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Non-Traded, Traded and Aggregate Inflation In Ireland

by

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The views expressed in this paper are not necessarily those held by the Bank and are the personal responsibility of the authors. Comments and criticisms are welcome.

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Abstract

The purpose of this paper is to shed light on some of the main unresolved issues surrounding the determination of Irish inflation. It does so by first surveying the international and national literature in the area and proceeds to formulate an underlying model that distinguishes between the traded and non-traded sectors of the economy. Our overall results, obtained using the Johansen multivariate cointegration technique, highlight the empirical relevance of the distinction between traded and non-traded prices. In the case of traded prices, full purchasing power parity (PPP) as a long-run equilibrium relationship was found to be consistent with the data (with full pass-through taking about three years). In the case of non-traded prices the data reject strict long-run PPP. Non-traded prices were, however, shown to cointegrate with a combination of world traded prices and the exchange rate. As would be expected, aggregate price results occupy an intermediate position, with full PPP being almost acceptable. However, a stationary combination of aggregate prices, world traded prices and the exchange rate is strongly accepted by the data. Finally, the common suggestion that wage growth is an independent (exogenous) cause of Irish inflation was strongly rejected by the data.

Contents

- 1. Introduction**
 - 1.1 Inflation: A definition
 - 1.2 Measures of inflation
 - 1.3 Costs of inflation
 - 1.4 Perspectives on Irish inflation
 - 1.5 Methodological approach

- 2. International Literature and Theories of Inflation**
 - 2.1 Phillips curve analysis of inflation
 - 2.2 International monetary theories of inflation
 - 2.3 Scandinavian models of inflation
 - 2.4 Summary

- 3. Irish Empirical Research on Inflation**
 - 3.1 Evidence on the pre-EMS period
 - 3.1.1 An accounting view
 - 3.1.2 The SOE model: Equilibrium and adjustment
 - 3.1.3 Domestic causative factors
 - 3.2 Evidence on the EMS period
 - 3.2.1 The role of the exchange rate
 - 3.2.2 External factors: The Reserve Currency Country
 - 3.2.3 Domestic factors revisited
 - 3.3 Summary

- 4. Inflation in Ireland: An Informal Analysis**
 - 4.1 Inflation: An international comparison
 - 4.2 Alternative measures of inflation
 - 4.3 Inflation and its underlying causes
 - 4.4 Summary and conclusions

- 5. Preliminary Theoretical Issues**
 - 5.1 Introduction
 - 5.2 An underlying economic model
 - 5.3 PPP and the domestic long-run contribution to Irish inflation
 - 5.3.1 Introduction
 - 5.3.2 PPP: International studies
 - 5.3.3 PPP: Irish studies
 - 5.3.4 PPP and domestic long-run inflationary influences: Some conclusions

6. Econometric Results

- 6.1 Introduction to the Johansen procedure
- 6.2 Discussion of the appropriate data set
- 6.3 Unit root tests
- 6.4 Choice of lag length
- 6.5 Choice of cointegrating rank
- 6.6 Long-run hypothesis testing
- 6.7 Completing the process: Short-run Dynamics
 - 6.7.1 Traded prices
 - 6.7.2 Non-traded prices
 - 6.7.3 Aggregate prices

7. Summary and Conclusions

- 7.1 Background
- 7.2 Empirical findings

7.3 Concluding remarks

1. Introduction

The main objective of the Central Bank of Ireland is to “safeguard the integrity of the currency”¹. For practical purposes, this is taken to mean the maintenance of low inflation. This paper will examine both the history of Irish inflation and its main determinants since entering the European Monetary System (EMS) in 1979. It is hoped that, by carrying out this exercise, the overall inflationary process in Ireland, together with the scope for its control will be better understood.

1.1 Inflation: A definition

Laidler and Parkin (1975), in an influential survey article, begin with the definition that “inflation is a process of continuously rising prices, or equivalently, of a continuously falling value of money” (p. 741). This definition highlights some important aspects of the inflationary process. Note first that prices have to be continuously rising and that once-off increases in, say, food prices, do not strictly comply with the above definition. Such once-off increases, other things being equal, are likely to be reflected in reductions in other prices and are unlikely to result in inflation². The second notable aspect of the above definition is its monetary nature. This is very much in keeping with Friedman’s (1963) well-known observation that “inflation is always and everywhere a monetary phenomenon”. Although it is generally agreed in the economics profession that, in the long run, inflation must be accompanied by a rise in the quantity of money, no consensus exists that money plays a causal role in this relationship. This issue is covered in more detail in Section 2.2.

1.2 Measures of inflation

A number of different price measures exist, although the most widely used in discussions of inflation is the consumer price index (CPI). This index measures the price of a representative bundle of consumer goods relative to its price in a representative base period. Alternative, lesser used, price measures include the Gross

¹ See Central Bank of Ireland Act, 1942, Section 6(1)

² Where the price of an important commodity, such as oil, increases by a substantial amount, this can, under certain circumstances, lead to the beginning of an inflationary process. Ball (1993) provides a good description of why certain types of once-off price increases are more likely to precipitate inflation than others.

Domestic Product deflator (PGDP) and the wholesale price index (WPI). The former measure is very broad, comprising the prices of private/public sector, investment and export goods and services. The WPI is, by contrast, quite narrow in its coverage, measuring the price of manufacturing output alone and hence is rarely covered in discussions of inflation³. Hanson and Weir (1992), argue that the implicit GDP deflator “lacks intuitive appeal because it encompasses both producer and consumer spending and also omits imported items” and that “for most practical or policy purposes it [inflation] is measured by some form of retail or consumer prices index, a recognition of its role in eroding the purchasing power of ordinary people’s disposable incomes” (p. 685)⁴. In this paper we conform with the usual practice by concentrating on the CPI. For completeness, however, the relationship between the various indices will be briefly discussed in Section 4.2.

1.3 *Costs of inflation*

There would be no imperative to study inflation if it did not have significant welfare effects. There has been a vast amount of academic research, both theoretical and empirical, on inflation and its associated costs. This literature is generally divided into situations in which inflation is perfectly anticipated, on the one hand, and imperfectly anticipated, on the other. Briault (1995) provides an excellent survey of the literature covering the costs of inflation in a recent Bank of England Quarterly Bulletin article. The main costs arising from perfectly anticipated inflation are due to the need to economise on real money balances (the so called “shoe leather” costs), and the distortions that arise from the less than full indexation of the tax system and various contracts. There are also the direct costs incurred in changing prices in the presence of so-called “menu costs”.⁵ In addition, there is the potential for misallocation of resources when relative prices move out of line, due to different speeds in sectoral responses to inflationary pressures.

³ For Ireland the general wholesale price index relates to domestically produced (i.e. agriculture and industry) and imported goods

⁴ Hanson and Weir also make the very important point that year-to-year measures of inflation may not be sufficient for informed policy decisions, as a given inflation rate measured by this method at any point in time could be consistent with very divergent inflationary developments. As a result, they suggest that “simultaneous account should be taken of at least the annual, six-month and three-month measurements” (p.688).

⁵ It has also been argued by Mankiw (1985), for example, that such menu costs can give rise to welfare-reducing macroeconomic fluctuations.

The costs associated with unanticipated inflation are felt to be even more serious than those listed above. The available empirical evidence cited in Briault (*op. cit.*) seems to suggest that inflation uncertainty is amplified as the rate of inflation increases. As a result it adds to uncertainty for those making economic decisions and can, therefore, result in a move away from longer term investments and the demand for risk premia by providers of capital. In addition, in a less than fully indexed economy, unanticipated inflation results in an unexpected redistribution of income and wealth from lenders to borrowers. Finally, and more fundamentally, the presence of unanticipated inflation makes it more difficult to interpret changes in relative prices and, in so doing, interferes with the efficient functioning of the marketplace. On a more general level, high inflation is alleged to impair the valuable functions which money provides as a unit of account, a store of value and as a means of exchange (see, for example, Laidler, 1990)⁶.

One would expect that, given the above arguments, inflation and its associated uncertainty would, all other things being equal, result in a reduction in the long run economic growth of an economy. Briault (1995) cites an extensive array of empirical studies of direct relevance, utilising time-series, cross-country and panel data approaches. The general consensus which emerges from the various studies seems to be that growth is significantly and negatively related to inflation. Levine and Renelt (1992), however, using extreme bounds analysis, do not find this type of result to be robust. In addition, McCandless Jnr. and Weber (1995), who examine the relationship between economic growth and inflation from 1960 to 1990, fail to uncover any negative relationship, while alluding to the contrast between this and earlier findings. Against this, however, two further and recent comprehensive studies, by Fischer (1993) and Barro (1995), which examine the impact of inflation on growth using cross-section and panel data for 80 and 100 countries respectively covering roughly the same

⁶ Dowd (1995), in a recent article, argues quite forcefully that even moderate inflations have much more damaging effects than are commonly allowed for by economists, by elaborating on the adverse impacts of the effects outlined above.

time period as above, find that inflation is indeed significantly negatively related to economic growth^{7,8}.

1.4 Perspectives on Irish inflation

Given the above welfare costs associated with inflation, it is important that the inflationary process in Ireland be properly understood. Although perspectives on the determination of Irish inflation have changed dramatically over the past 20 years or so, there is as yet no generally accepted model of Irish price determination. Geary (1974) provides an excellent summary of the thinking on inflation in Ireland about that time. As regards the international literature, Geary states that “there is near unanimity among the proponents of economic theories of inflation that an open economy which maintains fixed exchange rates with its main trading partners will in the long run inflate at a rate determined by their rates of inflation”. However, he goes on to emphasise that “short run divergences from the world rate of inflation, especially in the upward direction, can be achieved by the exercise of domestic policy” (pp. 5-6). International or “world” inflation is, according to the above view, transmitted to Ireland through a variety of different channels, including absorption, price-arbitrage, price-reserve-flow and portfolio-balance channels. These mechanisms are described in more detail in Section 2.2 . The strength of foreign influences on the Irish inflation rate was not widely acknowledged in Ireland at the time, however, as Geary demonstrates by the following quote from the Annual Report of the Central Bank 1973-74: “It is a fallacy, even for the open Irish economy, that inflation is due more to external than to internal causes and that it is beyond our power to curb or control it ... The fact is ... that even during 1973 when basic commodity and energy prices soared spectacularly and food prices continued to rise, imported inflation accounted directly for no more than half the rise in Irish retail prices”.

⁷ Although it is generally accepted by economists that higher inflation will be associated with lower overall welfare, it does not necessarily follow that this implies that the monetary authority should always disinflate in periods of positive inflation. In making a decision to disinflate the authority has to weigh the costs of any proposed disinflationary programme against the benefits that will be reaped in the new low inflation era. In economies where nominal rigidities prevail and with inertial expectations, such transition costs can be quite substantial. For a good debate on the cases for and against aiming for zero inflation, see Aiyagari (1990, 1991) and Hoskins (1991).

⁸ Even if inflation did not have any effect on economic growth, as certain studies suggest, we would expect high inflation to be associated with lower overall welfare, for the various reasons discussed above.

By the early 1980s the view that, under a fixed exchange rate, Irish inflation was determined abroad in the long run, had, however, become almost unanimously accepted (see Honohan, 1981). Early papers such as Geary (1976) and Bradley (1977) lent empirical support to such a standpoint. Following on from this, in the 1980s, Browne (1983), Flynn (1986), Honohan and Flynn (1986) and Callan and FitzGerald (1989) also provided the external price determination theory with support. It would, however, be very unfortunate to let this view, to which we largely subscribe⁹, lead to the notion that extreme vigilance towards the development of Irish inflation is not required.

There are several reasons why the strength of foreign factors should not be used as justification for ignoring domestic inflationary impulses. First, there is the fact that since 1979 our nominal exchange rate has not been rigidly fixed either to any single currency or to a weighted average of currencies. Under such conditions movements in the nominal exchange rate can validate excess domestic inflationary pressures¹⁰ and lead to permanent differences between the Irish and “world” inflation rates. This is what happened in the early years of the EMS when the Irish pound was forced to devalue on a number of occasions as our real exchange rate became overvalued as a result of internal inflationary forces. Second, even if a rigidly fixed nominal exchange rate is indeed maintained, short run deviations of Irish inflation from those prevailing abroad can have quite significant welfare implications. Kennedy (1974) made this point quite forcibly when discussing the determination of inflation in Ireland by stating that “potentially, the most dangerous fallacy in Irish economic thinking is that, because we have only limited autonomy, we can do nothing at all, or that the little we can do is of no consequence” (p. 14). We agree fully with these sentiments, and would suggest that they hold *a fortiori* in the current wide band exchange rate regime. In addition, there have been a number of recent papers which have argued that domestic forces may, after all, play an important role in the determination of Irish inflation. First of all, O’Connell and Frain (1989), in a paper mainly concerned with

⁹ We do not fully agree with the notion that inflation in Ireland under a fixed exchange rate is completely determined abroad. There remains some scope for differing inflation rates, even in the long run, if the differential rate of productivity growth between the traded and non-traded sector in Ireland differs from that prevailing abroad. This is one of the core predictions of the Scandinavian model of inflation, to which we return in section 2.3.

¹⁰ Devaluations can of course result in extra inflation as well as validating past inflationary pressures.

the pass-through of exchange rate changes to domestic inflation, also conclude that over the 1977 to 1985 period, domestic demand accounted for over a quarter of Irish inflation. In addition, Fountas, Lally and Wu (1995) purport to show that domestic cost factors (wages) had an important role in the determination of Irish inflation over the 1975-1992 period. Finally, Leddin (1995), in a survey covering the causes of Irish inflation, argues that “the main conclusion to emerge from this survey of the inflation literature is that domestic variables have an important bearing on Irish inflation” (p. 11). Although there is certainly room for domestic factors influencing Irish inflation in a non-fixed exchange rate regime we would have certain difficulties with the overall findings of the above three studies and their conclusions, and these are outlined later in the paper.

1.5 Methodological approach

From a methodological viewpoint, any analysis of Irish inflation must distinguish between the proximate and ultimate causes of inflation. Even though in a fixed rate regime the ultimate long-run causes of inflation in Ireland would be mainly external in origin, being proxied by a world price or monetary variable, a sensible theory would also need to take account of its shorter run proximate determinants. These can include, for example, domestic demand or cost pressures or inflation inertia. This point is well made by Williamson and Milner (1991) who suggests that this eclectic view of the proximate sources of inflationary pressures is not “in any way inconsistent with recognition that in the long run inflation in an open economy with a fixed exchange rate will stay close to inflation in the rest of the world. The eclectic view does, however, suggest that recognition of such long-run truths does not by itself furnish an adequate basis for policy formation, since the transitional consequences of anti-inflationary policy are critically important and can be profoundly influenced by the anti-inflation strategy that is adopted” (p. 413).

In this paper we distinguish between the traded and non-traded sectors of the Irish economy. This approach is particularly associated with the Scandinavian model of inflation and has proved to be especially useful for analysing the inflationary process in small open economics (SOEs) such as Norway and Sweden. It is assumed in such an approach that traded prices are given externally, while non-traded prices are capable of

being influenced, even on the long run, by productivity effects. Some versions of the model also allow for demand influences in the short to medium run. Such effects are held to influence inflation even in a fixed exchange rate regime. The potential for differing inflation rates is, of course, amplified in a quasi-fixed or floating regime.

In analysing the data themselves, we make use of Johansen's multivariate cointegration technique. This methodology is particularly well-suited to uncovering any long-run equilibrium relationships which may exist between the variables of interest and the speed of adjustment towards such equilibria. This method also lends itself to analysing short-run interactions between the relevant variables. Overall, therefore, it would appear that the Johansen technique is particularly well-suited for the type of questions we wish to address concerning Irish inflation.

The layout of the remainder of the paper is as follows: In Sections 2 and 3 we briefly review the main literature dealing with the causes and transmission of inflation, at both the international and national level respectively. Section 4 of the paper presents an informal empirical analysis of the price determination process in Ireland. This involves analysing a set of charts comparing our inflation both with that prevailing abroad and with the various factors purported to explain Irish inflation. The specification and description of the underlying model of the underlying theoretical model of the Irish inflationary process, forms the basis of Section 5 of the paper. Section 6 employs the Johansen cointegration methodology to analyse the inflation process in Ireland since we joined the EMS. Finally, Section 7 summarises and concludes.

