplest form of the normal cost (the cost at a normal level of capacity utilization) or mark-up pricing rule used by a monopolistic firm is

$$P = (1+\mu)\frac{W \cdot E}{Y} = (1+\mu)\frac{W}{LP},$$

where the price P is set by marking-up normal unit labour cost (W/LP; W-nominal wage per worker, E-number of employees, Y- output, LP-labour productivity) by a percentage, μ. If we let $m = \mu/(1+\mu)$, we have:

$$P = m \cdot P + W/LP$$

$$\text{Price} = \text{Profit per unit} + \text{cost per unit}$$

$$W/P = (1-m) \cdot LP$$

C.3 Relative price changes and inflation

The economists turn their attention to the relationship between inflation and relative price variability after the oil shocks (since the early 1970s). It has been observed that, for longer periods of time, the general price level and the variability of individual inflation rates have moved in the same direction, and that their peaks often coincide. The nature of the association and its causation are not very clearly, the different theories linking aggregate price changes to relative price variability following in three broad categories: increase relative price variability is a cause for increased inflation, increase inflation is a cause for increased relative price variability, the relationship is caused by macroeconomic disturbances that raise both the inflation rate and increase relative price variability.

There are two recent, influential models that predict the causality running from relative price variability to aggregate price level. Ball and Mankiw (1995) offer sound justification for including skewness of the distribution of relative price changes as an explanatory variable for inflation. When the distribution of shocks is skewed to the right, aggregate price level may rise because menu costs imply that firms react to more positive shocks that they do to negative. In this model, the inflationary bias occurs because the shocks driving relative price adjustment are asymmetric (positive skewness). The same time, Ball and Mankiw (1994) explain the mechanism through which inflation is influenced by the variance of the shocks. When there is a positive trend inflation that all agents have to count for, positive shocks cause firms to adjust quicker and more fully than negative shocks. This is because firms affected by a negative shock putting downward price pressure have the incentive not to pay menu costs simply waiting with unchanged nominal prices until inflation does the desired erosion to the relative price of their product. In this framework, the inflationary bias occurs only with positive trend inflation, even the shocks driving relative price adjustment are symmetric. The introduction of positive trend inflation is very important in the context of transition economy. During periods of high price dispersion within sectors (especially if few unusually large price increases dominate the process) aggregate price level tends to rise more rapidly (Wozniak 1999).

The transition from a centrally planned to a market-driven economy necessitates a new structure of relative prices given the large existing distortions. Both symmetric and asymmetric types of shocks are likely to occur. There are at least four reasons for asymmetric, relative price adjustments during the transition process (Rother 2000):

- the cost-recovery hypothesis: the relative prices for capital-intensive services may increase only slowly from their depressed levels during central economic planning, inducing a sequence of positive price adjustment shocks;
- relative wages of high-skilled workers may be slow to adjust to equilibrium;
- insufficient adjustment of measured prices for quality improvements may result in observed relative price changes exceeding actual ones;
- the Balassa-Samuelson effects leads to a relative increase in the price of nontradables if productivity gains in that sector fall behind those in the traded goods sector.

The empirical analysis of the relation between relative price variability and inflation is complicated by the many ways of measuring relative price variability. It can be measured in terms of variance or/and skewness. Also, a choice has to be made whether price changes should be weighted by their contribution to CPI or be unweighted. The same time, the measured variability depends on the degree of disaggregation of the price data, and the way the weights are used. The commonly used indicators are the Theil variance and the corresponding skewness measure. The Theil variance is defined as the weighted sum of squared deviation of individual inflations rates from the weighted overall inflation rate. The unweighted variance is the unweighted sum of such deviations from the unweighted average commodity inflation rate, divided be the number of goods and services in the price index. These measures reflect more accurately relative price shifts.

Theil variance: $T\,\mathrm{var} = \sum_{i=1}^{n} w_i \left(\pi_i - \overline{\pi}\right)^2$; Theil skewness: $Tsk = \dfrac{\sum_{i=1}^{n} w_i \left(\pi - \overline{\pi}\right)^3}{\left[\sum_{i=1}^{n} w_i \left(\pi_i - \overline{\pi}\right)^2\right]^{\frac{3}{2}}}$

where $\overline{\pi} = \sum_{i=1}^{n} w_i \pi_i$.

D. Empirical Analysis

D.1 Historical perspective

In the last twelve years, the transition of Romania toward a market-based economy has been a painful process. Compared with other accession economies in Central and Eastern Europe, this process was slow and uneven. Limited progress in structural reform and stop-and-go macroeconomic policies contributed to low growth, and high and variable rates of inflation. The performances of Romanian economy were among the weakest of transition economies in the region because of the difficult inheritance from the pre-transition period, but also to the lack of consistent policies.

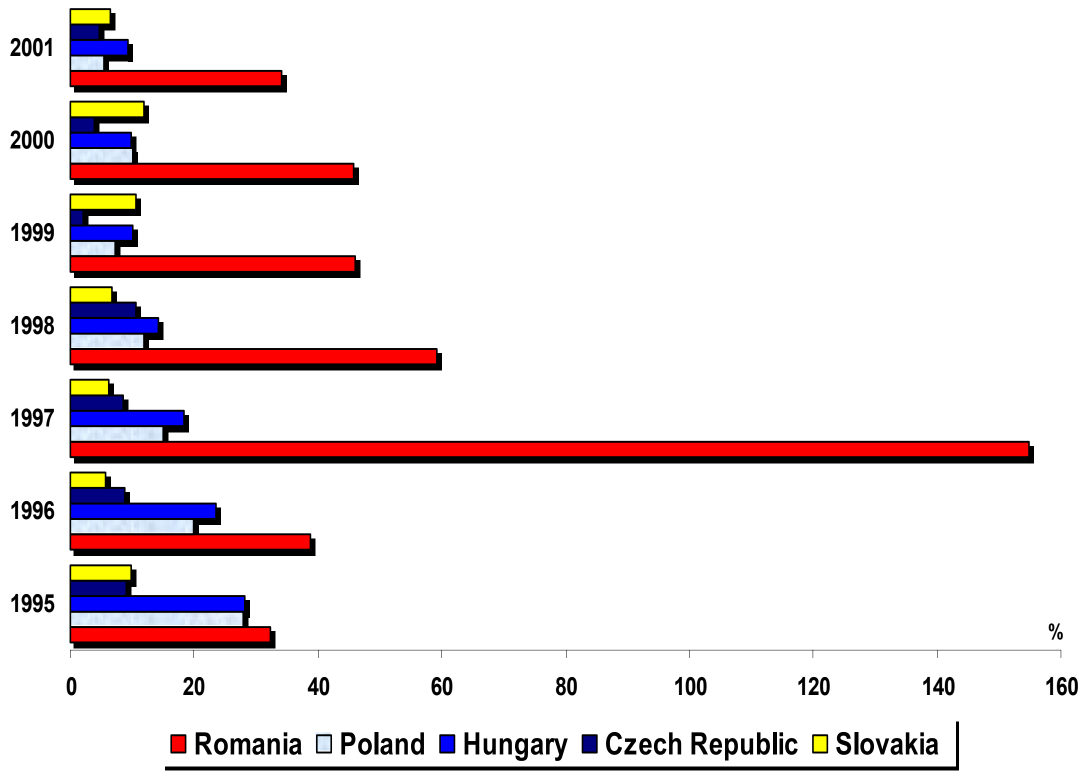
Table 1. Real GDP and inflation in CEE transition economies (annual percentage change)

Years	1995	1996	1997	1998	1999	2000	2001	1995	1996	1997	1998	1999	2000	2001
	Real Gross Domestic Product (annual change in %)							Consumer Price Index (average annual change in %)						
Romania	**7.1**	**3.9**	**-6.9**	**-5.4**	**-3.2**	**1.6**	**5.3**	**32.3**	**38.8**	**154.8**	**59.1**	**45.9**	**45.7**	**34.1**
Poland	7	6	6.8	4.8	4.1	4.1	1.5*	27.8	19.9	14.9	11.8	7.3	10.1	5.5
Hungary	1.5	1.3	4.6	4.9	4.5	5.2	3.8	28.2	23.6	18.3	14.3	10.0	9.8	9.2
Czech Republic	6.4	4.8	-1.0	-2.2	-0.8	3.1	-	9.1	8.8	8.5	10.7	2.1	3.9	4.7
Slovakia	6.7	6.2	6.2	4.1	1.9	2.2	-	9.9	5.8	6.1	6.7	10.6	12	6.5
Bulgaria	2.9	-10.1	-7.0	3.5	2.4	5.8	-	62.1	123	1082.9	22.3	0.3	10.1	7.4

Source: National Bank of Romania, Annual Report 2000; IMF Statistical Appendix for selected countries.

As it can be seen from Table 1 and Figure 2, inflation in Romania remains the highest in the region, with a peak in 1997 (154.8 percent a year). The dramatic surge in early 1997 was associated with the liberalization of agricultural and energy prices. Although the inflation rate fell after the initial surge, the persistence of inflation is very clearly and it is also very important given the disinflation policy pursued by policymakers. Understanding the causes for the persistence of inflation could help establish a correct pace for disinflation process with all cost implied taken into account.

Figure 2. Inflation in CEE transition countries (annual average percentage change in CPI)



In analysing inflation developments one can use many measures such as Consumer Price Index (CPI), Producer Price Index (PPI) or GDP deflator. The consumer price index remains the most used because it reflects the changes in prices for final goods in a representative basket of consumption and so it can be used to establish the evolution of living standards for large parts of the population. Beyond this advantage, the CPI is easily understood by the public and is released on monthly base. The GDP deflator takes into account the changes for all final goods and his structure is a variables one. The producer price index is often used as an indicator of changes in non-traded good prices versus traded goods prices (it used so to derive the real effective exchange rate).

Also one would ideally look at “underlying” inflation defined as changes in consumer prices excluding changes in regulated prices and indirect taxes (and potentially also food prices which are more supply determined and volatile), as well as reversible or discrete effects of exchange or interest rate changes. Such an “optimal” measure of inflation would be the best indicator of the stance of macroeconomic policies. Or one may look at “core inflation”, which excludes only the effect of changes in regulated prices and indirect taxes (and potentially food prices).

Figure 3. Inflation, average nominal net wages in industry, and ROL/USD exchange rate (twelve-month ended percentage change)

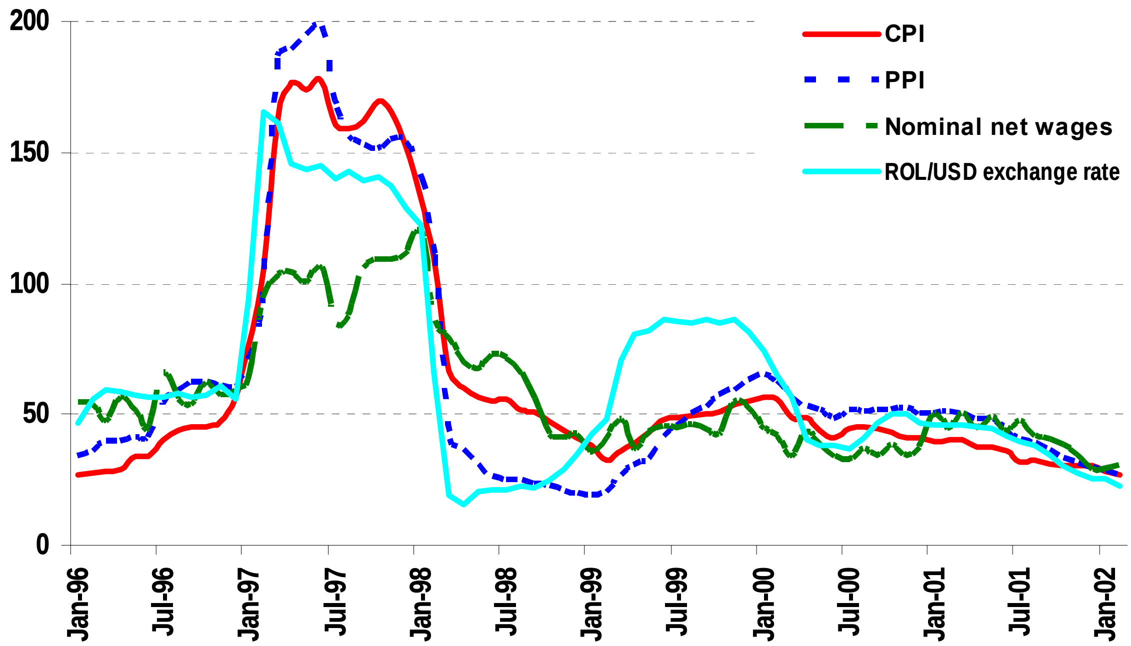


Figure 3 shows the evolution of inflation (measured by CPI and PPI) and of the other two important prices in every economy: average nominal wage in industry, and ROL/USD exchange rate. First, all the variables were very volatile between 1996 and 2002, especially in 1997 and 1998, although this volatility has decreased in the last year. Second, they have mostly moved broadly in line with each other. Third, in the short run there were large discrepancies in this evolution. For instance, although the evolution of CPI and PPI was almost the same all the time, 1998 is a notable exception, the increase in PPI being lower that increase in CPI. This is consistent with the real appreciation of national currency (in 1998 the CPI inflation were greater comparative to ROL/USD depreciation). So, different evolutions in nominal level for variables in the short run imply changes in real levels and effective shocks for real economy.

D.2 Data issues

Table 2. Variables definition and transformations

Label	Description
CPI	Consumer Price Index (December 1995 = 1)
M2X	Broad nominal ROL monetary aggregate M2 (includes currency outside banks, demand deposits, household savings, and time and restricted deposits)
M2XR	Broad real ROL monetary aggregate M2 (M2ROLN deflated with CPI)
M2XRSA	Broad real ROL monetary aggregate M2 seasonally adjusted (with Tramo/Seats)
M2R	Broad real monetary aggregate M2 (M2ROL + residents' currency deposits in foreign currency in ROL equivalent and deflated by CPI)
Y	Industrial production index (volume index, December 1995 = 1)
YSA	Industrial production index seasonally adjusted (with Tramo/Seats)
DR	Nominal deposit rate applied by banks to non-bank customers (% per year)
WAG	Monthly average net nominal wage and salary earnings in industry (Index December 1995 = 1)
WAGR	Net real wage and salary earnings in industry (Index December 1995 = 1)
EMPL	Number of employees in industry (Index December 1995 = 1)
LP	Labor productivity in industry (Index December 1995 =1; ratio between index of Industrial production and index of number of employees in industry $WP = Y/EMPL$)
EXUSD	Nominal exchange rate between ROL and USD (monthly average; national currency for one unit of foreign currency ROL/USD)
EXUSDR	Real exchange rate between ROL and USD (based on CPI)

Remark : Lxyz denotes the natural logarithm of xyz variable (for instance, LCPI = ln (CPI))
DLxyz denotes the first difference for Lxyz (for instance DLIPC denotes first difference for LIPC (DLIPC (t) = LIPC(t) - LIPC(t-1) and it is the inflation rate between t-1 and t)

Data sources: National Bank of Romania, Annual reports 1999, Annual Report 2000, and Monthly Reports 1998-2002
National Institute of Statistics, Monthly Statistical Bulletin on Prices 1996-2002

This model of inflation for Romanian economy is based on monthly data for 1996:01 - 2002:02. Even there are monthly observations for most of the economic variables, the data reflect problems encountered in all transition economies: short statistical series and limited information content. The ongoing structural transformation of the economy implies structural breaks in time series and makes difficult to capture stable relations in data. So, given the limited number of available quarterly observations (or annual observations), this study is carried out using monthly series. However, the monthly frequency of data does not always improve the power of statistical tests that are used.

