

# **Price Liberalization, Inflation, and Regulated Prices in the Kyrgyz**

## **Republic: an Econometric Analysis\***

Ainura Uzagalieva  
Center for Economic Research and Graduate Education (CERGE-EI)  
P.O. Box 882, Politických veznu 7  
111 21 Praha 1, Czech Republic

There is a close relationship between the general inflation level and the variability of relative prices. The purpose of this paper is to analyze the magnitude of influence caused by state regulated prices on the overall inflation level during economic reforms in the Kyrgyz Republic. We decompose the variability of relative prices within the CPI into three components (an inflation component, a real component, and an interaction component) and estimate in each of the components the size of variation caused by state controlled prices. Based on the results we argue that most state controlled prices largely contribute to the variance of relative prices and, thus, to the general inflation.

**Keywords:** Kyrgyz Republic, liberalization, state regulations, inflation, variability of relative prices.

**JEL Classification:** E31, E61, G38

---

\* The author is gratefully acknowledge the financial and professional support of CERGE-EI and World Bank in the framework of the research fellowship named "Price Liberalization, Inflation, and Regulated Prices in the Kyrgyz Republic: an Econometric Analysis". The author is especially grateful to Lubomir Lizal, Jacek Cukrowski, and Lawrence Smith for helpful comments, advises and discussions.

## **1. Introduction**

When implementing economic reforms one of the most important tasks the countries under transition faced in the beginning of the 1990s was to change from a policy of price controls to that of a free market economy. The government of the Kyrgyz Republic (KR) made a number of attempts to withdraw state controls over the economy. In their effort to reduce the blight of central planning and to reconstruct the economy the government undertook trade liberalization, abandoned price controls from almost all goods, and introduced value added tax. The sudden withdrawal of control followed by price liberalization without any attempt to organize a market system has led to a sharp increase in all prices due to a large gap between domestic and world prices, the collapse of trade links with other Commonwealth Independent States (CIS) and production fall in KR. This resulted in very high inflation rates at the beginning of the reforms (see Table 1 in Appendix). Inflationary pressures were exacerbated through much of 1992-1993 by a sharp increase in the prices of imported goods, in particular, energy products.

After unsuccessful attempts to stabilize the economy as a member of the rouble area<sup>1</sup>, the stabilization efforts were intensified with the introduction of a national currency, the KGS, on May 10, 1993 under a floating exchange rate and market-determined interest rate policies. This was the first action taken by any CIS country as a part of a comprehensive program of adjustment and structural transformation and attracted substantial financial and technician support from the Bretton Woods institutions and donors. As a result, a typical two-tiered banking system, including a central bank and

---

<sup>1</sup>After the collapse of USSR all CIS republics were using rouble as legal tender.

commercial banks, was established. According to the law on the National Bank of the Kyrgyz Republic (NBKR), the main purpose of the central bank is to control inflation.

NBKR influences the money market through the traditional instruments of monetary policy. Nowadays the most actively used instrument of monetary policy in KR is open market operations. The exchange rate is freely determined on the basis of spot and other exchange rates<sup>2</sup> on the foreign exchange market<sup>3</sup>. Inflation in KR is measured with the consumer price index (CPI), which is calculated on the basis of a consumer basket of 343 goods and services. The prices of 17 components in the consumer basket are controlled by the state. These components are presented in Table 2 (see Appendix).

A preliminary study of relative price changes within the CPI based on 10 aggregated groups in the consumer basket (Cukrowski, Uzagalieva 2001) suggest that the main components, which determine the inflation process in KR, are paid services, main food products, household goods, and state regulated goods and services. It also found that the relative price of goods, the nominal price of which are established and controlled by the state, have significantly declined during economic reforms. However, it is not clear yet how much and to what extent state regulations do contribute to the general inflation level. The purpose of the study is to analyze the behavior of relative price changes within the CPI and to describe a link between the variability of administrative price changes, which are initiated by the government, and the general inflation level.

---

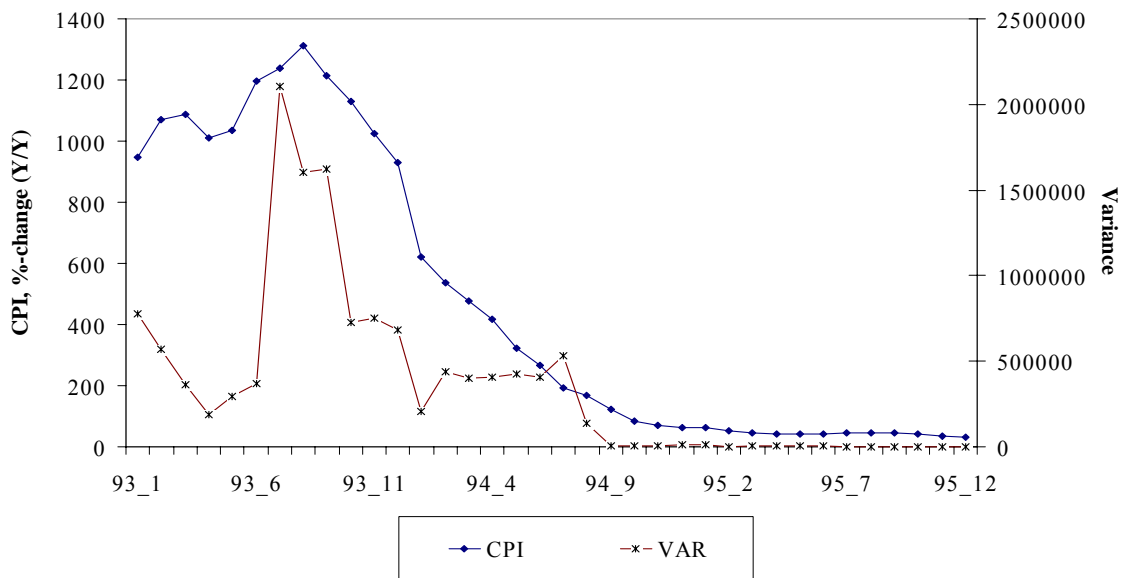
<sup>2</sup>Pursuant to the Law of the Kyrgyz Republic "On Operations in Foreign Exchange" as of 05.07.95, No 7-1, Article 7. The activity of NBKR on the foreign exchange market is limited to smoothing abrupt fluctuations in the exchange rate, while keeping international reserves at an adequate level.

<sup>3</sup>Between 1997– 1998 the exchange rate was determined on the basis of NBKR's auctions.

