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TOWARDS A PATTERN OF THE INFLATION PROCESS IN SLOVAKIA

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Towards a Pattern of the Inflation Process in Slovakia

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Introduction

In the EU pre-accession period, the development of inflation in transition economies has been the subject of increased attention. On the one hand there is the goal of bringing the rate of inflation close to that in the EU (EMU) countries, and on the other hand there is a recognition that the transition processes and the "catching up" may push inflation up to higher levels.

The material presented is the result of an effort to contribute to a better understanding of the inflation process in Slovakia and to formulate on the basis of this alternative views on its development over the medium term. It draws upon subject-matter knowledge and empirical analysis of time series.

Our paper builds on other work – such as the work done by the Monetary Division of the NBS (a short-term projection of inflation as part of the Monetary Survey[2], an econometric model NBS[3]), the Institute of Monetary and Financial Studies of the NBS[4], Infostat[5], ISWE[6] of the Slovak Academy of Sciences, the IMF[7], The East Europe Institute (Munich)[8] – all institutions that made partial contributions towards a better understanding of inflation in Slovakia. We assume that hand in hand with improving conditions for such analysis, in particular better accessibility of consistent statistical data, the body of work focused on the empirical (statistical, econometric) analysis of inflation in Slovakia will be built up.

Our main reference is Hostland[9]. In his working paper, he asked the question whether shifts in the Canadian inflation process can be identified over time. He raised that question at a time when the Canadian economy was in transition from a period of disinflation to one with low inflation.

In our work, we attempt to:

1. decompose the inflation process in Slovakia. Several points are well known – in particular the role of administrative measures, especially concerning taxation and prices. We have focused on an overall (simplified) characterisation of the inflation process in the period since the beginning

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[2] Monetary Survey. National Bank of Slovakia (monthly report, also available on www.nbs.sk)
[3] Tkáč, M., Gavura, M.: Econometric Model NBS. Paper Presented at the Macromodels´99 and AMFET´99. Rydzyna (Poland), December 1999
[4] Hajnovič, F.: Analysis of Economic Development of Slovakia Using Simple Macroeconomic Models (in Slovak language). Working Paper. Institute of Monetary and Financial Studies, National Bank of Slovakia, Bratislava, November 1997
[5] Olexa,M., Haluška, J., Országová, J.: Quarterly Econometric Model of Slovak Economy QEM-ECM. ACTA edition, Institute of Informatics and Statistics, Bratislava, January 2001
[6] Páleník, V. et al.: Quarterly Econometric Forecasting Model of Slovak Economy ISWE. Institute of Slovak and World Economy of Slovak Academy of Sciences, Bratislava, April 2001
[7] various country or CEE reports
[8] Frensch, R.: Wechselnde Ursachen persistenten Inflation im Tschechischen und Slowakischen Transformationsprozes. Working Papers. Osteuropa-Institut, München, January 1997
[9] Hostland, D.: Changes in the Inflation Process in Canada: Evidence and Implications. Working Paper 95-5. Bank of Canada, May 1995

of transformation (from January 1990), with the aim of putting in quantitative terms the impact of administrative measures. This has resulted in a model estimation of core inflation,

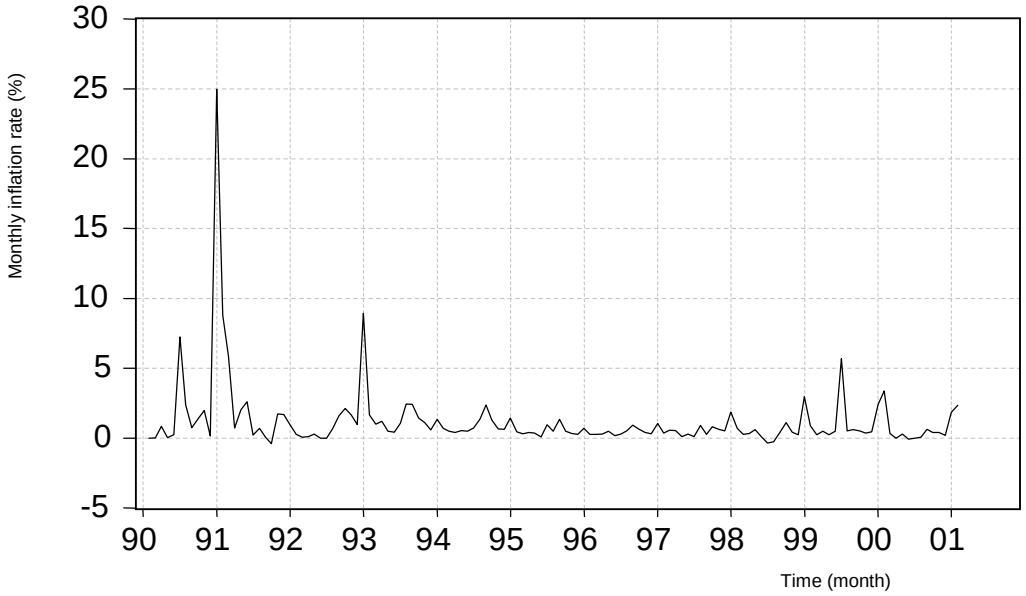
2. characterise the inflation process in Slovakia. This characterisation is focused on the size of the autonomous component of inflation and its inertia. We have identified four periods over the course of which different inflation processes occurred: the period until the creation of the SR (the commencement of the operation of the NBS), the period from the creation of the SR (monetary separation from the Czech, Republic) till the termination of internal convertibility of the koruna, the period from the announcement of external convertibility till the abandonment of a fixed exchange rate regime, the period of a (managed) floating of the koruna´s exchange rate,
3. set a condition for a disinflationary process in Slovakia.

