POLICY RESEARCH WORKING PAPER 1879

Relative Prices and Inflation in Poland, 1989–97

The Special Role of Administered Price Increases

Przemyslaw Wozniak

In Poland between 1989 and 1997, growth in money and wages fueled inflation and appreciation of the real exchange rate lowered it. Large administered price increases associated with adjustment — in utilities and other sectors controlled by the government — produced substantial upward inflationary pressures.

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Summary findings

Wozniak evaluates how much relative price shifts affected inflation in Poland between 1989 and 1997. He uses a theoretical model that predicts a positive relationship between variance and skewness in the distribution of relative price changes and the general inflation rate.

Regressions controlling for various shocks revealed that significant relative price changes — especially the large administered price increases associated with adjustment — produced substantial upward inflationary pressures.

Growth in money and wages were shown to fuel inflation. Appreciation of the real exchange rate lowered it.

Administered price increases — in utilities and other sectors controlled by the government — dominated inflation from 1989–97. And the adjustment of many controlled prices is not yet complete. Ideally, future administered increases should be frequent and moderate to prevent the large price shifts that increase inflation. But because frequent price increases are likely to be politically unpopular, sizable increases may be in order so that the current undervaluation of numerous services will diminish more quickly.

This paper — a product of the Office of the Director, Eastern Europe and Central Asia Region — is part of a larger effort in the region to disseminate the findings on the economic transformation in former socialist countries. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Luca Barbone, room J7-133, telephone 202-473-2556, fax 202-473-8466, Internet address lbarbone@worldbank.org. February 1998. (41 pages)

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Section 1: INTRODUCTION

The relationship between inflation and relative price variability has been at the center of economic dispute since the early 1970s. It is primarily the oil shocks that made economists turn their attention to the fact that the two phenomena: the general price level and the variability of individual inflation rates have moved in the same direction for longer periods of time and that their peaks often coincided . Following that observation the extensive body of literature have tried to explain the relationship theoretically and then support it with empirical analysis. However, up to now, both the nature of the association and its causation remain unclear. Theories were developed linking relative price variability to the level of anticipated as well as unanticipated inflation. Some authors have found that it is the increased variability of individual inflation rates that raises the general price level while others maintain that the relationship is caused by macroeconomic disturbances that raise both the inflation rate and increase relative price variability.

I believe that this phenomenon, although researched extensively in the framework of mature market economies, can be of particular interest in the context of transition economies. The unprecedented nature of transition from plan to market poses a great deal of policy challenges and raises a lot of questions most of which come down to inflation stabilization issues. Inflation in post-communist economies has to be looked at through a number of factors specific to the region including, among many others, a comprehensive price reform. Relative domestic prices have undergone dramatic realignments in the wake of price liberalization, removal (or sharp reduction) of subsidies and unification of the exchange rate. Those realignments have substantially increased the variability of inflation rates of individual groups of commodities comprising the consumer price index. According to some theories I mentioned above, this ongoing process of price adjustments could prove to be a substantial factor contributing to sustained inflationary pressures in transition economies.

From the multitude of hypotheses concerning the relationship between inflation and relative price variability, I chose the one that predicts causality running from increased relative

price variability to increased inflation. For a variety of reasons this group of theories seems to go very well with the developments of the inflationary processes in Poland as a representative transition economy and is the most helpful in terms of identifying the sources of inflationary pressures. I believe that the variability of relative prices in Poland, by far exceeding that of standard market economies, but mostly left out of the inflation analysis so far[2], could improve our understanding of the inflationary processes in Poland as well as in other transition economies.

Estimating the approximate short-term impact of relative price adjustment on the overall price level could also prove useful in terms of providing some sort of policy recommendation with respect to administrative price increases. In the case of a country like Poland where a certain number of prices is either directly set by the government or regulated by it in some other way, the adjustments are being made at discreet intervals. As predicted by the theory, those increases may, under certain conditions, have a substantial impact on the general price level. Finally, a better understanding of the transmission mechanism between the two phenomena in question, can prove helpful with respect to setting proper inflation targets by the government or the central bank as well as provide an additional tool for a yet better inflation forecasting.

Additionally the paper examines individual inflation rates of CPI components on a cumulative basis. While relative price variability may affect inflation in the short run, it need not result in permanent relative price realignments. It is therefore essential to detect those groups of goods and services that registered extraordinarily big relative price increases to identify the long-run sources of inflationary pressures.

The paper is organized as follows: Section 2 discusses Ball and Mankiw's models predicting the causality from relative price variability to inflation and discusses it in more detail. Section 3 provides a brief background of the factors underlying Polish relative price variability

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2 The topic has been taken up in Pujol and Griffith [1996] for Poland and in a cross-sectional framework by Coorey, Mecagni and Offerdal [1996]

and empirical evidence on relative price behavior in Poland . The theoretical model as well as obtained regression results are discussed in section 4. Section 5 takes a closer look at relative price changes on a cumulative basis and section 6 introduces the Cukierman and Leiderman model of price controls with its policy-related implications. Finally, section 7 concludes with a summary of results, conclusions and a sketch of possible policy recommendation.

Section 2 : THEORETICAL BACKGROUND

Despite dozens of publications aiming to explain the nature of the association between the movements in relative prices and inflation that have appeared in economic journals since the mid-60s, the main question of the analysis still remains unanswered. While most economists now acknowledge that relative price variability and inflation move closely together, there seems to be no unanimity as to the direction of causality between the two indicators and the theoretical grounds on which this causality should occur. [3] This section is devoted to reviewing recent models developed by Ball and Mankiw which will provide the theoretical basis for empirical analysis performed in later sections.

Ball and Mankiw's 1994 and 1995 models belong to the group of hypotheses which predict that causality runs from relative price variability to aggregate price level. In their 1995 paper "Relative Price Changes as Aggregate Supply Shocks" authors develop and test a model incorporating costs of price adjustments ("menu costs") to show the mechanism in which aggregate inflation is influenced by the shape of the distribution of relative supply shocks. Their 1994 model adds a great deal to the discussion by introducing positive trend inflation[4] and identifying other channels through which the association is enforced.

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[3] The different theories linking aggregate price changes to relative price variability fall into three broad categories:

- Increased relative price variability is a cause for increased inflation
- Increased inflation is a cause for increased relative price variability
- Inflation and relative price variability are influenced by common factors and therefore move together.

[4] Introducing positive trend inflation is crucial in the context of transition economies

The idea central to Ball and Mankiw's 1995 model is the firms' response to supply (cost) shocks. Authors assume that responding to shocks by changing prices is costly because of various menu costs that have to be incurred. In such a setting firms do not react if shocks are relatively small and respond only to shocks large enough to make paying menu costs worthwhile. With the assumption that the average relative shock is zero, Ball and Mankiw consider different distributions of shocks and look at the consequences that these differences have after the imposition of menu costs. In a symmetric distribution, the range of inaction arising from menu costs covers the same number of positive and negative shocks and the net effect on the price level is zero. However, when a distribution is skewed [5] to the right the upper tail is larger than the lower tail and menu costs imply that firms react to more positive shocks than they do to negative. Finally, if the distribution is skewed to the left the situation is reversed: the mass in the lower tail of the distribution is bigger and more firms experience downward shocks to their prices which results in the fall of the aggregate price level.

The basic implication of this reasoning is that in periods during which the distribution of shocks is skewed to the right, aggregate price level may rise as menu costs imply more price increases than price decreases. The authors formalize these ideas in a one-period theoretical model. They also observe that the analysis refers to the relationship of the distribution of ***unobserved*** real sectoral shocks and the rate of inflation. Recognizing that fact, they carry out a numerical analysis that proves that the relationship between the first, second and third moment of the distribution of unobserved shocks carries over to actual price changes under reasonable assumptions. In other words, one can use relative price data as a proxy for unobserved shocks since the two phenomena move monotonically closely together.

While Ball and Mankiw's 1995 paper offers sound justification for including skewness of the distribution of relative price changes as an explanatory variable, their earlier paper "Asymmetric Price Adjustment and Economic Fluctuations" (1994) explains the mechanism

[5] Positive skewness arises when there are few unusually large positive shocks and many small negative ones

through which inflation is influenced by the variance of that distribution. The underlying assumption of this paper is the positive trend inflation that all economic agents have to account for. With that assumption authors come much closer to the reality of transition economies, all of which have had to cope with high inflation levels. Introducing steadily growing price level adds a great deal of credibility to the analysis since intuition strongly suggest that high inflation has a substantial impact on firms' pricing decisions.

The model, as developed by Ball and Mankiw in 1994, assumes that in an inflationary environment firms make regular price adjustments to keep up with the growing price level[6] as well as change their prices in response to shocks for which they have to pay the menu cost. In this context, positive shocks trigger greater adjustment than do negative shocks of the same size and asymmetries arise even with a symmetric distribution of shocks. Firms affected by a negative sectoral shock putting downward price pressure have the incentive not to pay menu costs by simply waiting with unchanged nominal prices until inflation does the desired erosion to the relative price of their product. By contrast, positive shocks call for a prompt and more than offsetting action[7] on the part of the affected firm as the upward price pressure resulting from the shock is magnified by inflation which is continuously widening the gap between the firm's actual and desired relative price. Therefore authors claim that positive shocks cause firms to adjust quicker and more fully than negative shocks which, if not exceptionally large, are likely to leave firms' prices unchanged.

With the asymmetric price adjustment assumed, distribution of sectoral shocks need not be asymmetric to have a positive influence on the price level. Unlike in the 1995 paper where it was the asymmetry of the distribution of shocks that pushed prices upwards, in the 1994 model it is the greater relative price variability that itself exerts inflationary pressures. In the light of the

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[6] In the model authors assume steady rate of inflation. However, introducing variable (steadily falling) inflation does not change the findings as long as the rate is well-known and anticipated (which seems to be the case in Poland).