Section 2 International Literature and Theories of Inflation

Reflecting its central importance to economic policy makers, there exists a voluminous international literature on the causes of inflation. No attempt will be made here to describe *in toto* the detailed evolution of this complex research¹¹. Instead, three of the primary “component parts” in this vast literature are examined with a view to assessing, *inter alia*, which factors are likely to affect the inflation process in Ireland. Specifically, we outline some of main features of Phillips curve analysis, international monetary theories and also the Scandinavian model. In each case, a heavy emphasis is placed on the short and long-run implications for price determination and inflation. It should also be noted that our chosen categories are not mutually exclusive. As will become clear, monetary explanations do not rule out Phillips curve analysis and elements of monetarism and the Phillips curve have been incorporated into the analytics of the Scandinavian model. Furthermore, this classification is evidently not exhaustive. Little or no reference is given to some other “theories” of inflation (e.g. sociological).

2.1 Phillips curve analysis of inflation

The “Phillips curve” does not refer to a single “theory” of inflation but rather to a number of different formulations which have been developed over time. In its original form, the Phillips curve refers to a simple relationship between inflation and unemployment. The possibility of such a relationship has interested economists for several centuries¹². However, the work of Phillips (1958) brought the relationship between inflation and unemployment to centre stage. Phillips’ seminal paper provided empirical evidence, using UK data over the period 1861 - 1913, on the existence of an inverse relationship between the rate of change in nominal wages and the unemployment rate. The primary implication drawn from this relationship was that policy-makers had a choice between low unemployment and low inflation. This early analysis did not seek to distinguish clearly between the short and long-run. However,

¹¹ More comprehensive surveys are given in McCallum (1990) and Laidler and Parkin (1975).

¹² For early examples of such work see Humphrey (1986), pp. 91-98.

the trade-off was generally interpreted as being long-run in nature - one could achieve permanently lower rate of unemployment by choosing a higher rate of wage inflation¹³.

The absence of any role for price expectations in the original Phillips curve ultimately led commentators such as Friedman (1968) and Phelps (1967) to question its long-run validity. The basic rationale underlying the incorporation of expectations was that wage contracts are agreed on the basis of expected changes in the cost of living. Thus, it is the expected real wage which should enter the equation and not nominal wages. Proponents of this new, expectations augmented, Phillips curve, argued that unexpected price increases would cause firms to expand employment to take advantage of the resultant lower real wage. Accordingly, unexpectedly higher prices would be associated with lower unemployment. However, as soon as workers realised that their real wage had been reduced, they would bid up their nominal wage to compensate and the reduction in unemployment would disappear. Only by further increasing prices, again in an unexpected manner, can unemployment be reduced (again only temporarily). Accordingly, it is only at the cost of ever-increasing inflation that unemployment can be kept below the so-called *non-accelerating inflation rate of unemployment* (NAIRU)¹⁴. This insight has transformed the policy implications of the Phillips curve beyond recognition. The long-run trade-off between the level of unemployment and the rate of wage/price inflation ceased to exist. Instead, a relation between deviations in unemployment from its natural rate and increasing inflation took centre stage. Thus, the long-run Phillips curve was posited to be vertical at the natural rate of unemployment. However, insofar as the unemployment rate could deviate from its natural rate temporarily, some trade-off continued to exist in the short-run.

A key ingredient in any application of the Phillips curve is the choice of an excess demand proxy. Much research has assumed that the natural rate of unemployment is constant over time. On the basis of this assumption, researchers have employed the actual rate of unemployment as a measure of labour market disequilibrium. Other

¹³ A simple model where output prices are expressed as a mark-up on wages adjusted for productivity growth allowed the original wage change equation to be transformed into a price change relationship.

¹⁴ It should be stressed that the NAIRU or “natural” rate can be affected by structural supply-side policies. The natural rate hypothesis simply argues that unemployment cannot in the long-run be reduced below its natural rate by expansionary monetary policy.

work has turned to a parallel measure of excess demand in the goods market, i.e. the gap between actual and potential output (Gordon 1985) or a capacity utilisation series (e.g. Chadha, Masson and Meredith, 1992). The expectations augmented Phillips curve has, accordingly, been renamed, more generally, the *expectations excess demand hypothesis*. Unfortunately, all of these theoretical excess demand variables are themselves estimated with error giving rise to important econometric issues. However, regression analysis has generally been successful in establishing an empirical link between several excess demand measures and the rate of change of consumer prices (e.g. Gordon, 1985, McElhattan, 1985).

A second key ingredient in any empirical application of the Phillips curve is the choice of an expectations formation mechanism. Earlier work, including that of Phelps and Friedman, assumed that expectations were formed adaptively on the basis of past expectational errors. Under adaptive expectations, the expected rate of inflation could be accommodated empirically using a distributed lag specification of all past rates of inflation. The assumption of adaptive expectations permitted a short-run trade-off between inflation and unemployment to hold. However, some authors found difficulty with the notion that the public could be systematically fooled. Following on from the earlier work of Muth (1961), authors such as Lucas (1973) and Sargent (1973) replaced adaptive expectations with the assumption of rational expectations and, in so doing, altered the fundamental implications of the Phillips curve once again. Proponents of rational expectations argued that economic agents could not make the persistent systematic forecast errors that were implied by the earlier adaptive expectational assumption. Since agents were assumed to no longer make systematic errors regarding the expected rate of inflation, even in the short-run the trade-off between excess demand and inflation collapsed¹⁵. The formulation of a particular expectations generating process also allowed the Phillips curve to be explicitly extended to an open-economy setting. Parkin (1973), for example, models the expected wage as a weighted sum of the price of internationally traded and domestically produced goods. Cross and Laidler (1975), who also directly incorporate

¹⁵ Short-run trade-offs may exist under the assumption of rational expectations where excess demand shocks are invoked by the government. Generating such shocks to temporarily lower unemployment would not, however, appear to be a sensible course of action for a government to undertake under such circumstances.

foreign effects, cite the exclusion of foreign effects as a reason why so many studies do not find a coefficient of unity on the expected inflation term¹⁶.

Several key points can now be made in regard to the relevance of Phillips curve theory in an empirical study of Irish inflation. Any analysis of Irish inflation should bear in mind the almost unanimous rejection, on both theoretical and empirical grounds, of a long-run relationship between inflation and unemployment. Furthermore, according to the Lucas/Sargent rational expectations version of the Phillips curve there is no systematic short-run relationship between these two variables either. Stopping short of this extreme position, leads us to accept the proposition that such short-run relationships may exist¹⁷. Consequently, excess demand may be an important short-run or proximate determinant of Irish inflation. However, since it does not endogenise demand, the Phillips curve in no way provides us with an understanding of ultimate inflationary impulses. In an open economy context, the Phillips curve relationship may be even less useful in analysing inflation. Even if excess demand is related to short-run inflation, the external and internal components of this demand would need to be further investigated for a more complete understanding¹⁸. Thus, while Phillips curve theory may provide us with a behavioural relationship which has reasonably high explanatory power, it cannot be used to answer structural questions concerning the weight which should be attached to domestic as opposed to foreign inflationary impulses.

2.2 *International monetary theories of inflation*

Monetary theories of inflation can perhaps be viewed as formulating the inflation question at this deeper level of endogeneity. If we argue that money affects output, then excess money creation can generate excess demand which can in turn fuel

¹⁶ The unitary coefficient on the expected inflation term implies that in long-run equilibrium, i.e. when there are no price surprises, there will be no trade-off between inflation and unemployment.

¹⁷ Consequently, the empirical analysis in section 6 tests for the possibility of a relationship between the change in the unemployment rate and the rate of inflation.

¹⁸ Nickell (1990) has demonstrated that the two way trade-off between inflation and unemployment that may hold in a closed economy context is transformed into a three way trade-off including trade balance for an open economy. Excess demand which leads to low unemployment may result in a worsening of the trade balance rather than an increase in inflation.

inflation. The role of the supply of money relative to demand is central to monetary theories of inflation. Put simply, monetary theories of inflation imply that any increase in the money supply greater than that which is warranted by the growth of productive potential will give rise to inflation. The *quantity theory of money* provided the general framework within which this link can be established.¹⁹ In its most basic form the quantity theory can be expressed as a simple identity which equates a flow of exchanges of goods and services to a flow of money payments, i.e.

$$\begin{array}{c}
 \curvearrowright \\
 \mathbf{M \cdot V \equiv P \cdot Y} \\
 \curvearrowleft
 \end{array}
 \tag{2.1}$$

where P is the price level, T the real volume of transactions, M the money supply and V the velocity of money. This simple accounting relationship expressed in 2.1 does not constitute a theory of inflation. However, under certain assumptions it can be manipulated to yield a simple theory where any change in the money supply will be reflected one for one in the price level. The quantity theory thus provides a way of looking at long-run persistent changes in the price level in terms of the money supply. Accordingly, the quantity theory underlies Friedman's often quoted remark that inflation is always and everywhere a monetary phenomenon. Empirical work has largely borne out this proposition. In particular, it is true that countries which have high money stock growth rates have generally been found to have concomitantly high inflation. For example, in a recent cross-country study, McCandless Jnr. and Weber (1995) report a correlation coefficient of 0.95 between monetary growth and inflation. Furthermore, this near perfect correlation is shown to hold across several definitions of money²⁰.

A major controversy in the literature is the role money plays in the inflationary process. As already discussed, it is widely agreed by economists that inflation must be

¹⁹ For an excellent overview of the quantity theory, see Friedman (1987).

²⁰ It has, however, been widely noted that the velocity of money became very unstable in the 1980s and 1990s, thus leading to a breakdown in many previous stable relationships between money and prices. See, for example, Federal Reserve Bank of New York (1990).

accompanied by excessive monetary growth in the long run²¹. No such agreement exists, however, on whether money growth causes inflation or merely accommodates it²². Friedman himself argues that causality runs from excessive monetary growth to inflation; this in turn begs the question of why this excessive monetary growth should be permitted to occur in the first place. Excessive monetary growth may occur if a central bank deliberately decides to loosen policy in an attempt to stimulate activity, in which case it is truly exogenous. On the other hand, certain economists argue that money growth may merely be accommodative, responding to inflationary pressures which arise elsewhere in the economy. For instance, the monetary authority may be accommodating excessive fiscal deficits. Alternatively, extraneous factors such as increased militancy on the part of unions or commodity price shocks, may result in a wage-price spiral which may also lead to central bank monetary accommodation.

The causative/accommodative controversy has motivated an extensive analysis of the lead-lag structure in the relationship between money growth and inflation. If money growth could be shown to lead inflation then this might be taken as evidence against a purely accommodative role. However such inferences can never be completely justified. It is a fallacy to conclude that because one thing (monetary growth) precedes another (inflation) the former is a cause of the latter. Obviously, there may be some other factors involved²³. In an interesting study of the lead-lag structure in the money-price relationship, Cassese and Lothian (1983) have examined the issue from the point of view of a highly open economy. In their assessment, the interpretation of the lead-lag structure as evidence of causal role for money becomes increasingly fraught with danger the more open the particular economy under investigation.

²¹ One way in which long run inflation can result without excessive money growth, however, is by speculative “bubble” effects on the price level. This possibility is discussed by McCallum (1990) who describes such bubbles as “equilibria in which a component of the price process exists only because it is arbitrarily expected to exist, yet does so in a manner that does not violate expectational rationality” (p. 985). McCallum himself, however, doubts the empirical significance of such bubbles. Another, more likely, channel through which price increases can become divorced from the underlying monetary growth process is where the velocity of money is changing due, for example, to financial innovation. This latter possibility actually occurred in many countries in the 1980s/90s.

²² As King (1994) notes, Friedman’s statement that “inflation is always and everywhere a monetary phenomenon” is not very enlightening in this regard. By way of illustration, King goes on to say that in an analogous manner “a rise in the price of whisky is a whisky phenomenon - but that is not a very helpful statement” (p. 261)!

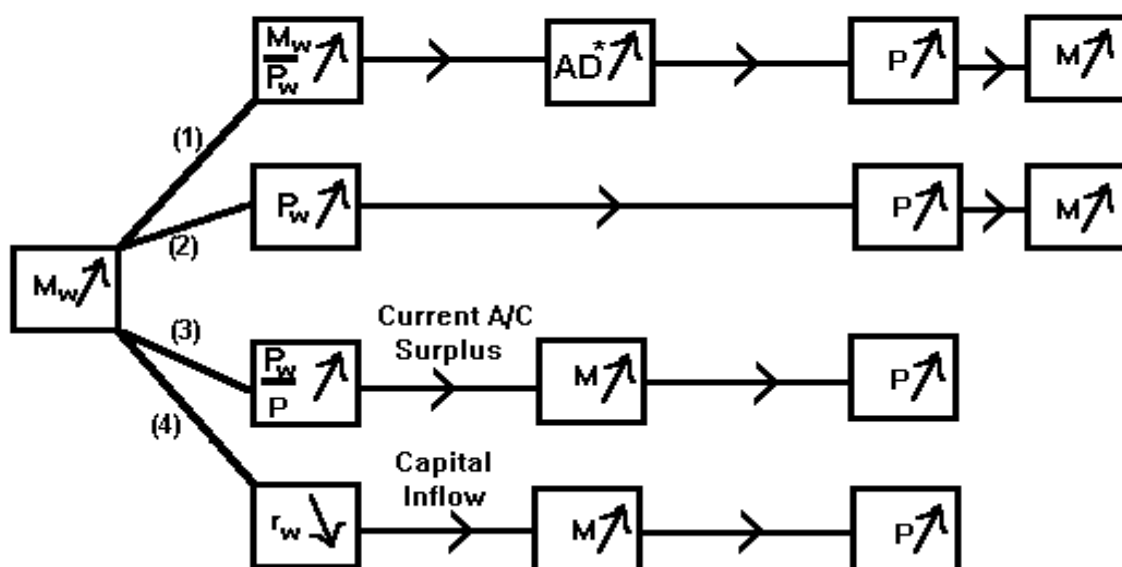
²³ See the quotation at the beginning of Surrey (1989) for a concise definition of this *post hoc, ergo propter hoc* fallacy.

Not surprisingly, given the global nature of the inflation problem which had arisen in the early 1970s, the monetary theory of inflation was seized upon to explain the transmission of inflation in a world of fixed exchange rates. In general, the international transmission of inflation has been analysed in terms of the response of domestic prices to changes in the reserve currency country (RCC) money supply. A flow chart analysis of four possible transmission channels, as identified in Lothian (1992), is provided in Figure 1 below. Lothian suggests that adjustment will take place through reasonably direct channels and also through more drawn out mechanisms. In the former category, an increase in the foreign demand for domestic goods would be expected following an exogenous monetary impulse in the RCC. This would eventually raise domestic aggregate demand and consequently the domestic price level *via* a Phillips curve type effect. This transmission mechanism, termed the *absorption* channel, is depicted as channel (1) in Figure 1. The law of one price also implies a direct *price arbitrage* channel (2) where domestic prices rise as a result of foreign price increases which emanated from a rise in the RCC money supply. Obviously, both of these direct channels could be expected to operate with a greater degree of potency in very small open economies. Lothian (1992) also suggests the *price-reserve-flow* (3) and the *portfolio balance* (4) channels which involve reserve flows and, hence, adjustment of relative money supplies²⁴. Under the former mechanism, the relative increase in the RCC traded goods prices (again emanating from an increase in the RCC money stock) is viewed as giving rise to a current account surplus in the domestic economy. In the latter case, adjustment takes place through the capital account. The reserve currency country monetary expansion exerts downward pressure on world interest rates and, hence, a capital inflow into the domestic economy. It is clear from Figure 1, that the two direct channels ((1) and (2)) imply a purely accommodative role for the domestic monetary stock in the domestic inflationary process. In contrast, domestic monetary growth precedes the rise in domestic prices under the two more the more drawn out mechanisms. Thus channels (3) and (4) imply a proximate causal role for domestic money.

²⁴ These two transmission mechanisms would appear to be equivalent, respectively, to the current and capital account channels discussed in Browne (1984).