The main difference of our work compared to Hostland´s work lies in the fact that we cannot rely on statistical tests as much as he did, due to the short time series and frequent shocks to the process. The time series which are available to us are of a short period (7 – 10 years) as a result of the principal system and institutional changes in 1990 and the establishing of an independent Slovak Republic in 1993. The short time series limit the reliability of the identification of sofisticated models, and the power of tests, frequent shocks and institutional changes causes structural breaks.

1. Decomposition of Inflation in Slovakia – Role of Administrative Measures and Estimation of Core Inflation

The development of inflation in Slovakia since 1990 is depicted in Fig. 1.

Fig. 1 Monthly inflation of consumer prices in the SR (%)



The data presented here reflect percentage changes in aggregate consumer prices over the preceding month, the monthly inflation rate.

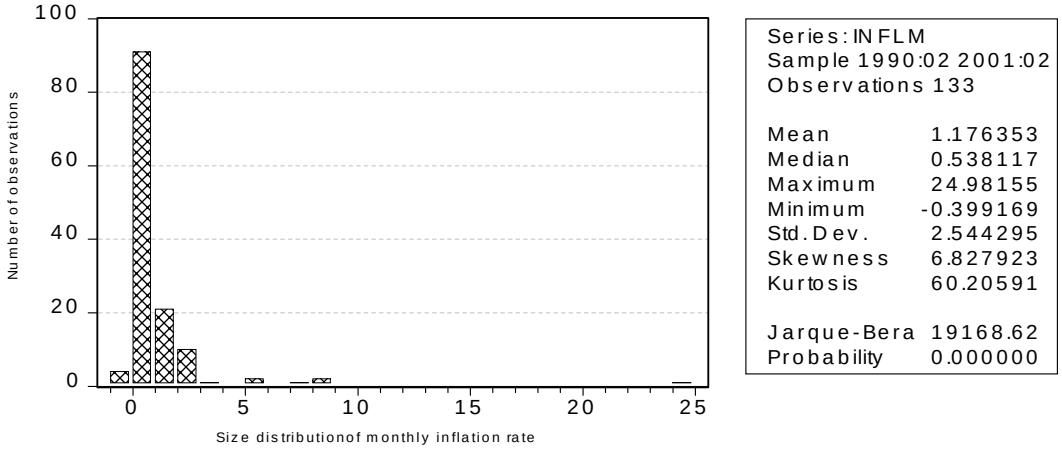
This figure clearly shows that there have been four periods with exceptional increases in consumer prices:

- the period of price adjustment in 1990 (the removal of a negative turnover tax),
- the period of commencing price liberalisation in 1991, when, as a result of price increases, the accumulated imbalance in the consumer market was eliminated and consumer prices grew on aggregate (in January of 1991) by 25%,
- the period of tax reform (a transition from a turnover tax to VAT) at the beginning of 1993,
- the period of economic stabilisation in 1999.

Identification of Big Price Changes

Apart from the mentioned "peaks", there are a number of smaller points of unevenness that can be spotted in the development of monthly inflation, some of which appear to be outliers. A glance at Figure 2 will show that this occurred in periods when monthly inflation exceeded 4%. These values apparently lie outside the central part of the distribution.

Fig. 2 Monthly inflation in consumer prices in the SR (%). Basic statistical characteristics.



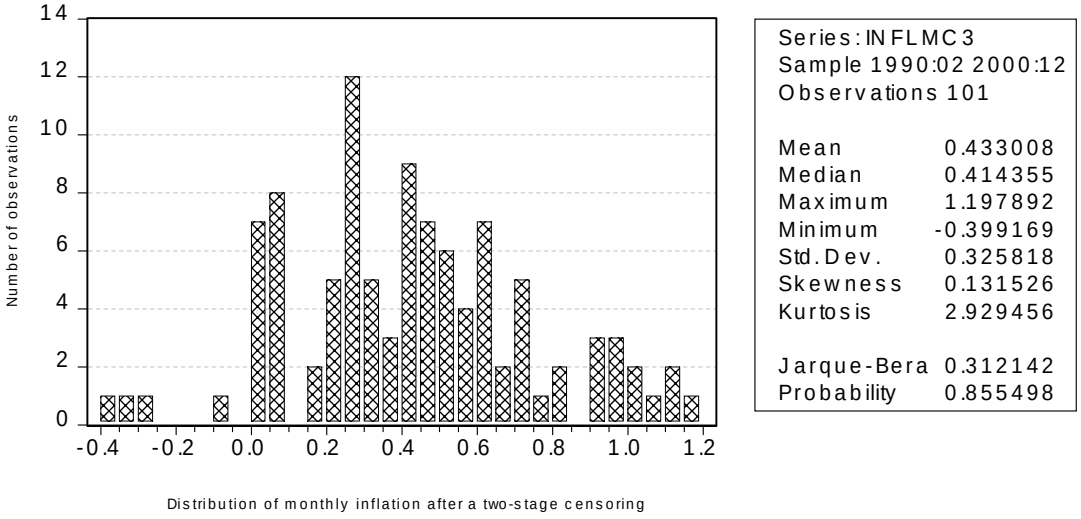
Elimination of these observations (through censoring them), reassessment of the distribution of the data and elimination of outliers will yield a reduced set (101 of an original 133) of monthly inflation data whose distribution is given in Fig. 3. This includes only observations (months) in which the monthly inflation did not exceed the value of 1.2%[10].