[7] In Ball and Mankiw's model both **range** and **size** of adjustment are asymmetric. If struck by a positive shock, firms adjust more in absolute value than would be the case with a negative shock because they raise their prices in response to the shock as well as catch up with inflation

model a relative shock that raises some firms' desired prices (and lowers the desired prices of others) induces more upward than downward adjustment. It is precisely for that reason that **greater relative price variability** is likely to be accompanied by **higher inflation** and lower output[8].

Combining the two models would yield a coherent and useful theoretical basis for studying the link between inflation and relative price variability in Poland. The authors themselves suggest putting the two hypotheses together and predict that the results would carry over.[9] The resultant model would view short run inflation developments in the light of the shape of the distribution of sectoral shocks as proxied by relative price shifts. With positive trend inflation, both variance and skewness of the distribution should add to the inflationary pressures as both downward price rigidity and prevalence of large positive price hikes result in a bigger asymmetry of firms' adjustment.

Summing up, the implications of Ball and Mankiw's models for the relationship between aggregate inflation rate and the distribution of individual inflation rates are straightforward. Aggregate price level tends to rise more rapidly during periods of high sectoral price dispersion especially if few unusually large price increases dominate the process. In other words, inflation rate should be positively correlated with the variance and skewness of the distribution of sectoral price changes.

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[8] In the absence of monetary accommodation, if firms fail to adjust their prices downward they have to face substantial output cuts. A more detailed discussion (beyond the scope of this paper) can be found in Ball and Mankiw [1994] pp. 252-256

[9] Ball and Mankiw [1995] p. 173

Section 3: RELATIVE PRICE DISTRIBUTIONS IN POLAND

3.1 : HISTORICAL FACTORS

As the name suggests, centrally planned economies relied heavily on economic plans. These plans set output goals in particular sectors taking into account the availability of labor and capital. Credit and money were assumed to adjust passively according to economy's needs as set out in the plan. Wages and prices were also determined by central planners. The resulting allocation of resources has been therefore highly inefficient and created serious distortions throughout the economy. Relative prices of goods did not reflect the relative demand and supply, but rather government's perception and preferences. All throughout the Eastern Europe and specifically in Poland, prices of staple foods, municipal services and transportation were set at extraordinarily low levels usually well below the cost recovery. Additionally, heavy implicit and explicit subsidies were prevalent in many sectors which disabled the signaling role of prices even more. As a result relative price structure deviated greatly from market patterns and carried no valid information on resource allocation.

Even though prices have been partially adjusted in Poland in the mid- and late- 1980s, the price structure was far from being market-determined when the first comprehensive reform package was initiated on January 1, 1990. The program often called *the Balcerowicz Plan* had been one of the "big-bang" type and called for rapid and economy-wide price liberalization, sharp reduction of subsidies and exchange rate unification. The goal of the program, macroeconomic stabilization, has been extremely difficult to achieve in the economy hovering on the edge of hyperinflation. The monetary overhangs that have been built up during years of rationing and shortages in the form of forced savings, have now made their way to the goods market. The much needed comprehensive price liberalization additionally contributed to inflationary pressures. Price controls were removed for most goods, reducing the portion of

administered prices from 50% to 10%.[10] The extent of upward adjustment was often bigger than expected and resulted in almost 80% inflation in January 90.[11] .

Following sharp upward movements of individual nominal prices, price relations have undergone significant shifts. It is obvious that inflation has not been even across all sectors. Some sectors, especially those in need of establishing higher relative prices of their products, have led the inflation process with others lagging behind. Even prior to looking at the distributions of relative price changes it should be expected that in many periods individual inflations of CPI components were dominated by one or two disproportionately big price increases (see footnote 10). Those could result from administrative price increases or occur in sectors struck by unusually large supply shocks. Whatever the reason, the outcome should be high positive skewness of the distribution as few outlier price hikes are matched with a large number of relatively small price increases.[12] According to the theory, it is these asymmetries that can fuel the inflation process contemporaneously as well as with a time lag.

3.2 : STATISTICAL EVIDENCE

The statistical data I use have been collected from various issues of Central Statistical Office (GUS) Monthly Bulletins on Price Changes.[13] They are individual inflation rates for more than 60 groups of goods and services. The level of disagregation varies within the sample for different years reflecting the availability of data. The number of categories is: 61 (for 1989 and 1990), 62 (for 1991 and 1992), 64 (1993, 1994 and 1995) and 63 (for 1996 and 1997). They cover the entire basket of goods and services constituting the basis of the Polish CPI index, so that the weights of all categories add up to one for each year[14].

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[10] Wellisz (1997) p. 157

[11] In January '90 the price of bread rose by 147%, electrical energy by 370% and furnace fuel, central heating and hot water by almost 400% .

[12] Unlike in the analysis of American inflation, the mean of the distribution in the case of Poland cannot be assumed to be close to zero and the distribution itself cannot be thought of as being composed of price increases and commensurate price declines. Rather, with the mean located at some positive π, the distribution is composed of big price increases matched with small price increases on the other side of the distribution.

[13] Source : GUS , Miesieczna Informacja o Zmianach Cen,, various issues

[14] The weights used by GUS to calculate inflation were updated every year and this paper takes that into account.

Even though the data were taken from the monthly bulletins they were aggregated to quarterly changes to eliminate excessive volatility due to high frequency[15] and focus on the shifts in relative prices that are stable over longer periods. For each quarter two distributions have been created: *distribution of unweighted inflation rates* (obtained from quarterly inflation rates for individual groups of goods and services) and *distribution of weighted inflation rates* (obtained from quarterly inflation rates for individual groups of goods and services multiplied by their weight in the basket). Using those distributions various measures of variance and skewness have been calculated:

- conventional variance and skewness of the unweighted distribution
- conventional variance and skewness of the weighted distribution
- Theil variance and skewness.

The above measures render different aspects of relative price changes. The mean of the weighted distribution is the aggregated inflation rate whereas the mean of the weighted distribution is the average inflation rate of commodities comprising the CPI basket. The unweighted variance assumes the value of zero when all individual inflation rates are equal and increases with higher dispersion of individual rates regardless of their share in the index. On the other hand, the variance of the weighted distribution measures the contribution of each group of commodities to overall variability on the basis of their weight in the basket and does not take on the zero value even if all rates are equal. Both measures seem to have considerable deficiencies with respect to describing the shape of the distribution in that they focus on one aspect of the variability neglecting the other. By contrast, the measure developed by Theil[16] takes account of several properties of the distribution thereby rendering a more comprehensive picture. Theil

[15]The effect that the frequency of the inflation data has on the volatility of relative prices is discussed in Blejer [1983]

[16] Theil [1967]

variance and skewness[17] as defined in the footnote have been used extensively in empirical work. Their advantage over conventional and weighted measures in the analysis of relative price variability relies on the fact that they reflect more accurately relative price shifts. Specifically, unlike *wvar*, *Tvar* assumes the value of zero when all inflation rates are equal i.e. when no relative price changes take place. Moreover, unlike *var,* it does take account of the relative share of a sector in the index, giving more weight to the variation in "important" prices. As will be shown in section 4, Theil measures are also the ones most closely correlated with inflation.

For each quarter in the sample the distribution of individual inflation rates has been obtained. Table 1 presents the set of descriptive statistics calculated for these distributions. The table shows that regardless of the statistic considered, on average (see last row of the table) the distributions were positively skewed and their variances varied substantially. To single out quarters with extraordinarily high and low levels of these statistics I sorted the data by the values of each statistic in an ascending order. Table 2 presents top five and bottom five observations according to respective statistics.

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[17] Theil variance - $TVAR = \sum_{i=1}^{n} w_i(\pi_i - \bar{\pi})^2$, Theil skewness - $TSK = \frac{\sum_{i=1}^{n} w_i(\pi_i - \bar{\pi})3}{\left[\sum_{=1}^{n} w_i(\pi_i - \bar{\pi})^2\right]^{3/2}}$, where $\bar{\pi} \doteq \sum_{i=1}^{n} w_i\pi_i$

