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Relative Prices and Inflation

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L Fraser Jackson "Relative Prices and Inflation"

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Abstract:

Much recent writing about inflation has focussed on factors like menu costs which affect individual prices and are aggregated up to provide micro foundations for inflation. Using such an approach, Ball and Mankiw(1995) argue that the observed skewness of price change distributions is evidence of the importance of supply shocks in the inflation process. In this paper a more macro approach is adopted, and inflation is perceived as being the result of a process in which an underlying latent factor leads to change in prices in individual commodity markets. Using the US Producer Price Index data of Ball and Mankiw it is shown that there are systematic patterns in relative price changes during the inflation process, and that these patterns can explain both a changing variance and skewness in price changes. The model therefore provides a means of integrating a wide range of empirical observations about patterns in relative price change and a mechanism whereby policy actions could impact on the mean, standard deviation and skewness of price change distributions.

Keywords: relative prices, inflation, skewness, price level, supply shocks.

Journal of Economic Literature classifications: D40, E31

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Relative Prices and Inflation[1]

There have been two central debates with respect to inflation. The first is epitomised by Ball and Mankiw(1995) with the question, 'What determines the rate of inflation?' They argued that their question is answered by a model in which short run inflation behaviour is largely determined by supply shocks. The second was studied by Vining and Elwertowski(1976) which examined the question of whether changes in the general level of prices were independent of the distribution of price changes. They showed that there was evidence of an interaction between the distribution of price changes and changes in the general level of prices.

Vining and Elwertowski quote Friedman(1974, p73)

> 'It is essential to distinguish changes in *relative* prices from changes in a*bsolute* prices. The special conditions that drove up the prices of oil and food required purchasers to spend more on them, leaving less to spend on other items. Did that not force other prices to go down or to rise less rapidly than otherwise? Why should the *average* level of all prices be affected significantly by changes in the prices of some things relative to others?

As expressed by Friedman, this process sounds to be quite capricious, but is that really the case? The purpose of this paper is to re-examine the data set used by Ball and Mankiw(1995) from a new perspective. They argue that the observed relative price changes should be interpreted as aggregate supply shocks, and that features of the exogenously determined distribution of these shocks appears to have a close association with the level of inflation. Thus they take the argument of Vining and Elwertowski a step further and bolster the popular perception among non-economists that shocks which influence specific prices play a part in modifying the general price level. The differences observed by Vining and Elwertowski are interpreted as the outcome of a process of exogenous supply shocks and pricing rules which take into account menu costs.

Inflation has long proved a particular puzzle to economists. Both demand based models in the Keynesian tradition and monetarist models have a very mixed record. Compared with those models, the supply shock model of Ball and Mankiw appears to fit a long historical period well. Ball and Mankiw argue that the strong relationships between inflation and both skewness, and the skewness*standard deviation interaction make it unlikely that the causative link lies from demand to the observed aggregate level of price change. We will argue that patterns in these variables could alternatively have been generated by either a demand based or a monetarist model and that their

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1 Professor Emeritus, Econometrics Group, Victoria University of Wellington, PO Box 600, Wellington, New Zealand. Email: Fraser.Jackson@vuw.ac.nz. I am indebted to Laurence Ball and Gregory Mankiw for supplying their data set and to Laurence Ball and Bob Buckle for their extremely helpful comments on the paper. However neither of them can be held responsible for the position it advances, and any errors which remain.

evidence is therefore not compelling. Okun(1981,p2) stated, 'The plain fact is that no school of economists has a satisfactory theory of inflation'. His assertion is unfortunately still true.

In critiquing Ball and Mankiw(1995) we do not want to suggest that some supply shocks may not be very significant in generating an inflation process. However it is somewhat of a puzzle to explain why supply shocks seem to have so consistently nudged prices upward over the period since the end of World War II. In Table I of their paper the simulation study of the effects of shocks and their skewness on the mean gives effects much smaller than implied by the estimates in the empirical part of their paper. This in itself suggests that additional mechanisms may be at work

Prices are set by individuals and agents diffused throughout an economic system. In inflation there must be factors, which influence the transactions they are making in such a way that the price changes. Obviously the process is unlikely to be instantaneous, and the specific grounds for change in particular cases may be quite different. Given that different product markets have both supply and demand functions which differ widely, it would be very surprising if the price elasticity in response to some shock or change in underlying conditions was the same. In this paper we seek to show that there are important systematic features in the price response of different commodities under inflationary conditions. Friedman is indeed right that changes will have differential effects, but he is wrong in making them sound capricious. It is argued that there is empirical evidence for systematic patterns of relative price change associated with the inflation process.

Vining and Elwertowski(1976, p700) stated

> It is the thesis of this paper that the popular folklore in fact enjoys ample justification in the data; it shall be shown that the behaviour of the general price level is related in a statistically systematic manner to the behaviour of individual prices relative to each other.

They demonstrated that changes in the general level of prices are associated with changes in the dispersion of those prices, and with the skewness of the distribution of price changes. Thus they showed that there was an interaction between changes in the general level and the distribution of price changes. In this paper we go very much further than that, and provide evidence that there is a systematic relationship between individual commodity price changes and changes in the general price level, and those changes mean that in inflation there are *systematic* changes in relative prices.

It is one of the puzzles in economics that some ideas recognised by early workers have never been taken up empirically. Cairnes(1873, p.51-76) outlined grounds for believing that there will be different responses in commodity prices to changes in monetary conditions. His argument was based on aspects of demand and supply in the market, and lags in the dispersion of the effects of a monetary change. Cairnes identified four commodity groups in terms of magnitude and timing of the response to changes in monetary conditions(p.64,65). Parks(1978) mentions Cairnes views, and provides a simple model which incorporates some of his ideas, but does not pursue it empirically, using it merely as a basis for his general argument.

If monetary conditions and determinants of aggregate demand have important roles in determining the conditions in all product markets they will have a pervasive influence which will be expected to shift the aggregate price level. In order to understand the aggregate behaviour the detailed behaviour in the constituent markets needs to understood. In our model the characteristics of the set of all price changes are determined by differing individual commodity behaviour. We show that systematic variations in the skewness of the price change distribution are generated, and those changes are capable of providing an alternative explanation of the phenomena Ball and Mankiw(1995) describe. There is no need to invoke asymmetric behaviour under the menu cost model though that may indeed be present. Because the timing of price changes depends on a diffusion of change through the economy, and our data are time aggregates we find that the current distribution of price changes depends on both present and past inflation rates, so there is not a unique relationship between the current level of inflation and the current price change distribution.

Our analysis also provides the coup de grace to the view that in a modern economy such as the United States, relative prices are independent of changes in the general price level. A neoclassical model in which relative prices are set purely by real factors may seem very appealing, but is not consistent with this evidence.

The common factors driving the price level change process could of course be determined by supply shocks in a restricted sense, monetary conditions, or any determinants of aggregate demand. Thus our model provides a framework with the potential to provide a closer link between policy measures and some features of the observed behaviour of prices. It does not answer the Ball and Mankiw(1995) question of 'What determines the rate of inflation?' but it provides a new way of thinking about it.

Our work proceeds in several steps. In Jackson and Haywood(1995a) we undertook a detailed time series analysis of changes in components of the New Zealand Consumers Price Index. In that paper using quarterly data two types of models were used to examine the series. Models of structural breaks based on the work of Perron(1989) were fitted and tests were undertaken for stochastic and deterministic trends. The alternative methodology of Kalman filtering was also used to generate models for the data, and it was shown that all of the filters fitted had a root near one. The most important observation in comparing these models was that there was a strong correlation between the error variances for the models, and these variances were clearly different for different commodities. In Section 1 we show that for the US PPI data there are similar persistent long run differences in the variance of commodity price changes. Over two periods just short of twenty years there is strong evidence of persistent differences in commodity behaviour.. This is evidence which supports the long held view by economists that some prices are much more variable than others.

