Price-Wage Dynamics and the Transmission of Inflation in Socialist Economies

Empirical Models for Hungary and Poland

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and
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Nominal anchors — particularly wage restraints — are impor-
tant in stabilization programs in reforming socialist economies.
Without conventional equilibrating mechanisms and effective
market restraints on wages, monopolistic pricing can result in
powerful inflationary pressures and higher-than-warranted out-
put costs.

This paper — a joint product of the National Economic Management Division, Economic Development Institute, and the Macroeconomic Adjustment and Growth Division, Country Economics Department — is part of a larger effort in PRE to analyze the sources and dynamics of inflation in transitional socialist economies. Copies are available free from the World Bank, 1818 H Street NW, Washington DC 20433. Please contact Olga Del Cid, room M7-047, extension 39050 (33 pages).

Commander and Coricelli set up a simple inflation model to analyze the transmission and short-run dynamics of inflation in partially reformed socialist economies. The n del has features derived from market economies with few producers and sticky prices. It also tries to capture some attributes of socialist economies, including chronic excess demand in goods markets. Most of the empirical analysis focuses on the period after 1982 when market-related reforms had been implemented.

Commander and Coricelli simultaneously estimate dynamic price and wage models. The estimated equations allow them to explore the role and weight of foreign prices and domestic factors in propagating inflation in Hungary and Poland.

They find that foreign prices matter but cost developments are critical in relating exogenous, policy-determined price adjustments to increases in inflation. In most periods, wages were indexed to prices — but in Poland more complex bargaining games emerged and a corresponding inability to make centralized wage norms hold. Polish planners relied increasingly on price adjustments to address emerging macroeconomic imbalances, but these only further destabilized the system and failed to address the underlying sources of macroeconomic imbalances. In contrast, the Hungarian experience points to some of the ways administered prices can be used to stabilize the system.

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I. Introduction

An apparently unique feature of classical centrally planned economies has been the absence of inflation. However, it is generally accepted that inflation was repressed with the result that translation into open inflation has become a hallmark of economies making the transition to market-based rules. By itself, the translation of repressed into open inflation cannot explain the acceleration -- and the persistently higher rates -- of inflation that has been observed in reforming socialist economies. Moreover, the rapidity of such acceleration threatens to dilute the desired signalling role for prices and jeopardizes the political sustainability of reform.

While an extensive literature exists that deals with the measurement of repressed inflation [1], analysis of open inflation is still largely anecdotal[2]. Moreover, little attempt has been made to pin down empirically the consequences of the particular behavioural rules and institutional routines, particularly monopolistic pricing, that are generally agreed to be characteristic of such regimes. In this paper we try to isolate key empirical regularities of the inflation process in reforming socialist countries.

Several features of the socialist economy distinguish them from standard market-based economies and indicate areas for specific analytical treatment. Such disparities include the administrative determination of prices, the wage setting framework and the imposition of full employment, external trading prices and regimes and the monopolistic structure of goods markets. Further,

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[1] See, inter alia, Nuti (1986); Portes(1977); Feltenstein (1989).

[2] Honohan (1989) for China and Rocha(1990) for Yugoslavia are among the few exceptions.

such economies might be expected to lack any endogenous mechanism of
equilibration given full employment and an absence of a conventional output-
price relationship. Incorporating, where feasible, these specific features,
we set up an inflation model, calling on Hungarian and Polish experience and
data. We concentrate on the propagation mechanism -- hence primarily on the
short-run dynamics -- while drawing upon models for market economies with
administered prices and small numbers of producers. To highlight the short-
run dynamics we estimate dynamic price and wage models using quarterly data
that cover much of the recent reform period. Our analysis pays particular
attention to the price-wage relationship and to the role of the exchange rate
in determining domestic inflation.

The organization of the paper is as follows. Section 2 provides a
discussion of the main institutional features and developments for both prices
and wages for Hungary and Poland. In the light of this information, we set up
a simple structural price and wage model suitable for estimation in Section 3.
The full model is laid out in Appendix 1. We then proceed on the basis of
available quarterly data to estimate the reduced form equations. The results
are reported in Section 4. Section 5 concludes.

II. **The Hungarian and Polish Setting**

Several salient features can be extracted from Hungarian and Polish
experience with price reform and inflation over the past three decades.
First, there has been a common and unambiguous upward shift in the price level
with such shifts being generally sustained. Moreover, Polish inflation has
been maintained at a consistently higher level over the 1980s and has
exhibited far greater variance than in Hungary. This culminated in a high
inflation burst in 1989 in Poland followed by a radical stabilization which,

by late 1990, had brought inflation down to below five percent per month. In the Hungarian case, inflation has been consistently ratcheted upwards, exceeding thirty percent per annum in 1990 with likely expansion to over fifty percent in 1991.

Second, both economies have moved away from strictly administratively determined prices. A series of price liberalization measures have reduced the weight of administered in total prices. Table 1 provides information on the distribution of different price categories. It should however be noted that neither free prices in Hungary nor contract prices in Poland were wholly free from administrative interference. Established ratios of costs to profits in the material sector and other guidelines constrained permissible price growth. In both economies, this diluted the potential impact on relative prices that might have been expected to result from a shift in the locus and timing of price adjustments. Consequently, major relative price rearrangements did not occur in Hungary until after 1987; in Poland significant change took place in 1981/82, 1988-89 and, more radically, with the 1990 stabilization. As part of this programme price controls were almost totally abandoned.

Third, price liberalization has been associated with a greater explicit linking of domestic to foreign prices [3]. Figures 1 and 2 show that imported inflation effects have become progressively more powerful. In Hungary, a

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[3] Nevertheless, exchange rate appreciation, subsidies and controls diluted this effect in Hungary after 1968. Between 1973 and 1978 consumer prices expanded at least six percentage points below OECD rates, necessitating a sharp upward adjustment to the price level in 1979/80 to eliminate the wedge between producer and consumer prices. Producer prices -- principally for exportables -- were then explicitly linked to international prices through the Competitive Pricing rule. In Poland the pass-through of foreign prices remained relatively weak for administered prices. An Equalization Settlements System equalized transaction prices for exporters and importers to domestic market prices via subsidies and taxes.

Table 1

Consumer and Producer Prices by Pricing Category:
Hungary and Poland, 1982-89

Category	1982	1984	1985	1987	1988	1989	1990
Hungary:							
Consumer Prices							
Fixed	15	15	6	6	-	-	-
Flexible	29	28	38	32	20	17	na
Free	56	57	56	62	80	83	na
Producer Prices							
Fixed	33*	30	32	28	25	23	na
Free	67*	70	68	72	75	77	na
Poland:							
Consumer Prices**							
Administrative	35	47	47	45	45	45	10
Regulated	15	3	3	2	0	0	0
Contract	50	50	50	53	55	55	90

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*=1980; Flexible consumer prices include those subject to maximum limit; Fixed producer prices also include all prices with upper limits **= expressed as share of total sales value for products covered by price category. Since 1990 changes in contract prices no longer require notification. Source: IMF
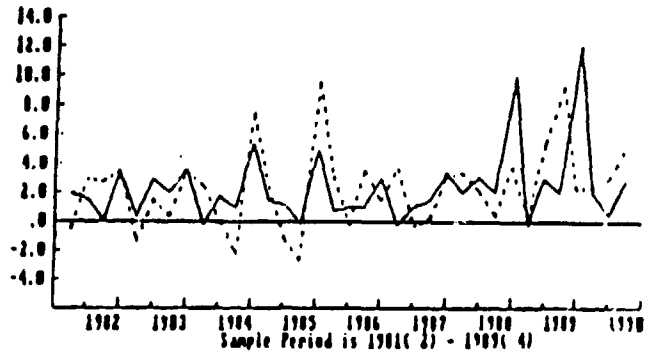
pattern of staggered adjustment of producer then consumer to foreign prices

appears to hold from the mid-1970s onwards. Import and domestic consumer

prices move more closely together over the 1980s. After 1986 there is a

fairly sharp divergence as Hungarian inflation began rapidly to exceed that of

its convertible trading partners. In Poland co-movement of import and

domestic prices became much stronger after 1982. Following a competitive

exchange rate policy aimed at boosting exports and reducing the gap between

official and parallel rates, the result was recurrent depreciation and a

strong imported inflation effect. In short, reduction in the share of

administered in total prices and explicit association to foreign prices appear

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Figure 1

Hungary,
Prices, Fiscal Deficit and Current Account (share of GDP)