Table 3. Descriptive statistics for used variables (sample 1996:01 – 2002:02, 74 observations)

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skew.	Kurt.	Jarq.-Bera	Prob.
LM2XR	9.22	9.18	9.62	8.99	0.18	1.02	2.89	12.97	0.00
LM2XRSA	9.22	9.15	9.61	9.01	0.18	1.10	3.01	14.87	0.00
LY	-0.05	-0.06	0.22	-0.32	0.13	0.13	2.19	2.24	0.33
LYSA	-0.05	-0.04	0.19	-0.26	0.12	0.21	2.06	3.26	0.20
DR	38.95	38.10	96.60	22.75	14.22	2.37	9.73	209.14	0.00
DLEXUSD	41.09	25.54	394.57	-31.48	61.31	4.33	23.64	1544.87	0.00
LLP	0.13	0.13	0.40	-0.10	0.13	0.11	2.09	2.74	0.25
LWAGR	-0.22	-0.25	0.06	-0.37	0.11	1.24	3.95	21.58	0.00

D.3 Estimation of the long run relationship for money demand

In this section we are looking for a stable long run relationship for money demand. To test for the presence of long run equilibrium relation we use the Johansen procedure. First, the choice of appropriate indicators is concerned. Second, the statistical properties of these variables are analysed. Third, estimation results are presented, and, finally, we conclude.

The choice of variables

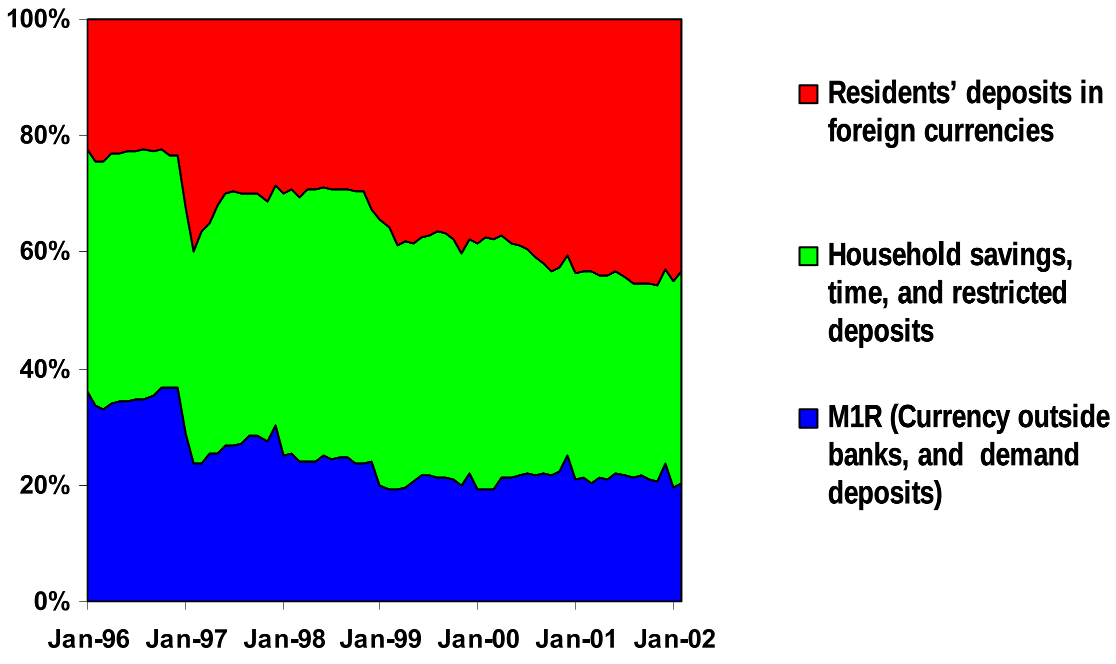
In Romania there are reported and used three main monetary aggregates: M0 (reserve money), M1, and M2 (as broad money). The structure of these monetary aggregates is reported in Table 4, while Figure 4 describes the structural changes for real M2 monetary aggregate (M2 deflated by CPI) .

Table 4. The structure of monetary aggregates in Romania

Monetary aggregate	Structure
M0	Currency outside the central bank Vault cash Currency outside banks Banks' deposits with central bank
M1	Currency outside banks Demand deposits
M2	M1 Quasi-money Household savings Time and restricted deposits Residents' deposits in foreign currencies

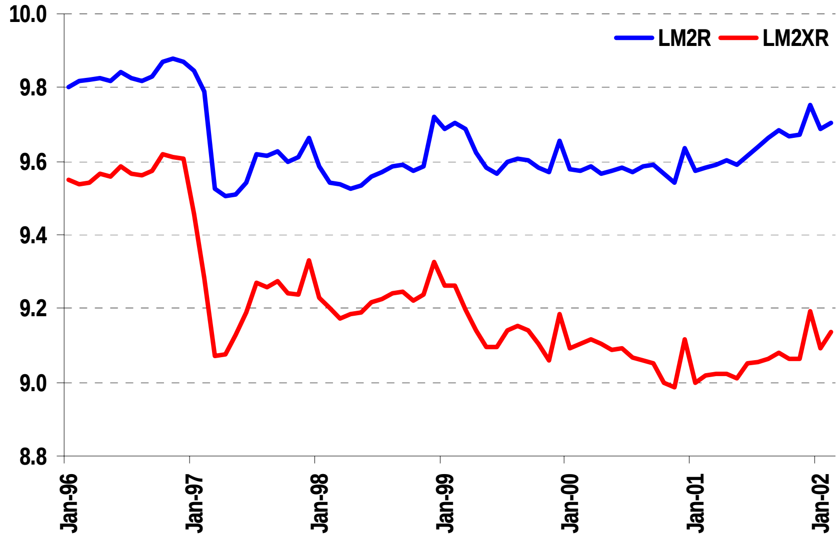
Source: National Bank of Romania, Annual Report 2000

Figure 4. The evolution of structure for M2 real monetary aggregate



In the period of January 1996 to February 2002 the structure of real M2 changed continuously. The weight of residents' deposits in foreign currencies increased during the entire period, from 22.23 % of real M2 in January 1996 up to 43.34 % of real M2 in February 2002 (a rise of 21.11 percent points). Moreover, almost all of this increase is explained by reduction in real M1 which decreased from 39.92 % of real M2 in January 1996 to 20.4 % of real M2 in February 2002 (a fall of 19.52 percent points). The coefficient of correlation between M1R and M2XR (M2 without residents' deposits in foreign currencies) is 0.963, while the coefficient of correlation between M1R and M2R is 0.877 (the same time the coefficient of correlation between M2XR and M2R is 0.863. In the period considered, M2R knew a relative stable evolution (excluding the structural break in the first months of 1997, the relative large increase in the beginning of 1999 caused by large depreciation of ROL, and seasonality for December month). The last months show an upward trend for M2R which is justified given the real GDP growth in 2001 and in the beginning of 2002. On the other hand, the M2XR monetary aggregate did not show such a relative stable evolution.

Figure 5. The evolution of real monetary aggregates M2XR and M2R



For modelling the long run demand for money we have chosen the real monetary aggregate M2XR. Our choice is justified by:

- the strong correlation between M1R and M2XR and the fact that, in general, M1R is considered the closest related to the transactional motive (in addition, in Romania all the payments must be settled using national currency ROL);
- the intention to capture the monetary substitution between ROL an currency deposits (which is evident given the relative stable evolution for M2R and the increase of weight of currency deposits in M2R);

- the greater volatility in M2XR and possible more interactions with the real economy;
- the avoidance of portfolio reallocation due to financial innovation.

To put in evidence the optimal portfolio selection, we use the nominal deposit rate applied by banks to non-bank customers (% per year) and the nominal depreciation of ROL against USD (% per year). The nominal deposit rate is the rate of return on M2RX and we expect a positive relationship between real money balances and this interest rate. The nominal depreciation of ROL against USD is used as proxy for return of deposits in foreign currencies as principal assets outside the M2XR. This is true only if the nominal interest rate for deposits in foreign currencies is relative stable. Moreover, this study does not take into account the return on other assets outside the M2XR (T-bills and real assets, for instance).

As scale variable we use the volume of industrial production. This variable can be considered as proxy for real activity depth. However, the evolution of industrial production is not strong correlated with GDP Table 5. The use of GDP is not yet possible given the short time and quarterly frequency of data, and strong seasonality due to methodology used.

Table 5. Real GDP and Industrial output in Romania (1995 - 2001)

Indicator	1995	1996	1997	1998	1999	2000	2001
Real GDP (Change from previous year)	7.1	3.9	-6.1	-4.8	-2.3	1.6	5.3
Industrial output (Change from previous year)	9.4	6.3	-7.2	-13.8	-7.9	8	8.2
GDP formation in industry (%)	32.9	33.2	30.9	27.8	27.1	27.6	25.76

Source: National Bank of Romania, Annual Report 2000
National Institute of Statistics, Status of main economic indicators 2001.

Figures 6 and 7 describe the evolution of the real monetary aggregate M2X, and of the index of industrial output. Given the high seasonality in December month for both variables we have chosen to use the seasonally adjusted time series. The seasonally adjustment was performed using Tramo/Seats package (the figure 6 and figure 7 describe also the adjusted series).

Figure 6. Evolution of M2XR monetary aggregate (in logs, unadjusted and seasonnlay adjusted)

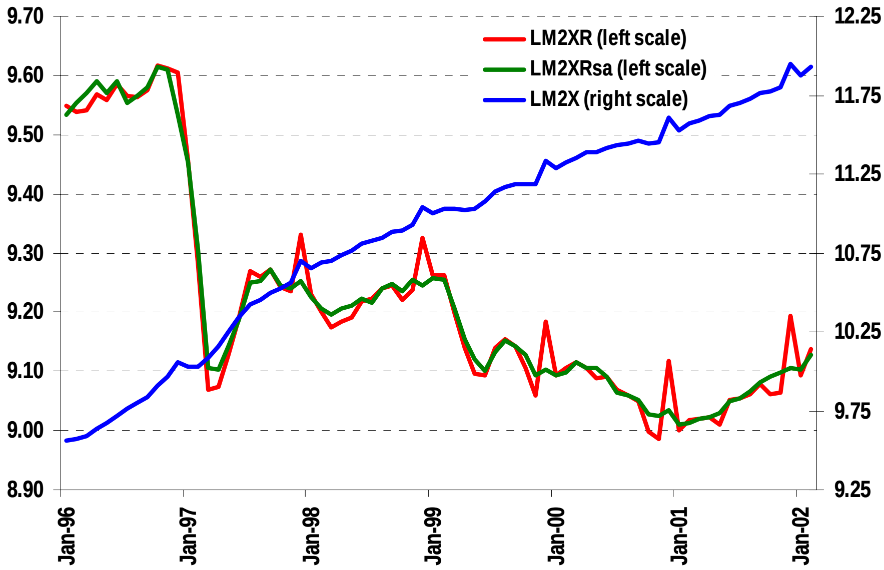
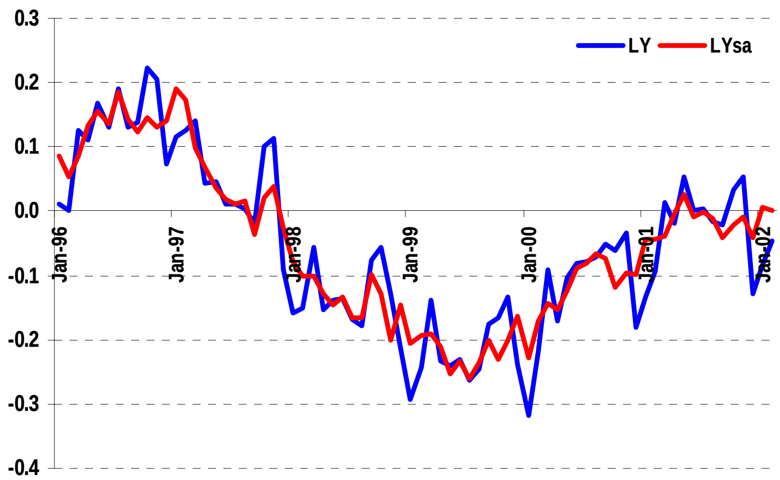


Figure 7. Evolution of industrial production (logs of index Dec 1995=1, unadjusted and seassonally adjusted)



To test for the presence of the long-run equilibrium relationship we use the Johansen procedure. The Johansen procedure is a full information likelihood estimate for vector autoregressive systems, and, as such, it is not concerned about the explanatory variables. However, the procedure imposes a heavy toll on the degrees of freedom and on the precision of econometric estimates in small samples because it uses a lag structure. Using the Johansen procedure implies testing the order of integration for all the variables used and choosing the appropriate number of lags in VAR.

Testing for unit roots was complicated by the presence of possible structural breaks in time series. Therefore, the series were tested for the presence of structural breaks and all the four series have proven to have a structural break in March 1993.

The tests for the time series order of integration are presented in Appendix, first section. All series used in cointegration, except nominal exchange rate depreciation, are integrated of order one at 99% critical value. The exchange rate depreciation can be nonstationary only at 95% (if we take into account some ADF lag specifications). However, testing the order of integrability for nominal exchange rate depreciation was much difficult given the existence of two periods with large level changes.

Determination of the appropriate lag length is fundamental. While economic-theoretical consideration would argue for including relatively long lags (given the monthly frequency of data), the limited data availability restrict the maximum number of lags which can be chosen. The optimal number of lags in unrestricted VAR was found using the general to specific procedure, based on the criteria information (Akaike Information Criteria, Schwarz Bayesian Criteria), and the log likelihood ratio (LR test). For a number of lags greater than four, we have obtained inconclusive results (significance of lags in unrestricted VAR but no cointegration or high probability of zero for coefficients in VEC). For a number of lags as greater as four, the sequential procedure is presented in Appendix, second section**.** Given these results, the optimal number of lags in unrestricted VAR has proven to be two or, equivalently, we must use one lagged differences in VEC.

We have found evidence on the following long run equilibrium relationship for real money balances:

$$LM2XRSA = 1.2873\,\mathrm{YSA} + 0.030255\,\mathrm{DR} - 0.0096157\,\mathrm{DLEXUSD} + 8.5340$$

This means that real money balances increase if the real economic activity is deepening and/or if nominal interest rate is increasing (for instance, a 1 percent point increase in industrial output implies an increase of 1.2873 percent points in the real money balances). A depreciation of nominal exchange rate implies a reduction in the holding of real money balances, given the substitution effect between ROL deposits and USD deposits. However, the size of the two coefficients is very different, which could suggest that the interest rate for ROL deposits is more important in decision regarding real M2XR holdings.

Additional tests were performed. It was accepted that the coefficient of industrial output is not statistically different from 1, and that the nominal depreciation of the exchange rate is weakly exogenously. It was not accepted that the nominal deposit rate is weakly exogenous with respect to money, which means that the interest rate reacts to the stance of money demand. On the other hand, the adjustment coefficient of the money demand equation seems to be very small, which means that the individuals do not adjust their money balances to the long run conditions. Table 6 reports the statistical from the Johansen procedure and additional tests performed.

The results of cointegration were sensitive to the inclusion of a dummy variable taking value 1 in month of March 1997 and value zero in rest. The inclusion of this dummy variable accounted for the structural break in the time series due to the large price liberalization in this month. However, the inclusion of dummies affects the distribution of cointegration test, new asymptotic tables being required (Johansen, Moskow, and Nielsen 2000).