The summary in Table 1 below characterises the economic background of the large changes in monthly inflation mentioned. In some instances we did not

[10] The actual procedure was a mixture of statistical and subject-matter assesment, with priority given to subject-matter knowledge

have enough information to clarify the background of price jumps or the given picture has been mixed (these changes are described as unidentified - NI).

Fig. 3 Monthly inflation in consumer prices in the SR (%).
Basic statistical characteristics.
Data following gradual adjustments (inflation rate below 1.2%)



Distribution of monthly inflation after a two-stage censoring

The majority of price jumps concern administrative decisions to change prices (price adjustment, deregulation), in other instances they have been caused by taxation measures (changes in VAT or excise duties – that is, changes in indirect taxes - IT), and the introduction of an import surcharge that was of lesser impact. The most significant price change was related to the liberalisation of most consumer prices in 1991, but administrative devaluations had an impact on prices as well (in 1990 and 1993). Other important inflationary stimuli were decisions about market (de)regulation in agricultural commodities. Their importance gradually decreased along with growing competition in the market for agricultural commodities and foodstuffs.

All in all, through using this procedure, we have identified 32 observations out of 133, for which monthly inflation appears as a price jump caused by artificial intervention in the inflation process. The third column in Table 1 gives the actual level of inflation in the month in question, the fourth column then contains the estimated impact of the respective administrative decision on inflation in the given month.

Table 1
Impact of administrative decisions on monthly inflation and other jump changes in monthly inflation (%). Slovak Republic Jan90 – Feb01

Year	month	change actual	impact adjustments	Content
1990	July	7.25	6.83	Price adjustment
1990	August	2.38	1.85	Price adjustment
1990	October	1.39	0.87	NI
1990	November	1.99	1.59	NI
1991	January	24.98	24.61	Price liberalisation, start of the economic reform
1991	February	8.80	8.35	Price liberalisation/deregulation
1991	March	5.84	5.31	Price liberalisation/deregulation
1991	May	2.05	1.53	Deregulation
1991	June	2.60	2.19	Deregulation
1991	November	1.73	1.48	NI
1991	December	1.69	1.15	NI
1992	September	1.62	1.08	NI
1992	October	2.12	1.60	NI
1992	November	1.65	1.03	NI
1993	January	8.94	8.29	Tax reform
1993	February	1.66	1.00	Tax reform
1993	August	2.46	1.80	administrative devaluation, IT, agricultural production
1993	September	2.42	1.85	impact of administrative devaluation, IT, agricultural production
1993	October	1.44	0.77	Impact of administrative devaluation, IT, agricultural production
1994	January	1.36	0.79	ND
1994	August	1.36	0.82	Fees, IT, agriculture
1994	September	2.38	1.88	IT, deregulation, agriculture
1994	October	1.30	0.79	deregulation
1995	January	1.43	0.93	NI
1995	September	1.34	0.86	Agriculture
1998	January	1.87	1.33	IT, deregulation
1999	January	2.96	2.43	Deregulation
1999	July	5.69	5.21	VAT (lower rate), IT, IS (7%)
2000	January	2.44	2.00	Deregulation, IT
2000	February	3.39	2.97	Deregulation
2001	January	1.84	1.46	Deregulation
2001	February	2.35	1.91	Deregulation

Abbreviations used:

IT	adjustments to (change) indirect taxes (VAT, excise duties)
IS	import surcharge
NI	not identified

Model Used and Estimated Effects of Administrative Decisions

The rationale behind determining the impacts is embodied in the following concept (model). There are three components to inflation for a given period (month):

1. the (proper) process of inflation, distinguished by an autonomous component and inertia,
2. one-off impacts of administrative adjustments (if any in a given month),
3. random disturbances (a (stationary) mix of different inflationary stimuli)

The given model can be represented in the following form:

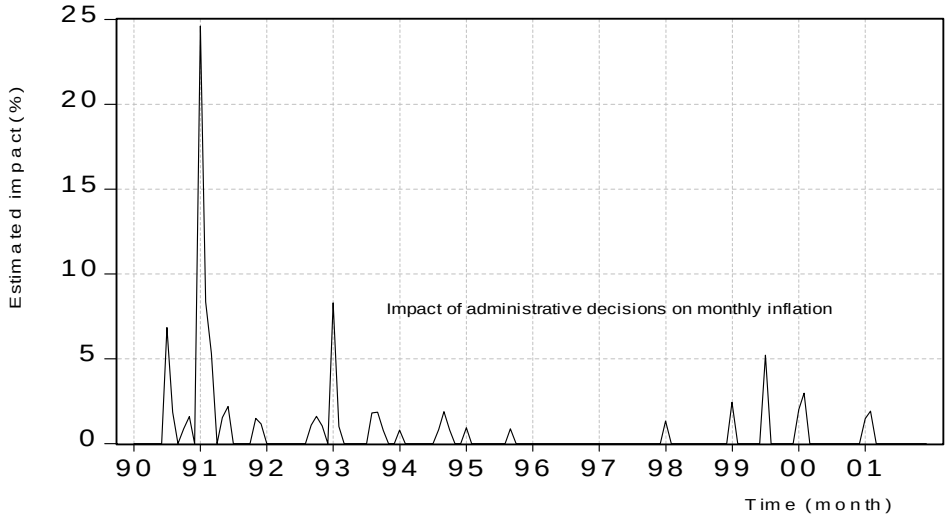
$$inflm(t) = C1 + C2*inflm(t-1) + \sum_i D(i)*(impact(i , t)-C2*impacti(i , t-1)) + u(t) \quad (1)$$

where:

	inflm(t)	stands for the (headline) monthly inflation in time t
	impact(i ,t)	represents (dummy) variable for the i-th artificial intervention
	D*(i)*	parameter (size of the impact of i–th intervention)
	C1	parameter (size) of autonomous inflation
	C2	parameter of inertia of inflation

An estimation with the use of this model (aiming to express the impacts in the 32 periods in question) yielded results given in the fourth column of Table 1. For example, prices started to be liberalized in January 1991. The prices rose 24.98% in January only (the third column of the Table). The impact of liberalisation in January 1991, as estimated on the basis of the model, is 24.61%. Another example – in July 1999 consumer prices grew by 5.69%, and, as indicated by an estimation based on this model, the increase in prices for this month due to the package of stabilisation measures adopted was equal to 5.21%.

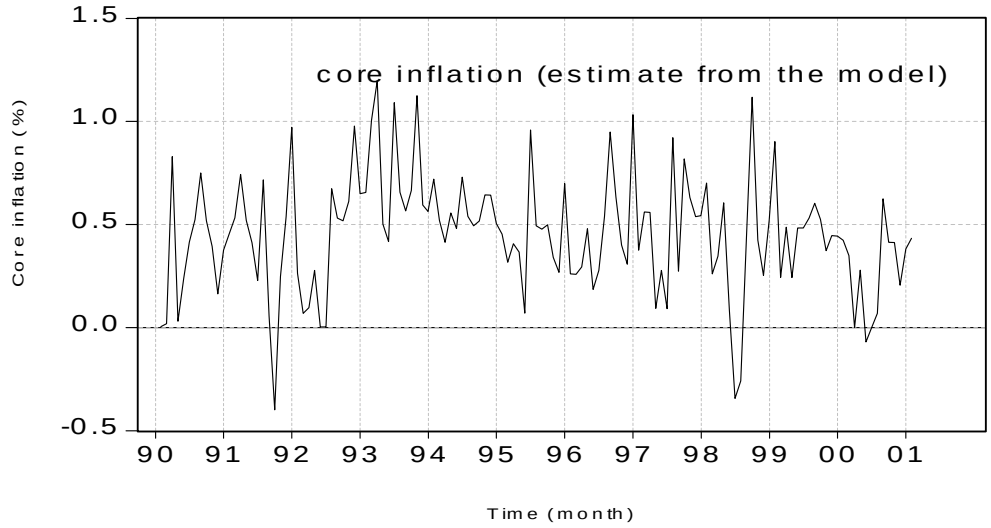
Fig.4 Monthly inflation in SR.
Estimated impact of administrative decisions.



In Figure 4, the identified impacts of artificial intervention on monthly inflation are presented a graph.

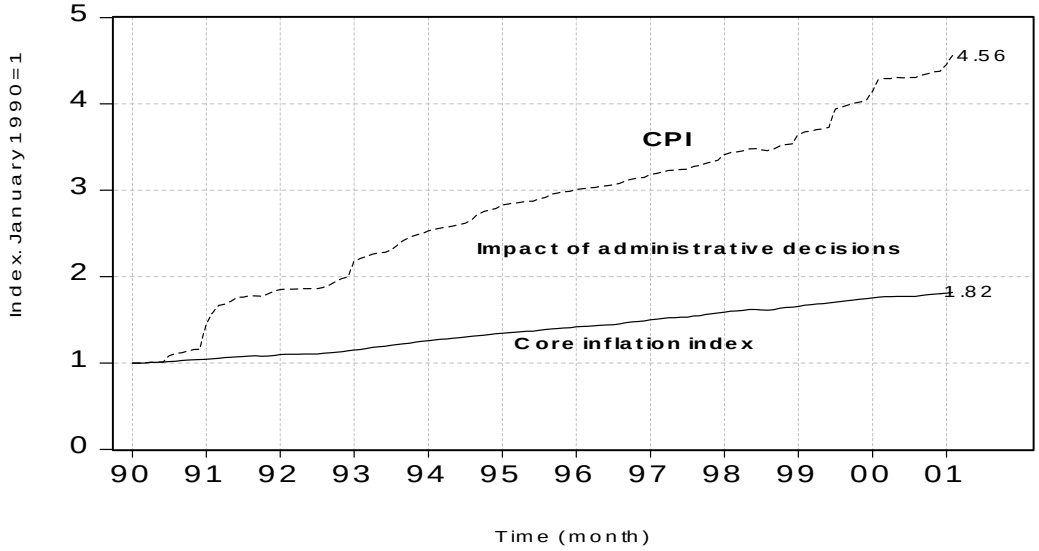
We have taken the difference between overall inflation and inflation due to administrative intervention as a model estimate of monthly core inflation. Its development is depicted by Figure 5.