The basic point to be made in relation to the international transmission of inflation, however, is that there are many possible lead and lag structures implied by the monetary approach to the balance of payments (MABP). In this regard, Cassese and Lothian (1983), stress that the relaxation of some basic assumptions gives rise to dramatic changes in the predictions of the MABP for the nature of the adjustment process and the timing of monetary and price changes. Empirical evidence on these alternative transmission mechanisms has been more difficult to pin-down. Since money and prices are highly correlated, regression analysis will find it very difficult - if not

Figure 1: Some International Transmission Mechanisms



KEY: M_w - RCC Money Stock, P_w - RCC Prices, P - Domestic Prices, r_w - RCC interest rates, AD^* - Foreign Aggregate Demand, M - Domestic Money Stock.

impossible - to distinguish the various mechanisms. To the extent that there is an international transmission process - and there undoubtedly is for an open economy with a rigid exchange rate - it is perhaps impossible to distinguish between competing channels empirically.

International theories of inflation can shed much light on the issue of the determinants of Irish inflation. The long-run cross-country evidence on the role of money in the inflation process is convincing. However, one of the primary implications of the international monetarist approach is that the analysis of inflation must be extended beyond the role of the domestic money supply. In particular, international theories suggest that if Ireland maintains a rigid exchange rate with most of its primary trading partners, then the role of foreign money and prices must be taken on board. Any study which does not examine the possible role of foreign variables will therefore be at best partial. At worst, such studies could lead to misleading or perhaps dangerous implications for policy. International monetary theories have also suggested several different channels of transmission. Unfortunately, since it is most likely that such channels operate in a simultaneous manner, it may be beyond the scope of regression analysis to distinguish between them empirically.

2.3 Scandinavian models of inflation

The Phillips curve is virtually silent concerning any role the structure of an economy might play in the inflation process. International monetary theories imply that economic structure may be of significant importance: i.e. the more open an economy, the greater the immediate impact of foreign money and prices on domestic prices. In contrast, by introducing a two sector dichotomy, the Scandinavian model makes explicit the role that economic structure may have in analysing inflation. The two sectors considered are the traded sector and the non-traded sector which differ insofar as only the former is exposed to international competition. We discuss below the analytical structure of the basic Norwegian/Swedish model and proceed to a more general discussion of empirical work which has evolved from it²⁵.

As formulated in Aukrust (1977), the Scandinavian model is a highly stylised model which seeks to describe the influence of world prices on prices in an SOE which operates under a fixed exchange rate regime. The model can also be used to explain

²⁵ By Scandinavian models of inflation we are therefore simply referring to any theory which starts by disaggregating an economy into sheltered and exposed sectors and then proceeds to draw out the implications that this structure has for price determination and inflation under a variety of different assumptions. Some of the earlier work along these lines was undertaken by Edgren, Faxen and Odhner (1973) for the Swedish economy and by Aukrust (1977) for the Norwegian economy.

why the inflation rate of such an SOE might deviate from the world rate even in the long-run. The traded sector is assumed to be made up of industries producing goods which are either exportable or importable²⁶. Under the assumption of smallness (price-taking behaviour in the traded sector), traded price inflation will necessarily be determined by world traded inflation adjusted for any change in the exchange rate. In the Aukrust (1977) formulation of the model, this is imposed as *both* a short and a long-run constraint. Thus traded inflation can never deviate from that prevailing abroad if the exchange rate is assumed to be fixed. Wage increases in the traded sector are then assumed to be determined by the given traded price increases and the rate of productivity growth in the traded sector. Using the assumption of homogenous labour markets, or solidarity in wage movements, wages will be equalised across sectors. In the non-traded sector, no external constraints on price determination are assumed to exist. Non-traded inflation is modelled as arising from mark-up behaviour over wages adjusted for exogenous productivity growth. It can be easily shown (see Lindbeck, 1979) that under these circumstances the rate of growth of the aggregate price level (\dot{P}) will be given by²⁷

$$\dot{P} = (a\dot{P}^* + \dot{w}) + (1 - a)(\dot{P}^T - \dot{P}^N) \quad (2.2)$$

where (\dot{P}^*) “a” represents the share of the traded sector in national output, and \dot{P}^T , \dot{P}^N refer to traded and non-traded productivity growth²⁸. One of the main shortcomings of the basic Scandinavian model is that its predictions are long-run in nature and demand is assumed to play no independent role in the inflation process. In short, demand is taken to be purely accommodating. The basic model, however, can incorporate demand effects by augmenting it with a Phillips curve. For example, in a short-run extension of the basic model, Lindbeck (1979) includes an expectations augmented Phillips mechanism in his wage equation. Lindbeck contrasts the implied adjustment mechanism in the Scandinavian model with some monetarist models in

²⁶ An exportable refers to goods which are actually exported as well as goods which are potentially exportable. Importables are any goods sold on the domestic market which have to compete with actual or potential foreign imports.

²⁷ This assumes that the aggregate price index is comprised of constant weights of both sectors.

²⁸ The dot above the variables represents their rates of change.

which prices are “pulled-up” by way of excess demand due to real balance effects emanating from a current account surplus. In the Scandinavian model, prices for non-tradables are “pushed-up” due to higher unit labour costs resulting from the equalisation of wage rates across both sectors (pp. 30 - 31). Again, while each model implies different types of short-run mechanisms, there is no reason why in terms of the actual transmission of inflation, each mechanism could not be operating simultaneously in a mutually-supportive manner.

For our purposes, at least two key inferences can be drawn from 2.2²⁹. First, it is clear that, even under a fixed exchange rate, and even for very small open economies such as Ireland differential rates of productivity growth between the traded and the non-traded sectors (i.e. $\phi_T > \phi_{NT}$) can give rise to persistent deviation in the domestic rate of inflation from the world rate of inflation. Thus the basic Scandinavian model predicts that countries with relatively large inter-sectoral productivity differentials will have higher rates of inflation relative to the rest of the world. To contrast it with the “imported inflation” represented by the first component ($\pi_W + \epsilon$) in 2.2, Lindbeck refers to the second component, i.e. $(1 - a)(\phi_T - \phi_{NT})$, as “structural inflation”. Second, even though π can differ from $(\pi_W + \epsilon)$, the basic model implies that any change in world traded prices will be transmitted one for one to domestic inflation (under the assumption that all of the right hand side variables can be taken as exogenous).

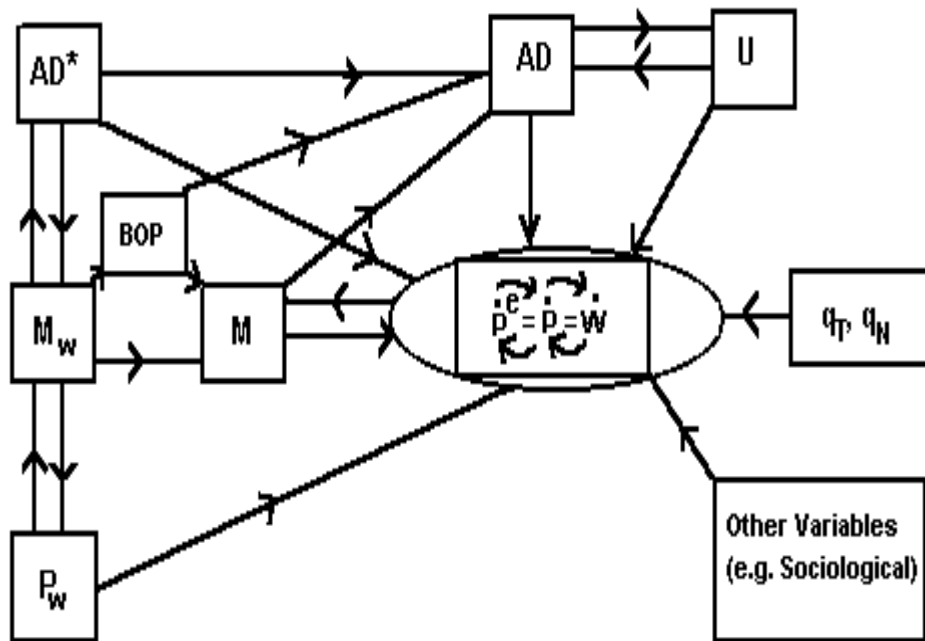
2.4 Summary

A highly stylised summary of the main theories identified in this brief outline of the international literature is given in Figure 2 below. The chart is a useful means of summarising some of the most important observations on the international literature which we have made.³⁰ For the sake of simplicity, the chart abstracts from any change

²⁹ Lindbeck(1979) draws several other inferences from the analytic structure of the Scandinavian model and points out that any inferences that can be drawn depend crucially on the endogeneity/exogeneity assumptions employed.

³⁰ Obviously, not all of the factors discussed can be included. World inflationary expectations are for example, excluded. One could envisage adding more variables and more boxes but only at a cost in terms of clarity.

Figure 2: Summary Chart of Inflationary Impulses



in the exchange rate. Hopefully, the preceding discussions have served to clarify the individual relationships which are depicted in the chart. We will not, therefore, comment on each of the arrows connecting the various boxes. However, as emphasised in Rowlatt (1992), the inflation process is perhaps best thought of as a systematic spiral with extensive interrelations among the relevant economic variables existing at various levels. This systematic nature of the inflation process is quite clearly evident from the flow chart. In fact, in the above representation of the various theories, there is no variable (apart from the productivity and “Other” variables) which is taken to be completely exogenous within this system, i.e. there is no box which does not have an arrow pointing towards it. From a methodological point of view, this suggests that the empirical economist can at best characterise the determinants of inflation in terms of a set of variables which can be assumed to be exogenous from the point of view of a small open economy. Such exogeneity assumptions might be justified on both theoretical and empirical grounds. Furthermore, very little support was found in the review for a simple causal role for wages in the inflationary process. Accordingly, the chart does not include wages as an exogenous cost-push inflationary impulse. Instead, at the centre of the inflation spiral, domestic wage inflation (adjusted

for productivity) and price inflation are represented as trending together in the long run with no assumptions being made concerning the direction of causation. This is because any of the variables which are deemed to exert a significant influence on prices must also be considered as having a potentially significant effect on wages. The diagram also clearly illustrates the potential interdependencies which exist between the separate theories which have been identified in this review. For example, it is quite clear that the Phillips curve analysis of inflation, captured by the unemployment (U), the aggregate demand(AD) and the expected inflation (P^e) boxes, are themselves potentially dependent on world inflationary pressures.

Section 3 Irish Empirical Research on Inflation

Like their international counterparts, Irish economists have invested a lot of effort in attempting to unravel the manner in which inflation is transmitted. Much of the Irish work in the area has directly reflected developments in the policy arena. As a result, despite several frequently recurring themes, there has been quite an evolution in the way in which Irish inflation has been analysed over the last 25 years. In order to clarify what has and has not been achieved, i.e. the current state of “play”, the main branches of Irish research are reviewed below. For heuristic reasons, the work is divided into papers analysing inflation both before and after Irish participation in the EMS³¹.

3.1 Evidence on the pre-EMS period³²

Prior to entry into the EMS in 1979, Ireland maintained a fixed exchange rate with a larger neighbouring economy (the UK) with which it conducted by far the most significant proportion of its trade³³. Not surprisingly, *most* of the research into the determinants of inflation in Ireland directly reflected this reality. In particular, empirical evidence emerged in support of the central implication of international monetary theories that, in the long-run, Irish inflation would converge to the rate of inflation of its main trading partner(s), i.e. the UK. Only in the short-run, it was agreed, could Irish inflation deviate from this externally determined rate.

3.1.1 An accounting view

Some commentators, however, clearly neglected the direct implications that a regime of fixed exchange rates had for Irish prices. In a symposium on inflation in the early 1970s, Geary (1974) remarked that discussions of inflation in policy circles rarely took place within the small open economy fixed exchange rate framework at all. Instead a fallacious “cost-accounting view” predominated in which external influences

³¹ Another recent survey is Leddin (1995).

³² In this section, we cover papers which are not necessarily dated prior to 1979 but also those papers published subsequently but which are constrained to use data which largely relates to the pre-EMS regime. In contrast, the next section is mainly concerned with papers which employ a sufficiently long run of data and can, therefore analyse inflation in the EMS regime.

³³ Effectively, prior to entry into EMS, Ireland had been in a monetary union with the UK for over 150 years. Between 1826 and 1928 the UK and Ireland shared the same currency. From 1928 to 1979, the exchange rate of the Irish pound and sterling was maintained on a fixed one-for-one basis.

entered only as a cost item, i.e. *via* import prices. Table 2 in the Inflation section of the Spring Bulletin of the Central Bank of Ireland 1974 decomposed the CPI into “sources of increase”. The domestic component - represented by incomes, profits and taxes - is by far the largest. Accordingly, the Bulletin stresses the need to “restrain the domestic causes of inflation, which include an excessive rate of expansion of public expenditure and credit as well as money incomes”. Support for this view was also found outside the Central Bank. Geary, Henry and Pratschke (1970), employed an input-output model to show that domestic wages were an important determinant of Irish inflation. While the Central Bank gave a large weight to domestic impulses, reference was also certainly made to external influences. The steady growth in the external sources of inflation is quite clearly displayed in the above-mentioned table: the import price “account” grew from 15% of the CPI in 1969 to 44% in 1973. However, it would appear that this influence was constrained to be no greater than the weight attaching to various factors in the input-output tables (oil and raw materials being among the most relevant).

What is missing in the above discussions is any clear distinction between short-run proximate determinants of inflation and long-run equilibrium forces. Since an input-output analysis of inflation does not make use of these key distinctions, it can give rise to some misleading implications for policy. The above analysis seems to suggest that a small open economy can use domestic wage controls to permanently lower its long-run rate of inflation even if it maintains a fixed exchange rate with most of its trading partners. In the long-run such actions are simply not possible. Furthermore, even if they were, they would lead to quite bizarre outcomes as discussed in Honohan (1981, p. 364).

3.1.2 The SOE model: Equilibrium and adjustment

Subsequent empirical research, which clearly distinguished in a meaningful way between the short and long-run, emerged in support of what we shall loosely term the SOE model³⁴. In a Phillips curve analysis, Geary (1976a) employs a version of the

³⁴ The term SOE model is used in the paper in the weak sense that domestic prices, in the absence of marked nominal exchange rate movements, will largely be determined abroad. The other strong implications sometimes inferred from this term, as discussed in Honohan (1981), are in no way intended.

Parkin (1973) wage-price model. The long-run equilibrium restrictions implied by the SOE model are accepted when the UK Retail Price Index (RPI) is used as a measure of “world prices” over the period 1953-1974. In particular, the evidence on the UK price series points to an extremely recursive version of the wage-price model in which UK inflation directly determines Irish inflation rather than working through the labour market. As would be expected, less conclusive evidence emerges when the OECD consumption deflator is employed. Furthermore, Geary’s analysis shows no statistical significance for the unemployment rate in either wage or price equations. He interprets this result as lending little support to the view that Irish wage or price inflation is determined by domestic excess demand. In an earlier paper, Geary and Jones (1975), despite allowing for the structural characteristics of the Irish labour force, report a similar finding.

Other, more atheoretical analysis, strengthened the case in favour of the long-run implications of the SOE model. In particular an investigation of the lag structures between domestic and foreign price measures suggested that external influences fed one-for-one into Irish inflation. The only remaining controversy surrounded the question of “when” rather than “whether” full feed-through occurred. One important finding in Geary (1976b) is that the lags in the transmission of the UK RPI to Irish inflation are quite long and are not necessarily geometrically declining. The analysis shows that it took at least eight quarters for UK inflation to be transmitted to the Irish economy. This finding lent greater substance to the idea (expressed in Kennedy, 1974) that the welfare implications of short run deviations, given that they can persist for quite long, should not be disregarded. However, Geary’s long lag structures are subsequently refuted in Bradley (1977) who found almost no “attenuation” in the transmission of the long-term and annual components of the UK RPI into the Irish CPI. In assessing the light which the above papers shed on the inflation debate, it is important to note that neither is intended as a structural analysis of inflation. Both studies should really be viewed as assuming rather than testing for the long-run implications of the SOE model. In particular, the explanatory power of the UK RPI is not tested in the presence of other possible domestic inflationary impulses. Other evidence supporting the assumptions of the SOE model is provided in Browne (1983). For the period 1961-1977, he applies a framework developed in Applebaum (1979)

and finds evidence in favour of the SOE price-taking hypothesis for Irish importers. The evidence in this paper for price-taking on the part of Irish exporters is less clear-cut. However, Browne (1982) employs a different methodology using the same data and produces strong support for price-taking on the part of Irish exporters.