Table 6. Cointegration analysis using Johansen procedure for long-run money demand

Cointegration with restricted intercepts and no trends in the VAR

72 observations from 1996M3 to 2002M2 . Order of VAR = 2.
List of variables included in the cointegrating vector:
LM2XRSA YSA DR DLEXUSD Intercept
List of I(0) variables included in the VAR:
DUMMY9703

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

Null	Alternative	Eigenvalues	Max-Eigen Statistic	99% Crit. Value	95% Crit. Value	90% Crit. Value
r = 0	r = 1	0.4962	49.37	33.24	28.27	25.80
r<= 1	r = 2	0.1903	15.20	26.81	22.04	19.86
r<= 2	r = 3	0.0800	6.00	20.20	15.87	13.81
r<= 3	r = 4	0.0128	0.93	12.97	9.16	7.53

Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Eigenvalues	Trace Statistics	99% Crit. Value	95% Crit. Value	90% Crit. Value
r = 0	r>= 1	0.4962	71.50	60.16	53.48	49.95
r<= 1	r>= 2	0.1903	22.13	41.07	34.87	31.93
r<= 2	r>= 3	0.0800	6.93	24.60	20.18	17.88
r<= 3	r = 4	0.0128	0.93	12.97	9.16	7.53

Max-eigenvalue test and Trace test indicates 1 cointegrating equation at 1% levels

Adjustment and cointegrating coefficients (standard errors in ( ) and t-statistic in [ ])

Variable	LM2XRSA	YSA	DR	DLEXUSD	Intercept
Normalized adjustment coefficient for:	-0.025066 (0.00614) [-4.07911]	0.016445 -0.00962 [1.70913]	5.244893 (0.79082) [6.63221]	-0.95072 -11.2829 [-0.08426]	
Unrestricted cointegrating coefficients for:	-0.28985	0.37313	0.0087696	-0.0027871	2.4736
Normalized cointegrating coefficients for:	-1.0000	1.2873 (0.42922) [-2.99916]	0.030255 (0.00430) [-7.03754]	-.0096157 (0.00219) [4.38687]	8.5340 (0.17448) [-48.9117]

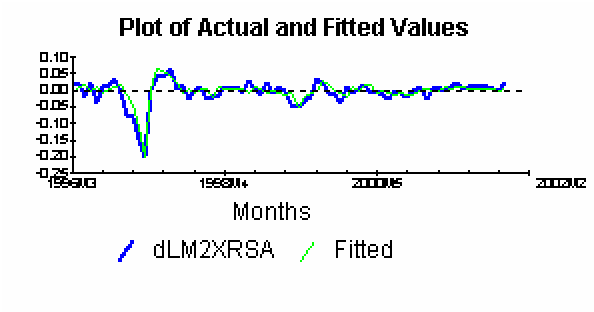
ECM for variable LM2XRSA estimated by OLS based on cointegrating VAR(2)

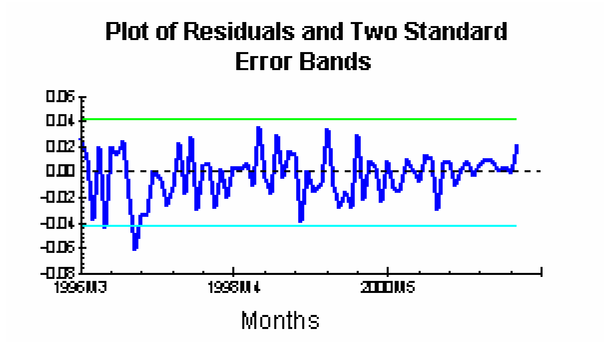
Dependent variable is :dLM2XRSA
Regressors are : dLM2XRSA1 dYSA1 dDR1 dDLEXUSD1 ecm1(-1) DUMMY9703
ecm1 = LM2XRSA – 1.2873 YSA -0.030255 DR + 0.0096157 DLEXUSD-8.5340

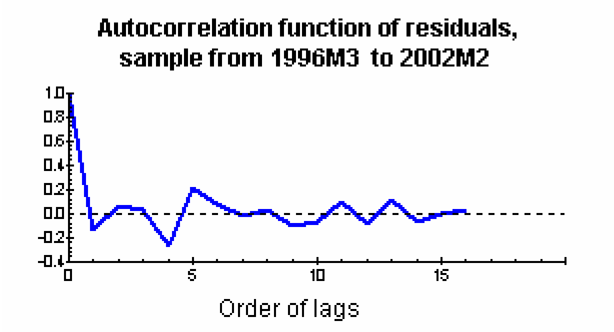
R-Squared	.70748	R-Bar-Squared	.68531
S.E. of Regression	.021200	F-stat. F(5, 66)	31.9245[.000]
Mean of Dependent Variable	-.0058986	S.D. of Dependent Variable	.037792
Residual Sum of Squares	.029663	Equation Log-likelihood	178.4392
Akaike Info. Criterion	172.4392	Schwarz Bayesian Criterion	165.6092
DW-statistic	2.1885	System Log-likelihood	-198.0254

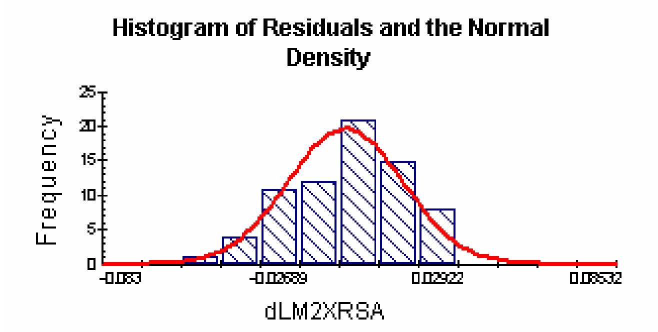
Test Statistics	LM Version	F Version
A:Serial Correlation	CHSQ(12)= 17.6796 [.126]	F(12, 54)= 1.4646 [.167]
B:Functional Form	CHSQ(1) = 10.8960 [.001]	F(1, 65)= 11.5907 [.001]
C:Normality	CHSQ(2) = 1.7717 [.412]	Not applicable
D:Heteroscedasticity	CHSQ(1) = .072134 [.788]	F(1, 70)= .070200 [.792]

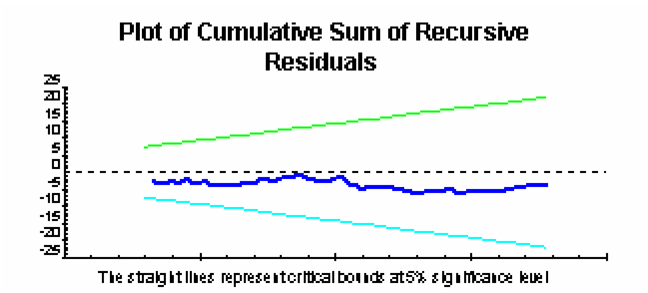
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values

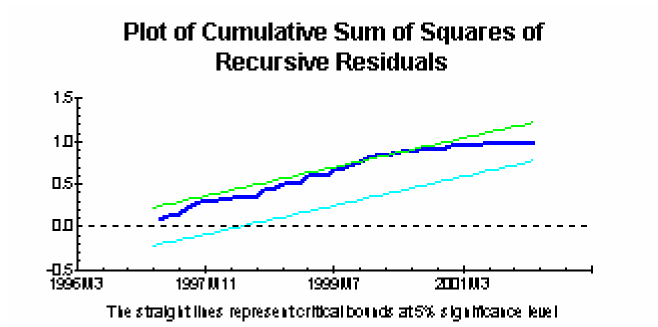












Cointegretion restrictions

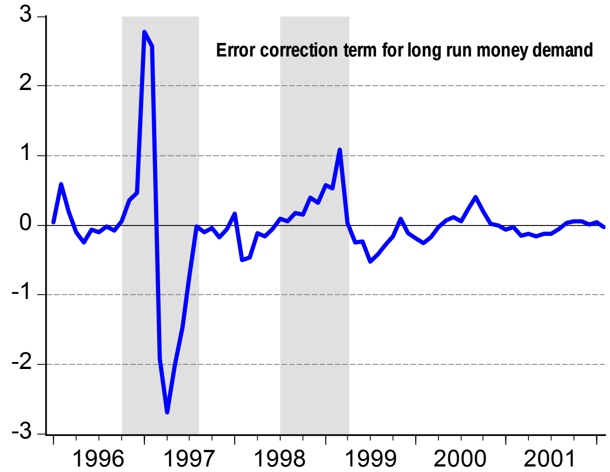
Coefficient of LYSA is 1

LR test for binding restriction	Chi-square(1)	0.428827			
	Probability	0.512565			
	LM2XRSA	YSA	DR	DLEXUSD	Intercept
Normalized cointegrating coefficients for:	1	-1	-0.02908	0.009058	-8.53988
			-0.00409	-0.00209	-0.16278
			[-7.10506]	[4.32713]	[-52.4642]
Normalized adjustment coefficient for:	-0.026698	0.017141	5.538708	0.7869	
	-0.00646	-0.01014	-0.83176	-11.8865	
	[-4.13591]	[1.69022]	[6.65903]	[0.06620]	

Weak exogeneity test for

		LYSA	DR	DLEXUSD
LR test for binding restrictions	Chi-square(1)	3.056465	28.42467	0.007007
	Probability	0.080416	0	0.933288

The error correction term from the long run equilibrium for real balances suggest that real money balances were in a relative stable equilibrium, excepting the year of 1997 (with large price liberalizations) and the early of 1999 (with large nominal exchange rate depreciation).

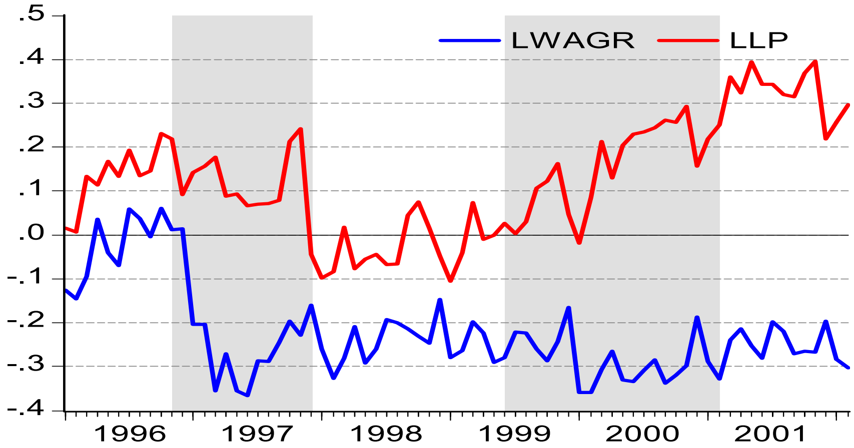


D.4 Estimating the long run relationship for the real wage

This section derives a long run relationship for real wages, following the theoretical approach presented in the section C.2 of the paper. It has been shown that within a imperfect competition framework, the effective real wage is given by $W/P = (1-m) \cdot LP$, where LP is the labour productivity and $1-m$ is a mark-up. The factor $1-m$ is given by $\frac{1}{1-\mu}$ where the price per unit of product can be expressed as $P = (1+\mu) \cdot C$ (C is the unitary cost with salaries).

The evolution of real wage and of productivity in industry is described in Figure 8. During the entire period analysed one can find two periods of discrepancies between the evolution of the two variables. First, there is the 1997 year when the high rates of inflation drastically eroded the purchasing power of the nominal wages. However, the 1997 was also the year when the industrial output began to decrease, but his decrease was much greater than the decrease in employees number. Consequently, the labour productivity (measured as units of output per worker) began to decrease, too. Second, in the end of 1999, there was an increase in labour productivity because the industrial output began to increase while the number of employee in industry continued to decrease.

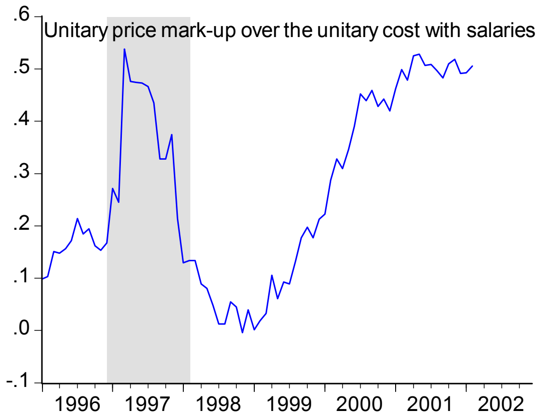
Figure 8. Labour productivity and real wages in industry



Behind the small fluctuations justified by monthly frequency of data, there are long periods of time when the nominal wages did not increased as much as the CPI did. This is the case for the 1997 year and the 2000 year. In these situations, a major role in tightening of wage policy was played by the Stand-by Agreements with IMF, upon witch the authorities agreed to limit the increase in the nominal wage bill of the state sector. The situation was rather different in 1998 when wages again grew strongly, especially in the state-owned regie autonomes (RAs) and commercial companies.

Regarding the mark-up over the labour productivity, from Figure 9 one can observe that 1997 was again a atypical period. Because of real wage reduction, his mark-up over the labour productivity has narrowed. This fact was similarly with a decrease of unitary firms expenditures with labour force. However, starting with 1998, the mark-up of real wages over labour productivity has again increased. The 2000 year shows a new return of the real wage – labour productivity correlation.

Figure 9. Evolution of real wage mark-up in industry



The tests for time series order of cointegration are presented in Appendix, first section. All series used in cointegration are integrated of order one at 99% critical value.

Using the Johansen approach, the following long run relationship between real wage and labour productivity was estimated (variables are in logs):

$$LWAGR = 1.07563 \cdot LLP + 0.69167 \cdot LMARKUP - 0.002221 \cdot Trend - 0.099123$$

According to this long-run relationship, a percent point increase in the labour productivity implies a 1.08 percent points increase in the real wage. On the other end, an increase in the mark-up of real wage over the labour productivity (equivalently to an increase of the weight of salary the unitary price) implies a lower increase in the real wage. The same time, there is a very small downward trending in the evolution of real wage. The speed of adjustments to the long run equilibrium is very high: 0.7668. This means that nominal wages are reacting very quickly to correct especially the changes in consumer and producer prices.

Estimation of the long run relationship was carried out using two centred seasonally dummy variables for December and January months. This is because the productivity displays high seasonality in these periods (given the seasonality of industrial output). Table 7 reports the statistics for Johansen procedure.