Table 1: DESCRIPTIVE STATISTICS OF THE DISTRIBUTIONS OF INDIVIDUAL INFLATION RATES

quarter	*inflation*	*var*	*sk*	*wvar*	*wsk*	*Tvar*	*Tsk*
89Q1	0.295	0.275	6.523	0.342	1.345	9.481	0.721
89Q2	0.249	0.020	0.655	0.219	2.554	1.946	0.030
89Q3	1.053	1.615	2.510	17.433	3.943	243.370	0.277
89Q4	1.230	1.015	4.542	5.658	2.588	43.326	0.384
90Q1	1.319	0.980	0.889	4.740	1.955	55.905	0.125
90Q2	0.163	0.032	0.861	0.247	2.752	2.778	0.115
90Q3	0.103	0.035	2.127	0.064	0.151	1.527	0.050
90Q4	0.174	0.041	2.083	0.302	3.298	4.161	0.251
91Q1	0.257	0.039	0.991	0.216	1.459	7.068	0.367
91Q2	0.106	0.081	3.523	0.191	2.762	6.105	0.322
91Q3	0.050	0.029	0.679	0.119	-2.203	2.550	-0.107
91Q4	0.098	0.011	2.328	0.079	2.216	1.198	0.225
92Q1	0.116	0.005	0.632	0.084	3.273	1.241	0.652
92Q2	0.096	0.005	0.645	0.044	2.156	0.450	0.124
92Q3	0.097	0.011	1.481	0.091	1.799	1.195	0.027
92Q4	0.077	0.004	2.388	0.039	2.846	0.594	0.208
93Q1	0.099	0.003	2.250	0.033	2.031	0.431	0.184
93Q2	0.056	0.003	-0.909	0.025	1.623	0.465	-0.061
93Q3	0.060	0.012	-1.497	0.122	-1.790	1.968	-0.227
93Q4	0.119	0.015	2.930	0.112	3.056	1.632	0.248
94Q1	0.050	0.019	-5.071	0.036	4.340	1.638	-0.399
94Q2	0.071	0.006	2.819	0.038	4.490	0.729	0.326
94Q3	0.079	0.012	3.616	0.019	0.971	0.726	0.334
94Q4	0.067	0.013	5.183	0.023	1.993	0.696	0.447
95Q1	0.081	0.005	-0.598	0.030	2.490	0.541	0.040
95Q2	0.052	0.002	-0.248	0.010	1.524	0.169	0.018
95Q3	0.025	0.006	-4.429	0.043	-3.863	0.988	-0.349
95Q4	0.047	0.003	3.936	0.021	4.308	0.459	0.333
96Q1	0.065	0.002	1.257	0.020	2.117	0.265	0.104
96Q2	0.047	0.002	-0.997	0.013	2.293	0.238	0.005
96Q3	0.023	0.007	-4.009	0.073	-2.641	1.259	-0.297
96Q4	0.041	0.003	5.195	0.034	6.192	0.585	0.424
97Q1	0.049	0.001	0.696	0.013	2.215	0.198	0.072
mean	0.197	0.131	1.302	0.925	1.947	11.996	0.151
st. dev.	0.330	0.359	2.647	3.214	2.086	43.199	0.257

source: author's calculations using GUS data

Table 2: QUARTERS RANKED BY VALUES OF DESCRIPTIVE STATISTICS

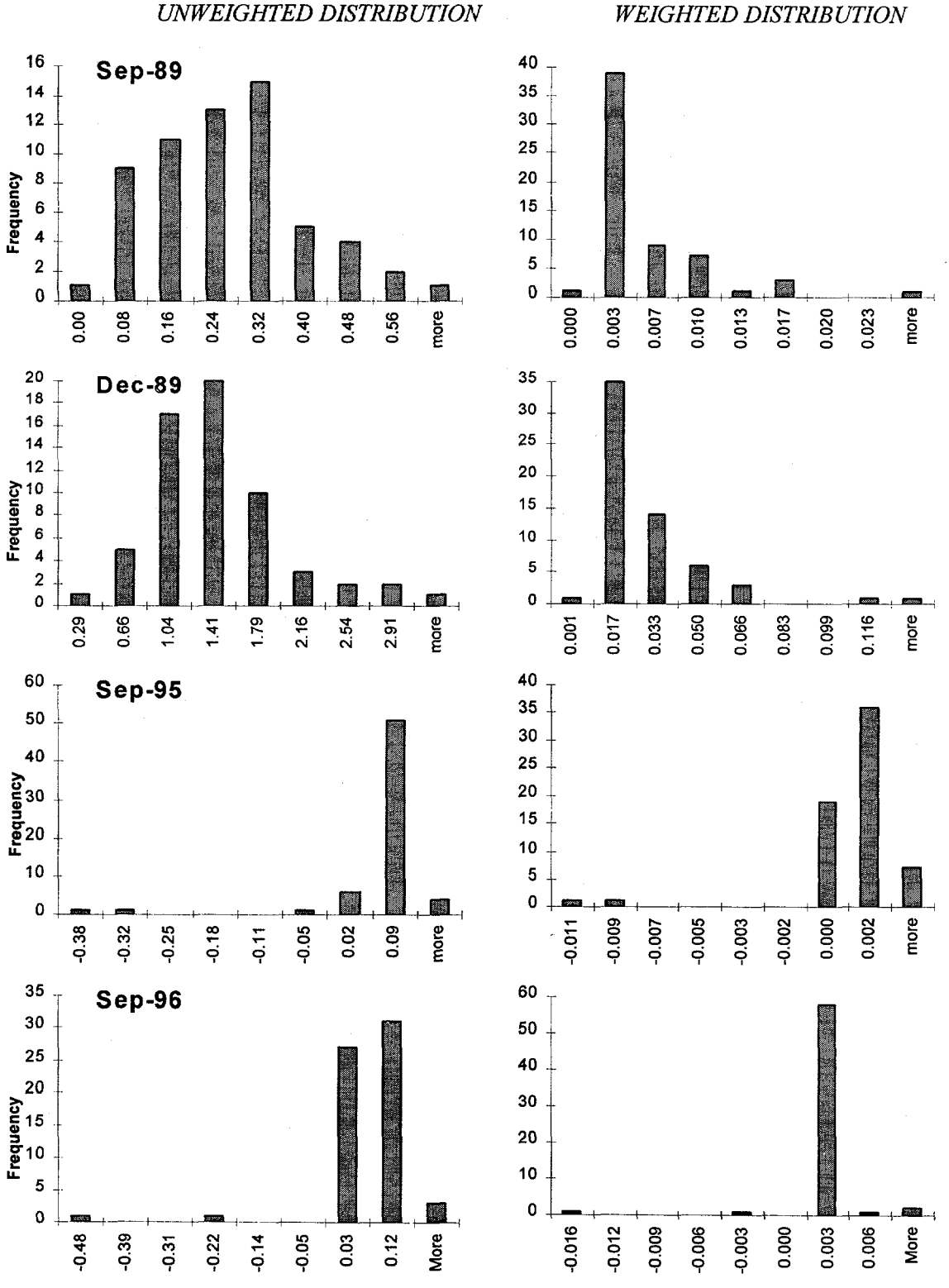
	Ranking	*Inflation*		*var*		*sk*		*wvar*	
	1	**90Q1**	1.319	**89Q3**	1.615	**89Q1**	6.523	**89Q3**	17.433
five	2	**89Q4**	1.230	**89Q4**	1.015	**96Q4**	5.195	**89Q4**	5.661
highest	3	**89Q3**	1.053	**90Q1**	0.980	**94Q4**	5.183	**90Q1**	4.740
	4	**89Q1**	0.295	**89Q1**	0.275	**89Q4**	4.542	**89Q1**	0.342
	5	**91Q1**	0.257	**91Q2**	0.081	**95Q4**	3.936	**89Q2**	0.219
	29	**95Q4**	0.047	**93Q1**	0.003	**96Q2**	-0.997	**95Q4**	0.021
five	30	**96Q2**	0.047	**96Q2**	0.002	**93Q3**	-1.497	**96Q4**	0.034
lowest	31	**96Q4**	0.041	**96Q1**	0.002	**96Q3**	-4.009	**96Q1**	0.020
	32	**95Q3**	0.025	**95Q2**	0.002	**95Q3**	-4.429	**96Q2**	0.013
	33	**96Q3**	0.023	**97Q1**	0.001	**94Q1**	-5.071	**97Q1**	0.013

	Ranking	*wsk*		*Tvar*		*Tsk*	
	1	**96Q4**	6.192	**89Q3**	243.370	**89Q1**	0.721
	2	**94Q2**	4.490	**90Q1**	55.905	**92Q1**	0.652
five	3	**94Q1**	4.340	**89Q4**	27.502	**94Q4**	0.447
highest	4	**95Q4**	4.308	**89Q1**	9.481	**96Q4**	0.424
	5	**89Q3**	3.943	**91Q1**	7.068	**91Q1**	0.367
	29	**90Q3**	0.151	**93Q1**	0.431	**91Q3**	-0.107
five	30	**93Q3**	-1.790	**96Q1**	0.265	**93Q3**	-0.227
lowest	31	**91Q3**	-2.203	**96Q2**	0.238	**96Q3**	-0.297
	32	**96Q3**	-2.641	**97Q1**	0.198	**95Q3**	-0.349
	33	**95Q3**	-3.863	**95Q2**	0.169	**94Q1**	-0.399

source: author's calculations using GUS data

The basic message that emerges from the tables is intuitionally obvious: the distribution of individual inflation rates is most heavily skewed and dispersed during initial stages of reform when most profound relative price changes took place. In the case of all statistics but one, second and third quarter of 1989 turn out to be the periods during which the measures peak. By contrast, more recent observations (1994-1997) tend to be characterized by lowest variance and skewness. To give a better idea of these outlier distributions, Figure 1 presents histograms of individual price changes for 89Q3 and 89Q4 (high positive skewness and variance) as well as 95Q3 and 96Q3 (high negative skewness).