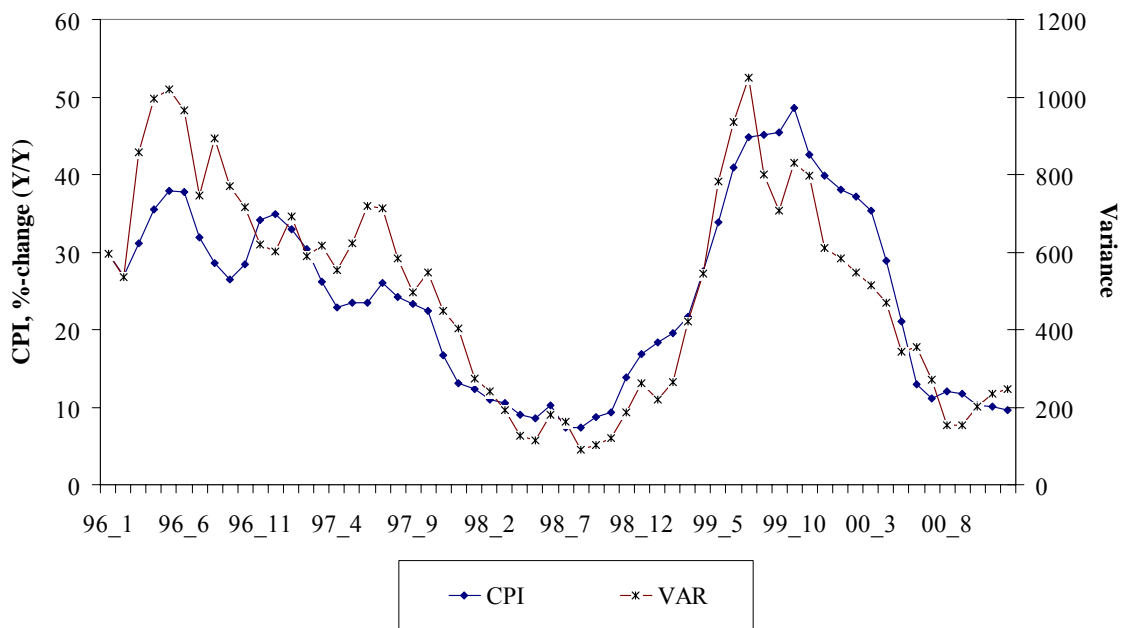
Finding and describing the link between prices controlled by the state and inflation during economic reforms is very important, because, on the one hand, the central bank controls the general inflation level measured by the CPI, and on the other, the government regulates some components of the CPI in an administrative order. If state-controlled prices contribute largely to the variability of relative prices and, consequently, have a large impact on the general inflation level, then the central bank can have only limited power to provide an efficient monetary policy. Moreover, tight credit policy implemented by the central bank for controlling inflation can significantly undermine the economic performance if government has a channel to influence inflation. In addition it can cause the development of a black market, which turns out to be one of the main problems and obstacles to market reforms. Consequently, the issue of removing state control on prices is crucial in transition economies, which makes it necessary to carefully study the relationship between the price controls and inflation.

It is a well-known stylized fact, which is described in the stream of theoretical and empirical literature (e.g. Ball and Mankiw 1994, 1995; Mussa 1977; Shleshinski and Weiss 1977), that there exist a close and positive relationship between the general inflation level and the variability of relative prices. In particular, an increase in the variability of relative prices causes high inflation and/or high inflation amplifies the variability of relative prices. The dynamics of general inflation and the variance of relative prices in KR, which are drawn in Figure 1, show such a relationship.

a)



b)



**Figure 1.** General inflation level based on CPI and the variance of relative prices:

a) 1993-1995; and b) 1996-2000

The objective of this work is to decompose the variability of relative prices within the CPI into three components: an inflation component, a real component, and an interaction component. The first component is caused mainly by general inflation in the economy. The second component stems from changes in the demand side of the economy (e.g. technical changes, income changes, and preferences). And, the third element of the variance, which is the joint combination of the first and the second components, captures the mix of two factors, inflation and real changes. In order to identify the variation coming from the change of controlled prices and to find its size in the total variance of relative prices we divide each of the three components into two separate elements. The first element is the size of variation caused by the change of state controlled prices, and the other one is the size of variation caused by the change of freely determined prices. This would give us an important indication on how prices, which are controlled by the state, do contribute to the variability of relative prices and, thus, to general inflation in the economy.

The study in this paper is based on the CPI data of KR for the period 1992-2000 disaggregated at the 305 level, including the total number of components in the consumer basket. The variability of relative prices within the CPI, the variability of state-controlled relative prices, and their link with general inflation receive the main attention. The paper consists of 5 sections. Section 2 provides a brief overview of theoretical background and literature for the relationship between general inflation and the variability of relative prices. Section 3 deals with information on the system of CPI measurement in KR and the behavior of individual prices within the CPI. Section 4 describes in detail a methodology for studying a link between general inflation and the variability of relative prices during

transition and deals with empirical estimation. And, section 5 summarizes the main empirical findings and concludes.

## **2. Literature review**

The relation between aggregate inflation level and the variability of relative prices is a very popular topic in the literature. Since the beginning of the 1970s i.e., from the times of the oil shocks the relation between the dynamic of relative prices and the level of inflation has been one of the main objects of economic research. There are various theoretical models in the literature, which attempted to explain the reasons and causes between individual prices and the general inflation level.

Examples of theoretical and empirical research in this field are Vinning and Elwertowski (1976), Mussa (1977), Shleshinski and Weiss (1977), Cukierman (1979), Fisher (1981), Domberger (1987), Clements and Nguyen (1982), Hartman (1991), Ball and Mankiw (1994, 1995). According to these studies there is a close relationship between aggregate inflation level and the variability of relative prices. In particular, Ball and Mankiw (1994, 1995) argue that high fluctuation in relative prices causes inflation strengthening. On the contrary, Mussa (1977), Shleshinski and Weiss (1977) suggest that inflation increases the fluctuation of relative prices. Without going deep into the details of these models, it is possible to state that there is a strong correlation between the general inflation level and the variability of relative prices.

Despite a strong correlation between the general inflation level and the variability of relative prices, which is widely observed in both developed and developing countries, explanations about economic reasoning for the variability of relative prices and the

sources of inflation differ significantly. Several examples can be presented based on the work of Parks (1978), Clements and Nguyen (1982), Hercowitz (1981) and Cukierman (1984). These studies used widely a variance decomposition methodology, splitting the variability of relative price into separate components in order to determine important sources of variation.

In particular, Parks (1978) decomposed the variability of relative prices<sup>4</sup> into the demand component (real income, family composition), unanticipated inflation and the supply component (technology, resource allocation). Parks's conclusion is that unanticipated inflation is the important determinant of relative price variability. The view of Hercowitz (1981) is closely related with the results of Parks, although he explains the problem from a different angle, e.g. the main reason for relative price dispersion are exogenous shocks that affect the economy through a sudden and unexpected change in the growth rate of money<sup>5</sup>. Later, Clements and Nguen (1982) decomposed the variability of relative prices<sup>6</sup> into the inflation component, the component of real factors and their joint combination. The authors argue that the important determinant of relative price variability is a real component.

The above-mentioned studies assume that prices in the economy are freely determined by market clearing, which is not realistic in the economies of transition. In transition economies not all prices are determined freely, some of them are controlled by the state administratively. In the literature there are only a few works, which take into

---

<sup>4</sup> Parks (1978) used the US data for the period 1930-1975 (page 85).

<sup>5</sup> Hercowitz (1981) used the German data during the period of hyperinflation (1921-1923), page (330).

<sup>6</sup> Clements and Nguen (1982) used the Australian data for the period 1959-1978.



consideration the relationship between controlled prices and the variability of relative prices. One of the examples of these works is Cukierman and Leiderman (1984), who develop the idea of Hercowitz (1981) by incorporating controlled prices into a model and find the impact of controlled prices on the variability of relative prices, which are determined freely.

Cukierman and Leiderman (1984) decomposed the variability of relative prices<sup>7</sup> using the aggregated inflation data into terms which involve the variance of relative prices determined freely, the variance of relative prices controlled by the government, and the variance between these two. The main conclusion of this study is that a necessary condition, which enables price controls to influence the variability of relative prices, is the lack of coordination between the government policy of price controls and the monetary policy of the central bank in managing the nominal supply of money. Such a lack causes an unexpected change in the growth rate of money supply, which in turn affects the variability of relative prices.

At the end of the 1990s the first work appeared on the countries of transition say Wozniak (1998). Wozniak (1998) argues that relative price adjustment, in particular, agricultural and administrative adjustment is the most important source of inflation in the transition economies, namely, in Czech Republic, Hungary, and Poland. However, none of the above-mentioned works give a definite answer to how much the administrative change of prices contributes to the variability of the general inflation level. To address this issue we decompose the variability of relative prices using the disaggregated inflation data of

---

<sup>7</sup>Cukierman and Leiderman (1984) used the Israel data for the period 1966-1980, page (280).

KR and find the size of variation caused by the change of prices controlled by the government.