Table 7. Cointegration analysis using Johansen procedure for long run real wage

Cointegration with restricted intercepts and restricted trends, no trends in VAR

64 observations from 1996M11 to 2002M2 . Order of VAR = 10.
List of variables included in the cointegrating vector:
LWAGR LLP LMARKUP Trend Intercept
List of I(0) variables included in the VAR:
DUMMYDEC DUMMYJAN

Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

Null	Alternative	Eigenvalues	Max-Eigen Statistic	99% Crit. Value	95% Crit. Value
r = 0	r = 1	0.6540	67.93	30.34	25.54
r<= 1	r = 2	0.2859	21.55	23.65	18.96
r<= 2	r = 3	0.0455	2.98	16.26	12.25

Cointegration LR Test Based on Trace of the Stochastic Matrix

Null	Alternative	Eigenvalues	Trace Statistics	99% Crit. Value	95% Crit. Value
r = 0	r>= 1	0.6540	92.46	48.45	42.44
r<= 1	r>= 2	0.2859	24.53	30.45	25.32
r<= 2	r>= 3	0.0455	2.98	16.26	12.25

Max-eigenvalue test and Trace test indicates 1 cointegrating equation at 1% levels

Adjustment and cointegrating coefficients (standard errors in ( ) and t-statistic in [ ])

Variable	LWAGR	LLP	LMARKUP	Trend	Intercept
Normalized adjustment coefficient for:	-0.76683	-0.21153	0.287776		
	0.242304	0.25253	0.370434		
	[-3.16475]	[-0.83762]	[0.77686]		
Normalized cointegrating coefficients for:	-1.0000	1.07563	0.69167	-0.002221	-0.099123
		-0.08339	-0.05966	-0.00025	
		[-12.8994]	[-11.5943]	[9.05362]	

ECM for variable LWAGR estimated by OLS based on cointegrating VAR(10)

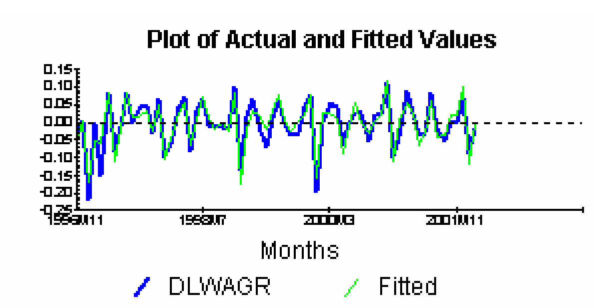
Dependent variable is : dLWAGR
Regressors are: dLLP (lag 1 to 9) dLMARKUP (lag 1 to 9) ecm1(-1) Intercept DUMMYDEC DUMMYJAN
ecm1 = LWAGR -1.07563 LLP – 0.69167 LMARKUP + 0.002221 Trend + 0.099123

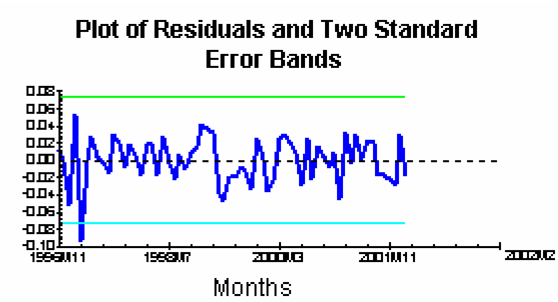
R-Squared	.85152	R-Bar-Squared	.71654
S.E. of Regression	.036441	F-stat. F(30, 33)	6.3083 [.000]
Mean of Dependent Variable	-.0056732	S.D. of Dependent Variable	.068445
Residual Sum of Squares	.043822	Equation Log-likelihood	142.3557
Akaike Info. Criterion	111.3557	Schwarz Bayesian Criterion	77.8930
DW-statistic	2.2248	System Log-likelihood	454.6893

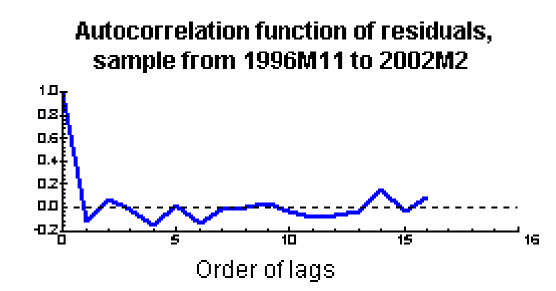
Diagnostic Tests

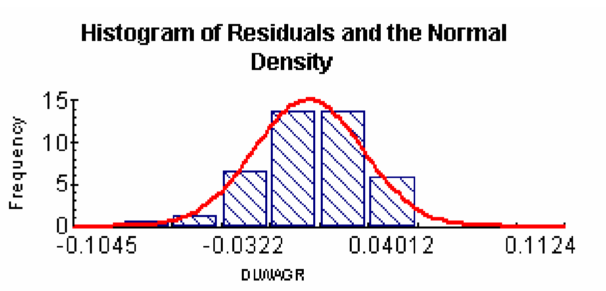
Test Statistics	**LM Version**		**F Version**	
A:Serial Correlation	CHSQ(12)= 20.9999	[.050]	F(12, 21)= .85465	[.600]
B:Functional Form	CHSQ(1)= .24359	[.622]	F(1, 32)= .12226	[.729]
C:Normality	CHSQ(2)= 7.0340	[.030]	Not applicable	
D:Heteroscedasticity	CHSQ(1)= 1.7031	[.192]	F(1, 62)= 1.6950	[.198]

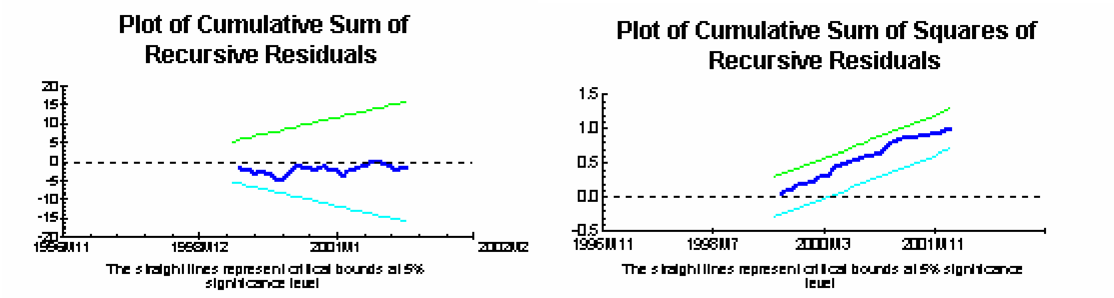
A:Lagrange multiplier test of residual serial correlation
B:Ramsey's RESET test using the square of the fitted values
C:Based on a test of skewness and kurtosis of residuals
D:Based on the regression of squared residuals on squared fitted values



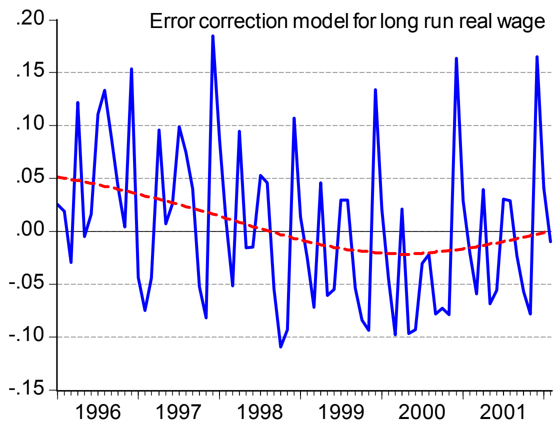








The error correction term for long run equilibrium of real wage displays high volatility. However, we can conclude that before 1999 the real wage was above his level of equilibrium, and that after this moment it was below the equilibrium level.



D.5 Administrative and relative price adjustments influences on inflation in Romania

Before 1990, Romania economy relied heavily on economic plans which set output goals in the particular sectors. Credit, money, wages and prices were also established by central planners. The allocation of resources was highly inefficient with serious distortions throughout the economy. At the same time, relative prices of goods did not reflect the relative demand and supply, and carried no valid information on resource allocation.

After 1990, following sharp upward movements of individual nominal prices, price relations have undergone significant shifts. Some sectors with prices set well bellow the cost recovery (municipal services, transportation, staple foods) by administrative decisions needed establishing higher relative prices of their products. Price liberalization in Romania was protracted. Most prices were liberalized in November

1990, in April 1991, and in July 1991, but the last major round of liberalization delayed until 1997.

Before 1997, government had maintained control on a wide range of items declared as being of “national importance” (energy, medicines, wood, bread, milk, railways, river and urban transport, post and telecommunication) and subject to review by Competition Office. Agricultural prices were liberalized in February 1997, and most administered producer and retailer prices were liberalized in March 1997. Railway, river and urban transport, post and water were still regulated by Competition Office, while some prices were regulated by ordinance (telecommunications, medicines, rents and radio and television subscriptions).

Table 8 presents the nine biggest price changes. The higest inflation rate was in March 1997: 30.7 % a month. As it has been shown before, this rate of inflation reflected the liberalization of the most producer and retailer prices still subject to government control at that time. Therefore, this inflation is the result of an administrative decision.

Table 8. Highest price changes between 1997 and 2002

Rank	Month	Inflation (% per month)	Rank	Month	Inflation (% per month)
1	March-97	30.7	**6**	February-98	7.2
2	February-97	18.8	**7**	April-97	6.9
3	January-97	13.7	**8**	October-97	6.5
4	December-96	10.3	**9**	March-99	6.4
5	July-96	7.5	**10**	November-96	5.8

The causes behind the other big monthly inflation rates are easily understood if we take into account the information offered by Table 12. The whole story can be summarized as follows. The high rate of inflation in February 1997 (18.8 % a month) and in January 1997 (13.3 % a month) were also due to administrative decisions regarding the exchange market and the agricultural prices liberalization. The administrative decisions concerning the prices of electric energy, gas, central heating and fuels continued to determine the major changes in the aggregate price level, even that the 1997 was the last big step in the price liberalization in Romania. This is the case for the months of May 1998, October 1998, March 1999, June 1999, August 2001, and November 2001. Another cause of high monthly inflation rates are the changes in indirect taxes system: value added tax (VAT), custom duties, and excise duties (for instance, December 1996). Nonetheless, the Easter and Winter Holydays usually give raise at rates of inflation higher than average.

We can conclude that there are some key prices, with heavily implication for the entire price system and economy: energy price, natural gas price and fuel prices. Fuel prices were deregulated in September 1998. The responsibility for electricity pricing belongs to ANRE, while ANRGN is the gas regulatory agency. These prices have been adjusted in line with movements in the exchange rate and/or consumer price index.

Figure 10. Twelve-month % change for fuel price, electric energy price, CPI and ROL/USD exchange rate

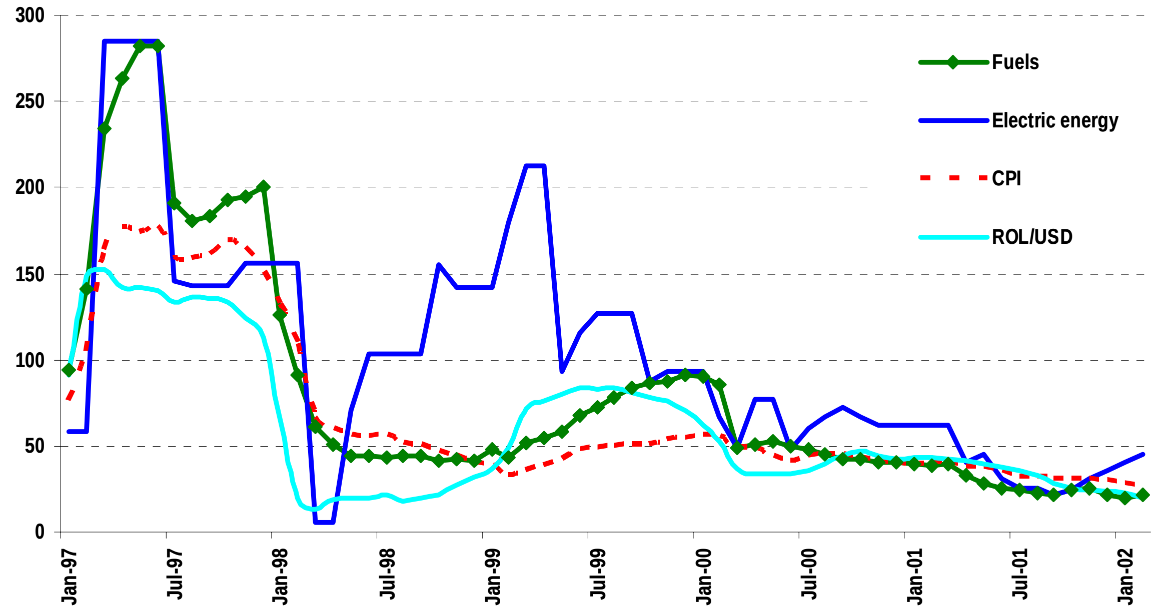


Figure 10 gives useful information about the evolution of fuel and energy prices. First, it easily can be seen the discrete change in energy price by administrative decisions. Second, the liberalization of fuel prices was followed by an even path for changes in these prices, strongly correlated with CPI and ROL/USD exchange rate changes. Third, almost all the times the annual changes in electric energy prices were higher than annual changes in CPI or ROL/USD annual rates of depreciation.

Even the changes in energy prices were higher than changes in CPI, the energy sector in Romania has been put in a precarious state. Because price adjustments are made in discrete fashion, these adjustments were often delayed and did not reflect the rising input costs. But the main reasons for precarious state of Romanian energy sector are the poor collection and payments discipline. The losses of Termoelectrica, the dominant thermo-power producer, supplying more than 50 percent of consumed energy and about 40 percent of heat to industrial users and district heating companies, skyrocketed to US$270 millions in 2000 from operations (0.7 % of GDP) or US$485 millions including non-collections (1.7 % of GDP). Another problem is the natural gas sector. Total implicit subsidy reached US$ 1264 million in 2000 (3.4 % of GDP), given the surge in import prices in 1999 and 2000 and the lack in final price adjustments.

The lowest rates of inflation usually can be found in the summer months (June, July, and August). This is because the prices of the food goods remain relatively unchanged or, eventually, decline during these months. Table 9 shows the smallest rates of inflation during the period of January 1996 to February 2002.

Table 9. Smallest price changes between 1997 and 2002

Rank	Month	Inflation (% per month)	Rank	Month	Inflation (% per month)
1	August-98	0.6	**6**	January-96	1.2
2	July-97	0.7	**7**	July-98	1.3
3	June-96	1	**8**	June-98	1.3
4	August-99	1.2	**9**	July-01	1.3
5	February-02	1.2	**10**	June-01	1.6

We can go further to analyse the evolution of individual prices (or prices for major classes within a representative consumption basket). In Romania, the CPI basket is composed of 35 major classes. The weights in the basket are annually changed on the basis of household consumption data, while the price information is collected three times a month.

Table 10 reveals the classes within the CPI basket's structure with the biggest cumulative price change during the period considered (January 1996 – February 2002), respectively the classes with the smallest one. The price information for each class of CPI basket is an index price with December 1995 as the reference month. Moreover, the index does not take account of the CPI weight for the respective class of goods.

Table 10. Unweighted cumulative price changes between 1997 and 2002

	Unweighted ten highest cumulative price changes (Index Dec 1995=1)		Unweighted ten lowest cumulative price changes (Index Dec 1995=1)	
Rank	**Classes from CPI**	**Index**	**Classes from CPI**	**Index**
1	Rent	183.43	Eggs	6.30
2	Other services	83.13	Vegetables and tinned vegetables	9.75
3	Mail and telecommunications	63.69	Cultural-sports products	10.38
4	Electric energy, gas and central heating	52.30	Sugar, confectioneries and honey	10.63
5	Water, sewerage, salubrity	34.01	Household appliances, furniture	10.92
6	Cinemas, theaters, museums and expenditures for education	31.45	Cocoa and coffee	11.09
7	Interurban transport	25.20	Fruit and tinned fruit	11.31
8	Medical care	22.87	Chemicals	11.60
9	Urban transport	21.25	Edible oil, bacon, fats	12.25
10	Fuels	21.13	Other food products	12.35
	Consumer Price Index during the period considered: 16.30			

The behaviour of the individual prices reveals the need for relative price adjustments. Between January 1996 and February 2002 the Consumer Price Index was 16.30, which means that the cumulative change in the aggregate price level was 1530 %. It is striking obvious the huge increase in the rent services. They have risen by as much as 183.43 times referring to December 1995, or by as much as 11.25 times more than CPI. The ranking reflects that important cumulative price changes also characterize other services as mail and telecommunications, cinema, theatre and museum, interurban and urban transport, medical care. The key prices of energy, gas, central heating, and fuels also have experienced great increases (as much as

52.30 times for energy, for instance). Lower price increases that the aggregate price levels can be found in the case of foods, with the eggs' price increasing by as much as 6.30 times relative to December 1995. These evolutions of prices make credible the cost recovery hypothesis and the Balassa-Samuelson effect (the prices of services reflect the evolution of non-tradable goods prices, while the prices of foods can be thought reflecting the evolution of tradable goods).