In Section 2 we explore the commonality in price changes in different series, and show that a very simple model incorporates a large part of the covariation of changes for different commodities. In Section 3 we use this base of empirical information from the observed detailed commodity price indices to construct a mixing model for distributions of price changes. The distribution of expected price changes is found and shown to be skew in many cases, and to have considerable changes in variance. It is shown that the model generates mean, variance and skewness properties of the price change distribution which are consistent with the historical experience of these characteristics over 1948-1989.

Ball and Mankiw(1995) define 'supply shocks' as changes in 'certain relative prices'. Now relative prices may change for reasons which are as much related to demand in product markets as to changes in supply conditions. If they occur initially in a 'primary product market' or in a factor market or as a result of technological change in some transformation then it may be appropriate to refer to them as a supply shock, but it is much more problematic if an important factor in the price change is a result of changes in monetary conditions which make it more or less attractive to purchase the commodity. The terminology of referring to these changes as 'supply shocks' is now widely used, but it needs to be noted that it is using the word 'supply' in a sense different from the traditional usage in economics. We will argue that over the period 1948-1989 there are consistent changes in the patterns of relative prices associated with the rate of increase in an index of prices but the factors driving the change could arise as easily from policy actions, or demand effects as from shocks which affect commodity supply.

Compared with previous work, we turn the question around. We assume there is a latent variable which is affecting all prices and influences their rate of change. We use as a proxy for that variable the observed rate of inflation. Other measures could be used, but we doubt that they would seriously alter the general tenor of the results. Given that rate we ask, What is likely to be the behaviour of particular commodity prices? The model that the expected commodity price change at a given inflation rate is the same for all commodities is strongly rejected by the data. This paper is largely an exploration of that observation.

Section 1 - The variance of commodity price changes

Throughout this paper we will use the data set used by Ball and Mankiw(1995). It consists of annual price indices of 400 components of the US PPI. For most of our analysis we use a subset of 168 prices which were available for the whole period from 1947 to 1989. In Figure 1 we show that the commodities included in our analysis had very similar mean price behaviour to the commodities excluded. Other analyses not reported here suggested that there was no serious sample selection problem arising from this choice.

For each commodity we measured price change as the change in the logarithm of the index numbers. The data set gave 42 price changes, but the models below include a lagged value of the aggregate index, so we have used the commodity price changes for the 41 observations of periods ending 1949, through 1989. This greatly simplifies presentation of the results and hypothesis testing, since the models are all applied to the same set of dependent variable values.

Many authors have endeavoured to assess the reliability of their model by applying the model to two data periods. Ball and Mankiw(1995) use the periods 1949-1969 and 1970-1989. For these two periods the variance in the annual inflation rates can be compared for each of the 168 commodities. Since all commodities experienced the same set of overall inflation rates, the variance provides evidence of other factors which influence the commodity price behaviour. Figure 2 gives a scatter plot of the SD of the price changes in the two periods. Figure 3 gives an estimated relationship obtained by fitting a running mean to points sorted on the basis of SD in the first period. It shows clearly an approximately linear relationship between the values of the SD of the commodity price changes in the two periods. If we fit the model

$$s_{2i} = a + b\, s_{1i} + e_i$$

where s_1 is the standard deviation in the first period and s_2 is the standard deviation in the second period, and the subscript i indicates the commodity we obtain

$$\underset{(2.905)}{s_2 = 0.0149} + \underset{(15.841)}{1.09334\, s_1} \qquad se = 0.0405 \qquad R^2 = 0.6018$$

(terms in brackets are t-statistics)

With this regression note that the significant positive intercept means that the standard deviations of the price change distributions are significantly larger in the second period. However the coefficient is not significantly different from one so the change is perhaps better described as a change in location of the distribution, rather than a change in scale. A similar model fitted to the variances is interesting. One point has excessive influence in the regression and if it is omitted, the result is a coefficient of 1.46 and a t-statistic for testing the deviation from 1 of 4.06. It therefore provides strong evidence that for most commodities there has been both a shift in location and a shift in scale of the distribution. In all of these regressions the residuals are heteroscedastic so the efficiency of the regression could be improved. If we construct variance ratios at the level of the individual commodities, and use the F distribution for critical values, the 1% point is at approximately 3.03 and 43 of the 168 commodities exceed that point. Clearly the commonly held view that there has been an increase in the variance of price changes is consistent with this data.

Figure 4 displays the histogram of the standard deviation of commodity price changes (for all commodities). It shows clearly that there is a long tail of commodities with a great deal of volatility in prices from year to year. Commodities in this group with high variances will tend to occur more frequently in the tails of the price change distribution, and those with small variances may never be found there. Because of this property, rankings of price changes for different commodities are likely to tell us more about variance than about means.

The diagrams of this section make it clear that if we are thinking of examining the distribution of price changes an appropriate model is a mixing distribution, with each commodity price change drawn from a distribution appropriate for that commodity. The fact that the distribution of standard deviations has a long tail plays an important part in our later argument.

It is very common in economic analyses to abstract from the properties of commodities. To talk of goods as if they can all be lumped into a common category. An essential feature in understanding price changes is to recognise that commodities are different, and that the institutional and technical factors influencing product markets are different. This section has emphasized that they generate price change distributions with different variances. In the next section we find that they also differ in the extent to which their expected value moves in response to an aggregate indicator, and in the time pattern of that response. Heterogeneity in all three respects is incorporated in the model we will develop.

Section 2 Modelling commodity price changes.

Let P_{it} be the log of the price index of commodity i at time t. To simplify our notation we will define

$$p_{it} = P_{it} - P_{it-1}$$

so p_{it} represents logarithmic price change in commodity i in the period t. Also let w_t be the logarithmic change in the Producers Price Index at time t.

The model of price change proposed by Lucas(1973) has

$$p_{it} = w_t + v_{it}$$

with the two components independent of each other. If this model is fitted to the data we find the residuals for a particular commodity have a significant correlation with w_{it}. It is therefore clearly incorrect to impose the restriction that

$$E(p_{it}) = w_t$$

A more general model is to permit partial adjustment with

$$E(p_{it}) = \beta_i w_t$$

This formulation permits the view that if some change impacts in a differential way on commodity markets, the price changes in those markets will be related in a systematic way. To include the phenomena of which Cairnes(1873) spoke it is necessary to also permit some differential in the time response to the change. We may want to be able to include not only a differential response, but a different time pattern of the response. The simplest model which incorporates this idea is of the form

$$E(p_{it}) = \beta_{i0} w_t + \beta_{i1} w_{t-1}$$

We will therefore use as our most general model

$$p_{it} = \alpha_i + \beta_{i0}\, w_t + \beta_{i1}\, w_{t-1} + v_{it} \qquad (1)$$

$$E(v_{it}) = 0 \qquad (1a)$$

$$E((v_{it})^2) = \sigma_i^2 \qquad (1b)$$

$$E(w_j\, v_{it}) = 0 \qquad (j = t, t\text{-}1) \qquad (1c)$$

It is easy to test some important nested models with this specification. In particular we will consider

$$\beta_{i1} = 0 \qquad \text{(all i)} \qquad (2)$$

thereby restricting current price changes to be dependent solely on current changes in the driving variable. We also consider

$$\alpha_i = \alpha, \quad \beta_{i0} = \beta \quad \text{and} \quad \beta_{i1} = 0 \qquad \text{(all i)} \qquad (3)$$

where we restrict the expected value of current prices to be the same linear function of the driving variable. The Lucas specification is a further restriction requiring that

$$\alpha_i = 0, \quad \beta_{i0} = 1 \quad \text{and} \quad \beta_{i1} = 0. \qquad \text{(all i)} \qquad (3a)$$

If we wish to estimate (1) the property (1c) is crucial for consistency. In our empirical work, we used the wholesale price index based on all 400 commodities as the independent variable, and prices of 168 commodities selected from them as the dependent variable. Hopefully that reduces the risk of serious problems from correlation of the errors and the independent variable but it does not completely eliminate this risk. It would be preferable to have some other instrumental variables to eliminate this effect, and further work is being undertaken to examine this.

A palliative is to use the median of the prices instead of the PPI which is a weighted mean of them. The details of the numbers of cases in various classes in the tests below change when the median is used instead of the mean, but the mean features of the results appear to be robust to this change.