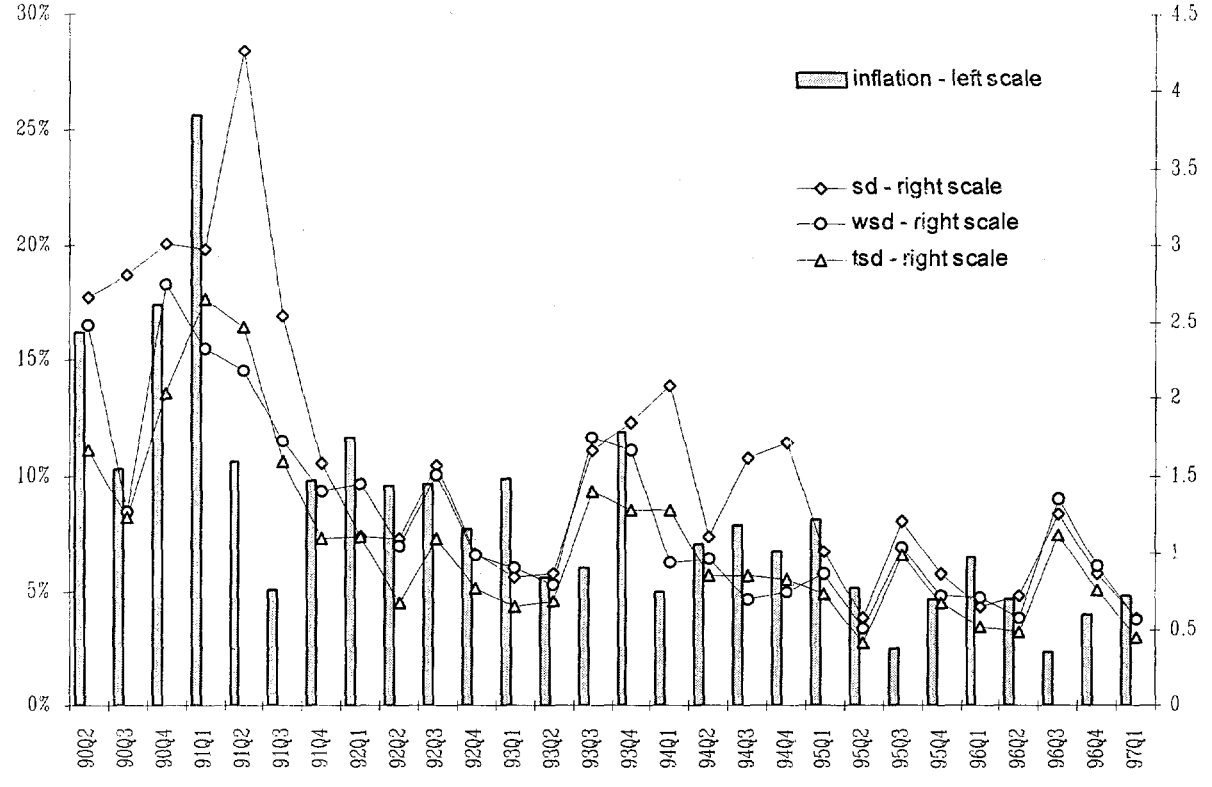
Figure1: HISTOGRAMS FOR INDIVIDUAL PRICE CHANGES FOR SELECTED QUARTERS



source: author's calculations using GUS data

Initial inspection of Tables 1 and 2 as well as Fig. 1 allows easily to detect a positive link between aggregate inflation and relative price variability. Fig. 2 depicts three different measures of standard deviation[18] used in the analysis along with the aggregate inflation. Because of disproportionately big values of these statistics for 4 initial observations (see table 1), they have been dropped from the sample.[19] This enables to observe the relationship in a much more detailed scale.

Figure 2: INFLATION AND VARIOUS MEASURES OF VARIANCE



source: author's calculations using GUS data

[18] Standard deviation was used instead of variance because of its bigger correlation with inflation (see Table 3). *Wsd* has been multiplied by 500 and *sd* by 15 to fit the figure's scale.

[19] For initial observations (1989-1990) inflation and variance move very closely together

Section 5 : ESTIMATION OF THE INFLATION MODEL

To empirically verify the presumptions on the link between inflation and relative price variability built on the theory as well as visual inspection of graphs and tables, I chose the model which appears in the 1996 paper by Coorey, Mecagni and Offerdal.[20] It is a simple static model for a two-sector economy (tradables and non-tradables). The economy is small and open and therefore takes world tradable prices as given. Additionally, money market is assumed to clear at all times. Using this basic set of assumptions authors derive seven structural equations describing market for nontradable goods, money market equilibrium, real income determination and inflation. The resultant model takes the following form[21]:

$$\pi = \gamma_1 + \gamma_2 m + \gamma_3 w + \gamma_4 (\pi_{NT} - \pi_T) + \gamma_5 V_\pi + seasonals$$

and takes account of:

- nominal money growth - m
- nominal wage growth - w
- real exchange rate based on relative inflation in tradable and non-tradable sector $\pi_{NT} - \pi_T$
- relative price variability - V_π
- quarterly seasonality - *seasonals*

The variables entering the model are based on the data from *Monthly Statistical Bulletins* and *Bulletins on Monthly Price Changes* of the *Polish Statistical Office* (GUS) and *Monthly Bulletins* of the *National Bank of Poland* as well as *International Monetary Fund's International Financial Statistics* . They are defined as follows:

1) π - *CPI index* ;

percentage changes of end-of-quarter value of the index

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[20] Coorey, Macagni and Offerdal [1996]

[21] For details see Coorey, Macagni and Offerdal [1996], pp. 73-78

2) *m - money supply* ;

percentage changes of end-of-quarter money stock

3) *w - nominal average monthly salary in the enterprise sector* ;

percentage change of a quarter's last month average value vis-à-vis previous quarter's last month average value

4) $\pi_{NT} - \pi_T = rer$ *- inflation rates of tradable and non-tradable components of CPI index*

difference in percentage changes of end-of-quarter values

5) V_π *- various measures of variance and skewness as well as their products*;

Definitions of variance and skewness measures used in regressions were slightly modified compared to those given in section 2. They are based on differences in log values of respective price indices instead of individual inflation rates. Using percentage change based measures would give rise to spurious regressions as the explanatory variables (variance, skewness) are based on differences of individual inflation rates and aggregate inflation (explained variable).

Before estimating the model it is worthwhile to take a look at the general correlation table (Table 3). It shows simple correlation coefficients for each pair of variables potentially to be included in the model. The table includes four different monetary aggregates as well as real exchange rate, wages, unweighted, weighted and Theil skewness, variance and standard deviation.

There are several important messages that emerge from the correlation table:

- Inflation seems to be more closely correlated with standard deviation than with variance.
- Of all the measures of relative price variability, Theil statistics yield highest correlation coefficients with inflation.
- Of three different monetary aggregates: M1, M2 and Domestic Credit (DC), M2 is the most closely correlated with inflation.
- All monetary aggregates are highly correlated with wages (ρ between 0.66 and 0.85). As the two variables appear both on the left side of the model equation, the resulting

Table 3 : CORRELATION TABLE

	π	*M1*	*QM*	*M2*	*DC*	*w*	*rer*	*Tvar*	*Tsd*	*Tsk*	*var*	*sd*	*sk*	*wvar*	*wsd*	*wsk*
π	1.00															
M1	0.84	1.00														
QM	0.77	0.54	1.00													
M2	0.85	0.72	0.97	1.00												
DC	0.63	0.53	0.63	0.67	1.00											
w	0.92	0.75	0.83	0.89	0.68	1.00										
rer	-0.25	0.05	-0.58	-0.48	-0.23	-0.51	1.00									
Tvar	0.66	0.42	0.40	0.45	0.28	0.68	-0.51	1.00								
Tsd	0.82	0.59	0.54	0.60	0.46	0.80	-0.40	0.96	1.00							
Tsk	0.17	0.02	0.11	0.09	0.26	0.11	-0.03	0.11	0.15	1.00						
var	0.82	0.63	0.44	0.53	0.38	0.75	-0.30	0.94	0.98	0.14	1.00					
sd	0.79	0.61	0.42	0.50	0.31	0.73	-0.31	0.94	0.96	0.10	0.99	1.00				
sk	0.11	0.09	0.08	0.10	0.29	0.13	-0.08	0.10	0.12	0.86	0.13	0.10	1.00			
wvar	0.76	0.52	0.57	0.61	0.38	0.80	-0.57	0.98	0.97	0.10	0.94	0.94	0.09	1.00		
wsd	0.82	0.64	0.44	0.53	0.38	0.75	-0.30	0.94	0.98	0.14	1.00	0.99	0.13	0.94	1.00	
wsk	0.15	0.08	0.13	0.12	0.09	0.25	-0.20	0.17	0.14	0.53	0.15	0.14	0.47	0.18	0.15	1.00

where

M1 - the sum of currency outside banks and demand deposits other than those of the central government *QM* - quasi-money, the sum of time, savings, and foreign currency deposits other than those of the central government; *M2* - the sum of M1 and QM ; *DC* - domestic credit includes net claims on general government, nonfinancial public enterprises and public sector ; *reer* = π_{NT} - π_T real exchange rate

source: author's calculations using GUS and IFS data

multicollinearity would increase standard errors of the estimates and render the t-statistics invalid.

- Domestic credit has the lowest correlation coefficient with inflation and as such will minimize the problem of multicollinearity if put into the model.

Table 4 presents estimates of three versions of the model carried out by Ordinary Least Squares method. Theil statistics were chosen to enter the model because of highest correlation coefficients with overall inflation. (see table 3). Resulting models have been obtained using the "General to Specific" procedure. Beginning with a fully unrestricted model with all explanatory variables lagged up to two periods, one variable with the lowest (insignificant) t-statistic has been dropped at a time. The procedure continued until all variables were significant at 10% significance level.[22]

[22] Seasonals were not eliminated even if their t-statistics fell below the level of significance

Table 4 : MODELLING INFLATION BY OLS (sample size: 89Q1-97Q1)

Explanatory variables	**Reg. I** coefficients	st. error	**Reg. II** coefficients	st. error	**Reg. III** coefficients	st. error
Constant	-0.067***[23]	0.011	-0.055***	0.007	-0.054***	0.009
DC	0.069*	0.039	-	-	-	-
DC_2	0.226**	0.091	-	-	-	-
M2_1			0.548***	0.054	-	-
w	0.450***	0.105	-	-	0.431**	0.104
w_1	-	-	-	-	0.217*	0.109
w_2	-	-	-	-	-0.162*	0.083
rer	-	-	-0.193***	0.065	-	-
rer_1	-0.643***	0.073	-0.575***	0.038	-0.425***	0.078
rer_2	-0.240***	0.054	0.114**	0.044	-0.128**	0.059
Tsd	**0.029*** **	**0.007**	**0.046*** **	**0.004**	**0.031*** **	**0.007**
Tsd_1	**0.012****	**0.005**	**0.020*** **	**0.003**	**0.013***	**0.007**
Tsd_2	**0.016*** **	**0.003**	-	-	**0.026****	**0.006**
Tsk	**0.070****	**0.031**	**0.113*** **	**0.025**	**0.081****	**0.031**
Tsk_1	-	-	-	-	**0.058***	**0.031**
CSeason	0.040	0.026	0.019	0.016	0.004	0.032
CSeason_1	0.030	0.026	0.056***	0.017	0.056*	0.027
CSeason_2	0.067**	0.029	0.030	0.018	0.046	0.028

source: author's calculations using GUS and IFS data

In the first version of the model, domestic credit (*DC*) was used instead of *M2* to reduce the danger of multicollinearity. However, even though of all monetary aggregates, *DC* is the one least closely correlated with wages, its correlation coefficient is still relatively high (0.68) and poses serious risk that the estimates of the coefficients' standard errors will be distorted. Therefore, two additional regressions were carried out, each including only one of the two correlated variables. Second and third column in Table 4 present the output of regressing inflation on the set of explanatory variables including money (*M2*) and wages, respectively.