Fig.6 Monthly core inflation in SR. Estimate from the model (1)



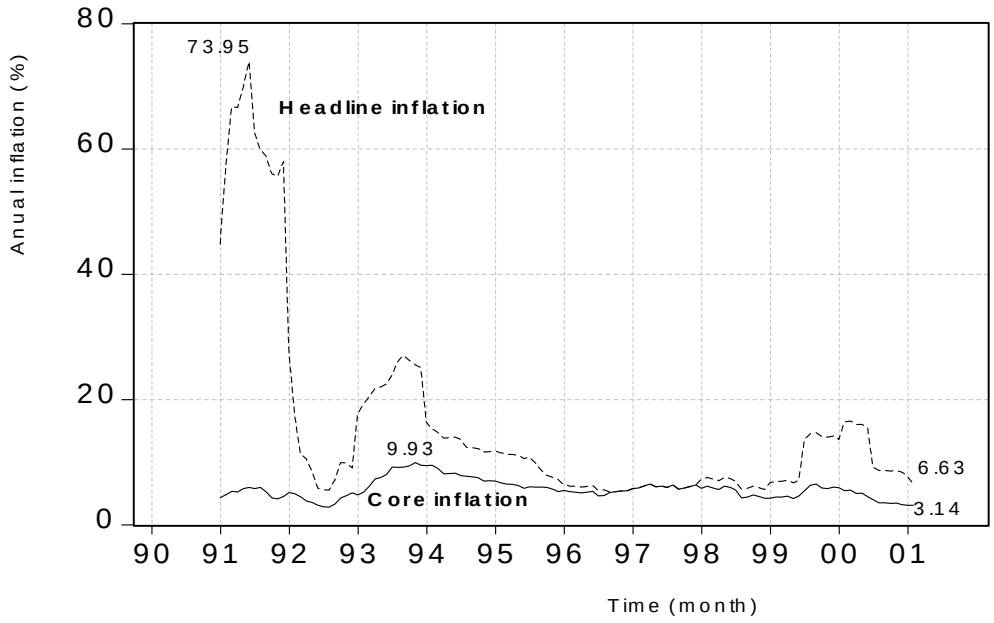
Estimations of impacts of administrative adjustments and monthly core inflation allow us to assess the weight of both of these components in the price development. From Figure 6 it can be seen that the growth of consumer prices in Slovakia since 1990 has been mainly concerned with liberalisation of prices, their administrative adjustments and tax adjustments. Only about one third of the increase (overall, prices grew to 4.56 times the level in January 1990) was associated with core inflation (which caused prices to increase to 1.82 times this level).

Fig. 6 Price development in SR. January 1990=1.
The role of core inflation and administrative decisions



Annual core inflation is then derived as a cumulative of monthly inflation. There are several interesting points to the development of annual core inflation, depicted in Figure 7.

Fig.7 Development of headline and core inflation in Slovakia.
(percent change against the same month of the previous year)



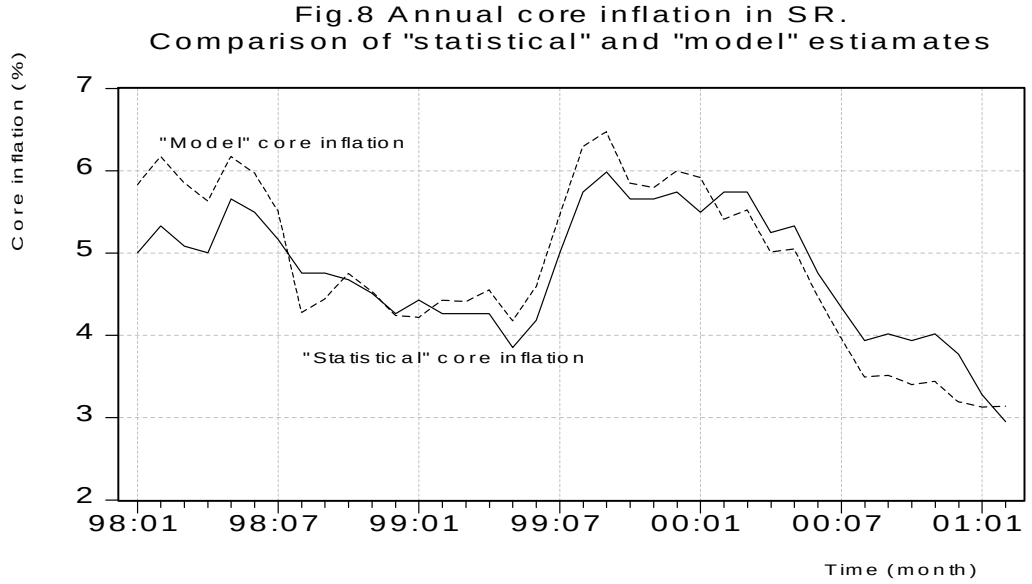
In the period prior to the formation of an independent Slovakia, core inflation had been reduced. The estimated development of core inflation in this period is influenced by the way in which it was identified, where a price liberalisation jump was identified as an administrative price adjustment. Although this adjustment occurred through the market mechanism, it was made based on an administrative decision and originated from a deep market imbalance maintained through administrative measures.