### 3. Data description

The official inflation data of KR are supplied by the National Statistics Committee of KR (NSC KR) through its publications<sup>8</sup> and WebPages (<http://nsc.bishkek.su>). The price indexes published by NSC KR include the producer price index, the agricultural price index, and the consumer price indexes. Inflation in KR is measured with the CPI by the Laspeyres formula as:

$$(1) \quad CPI^t = \frac{\sum_{i=1}^K p_i^0 q_i^0 \frac{p_i^t}{p_i^0}}{\sum_{i=1}^K p_i^0 q_i^0} .$$

The CPI data of KR disaggregated upto 10 groups can be obtained in the WebPage of NSC KR, the data at a higher level of disaggregation can be collected from the publications of NSC KR.

NSC KR has changed the structure of the consumer basket three times since the beginning of reforms. The first change took place in 1995 when the Parliament of KR altered the minimum level of the consumer budget. The next change was in 1998 when new items (education, public health and notary offices) were included in the consumer basket as separate observations. And, in 2001 the number of components in the basket was increased from 305 to 343. The CPI items are divided into three main groups: foods, non-foods, and paid services.

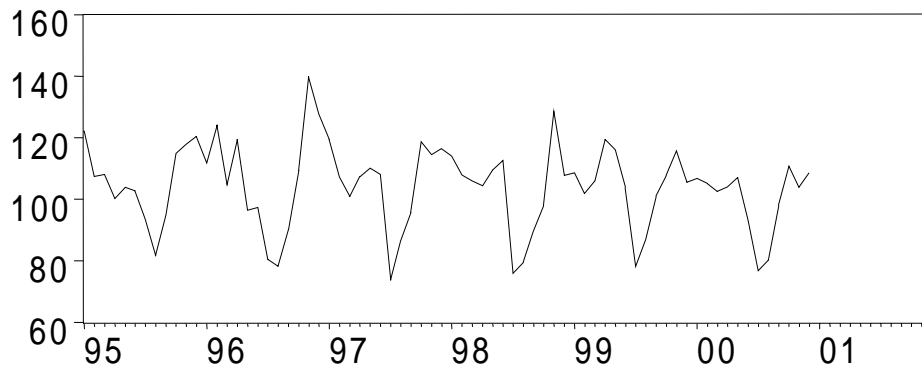
We should remark from Table 1 that the price changes of the main groups significantly deviate from the general inflation level. The studies of relative price changes

---

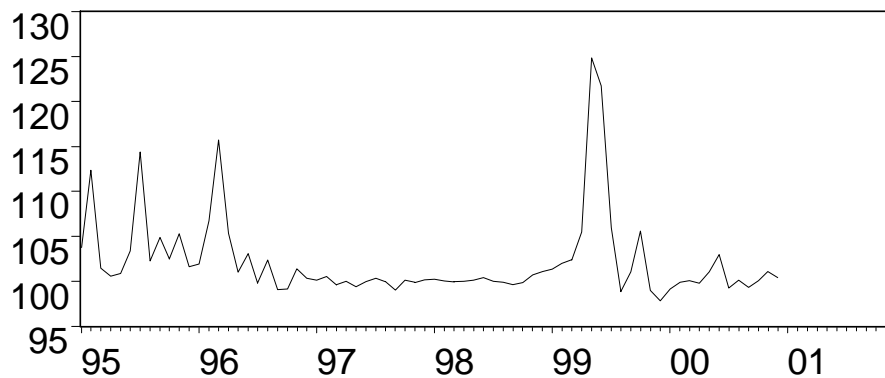
<sup>8</sup> See for example the quarterly publication of “Price indexes in Kyrgyz Republic”.

in KR during economic reforms using the ten groups of goods in the basket (Cukrowski, Uzagalieva 2001) suggest that the deviation of price changes across these groups as well as from the general inflation is much larger. Besides, the deviation of price indexes across groups significantly changes over time. For example, the price index of the group “Fruits” (see Figure 2 (a)) in the CPI fluctuates significantly differently from the price index of the group “Bread” (see Figure 2 (b)).

a)



b)



**Figure 2.** The dynamic of price indexes during 1995-2000: a) “Fruits”; b) “Bread”.

The dynamic of price changes across groups within the CPI is characterized by a different speed of change; the prices of some goods change more quickly compared to others. Another feature of individual price changes is that the distributions of individual prices within the CPI are not normal and skewed, mainly, to the right (see Table 3 in Appendix). This indicates the fact that during economic reforms large price increases on the majority of goods and services have taken place. The main components of the CPI, which determine the inflation process in KR, are paid services, main food products (bread, meat poultry and fish), household goods, and goods and services (rent, water, gas, electricity, other kinds of fuel) whose prices are regulated by the state. It is also found that the relative prices of goods, the nominal prices of which are established and controlled by the state, have significantly declined during economic reforms. These categories include, mainly, energy products. However, it is not clear yet how much and to what extent state regulations do contribute to the general inflation level.

The sample of CPI used in this study covers 305 categories of consumer goods for the period of July, 1995-December, 2000. CPI is presented as the weighted average of individual CPIs of 305 components, i.e.:

$$(2) \quad CPI_t = \sum_{i=1}^K w_{i,t} \pi_{i,t},$$

where  $w_{it}$  is the weight of  $i$ 's component of the CPI in period  $t$ , and  $\pi_{it}$  is individual inflation of  $i$ 's component in period  $t$ . The  $w_{i,t}$  in formula (2) is defined as

$$(3) \quad w_{i,t} = \frac{p_{i,t-1} q_i^0}{\sum_{j=1}^K p_{j,t-1} q_j^0},$$

which means that  $w_{i,t}$  is not a constant, but depends on the period chosen as the basis<sup>9</sup>. The constants are  $q_i$ 's which represent the structure of actual consumption expenses in the basis period. Consequently, under the calculation of monthly CPI the weights  $w_{i,t}$  change every month because absolute and relative prices change every month. The same phenomenon occurs when the quarterly inflation rates are calculated.

There are 17 components in the consumer basket whose prices are controlled by the state. For empirical estimation we analyze these components separately from the rest of the 288 goods and services in the basket, the prices of which are determined freely. In order to simplify our calculations, we aggregate the items with freely determined prices into 22 groups. Consequently, we analyze 39 components of the CPI as a whole, which are presented in Table 2, including 17 individual items with controlled prices and 22 aggregated groups with freely determined prices.

#### **4. Methodology, econometric model and evidence**

In an empirical estimation we use a methodology of decomposing the variability of relative prices. We put a strong emphasis on the quantitative size of controlled prices in the variability of relative prices. The methodology is based on the technique of Clements and Nguyen (1982) which we modify by incorporating the total number of goods and services in the consumer basket. Including all CPI items allows us to divide all three components (an inflation component, a real component, and an interaction component) into two parts (the shares of state controlled and freely determined prices) and to find the

---

<sup>9</sup>There are three possibilities of choosing the basis period: (1) the previous month, (2) December of the previous year, and (3) an appropriate month or period of the previous year. In this study weights are based on the third option.

size of variation caused by the change of state controlled prices in each. Thus, we distinguish the variation caused by the change of controlled prices in all three components. The rate of general inflation, measured by the CPI as the weighted mean of price changes in the consumer basket, is given by formula (2) which is mentioned in section 3. The variance of relative price changes is calculated using:

$$(4) \quad VAR_t = \sum_i w_{it} [\pi_{i,t} - CPI_t]^2.$$

There is a clear link between the variance of 39 items and the general inflation level (see Figure 2), namely, high inflation is accompanied by a high variance in individual prices and low inflation corresponds to a low variance. We estimate a link between the general inflation rate and the relative price change of an individual good  $i$  using the system of unrelated regressions (SUR) with the restriction  $\sum_i w_i = 1$  for  $\forall t$ , which means that the sum of weights should be equal 1 at any time. The restricted SUR, estimated on the sample data for the period November, 1994-December, 2000, is:

$$(5) \quad w_{it}(\pi_{i,t} - CPI_t) = \alpha_i + \beta_i CPI_t + \varepsilon_{it}, \quad \forall i, \quad i=1, \dots, 39,$$

where  $\alpha_i$  and  $\beta_i$  are coefficients and  $\varepsilon_{it}$  is an error term with  $E\varepsilon_{it}=0$ . We report the estimated coefficients of the restricted SUR model in Table 4 (Appendix). Excluding the period of hyperinflation (January, 1993 - October, 1994) allows us to receive coefficient estimates at more reasonable significance level.