[23] Number of stars beside a coefficient or a statistic indicates the level of significance: no stars -insignificant at up to 10% level, * - significant at 10%, ** - significant at 5% and *** - significant at 1%.

A series of diagnostic tests as well as overall regression evaluation have been performed for each regression. Table 5 presents the results.

Table 5 : REGRESSION EVALUATION AND TESTS

	Model I	Model II	Model III
R^2	0.995	0.996	0.995
DW	2.05	1.53	2.11
	Tests on the Overall Significance		
Wald Test	$Chi^2(6)$=3130.7[0.0000] ***	$Chi^2(5)$ = 4731.1 [0.0000] ***	$Chi^2(5)$ =2127.5 [0.0000] ***
F Test	F(12, 18)= 248 [0.0000]***	F(10, 20) = 498 [0.0000]***	F(13, 17) = 135 [0.0000]***
	Normality of Residuals		
	$\chi^2(2)$ = 0.0092849[0.9954]	$\chi^2(2)$ = 0.45765 [0.7955]	$\chi^2(2)$ = 2.8375 [0.2420]
	Tests on the Significance of Each Variable		
Constant	F(1,18)=38.256 [0.0000] ***	F(1, 20) =64.953[0.0000] ***	F(1,17)= 35.861 [0.0000] ***
M2	-	F(1, 20)=102.13 [0.0000] ***	-
DC	F(2, 18) =4.4713 [0.0265] **	-	-
w	F(1,18)=18.188 [0.0005] ***	-	F(3,17)= 7.9094 [0.0016] ***
rer	F(2,18) =44.779 [0.0000] ***	F(3, 20) =99.978[0.0000] ***	F(2,17) = 18.243 [0.0001] ***
Tsd	F(3,18) =14.293 [0.0001] ***	F(2, 20) =77.89 [0.0000] ***	F(3,17) =18.766 [0.0000] ***
Tsk	F(1, 18) =5.0635 [0.0372] **	F(1, 20) =20.205 [0.0002] ***	F(2,17) = 5.2678 [0.0166] **
CSeason	F(3, 18) =1.8298 [0.1779]	F(3, 20) =3.7858 [0.0267] **	F(3, 17) = 2.2897 [0.1151]

source: author's calculations using GUS and IFS data

Specification search in all three regressions (I, II and III) yielded statistically significant estimates in high explanatory power equations. Both F and Wald tests strongly confirm the overall significance of the postulated models. Stability of the modeled relationships was tested by various Chow tests (not quoted here), none of which indicated the danger of instability at the 5% significance level. Residuals were checked for normality by χ^2 tests which reported no significant departures from normality in any case. Visual inspection of residual plots did not indicate the presence of heteroscedasticity (no formal tests for heteroscedasticity were available because of the scarcity of observations). Even though some seasonal coefficients in the above

regressions turned out significant[24], on average, F-tests on the significance of explanatory variables did not confirm joint significance of seasonal factors in all but second regression.[25]

Because the models were estimated in a framework controlling for different shocks, it is possible to make statements about relative importance of factors fueling inflation. The main messages that emerge from the empirical analysis can be briefly summarized as follows:

- **Wages appear to be the most significant source of inflationary pressures.** If both monetary (*DC*) and wage (*w*) variables are included in the analysis (model I) the wage elasticity of inflation reaches 0.45, whereas that of credit growth (combined contemporaneous and lagged) about 0.3. If only wages are considered (model III), the elasticity rises to about 0.49. [26]

- **Real exchange appreciation substantially lowers inflation.** All regressions reveal significant dampening effect of real exchange appreciation on inflation. Coefficients of *rer* have all very large t-statistics (in absolute value) and add up to extremely high elasticities ranging from -0.648 (model III) to -0.883 (model I).

- **Relative price variability exerts considerable upward pressure on inflation.** In all regressions relative price variability is confirmed to raise overall inflation. The fact that the analysis was carried out in the framework controlling for wage/monetary and real exchange shocks adds more credibility to the result as the detected correlation is econometrically proven to be an autonomous macroeconomic phenomenon significant even in the absence of exogenous shocks. [27] Coefficients of Theil standard deviation and skewness are significantly positive suggesting that increased relative price variability fuels inflation. The influence of

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[24] *CSeason_2* in Reg. I, *CSeason_1* in Reg. II and *CSeason_1* in Reg. III have t-statistics significant at 5%, 1% and 10% significance level, respectively.

[25] However, seasonal variables were not removed from the regressions because of the general notion (and author's strong belief) that inflation in Poland is a highly seasonal phenomenon.

[26] The elasticity of *w_2* is negative suggesting some rebound effects of wage growth. The overall elasticity of 0.49 has been obtained by adding up the elasticities of *w*, *w_1* and *w_2*

higher dispersion of relative price changes (higher *Tsd*) seem to be persisting over time more than that of larger asymmetry (higher *Tsk*) which is reflected in the significance of both contemporanous and lagged coefficients of *Tsd* as opposed to insignificance (with one exception) of lagged *Tsk* coefficients in the regressions. On the other hand, pooled elasticity of the variables seems to give more weight to skewness than to variance: skewness has the elasticity of 7%, 11.3 % and 13.9% whereas variance - 5.7%, 6.6% and 7% in the first, second and third model respectively.

The significance of skewness and variance variables in the equation explaining inflation has serious implications. It means that, other things equal, any measures taken to reduce the volatility and disproportionality of individual inflation rates of various CPI components can depress overall inflation in the short run. Of course, policy makers have a limited control over a majority of factors which determine shape of the distributions of relative price changes. Most of the shifts result from seasonal supply shocks (food) and the volatility of world prices which Poland as a typical small economy takes as given.[28] However, in Poland still there is a substantial niche of the economy in which the government reserves itself the right to influence pricing policy in a number of ways. Administered price increases set price levels of most Polish utilities, drugs or vodka.[29] Putting aside the issues of political feasibility which will be taken up later on, it is the government that decides on the frequency and pace of those increases. In terms of the analysis presented above this means that the policy makers can influence the shape of the distribution of individual price changes to some extent by choosing the path of administered price adjustments. It is obvious that the policy of big and rare, one-time increases will magnify both skewness and variance of the distribution whereas the pattern of gradual and continuos adjustments will result in smaller values of these statistics. Therefore, big, outlier price hikes that make the distribution of relative price changes wide and heavily skewed and cause dramatic relative price shifts to take place rapidly do not facilitate fighting inflation. Rather, the main

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[27] The correlation may however be enhanced by monetary shocks as suggested by Fischer (1982) and Coorey et al (1996)

[28] In practice, most governments exercise some sort of policy aiming to „smooth out" seasonal volatility of prices of numerous agricultural products.

policy related recommendation emerging from this section is that the gradual pattern of administered price adjustment that favors frequent and moderate increases is preferred as it does not introduce excess distortions to the economy.

Section 6: CUMULATIVE RELATIVE PRICE CHANGES

The econometric analysis performed in section 4 gives some indication of the magnitude of the relative price movements on inflation in the short run. It does not however give any insights into the factors behind those movements. This section examines more closely the sources of relative price variability as well as provides a more disaggregated analysis of relative price shifts.

Estimating the relative price variability on the basis of differences in individual inflation rates of groups of commodities comprising the price index need not indicate whether any actual relative price shifts take place in the economy. It is possible that even during periods of persisting high relative price variability, relative prices measured at the end of the sample period did not change and the variability as detected by variance and skewness resulted from different paths of catching up with inflation among sectors. Therefore it is necessary to examine relative price changes on a cumulative basis. In the case of transition economies there is little doubt that high relative price variability was indeed accompanied by significant permanent relative price changes. A number of shocks that those economies were subjected to triggered higher price variability to produce a new price structure with price relations closer to those of market economies. While the market reforms implemented in the early stages of transition and their openness to international trade ensure that most absolute as well as relative prices gradually adjust and converge towards world levels, pricing of a certain number of goods and services still remains in the hand of the governments. Magnitude, pace and frequency of adjustments in these

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[29] The issue will taken up in more detail in the next section.

prices have all been the subjects of fierce debates as economically optimal outcomes have to be reconciled with political feasibility.

Citrin and Lahiri [1995] argue that these administered price increases have been the main factors fueling inflation in the FSU countries. While this may be true for Poland as well, it is important to look at those increases on a cumulative basis. Administered increases can only be considered a fundamental determinant of inflation if their purpose is to establish new and higher relative prices of controlled goods. Pujol and Griffiths [1996] employ simple regression technique to show that in Poland there has been strong correlation between a long lasting improvement in a particular sector's relative price and the number of times its price increases were distribution outliers.[30] In other words, exceptionally high price increases in some sectors may not just be the infrequent way of catching up with inflation[31] but should rather be considered an ongoing process of establishing a new higher relative price.