There is not the space in this paper to examine detailed commodity results, so we will summarise the results. Applying the model to data on all commodities with continuous price index series we obtain Table 1. This table can only be used in an indicative way, since model (1) has error variances which differ by commodity, but it does suggest that the terms in the model have substantial explanatory power, and that approximately 40 percent of the variance of within period commodity price changes is associated with this simple model.

Row	Model Components	d.f. for restrictions	Sum of Squares	Mean Square
a	(1) + (3)	2	11.0959	5.548
b	(1) + (2)	333	5.5659	0.0167
c	(1)	168	5.3765	0.0320
d	Residuals	6384	33.5034	0.0052
	Total		55.5417	

Table 1. Analysis of Variance for Models (1)-(3)

The simplest model fitted is

$$p_{it} = \alpha + \beta_0 w_t + v_{it}$$

and for that model row (a) of the Table 1 shows that the model gave an $R^2$of approximately 20 percent, with a sum of squares for the fitted values of 11.0959. The next model examined adds many parameters, since it is of the form

$$p_{it} = \alpha_i + \beta_{i0} w_t + v_{it}$$

Row (b) of the table shows that this added 5.5659 to the sum of squares for the fitted values and moved the R^2 to approximately 30 percent. Adding the smaller number of additional terms to move tto the full form of model (1)

$$p_{it} = \alpha_i + \beta_{i0} w_t + \beta_{i1} w_{t-1} + v_{it}$$

adds a further 5.376 to the sum of squares for the fitted values and raises the R^2 to almost 40 percent.

An alternative restriction on model (1) is that $\beta_{i0} = 1$ and $\beta_{i1} = 0$. This effectively gives a model of the form

$$p_{it} = \alpha_i + d_t + v_{it} \qquad (4)$$

and the commodity price change consists of two independent components one associated with the commodity, and the other the mean rate of price change in the time period. For model (4) the sum of squared residuals is 43.0131 so it only does marginally better than the restricted model (1) + (3) but requires 208 parameters to do so. Nearly all of the sum of squares for the model is associated with the time dependent terms d_t.

These general considerations suggest the usefulness of the additional terms we have proposed, but to establish that there are significant differences in the response of individual commodities we need to test the hypothesis that the β's differ for the distinguished commodities. To do so we fitted the general model

$$p_{it} = \alpha_i + \beta_0 w_t + \beta_1 w_{t-1} + v_{it} \qquad (5)$$

and constructed a two tailed t-test for deviations of the values of β obtained with model (1) from the β values in model (5). At a significance level of 5 percent for 38 commodities neither coefficient deviated from the common value, for 47 commodities one of the coefficients deviated from the common values, and for 83 commodities both coefficients were different from the common values.

We can therefore conclude that there are significant differences in the patterns of commodity price change in the inflation process, and they lead to systematic relative price changes. Because our models are in logarithmic terms, the coefficients can be interpreted as the elasticity of the commodity price relative to current and lagged changes in the level of inflation.

To illustrate the coefficients of these relationships, Figures 5 and 6 are histograms for the values of β_{i0} and β_{i1} in model (1). In Figure 5 the long tail to the left is associated with points in the tail to the right in Figure 6. Figure 7 gives the estimates of the sum of the coefficients, and shows they are less dispersed, and more symmetrical but still have a tail to the right.

Section 3 Implications of the Model

Now that we have a model we can start and explore some of the behaviours which it implies. Our model consists of the 168 commodity price change models. First of all we explore some properties of the mixtures model for the distribution of price changes. We can do so by estimating the expected price change for each commodity, using the actual historical values of w_t to generate 168 expected prices for each period.

Figure 8 shows that the model generates a distribution of expected values of price changes with a mean which closely approximates the observed values. It therefore provides a consistent link between the aggregate index and the commodity price changes.

However the real test of the model is in the extent to which it is consistent with other features of the set of price changes. Vining and Elwertowski(1976) provided evidence of an association between standard deviation and inflation. With our model both current and lagged inflation matter, hence one cannot expect a perfect relationship with just current inflation. In Figure 9 we demonstrate that the model generates a broad pattern of association consistent with increasing variance at large absolute values of the inflation rate. There is a clear lower boundary to the set of feasible points. The boundary is parabolic in shape, and therefore generates higher expected values of the standard deviation away from a minimum variance position. The points above the minimum values are generated by differences in the inflation level in the previous period. In Figure 10 we impose a more demanding test by asking if the model produces the same time pattern of estimates of standard deviation. We have only generated the distribution of the expected values of price changes for our commodities and there will be additional variation associated with the error terms in the models. The standard deviation of the predicted values should therefore be below the standard deviation of the observed changes. The similarity of the shape of the two curves, given this difference in location is compelling, and shows a remarkable ability to mirror the changing features of the distribution of relative price changes. The near consonance of the two patterns in 1951 and 1952 suggests some special features of price changes at that time.

In economic policy discussion the attitude towards inflation has changed since Vining and Elwertowski(1976) but model (1) provides evidence that not only are there increases in the variance of relative prices, but that these increases are associated with systematic changes in the relative prices of particular commodities. Thus the more extreme the inflation the larger the systematic effects will be. This model therefore gives a new point to their comment (p706)

> Indeed one would hardly expect general price level instability to be the public policy problem that it manifestly is if it didn't have some systematic and predictable effect on the prices that

are important to the individual, i.e., the prices of goods that he sells relative to those of the goods that he buys.

While the effects observed in our analysis are statistically significant, they still 'explain' a relatively small proportion of the total variance. They reduce the uncertainty in commodity prices, but not so much as to greatly reduce their standard error. They also provide evidence of differences in timing of inflation impacts by commodity, while for some commodities, price changes are almost independent of the level of inflation.

A detailed analysis of commodities would clarify some of these issues, and would therefore enable us to make a more informed comment on the likely price impacts of particular policy measures. A further paper examining these impacts in depth is envisaged

In their paper, Ball and Mankiw(1995) do not provide a mechanism which would generate the observed skewness. It exploits the skewness by arguing that it leads to a differential change in mean. Figure 11 shows that there is a clear general relationship between the values of the inflation rate and the skewness of the distribution of expected price changes. Figure 12 shows that apart from a period in the late fifties and early sixties, there is a remarkable similarity in the patterns of skewness generated by the model (1) and the historically observed values.

Figure 13 provides the relationship between the actual standard deviation and the standard deviation of the expected values in the form of a scatter plot, and the association between the two is obvious. Figure 14 provides the equivalent diagram for skewness and the skewness of the expected values. Ball and Mankiw argue that the skewness provides a new measure of supply shocks. In our model the skewness is endogenously generated by the process of inflation. It is a 'supply shock' in terms of their definition for it is associated with 'changes in certain relative prices', but in model (1) it is generated by commodity specific relative price responses in inflation.

The expected skewness is a complex function of the underlying inflation, and it is not surprising that different authors have formed different conclusions about its statistical significance. In the model formulated here, both current and lagged inflation influence the skewness, and the observed skewness is a function of the set of points at which the line representing the current and lagged skewness intersect each of the planes representing the price response of the commodities.

Ball and Mankiw argue for the importance of supply shocks. In the model of this paper one measure of supply shocks could the be magnitude of the errors about the expected values. Periods when supply shocks are important may be associated with larger variance of these errors. In Figure 15 there are two measures of dispersion of the residuals about our equations. The period 1973-1976 seems to have been a period of high variance but the plot of the standard deviation suggests similar levels were attained in the early fifties, and three times during the eighties. The mean absolute deviation provides a measure less sensitive to a small number of extreme values and suggests that the level of shocks in each of the years ended 1952 and 1973-1976 exceeds that for all other years.

It is noteworthy that the inflation of the late seventies and early eighties does not seem to be associated with the a high variance in the residuals in our equations. If we remove the three years when the standard deviation of the residuals exceeded 0.105 it is quickly found that there is no correlation between the standard deviation of the residuals in our equations and the level of inflation.