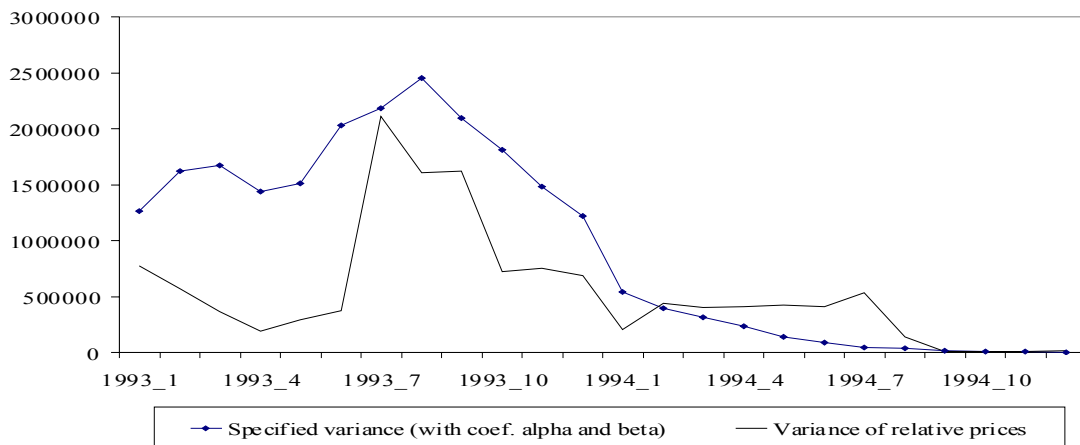
Dividing our estimated coefficients,  $\alpha_i$  and  $\beta_i$  by  $w_i$  and rearranging equation (2), we can find an autonomous trend in the relative price of  $i$ , which is  $\alpha_i/w_{it}$ . This trend reflects real changes in the economy. Then, the elasticity of relative prices with respect to the general inflation level is  $\beta_i/w_{it}$ . Using these values and substituting equation (2) with equation (3) we specify variance through:

$$\begin{aligned}
(6) \quad VAR_t &= \sum_i w_{it} [\alpha_i/w_{it} + (\beta_i/w_{it}) CPI_t]^2 = \\
&= \sum_i w_{it} [(\alpha_i/w_{it})^2 + 2(\alpha_i/w_{it})(\beta_i/w_{it}) CPI_t + ((\beta_i/w_{it}) CPI_t)^2] = \\
&= \sum_i \alpha_i^2/w_{it} + 2 CPI_t \sum_i (\alpha_i \beta_i)/w_{it} + CPI_t^2 \sum_i \beta_i^2/w_{it},
\end{aligned}$$

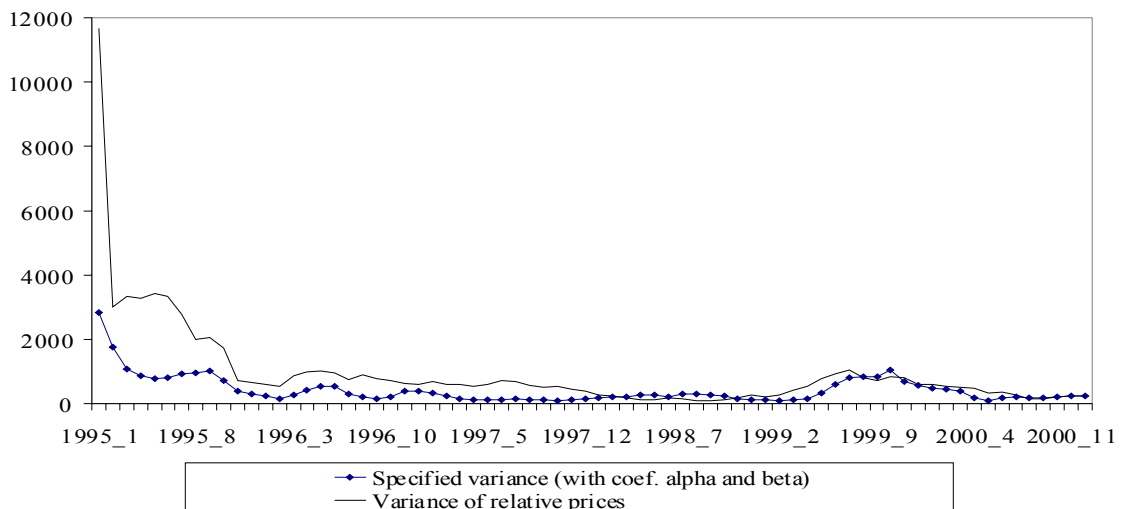
as  $E(e_{it})=0$ .

Figure 3 demonstrates the dynamic of both variances obtained by the equations (4) and (6), i.e., one is calculated statistically on the basis of 39 components, and the other accounts for the autonomous trend in relative prices and the elasticity of relative prices with respect to general inflation.

a)



b)



**Figure 3.** The variance of relative prices: a) 1993-1994; b) 1995-2000

Based on the equation (6) we obtain variance decomposition, dividing both its sides by the variance and rearranging it to:

$$(7) \quad \lambda_{it} = \alpha_i^2/w_{it}VAR_t + 2 \alpha_i \beta_i CPI_t/w_{it} VAR_t + \beta_i^2 CPI_t^2/w_{it} VAR_t.$$

The term  $\lambda_{it}$  is the unit sum of three components due to the real effect ( $R$ ), inflation ( $I$ ), and the interaction of real factors and inflation ( $RI$ ), i.e.:

$$(8) \quad \lambda_{it} = \lambda_{it}^R + \lambda_{it}^{RI} + \lambda_{it}^I.$$

The first term in the equation (8), which is  $\lambda_{it}^R$ , reflects variation coming from real changes in the economy because it contains the self-directed change of relative price or an autonomous trend in the relative price of good  $i$  that is caused by factors not related to the general inflation (see equation 5). The third term ( $\lambda_{it}^I$ ) represents variation coming from inflation, in particular, because it contains the elasticity of relative price of individual good  $i$  with respect to overall inflation. And, the second term is the combination of real factors and inflation. The standard errors of lambda coefficients ( $\lambda_{it}^R$ ,  $\lambda_{it}^{RI}$ , and  $\lambda_{it}^I$ ) are reported in Table 5 (see Appendix).