To give more insight into the outlier price increases, table 6 presents all CPI categories of products or services whose price rose more than 3 standard deviations of the unweighted distribution of price changes for a particular quarter. (3 standard deviations are denoted as 3sd and are given at the end of each quarter row).

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[30] Pujol [1996] regresses the change in a sector's relative price between Dec-89 and Jun-95 (ΔRCPI) on the number of times that sector registered an outlier price increase (NSK) and obtains statistically significant coefficients in an equation with a rather low explanatory power:$\Delta RCPI_i = 0.211\ NSK_i + 0.94$, $R^2 = 0.39$. The author uses this result to support the hypothesis that skewed relative price changes are causing Polish inflation.

[31] The low frequency of price adjustments may also suggest an attempt to avoid menu costs.

Table 6: OUTLIER PRICE INCREASES

quarter	Outlier Price Changes (3sd - 3*standard deviation)
89Q1	drugs 413 % ; **3sd 156%**
89Q2	transport fuels&lubricants 64%; vegetables 54%; furniture 54%; rents 46%; edible fats 46% tea and coffee 45%; fish products 43%; **3sd 42%**
89Q3	meat 660%; meat productsI 567%; butter 429%; meat products II 429%; **3sd 378%**
89Q4	sugar 329%; vehicles 256%; bread 232%; grains, cereals& their products 221% publications 196%; confectionary&honey products 189%; furniture 181%; **3sd 166%**
90Q1	drugs 452%; furnace fuels 405%; c/heating&hot water supply 398%; electricity 369%; gas 338% detergents 333%; **3sd 295%**
90Q2	postal and telecom services 71% ; fruits 64%; toys 54%; national transport 54%; **3sd 53%**
90Q3	c/heating&hot water supply 100%; electricity 79%; gas 58%; **3sd 56%**
90Q4	butter 103%; vegetables 90%; eggs 77%; **3sd 60%**
91Q1	c/heating&hot water supply 100% ; gas 78%; vegetables 66%; postal&telecom services 64% rents 60%; furnace fuels 59%; **3sd 59%**
91Q2	gas 163%; electricity 129%; **3sd 85%**
91Q3	postal and telecom services 82%; c/heating&hot water supply 61%; **3sd 51%**
91Q4	vegetables 50%; eggs 50%; butter 36%; fruits 33%; **3sd 31%**
92Q1	c/heating&hot water supply 100%; gas 70%; **3sd 48%**
92Q2	rents 38%; drugs 29%; **3sd 22%**
92Q3	eggs 49%; sugar 44%; cookies and pastries 38%; bread 33%; **3sd 31%**
92Q4	vegetables 39%; fruits 27%; furnace fuels 26%; national transport 24%; **3sd 20%**
93Q1	vegetables 38%; c/heating&hot water supply 26%; local transport 18%; **3sd 17%**
93Q2	national transport 25%; fruits 25%; **3sd 17%**
93Q3	eggs 55%; **3sd 33%**
93Q4	edible fats 63%; eggs 56%; fruits 51%; vegetables 44%; **3sd 36%**
94Q1	other food products 38 % ; **3sd 21%**
94Q2	fruits 49%; **3sd 22%**
94Q3	tea and coffee 47%; **3sd 31%**
94Q4	fish 86%; **3sd 34%**
95Q1	rents 30%; vegetables 22%; fruits 22%; **3sd 20%**
95Q2	vegetables 15%; fruits 15%; tobacco 15%; cheeses 13%; **3sd 12%**
95Q4	fruits 31%; vegetables 31%; eggs 27%; **3sd 17%**
96Q1	fruits 20%; vegetables 20%; bread 16%; gas 13%; culture&arts 13% **3sd 13%**
96Q2	tobacco 16%; bread 16%; **3sd 14%**
96Q4	fruits 42%; vegetables 20%; **3sd 17%**
97Q1	electricity 17%; rents 13%; vegetables 13%; culture and arts 12%; gas 12%; **3sd 11%**

source: author's calculations using GUS data

The most striking pattern that emerges from the table is that of high seasonality. With the exception of 1989 and 1990 when most prices have undergone significant adjustments, on average first quarters seem to be highly dominated by increases of controlled prices such as energy, gas or water supply . Sometimes these administered increases are extended into the second quarter as well (1991 and 1992). Seasonal foods increases account for biggest hikes in the fourth and second quarter as the reduced supply of fruits and vegetables combined with protectionist food market policies drive prices up. Third quarter emerges as the period with relatively small price increases with no clear pattern (with the exception of eggs) and no increases exceeding 3 standard deviation in both 1995 and 1996.[32] This is certainly the result of food price decreases brought about by positive seasonal supply shocks.

Big price increases need not cause significant shift in a sector's relative price if unless they are regular and frequent. Establishing higher relative prices requires continuos increases well in excess of inflation rates. To trace those continuos relative price shifts the author calculated the relative price index RP_i for all individual CPI categories throughout the sample period.[33] It is defined as follows:

$$RP_t^i = \frac{P_t^i}{CPI_t} \quad \text{for } i = 1,\ldots,65 \quad \text{and t} = 0\ (88Q4),\ \ldots,\ 33\ (91Q1)$$

$$\sum_{i=1}^{65} w_t^i = 1 \text{ for all t, where } w_t^i - \textit{CPI weights}$$

In the calculations I set t = 0 (88Q4) to be my basis period so that:

$$P_0^i = CPI_0 = RP_0^i = 1$$

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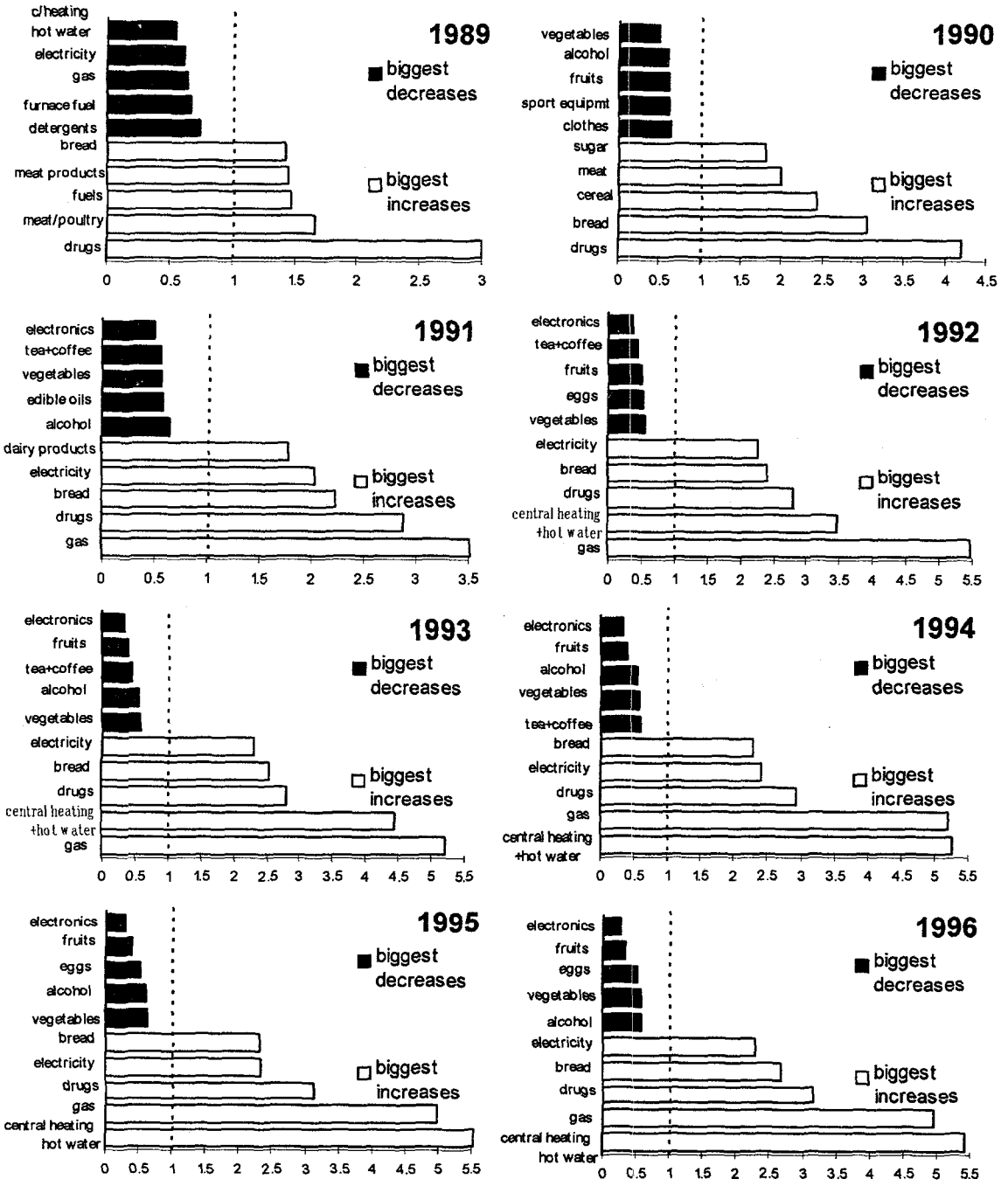
[32] This finding can be linked to negative skewness of third quarters for 1995 and 1996 as well as for most other years (see table 1)

[33] Since the number of categories differs across years due to data availability, the categories for which the data coverage was incomplete throughout the sample had to be dropped, leaving the total number at 61 for the entire sample period.