4. Some Conclusions

This paper has argued that there is an alternative model which encapsulates all of the empirical features explained by the model of Ball and Mankiw. It goes beyond their model in that the changes in skewness and variance of price changes are endogenous. It still leaves open however the question of what is driving the inflation process.

In an earlier paper Jackson and Haywood(1995b) an exploration of quarterly New Zealand CPI data provided evidence that the kurtosis of price change distributions made the sampling distribution of skewness much more variable than for a normal distribution, and the sort of values observed in Vining and Elwertkowski(1976), and Ball and Mankiw(1995) can readily arise. It was also show that there was a correlation in the samples between the skewness and the mean so that some part of the observed association could have been because of sampling fluctuations in the inflation measurement process. But those variations were small, and of similar order to some of the changes in Ball and Mankiw(1995) Table 1. They are clearly not large enough to generate effects of the magnitude of the skewness effects found in their fitted equations. In this paper we have generated an alternative mechanism, which is rooted in the market structure whose behaviour we are endeavouring to summarise and it generates correlated fluctuations in mean, variance and skewness. The skewness does not drive the inflation. It appears to be a natural feature of it, irrespective of whether demand or supply shocks have initiated the process.

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13 June, 1996

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Figure 1

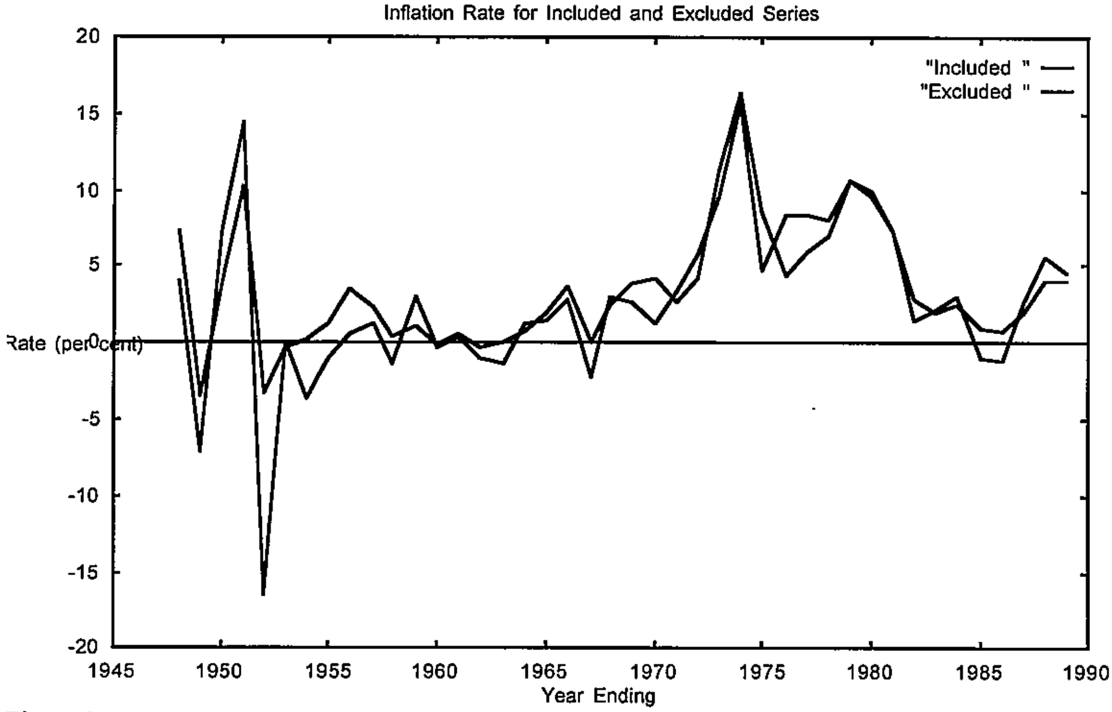


Figure 2

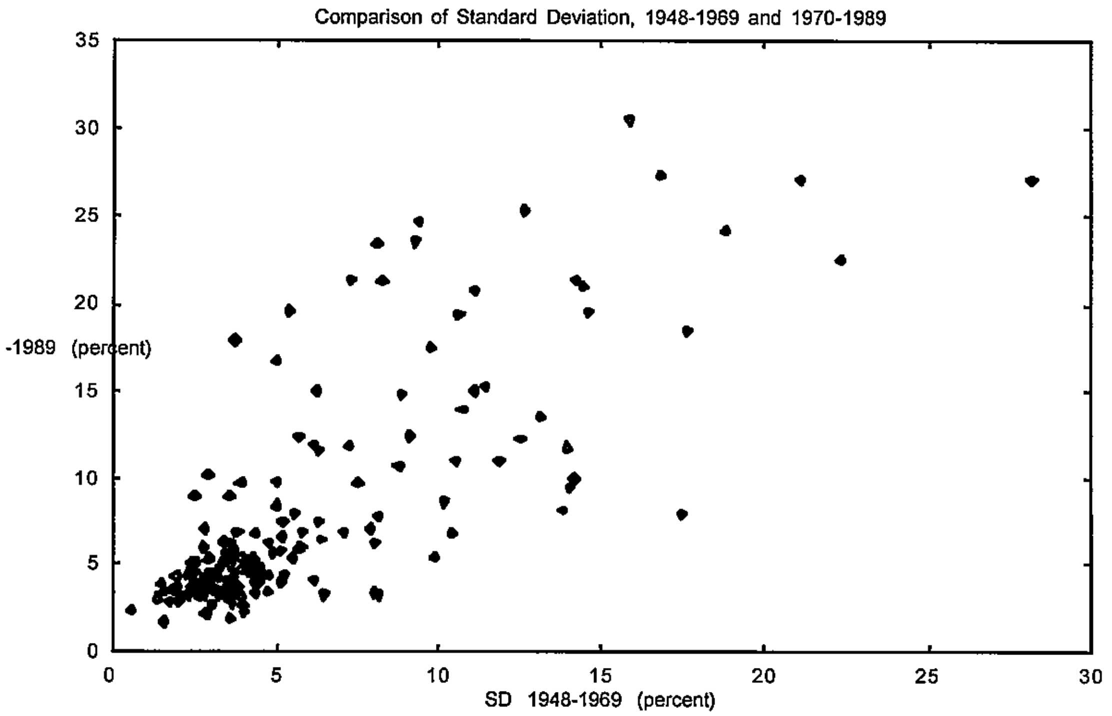


Figure 3

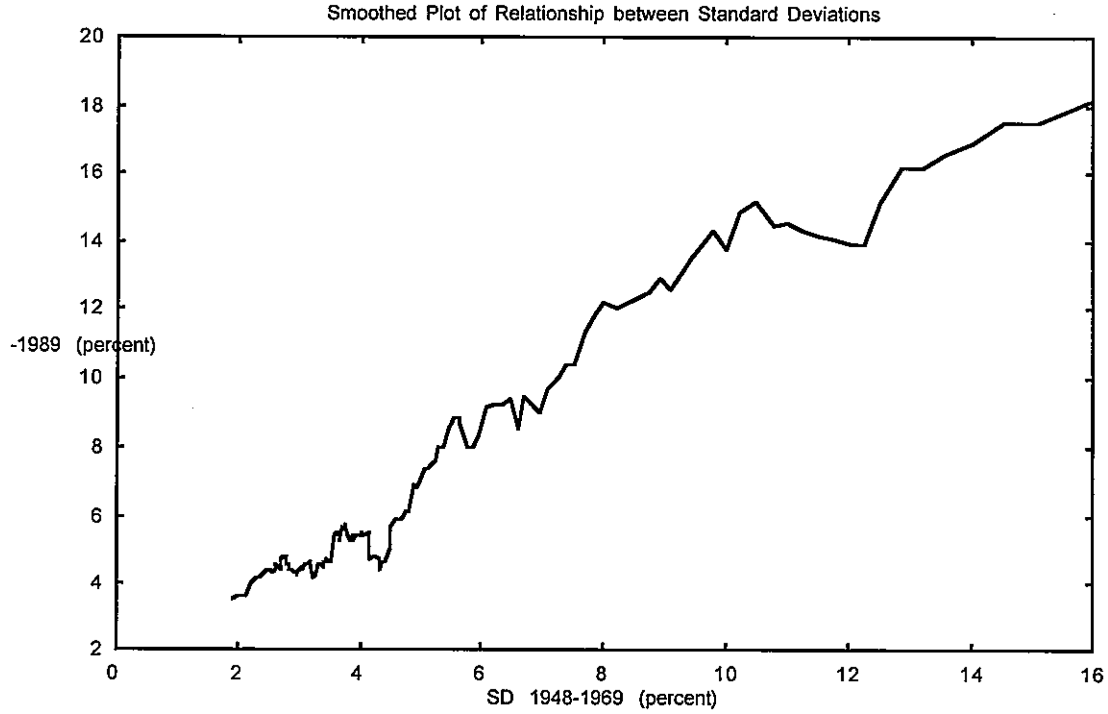


Figure 4

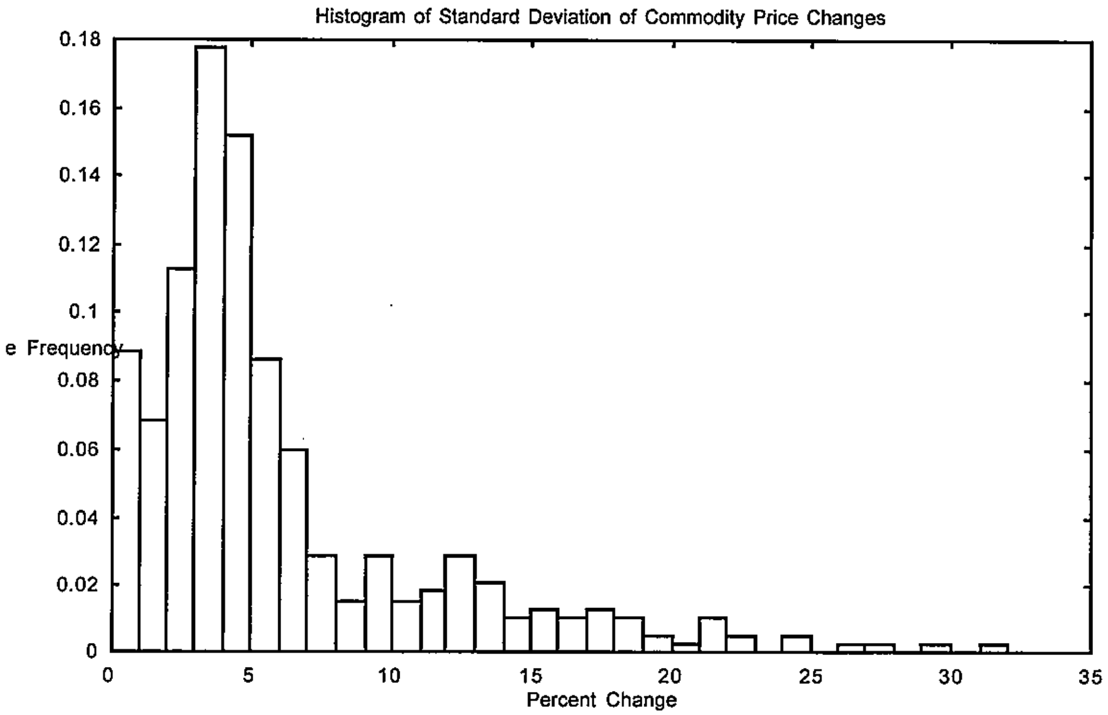
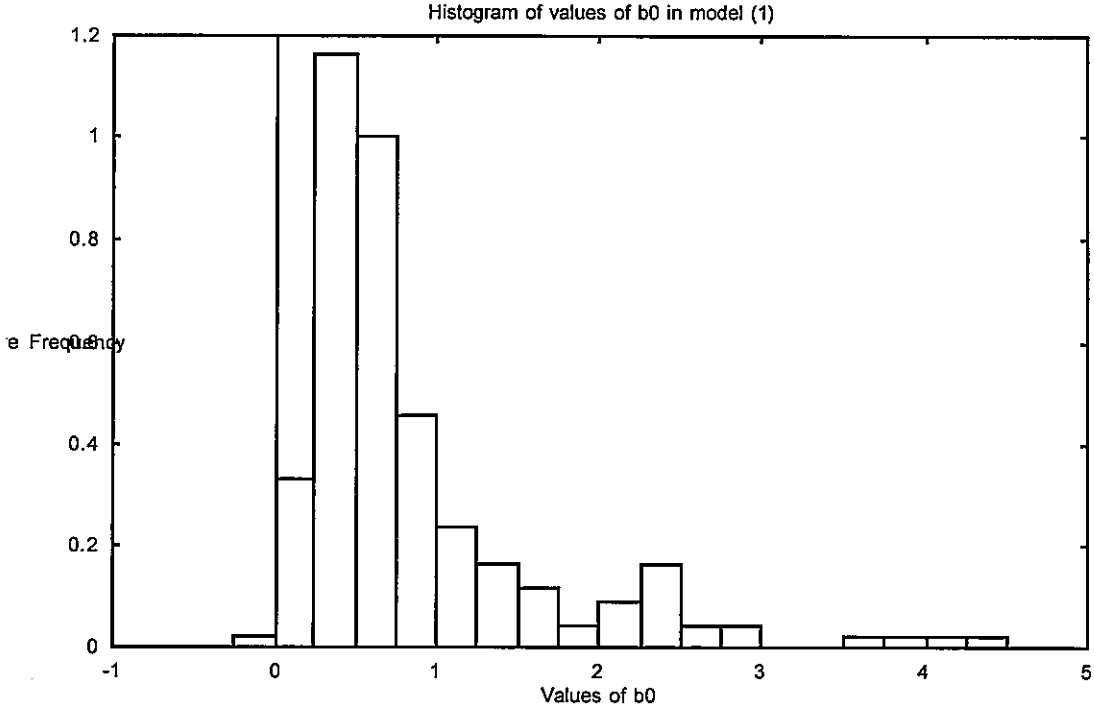


Figure 5



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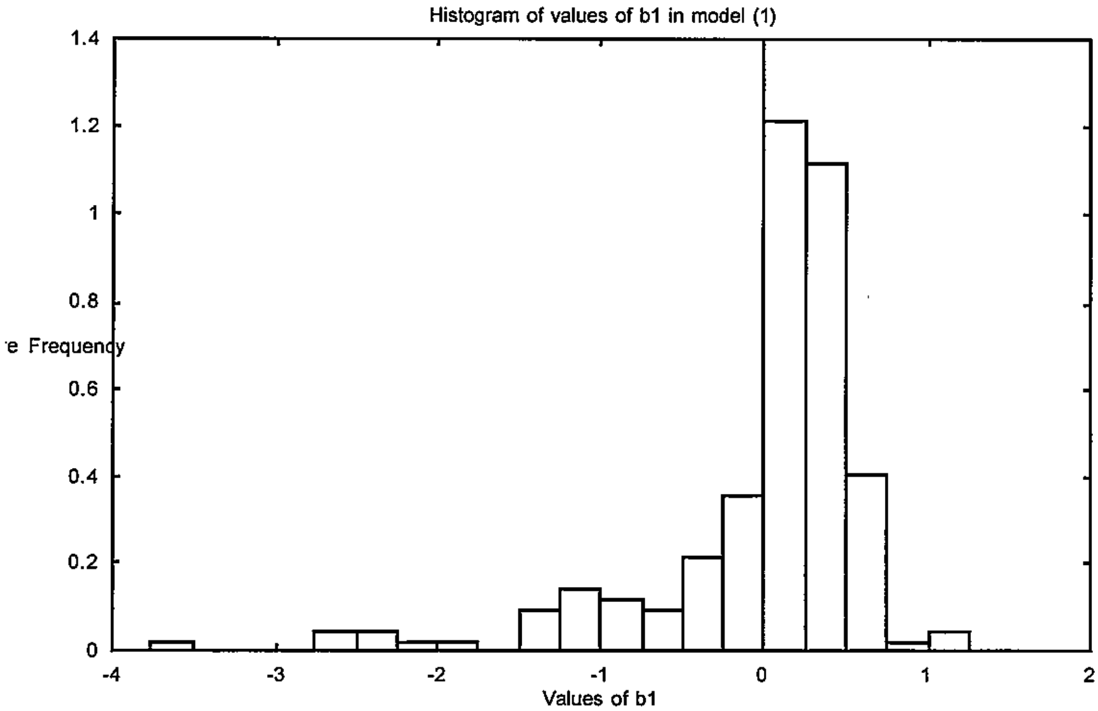