In the next step we sum up all three components over  $i$ , where  $i=1,\dots,K$  and  $K$  is the total number of all components in the consumer basket (in our case 39), which gives us the following:

$$(9.1) \quad \lambda_t^R = \sum_i^K \lambda_{it}^R = \sum_i^K (\alpha_i^2/w_{it}) /VAR_t,$$

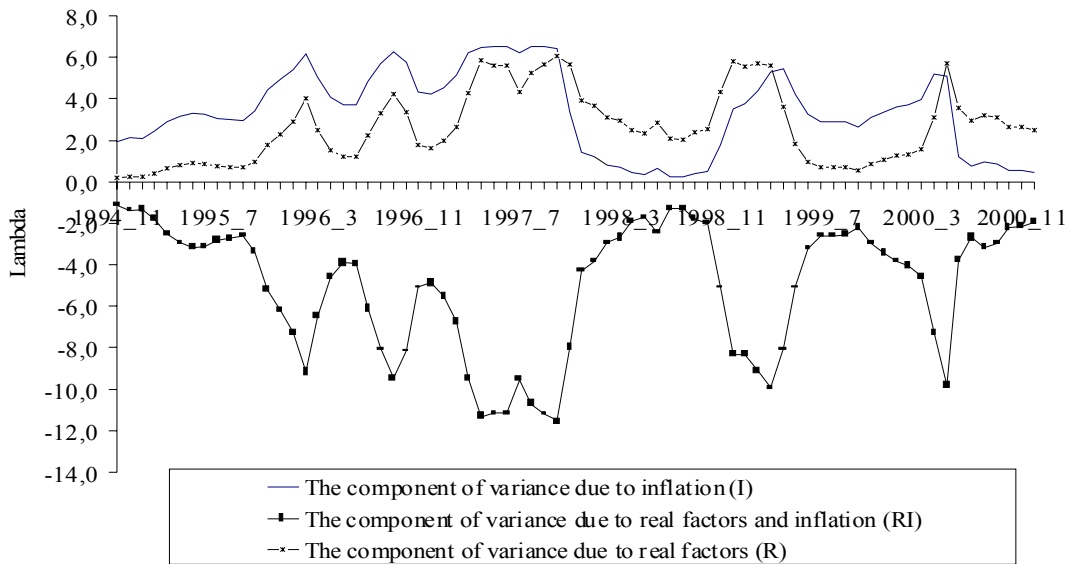
$$(9.2) \quad \lambda_t^{RI} = \sum_i^K \lambda_{it}^{RI} = \sum_i^K 2\alpha_i (\beta_i/w_{it})CPI_t/VAR_t \text{ and}$$

$$(9.3) \quad \lambda_t^I = \sum_i^K \lambda_{it}^I = \sum_i^K (\beta_i^2/w_{it}) CPI_t^2 / VAR_t, \text{ such that}$$

$$(10) \quad \lambda_t^R + \lambda_t^{RI} + \lambda_t^I = 1.$$



Figure 4 demonstrates the dynamic of real, interaction, and inflation components, which are  $\lambda_t^R$ ,  $\lambda_t^{RI}$ , and  $\lambda_t^I$ , correspondingly, over  $t$  aggregated over all components in the consumer basket.



**Figure 4.** The decomposed variance: the dynamics of  $\lambda_t^R$ ,  $\lambda_t^{RI}$ , and  $\lambda_t^I$ , during November, 1994 –December, 2000

We should remark that in Figure 4 the term describing the interaction of inflation and real components is always negative. This suggests the fact that relative price increases in response to real changes in the economy, but decreases due to inflation. Clements and Nguyen (1982) noted that there is no adequate way of allocating the interaction term to the real and inflation components due to its similarity to a covariance. For this reason, the

authors used an approach that attributes the fraction  $\lambda^R_i/(\lambda^R_i+\lambda^I_i)$  of the interaction term to the real source<sup>10</sup> of relative price variation and  $\lambda^I_i/(\lambda^R_i+\lambda^I_i)$  to the inflation<sup>11</sup> source.

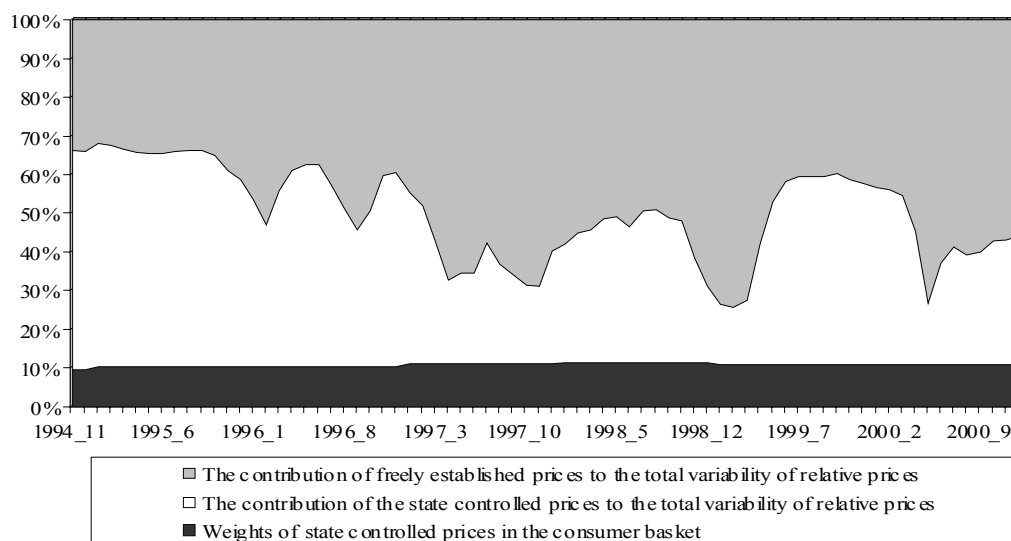
We interpret  $\lambda^R_i/(\lambda^R_i+\lambda^I_i)$  as the share of real factors, and  $\lambda^I_i/(\lambda^R_i+\lambda^I_i)$  as an inflation share in the total variance after allocating interaction term  $\lambda^{RI}_i$  between these two shares. The shares of real factors and inflation as well as the share of commodity  $i$  in the total variance  $\lambda_i$  are provided in Table 6 (see Appendix). The relative price of controlled goods and services in the basket accounted on average 44% of the total variability during 1994-2000, while the sum of weights of these components did not exceed 12.48% during the period. This indicates the fact that controlled prices largely contributed to the variance of relative prices despite the fact that the relative prices of goods, the nominal prices of which are established and controlled by the state, have significantly declined during economic reforms.

The magnitude of controlled prices in the total variability of relative prices during the period November, 1994 –December, 2000 is presented in Figure 5.

---

<sup>10</sup> as  $\lambda^R_i/(\lambda^R_i+\lambda^I_i) = (\lambda^R_i[1+\lambda^{RI}_i/(\lambda^R_i+\lambda^I_i)])/((\lambda^R_i+\lambda^I_i)[1+\lambda^{RI}_i/(\lambda^R_i+\lambda^I_i)])$ , see Clements and Nguyen (1982), page 262.

<sup>11</sup> as  $\lambda^I_i/(\lambda^R_i+\lambda^I_i) = (\lambda^I_i[1+\lambda^{RI}_i/(\lambda^R_i+\lambda^I_i)])/((\lambda^R_i+\lambda^I_i)[1+\lambda^{RI}_i/(\lambda^R_i+\lambda^I_i)])$ , see Clements and Nguyen (1982), page 262.



**Figure 5.** The magnitude of controlled prices in the total variability of relative prices during November, 1994 –December, 2000

As one can see from Figure 5, the contribution of controlled prices to the total variance of relative prices is large and has no relationship with the weights of the items controlled by the state in the consumer basket. We should also note from Table 6 that the 44% share of controlled prices in the total variance of relative prices is built up by 136.14% of real factors, 205.49% of inflation, and minus 297.66% of interaction between the real factors and inflation. At the same time, the 56.03% share of freely determined prices in the total variance of relative prices is caused by 128.96% of real factors, 131.97% of inflation, and minus 204.9% due to the interaction of real factors and inflation. To see how much of relative price variability is attributed to the real factors and to inflation, we allocate the interaction term into corresponding components in two groups separately: (1) in the group of state controlled prices; and (2) in the group of freely determined prices. We found that

the variability of relative prices attributed to the real factors is smaller in the first group with 39.85% due to real factors and remaining 60.15% due to inflation. In the second group, about 50% of the variability of relative prices is attributed to the real factors.