Sample Period is 1971 - 1989
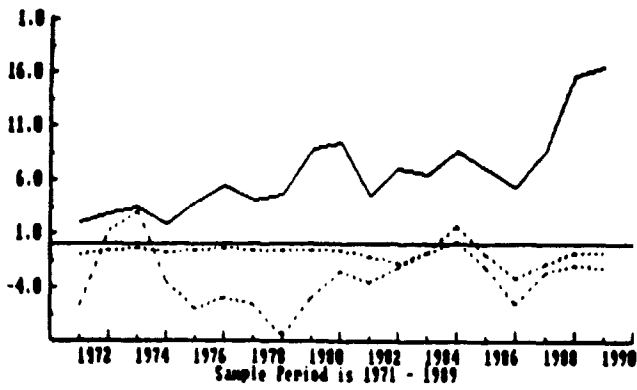
Hungary
Prices and Wages
(changes in percent)

Sample Period is 1981(3) - 1989(4)

Hungary
Changes in Prices, Official Exchange Rate

Sample Period is 1981(2) - 1990(1)
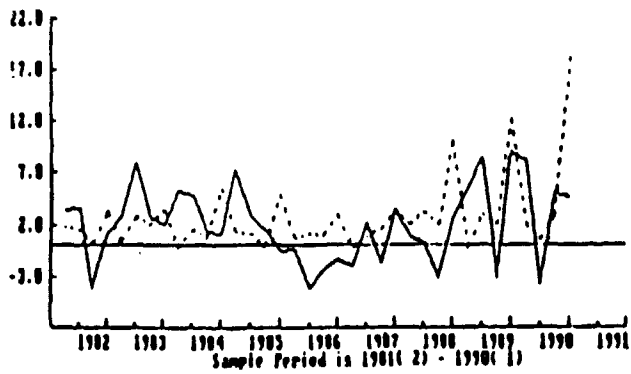
Hungary
Changes in Prices and Money (M2)

Sample Period is 1981(2) - 1990(1)

Figure 2

Poland: Inflation rate
yearly percentage change

Poland
Changes in Money and Prices

Poland: Budget deficit
percentage of GDP

Poland
Changes in Official Exchange Rate and Prices

Poland
Black Market Currency Premiums

Poland
Changes in Prices and Wages

5
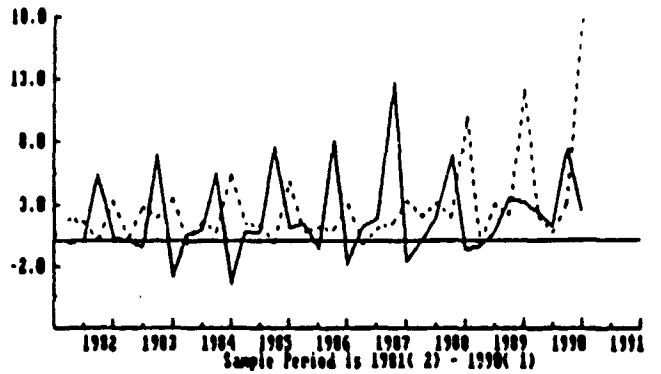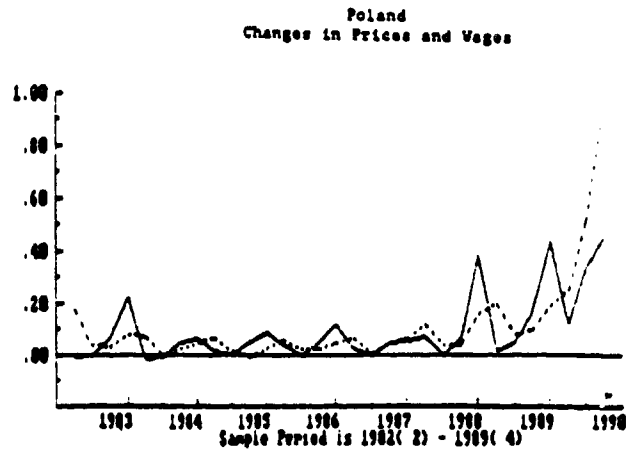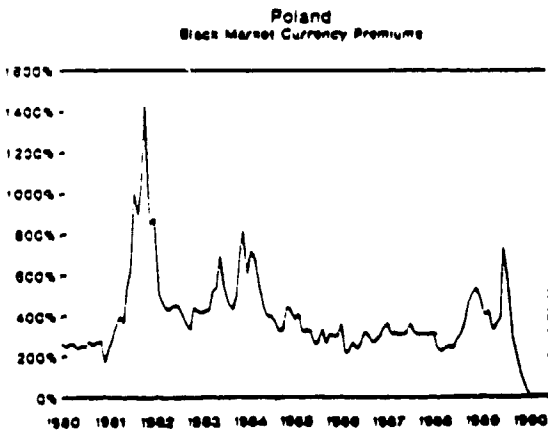
to have allowed some linkage, albeit very weak, of price changes to the real
side of the economy. The conventional inverse output to price relationship
appears absent.

For both Hungary and Poland in the 1980s consumer prices, wages and unit
labor costs moved together closely. For the former, an annual inflation model
covering the period 1969-1987 and relating change in consumer prices to lagged
inflation, import prices, unit labour costs and an excess demand term --
measured as the deviation from trend of M2 over retail sales [4]-- provides a
reasonably robust explanation of Hungarian inflation, particularly over the
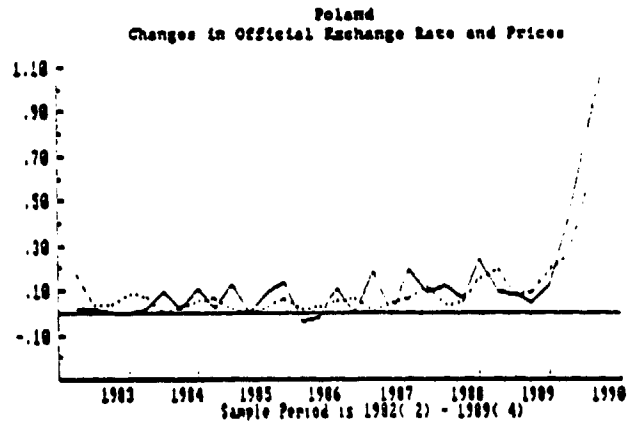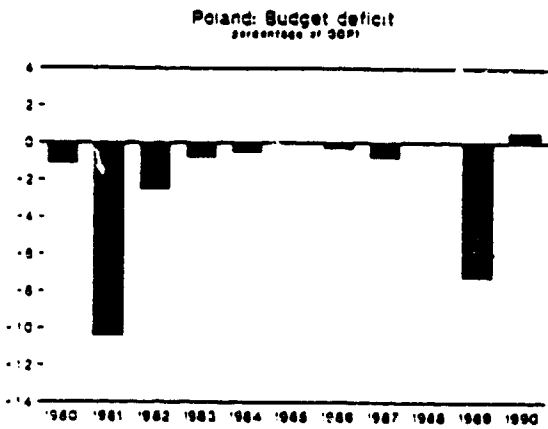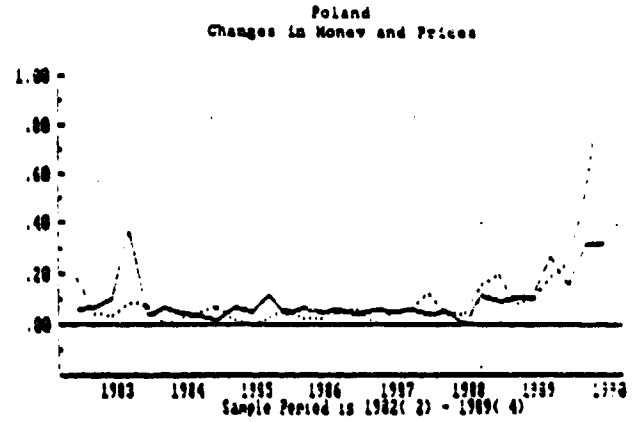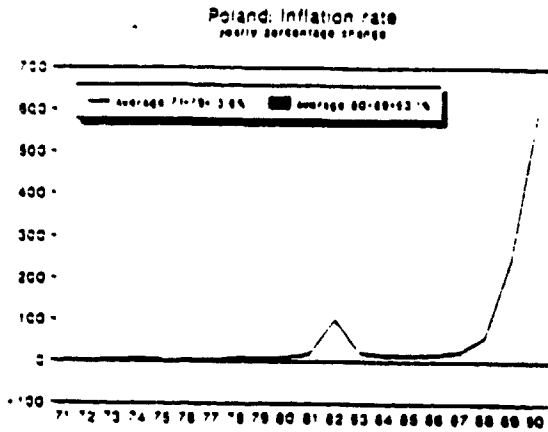pre-1982 period [5]. There is no evidence of structural change in Hungary over
the period to 1987. Inflation has had a marked inertial component, as would
be expected in a system with a significant share of administered prices.
There is strong covariation of cost factors and domestic prices. Changes to
unit labour costs and excess demand appear to have been more powerful
determinants than first-round import price effects of the inflation rate.

