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## Article

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# Inflation-Induced Price Lags and Their Redistributive Effect

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## I. Empirical Differences of Price Adjustment Patterns

For inflation not to have any redistribution effects, all prices must rise at equiproportionate rates. In a real world setting, however, price adjustments to a given inflation rate will necessarily involve random errors for reasons of imperfect knowledge alone. The ratio  $r_t$  of two given prices would thus be expected to fluctuate around its mean  $\bar{r}$  over time.

However, any deviation from  $\bar{r}$  also gives rise to relocations between the two markets involved. Therefore, if price adjustments are not to cause any net redistributions, the alternations in  $r_t$  would have to be self-cancelling in the sense that any gains and losses to which they give rise tend to offset each other with passage of time.

We assume that, given enough time, all markets will eventually complete their adjustments to this given rate of inflation. Moreover, there are no real adjustments other than those arising out of inflation. Under these conditions  $\bar{r}$  is of a given magnitude which reflects the real relation between two markets. It is also clear that changes  $\Delta r_t$  in  $r_t$ , and changes  $\Delta^2 r_t$  in  $\Delta r_t$  must converge to zero, i. e.

$$E(\Delta r_t) = 0$$

$$E(\Delta^2 r_t) = 0 .$$

Now suppose that for some reason one of the markets requires more time than the other to adjust its price to this inflation rate. This inability now would present itself in the form of a tendency for  $r_t$  to deviate from  $\bar{r}$  in one direction over a longer period of time than in the other. As a result, the distribution of  $r_t$ ,  $\Delta r_t$  and  $\Delta^2 r_t$  would now be skewed. The expected values of  $\Delta r_t$  and  $\Delta^2 r_t$  would still remain zero under our assumption that no real change occurred. However, the pos-

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sibility of a redistributive shift between the two markets and its statistical manifestation now needs to be investigated.

Skewness in the presence of high variance is difficult to establish statistically. Fortunately, as has been shown [9], a stronger test can be devised since the variates  $r_t$ ,  $\Delta r_t$ , and  $\Delta^2 r_t$  have a time dimension.

In following the previously developed test, we focus on the distribution of  $\Delta^2 r_t$ . It is clear that with skewness the sum of the averages obtained separately of the positive elements on the one hand, and negative elements in the distribution of  $\Delta^2 r_t$  on the other, denoted by  $\bar{A}$  and  $\bar{D}$ , respectively, would now differ from 0. This would indicate that, whenever  $r_t$  changes these changes tend to accelerate and decelerate at different rates.

Recent evidence on pricing behaviour in non-competitive markets strongly suggests that there is a significant difference between  $\bar{A}$  and  $\bar{D}$ . When examining some 30 Canadian retail meat price series over a length of 84 months each, strong evidence emerges that the average monthly accelerations in the retail price of meat exceed the average monthly decelerations computed on the basis of annual periods [9].

This finding is further supported by evidence resulting from an extensive investigation of relative price movements within the food component of the Canadian Consumer Price Index [10]. Using disaggregated price series in 10 Canadian localities the result again emerges that  $\bar{A} > \bar{D}$ .

In graphical terms, the evidence suggests that  $r_t$  describes a path whose peaks are flatter and more drawn out than the troughs.

## II. Redistributive Effects of Relative Price Movements

We will distinguish between two mutually exclusive groups of individuals, suppose they are the sellers and buyers of foods,  $S$  and  $B$ , respectively.  $B$  spends a given proportion of his earnings on food. He derives the income from the sale of a given combination of factor services represented in units of  $V$  at price  $P_v$ .

We next interpret the price of food as specified in the Consumer Price Index relative to  $P_v$  as the terms of trade of food  $TT_F$ , for short. This terminology will focus on the fact that any change in this ratio will affect the number of units of  $V$  that will exchange in the market

place for a unit of food. More precisely, the  $TT_F$  governs the relative magnitude of the physical quantity flows that accrue to  $S$  and  $B$ .

In the presence of prices for all other goods in the economy, these flows can be expressed in generalized physical units of goods and services that go to  $S$  and  $B$ . However, we are presently only interested in that component of these flows per period, that is periodically re-distributed between  $S$  and  $B$  on account of variations in  $TT_F$ . The magnitude of this flow of real resources is denoted by  $y$  and shown in Figure 1 by the length of the ordinate to the time axis. Both these co-ordinates together with their parallels, form the rectangle  $t_1 ACt_n$ . Its area now represents the total amount of resources that has been re-distributed by inflation after the period of length  $t_n - t_1$  has elapsed. The objective next is to see how this amount is proportioned between  $S$  and  $B$ .

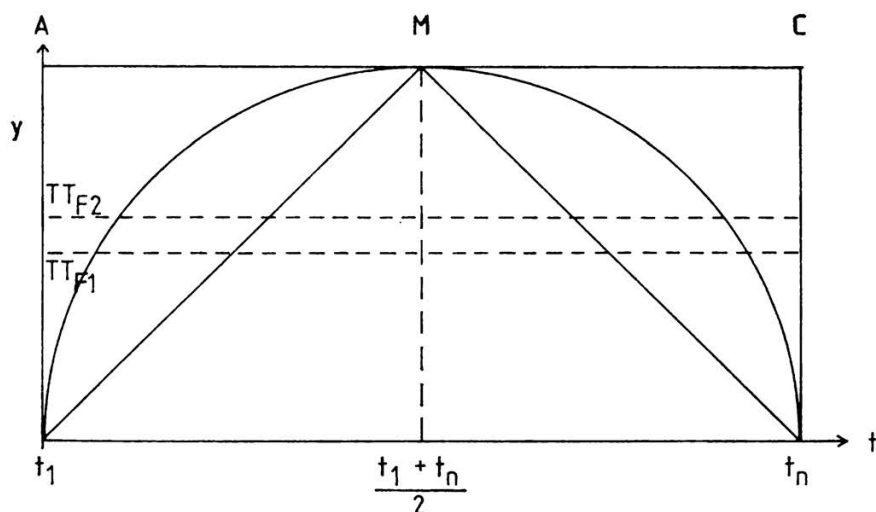


Figure 1

Consider two possible time paths for  $TT_F$  during the time interval shown on Figure 1. First we look at a path consisting of two straight line sections running from  $t_1$  to  $M$  to  $t_n$ . It follows from our definition of  $TT_F$  that any area below this path indicates an amount of real resources received by  $S$  and any area above it the corresponding amount of real resources that went to  $B$ .