More interesting conclusions are obtained if the weights of the categories of goods and services are taken into account (Table 11). The result is striking. The foods and energy are the items with the higher weighted price index, and therefore with the greater contribution to the aggregate level of inflation. The contribution of services to overall inflation is smaller, even their prices have increased more rapidly than the aggregate price level.

Table 11. Weighted cumulative price changes between 1997 and 2002

	Weighted ten highest cumulative price changes (Index Dec 1995=1)		Weighted ten lowest cumulative price changes (Index Dec 1995=1)	
Rank	**Item classes from CPI**	**Index**	**Item classes from CPi**	**Index**
1	Meat, tinned meat and meat products	1.406	Hygiene and cosmetics	1.008
2	Milling and bakery products	1.308	Making and repairing clothing and footwear	1.013
3	Fuels	1.210	Other services of industrial nature	1.017
4	Clothing, hosiery, small wares articles, trimm.	1.209	Motor and electronic repairs and photo works	1.019
5	Electric energy, gas and central heating	1.202	Medical care	1.020
6	Vegetables and tinned vegetables	1.165	Fish and tinned fish	1.026
7	Milk and dairy products	1.155	Rent	1.030
8	Footwear	1.152	Cinemas, theaters, museums and expenditures for education	1.031
9	Cultural-sports products	1.118	Urban transport	1.032
10	Hygienic, cosmetic and medical articles	1.099	Eggs	1.037

Starting with the structure of the CPI basket, we next calculate the unweighted and weighted skewness and standard deviation. For every point in time from January 1996 to February 2002 we have a distribution represented by the price changes for the 35 classes of goods and services included in structure of the consumer price index. The evolution of the two parameters is presented in Figure11 and Figure 12.

Figure 11. Evolution of inflation and weighted skewness

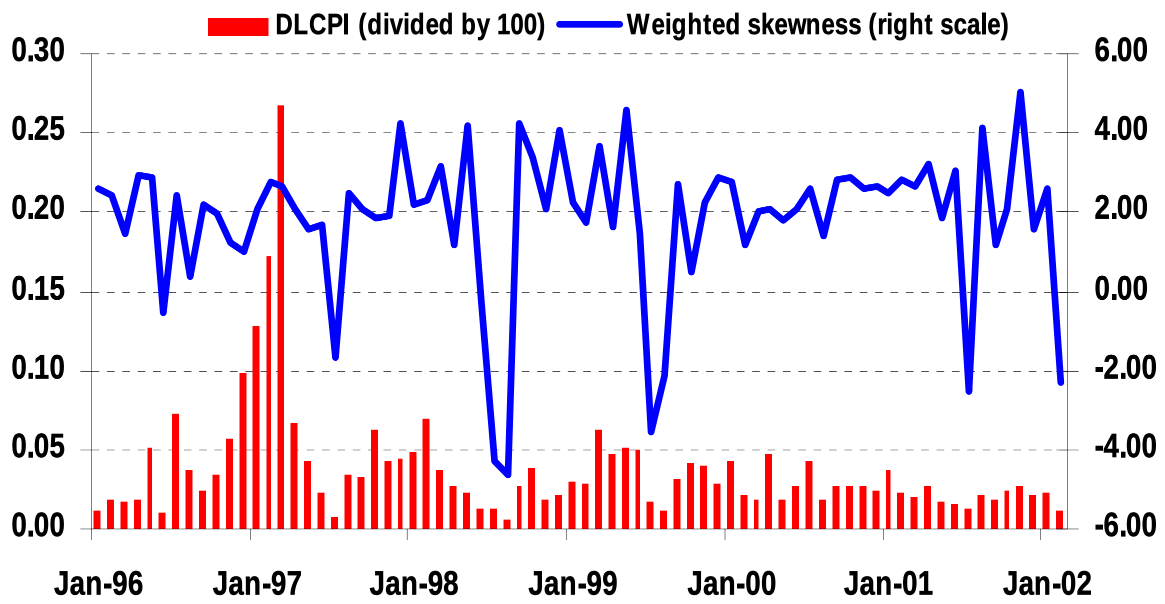
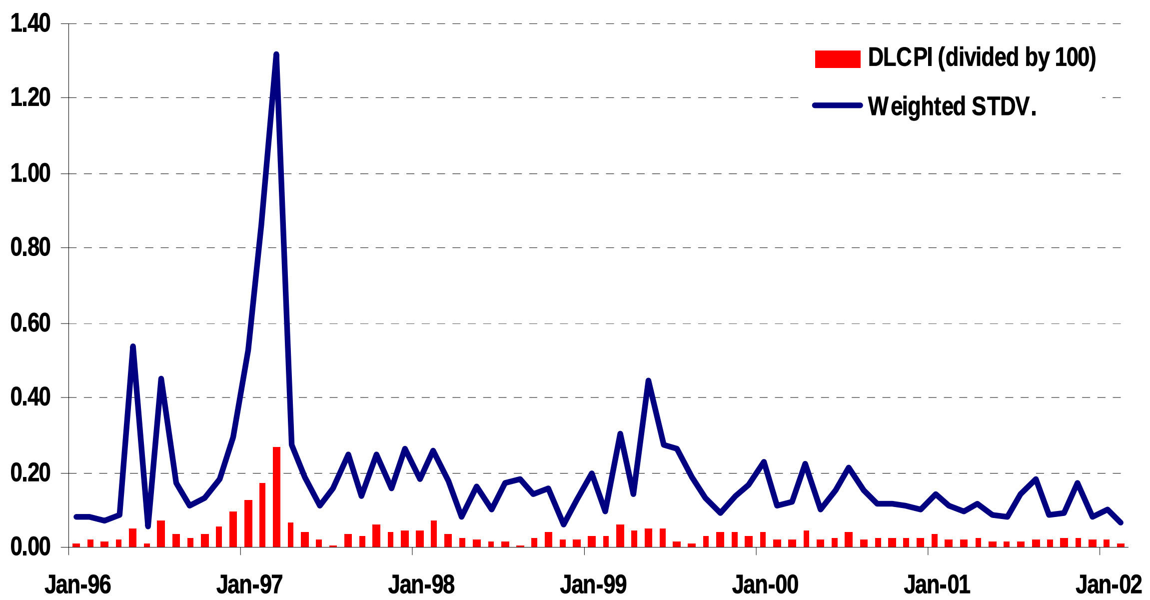


Figure 12. Evolution of inflation and weighted standard deviation



The theoretical framework for positive skewness of price changes was set up in the section C of the paper (asymmetrical shocks and/or positive inflationary trend with symmetrical shocks). That section explained the implications of positive skewness in generating positive inflationary bias. In Romanian case, the Figure 11 shows high positive skewness and high variability of inflation rate across the classes of CPI basket. We have to make here two observations. First, the months in the early of 1997 do not exhibit high weighted skewness even the biggest price changes can be found at this moment. This suggests again that this inflation was the result of administrative decision about prices and that price increases affected all goods and services. Second, negative weighted skewness are found for the summer months, which reflect small increases (or possible reduction) in prices for some goods. Valuable information using skewness and standard deviation as parameters for characterizing the changes in prices of goods and services are offered in Table 12. The table shows the ranking over the two parameters, and in all situations taken into account, the three biggest price changes explain more than 50% of overall inflation. Figure 13 shows a typical positive skewness price distribution (November 2001: skewnes = 5.019, and May 99: skewness = 4.564).

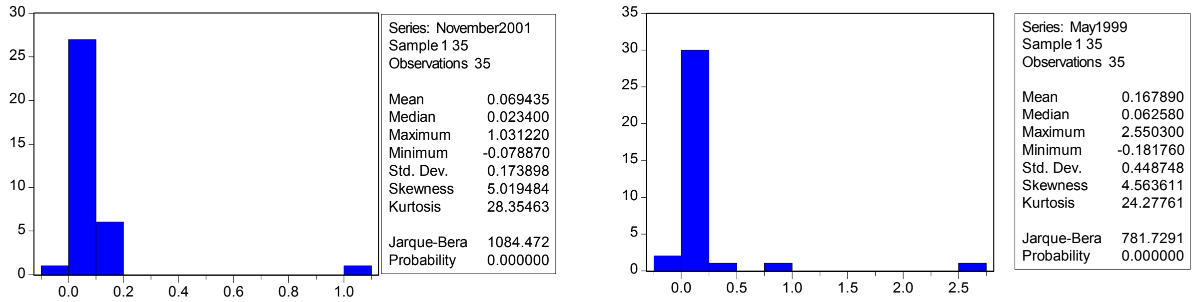
Table 12. Ranking price changes over weighted skewness and standard deviations

	WEIGHTED SKEWNESS			WEIGHTED STANDARD DEVIATION		
1	November-01	2.43	weight	March-97	31.13	weight
	Electric energy, gas and central heating	1.03	42.43	Milling and bakery products	6.04	19.38
	Fuels	0.15	5.99	Meat, tinned meat and meat products	4.73	15.19
	Milk and dairy products	0.15	5.98	Electric energy, gas and central heating	3.40	10.91
	TOTAL		54.40	TOTAL		45.48
2	May-99	5.88	weight	February-97	19.24	weight
	Rent	2.55	43.40	Meat, tinned meat and meat products	4.16	21.62
	Milling and bakery products	0.89	15.11	Milling and bakery products	2.68	13.95
	Vegetables and tinned vegetables	0.47	8.05	Vegetables and tinned vegetables	1.94	10.10
	TOTAL		66.56	TOTAL		45.67
3	December-97	4.54		May-96	5.77	weight
	Meat, tinned meat and meat products	1.49	32.72	Meat, tinned meat and meat products	2.22	38.41
	Clothing, hosiery, small wares articles, trimmings	0.46	10.10	Milk and dairy products	1.88	32.51
	Milk and dairy products	0.45	9.89	Tobacco, cigarettes	1.34	23.20
	TOTAL		52.71	TOTAL		94.12
4	September-98	2.86	weight	January-97	14.71	weight
	Vegetables and tinned vegetables	0.83	29.21	Clothing, hosiery, small wares articles, trimmings	2.30	15.66
	Other services	0.27	9.29	Fuels	1.88	12.81
	Clothing, hosiery, small wares articles, trimmings	0.20	6.96	Vegetables and tinned vegetables	1.25	8.47
	TOTAL		45.46	TOTAL		36.94

5	**May-98**	**2.43**	**weight**	**July-96**	**8.89**	**weight**
	Electric energy, gas and central heating	0.91	37.49	Clothing, hosiery, small wares articles, trimmings	0.16	1.82
	Fruit and tinned fruit	0.30	12.44	Meat, tinned meat and meat products	0.13	1.50
	Clothing, hosiery, small wares articles, trimmings	0.22	9.12	Household appliances, furniture	0.11	1.18
	TOTAL		**59.06**	**TOTAL**		**4.50**
6	**August-01**	**1.98**	**weight**	**May-99**	**5.88**	**weight**
	Electric energy, gas and central heating	1.02	51.30	Rent	2.55	43.40
	Water, sewerage, salubrity	0.23	11.47	Milling and bakery products	0.89	15.11
	Meat, tinned meat and meat products	0.22	10.88	Vegetables and tinned vegetables	0.47	8.05
	TOTAL		**73.65**	**TOTAL**		**66.56**
7	**December-98**	**2.35**	**weight**	**March-99**	**6.10**	**weight**
	Vegetables and tinned vegetables	0.72	30.55	Fuels	1.67	27.37
	Fruit and tinned fruit	0.23	9.63	Milling and bakery products	0.73	11.96
	Clothing, hosiery, small wares articles, trimmings	0.18	7.50	Electric energy, gas and central heating	0.57	9.33
	TOTAL		**47.68**	**TOTAL**		**48.66**
8	**March-99**	**6.10**	**weight**	**December-96**	**10.50**	**Weight**
	Fuels	1.67	27.37	Vegetables and tinned vegetables	1.10	10.47
	Milling and bakery products	0.73	11.96	Alcoholic beverages	0.99	9.47
	Electric energy, gas and central heating	0.57	9.33	Clothing, hosiery, small wares articles, trimmings	0.76	7.22
	TOTAL		**48.66**	**TOTAL**		**27.16**
9	**October-98**	**3.45**	**weight**	**June-99**	**3.14**	**Weight**
	Electric energy, gas and central heating	0.84	24.25	Milling and bakery products	1.01	32.16
	Cinemas, theaters, museums and expenditures for education	0.49	14.33	Electric energy, gas and central heating	0.99	31.54
	Vegetables and tinned vegetables	0.25	7.38	Fuels	0.42	13.25
	TOTAL		**45.96**	**TOTAL**		**76.95**

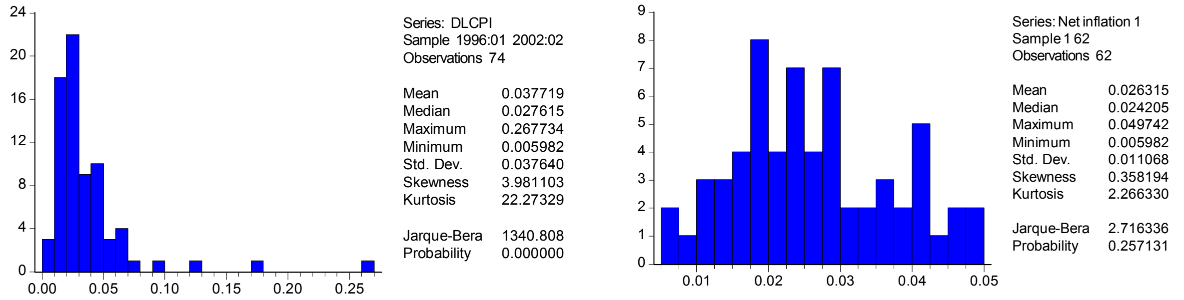
Weights are referring to the percents explained by the respective item from total inflation. For instance, in November 2001, inflation was 2.43 percent points a month. Electric energy, gas and central heating accounted for 1.03 percent points or, equivalently 42.43 % from the monthly inflation. Similarly, the first three classes of goods considered accounted for 54.40 of total monthly inflation.

Figure 13. High skewned distribution of price changes



Up to now, we have found that large jumps concerned administrative decisions (price liberalization, energy price, gas prices and fuels, etc.). It is important to determine the impact of such decisions on monthly inflation rates. The Figure 14 reveals the distribution of inflations rates during the entire period, and the distribution of inflation rates after the elimination of eleven exceptionally increases in price levels (March 1997, February 1997, January 1997, December 1996, July 1996, February 1998, April 1997, October 1997, March 1999, November 1996, May 1996, May 1999). The elimination of these outlier values improves the distribution of the remaining inflation rates.

Figure 14. Distribution of price changes between 1997 and 2002 (outlier values included and excluded)



Following František Hajnovič (2001), we consider that there are three components to inflation for a given month: the proper process of inflation, distinguished by an autonomous component and inertia, one-off impacts of administrative adjustments (if any), and random disturbances (a stationary mix of different inflationary stimuli). The model of inflation can be representing in the following form:

$$DLCPI(t) = C1 + C2 \cdot DLCPI(-1) + \sum_{i=1}^{t} D(i) \cdot \left(impact(i,t) - C2 \cdot impact(i,t-1)\right) + u(t)$$

where C1 is a parameter describing the autonomous inflation, C2 describes the inertia of inflation, $impact(i,t)$ represents a dummy variable for artificial intervention in month i, and $D(i)$ measures the size of the impact of i-th intervention on monthly inflation.