For Poland over the period 1953-1982, when prices were fully controlled
from the centre, consumer prices have broadly reflected movements in total

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[4] If we take anticipated output to equate trend output and assume that other
variables accommodate to output, the deviation from trend of the monetary impulse
can be considered a suitable proxy for excess demand.

[5] Hungary: Annual Inflation Model, 1960-1987 :
Estimation Method: Two Stage Least Squares
$$DLCPI=0.018 + 0.47*DLCPI_{-1} +0.18*DLM2RET + 0.08*DLIMP_{-1} +0.32*DULC_{-2}$$
    (2.6)   (3.55)   (1.98)   (1.69)   (3.15)
+0.04*D79
(3.04)
$R^2 =0.86$; e= 0.011; DW = 2.27
where; DLCPI= first difference of log of consumer price index; DLM2RET= deviation
from trend of ratio of M2 and real retail sales; DLIMP= first difference of log
of import price index;DULC= first difference of log of unitcost variable;
D79 = 1 for 1979 and 0 elsewhere.

costs. However, within this aggregate movement, large changes in relative prices took place in the period. Prices of basic items -- food, transport and rents, as well as energy -- lagged consistently behind the overall price index. In addition, monetary growth outpaced price growth in the seventies, creating a significant imbalance -- monetary overhang -- which was further associated with a large premium of the black market exchange rate over the official exchange rate. The price reform of 1982, with the attendant jump in administered prices, aimed at changing both relative prices and reducing the monetary overhang. The initial jump in the price level translated in an upward shift of the rate of inflation which stabilized before 1987 at around 15-20 percent per annum. Empirical evidence including tests for structural breaks suggests that the period post-1982 represents a new regime in price behaviour and not simply an increase in the rates of inflation [6]. This result seems consistent with the qualitative shift from a system of fully controlled prices to a mixed system of controlled and, in principle, market based prices.

In summarizing the respective inflationary experiences under reform, it is important to understand why rather similar ground-rules generated radically divergent inflationary paths. This can best be treated in relation to the conditions under which the accelerated reforms of the 1980s were enacted. In Poland that decade was marked by major external imbalances, persistent current account deficits and pressure on the exchange rate. Unlike for Hungary, the black market exchange rate premium remained very substantial throughout the 1980s -- one indicator of the presence of repressed inflation in the system.

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[6] Chow tests and recursive estimations were performed on an annual model for the period 1953-89. The results were reported in an earlier version of this paper presented at a World Bank/EDI seminar on "Managing Inflation in Socialist Economies" held at Laxenburg, Austria, in March 1990. These results are available upon request from the authors.

Before 1989, however, the frequent devaluations of the official exchange rate did not succeed in reducing the size of the premium.

A second divergent feature relates to the wage setting. Wage determination is critical as there is no effective endogenous mechanism of wage restraint in a socialist economy. In Hungary centrally imposed wage norms and bargaining rules were largely sustained and wage drift was restricted. This was not true for Poland where wage bargaining can best be interpreted in a non-cooperative setting [7]. The outcome was stronger wage and cost-side pressure through to prices. Polish inflation was consequently powerfully linked to changes in the two key flow variables; wages and the exchange rate [8].

These factors are important but not sufficient for explaining the jump into high inflation in 1989 in Poland. There was undoubtedly a sharp deterioration in the fiscal accounts, particularly in the first half of 1989. Revenue losses amounting to over 7% of GNP pushed the fiscal deficit close to 8% of GNP [9]. However, it required continuous depreciation of the exchange rate, liberalization of food prices, major shocks to administered prices and the introduction of an ex post indexation scheme in July 1989 to generate a wage-price spiral that tipped the economy into hyperinflation. At that stage, the system lacked any basic anchors. Money was essentially passive. Cost side effects were simply passed through by producers and accommodated. Money

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[7] A more thorough analysis of wage setting in these economies is contained in Commander and Staehr (1990).

[8] Lipton and Sachs (1990)

[9] Since 1981 the fiscal deficit had generally been restrained to under 1% of GNP and in 1988 was held to 0.22%. In 1989 the deficit expanded to over 7% and seignorage to 13.5% of GNP.

could not anchor the system in the absence of exchange rate and wage stability. Further, with the lifting of price controls, and the large increases in administered prices, the latter could no longer anchor the system adequately. Sharp upward adjustments to administered input prices in late 1989 were initially passed through to final prices by producers [10].

Additional, large increases in administered input prices and a maxi-devaluation at end-1989 contributed to high inflation rates in the first two months of the stabilization program. The deceleration of inflation post-February 1990 can be attributed not only to a major fiscal correction but to the reinstallation of anchors in the system [11]. The exchange rate and wages have been the principal anchors but temporary restraint on adjustments to remaining administered prices has also been applied. Measures to break the accommodating role of money have been implemented through independence of the Central Bank, interest rate policy and credit ceilings. Tight money, input price adjustments and a fall in domestic effective demand, alongside a trade liberalization aimed at importing international prices and a new relative price structure, led producers in 'exposed' sectors -- particularly consumer goods -- to lower mark-ups. For producer goods, constant mark-ups were sustained longer, given intra-producer trades and a slower shift in the demand curve [12]. These measures reduced monthly inflation to under 5% by October 1990, but alongside an output decline of around 28% in the industrial sector over the first eight months of 1990 and an increase in unemployment to 7.5% of

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[10] A result of the soft-budget constraint facing enterprises and the pricing rules operated by those enterprises.

[11] For a fuller discussion of the 1990 programme, see Coricelli and Rocha (1990).

[12] Frydman and Wellisz (1990).

the labour force [13].

III. The Model

Prior to summarizing our model, we hold that prices are a function of money, the exchange rate, foreign prices and real side factors. An additional feature would be the inclusion of a choice variable summarizing the planner's preference for a given price level. The sustaining conditions for price growth can be traced both to the fiscal-monetary side and to the discrete effects of exchange rate adjustment. In the former case, the rate of monetization will be directly acted on by the consolidated fiscal deficit. In so far as this measure adequately incorporates the relevant fiscal and quasi-fiscal accounts, including the profit and loss accounts of the Central Bank, this provides a means by which prices and the exchange rate determine monetary expansion. Sustained inflation can be attributed to the presence of fiscal deficits that cannot be financed through debt issue on a sustainable basis [14].