Starting at  $t_1$  when  $TT_F$ , as applied to the income component specified, is 0, all resources accrue at that instance to  $B$ . As time elapses the flow of these resources to  $B$  will decline and that of  $S$  increase until  $S$  is the sole recipient at  $M$ . When  $t_n$  is reached, all benefits again go to  $B$  to the exclusion of  $S$ . Total resources that have gone to  $B$  and  $S$  at  $t_n$  are equal since  $t_1 M_{tn} = t_1 AM + MCt_n$ . The same result would have been produced had  $TT_F$  been constant at  $\frac{1}{2} At_1$  throughout the period indicated by  $TT_{F1}$ . Since both gained equally, we can define path  $t_1 Mt_n$  as a distributionally neutral relative price movement and we represent it by the period average  $TT_{F1}$ .

Empirically, if this neutral path continued over time, we should observe that accelerations and decelerations in  $TT_F$  tend to be equal on the average.

Now consider, in contrast, a curved path shown by the line running from  $t_1$  to  $M$  to  $t_n$ . The course of this movement is now indicated by the shaded area. In comparison, the amount received by  $B$  is shown by the unshaded area. Since the former is clearly larger than the latter, the average  $TT_{F1}$  that would have had to prevail to achieve the same proportioning in favour of  $S$ , would be higher than  $TT_{F1}$ . It is shown in the diagram as  $TT_{F2}$ . This curved movement in  $TT_F$  is therefore distributionally non-neutral. If it continues period after period, the data must show a tendency for average accelerations to exceed average decelerations which was suggested earlier.

### III. Source of Inflationary Pressure

We now revert to the inflationary process of which we singled out one short period only. Inflation is at rate  $g$  so that each group will have to raise their prices at an average rate  $g$  to maintain its relative earnings vis-a-vis the rest of the economy. However, knowing that the responses by  $S$  and  $B$  form the arched  $TT_F$  path in Figure 1 we can now show that the attempt to maintain constant relative income shares between  $S$  and  $B$  results in an upward pressure on prices.

The assumption is made that neither group willingly loses out to the other. Instead, the losers will try to recuperate any loss of real resources, sustained in one period, by raising their price in the subsequent period.

Returning to Figure 1, a higher  $P_v$  that is to raise  $B$ 's share will lower  $TT_{F2}$  in the subsequent period for the given price adjustment pattern

of food. However, in the period following immediately thereafter,  $B$  will again lose out as it must after each period following restoration of its relative share for as long as  $TT_F$  continues the arched path. As a result,  $B$  will raise  $P_v$  in alternating periods over time in excess over an average rate of increase  $g$  designed to keep up with inflation.

It is in that sense that we conclude that the particular food price adjustment pattern observed in the previous studies created inflationary pressure in excess of that to which it may be responding.

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### Zusammenfassung

#### Inflationsinduzierte Preisverzögerungen und ihre redistributiven Wirkungen

Die vorliegende Untersuchung stützt die Vermutung, daß die redistributiven Wirkungen von unzulänglich aufeinander abgestimmten Preisanpassungen durch Analyse der periodischen Eigenschaften der relativen Preisbewegungen erkannt werden können.

Die Studie geht von verteilungsneutralen Anforderungen für Preisangleichungen aus.

Abweichungen von einem solchen neutralen Ablaufmuster werden dann als Indikatoren für redistributive Gewinne oder Verluste interpretiert.

Auf dieser Grundlage werden die Ergebnisse von einigen früheren Untersuchungen dahingehend reinterpretiert, daß sie nachweisen, daß typischerweise manche Bereiche während der Inflation auf Kosten anderer hinzugewonnen haben.

### **Summary**

#### **Inflation-Induced Price Lags and Their Redistributive Effect**

The present investigation suggests that redistributive effects of imperfectly synchronized price adjustments may be recognized by analyzing the periodic properties of relative price movements.

The study sets out the requirements for price adjustments to be distributionally neutral. Deviations from such a neutral pattern are then interpreted as indicating redistributive gains or losses. On the basis of this approach, the results of some earlier investigations are reinterpreted as demonstrating that some sectors typically gained on others during inflation.

### **Résumé**

#### **Les délais d'adaptation des prix (time-lags) induits de l'inflation et leurs effets redistributifs**

La présente étude appuie la présomption selon laquelle les effets redistributifs d'adaptation de prix insuffisamment coordonnés peuvent être identifiés par l'analyse de propriétés périodiques des mouvements relatifs des prix.

L'étude se fonde sur des revendications, neutres du point de vue de la répartition, de rattrapages de prix. Les écarts par rapport à ce modèle neutre sont interprétés comme indicateurs de pertes ou de gains redistributifs.

L'on a sur cette base réinterprété les conclusions de certaines recherches antérieures qui en viennent à démontrer que assez typiquement maints secteurs ont au détriment d'autres tiré avantage de l'inflation.