In the group of state controlled prices the components, which largely contributed to an increase in the variance of relative prices, are the following: apartment rent (28.92%), water (5.77%), and notary services (3.23%). The water item has the highest sensitivity to inflation with 97.48% of relative price variability attributed to inflation. The other two items with the 62.17% (apartment rent) and 58.76% (notary services) inflation shares in the total variability have lower sensitivity to the influence of inflation. These findings suggest that there is no necessity to control prices for apartment rents or notary services, because they contribute largely to the variability of relative prices and, thus, to general inflation. Besides, these items do not belong to the products of natural state monopoly as, for example, water, which is monopolized and controlled by the state despite its large contribution to inflation.

The items in the CPI with the highest sensitivity to general inflation, but with a modest contribution to the increase of relative price variability are telegraph services, transport services, and education. The inflation share of these items in the total variance of relative prices amounted to 83.6%, 80.5%, and 73.6%, respectively, while their contribution to the variability of relative prices is 0.01%, 0.54%, and 0.001%, correspondingly. It can be concluded from this that price controls for these items helped Kyrgyz authorities to impede inflation. The items, the prices of which change mainly due to real changes in the economy, are railway, central heating, and international telephone

services; the share of real factors in the total variance of relative prices amounted to 92.04%, 78.21%, and 74.42%, correspondingly.

These findings suggest that price controls are reasonable only for certain items in the consumer basket. The example of these are such items which either have a smaller contribution to the variance of relative prices and have a lower sensitivity to real factors (e.g. telegraph, education, railway, mail services) or monopolised by the state (e.g. water, electricity, gas, wood, coal, central heating). On the contrary, for such items as apartment rent, notary services, telephone services, transport services price controls are not efficient, because of a large contribution to the variability of relative prices and general inflation. These items largely contribute to the variance of relative prices and, thus, to the general inflation irrespective whether the government controls price or not. In addition, if controlled prices have a strong impact on general inflation, the government creates a channel to influence inflation and limit the power of monetary authorities to provide monetary policy effectively. Consequently, price controls over goods, which largely contribute to the variability of relative prices and have higher sensitivity to real factors, but do not have to be monopolised by the state, should be abandoned.

In the group of freely determined prices the items which contribute essentially to the variation of relative prices are clothes and shoes, meat products, bread and flour products, and vegetables. The items, the prices of which are fluctuating mainly due to the inflation pressures in the economy, are mostly imported goods (e.g. vegetable oil, clothes and shoes). In general, real factors have a stronger impact on the freely determined prices and weaker one on the variation of controlled prices. Bricks and meat products are examples of freely determined prices, which highly responded to real factors.

The last row of Table 6 (see Appendix) gives the shares of real, interaction and inflation components for the total number of goods and services in the consumer basket. We can see that 44% of the variance of relative price changes is due to real effects and 56% is due to inflation, indicating that the inflation component is more important in determining the relative price variability compared to the real component. In general, these findings suggest that the government of KR has a direct channel to influence general inflation through controlling the prices of goods in the consumer basket which have a large contribution to the relative price variability and inflation measured by the CPI.

## **5. Conclusion**

In this study we decomposed the variability of relative prices within the CPI in KR into three components (an inflation component, a real component, and an interaction component). In an empirical estimation we used a methodology proposed by Clements and Nguyen (1982) incorporating the total number of goods and services in the consumer basket. Including all CPI items, disaggregated at the 305 level, allowed us to put a strong emphasis on the quantitative size of controlled prices in the variability of relative prices. In particular, we divided all three components into two parts (the share of state-controlled prices and the share of freely determined prices) and found the size of variation caused by the change of state controlled prices in each. Thus, we distinguished the variation caused by the change of controlled prices in all three components.

Based on the results of variance decomposition we argue that controlled prices largely contribute to the variance of relative prices despite the fact that their weights are relatively low and that the relative prices of controlled goods significantly declined during

reforms. For example, the relative price of controlled goods and services in the consumer basket accounted on average 44% of the total variability during 1994-2000, while the sum of weights of these components did not exceed 12.48%. The size of contribution made up by 17 controlled items in the consumer basket to the total variance of relative prices shows that there is no necessity to control prices for all of these goods. The reason for this is that some of these items (e.g. apartment rent, notary services) largely contribute to the variance of relative prices and, thus, to the general inflation, irrespective whether the government controls prices or not. On the contrary, other items (e.g. telephone services, railway) have higher sensitivity to the influence of real factors than of inflation. Consequently, price controls on such goods and services are not an appropriate way to impede inflation in KR.

In general our results suggested that the inflation component in KR is more important in determining the relative price variability compared to the real component. Namely, 56% of the variance of relative price changes was due to inflation during the reforms, while 44% was due to real factors. This indicates that the government of KR has a direct channel to influence general inflation through price controls on some of the goods and services, which largely contribute to the variance of relative prices, and, thus, the general inflation measured by CPI. Since price controls can be reasonable only for certain items in the consumer basket, which either have a small contribution to the variance of relative prices or belong to the products of natural state monopoly (e.g. water, electricity, central heating), abandoning price controls for all other goods and services seems necessary.

This necessity stems from the fact that the central bank of KR manages the general inflation level measured by the CPI that contains components controlled directly by the

government. A large contribution of these components to the variability of relative prices and, consequently, to the general inflation level might limit the ability of the central bank to provide an efficient monetary policy. Moreover, tight credit policy implemented by the central bank for controlling inflation can significantly undermine the economic performance, especially when the government has its own channel to influence inflation. In addition it can cause further development of the black market. Therefore, it seems that the issue of removing state controls on prices, which strengthens the variability of relative prices, should attract much attention of the Kyrgyz authorities and be carefully addressed.



## Appendix : Tables

**Table 1.** Inflation rate, %-change compared to December of previous year Y/Y

	1992	1993	1994	1995	1996	1997	1998	1999	2000
<b>All items</b>	<b>2032,7</b>	<b>1366,0</b>	<b>87,2</b>	<b>32,1</b>	<b>34,8</b>	<b>13,0</b>	<b>16,8</b>	<b>39,9</b>	<b>9,6</b>
Foods	2875,8	980,0	72,6	41,1	38,9	14,8	16,7	45,5	10,2
Non-foods	1062,6	940,0	72,8	12,6	20,2	6,4	11,3	30,0	7,5
Paid services	440,4	5790,0	508,7	138,1	42,5	17,6	27,3	35,9	16,2