While a fiscal model of inflation can explain persistence of inflation, certain features of the partially reformed socialist economy need explicitly to be incorporated. In systems where administered prices are significant, budgetary subsidies arising from price controls would tend to feed through by the same channel. But to the extent that such controls repress inflation in the short run, elimination of subsidies would result in translation of that repressed inflation into open inflation. Moreover, with regard to the

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[13] The fall in output can in part be attributed to the size of the supply shock engendered by further massive increases to administered input prices in January 1990 in the context of a tight monetary stance (Calvo and Coricelli,1990). It has also been suggested that monopolistic pricing may have contributed (Blanchard et al,1990). Provisional testing for structural breaks on price data for the first quarter of 1990 do not however point to a significant structural break in pricing behaviour.

[14] Anand and van Wijnbergen (1987).

exogenous shift factors affecting the inflation rate, specific weight has to
be attached to the role of discrete adjustments to administered prices by the
planner. Indeed, major disturbances to the price level in both Hungary and
Poland can generally be attributed to such adjustments, as in 1979,1982,1988
and 1989. Such adjustments can be viewed as a lagged response by the planner
to macroeconomic imbalances, particularly excess demand in goods markets and
as an attempt to modify the structure of relative prices. However, such
excess demand would be determined not simply by unanticipated changes to
foreign price, monetary and fiscal impulses but also by the effect of fixed
price regimes.

The dynamic adjustment is also affected by the timing of price
decisions. Administrative rules generally impose long lags between
adjustments of controlled prices. The timing of changes for market prices is,
at least in principle, determined by price setters. A mixed system of
controlled and market prices leads to two sources of non-synchronization in
the price setting [15]. The first relates to the non-synchronization between
the change of controlled and the change of market prices. The second arises,
as in market economies, from the decentralization, and thus lack of
coordination, of price setting for the market goods [16]. Liberalization of
prices for certain categories of goods is likely to increase the flexibility
of the price system but by introducing an element of non-synchronization in

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[15] For a fuller treatment of this issue, see Commander and Coricelli
(1990).

[16] As often underlined in studies of inflation -- for example, Taylor
(1979); Pazos (1972) -- the staggering of price decisions increases the inertia
in the price system.

price changes can increase the inertia [17]. Both price staggering and wage indexation could be expected to facilitate translation of shocks to the price level into persistent increase in the rate of inflation. To the extent that enterprises operate a constant mark-up rule, wages are inflexible and the planner adjusts administered prices in lagged response to excess demand in goods markets, this would provide a sufficient explanation for the persistence of inflation.

The model we estimate below (and whose detailed features are presented in Appendix 1) describes a simple mark-up pricing system in which price movements, either through government controls or through the behaviour of monopolistic firms, reflect cost movements [18]. This pricing routine has to be related to the absence of any strong, market-based restraint on either the price or wage side. Consequently, both price and wage controls have been intrinsic to the stability of the system with prices and market power restrained by permissible margins on the mark-up and wages restrained by reference to expected inflation and some association to productivity.

The reduced form dynamic models for prices and wages that we estimate using Hungarian and Polish quarterly data are written as follows:

Prices

$$Dp_t = \alpha_0 + \alpha_1 Dp_{t-1} + \alpha_2(Dw_t - D(y/L)_t) + \alpha_3(y_t - y^*) + \alpha_4(Dpw_t + De_t) + \alpha_5((M/S)_{t-1} - (M/S)^*_{t-1})$$

$$- \alpha_6(p - p^*)_{t-1} \tag{1}$$

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[17] This could partially account for the persistence of inflation, at around 4 percent per month, for Poland after February 1990.

[18] This characterization appears to reflect adequately the explicit pricing rules adopted in both Hungary and Poland in the period of partial reform; IMF (1990a and 1990b); Kornai (1986).

Wages

$$Dw_t = \beta_0 + \beta_1 Dwc_t + \beta_2(D(y/L)_t) + \beta_3(w-w^*)_{t-1} + \beta_4 Dbmer_t + \beta_5((RS/P)_t - (RS/P)^*_t) \quad (2)$$

Consumer prices (eq.1) are related to lagged prices (α_1), unit labour costs (α_2), capacity utilization (α_3), import prices (α_4), an excess demand variable (α_5) -- constructed as the deviation from a perceived 'normal' ratio of monetary holdings in the household sector to retail sales -- and a correction term (α_6). Wages (eq.2) are related to a centralized wage norm (β_1), a productivity term (β_2), a black market exchange rate premium (β_4) variable (for Poland) and a variable (coefficient β_5) that attempts to capture the sensitivity of wage demands to the availability of goods in consumer markets [19]. This is done through deviation from trend of real retail sales of consumer goods. Finally, a correction term (β_3), embodying a real wage target, is included.

The specification of the correction terms, implying some convergence in the period studied to equilibrium values, or simply to certain target values or attractors, deserves some further comment as socialist economies are commonly thought to be disequilibrium regimes. Two aspects have to be emphasized. First, an error correction implies the presence of feedbacks, which induce changes in the dependent variable when the system deviates from its long-run point of attraction, being total costs or money for prices or

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[19] We assume a generally positive effect on wage demands of greater perceived availability of goods. However, if increased availability led to increased labor supply a decline in the real wage would follow. Aggravated shortages could also imply that a higher statistical real income be required to achieve the same real level of consumption. We thank an anonymous referee for these observations.

prices and productivity for wages. This does not imply any concept of equilibrium, such as market clearing. Indeed we emphasize the fact that such systems lack endogenous equilibrating mechanisms operating via the labour market or capacity. However, underlying regularities or rules of price and wage behaviors can be isolated. These we found to have been fairly stable during the 1980s. Interestingly, these rules were, in the case of pricing, embedded in the institutional setting in which price changes explained by cost changes were permitted and justified. The error-correction approach simply implies that the dynamics is affected by a tendency towards these underlying rules [20].

IV.   **Short Run Price and Wage Dynamics: Results from Quarterly Models**

The reduced form equations that we now present in Tables 2 & 3 for Hungary and Poland are based on quarterly data for the specified periods. The latter are in part given by data availability. To explore the price-wage interdependency and to avoid simultaneity bias we employ the three-stage least squares procedure. Prior to estimating the dynamic models, we tested for stationarity with Dickey Fuller and Augmented Dickey Fuller tests. We recognise that these are weak tests but conveniently the time series proved to be largely integrated of the first order, I(1), so that first differencing of the data was appropriate. Estimation was initially done with levels with discrete price and wage equations. We then estimated in dynamic form with the specifications requiring truncation of the lag polynomials and some restrictions on coefficients. The correction terms represent the lagged residuals from discrete, truncated levels equations, tested for non-

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[20] Monetary variables do not figure in the correction term, despite the fact that domestic money and prices are cointegrated. We exclude money because of its passive and accomodating role in such economies.

stationarity of the residuals. Finally, the equations were tested for
parameter stability and for sensitivity to changes in sample period.

1. <u>Hungary: 1981(3) - 1989(2)</u>

The results of simultaneous estimation of quarterly price and wage
models are reported in Table 2. Consumer price changes are related to lagged
prices, the exchange rate, a contemporaneous and lagged unit labour cost term
summarized in a first period moving average, a money term proxying demand-
side features, and a correction term relating prices to unit labour costs.
Wages are related to consumer prices, productivity in the material sector and
a correction term, specifying a real wage target. The price equation retains
many of the features of the annual model alluded to above.

The variables are stationary, or I(0), and are significant at a 5% and
more level. For the price equation the overall fit is quite acceptable, there
is parameter stability when estimated recursively and an absence of serious
autocorrelation. The equation is not sensitive to altering the sample
period. The wage equation is more problematic, appearing under-identified and
with its fit deteriorating seriously toward the end of sample. Nevertheless,
both equations capture reasonably well the short-run dynamics.