In 1993, core inflation grew due to several adopted measures (tax reform, devaluation…) and reached the highest values – almost 10%. Starting from 1994 it was reduced up until mid - 1996, when the fluctuation band for the koruna was expanded and when, due to a deepening foreign trade deficit, devaluation pressures started to build up.

A certain decrease in core inflation has been observed after the transition to a floating rate, except for a period towards the end of 1999, when measures that were a part of the stabilisation package were translated into core inflation. At present, core inflation is on a downward trend when compared to its history considered in this analysis – its estimated value for February 2001 is only 3.14%.

Comparison of Statistical Core Inflation with Its Model Estimate

Starting from 1998 it is possible to compare core inflation determined in this way and core inflation derived by the NBS and CSO SR using detailed price statistics ("statistical core inflation")[11]. This comparison is given in Figure 8.



This comparison shows, anong from other things, that although the impact of core inflation as derived from the model follows the trends of development in statistical core inflation, some differences still remain[12]. At the moment we are not able to say whether this is caused by the estimation of core inflation from the model, that is, through the estimation of impacts of the adopted administrative measures on inflation (inadequately identified outliers, an inappropriately constructed model, inappropriate estimation method), or by statistical definition of core inflation (selection of representative items, partial inclusion of such price movements that do not belong to core inflation, such as movements due to energy price movements).

2. Character of the Inflation Process

There have been four significant periods of monetary policy in Slovakia:

1. the period up to the creation of an independent Slovakia, i.e. in our case the period from January 1990 – December 1992. Monetary policy was common for the whole Czech and Slovak Federal Republic,
2. the period (January 1993 – September 1995), i.e. from the creation of an independent Slovakia, when, following the break-up of the Czechoslovak Monetary Union, the NBS started its operation. This was characterised by its regime of internal convertibility, a fixed exchange rate regime (with limited fluctuation) and one jump devaluation

[11] "statistical core inflation" is now regulary computed on the basis of the development of prices of representatives within the consumer basket and the weight of these items and on the basis of knowledge of specific administrative measures (deregulations, IT changes) adopted, estimating their the so-called (presumed) direct impact on prices.
[12] our estimate is directly comparable to what is termed the "core inflation component of headline inflation"

(July 1993), a payment agreement with the CR with a dual exchange rate against the Czech koruna. This period ended in September 1995 through the announcement of current account convertibility.

3. over the next period (October 1995 – September 1998), the fluctuation band for the exchange rate movements was expanded[13], the exchange rate regime however remained fixed until September 1998,
4. from October 1998 onwards, a regime of (managed) floating rate has been in place

Analysis of model parameters for the above-mentioned periods yielded some interesting findings.

The process of monthly core inflation – for the whole period subject to review – can be characterised by the following equation[14]:

$$coreinflation(t) = \underset{(7.2)}{0.32} + \underset{(3.5)}{0.29} * coreinflation(t-1) + u(t), \quad S.E. = 0.28 \qquad (2)$$

[15]

where u(t) is a stochastic component expressing the interplay of different (market) inflationary stimuli. It involves stationary (uncorrelated, normally distributed) stochastic stimuli. This means that each month prices grew autonomously by 0.32% in the inflation process in Slovakia. This increase – together with random inflationary and disinflationary stimuli – was reproduced at a relatively high rate – which is shown by the parameter of 0.29. Residual inflationary stimuli were comparatively large – their standard deviation is 0.28(%). (Beware that this concerns monthly changes in prices). The process of (core) inflation in Slovakia from January 1990 up to today may be characterised as a process:

- with a relatively high autonomous component of inflation,
- with a relatively high inertia,
- subject to relatively significant (random) inflationary and disinflationary impulses

Should such inflationary process be taking place without impacts of interventions and random stimuli, the monthly (core) inflation would then stabilise at the level of 0.45%, which means that annual core inflation, that is a more frequently used indicator, would achieve the level of 5.5%. After two months, a stochastic inflationary stimulus would "cease" to one tenth of its value.

Stability of the Inflation Process

Visual inspection of the stability of (recursive estimates of) parameters of the given model (2) (Figures 9a,b) showed that the inflationary process differed over the periods mentioned. However, statistical tests (c.f. Chow test[16]) do not

[13] +/-7%,
[14] ADF supports stationarity of the process. ACF and PACF indicate, that only the first order AR may be relevant. With lower level of significance one can find a higher order of AR, too
[15] t-values
[16] the software we use is E-views 3.0

allow – due to the short time series and a relatively high residual variability of the process – this to be confirmed with statistical reliability.