The insignificant unemployment rate in Geary (1976a) casts doubt on the appropriateness of the Phillips curve as a tool for analysing Irish inflation. Furthermore, the analysis of lag structures in Geary (1976b) and Bradley (1977) implied only a direct commodity arbitrage transmission channel. However, theories on the international transmission of inflation suggested several more complex channels. In a monetarist approach, Browne (1984) attempts to assess the relevance of competing channels of transmission. In particular, he posits a strong role for foreign money which gives rise to capital flows into the SOE, ultimately leading to inflation. He thus challenges the standard interpretation of the MABP which sees the transmission of inflation taking place only *via* current account balances or direct commodity arbitrage. For the sterling link regime, Browne claims his results validate the SOE model. He cannot reject the hypothesis that UK monetary policy, operating through both the current and capital account, has a long-run one-for-one effect on the Irish rate of inflation. In contrast, while he finds domestic monetary policy to have a significant short-run effect, long-run neutrality cannot be rejected after about six months. As a result, this analysis provides strong support for the basic restrictions of the SOE model. However, there are problems associated with the structural conclusions drawn by Browne. Browne's transmission equation contains a very large number of right-hand side variables which one would expect to be endogenous and/or highly correlated³⁵. As a result, the strict identification of the estimated parameters on certain regressors with particular transmission channels may not be valid. More fundamentally, in our view the capital flow transmission channel cannot be separately identified from the popular current account channel, which is a central objective of the paper.

³⁵ The presence of possible multicollinearity in the equation would raise the standard errors of some of the estimated parameters. This may explain the inability to reject the hypothesis that some long-run effects are zero.

3.1.3 Domestic causative factors

Not surprisingly, while the SOE model has received wide-ranging support in some quarters, there have been dissenting opinions on its applicability. Many of the above Irish papers which purport to validate the long-run implications of the SOE model during the pre-EMS period find wages to be significant as explanatory variables in price equations. Both Geary (1976a) and Browne (1984), for example, had found wages to be significant in some of their empirical formulations for the pre-EMS period. Some have interpreted the significance of wages as evidence of *cost-push* inflation in a mark-up model which is contrary to the assumptions of the SOE model. Other empirical evidence of a cost-push nature is provided in Hackett and Honohan (1981). The empirical evidence reported shows that 75% of the variation in the Irish CPI can be explained by import prices and wages together with lagged dependent variables. However, the estimated co-efficient on the wage term appears to be unacceptably high. Consequently, the authors argue against any conclusion that control of domestic wages is a suitable means of maintaining stable prices in a small open economy.

We would largely concur with this assessment of the results of the mark-up model. The significance of wages in an Irish price equation does not, on its own, constitute evidence of domestic cost-push inflation. In a small open economy it is not possible to assume that wages are exogenous, i.e. determined independently of the world at large. Furthermore, it would be most surprising if wages and prices did not move together in the long-run abstracting from productivity effects. Thus the high positive correlation between wages and prices in many of the above Irish studies could be due to a common external exogenous factor, e.g. world prices. Consequently, we cannot conclude on the basis of the significance of wages in these equations that domestic cost-push factors are relevant in the long-run. Some evidence on the exogeneity of Irish wages with respect to world inflationary impulses would also be required. We feel it is unlikely that this type of exogeneity assumption could ever be supported and, consequently, we refer to the above erroneous interpretation of the wage parameter as the *wage significance fallacy*.

In a Scandinavian-type approach, Cassidy (1982) examines the relevance of domestic variables in equations for both traded and non-traded prices. Cassidy's study, applied

over the 1955-1972 period, attributes a significant role to UK price inflation in the explanation of changes in both traded and non-traded prices. However, the size of the effect is much smaller in relation to the price of non-traded goods and services. Even more interesting, is the finding that wages are significant in the non-traded price equation but not in the case of traded prices. The results are interpreted by the author as casting doubt on the rigid price-taking assumptions of the SOE model at least in the short-run. Moreover, in both cases, a proxy for domestic excess demand is found to be significant. Consistent with the subsequent analysis in Mellis (1993) for the UK, and the adjustment path suggested by Lindbeck (1979), Irish traded prices are also found to be significantly related to Irish non-traded prices. This is the only study for Ireland which has explicitly made use of traded/non-traded distinction and the results are largely consistent with some of the main predictions of the Scandinavian model. One troubling feature in Cassidy's study, however, are the relatively low R^2 on both price equations.

Other research which suggested a role for domestic variables was conducted in a monetarist vein. Geary (1981) had found statistical evidence of a role for domestic monetary policy. While the author cautions against any structural conclusions, it is our view that the results cast doubt on the extreme monetarist position whereby the domestic money stock is viewed as being fully endogenous with respect to externally determined domestic prices. As the analysis of Browne (1984) makes clear, however, a significant role for the domestic money stock may constitute a proximate analysis of a transmission mechanism where the ultimate long-run determinants are foreign. In a similar vein, Honohan (1982) notes that these correlations are between endogenous variables and as such must be interpreted with caution. Both variables could have been "caused" by an omitted exogenous variable such as foreign inflation. Thus, the same logic which applied in the above arguments relating to the wage significance fallacy also applies here. Geary(1981) did not, for example, test for the significance of domestic money in the presence of any foreign alternative. We would therefore advise against any causative interpretation of these results. Instead, they constitute an analysis of the "information content" of various variables in terms of how they can explain price movements.

3.2 Evidence on the EMS period

If it was a reasonable approximation of the way inflation was transmitted to the Irish economy, the SOE model had both an upside and a downside. If, on the one hand, Ireland fixed its exchange rate vis-à-vis a low and stable inflation economy, it too could be expected to reap the benefits of price stability. On the other hand, if the economy to which Ireland was linked showed signs of being prone to frequent bouts of inflation, Ireland would have to suffer the unavoidable consequences. The decision to break the link with sterling in 1979 and peg the Irish pound directly to the DM can be viewed as a policy choice in favour of the former scenario. Accordingly, this change in exchange rate policy constituted a very strong real world example of policy being influenced by the so-called SOE model. However, somewhat paradoxically, this decision created an environment in which the Irish rate of inflation could deviate from that of the countries to which it was tied³⁶. The new regime was, for example, far short of a complete monetary union. The exchange rate, while effectively pegged to the DM within a narrow band, was no longer rigidly fixed. Thus, there was always the possibility of adjusting the parities within the system and economic agents would take this into account in formulating their price expectations. Furthermore, since the UK stayed outside the ERM, the Irish pound began to float vis-à-vis the economy with which it conducted a large proportion of its trade. Ireland could, for example, avoid “importing” UK inflation by allowing the Irish pound/sterling exchange rate to appreciate³⁷.

In summary, these new realities (and the same forces are essentially at play today) required a re-appraisal of the manner in which the determinants of inflation could be assessed. In particular, it was no longer true that the SOE model of pure long-run external price determination would necessarily hold fully for Ireland. Accordingly, a proper understanding of the role of the exchange rate in such a regime is vital if the inflation forces in Ireland are to be properly understood. This is even more true since the wider ± 15 per cent. bands were introduced into the ERM in August 1993.

³⁶ We have already seen how Irish inflation could deviate from that of its partner countries in the presence of productivity differentials. The new regime, with its quasi-fixed exchange rates, allowed even greater divergences to occur.

³⁷ This is exactly what happened in the late 1980s, when the UK experienced a sharp rise in inflation (see Chart 2).

3.2.1 The role of the exchange rate

As noted above, under the new monetary arrangements, the role of actual and possible exchange rate changes would have to be included in the analysis of inflation. The SOE model implies that - from a position of equilibrium - any change in the exchange rate will feed through one-for-one into domestic inflation³⁸. The model therefore implies that no long-run competitive gain can be reaped from a devaluation. Flynn (1986), in a simulation exercise analysing the effect of a 10% devaluation, shows that this adjustment does indeed take place at a reasonably rapid pace. In particular, a very fast response of import prices, export prices, output prices and raw materials prices is reported. Most of the adjustment takes place within four quarters. However, complete adjustment of wages and consumer prices takes about 16 and 18 quarters respectively. These basic findings are supported in a subsequent study by Flynn and Honohan (1986) who estimate import price, consumer price and wage equations over the period 1972-1984. The error correction mechanism (ECM) employed in the CPI equation implies that while wages have a significant short term effect, they do not prevent convergence of domestic prices to foreign prices provided there is no change in the exchange rate. However, the authors appear to assume rather than test for this ECM specification. Flynn and Honohan (1986) also provide a theoretical analysis of the new exchange rate regime. They argue that the EMS regime may give rise to an inherent lack of stability. A once-off shock to prices can be converted into persistent inflation and this effect may be magnified the greater the tendency to adjust the exchange rate.

In contrast to the above studies, a subsequent analysis by O'Connell and Frain (1989) argued that changes in the exchange rate may not be fully reflected in the domestic rate of inflation (p. 4). The authors apply the Himarios (1987) variant of the Bruno (1979) model to Irish data over the period 1973 - 1987³⁹. While two separate versions of the model are estimated, the basic conclusion is that only half of the change in the

³⁸ If a country's real exchange rate is overvalued relative to equilibrium, a devaluation may merely result in equilibrium being achieved. Devaluation under such circumstances may, therefore, merely validate past inflation pressures rather than result in new ones. Nevertheless, under such circumstances, it is easy to envisage an inflation spiral taking hold.

³⁹ The model has been subsequently updated in Nugent (1994) where the basic conclusions were shown to hold.

exchange rate is passed through to domestic prices. This conclusion is based on the fact that the sum of coefficients on the lagged exchange rate is approximately 0.5. The authors claim that their study casts doubt on the ECM specification in the Flynn and Honohan (1986) study since purchasing power parity between domestic and foreign prices may not be a binding long-run constraint. However, this criticism is only strictly valid if the two or three lags on the foreign price and exchange rate terms are an acceptable definition of the long-run. When further lags of the exchange rate are used by the authors (i.e. 6, 7 & 8 lags) the hypothesis of 100% pass-through cannot be rejected (see Table 2, p. 21). In addition the O'Connell and Frain (1989) analysis of the relevant variables is conducted in first differences, thereby omitting long-run information contained in the data. In the empirical section of this paper, it is argued that the proper analysis of the exchange rate co-efficient must be undertaken using a cointegration analysis of the relevant variables in levels.

3.2.2 External factors: The Reserve Currency Country

Prior to joining the ERM, external inflationary pressures had largely originated in the UK (abstracting from world commodity price shocks). Membership of the EMS, however, required a redefinition of the external influences on the Irish economy. Since Germany was the hegemonial economy in the system, the role of German prices and monetary policy had to be assessed. In an early empirical study Browne (1984) found little evidence of a strong role for Germany as the reserve currency country (RCC) of the ERM over the period March 1979 to October 1983. Variations in the German money stock were found to have no significant role on Irish inflation. Browne cites the day-to-day variation and periodic re-alignments in the IR £/DM exchange rate as the main reason why this result is to be expected. Perhaps more significantly, Browne also finds that for the EMS Regime - in contrast to the earlier sterling link period - domestic monetary policy has an enduring effect on prices.

Browne's analysis was, however, restricted in its use of an admittedly small data set. More recent studies, with a longer run of data, have found greater evidence of a long-run role for German influences. Callan and Fitzgerald (1989) examine the

determination of prices in the Irish manufacturing sector⁴⁰. Within a cointegrating framework, the hypothesis of a long-run equilibrium relationship between Irish and UK prices and Irish and German prices (both converted to Irish pounds) is tested. The evidence relating to the period 1975 - 1987 suggests that Irish prices may not be cointegrated with either UK or German prices separately. The authors do, however, find that Irish prices may cointegrate with a weighted average of both UK and German prices. Furthermore, the role of German prices is much more significant when the post-EMS regime is considered on its own. Subsequent research has sought to overturn this basic finding. Leddin and Hodnett (1995), employing consumer price series over the 1960-1994 period, find no evidence to support cointegration between Irish and German prices.

3.2.3 Domestic factors revisited⁴¹

The changing environment associated with membership of the ERM has produced further empirical evidence on a persistent role for domestic variables in determining Irish inflation. Browne (1984) found that changes in domestic monetary policy as proxied by the domestic component of the monetary base had an enduring effect on Irish inflation in the post EMS period. O'Connell and Frain (1989) also attribute a significant role to a measure of domestic excess money creation in explaining Irish CPI inflation. In their summary table, the authors claim "domestic demand" accounts for approximately 26% of Irish inflation between 1977 and 1985. One question surrounding this number is whether it can be interpreted as a short-or long-run effect. We would argue that it can only be interpreted in a short-run sense since the regressions are run in first differences and only one lag of the excess money variable is included in the estimated equation. In an atheoretical VAR analysis, Howlett and McGettigan (1995) find some role for domestic monetary aggregates in predicting future Irish inflation. However, the authors do not interpret this as implying causation. A key issue which arises in all of these studies is whether the variation in the domestic component of the monetary base can be considered to be exogenous with respect to changes in foreign (e.g. German) prices and monetary policy. Intuitively, for an SOE

⁴⁰ Accordingly, their study must be considered as an analysis of traded prices only.

⁴¹ The potential role of domestic factors in Irish inflation is also covered in some detail in section 5.3.

with such a large traded sector, this assumption of strict exogeneity may not be absolutely binding.

Wage growth continues to receive attention as a domestic determinant of inflation thus signalling that the wage significance fallacy is alive and well. As an alternative to their open economy specification, Callan and Fitzgerald (1989) consider the role of wages in a closed economy model of price determination. Only a short-run role for wages is allowed in their chosen specification. However, a long-run wage effect is observed in two individual industries in the manufacturing sector⁴². In a recent contribution, Fountas, Lally and Wu (1995) make use a framework developed in Mehra (1991) to consider the relationship between inflation and wage growth. They report a long-run equilibrium relationship between prices, wages and an output gap variable as evidence in favour of a cost-push theory of inflation. The coefficient on the wage term in the cointegrating vector is unusually large (3.445). In the short-run ECM analysis, the authors find that wages Granger cause prices and not *vice-versa*. However, the exogeneity of this “wage-push” with respect to external inflationary pressures is not tested. The strong conclusion in favour of long-run domestic causative impulses would appear, therefore, not to be fully justified. The significance of the output gap variable, and the high coefficient estimate (6.97), in a cointegrating relationship with the level of the consumer price index is also a surprising result. Under the Phillips curve approach, the output gap would only be expected to be related to the rate of change in the CPI. On empirical grounds, the inclusion of the output gap might be justified since it is found to be non-stationary. However, the deviation in output from capacity, i.e. the cyclical component in output, is generally thought to be stationary (see, for example, Canova, 1993). The finding of non-stationarity in the output gap measure may, therefore, be due to the simple detrending procedure employed in its construction. Another shortcoming of this study is that the analysis is biased in favour of domestic factors. External influences enter only *via* import prices and energy costs.

⁴² Electrical Engineering and Paper Products Industries.

3.3. Summary

Some of the main findings/conclusions in the papers reviewed above are summarised in Table 1⁴³. In general, prior to 1979, researchers uncovered a reasonable amount of evidence which was consistent with the long-run implications of the SOE model. Accordingly, while short-term deviations were permitted, the prominent role of UK and import prices in determining the long-run rate of inflation in Ireland was stressed. The Table clearly illustrates the pervasive finding that UK prices were an important determinant of Irish inflation during this period. However, in the period since Ireland joined the ERM, while wages and import prices continued to be frequently cited as significant, the role of UK prices has been less pervasive. The new exchange rate regime has in fact produced significantly less agreement in relation to (a) the impact of exchange rate changes, (b) the nature of the foreign effect and (c) the role of domestic causative factors. While there is certainly agreement that the exchange rate is a significant determinant of Irish prices, the size of the effect of exchange rate changes is far from agreed. Estimates on the degree of pass-through currently range from 50 to 100 per cent. Furthermore, some studies of the post-EMS regime, which stress the role of external factors, are restricted insofar as they appear to have assumed rather than actually tested the long-run restrictions of the SOE model. Other studies, which emphasise the role of domestic factors such as domestic money and wage-push, fail to address the endogeneity of such factors both with respect to Irish prices themselves and with regard to foreign factors. The significance of domestic “demand” conditions is found to be mixed, with some support for the role of output, but no role being found for unemployment.