For the price equation, several features stand out. A lagged price term is
included on the right hand side. Argument for inclusion of this term relates to the
weight of administered prices where such prices can be considered to have stronger
than normal properties of exogeneity. The coefficient on a one period lag at 0.24
points to the fairly high degree of inertia in the system. The impact elasticity

Table 2
Hungary: Quarterly System
Estimation Method: Three Stage Least Squares
Sample: 1981.3 - 1989.2

<u>Dynamic Model</u>:

<u>Equation 1</u>:   DLCPI — c_1 * $DLcpi_{-1}$ + c_2 * DLexr + c3 *d01Dulc

+ c4 * DLM2/ret + c5 * $ecmulc_{-2}$

<u>Equation 2</u>:   DLwage — c_6 * DLpro * c7 * DLcpi + c8 * $ecmw_{-1}$ + D84.4 + D88.1

<u>Quarterly System Results</u>[1]

<u>Equation 1</u>:

DLcpi — 0.23 * $DLcpi_{-1}$ + 0.23 * Dlexr + 0.65 * d01Dulc +
        (2.70)   (4.11)   (6.49)

+ 0.21 * DLM2/ret - 0.14 $ecmulc_{-2}$
  (2.22)   (-1.87)

R^2 —0.80; e — 0.016; F — 17.73; DW — 1.87

<u>Equation 2</u>:

DLwage — 0.86 * DLcpi + 0.19 * DLpro - 0.05 * D84.4 - 0.05 * D88.1 -
         (5.94)   (1.89)   (-2.32)   (-2.26)

-0.52 * $ecmw_{-1}$
(-3.65)

R^2 — 0.65; e — 0.022; F — 9.91; DW — 1.82

<u>Legend:</u>
DLCPI   — The first difference of log of consumer price index
DLWAGE   — The first difference of log of wage index
DLEXR   — The first difference of log of official exchange rate
d01Dulc   — One period moving average of first difference of Lwage-Lprod
DLM2/ret — The first difference of log of M2 over retail sales
DLPRO   — The first difference of log of industrial production / industrial
            employment
ecmw   — Lwage— c_1 + c_2 * Lcpi
ecmulc   — Lcpi— c_1 + c_2 * Lulc
[1] — t-statistic in parenthesis

with respect to the exchange rate at 0.23 is greater than in the annual model, but could be expected given the more active exchange rate policy and stronger explicit linkage of domestic to foreign prices over this period. The demand pressure variable is very significant. However, little can be said in this context regarding the interactive effects on administered and market prices of demand pressure but the elasticity indicates the somewhat diluted translation into aggregate price increase.

In the initial single equation estimation, we inserted an output gap variable. It could have been expected that with the progressive introduction of market-based rules into the Hungarian economy that a more conventional output to price relationship would emerge. Recursive estimation and shortening of the sample at the end of the period did indeed result in the term picking up significance toward the end quarters but closer examination of the residuals indicated that the significance was largely taken from the noise associated with the price shifts during and after 1988 and the term was not included in the final estimations. The unit labour cost variable, with a moving average elasticity of 0.64, substantiates the powerful link of price growth to costs, as would be expected from the model elaborated above. The correction term (ecmulc) is the argument that prices are cointegrated with unit labour costs [21]. The Dickey Fuller test exceeds the 5% critical value for the null hypothesis for this specification [22]. The coefficient enters the equation with the right sign and is significant at the 5% level. The mean lag of adjustment is reasonably rapid at around four quarters.

The fit of the price equation is satisfactory. Recursive estimation and Chow

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[21] viz; $p - \alpha_1 ulc - \alpha_2$ I(0)

[22] The Dickey Fuller test gives (t-statistics in brackets);
ecmulc= -0.013*Constant+0.0007*Trend-0.71*ecmulc$_{-1}$
     (-0.56)   (0.71)   (-4.03)

tests prompt inclusion of a dummy for the first quarter of 1988. There is no serious autocorrelation; a feature of the model even when the lagged price term is dropped [23]. There is a slight widening of the bands for the recursive estimations at the end of the period, pointing to larger unexplained variation at the end of the sample. One step residuals confirm this feature while Chow tests show a lack of smoothness toward the end of the period, with a persistent spike at 1988(1). This is unsurprising given the timing of changes to administered prices and the tax system in this period. The dummy for 1988(1) in the single equation estimation was significant but did not change the size of the other coefficients nor improve the overall fit or properties of the model. Consequently, in the final system estimation it was omitted.

The wage equation, though reasonable, is less satisfactory. The equation appears under-identified and there is some negative autocorrelation in the residuals. There is a very marked deterioration in performance at the end of the sample. No wedge term could be adequately specified capturing any gap between producer and consumer wage a 1 there is no explicit treatment, due to lack of data availability, of the wage tax effect. Closer examination of the descriptive statistics show that up to 1985 wage changes we.e clustered in the first quarter; thereafter the annual wage round gives way to more random adjustments. Intra-annual wage adjustments appear to have been adopted as an inst'.tutional routine associated with the acceleration in consumer prices over the later part of the sample. For consumer and producer prices there is a similar clustering of changes in the first quarter. In the case of productivity -- measured over the socialist material sector -- changes generally fall in second and fourth quarters. The spike

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[23] Tests for heteroscedasticity, including ARCH and Chi-square normality test, proved borderline and somewhat ambiguous.

in the fourth quarter can partly be explained by the structure of the wage round and the effect of the wage tax in associating wage and productivity paths. Stability tests moreover picked out breaks at 1984(4) and, as for the price equation, at 1988(1), for which dummies were inserted. In general, institutional particularities, changes to the wage system and wage tax rules and their incomplete specification in the model explain the limitations of the reported equation [24].

Several tentative conclusions on the wage side emerge. In the first instance, the 0.86 coefficient on the price term in the wage equation points to the strong association of wage to consumer price movements. There appear to be no effective unanticipated price changes or price surprises. Testing this further by inserting a price surprise variable yielded a weak positive coefficient which was very insignificant. The absence of any price surprise, despite the acceleration in inflation over this period, can best be explained with respect to a real wage target maintained by the planner. Wages appear to have been fixed in relation to announced prices. Changes to administered prices have been very largely accomodated by wages over this period. To the extent that centrally-given wage norms have aimed to impose an inflation penalty, bargaining has succeeded in reconverging the wage and price path. The productivity term is likewise significant at more than a 5% level and its coefficient has roughly the same magnitude as for market economies. The correction term is written as a real wage target, is very significant and points to a rapid adjustment speed [25]. It should however be interpreted with some caution as an observed association between wage and price variables over the sample period rather than as a long run equilibrium relationship. It is evident that there is an

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[24] A fuller discussion can be found in Commander and Staehr (1990).

[25] Dickey Fuller test: $Decmw = -0.002*Constant + 0.0001*Trend - 0.56*ecmw_{-1}$
$$(-0.002) \qquad (0.16) \qquad (-3.29)$$

underlying linkage between price, productivity and wage changes, as suggested by our model. Consequently, the wage does not enter as a completely exogenous variable.

In summary, our estimations allow us to pin down some key dynamic features for price and wage changes over the 1980s. While foreign prices are important in the transmission of inflation, cost-side factors have greater weight. Demand-side pressures matter and it seems likely that one mechanism is through the impact on the relative prices of administered and market goods as a factor determining the scale of adjustment to administered prices. Strikingly, no standard association between output or capacity utilization and prices exists. This emphasizes the lack of an underlying mechanism of equilibration in the economy despite the introduction of greater market-based features. Finally, the presence of administered prices imparts inertia to the system but the models, as presently specified, cannot explicitly capture the price-price dynamics associated with non-synchronisation in price adjustment over administered and market prices.

Poland 1983.4 - 1990.1

The Polish price system has been subjected to a set of major institutional changes, the first occurring in 1982 with the creation of a mixed system of free and controlled prices, further modifications in 1988/89 and a major change in January 1990. Using annual data, Chow tests and recursive estimation identify 1982 as a structural break. Our estimations consequently use quarterly information for the post-1982 period. Preliminary testing for a break in 1990(1) does not indicate a comparable break in the pricing regime.