We have regressed the monthly inflation rate on an intercept, the previously monthly inflation rate, and dummy variables for every month with outlier inflation rate (the dummy variable takes value 1 in respective month and value 0 in the rest). The results are presented in Table 13.

Table 13. Statistic parameters for the ecuation of net inflation

Ordinary Least Squares Estimation

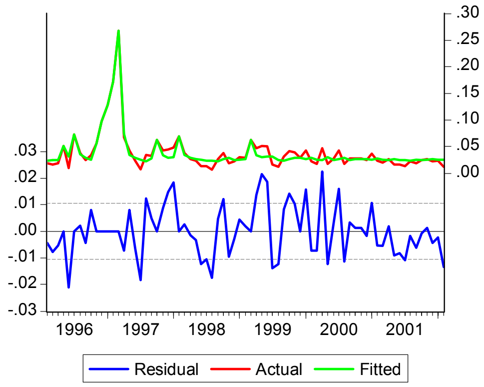
Dependent variable is DLIPC
73 observations used for estimation from 1996M2 to 2002M2

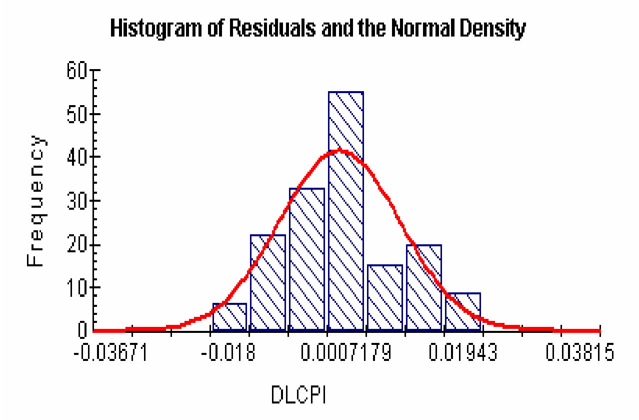
Regressor	Coefficient	Standard Error	T-Ratio	[Prob]
DLIPC(-1)	0.19922	0.039375	5.0597	[.000]
INTERCEPT	0.020778	0.0018817	11.0420	[.000]
DUMMY9605	0.027116	0.010539	2.5728	[.013]
DUMMY9607	0.049561	0.010565	4.6909	[.000]
DUMMY9611	0.028942	0.010522	2.7505	[.008]
DUMMY9612	0.066024	0.010558	6.2532	[.000]
DUMMY9701	0.088085	0.010818	8.1421	[.000]
DUMMY9702	0.12591	0.011157	11.2857	[.000]
DUMMY9703	0.21264	0.011844	17.9530	[.000]
DUMMY9710	0.035729	0.010522	3.3955	[.001]
DUMMY9802	0.039218	0.010536	3.7223	[.000]
DUMMY9903	0.035562	0.010524	3.3790	[.001]

R-Squared	0.9353	R-Bar-Squared	0.92363	
S.E. of Regression	0.01044	F-stat. F(11, 61)	80.1616	[.000]
Mean of Dependent Variable	0.038072	S.D. of Dependent Variable	0.037776	
Residual Sum of Squares	0.0066481	Equation Log-likelihood	236.0094	
Akaike Info. Criterion	224.0094	Schwarz Bayesian Criterion	210.2666	
DW-statistic	1.7487			

Test Statistics	LM Version		F Version	
A: Serial Correlation	CHSQ(12)= 14.4218	[.275]	F(12, 49)= 1.0053	[.459]
B: Functional Form	CHSQ(1) = 2.7374	[.098]	F(1, 60)= 2.3376	[.132]
C: Normality	CHSQ(2) = 1.2354	[.539]	Not applicable	
D: Heteroscedasticity	CHSQ(1) = 1.9668	[.161]	F(1, 71)= 1.9659	[.165]

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values





After some calculation, we find the impact of administrative adjustments of prices over the headline inflation as it is described in Table 14. We define "net inflation" as the inflation resulted from headline inflation after the impact adjustments were taken-off.

Table 14. Net inflation estimation for periods with administrative price changes

Moment	**Headline inflation (% per month)**	**Impact adjustments (% per month)**	**Net inflation (% per month)**
May-96	5.16	2.71	2.45
July-96	7.23	4.96	2.28
November-96	5.64	4.69	0.95
December-96	9.80	9.03	0.78
January-97	12.84	12.16	0.68
February-97	17.23	16.83	0.40
March-97	26.77	21.26	5.51
October-97	6.30	3.57	2.72
February-98	6.95	3.92	3.03
March-99	6.20	3.56	2.65

Remark: The headline inflation was calculated as difference between logs of CPI (December 1995 = 1).

Analysing the parameters of the model, we have found out that each month prices grew autonomously with 2.0778 %, which means a 27.99 % per year inflation. This autonomously inflation rate (together with all other inflationary factors) displays a coefficient of inertia as greater as 0.199. The headline inflation and the net inflation are described in Figure 15 and in Figure 16.

Figure 15. Headline and net inflation in Romania (monthly changes)

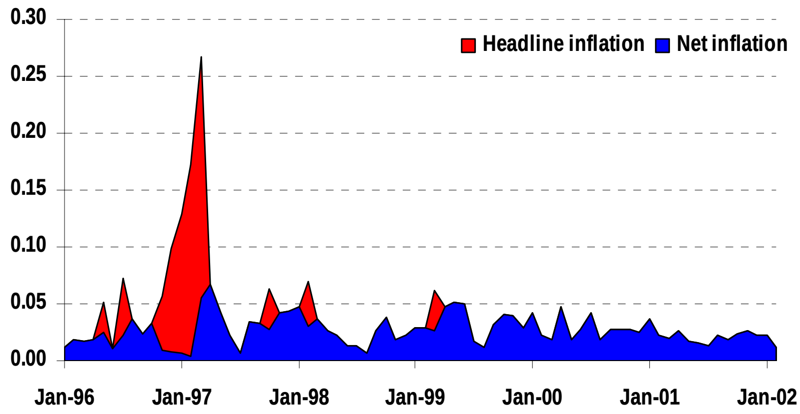
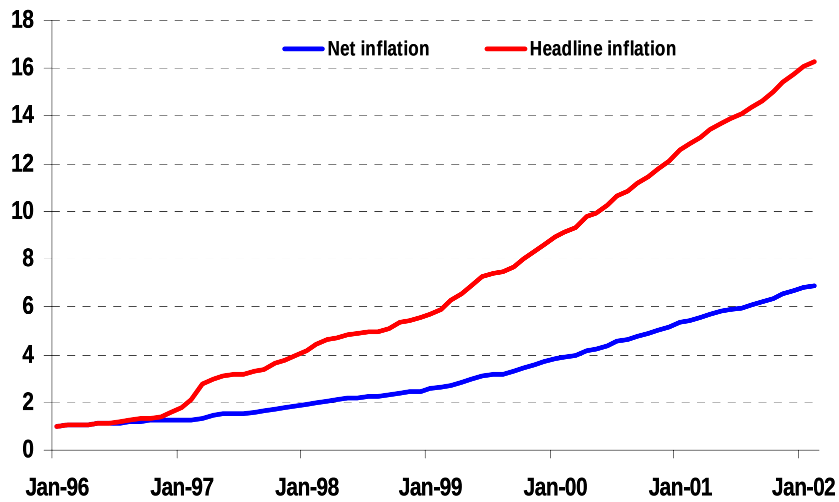


Figure 16. Headline and net inflation in Romania (Index, December 1995 = 1)



This section pointed out the great role that administrative prices have in explaining the high rates of inflation in Romania. The most important thing is to find the factors that are behind the persistent character of inflation and behind high level of this. This is the topic in the next section of the paper.

D.6 Dynamic, short run model of inflation

In order to capture the short run dynamics of inflation, we use an unrestricted vector auto regressive including as exogenous variables the changes in inflation, real monetary aggregate M2XR, and real exchange rate between ROL and USD. As exogenous variables in UVAR are included the lagged differences of the error correction terms derived from long run equilibrium on the money market and on the labour market, the weighted skewness and the standard deviation of price changes, as some dummy variables for reflecting administrative decision regarding the prices.

The highest order in the UVAR is one. It was chosen by a general to specific modelling starting with a VAR of order three and dropping one by one the lags of order three and two due to the statistical insignificance. The error correction term for the equilibrium on the money market is lagged one period, the error correction term for the equilibrium on the labour market is lagged two periods, while the weighted skewness and standard deviation are taken to be the current period values. For dummy are included taken value 1 in respective month and value 0 in the rest: DUMMY9605, DUMMY9612, DUMMY9701 and DUMMY9905. As it was shown before, the four dummy variables are accounting for price changes due to administrative decisions. The estimation results from the inflation equation are summarized in Table 16. The only one insignificant variable in the regression is DLM2XR lagged one period (the probability associated to the t statistic is 0.22).

According to this estimation, the coefficient of inflation inertia is 0.24 (a close value to that of 0.19 obtained in the first regression). The coefficients of lagged change in real money and the real depreciations of the ROL are positive, which means that the current inflation increases when M2XR and real exchange rate increase. However, paying no attention to the high probability of zero for the coefficient of real money changes, the coefficient of the real exchange rate depreciation is greater, revealing a greater influence of this variable on the next period inflation than the real money. The other two variables of great interest are the error correction terms for money and labour market. There is a positive relation between the current inflation and the lagged disequilibria on the two markets. Even the coefficient of lagged money error correction term is statistically significant, it is very small, which reflects a weak influence of money market disequilibrium on next month inflation. The influence of labour market disequilibrium on inflation is much strongly, which confirms the great speed of adjustment for real wages to the long run equilibrium level found in the previous section of the paper (the speed of adjustment was shown there to be 0.7668).

The study emphasizes the importance that skewness and standard deviations of monthly price changes have in driving up inflation. The most important factor in explaining inflation evolution is the variability of price changes. The coefficient of this variable in the inflation equation is 0.15 (from the Table 15 it can be seen that the correlation between inflation and weighted standard deviation of inflation is also very high 0.93).

Table 15. Correlation between variables

Pair wise correlation matrix

	DLCPI	DLCPI(-1)	DLM2XR(-1)	DLEXUSDR(-1)	WSKEW	WSTDEV	ECTMONEY(-1)	ECTWAGE(-2)
DLCPI	1.00	0.63	-0.43	0.42	0.21	0.93	0.49	0.07
DLCPI(-1)		1.00	-0.65	-0.22	0.05	0.54	0.05	-0.01
DLM2XR(-1)			1.00	-0.05	-0.07	-0.36	-0.29	-0.31
DLEXUSDR(-1)				1.00	0.12	0.45	0.82	0.07
WSKEW					1.00	0.13	0.17	-0.10
WSTDEV						1.00	0.46	-0.03
ECTMONEY(-1)							1.00	-0.01
ECTWAGE(-2)								1.00

Figure 17. The evolution of real exchange rate

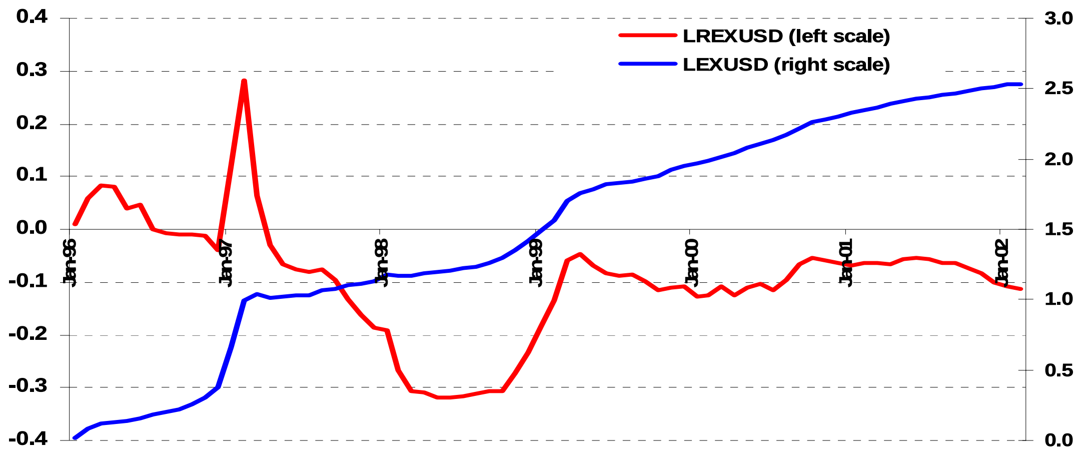


Table 16. Estimation of inflation using a VAR

OLS estimation of a single equation in the Unrestricted VAR

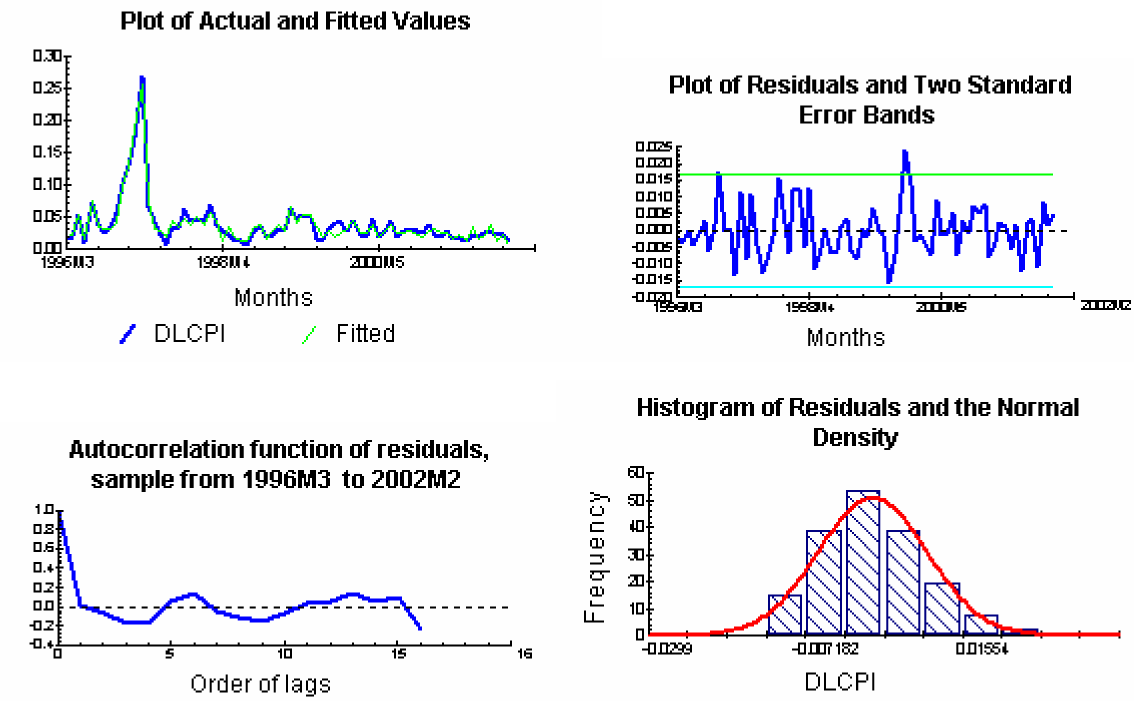
Dependent variable is DLCPI
72 observations used for estimation from 1996M3 to 2002M2