⁴³ The Table is intended as a summary of the principle findings in these previous studies, i.e. explanatory variables are marked as being significant if they are deemed by the authors to be relevant in explaining Irish inflation. Obviously, the Table cannot make the vital distinction between short and long-run determinants and consequently it is subject to the more detailed qualifications made earlier in the text.

Table I: Explaining Irish Inflation Both Before and After EMS Membership⁴⁴

	P ^{UK}	P ^{GR}	P ^M	P ^X	P ^O	Y	Y ^W	M*	M	C	r	r ^W	W	U	E
<i>Pre-EMS Period</i>															
Geary, Henry and Pratsche(1970)													*		
Geary(1976a)	*												*	X	
Geary(1976b)	*		*	*	*										
Geary and McCarthy(1976)			*	X									*	X	
Bradley(1977)	*		*	*	*										
Browne(1984)	*					*	X	*	X			*	*		
Hackett and Honohan(1981)			*										*		
Geary(1981)									*						
Leddin and Hodnett(1995)	*														
<i>EMS Period</i>															
Browne(1994)	*	*	*	*		X		X	*				X		*
Flynn(1986)			*		*								*		*
Flynn and Honohan(1986)			*										*		*
O' Connell and Frain(1989)			*						*						*
Callan and Fitzgerald(1989)	*	*											X		*
Leddin and Hodnett(1995)	X	X													
Howlett and McGettigan(1995)			*	*		X		X	*	X	X				
Fountas, Lally and Wu(1995)			*			*							*		

N.B. A * indicates that the variable was generally found to be significant. In contrast an X indicates that while the variable was considered it was not a significant determinant/predictor of inflation.

44

KEY: P^{UK} - UK Prices, P^{GR} - German Prices, P^M - Import Prices/Unit Values, P^X - Export Prices/Unit Values, P^O - Output Prices/Wholesale Prices, Y - Domestic Output Variable/Output Gap, Y^W - World Output Variable, M* - Foreign Money Stocks, M - Domestic Money Stock(M1, M3), Excess Money, C - Domestic Credit Series, r - Domestic Interest Rate Variable, r^W - World or Foreign Interest Rate Variable, W - Wages/Unit Wage Costs, U - Unemployment Rate, E - Exchange Rate.

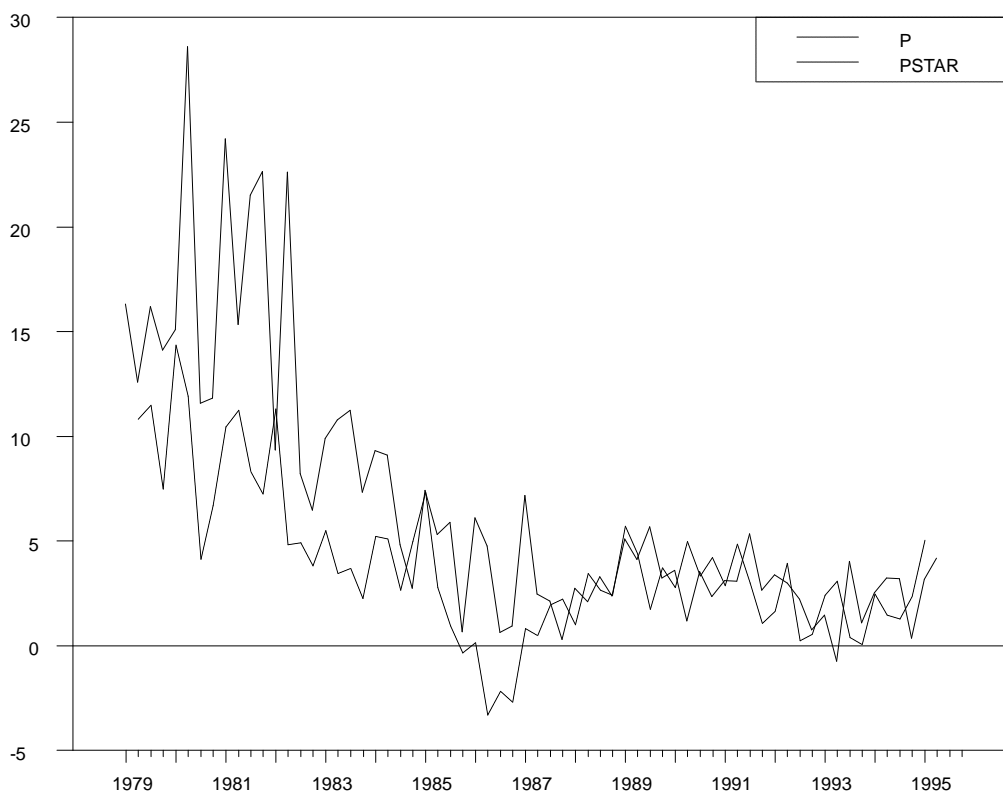
4. Inflation in Ireland: An Informal Analysis

In this section of the paper we present an informal analysis of inflation in Ireland. First, we compare Irish inflation with that prevailing elsewhere from the late 1970s to date, and proceed to examine the relationship between the commonly-used CPI-based inflation measure and some alternatives. Finally, the relationships between Irish inflation and its main potential underlying causes, outlined in the previous two sections, are examined informally as a precursor to the econometric investigation that follows.

4.1 Inflation: An international comparison

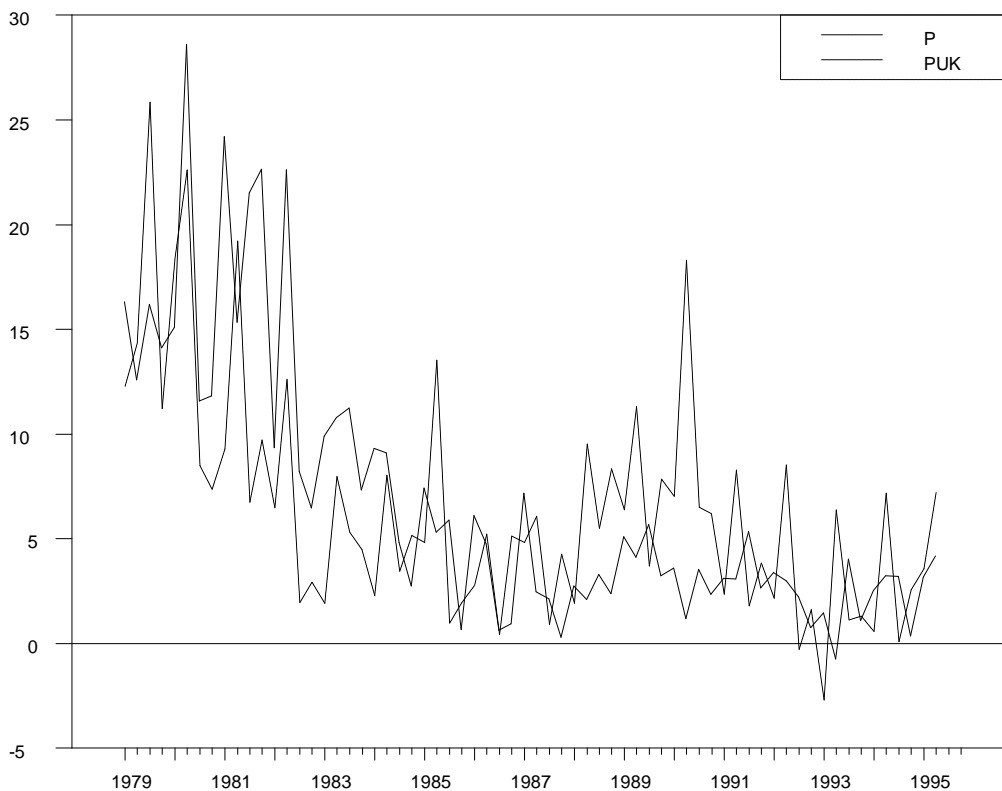
We begin by examining how our inflation record compares with that of industrial countries generally and with our closest neighbour, the UK. In Chart 1 our inflation rate (P) is compared with that of a weighted average of UK and German traded price

Chart 1: Irish and World Inflation



inflation(π^*)⁴⁵, for the period 1978 to 1995⁴⁶. The most interesting feature to emerge from the above chart is the fact that there have been two distinctive “regimes” over the period covered. It can be quite clearly seen that up until 1987 Irish inflation was markedly higher than that of industrial countries generally. By contrast, since that date we have become much more closely aligned with the externally prevailing inflation rate (which itself has, in turn, fallen sharply since the earlier period). One of the reasons for such a shift is suggested in Chart 2 below.

Chart 2: Irish and UK Inflation



⁴⁵ π^* is presented in the chart as it is the foreign price variable used in the econometric section. We would, of course, expect Irish consumer price increases to exceed foreign traded price rises over the period, even if the consumer price inflation rates were the same. This is due to the stylised fact that non-traded inflation generally exceeds that of traded inflation. Notwithstanding this proviso, the emergence of two distinct regimes is, nevertheless, clear. For details of the construction of π^* and other data used throughout the paper, see the Data Appendix.

⁴⁶ The inflation rates are calculated as the annualised quarterly growth rate of the relevant index. This ensures compatibility with the logged first difference price measures used in Section 6.

From the establishment of the state until our ERM membership, the Irish pound was pegged with sterling and, as a result, our inflation rate was inextricably linked with that of the UK.⁴⁷ It was expected that, by joining the ERM, we would break away from the UK's poor inflationary record and converge to the lower rates prevailing in Germany and elsewhere. Far from this expected convergence occurring, however, we continued to track (and indeed lag behind) the poorer UK inflation record until 1987. This serves to demonstrate, *inter alia*, the importance of inertia in the inflationary process and how difficult it is to break away from an inflationary cycle once it has begun. Many reasons have been put forward for our failure in this respect in the early 1980s, including the lack of credibility on the part of the authorities and the failure to implement the necessary (painful) adjustment policies at the time⁴⁸. By 1987, however, it had become clear that corrective action needed to be taken and it is commonly recognised that appropriate policies began to be applied in earnest around this time. In addition, as such policies were being implemented, and as we remained firmly pegged to the DM, inflationary expectations were gradually reduced, thereby signalling the beginning of a new inflation regime.

4.2 *Alternative measures of inflation*

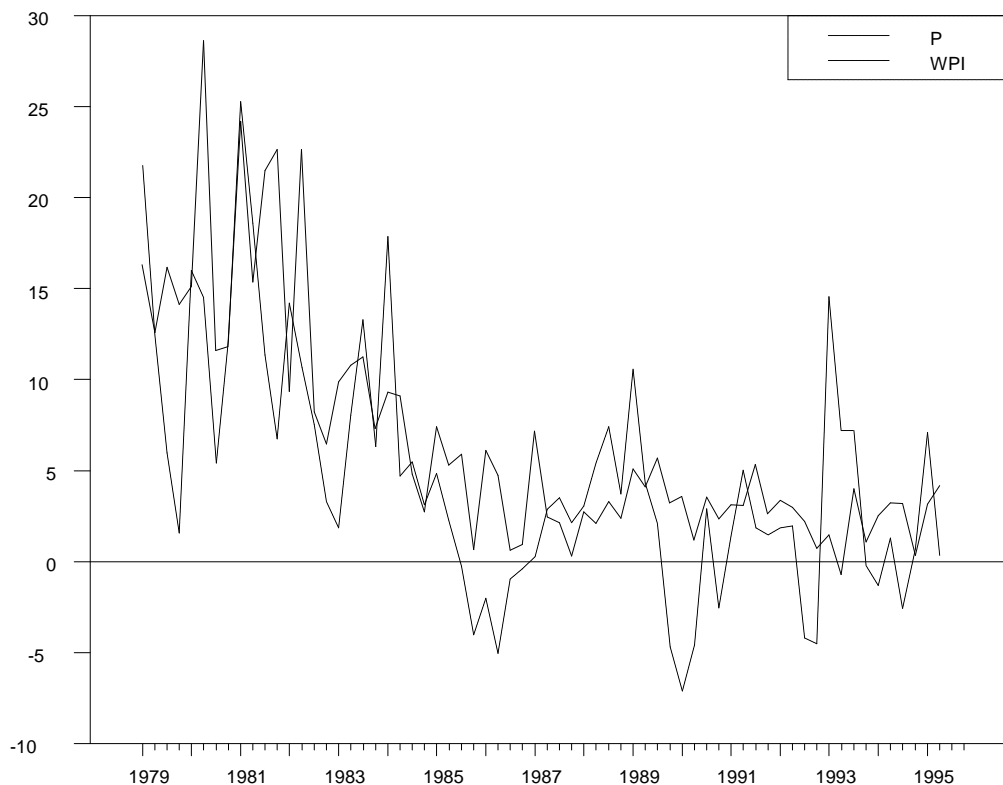
Before proceeding to analyse the relationship between Irish inflation and its underlying causes, it is worth examining briefly the relationship between the most commonly used measure, based on the CPI, and the main alternatives based on the wholesale price index (WPI) and the gross domestic product (GDP) deflator. In Chart 3 below it can be seen that, although both the CPI and WPI measures are quite highly correlated (the correlation coefficient between the two series is 0.66), there is quite a substantial difference in their respective means (i.e. 2.0 per cent.). *A priori*, we would have expected such a difference, however, given that the CPI contains a significantly larger non-traded component than the WPI. In addition, the CPI is subject to a good deal of influence from the non-traded sector in the form of distribution and retail

⁴⁷ See evidence in section 3.1.2.

⁴⁸ See NESG (1986) for a discussion of the various issues.

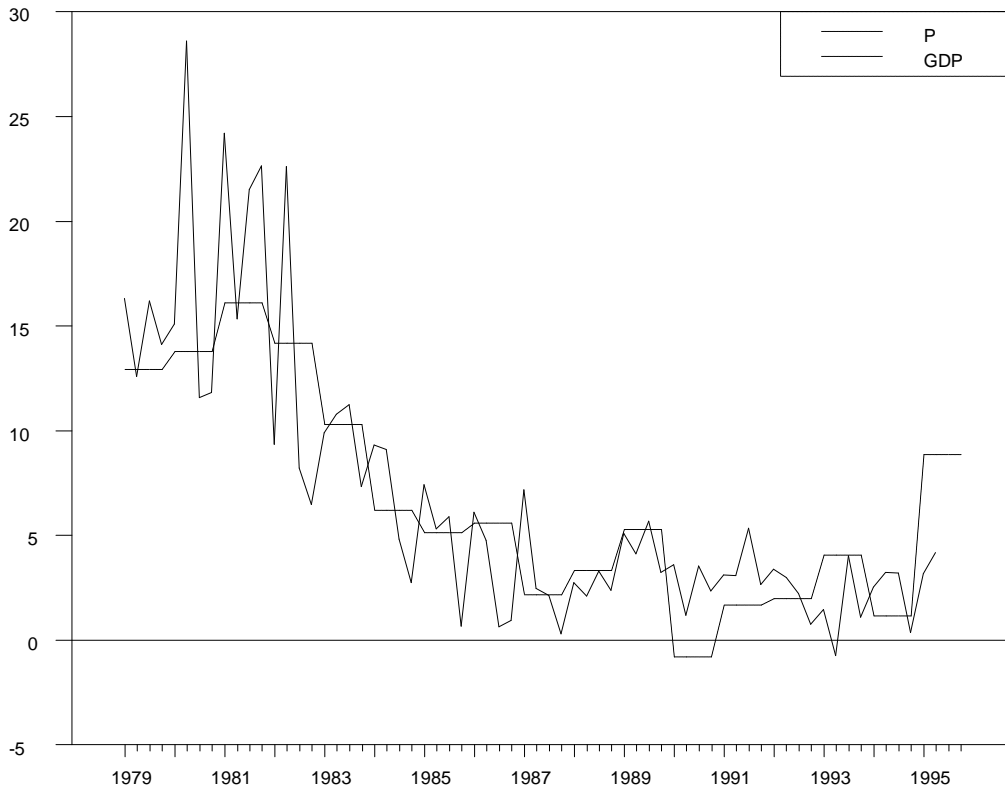
margins, and also to domestic taxes. The WPI, on the other hand, largely comprises traded goods where lower inflation rates would be expected to prevail, as discussed earlier in Section 2.3.

Chart 3: CPI Inflation and WPI Inflation



As can be seen from Chart 4 below, both the CPI and the (annual) GDP deflator inflation rates are even more highly correlated than is the case for the WPI and their means lie much more closely together. (The sample means differ by only 0.2 per cent. and the correlation between the two series is very high at 0.83). This is what we would expect, *a priori*, given the preponderance of non-traded items in the GDP deflator.