Therefore, the initial relative price for all goods at the end of 1988 is 1. If in any sample period RP of a good drops below 1 this means that the upward adjustments in its nominal price have fallen short of overall inflation and that the relative price of this good has deteriorated. By contrast, RP bigger than 1 indicates relative improvement in the product's price.[34] Values of RP were calculated for each quarter in the sample using the formula above. Figure 3 presents RP indices averaged over four quarters for each full sample year (1989-1997) to get rid of seasonality. For the purpose of graphical presentation these annual averages were sorted in descending order and middle 51 categories were skipped. The graph bars represent five highest downward and upward relative price shifts (five top and bottom bars, respectively) in relation to the price structure of end 1988. Dotted vertical line shows aggregate CPI whose relative price is always equal to 1 by definition.

[34] All the statements about price changes are relative to the basis period i.e. to the end of 1988.

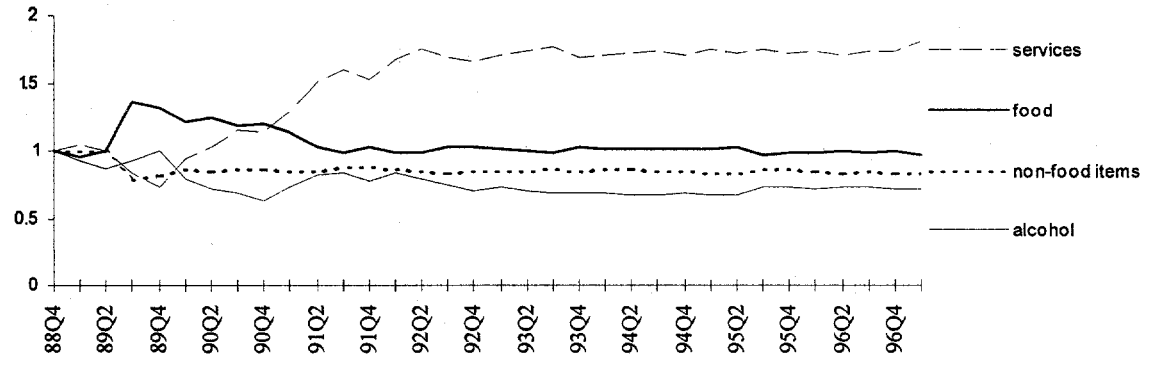
Figure 3: EXTREME RELATIVE PRICE CHANGES (basis period end-88)



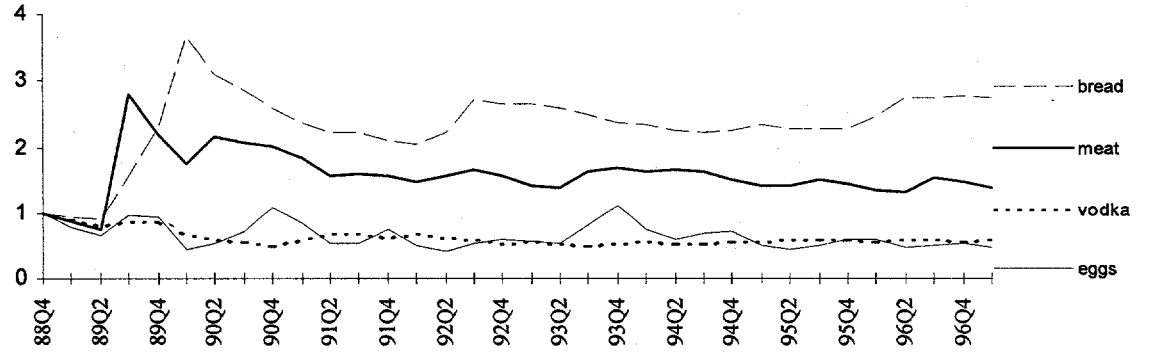
source: author's calculations using GUS data

Figure 4: CUMULATIVE RELATIVE PRICE CHANGES

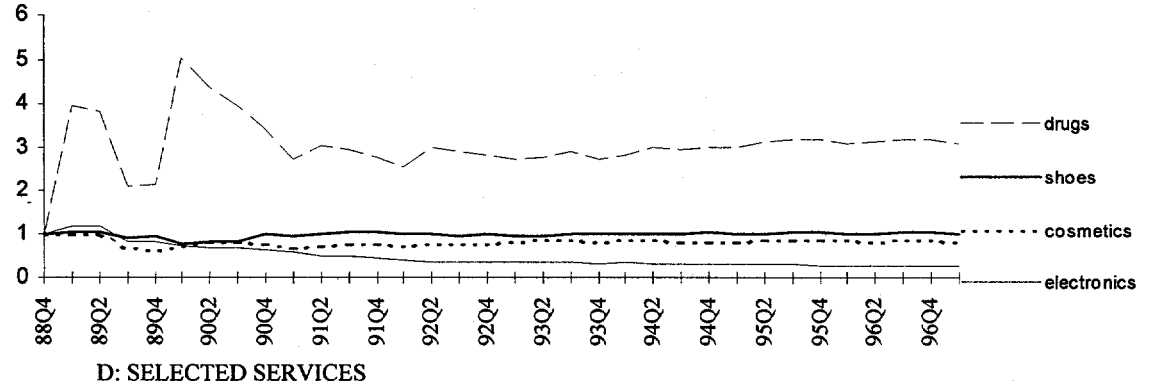
A: MAIN CATEGORIES



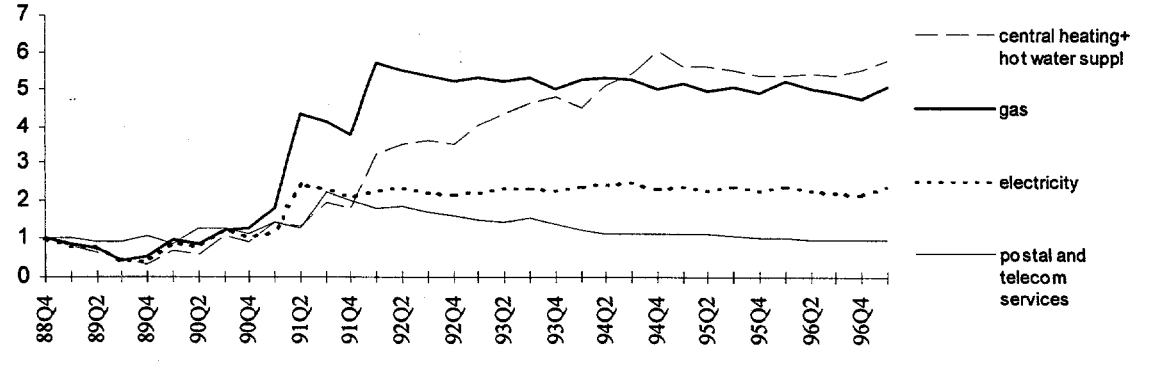
B: SELECTED FOODSTUFFS



C: SELECTED NON-FOOD ITEMS



D: SELECTED SERVICES



source: author's calculations using GUS data

To give a better idea of the path of relative price changes over time, Figure 4 presents cumulative relative price changes for main CPI categories as well as selected items from these categories.

The main messages from Fig.3 and Fig.4 can be summarized as follows:

- **The biggest relative price shifts took place between 1989-1991.**

As Fig. 3 and Fig. 4 suggest after 1991 no significant changes in the top and bottom relative price shifts occurred. Graphs confirm the notion that following the period of profound changes prior to 1992, most prices have stabilized and the process of adjustments that is still going on in some cases [35] is by far less abrupt than in the initial stages of transition.

- **Increases in the prices of utilities have undoubtedly led the inflationary process.**

Out of 5 biggest relative price increases, 3 took place in the sector of utilities. Prices of utilities rose by as much as 5 (gas) to 5.4 (central heating and water supply) times more than the CPI index. Pricing of most utilities are up till now controlled by the government which sets the pace of upward adjustments. (The issue of controlled prices will be taken up in more detail in the next section.)

- **Relative prices of staple foods have risen significantly.**

Prices of bread and dairy products (see Table 7 below) have outpaced inflation more than twice. This substantial relative price increase may be partially due to extraordinarily low prices of these foods before 1989 reflecting high subsidies which were part of the government's social safety net at that time.

- **Commodities from the category *electronics* experienced by far the largest and most permanent decline[36] in its relative price.**

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[35] Slow gradual upward adjustments continue in the case of for example: central heating and hot water supply.

[36] The relative price of the category *electronics* continues to decline systematically and reached the lowest value of RP=0.25 at the end of Mar-97

This certainly reflected a strong positive supply shock as the market with relatively scarce supply of electronics before 1989, got suddenly saturated with a large number of suppliers following market reforms in 1990.

It should be clear by now that administered price increases have indeed dominated the inflation performance in Poland during 1989-1997. To shed more light on the magnitude of that influence table 7 presents names of 15 sectors that managed to raise their prices the most along with their RP averaged over four quarters of 1996. The table additionally presents three sectors subject to government price controls which registered RP changes below 15 top increases. Sectors whose prices are strictly set by the government were typed bold. Sectors that were underlined are partly controlled by the government. This can take the form of:

- controlling a small number of items within the sector comprised of numerous categories (like *TV and radio subscription fee* in the sector: *culture and arts* and *fuels* or *railway tickets* in *national transport*),
- influencing the pricing policy at the industry level (like *coal* in the sector: *furnace*),
- setting the prices (or approving the planned price increases) by the local government *(non-private local transport*).