Fig. 9a Recursive estimates for C1

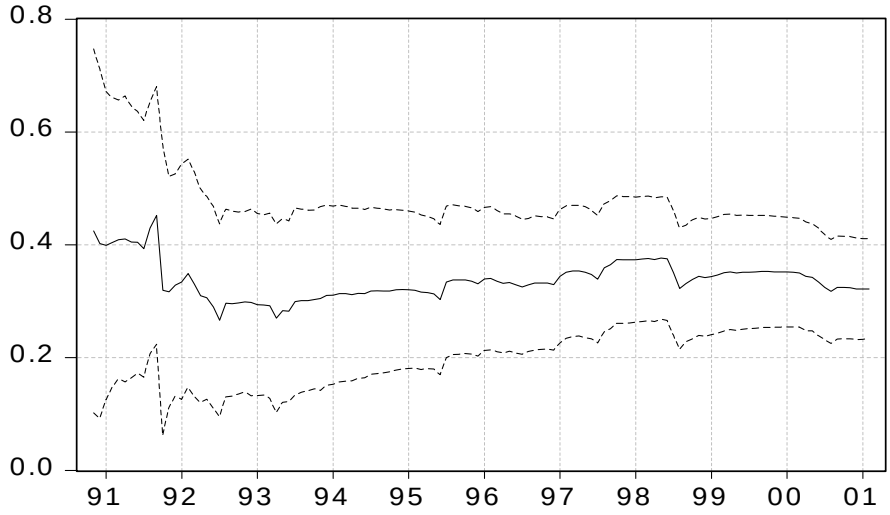
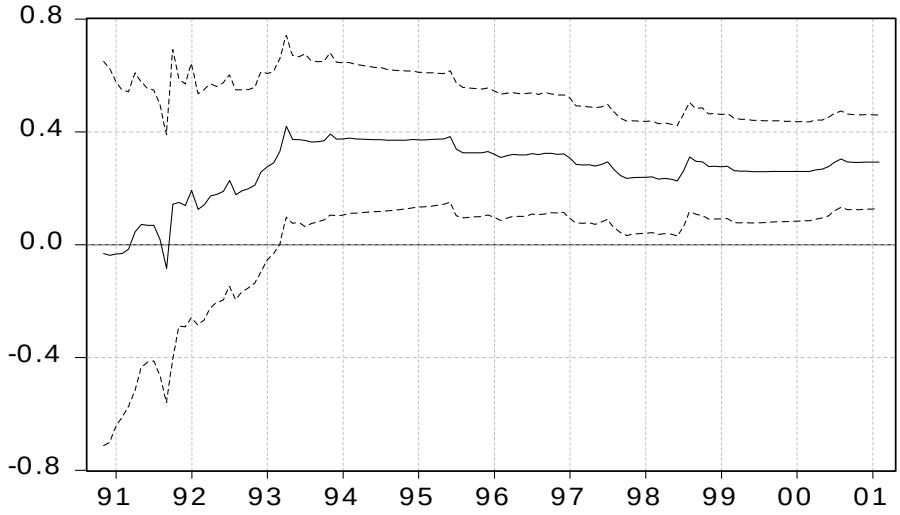


Fig. 9b Recursive estimates for C2



The results of this analysis indicate that at the beginning of the period considered – in the environment of the federative Czechoslovakia – the autonomous component was already realtively low (probably also under the influence of a "buffer" created by a deep stepwise devaluation over the course of 1990 and thanks to the fixed exchange rate). Negative expectations with regard to the ability of the Slovak economy to maintain the exchange rate and exchange rate parity of 1:1 against the Czech koruna and subsequent devaluation renewed the growth of the autonomous component of inflation, which is shown in a gradual increase in the recursive estimates of the parameter C1. It also seems to be the case that even under the federation the lowering of the autonomous component of inflation was already accompanied

by growing inertia. This does not necessarily turn out to be an unfavourable phenomenon under any circumstances. Quite conversely, low autonomous inflation combined with high inertia may stabilise the inflation at a low level. This will depend on the size in which other stimuli – both administrative and random ones (such as external price shocks) are manifested in the inflation process. A low autonomous rate of inflation, high inertia of this low rate of inflation and the ability of the economy to depress other inflationary stimuli is one of the preferable patterns of the inflation process.

We have arrived at the following parameters for the above-mentioned stages of monetary policy in Slovakia:

Table 2 Parameter estimates for different stages of monetary policy in Slovakia

Period	C1	C2	sigma	LR inflation[17]	
				monthly	annual
01/90 - 12/92	0.30	0.26	0.30	0.40	4.9
01/93 - 09/95	0.52	0.14	0.24	0.60	7.5
10/95 - 09/98	0.33	0.20	0.29	0.41	5.1
10/98 – 02/01	0.31	0.24	0.24	0.40	4.9
01/90 - 02/01	0.32	0.29	0.28	0.45	5.6

The two last columns of the table given above express the (long-run) value of – both monthly and annual – inflation towards which the inflation process with the given parameters would converge if not affected by other (administrative or accidental) influences.