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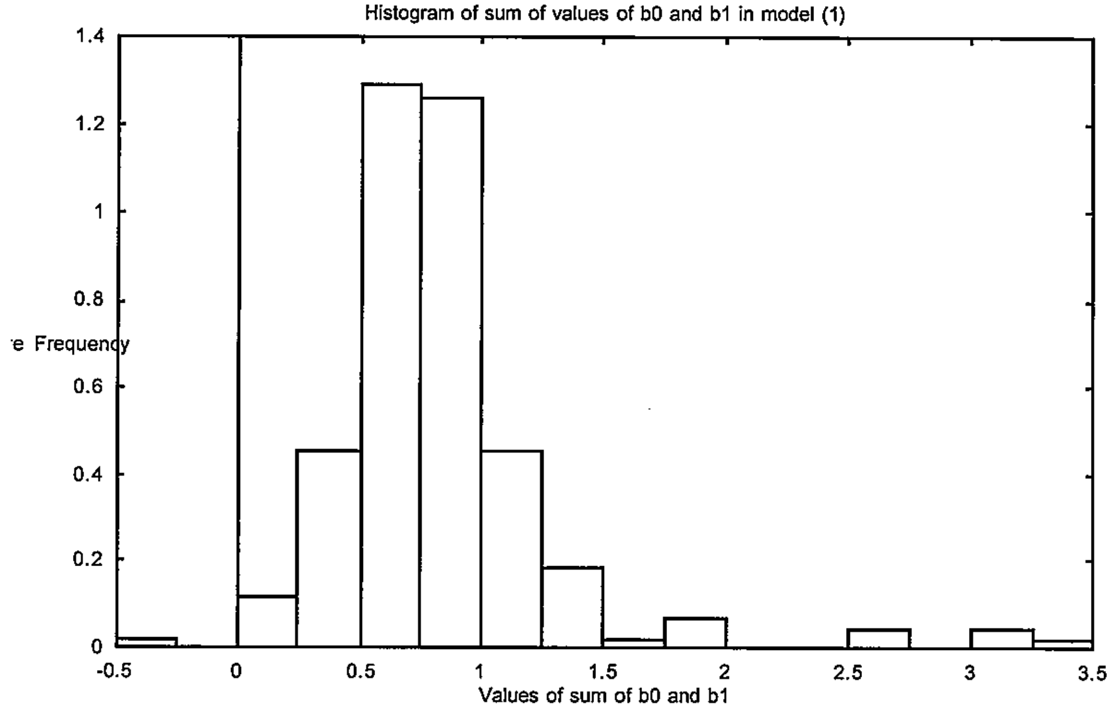

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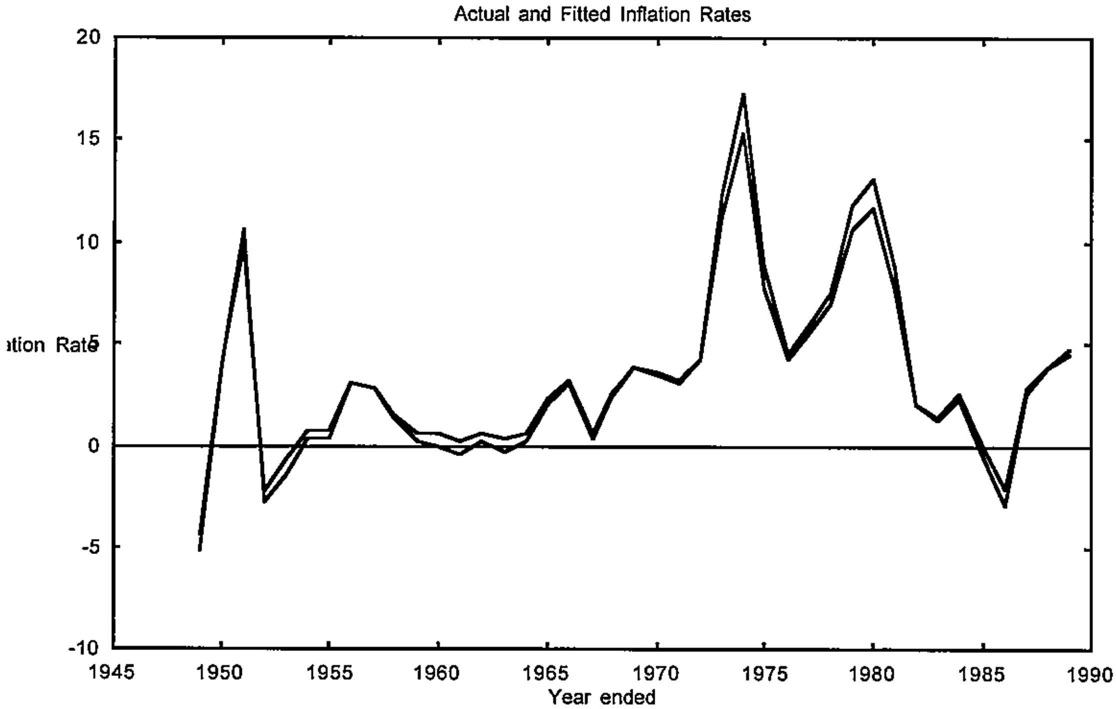

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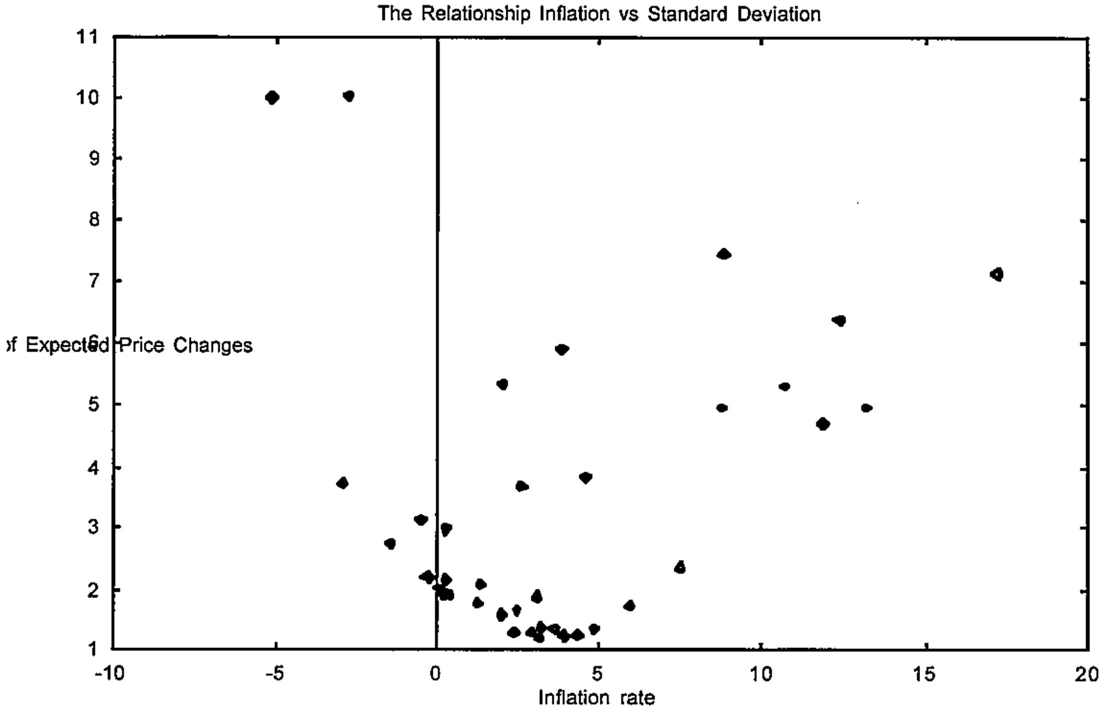