As Table 7 suggests, there are 12 sectors in the economy in which the government reserves the right of either strict price setting (bold) or influencing prices in some parts of the sector leaving others be determined by market clearing (underlined). Of the total of 12 such sectors, 9 are listed in the table (i.e. are among 15 sectors with highest increases) and all but three have experienced relative price increase. The average (unweighted) relative price of all government controlled goods increased more than twofold since 1989 or almost threefold when only direct price setting items (typed bold) are considered. The same figure for all other goods with free prices equals 1.034 suggesting that on average, market - determined prices were rising at the pace of overall price level.

Table 7: 15 BIGGEST RELATIVE PRICE INCREASES 1989-1996
(controlled prices - underlined, administrative prices - bold)

#	sector i	RPI_{1996}	#	sector i	RPI_{1996}
1	**central heating and hot water supply**	**5.419**	**11**	**rents**	1.709
2	**gas**	**4.939**	12	hairdresser's and cosmetic care	1.651
3	**drugs**	**3.151**	13	publications	1.556
4	bread	2.68	14	furnace fuels	1.545
5	**electricity**	**2.274**	15	grains, cereals and their products	1.527
6	local transport	2.18			
7	health	2.067	26	culture and arts	1.152
8	dairy products	2.036	**38**	**postal and telecom services**	**0.969**
9	dry-cleaning, dyeing and other	1.793	**55**	**vodka**	**0.587**
10	national transport	1.785			

source: author's calculations using GUS data

Section 7: ADMINISTERED PRICE INCREASES

Having acknowledged the special role of administered price increases in the process of establishing the new relative price structure, I now turn to the final topic of this paper which links those increases to the overall relative price variability and inflation.

Even though the evidence clearly points to utility prices as the ones that outpaced inflation the most, it is remarkable that after a dramatic upward shift that occurred during 1989-1992, their relative prices remained fairly stable afterwards. This suggests that the process of adjustments came to a halt in 1992 and administered increases just make up for inflation since then. However, as Pujol and Griffiths (1996) point out, the process is still very far from being

complete and there is a strong need to continue the adjustments. The authors calculate their own relative cost of living index comparing prices of the same consumption basket in a couple of Eastern European countries including Poland and Austria. The results are striking : the overall index for Poland in percent of the Austrian index equals 60.4%, the food index- 67.3% and the index for utilities - just 22.6% ! [37] While the calculations were made using data from March 1994, the size of undervaluation of utilities as compared to other CPI categories should not differ significantly as the relative prices of Polish utilities have hardly risen since 1994 (see Fig. 6 and Fig. 7). Pujol and Griffiths also calculate the coefficient of variation that captures the extent to which individual ratios of commodity prices in both countries deviate from the overall index. The relatively high value of that coefficient for Poland suggests that undervaluation varies enormously for different goods. In particular, authors note that much of this variation comes from relatively high undervaluation of utilities. They conclude that while the low value of the overall cost-of-living index points to significant undervaluation of the Polish currency, the desired appreciation[38] will not eliminate the existing disparities within the index. Therefore, it is important to continue corrective adjustments of prices of utilities (which seem to be most undervalued) to bring the relative price structure closer to world levels. Upward adjustments in these prices are also important if the sectors are to be provided with full cost recovery as well as funds for necessary investments. Finally, bringing these prices up to the real levels would induce their proper economical use and discourage overconsumption.

The need for further adjustments entails the question of the optimal path of the process. Putting aside the implications of such adjustments in the sphere of political economy, what is the least distorting way of establishing higher relative prices ? Is the big-bang approach of large one-time increases more desirable than continuos gradual adjustments that take longer to achieve the same effect ? The results of the model estimated in Section 5 suggested that gradual adjustment is clearly preferred on the grounds that it does not contribute to wide and skewed relative price

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[37] The utilities index equals 73.6 % in Slovenia, 35% in Hungary, 29.6% in the Czech Rep. and 10.9% in Slovakia

[38] Real appreciation has been indeed taking place systematically during the entire period 1989-1997, in particular since 1994 (Pujol and Griffiths' data) up to date.

distributions which were proven to raise aggregate inflation. Additionally, the paper by Cukierman and Leiderman: "Price Controls and the Variability of Relative Prices"[39] sheds more light on the same policy dilemma. Authors develop a model in which they decompose the economy into two sectors: one controlled by the government and the other one with prices determined in the market. They find that if an increase in the aggregate price level of controlled goods does not go in line with the expected money growth, relative price variability is likely to be magnified [40]. In the light of the theory presented in section 3 as well as its empirical support in sections 4, higher relative price variability means higher overall inflation. As shown by Cukierman and Leiderman, the variability of free prices can be substantially increased if the administered price increases diverge from the money growth path. By contrast, if the pace of those increases resembles that of money expansion, the resulting relative price variability in the free goods sector is minimized.

The main message from Cukierman and Leiderman's paper may not be directly applicable in Poland. Using the paper's main finding as a policy recommendation would amount to increasing administered prices at the pace of general inflation and hence preserving existing undervaluation in a number of sectors[41]. This is clearly not an option considering that relative prices of utilities and other undervalued commodities have to be substantially increased. However, the theory also predicts that any reduction of the gap between the pace of adjustment and money growth will decrease the magnitude of the impact. Therefore, if the government wants to take measures to curb inflation while at the same time making necessary administered increases it should adopt a rather gradual approach. Frequent increases slightly above the inflation rate are recommended in the light of the analysis as they are not causing the relative price variability to increase by as much as would be the case with occasional big changes.

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[39] Cukierman A. and L. Leiderman (1984)

[40] In particular, the novelty of Cukierman-Leiderman model it that the gap between money growth path and the pace of administered price increases, raises the relative price variability within the sector of free goods.

[41] Assumption is being made that money growth translates fairly accurately into inflation.

This pace of price adjustments may not be , however, optimal for policy makers. The same issue analyzed in the context of political economy yields a different outcome: from the point of view of the government it might be better to avoid frequent price increases. Any decision to raise prices is likely to be costly for the authorities in terms of the loss of popularity and the cost is clearly minimized by lowering the frequency of adjustments. These political costs may be thought of as an important part of menu costs introduced earlier in the paper. Just like standard menu costs, they make (administered) prices more sticky in that they discourage the government from making frequent inflation-driven adjustments. Keeping in mind that all governments whether populist or not are subject to those same constraints, it may turn out that the economically rational option of small repeated adjustments is not politically feasible. Therefore, with only limited frequency of administered increases available, the revised policy recommendation could suggest bigger adjustments because only they can ensure that necessary relative price realignments take place. In other words, when political economy rules out the feasibility of regularly repeated increases, sizable adjustments might be preferred to small ones.

Section 8: SUMMARY AND CONCLUSIONS

This paper has been designed as an attempt to estimate the magnitude of relative price shifts on the overall price level in Poland during the transition period 1989-1997. For that purpose, the theoretical model has been found that builds on menu costs and trend inflation to derive a positive relationship between variance and skewness of the distribution of relative price changes and the general inflation. The model allowed to estimate the effect of relative price shifts within the framework controlling for nominal and real shocks. Using Polish data, a set of 3 versions of the model were estimated. All of them yielded high explanatory power and statistically significant coefficients on most variance and skewness variables thus giving a strong empirical support to the theoretical relationship. Larger shifts in relative prices accompanying the adjustment process and detected by higher variance in the equation were proven to exert substantial upward pressure on inflation that persists over time. On the other hand, high positive skewness reflecting the domination of the adjustment process by few large increases was

confirmed to produce contemporaneous upward impulse that tends to wear off after one quarter but is stronger in magnitude than that coming from higher variance. Including other explanatory variables like real exchange rate, wages and/or money allowed for observing the relative importance of inflationary factors. The analysis revealed that money and wages remain to be the main factors fueling inflation and have a joint elasticity of up to three quarters. If their impact is evaluated separately, wages contribute about one half of inflation and domestic credit almost one third. On the other hand, real exchange rate appreciation was confirmed to significantly lower inflation. The measure based on different paces of inflation between tradables and non-tradables has proven to be a substantial dampening factor with an average elasticity of about minus three quarters.

Additionally, a closer look has been cast at the distributions of individual inflation rates of CPI components. High variance and positive skewness have been the typical features of these distributions. This suggests that some profound relative price shifts were taking place (variance) and that a small number of large price increases have led the inflationary process (skewness). Individual inflation rates have also been looked at on a cumulative basis. This analysis revealed that prices in the sector of controlled utilities have experienced the highest relative increases with some services (central heating and hot water supply, gas) outpacing the aggregate inflation 5 times and more. While most of these changes occurred during initial years of reform: 1989-1991, in general sectors controlled by the government have registered biggest relative price increases on a cumulative basis: 8 of them are among 15 sectors with top relative price increases and their average relative price in 1996 has more than doubled since the end of 1988.

Even though the data clearly show that significant increases in some relative prices have indeed taken place, the adjustment process should not be considered complete. As evidenced in the literature, prices in most of the sectors controlled by the government are still substantially undervalued and need further upward adjustments if Polish economy is to successfully integrate with the world economy. According to the Cukierman-Leiderman's model the optimal path of controlled price increases is the one that follows money expansion. The overall relative price variability induced by those administered increases will then be minimized which according to

this paper's earlier findings can contribute to lower overall inflation. Therefore, the main recommendation for conducting anti-inflationary policy should be frequent increases slightly in excess of overall inflation so that upward adjustments can take place without inducing larger price variability. However, when one considers the same issue in the context of political economy, this recommendation may not turn out optimal for policy makers. Less frequent adjustments are clearly more preferred by the government who has to bear the brunt of its unpopular decisions. Therefore, when frequent adjustments are not feasible, sizable increases have to be recommended as they ensure that the existing undervaluation of numerous services will diminish more quickly.

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