The results of our estimations are presented in Table 3. Prior to estimating the system, price and wage equations were run discretely to test for parameter stability, data coherence and goodness of fit. Prices were regressed on a lagged

price term, a cost variable, a lagged demand pressure variable and a correction
term. A lagged price term is included for the reasons already alluded to in the
Hungarian model. In this specification, the measure of money was M3, excluding
foreign currency deposits, deflated by retail sales. Prices are cointegrated with
unit labour costs and the official exchange rate; here discretely specified rather
than weighted in a total cost variable. In the wage equation, wages were related to
prices, productivity in the material sector, the exchange rate premium and a
variable denoting deviation from trend of real retail sales. The correction term
reflects cointegration between wages and prices, the exchange rate premium and
productivity [26].

Both equations appear quite satisfactory. All variables are highly
significant. For the price equation, the fit is very acceptable, the variables are
stable [27]. For the wage equation also the fit is very satisfactory but there is
clear evidence (detected through recursive estimations and Chow tests) of a large
spike at 1988.1 and 1989.1. We therefore enter dummy variables for both periods.
These dummies can be interpreted as representing some independent wage-push, which
occurred in a period of increasing social unrest.

As indicated in Section 3, we used a cost-plus specification, linking the
short-term dynamics to an adjustment to an underlying tendency to a normal mark-up
pricing rule. This specification includes monetary variables only as a determinant
of short run movements and not a long-run equilibrium relation. While this
hypothesis is consistent with the view of accommodating monetary policy, we tested

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[26] We tested for the order of integration of the series, which indicated
they are all integrated of order one (I(1)).

[27] The bands on the recursive estimates narrow with greater unexplained
variation only at the fourth quarter of 1989. One step residuals and the
Decreasing Chow test support this and suggest possible instability over the final
quarter of 1989.

Table 3

Poland: Quarterly System

Dynamic Model

Equation 1: $DLCPI = c_1 \ast DLulc + c_2 \ast DLoer + c_3 \ast DL(m3/r)_{-1} + c_4 \ast ecmp_{-1} + c_5 \ast DLcpi_{-1}$

Equation 2: $DLWAGES = c_6 \ast DLprem + c_7 \ast DLpro + c_8 \ast resret_{-1} + c_9 \ast ecmw_{-1} + c_{10} \ast D881 + c_{11} \ast D891$

Correction terms:

ECMP: $LCPI - c_1 + c_2 \ast Lulc + c_3 \ast Loer$

ECMW: $LWAGES - c_4 + c_5 \ast Lcpi + c_6 \ast LPRO$

Legend:

DL	- First difference of logs of;
DLCPI	- Consumer Price Index
DLulc	- Unit labor costs
DLoer	- Official exchange rate
DLwage	- Average Monthly Wage Index
DLprem	- Black Market Exchange Rate Premium
D881	- Dummy for first quarter of 1988=1, 0 elsewhere
D891	- Dummy for first quarter of 1989=1, 0 elsewhere
DL(m3/r)	- Ratio of M3 to retail sales
Resret	- Deviation from trend of real retail sales
DLpro	- Productivity in the industrial sector

<u>Poland : Quarterly System Results</u>

<u>Estimation Method: Three Stage Least Squares</u>

<u>1983.4 - 1990.1</u>

<u>Equation 1</u>: DLCPI = 0.33 * DLcpi$_{-1}$ + 0.43 * DLulc + 0.33 * Dloer +0.34 * DL(m3/r)$_{-1}$ -
             (4.2)   (5.9)   (7.6)   (5.4)

                -0.17* ecmp$_{-1}$
                 (-1.6)

             R^2 = 0.98; e = 0.04; F = 220.02; DW = 1.88

<u>Equation 2</u>: DLWAGE= 0.58 * Dlpro + 0.68 * Dlcpi + 0.20 * resret$_1$ - 0.40 * ecmw$_1$ +
                (3.1)   (16.4)   (2.8)   (-4.5)

             + 0.20 * D881 + 0.24 * D891
               (5.8)   (6.6)

             R^2 = 0.93; e = 0.056; F = 60.86; DW = 2.12

<u>Error correction equations (cointegration tests)</u>

Lwage(estimated) = -5.30 * Constant + 0.81 * Lcpi + 1.33 * Lpro
                   (-5.4)   (22.6)   (5.5)

Lwage(actual)-Lwage(estimated)= ecmw

Lcpi(estimated) = -0.22 * Constant + 0.63 * Lulc + 0.39 * Loer
                  (-1.3)   (4.7)   (4.2)

Lcpi(actual)-Lcpi(estimated)= ecmcpi

<u>Dickey-Fuller test</u>

Decmw = -0.028 * Constant + 0.001 * Trend -0.70 * ecmw$_{-1}$
        (-0.82)   (0.70)   (-4.40)**

Decmp = 0.089 * Constant - 0.004 * Trend -0.82 * ecmp$_{-1}$
        (3.2)   (-3.3)   (-5.3)**

** Significant at 5 percent level.

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empirically for the presence of a significant long-run relation between prices and money. Using a simple standard money demand approach we indeed found the presence of cointegration between prices and money. However, the inflation transmission mechanism is very poorly reflected by a dynamic equation based on this long run tendency. This strengthens our view that, while clearly prices, wages and monetary aggregates move together in the long-run, this is more the result of monetary accommodation than a causal relation running from money to prices.

The first aspect to be emphasized is that inflation is characterized by a relatively high degree of inertia throughout the period. This is not only captured by the presence of a lagged inflation term in the regression, but also by a relatively low coefficient of the correction term, implying a somewhat slow reaction to deviations from a "normal" relation between prices and costs. This pattern accords well with the observation of a relatively high, and stable, inflation over the period 1984-1987. Moreover, the stability of the relation throughout the period, 1983-1990 suggests that this degree of inertia survived during the acceleration of inflation post 1987. Although the coordination problem typical of system with a large number of price setters did not affect Poland, the inertia in inflation may have arisen from the peculiar features of a mixed system of market and controlled prices [28] in addition to the high degree of de facto indexation of wages to prices. Different rules and timing of price decisions in the different price categories likely gave rise to a substantial staggering of price decisions and a consequent inertia in inflation [29].

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[28] See Commander and Coricelli (1990) for an analytical treatment of this issue.

[29] Disaggregating for the price equation the contribution of each variable to average inflation across two periods, 1983 to 1987 and 1988 to 1990, we find that for the former, the exchange rate and unit labour costs are the most important; this continues to be true for 1988/89. The monetary variable only

The wage equation helps to stress the role of wages in the transmission of inflationary impulses, especially in the period 1988-1990. First we can note that wages have been de facto almost fully indexed to prices throughout the period. Besides the inflation term, the other variables entering the equation show an effect of productivity on wages, an effect of "availability" of goods on wage demands and, finally, some effect of changes in the premium of black market over official exchange rate on wage movements. The latter effect may indicate that workers are concerned with the purchasing power of wages not only in terms of domestic goods, but also of "dollar-goods." This can be explained by the presence of shops (Pewex shops) selling foreign goods for foreign currency [30].

The relation between wages and productivity is somewhat puzzling. The rather high coefficient may be partly explained by the system of bonus payments, and by a similar seasonal pattern of wages and productivity changes. The high (0.20) elasticity of wages with regard to the demand pressure variable is also striking. Contrary to theories of 'wage illusion', which might have been relevant in the 1960's and 1970's [31], this result suggests that the perception of a greater availability of goods in the market exerted an upward pressure on wage demands. The correction term can be interpreted as a real wage target, adjusted for productivity changes and the resulting payment of bonuses. Moreover, the speed of adjustment to deviations of wages from the "target" level is rather rapid [32]. The coefficient of

exerts significant inflationary pressure in 1989 when wage-push, devaluations and money expansion, primed by the fiscal deficit, accelerated inflation.