Source: NSC of KR

**Table 2.** The components of CPI

	1993	1994	1995	1996	1997	1998	1999	2000
<b>Goods and services with state controlled prices, including:</b>	<i>The sum of weights in the consumption basket</i>							
	0,1010	0,1033	0,1122	0,1115	0,1225	0,1248	0,1176	0,1176
	<i>Annual inflation rates, % Y/Y</i>							
Apartment rent per sq.m.	4056,3	2192,6	57,4	72,5	12,2	1,2	101,1	0,6
Water	7600,9	188,8	152,6	194,7	5,8	38,0	32,4	9,9
Electricity	4942,9	37,1	2,6	98,6	-0,5	16,7	29,6	16,0
Gas	979,3	38,2	-4,1	12,3	2,7	85,3	51,9	16,2
Central heating	4619,2	36,1	16,7	132,8	15,4	17,4	42,6	140,0
Coal	585,9	37,3	3,6	30,3	28,2	33,1	24,5	6,1
Wood	459,5	41,3	41,2	6,5	2,7	3,7	-3,0	4,0
Public transportation	1078,3	30,2	29,7	35,6	28,8	4,8	57,6	1,3
Transport services	1259,5	20,4	31,2	7,0	13,8	16,6	38,0	4,7
Railway	4200,1	36,9	64,7	39,0	23,5	48,0	36,3	-21,3
Airway	1236,0	32,4	2,3	15,4	35,4	64,4	31,6	72,6
Education	4675,8	126,0	38,6	13,3	35,3	13,9	25,6	6,5
Mail services	0,0	75,2	150,2	5,5	66,2	0,4	0,1	0,0
Telephone services	852,5	-16,9	94,0	43,0	-0,4	102,4	0,4	47,0
International telephone services	2250,2	79,7	13,0	19,1	1,1	154,8	24,1	58,8
Telegraph	549,1	145,5	136,0	-3,8	0,9	25,0	0,1	0,0
Notary services	1,1	1267,8	0,0	0,0	3,6	3,3	0,1	-17,7
<b>The groups of goods and services with freely determined prices</b>	<i>The sum of weights in the consumption basket</i>							
	99,8990	99,8967	99,8878	99,8885	99,8775	99,8752	99,8824	99,8824
	<i>Annual inflation rates, % Y/Y</i>							
Bread and flour products	528,0	98,3	66,9	41,0	-0,8	2,0	83,6	3,3
Meat, poultry and fish	868,8	36,4	59,9	63,6	52,6	4,2	26,3	37,3
Milk products, eggs	1305,7	24,2	41,8	51,7	12,4	11,1	26,3	27,1
Vegetable oil, fats	979,7	87,1	23,4	21,7	26,7	28,8	28,9	3,8
Fruits	462,8	-23,1	80,7	81,9	60,1	24,0	52,7	-9,6
Vegetables	1446,9	-2,8	28,2	3,4	-41,1	26,4	13,0	18,8
Sugar, coffee, tea, confectionery goods	748,6	16,1	17,2	24,0	17,3	29,2	30,9	20,7
Drinks	408,2	12,5	23,6	35,8	15,3	33,5	42,8	6,3

Tobacco	721,3	45,5	4,2	39,3	1,5	44,9	29,6	6,1
Clothes and Shoes	981,5	47,7	7,0	14,2	3,0	4,7	8,7	5,5
Bricks	4329,4	23,4	31,0	76,5	8,9	7,6	11,8	13,8
Wallpaper	3076,6	11,9	28,3	22,7	15,6	2,8	1,7	3,9
Wood	1037,2	57,8	39,5	77,2	15,3	11,2	27,9	36,0
Cement	4896,2	402,6	27,7	11,1	21,6	21,6	19,0	34,0
Paint	1769,3	417,8	19,7	24,8	16,6	6,2	31,6	15,2
Glass	684,4	27,6	55,2	102,3	4,6	35,2	-6,5	149,6
Furniture, household devices	898,6	155,3	8,3	22,3	7,7	15,5	27,0	7,5
Public health services	4475,0	123,8	24,3	23,3	8,8	21,5	27,5	13,8
Transport	992,8	28,7	35,6	24,9	15,0	14,4	65,9	5,2
Rest, entertainment and cultural services	849,8	86,9	20,1	16,6	6,3	16,7	28,9	7,3
Hotels, cafe and restaurants	372,0	14,8	46,5	44,1	31,2	30,3	28,9	17,5
Other goods and services	1494,4	307,6	28,2	21,4	11,8	37,2	27,1	17,8

Source: NSC of KR

**Table 3.** Weighted skewness and kurtosis of CPI distributions

	Monthly CPI		Quarterly CPI		Annual CPI	
	Skewness	Kurtosis	Skewness	Kurtosis	Skewness	Kurtosis
Mean	5.8	172.4	4.3	62.5	6.2	155.1
Median	2.3	17.0	2.9	32.3	3.8	21.5
Standard deviation	8.6	370.2	4.9	88.0	7.6	323.4

Sources: NSC of KR, calculations of the author

**Table 4 .** Regression coefficients [ $w_{it}(\pi_{i,t} - CPI_t) = \alpha_i + \beta_i CPI_t + \varepsilon_{it}$ ]

<i>CPI components with freely determined prices</i>	Coefficients		<i>CPI components with controlled prices</i>	Coefficients	
	$\alpha$	$\beta$		$\alpha$	$\beta$
Bread and flour products	-3,569 0,848***	0,191 0,026***	Apartment rent per sq.m.	-0,687 0,148***	0,035 0,005***
Meat, poultry and fish	2,768 0,491***	-0,060 0,015***	Water	-0,062 0,115*	0,016 0,004***
Milk products, eggs	0,671 0,122***	-0,029 0,004***	Electricity	0,230 0,101**	-0,008 0,003**
Vegetable oil, fats	-0,034 0,214*	0,005 0,007*	Gas	0,171 0,095*	-0,006 0,003*
Fruits	0,490 0,080***	-0,012 0,002***	Central heating	0,216 0,044***	-0,004 0,001**
Vegetables	-0,243 0,351*	-0,029 0,011**	Coal	0,353 0,043***	-0,016 0,001***

Sugar, coffee, tea, confectionery goods	1,342 0,352***	-0,061 0,011***	Wood	-0,007 0,004**	0,000 0,000**
Drinks	1,197 0,509**	-0,041 0,016**	Public transportation	0,239 0,067**	-0,009 0,002***
Tobacco	0,066 0,049*	-0,004 0,002**	Transport services	0,145 0,053**	-0,012 0,002***
Clothes and Shoes	-0,463 0,210**	-0,061 0,007***	Railway	0,035 0,019*	0,000 0,001*
Bricks	0,007 0,011*	0,000 0,000*	Airway	0,071 0,011***	-0,003 0,000***
Wallpaper	0,008 0,003**	-0,001 0,000***	Education	0,014 0,057*	-0,001 0,002*
Wood	0,007 0,014*	0,001 0,000*	Mail services	0,003 0,007*	0,000 0,000*
Cement	-0,043 -0,023*	0,002 0,001**	Telephone services	0,212 0,020***	-0,006 0,001***
Paint	-0,034 0,011**	0,002 0,000***	International telephone services	0,098 0,017***	-0,002 0,001***
Glass	0,041 0,009***	-0,001 0,000***	Telegraph	-0,002 0,006*	0,000 0,000*
Furniture, household devices	-0,898 0,258**	0,028 0,008**	Notary services	-0,159 0,044***	0,007 0,001***
Public health services	-0,088 0,082*	0,002 0,003*			
Transport	0,341 0,174**	-0,013 0,005**			
Rest, entertainment and cultural services	-0,139 0,046***	0,001 0,001*			
Hotels, cafe and restaurants	0,410 0,045***	-0,013 0,001***			
Other goods and services	-0,615 0,248**	0,035 0,008***			

Sources: NSC of KR, calculations of the author

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

**Table 5.** The standard errors of lambda coefficients

	$\lambda_{it}^R$	$\lambda_{it}^{RI}$	$\lambda_{it}^I$
Apartment rent per sq.m.	0.009***	0.089***	0.00773***
Water	0.002***	0.019	0.002***
Electricity	0.0001***	0.001***	0.0001***
Gas	0.000***	0.001***	0.000***
Central heating	0.0002***	0.002***	-0.0002***
Coal	0.001***	0.006**	0.0005
Wood	0.00003**	0.0003***	0.00002*