Regressor	Coefficient	Standard Error	T-Ratio [Prob]
DLCPI(-1)	.24457	.059900	4.0829 [.000]
DLM2XR(-1)	.034133	.027637	1.2350 [.222]
DLEXUSDR(-1)	.093678	.038407	2.4391 [.018]
ECTMONEY(-1)	.00075	.2455E-3	3.0550 [.003]
ECTWAGE(-2)	.046904	.015338	3.0580 [.003]
WSKEW	.0026992	.5409E-3	4.9906 [.000]
WSTDEV	.15498	.011147	13.9034 [.000]
DUMMY9605	-.036462	.0097396	-3.7437 [.000]
DUMMY9612	.040299	.0086177	4.6763 [.000]
DUMMY9701	.025378	.0090840	2.7937 [.007]
DUMMY9905	-.031338	.0092247	-3.3972 [.001]

R-Squared	.95726	R-Bar-Squared	.95025
S.E. of Regression	.0084693	F-stat. F(10, 61)	136.6200[.000]
Mean of Dependent Variable	.038339	S.D. of Dependent Variable	.037972
Residual Sum of Squares	.0043755	Equation Log-likelihood	247.3387
Akaike Info. Criterion	236.3387	Schwarz Bayesian Criterion	223.8170
DW-statistic	1.9886	System Log-likelihood	538.5903

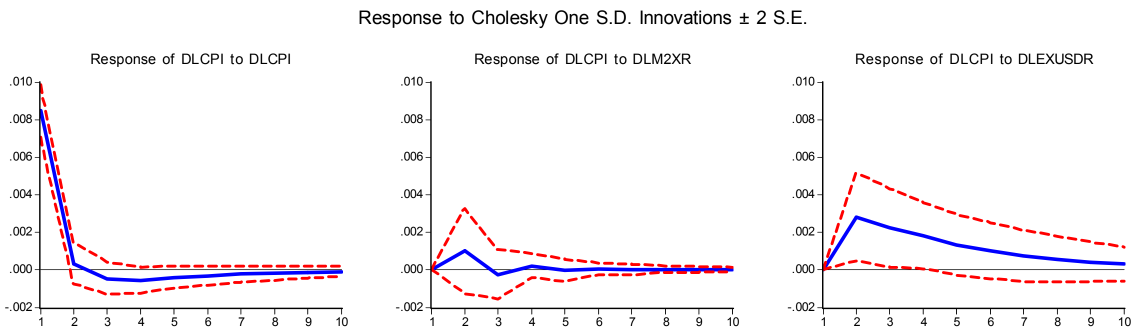
Test Statistics	LM Version		F Version	
A: Serial Correlation	CHSQ(12)= 12.4871	[.407]	F(12, 49)= .85677	[.594]
B: Functional Form	CHSQ(1)= 3.5531	[.059]	F(1, 60)= 3.1146	[.083]
C: Normality	CHSQ(2)= 3.4830	[.175]	Not applicable	
D: Heteroscedasticity	CHSQ(1)= 1.1183	[.290]	F(1, 70)= 1.1044	[.297]

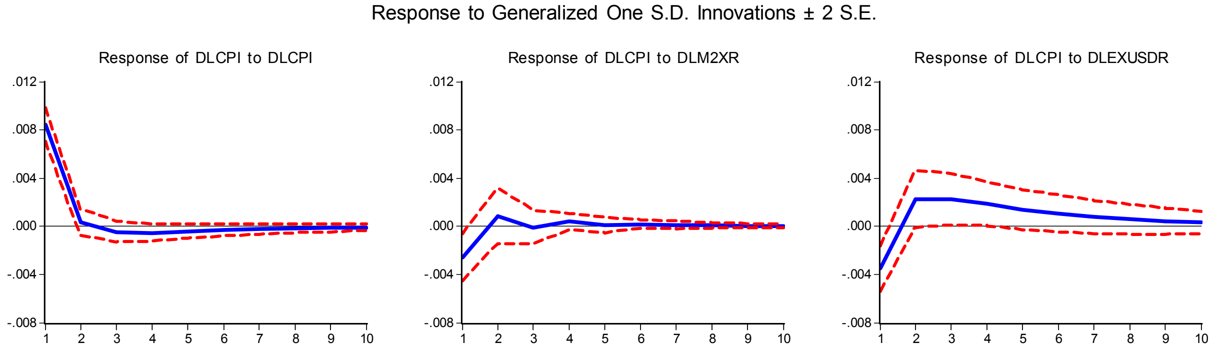
A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values



The simulation properties of the unrestricted vector autoregression model were assessed by imposing shocks to the endogenous variables. For the recovery of structural shocks were used the Cholesky and generalized decompositions. Figure 18 shows the impulse response functions for inflation to structural shocks in the equations of the three endogenous variables (inflation, real money growth, and real exchange change).

Figure 18. Impulse response functions





A shock in the inflation equation implies only a temporary effect on the next evolution of inflation. The initial increase in inflation is followed by successive small reduction in price level that tends to offset the initial increase. On the other hand, the real exchange rate depreciation leads to persistent increases in inflation. An increase in the real monetary aggregate has no important effects on the inflation evolution. We can conclude that the real exchange rate has a greater influence on the evolution of inflation than the monetary aggregate do. This conclusion is stressed by the variance decomposition of inflation too (Table 17).

Table 17. Variance decomposition for inflation

Variance Decomposition of DLCPI:				
Period	**S.E.**	**DLCPI**	**DLM2XR**	**DLEXUSDR**
1	0.008469	100.00	0.00	0.00
2	0.008980	89.09	1.23	9.68
3	0.009266	83.94	1.22	14.84
4	0.009462	80.84	1.23	17.93
5	0.009561	79.35	1.20	19.45
6	0.009620	78.50	1.19	20.31
7	0.009651	78.05	1.19	20.76
8	0.009669	77.80	1.18	21.02
9	0.009678	77.66	1.18	21.16
10	0.009684	77.58	1.18	21.24

Starting with the initial specification of the VAR model, we construct a parsimonius model by dropping out the insignificant variables. The resulting system was the following one:

DLCPI regressed on: DLCPI(-1) DLEXUSDR(-1) ECTMONEY(-1) ECTWAGE(-2) WSKEW WSTDEV DUMMY9605 DUMMY9612 DUMMY9701 DUMMY9905

DLM2XR regressed on: DLM2XR(-1) DLCPI(-1) ECTMONEY(-1) ECTWAGE(-1) WSKEW WSTDEV DUMMYDEC Intercept

DLEXUSDR regressed on: DLEXUSDR(-1) WSTDEV DUMMY9701 DUMMY9702 DUMMY9703 Intercept

The system was estimated using methods of least squares, iterative weighted least squares, and iterative seemingly unrelated regression. All the three methods offered similar results (Table 18).

Table 18. Estimation of inflation using a parsimonius system

	Least Squares				**Iterative Weighted Least Squares**				**Iterative Seemingly Unrelated Regression**			
	Coef	**SE**	**t-st.**	**Prob.**	**Coef**	**SE**	**t-st.**	**Prob.**	**Coef**	**SE**	**t-st.**	**Prob.**
DLCPI(-1)	0.195	0.045	4.346	0.000	0.195	0.042	4.684	0.000	0.234	0.039	5.947	0.000
DLEXUSDR(-1)	0.079	0.037	2.157	0.032	0.079	0.034	2.325	0.021	0.110	0.031	3.504	0.001
ECTMONEY(-1)	0.001	0.000	2.785	0.006	0.001	0.000	3.002	0.003	0.001	0.000	2.454	0.015
ECTWAGE(-2)	0.038	0.014	2.791	0.006	0.038	0.013	3.008	0.003	0.036	0.011	3.356	0.001
WSKEW	0.003	0.001	4.937	0.000	0.003	0.001	5.320	0.000	0.002	0.001	4.977	0.000
WSTDEV	0.158	0.011	14.570	0.000	0.158	0.010	15.701	0.000	0.151	0.009	16.101	0.000
DUMMY9605	-0.038	0.010	-3.899	0.000	-0.038	0.009	-4.201	0.000	-0.030	0.007	-4.266	0.000
DUMMY9612	0.041	0.009	4.768	0.000	0.041	0.008	5.138	0.000	0.019	0.006	2.998	0.003
DUMMY9701	0.027	0.009	2.965	0.003	0.027	0.008	3.196	0.002	0.017	0.007	2.336	0.021
DUMMY9905	-0.034	0.009	-3.765	0.000	-0.034	0.008	-4.057	0.000	-0.033	0.007	-5.038	0.000
R-squared			0.9562				0.9562				0.9496	
Adjusted R-squared			0.9498				0.9498				0.9423	
S.E. of regression			0.0085				0.0085				0.0091	
Durbin-Watson stat			2.0233				2.0233				1.7903	
Mean dependent var			0.0383				0.0383				0.0383	
S.D. dependent var			0.0380				0.0380				0.0380	
Sum squared resid			0.0045				0.0045				0.0052	

The regressions point out the influence of the relative prices adjustments on inflation. The real exchange rate and the real wage are also important factors in explaining the price changes. On the other hand, excess real money balances have no influence on inflation.

E. Conclusions and policy implications

This study addresses the problem of the determinants of inflation in Romania. The analysis is very similar to other researches for Central and Eastern European Countries in Transition.

As main inflation determinants are considered both demand and supply factors. This approach is justified by the ongoing process of transformation specific to transition economies. Within this framework, there are several potentially sources of inflation: monetary growth, exchange rate depreciation, wage increases, fiscal policy, oil price supply shocks, and, nonetheless, relative price adjustments and administrative prices.

Following this approach, we have found that for Romania case the roots of inflation are highly correlated with the transformation process this country has engaged to. The most important factors in driving inflation are the relative price adjustments and the high volatility of inflation.

The relative price adjustment process was necessary giving the initial situation. For a long period of time, a large share in the consumer basket was represented by goods and services whose prices were established by administrative decisions. The 1997 year was the last step in the liberalization of prices. However, the price of electric energy and natural gas still remain regulated by National Agencies. The pattern for the evolution of these prices can be characterized as large shocks induced in the overall price system. Also, the persistence of inflation and the relative price adjustment process increase the variability of inflation every time these shocks are happening.

Nominal exchange rate depreciation generates inflation by the prices of imported goods. As long as the raw material products (for instance oil, fuels, and natural gas) still have a large share in the import structure, the nominal exchange rate depreciation implies new pressures on overall inflation. The Ballasa-Samuelson effect seems to be present in Romanian economy. However, the greater increase in the price of non-tradable goods versus the price of tradable goods can be the expression of relative price adjustment or quality improvements.

Another important factor in explaining inflation is the evolution of nominal wages. The mention we want to make is that the last year has shown the return of the correlation between real wages and productivity in industry. This happens after a period of greater improvements in the labour productivity without similar increases in the real wage. We think that in the next period the real wages evolution will not be an inflationary source.

However, the nominal wages increases remain a source of inflationary pressures. The reason is that these increases are based on large inflationary expectation. We found that there is an important inertia component in the inflation evolution, and that the autonomous level of inflation is very higher.

The monetary sector of the economy is not an important determinant of inflation. We argue that monetary policy has been enough tight during the period analysed. This happened even when there were many situations in which central bank had to issue high powered money beyond the real economy necessities. In these situations sterilization was absolute necessary and the costs for the central bank were important.

Our analysis suggests that inflation in Romania remains the most important issue for the conduct of monetary policy. However, the roots of inflation are strongly related to the expectations and the beliefs of the public. These inflationary expectations can be cut off only through coherent structural policies.

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Appendix

1 Unit roots tests

```
***************************************
ADF Test for series:      DLCPI

number of observations:   68
sample:                   1996.07 - 2002.02
lagged differences:       5
no intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-2.56      -1.94      -1.62
value of test statistic: -1.4002
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.1156       -1.4002
dx(-1)        -0.1720       -1.2761
dx(-2)        -0.0169       -0.1318
dx(-3)        -0.0382       -0.3009
dx(-4)        -0.2449       -1.9454
dx(-5)        -0.1285       -1.0362
RSS            0.0617
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      DLCPI

number of observations:   68
sample:                   1996.07 - 2002.02
lagged differences:       5
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -2.7166
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.4084       -2.7166
dx(-1)         0.0344        0.2176
dx(-2)         0.1430        1.0050
dx(-3)         0.1067        0.7729
dx(-4)        -0.1134       -0.8431
dx(-5)        -0.0396       -0.3146
constant       0.0160        2.2986
RSS            0.0568
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      DLCPI

number of observations:   73
sample:                   1996.02 - 2002.02
lagged differences:       0
no intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-2.56      -1.94      -1.62
value of test statistic: -2.6897
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.1826       -2.6897
RSS            0.0692
---------------------------------------
```

```
***************************************
ADF Test for series:      DLCPI

number of observations:   73
sample:                   1996.02 - 2002.02
lagged differences:       0
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -4.0189
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.3707       -4.0189
constant       0.0141        2.8626
RSS            0.0621
```

```
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
****************************************
ADF Test for series:      LCPI

number of observations:   72
sample:                   1996.03 - 2002.02
lagged differences:       1
intercept, time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.96      -3.41      -3.13
value of test statistic: -1.7850
regression results:
```

```
****************************************
ADF Test for series:      DLM2XRSA

number of observations:   68
sample:                   1996.07 - 2002.02
lagged differences:       4
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -3.8973

regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.6865       -3.8973
dx(-1)         0.2705        1.8377
dx(-2)         0.2502        1.7994
dx(-3)         0.2445        1.8578
dx(-4)        -0.1410       -1.1375
constant      -0.0047       -1.1943
RSS            0.0579
---------------------------------------
optimal number of lags (maximum 10):

Akaike info criterion:    4
Final Prediction Error:   4
Hannan-Quinn criterion:   3
Schwarz criterion:        0
```

```
****************************************
ADF Test for series:      DDR

number of observations:   69
sample:                   1996.05 - 2002.01
lagged differences:       3
no intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-2.56      -1.94      -1.62
value of test statistic: -6.1544
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.9452       -6.1544
dx(-1)         0.4893        3.5795
dx(-2)         0.2663        2.1557
dx(-3)         0.3770        3.2866
```

```
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.0331       -1.7850
dx(-1)         0.5884        6.1064
constant       0.0717        2.2783
trend          0.0010        1.3100
RSS            0.0567
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    1
Final Prediction Error:   1
Hannan-Quinn criterion:   1
Schwarz criterion:        1
```

```
****************************************
ADF Test for series:      LM2XRSA

number of observations:   68
sample:                   1996.07 - 2002.02
lagged differences:       5
intercept, time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.96      -3.41      -3.13
value of test statistic: -2.2327
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.1102       -2.2327
dx(-1)         0.5967        4.8622
dx(-2)         0.0217        0.1655
dx(-3)         0.0438        0.3354
dx(-4)        -0.3365       -2.5770
dx(-5)         0.1861        1.5045
constant       1.0098        2.2214
trend         -0.0005       -1.1329
RSS            0.0509
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    5
Final Prediction Error:   5
Hannan-Quinn criterion:   1
Schwarz criterion:        1
```

```
****************************************
ADF Test for series:      DR

number of observations:   68
sample:                   1996.07 - 2002.02
lagged differences:       5
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57

value of test statistic: -2.1333
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.1291       -2.1333
dx(-1)         0.6565        5.1752
dx(-2)        -0.1633       -1.2015
```

```
RSS            1865.8757
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    3
Final Prediction Error:   3
Hannan-Quinn criterion:   3
Schwarz criterion:        3
```

```
dx(-3)         0.2052        1.4922
dx(-4)        -0.3856       -2.8721
dx(-5)         0.1936        1.5178
constant       4.9589        1.9867
RSS            1709.3161
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    5
Final Prediction Error:   5
Hannan-Quinn criterion:   1
Schwarz criterion:        1
```