Chart 4: CPI and GDP Inflation



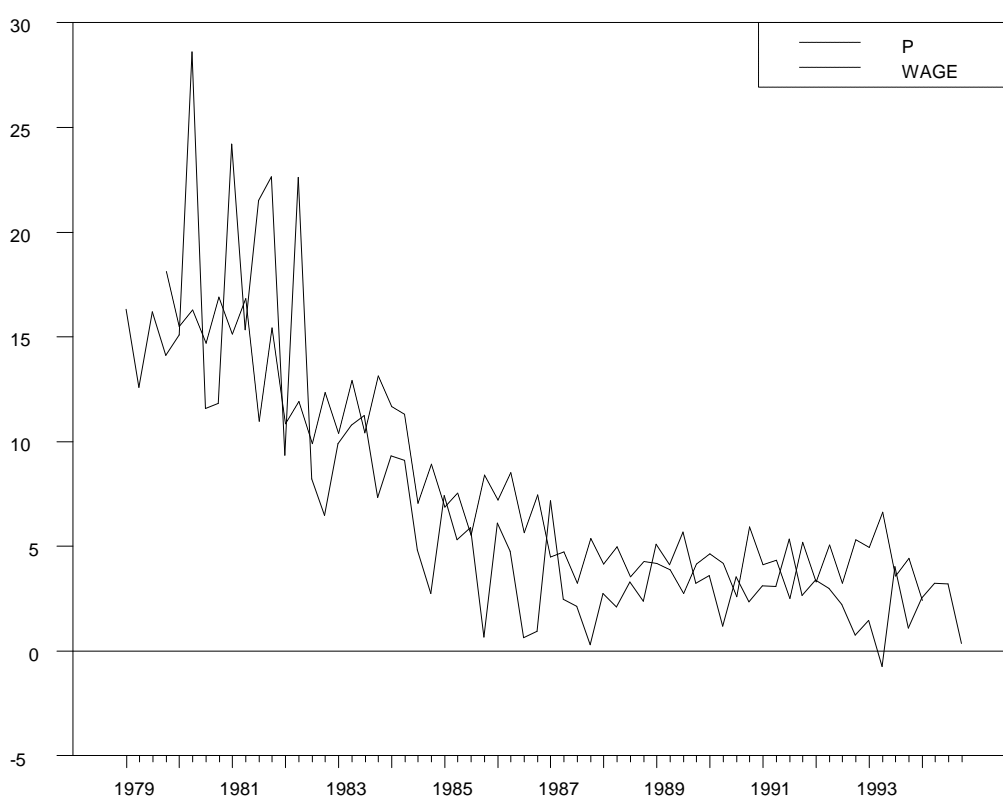
4.3 Inflation and its underlying causes

In this section we present a brief informal examination of the relationships between inflation and the main potential underlying causes which have been identified in the previous two sections of the paper. Overseas inflation, commonly held to be an important determinant of Irish inflation, has already been examined. Given the partial nature of graphical analysis it should be noted that any conclusions reached in this section are necessarily tentative.

Wage costs have been widely mentioned in previous studies as an important “cause” of Irish inflation. Comparing a moving average of Irish manufacturing wage increases with overall inflation it can be seen that, there is a very strong relationship between the

two variables, as would be expected (see Chart 5 below)⁴⁹. Nonetheless, the direction of causation between the two variables is far from clear. Several of the Irish studies surveyed report wages as an important “cause” of Irish inflation. This possibility is examined later in Section 6, along with the alternative that wages merely accompany rather than cause price inflation.

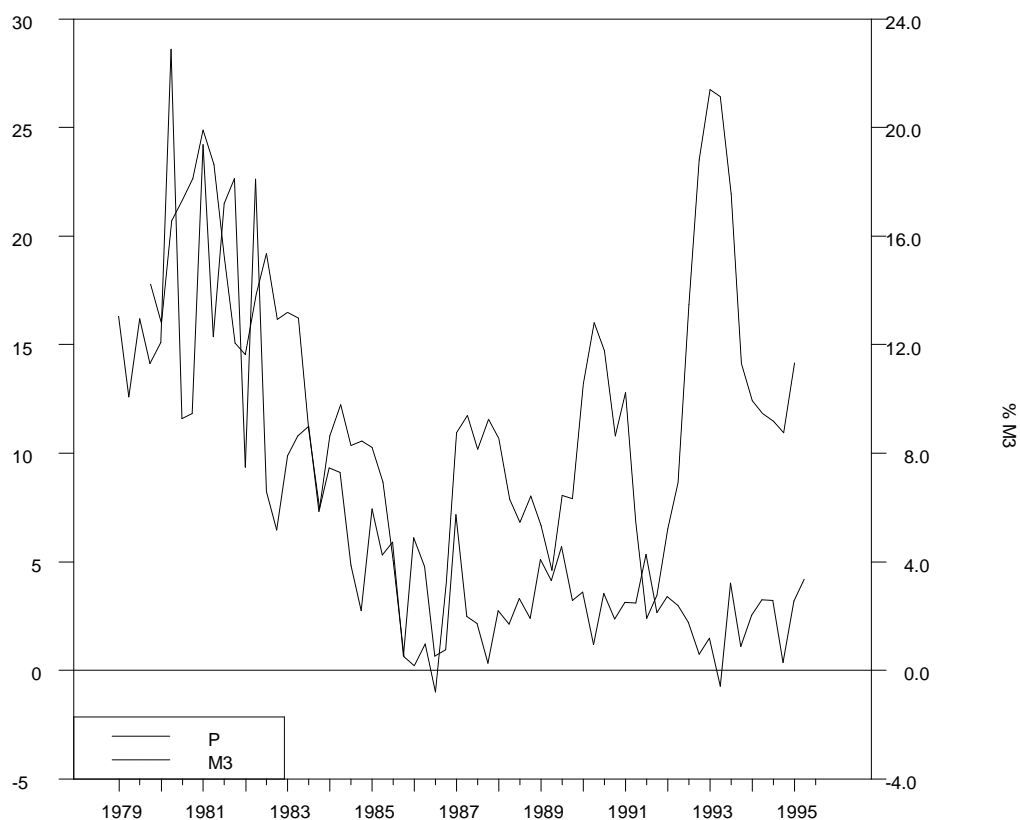
Chart 5: Inflation and Wages



Another important variable, which is held by some to be the dominant causal factor lying behind inflation, is money. Accordingly, in Chart 6 below, we have compared a five period moving average of the rate of growth of the wide money stock, M3, with

⁴⁹ The mean of the wage inflation rate is 0.9 % higher than that of price inflation, reflecting, *inter alia*, rewards for productivity increases over the period. If the sample is restricted to begin in 1983 the respective means then differ by a more substantial 1.5%.

Chart 6: Inflation and M3 Growth



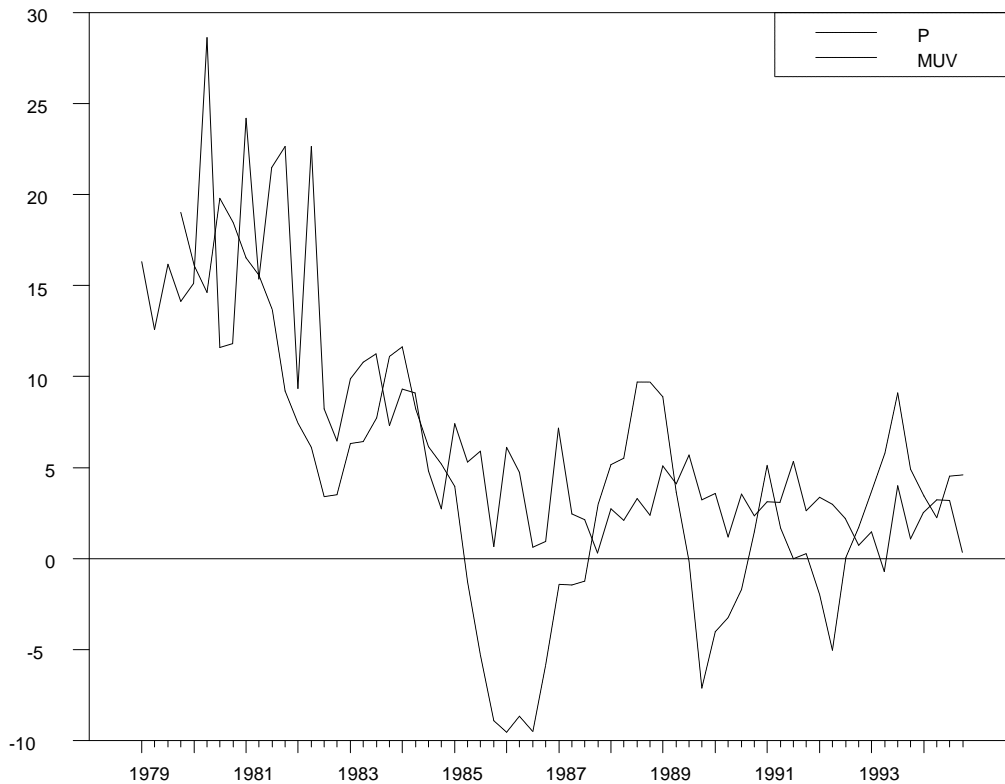
inflation. A straightforward interpretation of the quantity theory of money suggests that, where the velocity of money is constant, the rate of growth of the money stock is equal, by definition, to the rate of growth of nominal GDP. Where the trend growth rate of real GDP is also roughly constant, a proportional relationship will exist between the rate of growth of the nominal money stock and price increases. Although there is wide agreement among economists that, over the long run, the rate of growth of money has, generally, been highly correlated with price increases, both within and across countries (see, for example, McCandless Jr. and Weber, 1995), no such agreement exists on the causal nature of this relationship. The issue of whether money increases lead to price increases, or whether, on the other hand, inflation is merely accommodated by money increases has already been discussed.

It can be seen from Chart 6 above that, although a fairly close relationship held between the two variables in Ireland until 1988, this is no longer the case. Since 1988, the growth of M3 has been quite rapid and erratic and its velocity seems to have behaved in such a way that destroyed any relationship which previously existed between the variables. Similar patterns to the above are exhibited for the narrower measures of the money stock, M0 and M1⁵⁰. Although it is not reported to conserve space, the relationship between bank credit and inflation broke down around the same time as that of money. In addition, it was found that there was even less of a robust relationship between “world” money growth (proxied by money growth in Germany, the UK and the US) and Irish inflation over the full sample, whether this is translated into Irish pounds or left in dollars.

Traded goods prices, in the form of export and (especially) import unit values, have been widely cited as important determinants of Irish inflation. As expected, it was found that import and export unit values tracked each other very closely, and hence, for ease of exposition, we simply present a five period moving average of import unit values alongside inflation (see Chart 7 below). It can be seen that even though the two series tracked each other fairly closely for the first few years of the sample period, after 1984 no meaningful relationship seems to exist between the variables. In addition, as expected, the mean value of the import unit value series is 2.2 per cent. lower than that of CPI inflation.

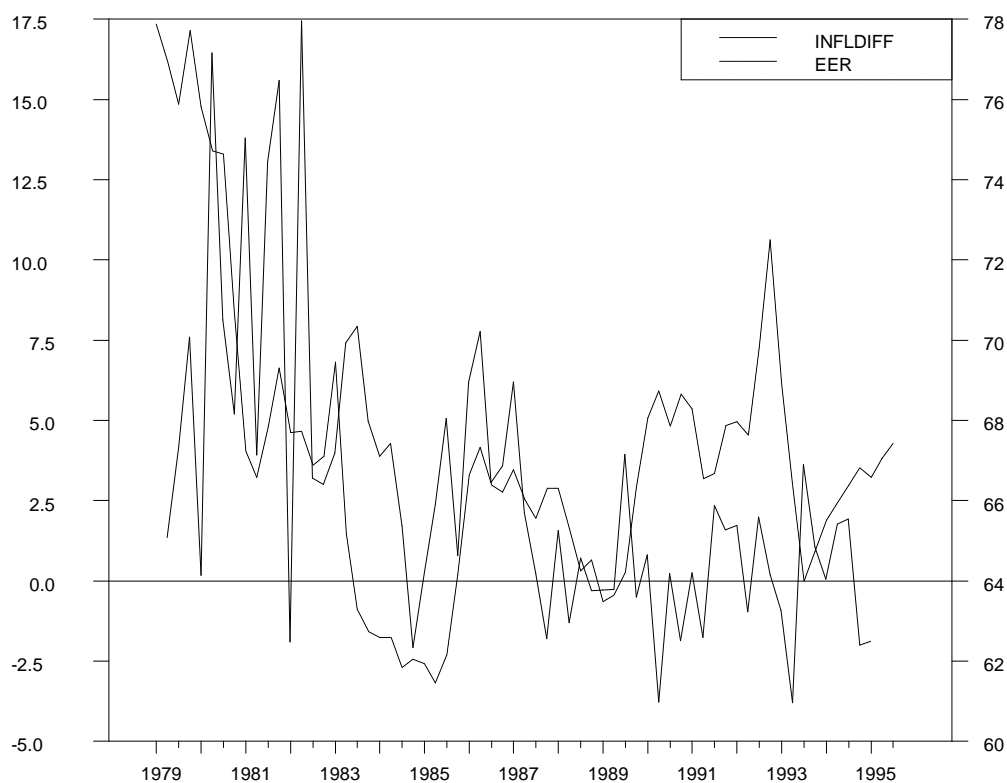
⁵⁰ This finding for Ireland is not unusual by international standards. The breakdown of many previously stable relationships between monetary aggregates and prices during the 1980s has led many central banks to concentrate their attention on alternative information variables when formulating policy.

Chart 7: Inflation and Import Unit Values



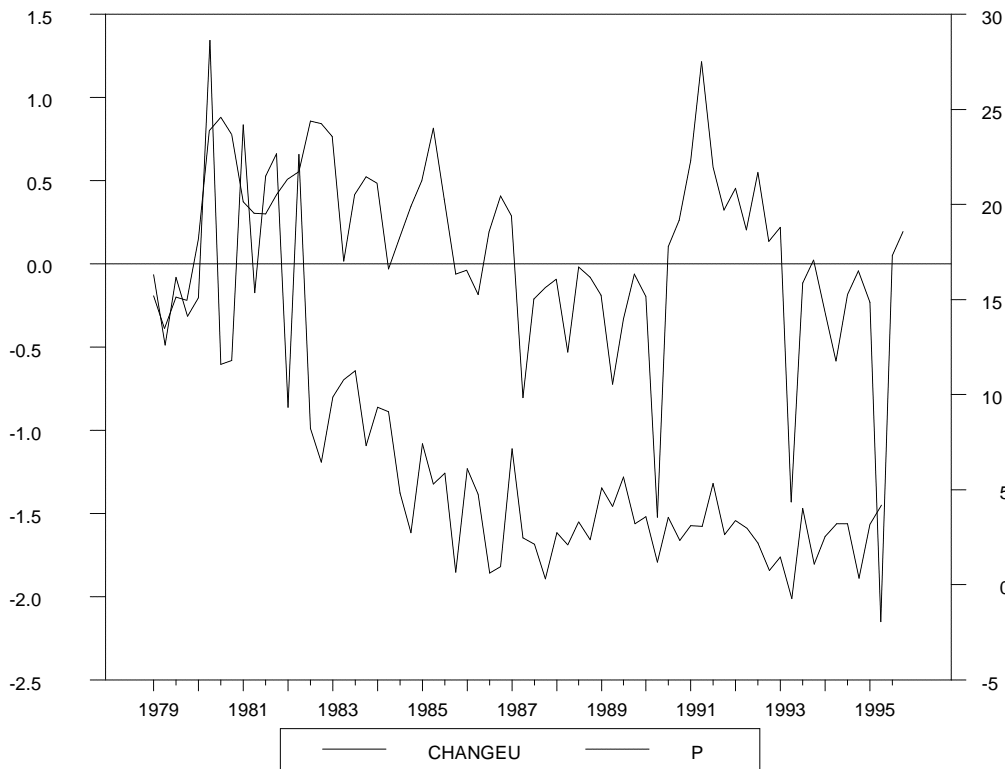
If it is believed that long run purchasing power parity holds, then we would expect a negative relationship to emerge between the nominal effective exchange rate and the differential between Irish and foreign inflation. It can be seen from Chart 8 below, that such a relationship does indeed emerge. In the first part of the sample Irish inflation exceeded that prevailing abroad. Our nominal effective exchange rate depreciated quite substantially over this period, falling, for example, from a value of 78 in 1979 to 61 in 1985. Since then it can be seen that, as our relative inflation performance improved, the nominal effective exchange rate rose to a peak of over 72 in 1992 before falling back somewhat in the aftermath of the ERM crisis which followed shortly after. More formal analysis of this relationship is left until Section 6.