[30] Another possibility would be that of using the premium as a proxy for prices in non-official markets.

[31] As, for instance, argued by Charemza and Gronicki, 1988.

[32] We checked whether a price surprise term would induce a temporary fall in the real wage. In all specifications, the variables were not only insignificant but entered with positive coefficients.

that variable, together with a coefficient of nearly 0.7 on the price term, points

to an high degree of rigidity of real wages, both in the changes and in the levels.

We finally note that the model, as shown by stability tests, survives through

the period of high, almost hyper, inflation of 1989-90. Interestingly, this seems

to suggest that administered price changes, staggered adjustment of other prices,

wage indexation and an effectively indexed exchange rate, maintained, if not

increased, inertia in the inflation process [33] .

V. Concluding Remarks

We have attempted in this paper to set up a simple inflation model centered on

the transmission process and on the short run dynamics of inflation in partially

reformed socialist economies. The model has features derived from market economies

with few producers and sticky prices. It also attempts to capture some of the

specific attributes, including chronic excess demand in goods markets, of socialist

economies. The bulk of the empirical analysis concentrates on the post-1982 period

when significant market-related reforms had been implemented. While we accept that

socialist economies have been characterized by major disequilibria, we believe that

appropriately specified and tested econometric models can account for these

features, without explicit recourse to disequilibrium econometric procedures. We

estimate simultaneously dynamic price and wage models. For both Hungary and

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[33] For the high inflation period we attempted to verify three standard
properties of high inflationary experiences -- the emergence of the black market
exchange rate as the main determinant of inflation, the disappearance of inertia
in the inflation process and declining influence of the official exchange rate
as inflation accelerates. Replicating a test performed by Sachs on Bolivia
(1986) we carried out a simple monthly regression for the period 1988.1-1990.1,
relating domestic prices to lagged prices, the official and the black market
exchange rates. The results, identifying inertia with the coefficient of lagged
inflation, signalled rather an increase in inertia during 1989. A similar result
was obtained through a Kalman Filter estimation of a time-varying-coefficient
regression. This can be attributed to a combination of wage indexation and the
presence of many controlled prices. Detailed results are available upon request
from the authors.

Poland, the estimated equations allow us to explore quite satisfactorily the role and weight of foreign prices and domestic factors in propagating inflation. Foreign prices are shown to matter but developments on the cost side are critical in relating exogenous, policy determined adjustments to the price level to increase in the rate of inflation. Indexation of wages to prices obtains for most periods with, however, the emergence of more complex bargaining games in Poland and a corresponding inability to make centralized wage norms hold. Polish planners relied increasingly on price adjustments for addressing the macroeconomic imbalances that emerged, but these only further destabilized the system and failed to address the underlying sources of these imbalances. In contrast, the Hungarian experience points to some of the ways in which administered prices can be used to stabilize the system; an issue that we explore in more detail elsewhere [34].

An important implication of our results is that nominal anchors, particularly wage restraints, must feature in stabilization programs adopted in reforming socialist economies. The absence of conventional equilibrating mechanisms and hence of effective market restraints on wages alongside the presence of monopolistic pricing behaviour can easily result in powerful inflationary pressures and ultimately higher than warranted output costs.

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[34] Commander and Coricelli, 1990.

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APPENDIX 1

The Model

The economy has two sectors -- a material and non-material sector. The distinction is useful with regard both to wage determination and the relative influence of foreign prices. In addition, each goods sector has a controlled and non-controlled price sub-sector. Inflation is a weighted average;

$$p = (1-\alpha)pm + \alpha pn \qquad (1)$$

where,

$$pm = \beta_1 pm_c + \beta_2 pm_n \qquad (1a)$$

$$pn = \theta_1 pn_c + \theta_2 pn_n \qquad (1b)$$

We assume some linkage of domestic to foreign prices. In the case of the material sector exposed to competition from the hard currency zone, export and import prices are rendered in a standard way. Export prices are world prices (p_w) by the export exchange rate (e);

$$p_x = p_w + e \qquad (2)$$

Import prices are formed by world prices, the exchange rate for imports and tariffs (T). A terms of trade parameter (α) is also included;

$$p_m = \alpha T(p_w + e) \qquad (3)$$

Including control and non-control prices, total prices in the material sector trading outside the CMEA system would be a weighted average (k). The latter would be positively associated with the share of controlled to total prices.

$$p_m = k(pw + e) \qquad (4)$$

For the non-material sector and that part of the material sector isolated from the competition of hard-currency goods, the following mark-up pricing is assumed:

$$p_o = (1+\mu) \frac{piI + wL}{y} \qquad (5)$$

where μ=mark-up, pi=price of inputs; I=inputs volume, w= wages; L= labour volume and y=output.

The mark-up rule has standard properties. Changes in output prices will thus depend on unit factor costs, and on the mark-up μ. Foreign prices do not matter.[35] To the extent that the mark-up relates to some normal level of output, the lower the weight of k in eq. (4) the more likely it is that price change will be positively associated with the level of capacity utilization. Capacity utilization

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[35] Coutts, Godley and Nordhaus, 1978

can be written in the usual way as deviation of output from trend;

$$c u_t = (y_t - y^*) \tag{6}$$

The greater the preponderance of controlled prices in total prices, the weaker the link between price changes and capacity levels. One would therefore expect a classical planned economy to lack any conventional equilibrating mechanism. In addition, this introduces a relative price effect so that the coefficients depend not only on components of costs but also the elasticity of μ with respect to the overall domestic price index. Writing in rates of change this yields the following linearized, preliminary price equation;

$$p = \alpha_0 + \alpha_1(wL/y) + \alpha_2(pII/y) + \alpha_3(pw+e) + \alpha_4(y-y^*) + \alpha_5 p_{t-1} \tag{7}$$

Prices are a positive function of lagged prices, the mark-up, foreign prices and deviations from trend for capacity utilization. Clearly, foreign prices also enter through α_2 as I includes imported inputs. Price setting in the non-material sector would be a subset of eq. (7), obtained by omitting α_3.

Eq. (7) closely resembles a standard mark-up model applied extensively to non-socialist economies. We now accomodate some stylized features of socialist economies -- the widespread presence of goods shortages and high liquidity ratios. We assume that the planner cares about macro-disequilibria and periodically uses the price level, acting on controlled prices, to reduce perceived imbalances. Excess purchasing power in consumer markets may generate undesirable effects in the view of the planner. First, excess liquidity is likely to raise search and queueing costs for consumers, with possible negative productivity implications. Similarly a rising gap between notional and effective demand could of itself reduce effort and hence productivity; a likely response when the labour/leisure trade-off is constrained [36]. While this will ultimately show up as a real side effect, the presumed concern with relative prices on the part of the planner suggests that demand pressure in goods markets can best be captured in a price equation by a variable $((M/S)-(M/S^*))$ measuring deviation from a perceived 'normal' ratio of monetary holdings in the household sector [37] to retail sales. This indicates the measure of excess purchasing power in consumer markets and hence the assumed demand side pressure for relative price adjustment on the part of the planner [38]. The inclusion of both an

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[36] This latter effect is in fact broached in the disequilibrium literature which indicated the possible negative effect on labor supply due to shortages in consumption goods markets. With full employment institutionally guaranteed, one would expect a reduction in effort per unit of time worked.

[37] In these economies the financial sector is genuinely segmented with household and enterprise savings passing through distinct circuits.

[38] Alternatively, invoking Walras' Law we can simply assume that excess demand in goods markets translates into excess supply in the money market, viz; $ED = M/p - Md/p$. With the expectations term given as lagged inflation, this can be derived from a standard money demand function of the form; $Md/p = \alpha_0 + \alpha_1 y + \alpha_2 p_{t-1}$. The interest rate is assumed irrelevant.

output gap and an explicit purchasing power variable is an attempt to pin down the particular excess demand features of these economies when controlled and market prices co-exist and when the planner monitors their relative price. To the extent that supply remains insensitive to price changes, one would expect a strongly damped equilibrating relation between shortage and inflation.