Another conclusion to be drawn from this table is that already under the Czechoslovak federation the central bank had managed to get the inflation process under control. As a result of significant changes immediately following the year 1993, the inflation process was destabilised, with its autonomous component (C1) rising to the monthly level of 0.52% for that period in particular. The inflationary process over this period seems to have been driven towards stability by a comparatively tied foreign currency and exchange rate policies. Over the course of 1994 and particularly in 1995, the NBS managed to stabilise the process and, during the course of the period following the announcement of current account convertibility, to bring down its autonomous component. The loosening of the exchange rate regime (and other factors) seems to have pushed up inflation volatility (the sigma parameter). On the whole, the inflation process however comprised lower levels of core inflation. Since, on the top of that, within the period in question no major administrative decision with an impact on prices was implemented (deregulation was virtually stopped), headline and core inflation stood at a low level and barely differed from each other.

[17] C1/(1-C2), expected LR

The current period – since the change in the foreign exchange regime in October 1998 – is characterised by a lower level of the autonomous component of inflation, of 0.31% (per month, i.e. approximately 3.8% per year). Also, (residual) volatility of the inflation process declined (standard deviation of 0.24). This process however has one drawback, namely its still relatively high inertia (the C2 parameter), which may destabilise the inflation process and, notably, further disinflationary endeavours.

The inflationary process in Slovakia, taken as a whole for the entire period in question, may be characterised as follows:

- following its stabilisation, still under the conditions of the federal Czechoslovakia, the inflation process was destabilised due to big changes in 1993. It was, however, successfully handled and the NBS gradually accomplished **disinflation, from an (expected) LR core inflation of 7.5% per year to its current LR level of 4.9%,**
- residual volatility of the inflation process has changed slightly,
- the nature of the inflation process over the period in question, taken as a whole, has not however changed significantly. It has been marked by a high autonomous component and high inertia. For the moment, the residual volatility of the inflation process has been, even if disregarding ongoing deregulation, comparatively high.

Although the results of the disinflation process make for an indisputable success story for the monetary policy of the NBS as pursued since its creation, it is necessary to continuously look for ways of furthering these.

Conclusion

As follows from the above analysis, the following three factors will play a major part in the process of disinflation in the future period:

- the development of core inflation
- the conduct of deregulation
- the price impact of other (external or internal) factors.

Let us now briefly assess their possible impact and role in the disinflation process.

Reducing Core Inflation

In the context of the aforementioned analysis, the lowering of core inflation is mainly connected with the lowering of its LR value, i.e. a value that the core inflation would reach if not affected by other (inflationary or disinflationary) stimuli. Since its development is driven by the auto-regressive process (which in our case is a process of the first order), the expected long-run level of core inflation (inflation_LR) will be determined by a simple relationship to parameters C1, C2 in the inflation model:

$$inflation\_LR = C1 / (1 - C2) \qquad (3)$$

(these values can be found in the last but one column in table 2).

In this context, what disinflation is essentially all about is setting parameters for the inflation process so as to make inflation, as determined by the relationship (3), lower. Decline in inflation is only possible under the precondition that:

$$d(C1) + d(C2) * C1/(1-C2) < 0 \qquad (4)$$

where d stands for differential.

Analysis of the relationship (4) shows that disinflation will occur only where reduction of the autonomous component (C1) is not outbalanced by increased inertia of the inflation process.

Parameters of the process of inflation are related to properties of those processes that influence inflation – the wage-bargaining process and labour market situation, demand pressures and capacity development, competition and competitiveness, (nominal) exchange rate development, uncertainty involved in decision-making, dual inflation…Besides real economic causes, there is also a psychological aspect to the level and inertia of the inflation process – which relates to impacts on inflationary expectations and the credibility of the central bank. As a result of the formation of long-term expectations and the adoption of long-term decisions, these are likely to become embedded in real economic processes. This could endanger the disinflation process.

As regards the volatility of the process, for the long-run we have:

$$sigma\_LR = sigma/(1-C2),$$

and for the annual (core) inflation:

$$annual\_sigma\_LR = sqrt(12)*sigma\_LR = 3.5*sigma/ (1-C2).$$

For current residual volatility and inertia of the inflation process this represents 1.15% (of standard error) of volatility of annual (core) inflation. Apparently, this volatility has so far been relevant[18].

In the event that the central bank, for a variety of reasons, is not able to bring about a reduction of the autonomous component of inflation, or in the event that inflationary stimuli originating in administrative decisions or external price shocks are of significant size and not depressed by the economy, it will be necessary to shift attention to lowering the inertia of the inflation process and, if need be, to give this strategy priority over the reduction of the autonomous component of inflation. This strategy may also prove to be expedient in the case of Slovakia, since some of the important deregulatory steps are still ahead of us and the impact of exchange rate and price shocks caused by the external environment may prove to be quite significant. Nevertheless, a greater part in this context should be played by economic policy, which should eliminate the impact of the respective shocks on inflation.

[18] this volatility, inter alia, corresponds to the size of forecasting error for inflation forecasts