Chart 8: Inflation Differential and Nominal Effective Exchange Rate



Finally, two measures of the amount of spare capacity in the economy are often related to inflation. The first measure, which came to prominence with the formulation of the Phillips curve, is the degree of labour market slack in the economy. As we have already discussed, the Phillips curve holds that there is a relationship (at least in the short run) between deviations of unemployment from its natural rate, on the one hand, and inflation on the other. Unfortunately, there are grounds for suspecting that the natural rate of unemployment in Ireland has closely tracked the actual rate, and hence it is very difficult to measure such deviations accurately. What we have done here is to side-step the issue by simply comparing the rate of change of the unemployment rate with inflation over the sample period (see Chart 9). If there is any relationship between these two variables it is very weak and is not immediately obvious from the chart. Further investigation of any possible relationship which might exist is carried out in Section 6.

Chart 9: Inflation and Changes in the Unemployment Rate %



The other widely used measure of slack in the economy is the output gap⁵¹.

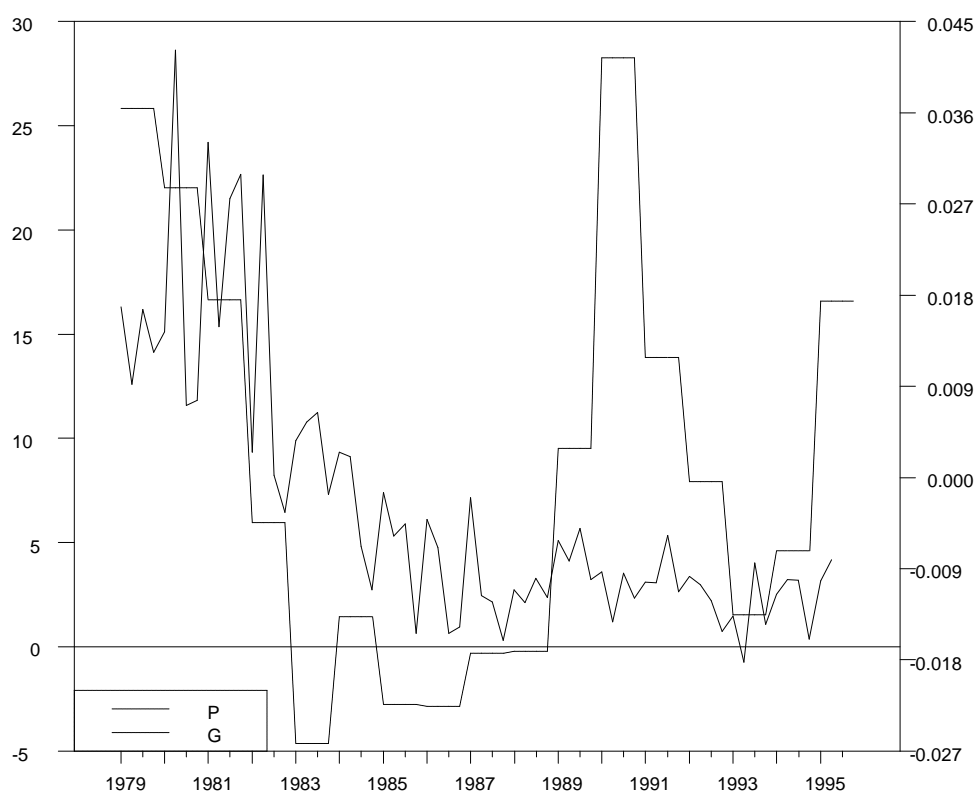
Intuitively, the greater the degree of spare capacity in the economy, the less we would expect inflationary pressures to prevail. In Chart 10 inflation and a comparatively simple measure of the output gap is presented. It is derived by detrending GDP at factor cost using the Hodrick-Prescott filter.⁵² As computed, a positive value for the output gap indicates that output is above trend and capacity constraints may exist. Unfortunately, such measures are only available on an annual basis and with some lag, as they are derived from the national accounts. It can be seen quite clearly from the chart that until 1987 a relatively robust relationship between the output gap and

⁵¹ See Browne, 1993, and Kenny, 1995 and 1996, for discussions of the output gap in an Irish context.

⁵² See Kenny (1995) for a discussion

inflation seems to have held. Unfortunately, it also emerges that this relationship has since broken down and the gap measure seems to have lost its earlier reliability.

Chart 10: Inflation and the Output Gap

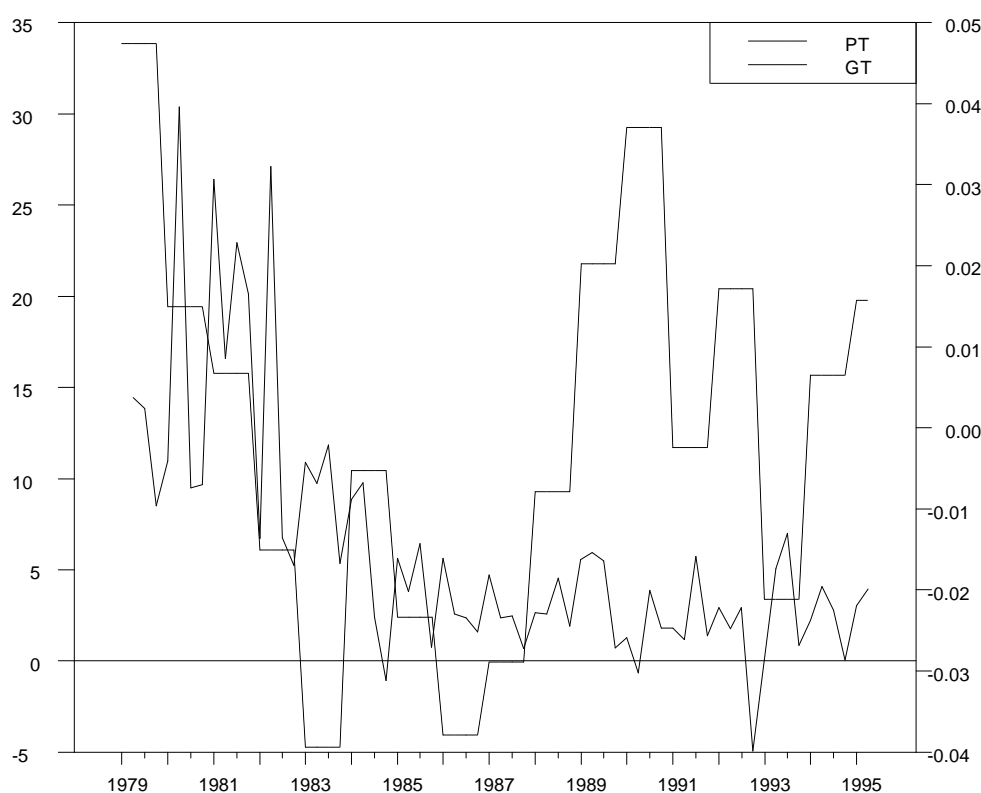


It is also interesting to derive output gap measures for both the traded and non-traded sectors of the economy.⁵³ *A priori* we might expect the relationship between the output gap measure for the non-traded sector and inflation in this sector to be stronger than for the traded sector, where international factors would have a predominant

⁵³ The simple goods/service distinction is employed to separate output into its traded and non-traded components. Thus, the measures of Industrial and agricultural output (items 43 & 44 in Table 4 of the National Accounts) are taken as the traded component of output. The remaining component of GDP is assumed to be non-traded. In the calculation of the output gap/capacity utilisation series, both traded and non-traded output are detrended using the HP filter described earlier.

influence⁵⁴. However, this contention is not really borne out in Charts 11 and 12 below where output gap measures are graphed together with, respectively, inflation measures in the traded and non-traded sectors⁵⁵. Indeed, neither relationship is any more stable than in the case of aggregate inflation. For both traded and non-traded inflation, the strong positive correlation implied by economic theory is quite clearly evident up until the about 1987. However, in both cases, it can subsequently be seen to break down.

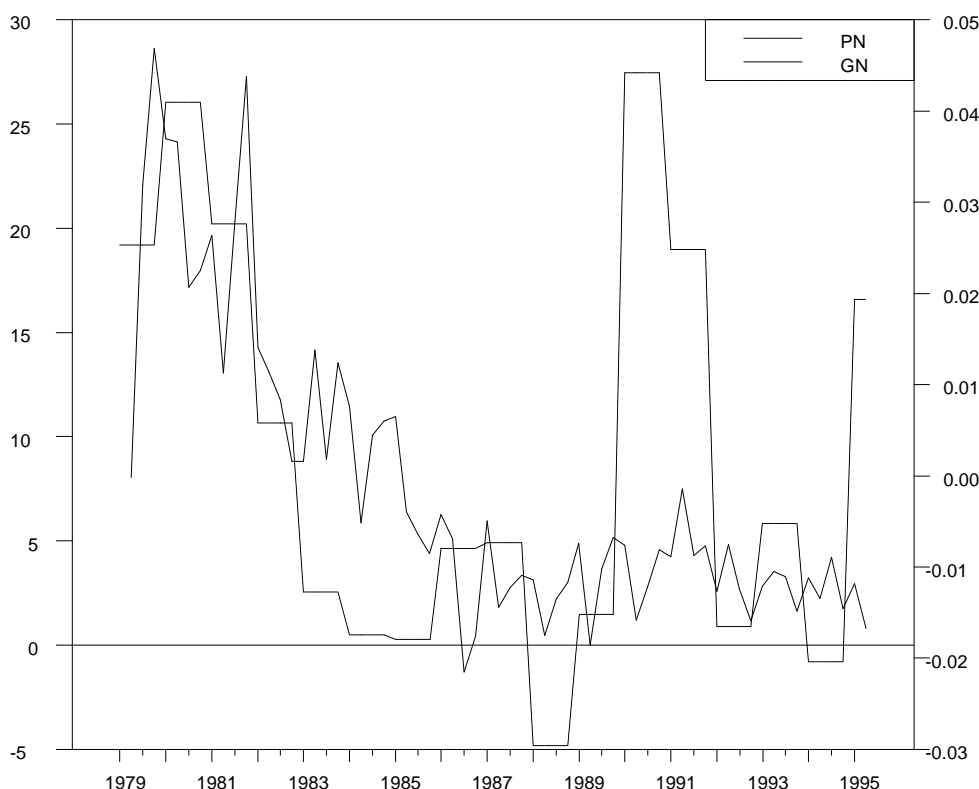
Chart 11: Inflation and The Output Gap, 1979-1995: Traded Sector



⁵⁴ There are of course international transmission channels where traded sector inflation is linked to a rise in aggregate demand due to increased foreign absorption. Thus, even if one takes the view that traded sector inflation is ultimately determined abroad, this does not rule out a correlation between traded sector inflation and capacity utilisation/output gap variables.

⁵⁵ The data for traded and non-traded prices is derived by breaking down the CPI into its component parts. The construction of this data set is described in more detail in Section 6 and also in the Data Appendix.

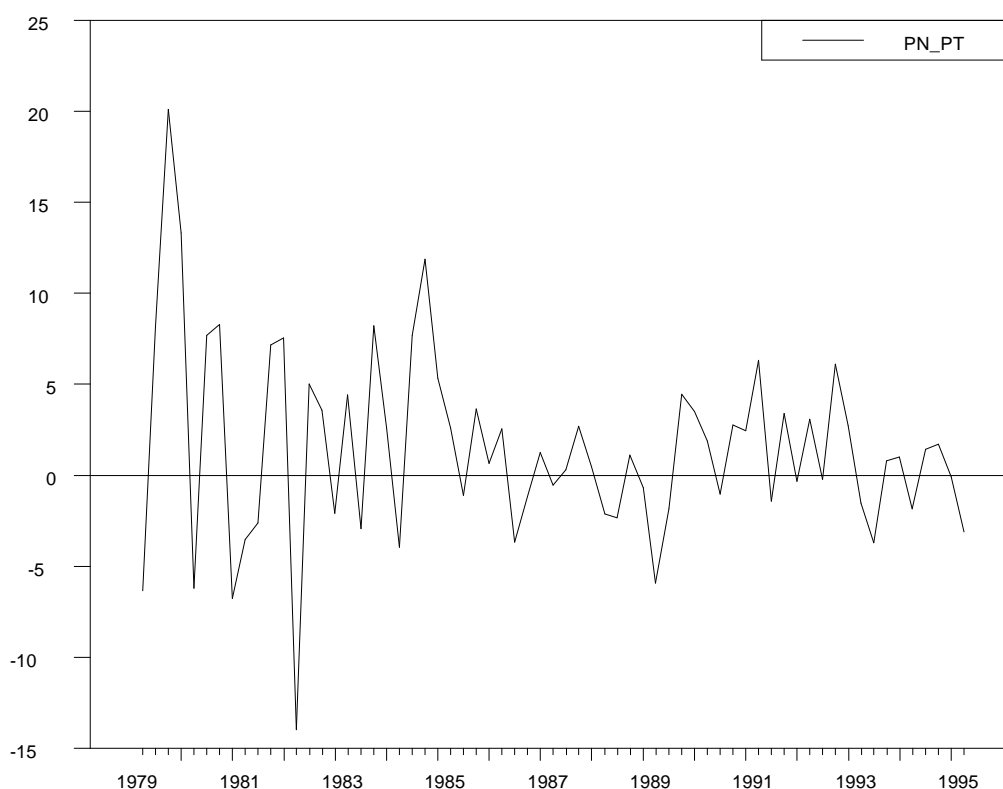
Chart 12: Inflation and The Output Gap, 1979-1995: Non-Traded Sector



It is also interesting to examine the relationship between inflation in both sectors. The differences between the measures of traded and non-traded inflation can be observed by comparing Chart 11 with Chart 12. The mean rate of inflation in the non-traded sector is approximately 7.68%. In the traded sector, the average rate of inflation was approximately 6.20% over the sample. This corresponds to a positive inflation wedge of about 1.48% over the sample. Such a positive wedge between traded and non-traded inflation conforms with the predictions of both Balassa (1964) and the Scandinavian school that non-traded inflation generally exceeds that in the traded sector. In order to provide further insight into this issue, Chart 13 below graphs the inflation wedge over time. One interesting observation that can be drawn from the graph is the sharp break in the variance which occurred around mid-sample. Deviations between traded and non-traded inflation thus appear to have been much more significant prior to 1987. Over the 1979-1987 period, the variance was approximately 47.33. Since then, there is evidence of much greater convergence in inflation rates in each sector: the variance in the inflation wedge declined to an average

of 7.50 over the 1987-95 period. In support of this contention, it should be noted that the inflation wedge over the 1987-95 period has averaged only 0.71 compared with an average wedge of 2.41 between 1979-87. One possible explanation for the significantly larger wedge in the earlier period is the monetisation of fiscal deficits which occurred at the time⁵⁶. In the light of the Scandinavian model, however, the significant decline in the average wedge is somewhat surprising. *A priori* one might expect that, given the growing importance of a capital-intensive multinational sector in Ireland, productivity differentials between traded and non-traded sectors would have widened. This in turn, under the Scandinavian explanation of inflation in an SOE, should have given rise to an increase in the wedge between traded and non-traded inflation. Quite clearly, this has not happened.

Chart 13: Inflation Wedge in Ireland: 1979 - 1995



One possible explanation is that increasingly, the non-traded sector has become more exposed to competitive forces acting *via* the traded sector. In other words, traded and non-traded inflation may share a common (external) cause even in the long-run. This is

⁵⁶ Browne and McGettigan(1993).

in direct conflict with the Scandinavian model. The empirical analysis in Section 6 throws further light on this topic.