Before turning to the wage setting, we can now set up in dynamic form the following inflation equation, where D is a first difference operator and α_5 is the correction term.

$$Dp_t = \alpha_0 + \alpha_1(Dw_t - D(y/L)_t) + \alpha_2(y_t - y^*) + \alpha_3(Dpw_t + De_t) + \alpha_4((M/S)_{t-1} - (M/S)^*_{t-1}$$

$$-\alpha_5(p-p^*)_{t-1} + \alpha_6 Dp_{t-1} \tag{8}$$

Wages

With regard to wage determination, we work from the following particularities of the socialist economy. First, an excess demand for labour regime obtains throughout. No usual convex relationship between labour market pressure and wage growth obtains. Second, the restrictions on profit maximizing behaviour at the level of the enterprise [39] -- the presence of soft budget constraints -- implies, in combination with full employment, that the wage share would not necessarily be endogenously restrained in some channel given by productivity and prices . To the extent that a true exposed sector emerges and acts as wage leader, then the wage share could be expected to be a stationary stochastic variable [40]; in the absence of this condition wage controls remain a basic precondition for restraint. Accordingly, wages are treated as largely exogenous and structured by centrally determined norms. Productivity-related wage components -- a feature of all partially reformed economies -- introduce a crude association to average productivity, rather than marginal products. We circumvent the more complex dynamics associated with plant-level bargaining, relying rather on recursive estimation to test for the stability of parameters in the wage equation.

Distinguishing again over material and non-material sectors, aggregate wage growth is a weighted average. In the material sector, wages are set in relation to price and productivity changes, with the latter linked to plant-level performance. In the non-material sector wage growth adjusts to the centrally determined rate of annual expansion. In so far as total wages converge to productivity corrected wage levels for the material sector, a faster rate of productivity increase in the material sector would, ceteris paribus, accelerate inflation. A diluted discipline from international prices implies a structural inflation term $(q_m - q_n)$ with an

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[39] If enterprises face no hard budget constraint, no systematic association between the ability to pay above agreed norms and actual wage payments could be expected. The distribution of the wage drift would be random.

[40] Expected wage inflation would be related to growth in prices and productivity; $E(Dw) = Dy_t + Dq_t$. An error correction model would then take the following shape; $Dw_t = \alpha_0 + \alpha_1(L)(Dq_t + Dy_t) - \alpha_2(w_{t-1} - q_{t-1} - y_{t-1}) + e_t$.

unambiguous positive association between productivity growth and inflation.

Wage contracts are of annual duration with explicit commitment to real wage stability. Unlike in models of compulsory arbitration with a penalty exacted through lagged wage adjustment [41], such outcomes in a socialist economy context require a price surprise with no term correction. Available evidence indicates in general adherence to a real wage target [42]. Any penalty might better be measured as the gap between statistical real wages and real wages; but that is beyond the scope of this paper. In the absence of formal indexation rules, except in Poland in 1989, it is important to establish whether de facto indexation is of a backward or forward-looking type. In this regard there is a degree of ambiguity in both the Polish and Hungarian cases. In principle a form of forward-looking, or ex ante indexation should be operating. Indeed, increases related to the centrally imposed norm reflects expected, or planned, inflation. In this case

$$Dwc_t = \alpha_1 + \alpha_2 E_{t-1}(Dp_t) \ , \qquad (9)$$

where wc_t=centrally imposed wage and E is the expectation operator. The real wage is a decreasing function of expectational errors, or inflation surprises [43]:

$$Dwc_t = \alpha_1 + \alpha 2 Dp_t - \alpha_2(Dp_t - E_{t-1}(Dp_t)). \qquad (10)$$

An ex post indexation scheme would imply

$$Dwc_t = \alpha_1 + \alpha_2 Dp_{t-1} \qquad (11)$$

Any increase in the inflation rate, Dp_t, reduces the real wage, while the indexation scheme introduces inertia in the inflationary process, slows down a reduction in the inflation rate and makes the wage setting insensitive to any announcement effects (which in the ex ante specification will immediately reduce the increase in wages) [44]. Consequently, when $\alpha_2=1$ and the surprise term is insignificant, one can either assume that an effective ex ante indexation scheme was in force, and that actual inflation and planned inflation were consistently equal, or that an ex post indexation operated, with the frequency of changes in wages (de facto and not that associated with the annual wage round) higher than that of price changes. Combining these features with the postulated wage-average productivity

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[41] An annual wage cycle with no mid-term correction would yield the following penalty: $w_t = \alpha' p_{t-2} - 2 \ '\Sigma p_{t-2-i}$

[42] See, inter alia, Adam, 1979; IMF, 1990

[43] The residuals of an univariate process for p_t may be assumed or an acceleration term, $D(Dp_t)$, can approximate the surprise term.

[44] The forward-looking indexation scheme is normally viewed as superior to backwood-lookinmg schemes with regard to the macroeconomic implications (eg Simonsen 1986). Recently, Fischer(1988) has shown how the ranking is more complex than assumed in Simonsen, depending crucially on the exchange rate policy followed by the country.

relationship yields the following equation to be estimated;

$$Dw_t = \beta_0 + \beta_1 Dwc_t + \beta_2 (Dqm_t + Dp_t - D(1+t_1)) \qquad (12)$$

where; wc_t = centrally imposed wage growth (applying to all sectors); qm_t = rate of change in average productivity in material sector; p_t = price inflation; t_1 = tax rate on wage growth exceeding $(Dwc_t + Dqm_t)$. In other words, wage expansion could be expected to result from a centralized component related to expected inflation and drift attributable to productivity changes in the material sector, offset by tax increases.

Eq. (12) would not adequately capture a clear feature of recent Polish history; the persistent increase in real wages up to the 1970's and apparent episodes of wage push during the 1980's. Assuming bargaining and a concern on the part of workers with a real wage target, the insertion of an error correction term in the equation appears appropriate:

$$Dw_t = \beta_0 + \beta_1 Dwc_t + \beta_2 (Dqm_t + Dp_t - D(1+t_1)) + \beta_3 (w-w^*)_{t-1} \qquad (13)$$

where, $w^* = p$. As with the price equation, we need to modify eq. (13) by introducing features specific to a socialist economy.

We consider two variables which may affect the wage dynamics. The first is linked to the fact that the official price index may not reflect the actual inflation rate in economies with significant parallel and black goods markets [45]. In such a context, wages are likely to be indexed to an actual or implicit price index which incorporates unofficial markets. We select the premium of the black market exchange rate over the official exchange rate ($bmer_t$) as a proxy for this unrecorded inflation. The second tries to capture the sensitivity of wage demands to the availability of goods in the economy. In economies characterized by chronic shortages, availability of goods may significantly affect wage demands. Assuming 'rationality' in the wage setting, greater availability should induce demand for higher wages, as these can be translated into higher real consumption. An inverse relation between availability of goods and wage increases would suggest some sort of 'wage illusion'. A variable measuring the deviation from trend of inventories of consumer goods at the retail level $((RS/P)_t - RS/P)^*_t)$ may approximate availability, as traditionally inventories of consumer goods are kept to a minimum in socialist countries [46]. The general form for the dynamic wage equation now becomes:[47]

$$Dw_t = \beta_0 + \beta_1 Dwc_t + \beta_2 (Dqm_t + Dp_t - D(1+t_1)) + \beta_3 (w-w^*)_{t-1} + \beta_4 Dbmer_t + \beta_5 ((RS/P)_t - (RS/P)^*_t) \qquad (14)$$

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[45] More relevant for Poland than for Hungary

[46] Kornai (1985).

[47] However, as we hold that consumer goods market imbalances and currency substitution have been more powerful in the Polish case, we will drop these terms at the outset from the Hungarian estimations.

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