Public transportation	0.0001***	.001***	0.0001***
Transport services	0.001***	0.010***	0.001
Railway	0.0001***	0.001***	0.0001***
Airway	0.0002***	0.002***	0.0002***
Education	2.47e-06***	0.00002***	2.07e-06***
Mail services	4.87e-06***	0.00005***	4.09e-06***
Telephone services	0.003***	0.031***	0.003***
International telephone services	0.0002***	0.002***	0.0002***
Telegraph	0.00002***	0.0002***	0.00001***
Notary services	0.003***	0.029***	0.002***
Bread and flour products	0.004***	0.039***	0.003***
Meat, poultry and fish	0.003	0.027***	0.002***
Milk products, eggs	0.001***	0.005**	0.0004***
Vegetable oil, fats	0.00002	0.0001***	0.000***
Fruits	0.000***	0.006***	0.0005***
Vegetables	0.001	0.010***	0.001***
Sugar, coffee, tea, confectionery goods	0.000***	0.004***	0.000**
Drinks	0.000***	0.004***	0.000***
Tobacco	0.000***	0.000***	0.000***
Clothes and Shoes	0.001	0.012***	0.001***
Bricks	0.0004**	0.004***	0.000***
Wallpaper	0.0001**	0.001***	0.000***
Wood	0.0003	0.003**	0.0002
Cement	0.000***	0.001***	0.000***
Paint	0.000***	0.001***	0.000*
Glass	0.000***	0.002***	0.000***
Furniture, household devices	0.001***	0.006***	0.000***
Public health services	0.000***	0.000***	9.68e-06***
Transport	0.000***	0.002**	0.000***
Rest, entertainment and cultural services	0.000***	0.000***	0.000***
Hotels, cafe and restaurants	0.000***	0.003***	0.000***
Other goods and services	0.001***	0.014***	0.001***

Sources: NSC of KR, calculations of the author

\*, \*\*, and \*\*\* denote statistical significance at the 10%, 5%, and 1% levels, respectively

**Table 6.** Decomposition of variance of relative prices: monthly data, November 1994-December

2000

		Components sample means				Share of $\lambda_i^R + \lambda_i^I$ due to	
		Real $\lambda_i^R$	Interaction $\lambda_i^{RI}$	Inflation $\lambda_i^I$	Total $\lambda_i = \lambda_i^R + \lambda_i^{RI} + \lambda_i^I$	Real component $\lambda_i^R / \lambda_i^R + \lambda_i^I$	Inflation component $\lambda_i^I / \lambda_i^R + \lambda_i^I$
<b><i>CPI components with controlled prices</i></b>		136,14	-297,66	205,49	43,97	39,85	60,15
#	including:						
R1	Apartment rent	98,91	-232,52	162,53	28,92	37,83	62,17
R2	Water	0,20	-2,32	7,88	5,77	2,52	97,48
R3	Electricity	1,46	-2,23	1,01	0,25	59,12	40,88
R4	Gas	1,16	-1,88	0,91	0,19	55,98	44,02
R5	Central heating	4,10	-3,95	1,14	1,30	78,21	21,79
R6	Coal	4,08	-8,34	5,09	0,83	44,50	55,50
R7	Wood	0,02	0,05	0,03	0,10	39,01	60,99
R8	Public transportation	1,41	-2,53	1,36	0,24	50,95	49,05
R9	Transport services	0,40	-1,47	1,60	0,54	19,95	80,05
R10	Railway	0,22	-0,12	0,02	0,12	92,04	7,96
R11	Airway	1,38	-2,15	1,00	0,23	57,89	42,11
R12	Education	0,01	-0,02	0,02	0,00	26,41	73,59
R13	Mail services	0,01	0,02	0,02	0,05	27,14	72,86
R14	Telephone services domestic lines	7,89	-10,64	4,28	1,53	64,87	35,13
R15	International telephone services	2,43	-2,61	0,84	0,66	74,42	25,58
R16	Telegraph	0,00	-0,02	0,02	0,01	16,43	83,57
R17	Notary services	12,45	-26,95	17,73	3,23	41,24	58,76
<b><i>CPI components with freely determined prices</i></b>		128,96	-204,90	131,97	56,03	49,42	50,58
#	including:						
F1	Bread and flour products	31,26	-73,69	52,29	9,87	37,41	62,59
F2	Meat, poultry and fish	35,39	-34,51	10,08	10,96	77,83	22,17
F3	Milk products, eggs	4,93	-9,45	5,39	0,88	47,78	52,22
F4	Vegetable oil, fats	0,01	-0,07	0,13	0,07	7,30	92,70
F5	Fruits	11,37	-12,93	4,37	2,80	72,24	27,76
F6	Vegetables	0,49	2,66	4,28	7,43	10,32	89,68
F7	Sugar, coffee, tea, confectionery goods	8,65	-17,65	10,73	1,72	44,63	55,37
F8	Drinks	7,18	-11,05	5,06	1,19	58,64	41,36

F9	Tobacco	0,19	-0,50	0,39	0,08	32,87	67,13
F10	Clothes and Shoes	0,74	4,40	7,79	12,94	8,70	91,30
F11	Bricks	0,17	-0,01	0,00	0,16	99,86	0,14
F12	Wallpaper	0,06	-0,18	0,17	0,05	24,15	75,85
F13	Wood	0,02	0,08	0,07	0,18	24,54	75,46
F14	Cement	0,42	-1,06	0,80	0,16	34,21	65,79
F15	Paint	0,61	-1,29	0,82	0,13	42,65	57,35
F16	Glass	1,33	-1,77	0,70	0,26	65,46	34,54
F17	Furniture, repairs, household devices	9,97	-14,12	5,97	1,81	62,56	37,44
F18	Public health services	0,16	-0,18	0,06	0,04	72,27	27,73
F19	Transport	1,12	-1,94	1,01	0,19	52,67	47,33
F20	Rest, entertainment and cultural services	0,52	-0,15	0,01	0,38	97,42	2,58
F21	Hotels, cafe and restraurants	4,82	-6,79	2,84	0,88	62,96	37,04
F22	Other goods and services	9,55	-24,70	19,01	3,85	33,44	66,56
Total goods in the consumption basket		265,10	-502,55	337,46	100,00	44,00	56,00

Sources: NSC of KR, calculations of the author

## **Bibliography**

- Ball, L., Mankiw, N.G., 1994 *Assymetric Price Adjustment and Economic Fluctuations*.  
Economic Journal, Vol. 104, No.423.
- Ball, L., Mankiw, N.G., 1995 *Relative Price Changes as Aggregate Supply Shocks*. The  
Quarterly Journal of Economics, Vol. CX 1.
- Clements, W., Nguyen, P., 1982 *Inflation and Relative Prices. A Decomposition Analysis*.  
Economic Letters, 9, 257-262.
- Cukierman, A., 1979 *The Relationship between Relative Prices and the General Price  
Level: A Suggested Interpretation*. The American Economic Review, Vol.69,  
No.3.
- Cukrowski, J., Uzagalieva A., 2001 *Динамика относительных цен и инфляция в  
Кыргызской Республике* The dynamic of relative prices and inflation in the  
Kyrgyz Republic, CASE-Center for Social and Economic Research, Studies and  
Analyses, No. 232, Warsaw.
- Domberger, S., 1987 *Relative Price Variability and Inflation: A Disaggregated Analysis*.  
Journal of Political Economy, Vol. 95, no.3.
- Fisher, S., 1981 *Relative Shocks, Relative Price Variability, and Inflation*. Brookings  
Papers on Economic Activity, 2, p. 381-441.
- Fisher, S., 1981 *Relative Price Variability and Inflation in the United States and Germany*.  
European Economic Review: 18.
- Mussa M., 1977 *The Welfare Cost of Inflation and the Role of Money as a Unit of  
Account*. Journal of Money, Credit and Banking, 9, pp. 276-286.

- Shleshinski, E., Weiss, Y., 1977 *Inflation and Cost of Price Adjustment*. Review of Economic Studies, 54, pp. 287-303.
- Vinning, D., Elwertowski, T., 1976 *The Relationship Between Relative Prices and the General Price Level*. American Economic Review, Vol. 66, pp.699-708.
- Woźniak, P., 1997 *Relative Prices and Inflation in Poland 1989-1997*. CASE-Center for Social and Economic Research, No.121, Warsaw.
- Woźniak, P., 1998 *Relative Prices Adjustment in Poland, Hungary and the Czech Republic, Comparison of the Size and Impact of Inflation*. CASE-CUE Working Paper No. 12.