4.4 Summary and conclusions

Before proceeding to formal econometric analysis, it is worth summarising briefly the main findings of this section. After first confirming that the CPI measure of inflation bore a close relationship to alternative inflation indicators, we then proceeded to analyse its relationship with the most commonly cited causal factors. It was first seen that our inflation rate need not necessarily closely resemble that of our closest economic partners since the inception of the quasi-fixed ERM exchange rate regime. This is now more true than ever in the current wide-bands exchange rate arrangement. In spite of our joining the ERM in 1979, it was not until the mid-1980s that Ireland managed to break away from the poor British inflation record and converge to more favourable one of our partners. Put simply, low international price increases do not necessarily translate into low Irish inflation and, accordingly, the Central Bank must always remain vigilant in order to keep inflation at bay. If purchasing power parity is a workable proposition, however, any deviation of Irish from international prices must be reflected in the nominal exchange rate. On the basis of the informal analysis this seems to be borne out in the charts. Any firm conclusions must, however, await the formal econometric investigation in the following section of the paper.

Most of the other causal factors which were listed in Table 1 were also examined in this section. Although the link between wages and prices is fairly strong over the sample period, there is widespread confusion concerning the causal nature of this relationship. Many of the other relationships between inflation and the variables of interest seem to have collapsed at some stage or other in the 1980s. In common with many other economies, the relationships that seem to have held reasonably well between inflation and various credit/monetary aggregates, became undone in Ireland in the late 1980s. Similarly, the associations between inflation and import/export unit values and the output gap failed to hold from the early and late 1980s respectively. Finally, no strong relationship emerged between inflation and the change in the unemployment rate.

Despite the shortcomings of simple bivariate chart-based analysis, it is felt that the findings of this section will provide much useful information for the more formal econometric work that follows later in the paper. Before proceeding to this, however, an outline of the economic theory underlying our approach is briefly presented in the next section.

5. Preliminary Theoretical Issues

5.1 Introduction

Thus far in the paper, after first introducing the concept of inflation and providing reasons for its examination, the relevant national and international literature on the subject was reviewed. The analysis provided an outline of how we view the inflationary process in Ireland and the most important factors involved. The main variables suggested by this review were then examined in an informal manner in the previous section. While useful in its own right, chart-based investigation is partial in nature, and its main purpose was to serve as a precursor and a supplement to formal econometric investigation. Our econometric approach is largely data based. Nonetheless, it is essential to have some underlying theoretical model in mind before embarking on the analysis. Below, we outline such a model, based on the Scandinavian approach, and attempt to draw out its main implications. Central to this underlying model is the purchasing power parity assumption. As a result, the section also discusses the validity and implications of this key assumption in an Irish context.

In Section 5.2 we outline the model upon which we base our econometric approach. We employ a very simple version of the Scandinavian Model which is adapted from Lindbeck (1979). The Scandinavian model does not have anything to say about the long-run domestic contribution to inflation, apart from differential productivity increases in the traded and non-traded sectors of the economy. The role of domestic factors from both a short-and long-run perspective is a very important concern for Irish policymakers and remains a contentious issue, as demonstrated by Leddin (1995). In Section 5.3 we argue that if PPP holds, a simple examination of the movement of the nominal exchange rate provides the necessary information on the domestic contribution to inflation.

5.2 Underlying economic model

The so-called Scandinavian model of inflation, which was described briefly in Section 2.3, has been widely used to analyse inflation in other SOEs, such as Norway and

Sweden. Here we outline a version of this model which is an adaptation of Lindbeck (1979).

$$\dot{P}^T = \dot{E} + \dot{P}^* \quad (5.1)$$

$$\dot{W}^T = \dot{P}^T + \dot{q}^T + \mathbf{b}f(d) \quad (5.2)$$

$$\dot{W}^N = \dot{P}^T = \dot{W} \quad (5.3)$$

$$\dot{P}^N = \dot{W}^N - \dot{q}^N \quad (5.4)$$

$$\dot{P} = \mathbf{a}\dot{P}^T + (1 - \mathbf{a})\dot{P}^N \quad (5.5)$$

$$\dot{q}^T = \dot{q}^N \quad (5.6)$$

where:

P	=	Aggregate domestic price level
P^T	=	Domestic price level for the traded sector
P^N	=	Domestic price level for the non-traded sector
E	=	Nominal exchange rate
P^*	=	World price of tradeables
W^T	=	Wages in the traded sector
W^N	=	Wages in the non-traded sector
W	=	Economy-wide wages
q^T	=	Labour productivity in the traded sector
q^N	=	Labour productivity in the non-traded sector
$f(d)$	=	Aggregate demand variable

and where a dot above a variable indicates the rate of change of a variable. Equation (5.1) assumes purchasing power parity in the traded goods sector. Equation (5.2) assumes long-run constant factor income shares in the traded sector (we assume that $\beta = 0$ in the long run), as does equation (5.4) for the non-traded sector. The assumption of solidaristic wage claims, resulting in the equality of wages in both sectors, is made in (5.3). In (5.5), the overall price index, P , is expressed as a weighted average of the

price of traded and non-traded goods where the weights are assumed constant over time. Finally, equation (5.6) assumes a higher rate of productivity increase in the tradeable than in the non-tradeable sector.

By simple substitution it can be seen that

$$\dot{P} = \left(\dot{E} + \dot{P}^* \right) + (1 - \mathbf{a}) \left(\dot{q}^T - \dot{q}^N + \mathbf{b}f(d) \right) \quad (5.7)$$

In the long run $\mathbf{b} = 0$ and the equation becomes

$$\dot{P} = \left(\dot{E} + \dot{P}^* \right) + (1 - \mathbf{a}) \left(\dot{q}^T - \dot{q}^N \right) \quad (5.8)$$

In the econometric section, we abstract from the productivity differential term and test for straightforward PPP. This makes rejection of our hypothesis more likely, even though some relationship, allowing for productivity differentials, may, in fact, exist. One of the advantages of the Johansen methodology, which we shall shortly illustrate, is that a number of long-run equilibrium relationships may be uncovered from a set of data. Combining equations (5.2) and (5.3) gives us the following relationship:

$$\dot{W} = \dot{P}^T + \dot{q}^T + \mathbf{b}f(d) \quad (5.9)$$

In the subsequent analysis we will test both PPP and a wage-price relationship, as illustrated in (5.9).

5.3 Determining the domestic contribution to Irish inflation

5.3.1 PPP and the domestic long-run contribution to Irish inflation

When modelling Irish inflation it is very difficult to incorporate a domestic explanatory variable which is truly exogenous. For instance, any aggregate demand variable

included in the above model is of course subject to international influences. As such, it is not possible to accurately assess the long-run domestic contribution to inflation on the basis of such structural models. This was not perceived as a large problem in the pre-1979 fixed exchange rate regime. Once the accounting view of inflation was superseded, it was widely accepted that domestic influences had no long-run role to play in the determination of Irish inflation⁵⁷. This was also borne out by some of the empirical studies at the time, including Geary (1976a, 1976b) and Bradley (1977), as noted already in Section 3.1.2. Once Ireland entered the ERM, however, with the associated possibility of nominal exchange rate adjustment, this assumption no longer automatically held. The controversy which prevailed up until the 1970s regarding the long-run influence of domestic factors on inflation was thus resurrected (as evidenced by the recent survey on inflation by Leddin, 1995).

After reviewing the main studies of Irish inflation over the past 25 years or so, Leddin makes the following statement: “The main conclusion to emerge from this survey of the inflation literature is that domestic variables have an important bearing on Irish inflation” (p. 11). While we would admit that domestic factors could indeed be important in this respect, even in the long run, we do not think that the evidence cited by Leddin necessarily supports this view. Basically, Leddin’s conclusions are based on the following two pieces of evidence: (1) certain studies of Irish inflation find a significant role for “domestic” variables; and (2) the evidence on PPP, even in the long run, is mixed for Ireland. Our difficulties with the first piece of evidence is that the “domestic” variables cited, such as wages and money could at best be regarded as “quasi-exogenous”, and are in turn largely dependant on foreign influences. Put differently, we would regard such variables as being proximate, rather than ultimate, “causes” of Irish inflation. Any purely domestic aspect of such variables is extremely difficult to uncover. As regards (2), the presence or otherwise of PPP does not provide an answer to the question of whether domestic factors are important for Irish inflation. Such domestic influences can prevail in the long run, whether or not PPP holds. This point is explained in some detail below. Nevertheless, it is felt that a

⁵⁷ We have, however, already seen that real factors, such as productivity differentials can drive a permanent wedge between domestic and world inflation, even under fixed exchange rates.

careful examination of the PPP condition, along with the associated real exchange rate, can offer useful insights into the important question of whether there has been any long-run role for domestic influences over Irish inflation since entry into the ERM.

Purchasing power parity is a fairly simple proposition and can be formulated as follows:

$$P_t = P_t^* + E_t \quad (5.10)$$

In order to allow for a constant price differential between baskets, the following relative PPP condition is often used:

$$\Delta P_t = \Delta P_t^* + \Delta E_t \quad (5.11)$$

If PPP holds, it does not necessarily mean, however, that there is no room for domestic influences over Irish inflation. Whether or not this is the case is, of course, dependant on the movement of the nominal exchange rate. If the nominal exchange rate is fixed, and PPP holds, then, given Ireland is a SOE, it is plausible to assume that causation runs from P_t^* to P_t rather than *vice versa* and that domestic influences over Irish inflation are transitory, at most⁵⁸. On the other hand, if PPP holds, and the nominal exchange rate is depreciating over time, this implies that domestic factors are contributing to Irish inflation in the long run, and causing it to permanently exceed world inflation⁵⁹. Hence, it would seem that, if PPP were acceptable as a long-run proposition for Ireland, the size of the domestic contribution could be accurately gauged from movements of the nominal exchange rate (i.e. the inflation differential itself), thus answering the fundamental domestic/foreign causation question in a very simple manner.

⁵⁸ This was, essentially, the model accepted by most Irish economists prior to our entry to the ERM.

⁵⁹ Such a situation could be caused either by domestic inflationary policies or external deflationary policies which have not been followed at home. As such the information provided by the nominal exchange rate under such circumstances is of domestic inflation policies relative to those prevailing abroad, rather than on our absolute inflation performance.

On the other hand, if PPP were not accepted, then there is always at least some role for domestic long-run inflationary influences⁶⁰. Leddin, after surveying the relevant Irish work concludes that “[a]t best, the above papers only offer tentative support for the long run PPP hypothesis and none at all for the short run version” (p. 10) and infers, as a result, that domestic influences have at least some role to play. We have already seen, however, how such influences can also be present even where PPP is found to hold.

5.3.2 PPP: International studies

The question of whether long-run PPP holds for Ireland is, nevertheless, a very important one, the answer to which provides important information on the domestic/foreign sources of Irish inflationary pressures. International evidence on PPP is mixed, as described in an excellent recent survey article by Froot and Rogoff (1995). One of the main reasons for this seems to be the short data sets employed in some of the tests, however. As Froot and Rogoff explain, given slow reversion towards PPP, the post-Bretton Woods data sets typically employed in tests may be too short to address the question of whether or not it holds in a proper manner. This is due to the low power of the unit root tests typically employed. They provide an example whereby if the true half-life of PPP deviations is three years, it would take 72 years of data to reject a unit root in the real exchange rate on the basis of Dickey-Fuller tests at 5 per cent. confidence levels! Given this problem, many recent international studies employ longer time series datasets. These latter tests almost uniformly confirm PPP as an acceptable long-run proposition with the typical half-life of deviations at around 4 years.

There are, of course, a number of reasons why medium- to long-run movements of the real exchange rate may be expected. The most popular hypothesis is that of Balassa (1964) and Samuelson (1964)⁶¹ whereby high-productivity countries would be

⁶⁰ It is important to note that this is the case even under a fixed exchange rate regime.

⁶¹ This hypothesis argues that productivity growth rates in the non-traded sector (NTS) tend to be appreciably slower than in the traded sector (TS) and does not vary as much across countries. This means that the difference between productivity growth rates of the TS and the NTS is greater in fast-growing countries. The knock-on effects of the high wage growth rates of the TS onto the NTS leads to higher prices in the latter sector in such countries. This can, accordingly, lead to an appreciation of the real exchange rate over time.

expected to experience long-run appreciations of their real exchange rate⁶². Supporting evidence for this hypothesis was provided by Balassa himself, as well as by Hsieh (1982), Marston (1987) and Edison and Klovland (1987) although more negative results have been obtained by Froot and Rogoff (1991a, 1991b). Another reason for real exchange rate movements concerns the role of government expenditure, where this falls disproportionately on nontraded goods. Supporting evidence on the medium-term role of government expenditure in explaining real exchange rate movements is provided by Froot and Rogoff (1991b), De Gregorio, Giovannini and Wolf (1994) and De Gregorio and Wolf (1994). Finally, deviations from the law of one price in the traded goods sector (which have, for example, been noted by Isard, 1977, and Giovannini, 1988), which result in real exchange rate movements, may be due to menu costs or “pricing to market” by firms. Ghosh and Wolf (1994) is a recent example of a paper confirming the importance of these factors.

5.3.3 PPP: Irish studies

Turning to the Irish papers on this subject, given the short data sets typically employed it is, perhaps, surprising that any support is found for the existence of PPP! Leddin (1988) carries out a simple test of short-run absolute PPP, which he, not surprisingly, rejects. Thom (1989), employing both unit root and cointegration tests on 8 years of ERM data, rejects PPP using Irish/US wholesale prices (also used in the other tests described in this paragraph), and finds mixed results for both the Irish/UK and Irish/German data sets. Similarly, Callan and FitzGerald (1989) reject PPP in the US case but find some supporting results for a weighted average of German and UK data. Wright (1993) confirms that the Irish/UK and Irish/German real exchange rates are non-stationary. Nevertheless, he specifically highlights the drawbacks associated with the use of short data sets (his sample runs for just over 11 years) and, as an effort to partly overcome this problem, Wright employs a method proposed by Cochrane (1988) for quantifying the non-stationarity in a series. The results of this test suggest that the non-stationarity in the Irish/German real exchange rate is small, although the

⁶² This real appreciation can, under an adjustable exchange rate regime, occur through higher inflation than elsewhere, an appreciation of the nominal exchange rate, or a combination of both. In a fixed exchange rate regime the only way in which such appreciations can occur is through higher domestic inflation.

results for the UK are more ambiguous. Furthermore, he suggests that “longer data may provide even stronger evidence for mean-reversion in real exchange rates” (p.118). In a further paper Wright (1994) finds strong evidence of PPP in both the UK and German cases using multivariate co-integration techniques, when the system is supplemented with short interest rates.

The above papers serve to highlight the problems associated with short data runs when analysing PPP. Nevertheless, it is encouraging to see that, in spite of this, there is at least some support for PPP in both the Irish/UK and Irish/German cases. As noted above, one way of overcoming these econometric problems is to extend the period covered. Leddin and Hodnett (1995) employ a data set covering the 1922 to 1994 period for Ireland and the UK and from 1960 to 1994 for Ireland and Germany. Unfortunately, the UK sample period was split in the paper into 1922-1939, 1939-1974 and 1975-1994 subperiods, to take account of structural change. Evidence in support of PPP between Ireland and the UK was found for the 1939 to 1974 period, although it was rejected for the other (shorter) periods. No support could be found for PPP using the shorter Irish/German dataset. It would be interesting to extend this analysis by using the entire dataset and incorporating the structural change effects in some other manner.

5.3.4 PPP and domestic long-run inflationary influences: Some conclusions

Overall, although both Irish and international evidence on the existence of PPP in the long run is mixed, it is encouraging to note that recent papers using longer stretches of data have been mainly supportive of the proposition. As Ireland is a small and highly open economy we might expect PPP to hold between ourselves and our main trading partners in the absence of real factors such as traded sector productivity differentials or excessive government expenditure, as illustrated above. If this was found to be the case, domestic long-run policy influences on inflation could be ascertained simply by examining movements of the nominal exchange rate (i.e. the inflation differentials themselves). On the other hand if, for example, high Irish productivity growth rates, resulted in medium- to long-run deviations from PPP, the analysis of domestic long-run contributions to inflation would become more complex. In such circumstances inflation differentials could be accounted for by both different inflation policies from

those prevailing elsewhere and real factors such as productivity differentials⁶³.
Movements of the nominal exchange rate since 1978 were examined earlier in section 4.3.

⁶³ It is important to note that such real factors are also problematic in a fixed exchange rate regime, in that long-run deviations of domestic inflation from that prevailing elsewhere are possible.