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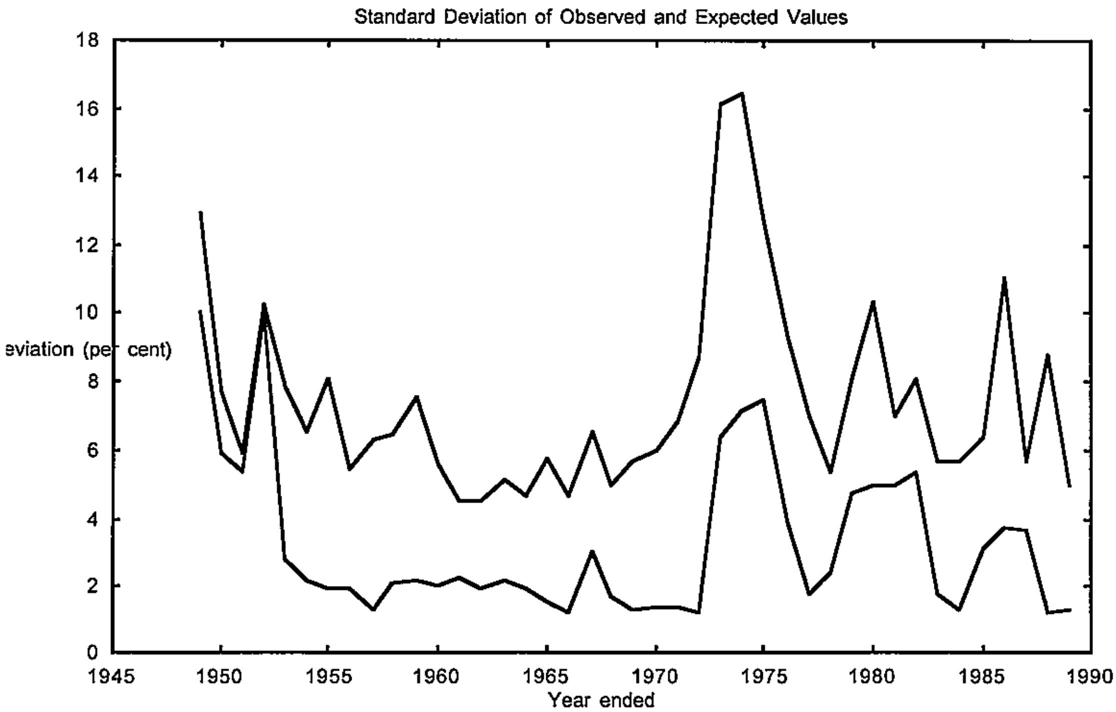

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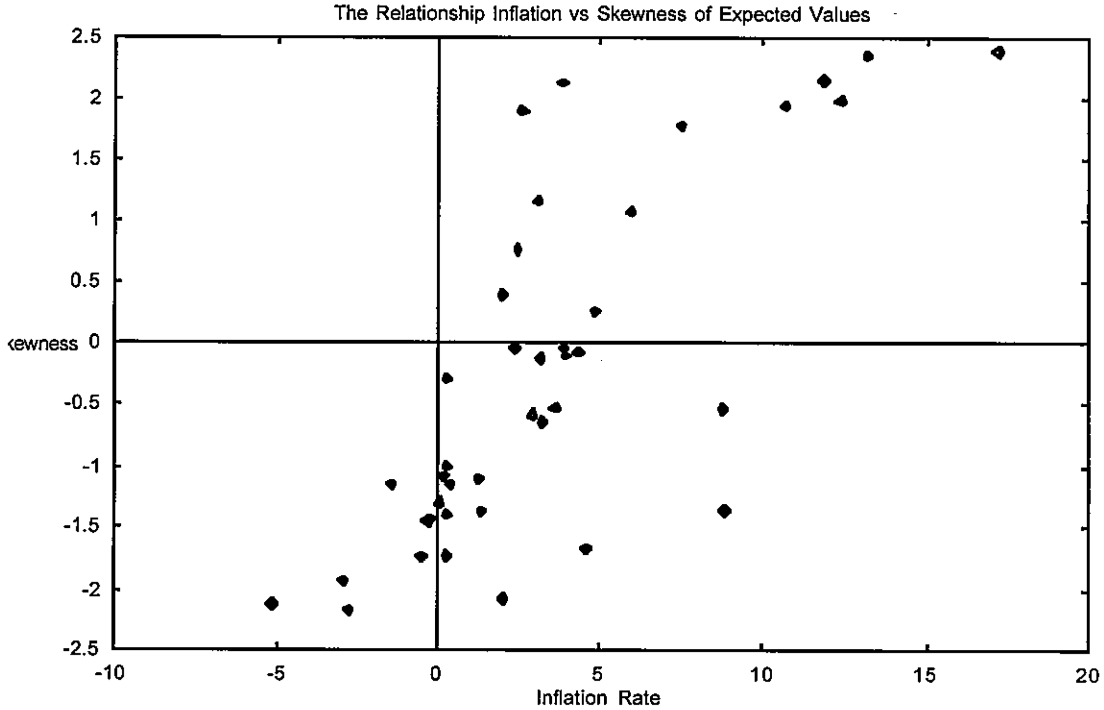

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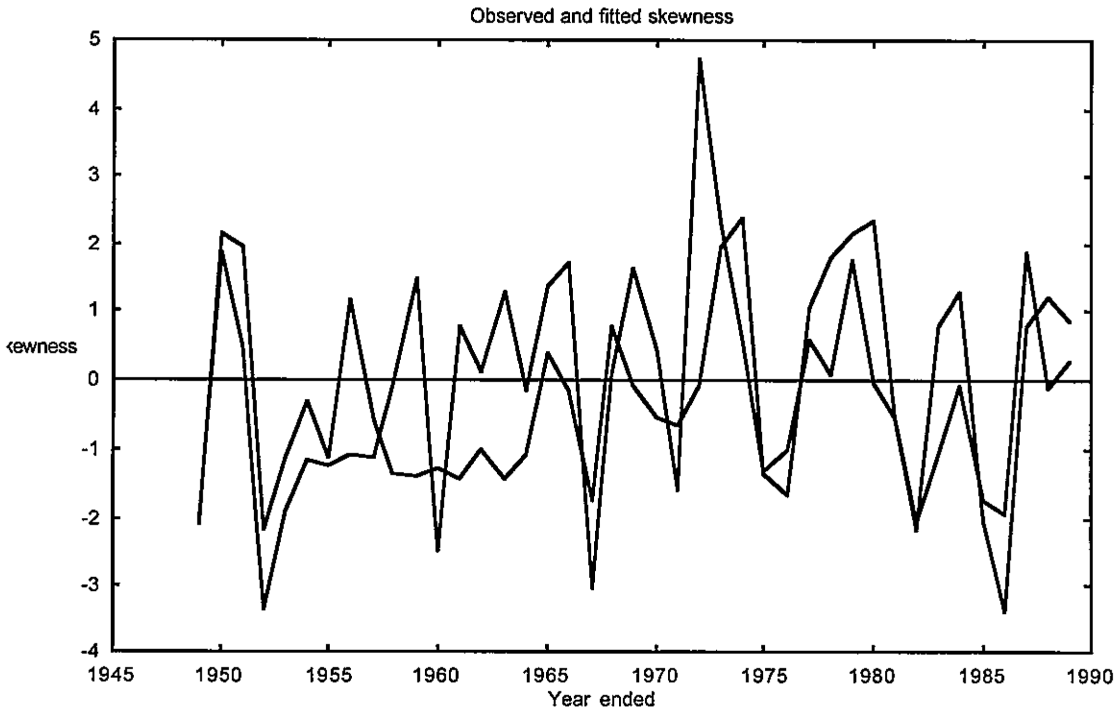