****

ADF Test for series: DLLP

```
number of observations:   70
sample:                   1996.05 - 2002.02
lagged differences:       2
no intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%        5%        10%
-2.56     -1.94     -1.62
value of test statistic: -7.6880
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -1.8275       -7.6880
dx(-1)         0.6038        3.4404
dx(-2)         0.2830        2.3593
RSS            0.3103
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    2
Final Prediction Error:   2
Hannan-Quinn criterion:   2
Schwarz criterion:        2
```

****

ADF Test for series: LLP

```
number of observations:   70
sample:                   1996.05 - 2002.02
lagged differences:       3
intercept, time trend
asymptotic critical values (MacKinnon 1993):
 1%        5%        10%
-3.96     -3.41     -3.13
value of test statistic: -1.4505
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.1158       -1.4505
dx(-1)        -0.1581       -1.2300
dx(-2)        -0.2678       -2.2531
dx(-3)        -0.2519       -2.0214
constant       0.0206        1.5712
trend          0.0006        1.3039
RSS            0.2965
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    3
Final Prediction Error:   3
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

****

ADF Test for series: DLMARKUP

```
number of observations:   72
sample:                   1996.03 - 2002.02
lagged differences:       0
no intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%        5%        10%
-2.56     -1.94     -1.62
value of test statistic: -9.2807
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -1.0966       -9.2807
RSS            0.2036
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

****

ADF Test for series: LMARKUP

```
number of observations:   73
sample:                   1996.02 - 2002.02
lagged differences:       0
intercept, time trend
asymptotic critical values (MacKinnon 1993):
 1%        5%        10%
-3.96     -3.41     -3.13
value of test statistic: -1.4372
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.0590       -1.4372
constant      -0.0214       -1.6918
trend         -0.0003       -0.9285
RSS            0.1973
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      DLYSA

number of observations:   70
sample:                   1996.05 - 2002.02
lagged differences:       2
no intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-2.56      -1.94      -1.62
value of test statistic: -4.0381
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.9203       -4.0381
dx(-1)        -0.2042       -1.1651
dx(-2)        -0.2944       -2.5435
RSS            0.0727
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    2
Final Prediction Error:   2
Hannan-Quinn criterion:   2
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      LYSA

number of observations:   70
sample:                   1996.05 - 2002.02
lagged differences:       3
intercept, time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.96      -3.41      -3.13
value of test statistic: -0.9946
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.0381       -0.9946
dx(-1)        -0.1273       -1.0531
dx(-2)        -0.0919       -0.7716
dx(-3)         0.2832        2.3731
constant      -0.0038       -0.8539
trend          0.0002        0.7656
RSS            0.0690
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    3
Final Prediction Error:   3
Hannan-Quinn criterion:   3
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      WSKEW

number of observations:   73
sample:                   1996.02 - 2002.02
lagged differences:       0
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -7.1013
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.8633       -7.1013
constant       1.5548        4.8794
RSS            255.9000
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      WSTDEV

number of observations:   73
sample:                   1996.02 - 2002.02
lagged differences:       0
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -5.0330
regression results:
---------------------------------------
variable      coefficient   t-statistic
---------------------------------------
 x(-1)        -0.5268       -5.0330
constant       0.1025        3.6598
RSS            1.9069
---------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    0
Final Prediction Error:   0
Hannan-Quinn criterion:   0
Schwarz criterion:        0
```

```
***************************************
ADF Test for series:      DLEXUSD

number of observations:   69
sample:                   1996.06 - 2002.02
lagged differences:       3
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -4.1349
regression results:
---------------------------------------
variable      coefficient   t-statistic
```

```
***************************************
ADF Test for series:      DLEXUSDR

number of observations:   71
sample:                   1996.04 - 2002.02
lagged differences:       1
intercept, no time trend
asymptotic critical values (MacKinnon 1993):
 1%         5%         10%
-3.43      -2.86      -2.57
value of test statistic: -7.0697
regression results:
---------------------------------------
variable      coefficient   t-statistic
```

```
--------------------------------------
 x(-1)        -0.5532       -4.1349
dx(-1)         0.4794        3.4564
dx(-2)        -0.1751       -1.4535
dx(-3)         0.2236        1.8363
constant       23.1516       2.9050
RSS            139333.3422
--------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    3
Final Prediction Error:   3
Hannan-Quinn criterion:   3
Schwarz criterion:        1
```

```
--------------------------------------
 x(-1)        -1.0376       -7.0697
dx(-1)         0.2803        2.4346
constant      -0.0026       -0.5134
RSS            0.1258
--------------------------------------
optimal number of lags (maximum 10):
Akaike info criterion:    1
Final Prediction Error:   1
Hannan-Quinn criterion:   1
Schwarz criterion:        1
```

2 Johansen procedure for long run money demand

```
 Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
******************************************************************************
 Based on 70 observations from 1996M5  to 2002M2 . Order of VAR = 4
 List of variables included in the unrestricted VAR:
 LM2XRSA        YSA             DR              DLEXUSD
 List of deterministic and/or exogenous variables:
 DUMMY9703
******************************************************************************
 Order    LL       AIC      SBC             LR test         Adjusted LR test
   4  -161.6773 -229.6773 -306.1261              ------              ------
   3  -169.2131 -221.2131 -279.6740  CHSQ( 16)=  15.0717[.519]   11.4114[.783]
   2  -184.3679 -220.3679 -260.8408  CHSQ( 32)=  45.3811[.059]   34.3600[.355]
   1  -207.1023 -227.1023 -249.5873  CHSQ( 48)=  90.8501[.000]   68.7865[.026]
   0  -868.1774 -872.1774 -876.6744  CHSQ( 64)=   1413.0[.000]    1069.8[.000]
******************************************************************************
 AIC=Akaike Information Criterion     SBC=Schwarz Bayesian Criterion
```

```
 Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
******************************************************************************
 Based on 71 observations from 1996M4  to 2002M2 . Order of VAR = 3
 List of variables included in the unrestricted VAR:
 LM2XRSA        YSA             DR              DLEXUSD
 List of deterministic and/or exogenous variables:
 DUMMY9703
******************************************************************************
 Order    LL       AIC      SBC             LR test         Adjusted LR test
   3  -173.2750 -225.2750 -284.1046              ------              ------
   2  -188.3733 -224.3733 -265.1015  CHSQ( 16)=  30.1967[.017]   24.6677[.076]
   1  -211.8940 -231.8940 -254.5208  CHSQ( 32)=  77.2380[.000]   63.0958[.001]
   0  -880.7394 -884.7394 -889.2648  CHSQ( 48)=   1414.9[.000]    1155.9[.000]
******************************************************************************
 AIC=Akaike Information Criterion     SBC=Schwarz Bayesian Criterion
```

```
 Test Statistics and Choice Criteria for Selecting the Order of the VAR Model
******************************************************************************
 Based on 72 observations from 1996M3  to 2002M2 . Order of VAR = 2
 List of variables included in the unrestricted VAR:
 LM2XRSA        YSA             DR              DLEXUSD
 List of deterministic and/or exogenous variables:
 DUMMY9703
******************************************************************************
 Order    LL       AIC      SBC             LR test         Adjusted LR test
   2  -191.3755 -227.3755 -268.3555              ------              ------
   1  -216.6417 -236.6417 -259.4084  CHSQ( 16)=  50.5324[.000]   44.2159[.000]
   0  -892.4138 -896.4138 -900.9671  CHSQ( 32)=   1402.1[.000]    1226.8[.000]
******************************************************************************
 AIC=Akaike Information Criterion     SBC=Schwarz Bayesian Criterion
```

```
       Cointegration with restricted intercepts and no trends in the VAR
   Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix
******************************************************************************
 72 observations from 1996M3  to 2002M2 . Order of VAR = 2.
 List of variables included in the cointegrating vector:
 LM2XRSA        YSA             DR              DLEXUSD         Intercept
 List of I(0) variables included in the VAR:
 DUMMY9703
 List of eigenvalues in descending order:
.49623     .19034    .079980    .012793      .0000
```

```
*****************************************************************************
 Null    Alternative    Statistic     95% Critical Value     90% Critical Value
 r = 0      r = 1        49.3655           28.2700                25.8000
 r<= 1      r = 2        15.2020           22.0400                19.8600
 r<= 2      r = 3         6.0019           15.8700                13.8100
 r<= 3      r = 4         .92704            9.1600                 7.5300
*****************************************************************************
 Use the above table to determine r (the number of cointegrating vectors).


       Cointegration with restricted intercepts and no trends in the VAR
          Cointegration LR Test Based on Trace of the Stochastic Matrix
*****************************************************************************
 72 observations from 1996M3  to 2002M2 . Order of VAR = 2.
 List of variables included in the cointegrating vector:
 LM2XRSA        YSA             DR              DLEXUSD         Intercept
 List of I(0) variables included in the VAR:
 DUMMY9703
 List of eigenvalues in descending order:
.49623     .19034    .079980    .012793      .0000
*****************************************************************************
 Null    Alternative    Statistic     95% Critical Value     90% Critical Value
 r = 0      r>= 1        71.4964           53.4800                49.9500
 r<= 1      r>= 2        22.1309           34.8700                31.9300
 r<= 2      r>= 3         6.9289           20.1800                17.8800
 r<= 3      r = 4         .92704            9.1600                 7.5300
*****************************************************************************
 Use the above table to determine r (the number of cointegrating vectors).


       Cointegration with restricted intercepts and no trends in the VAR
Choice of the Number of Cointegrating Relations Using Model Selection Criteria
*****************************************************************************
 72 observations from 1996M3  to 2002M2 . Order of VAR = 2.
 List of variables included in the cointegrating vector:
 LM2XRSA        YSA             DR              DLEXUSD         Intercept
 List of I(0) variables included in the VAR:
 DUMMY9703
 List of eigenvalues in descending order:
.49623     .19034    .079980    .012793      .0000
*****************************************************************************
 Rank      Maximized LL       AIC             SBC             HQC
 r = 0      -222.7081       -242.7081       -265.4748       -251.7716
 r = 1      -198.0254       -226.0254       -257.8987       -238.7142
 r = 2      -190.4244       -224.4244       -263.1277       -239.8323
 r = 3      -187.4234       -225.4234       -268.6801       -242.6440
 r = 4      -186.9599       -226.9599       -272.4932       -245.0869
*****************************************************************************
 AIC = Akaike Information Criterion    SBC = Schwarz Bayesian Criterion
 HQC = Hannan-Quinn Criterion


Estimated Cointegrated Vectors in Johansen Estimation (Normalized in Brackets)
       Cointegration with restricted intercepts and no trends in the VAR
*****************************************************************************
 72 observations from 1996M3  to 2002M2 . Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LM2XRSA        YSA             DR              DLEXUSD         Intercept
 List of I(0) variables included in the VAR:
 DUMMY9703
*****************************************************************************
                 Vector  1
 LM2XRSA           -.28985
                (  -1.0000)

 YSA                .37313
                (   1.2873)

 DR               .0087696
                (  .030255)

 DLEXUSD         -.0027871
                (-.0096157)

 Intercept          2.4736
                (   8.5340)

*****************************************************************************
```

```
            Estimated Long Run Matrix in Johansen Estimation
       Cointegration with restricted intercepts and no trends in the VAR
*******************************************************************************
 72 observations from 1996M3  to 2002M2 . Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LM2XRSA        YSA            DR             DLEXUSD         Intercept
 List of I(0) variables included in the VAR:
 DUMMY9703
*******************************************************************************
                  LM2XRSA         YSA             DR          DLEXUSD
 LM2XRSA           -.025066        .032267       .7584E-3      -.2410E-3

 YSA                .016445       -.021170      -.4976E-3       .1581E-3

 DR                  5.2449        -6.7518        -.15869        .050434

 DLEXUSD            -.95072         1.2239        .028764      -.0091418

            Estimated Long Run Matrix in Johansen Estimation
       Cointegration with restricted intercepts and no trends in the VAR
*******************************************************************************
 72 observations from 1996M3  to 2002M2 . Order of VAR = 2, chosen r =1.
 List of variables included in the cointegrating vector:
 LM2XRSA        YSA            DR             DLEXUSD         Intercept
 List of I(0) variables included in the VAR:
 DUMMY9703
*******************************************************************************
                 Intercept
 LM2XRSA             .21391

 YSA                -.14034

 DR                -44.7599

 DLEXUSD             8.1134
```

```
    ECM for variable LM2XRSA estimated by OLS based on cointegrating VAR(2)
*******************************************************************************
 Dependent variable is dLM2XRSA
 72 observations used for estimation from 1996M3  to 2002M2
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 dLM2XRSA1                   .46705             .10541            4.4306[.000]
 dYSA1                      .090467            .076761            1.1785[.243]
 dDR1                      .0010841           .6834E-3            1.5863[.117]
 dDLEXUSD1                -.4170E-4           .8335E-4           -.50030[.619]
 ecm1(-1)                   .086477            .021200            4.0791[.000]
 DUMMY9703                 -.085769            .025726           -3.3339[.001]
*******************************************************************************
 List of additional temporary variables created:
 dLM2XRSA = LM2XRSA-LM2XRSA(-1)
 dLM2XRSA1 = LM2XRSA(-1)-LM2XRSA(-2)
 dYSA1 = YSA(-1)-YSA(-2)
 dDR1 = DR(-1)-DR(-2)
 dDLEXUSD1 = DLEXUSD(-1)-DLEXUSD(-2)
 ecm1 =   -.28985*LM2XRSA +   .37313*YSA + .0087696*DR -.0027871*DLEXUSD +   2
.4736
*******************************************************************************
 R-Squared                     .70748   R-Bar-Squared                   .68531
 S.E. of Regression           .021200   F-stat.    F(  5,  66)   31.9245[.000]
 Mean of Dependent Variable -.0058986   S.D. of Dependent Variable     .037792
 Residual Sum of Squares      .029663   Equation Log-likelihood       178.4392
 Akaike Info. Criterion      172.4392   Schwarz Bayesian Criterion    165.6092
 DW-statistic                  2.1885   System Log-likelihood        -198.0254
*******************************************************************************
```

```
                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version          *
*******************************************************************************
*                     *                          *                            *
* A:Serial Correlation*CHSQ(  12)=  17.6796[.126]*F(  12,  54)=   1.4646[.167]*
*                     *                          *                            *
* B:Functional Form   *CHSQ(   1)=  10.8960[.001]*F(   1,  65)=  11.5907[.001]*
*                     *                          *                            *
* C:Normality         *CHSQ(   2)=   1.7717[.412]*       Not applicable       *
*                     *                          *                            *
* D:Heteroscedasticity*CHSQ(   1)=  .072134[.788]*F(   1,  70)=  .070200[.792]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
```

D:Based on the regression of squared residuals on squared fitted values

Vector Error Correction Estimates
Sample(adjusted): 1996:03 2002:02
Included observations: 72 after adjusting endpoints
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
LM2XRSA(-1)	1.000000
LYSA(-1)	-1.287302 (0.42922) [-2.99916]
DR(-1)	-0.030255 (0.00430) [-7.03754]
DLEXUSD(-1)	0.009616 (0.00219) [4.38687]
C	-8.534000 (0.17448) [-48.9117]

Error Correction:	D(LM2XRSA)	D(LYSA)	D(DR)	D(DLEXUSD)
CointEq1	-0.025066 (0.00614) [-4.07911]	0.016445 (0.00962) [1.70913]	5.244893 (0.79082) [6.63221]	-0.950716 (11.2829) [-0.08426]