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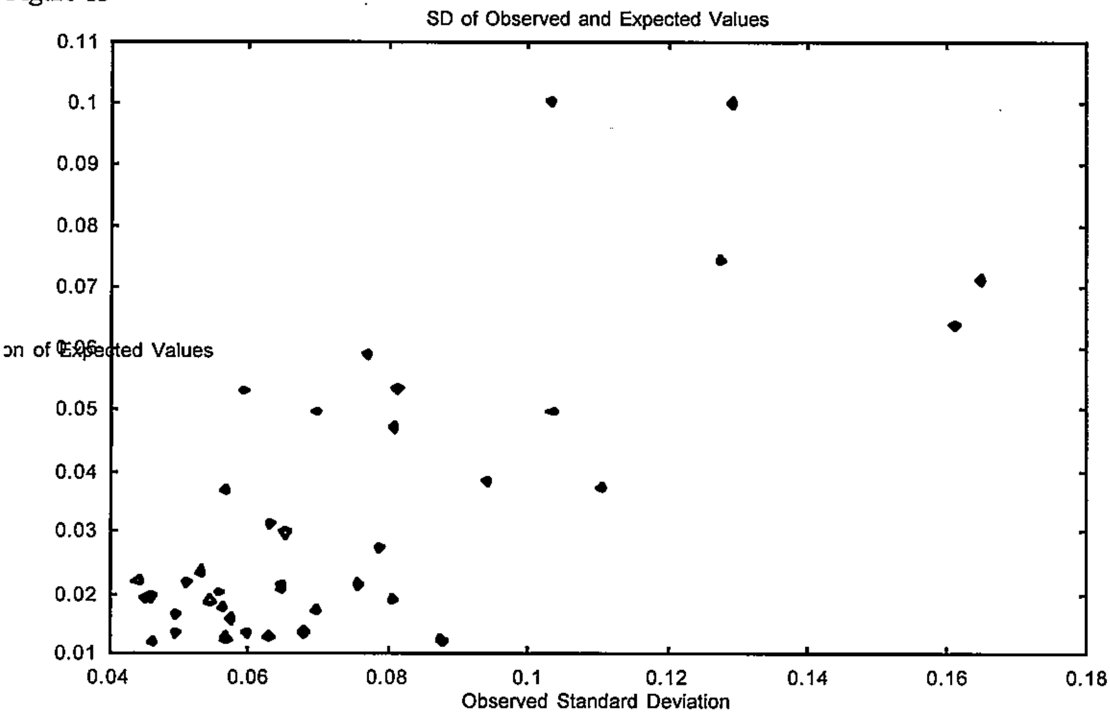

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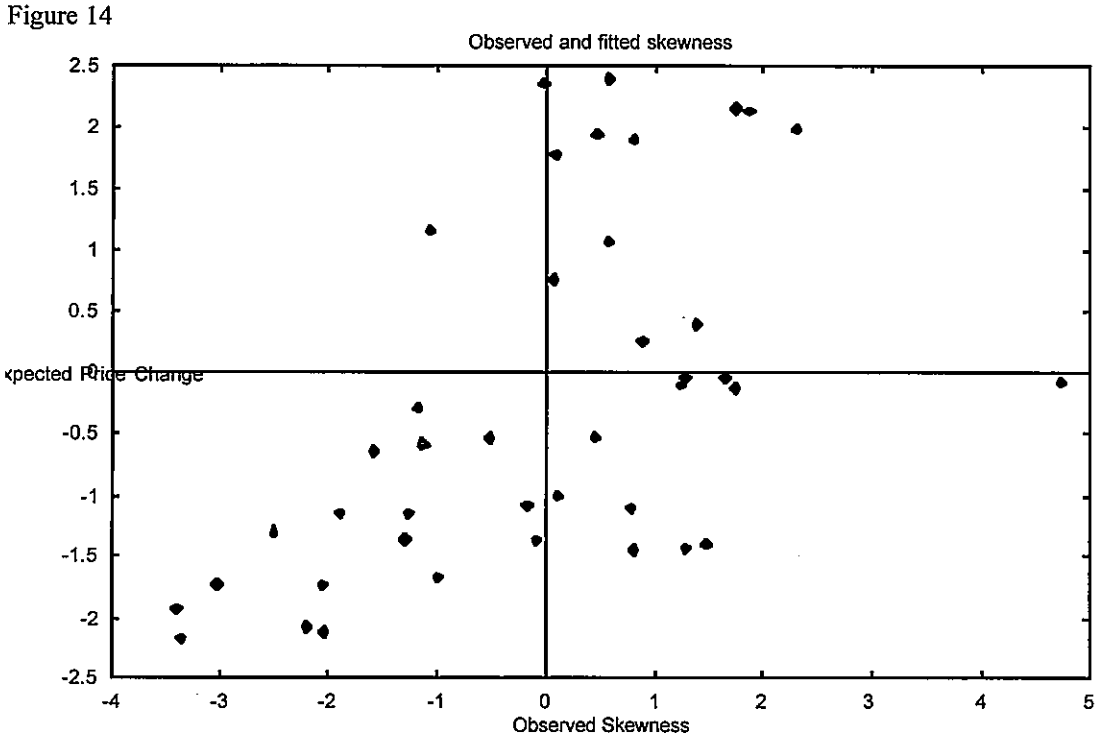

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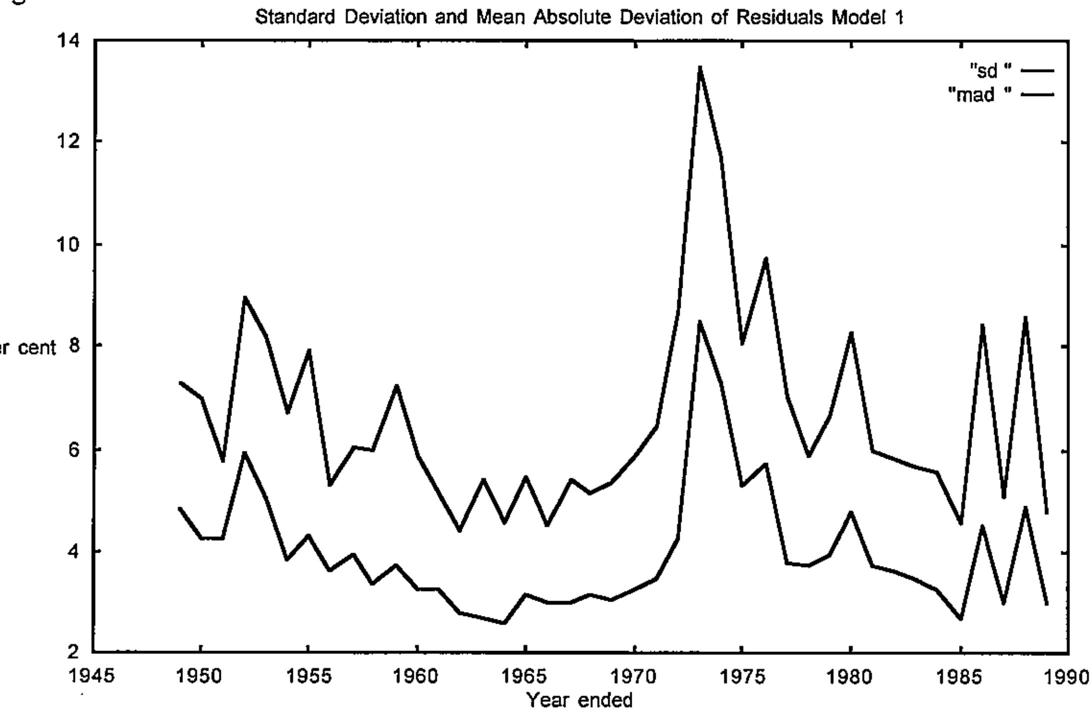

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