

Another Look into the Phillips' Curve

Philip Arestis and Malcolm Sawyer

University of Cambridge, Levy Economics Institute and University of Leeds

Abstract: The paper begins by remarking on the central role played by the Phillips' curve in macroeconomic analysis. The paper argues that the reduced form formulation of the Phillips' curve with the level of economic activity influencing the pace of inflation is unsatisfactory. We consider the initial theoretical backing for the Phillips curve as an excess demand adjustment mechanism, and then the New Keynesian approach, and in each case argue that there is a failure to establish a relationship between inflation and the level of economic activity.

Address for correspondence:

Malcolm Sawyer
Economics Division
University of Leeds
Leeds LS2 9JT,
UK
Email mcs@lubs.leeds.ac.uk

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1. Introduction

The Phillips' curve relationship continues to play a central role in macroeconomics, and this is evidenced by its central position in the recent literature of the New Consensus Macroeconomics (NCM).¹ The notion of a short-run trade-off between inflation and economic activity and a long-run vertical relationship at a supply-side equilibrium position play key roles in thinking about macroeconomic analysis, the rationale and operation of monetary policy etc. The purpose of this paper is to query the theoretical basis of the Phillips' curve and to argue that the reduced form approach to the Phillips' curve based on a single equation is unsatisfactory.

The Phillips' curve forms a key part of the model of the NCM in which a Phillips' curve is one of the three key equations representing this approach (in this case the Phillips' curve is generally represented in terms of price inflation depending on expected inflation and deviations of output from trend). At least implicitly notions of the Phillips' curve underlie the orthodox approach to monetary policy in two senses. First, the use of interest rates to target inflation draws on the linkage: interest rate – aggregate demand – economic activity – inflation, and the Phillips' curve is the final link in that chain. The sole use of monetary policy in the form of interest rates to target the rate of inflation would be difficult to justify without that final link in the chain (and it also requires the assumption that interest rates do have a significant impact on aggregate demand, on which see Arestis and Sawyer, 2004a). Second, the notion of the trade-off between inflation and unemployment has been used to argue the case for independence of Central banks on the grounds that politicians are tempted to stimulate the economy to reduce unemployment without regard for the longer-term inflationary consequences. Further the supply-side equilibrium is portrayed as unaffected by the path of demand and as a position towards which the economy moves, the classical dichotomy is embedded which enables the argument to be put for the focus of monetary policy on inflation without regard to longer term effects on the level of economic activity.

In this paper we use the term Phillips' curve and also reduced form Phillips' curve to signify a single equation relationship between some measure of inflation (price or wage) as a function of expected inflation and some measure of economic activity.

¹ We have dealt with the nature of the NCM approach in separate papers (see, for example, Arestis and Sawyer, 2004a) and in a book (Arestis and Sawyer, 2004b).

In the next section we review the emergence of the Phillips' curve and the continuing role it is given. A few notes on it follow in sections 3 and 4, before we investigate the New Keynesian approach on the matter, in section 5. Our alternative view is explored in section 6, with section 7 being devoted to a Summary and Conclusions.

2. The emergence of Phillips' Curve

The term Phillips' curve is used in this paper to signify a single equation in which some measure of inflation (price or wage) is taken as a function of expected inflation (usually with a coefficient of unity) and of some measure of the level of economic activity (unemployment, output etc.). There can be little doubt as to the central role played in macroeconomic analysis and policy making by the Phillips' curve in the half century since it made its appearance in Phillips (1958)².

The Phillips' curve started life as an empirical generalization on the relationship between wage inflation and unemployment (which also embodied features since largely forgotten, such as a clear floor under nominal wages changes at around – 1.0 per cent per annum with the horizontal portion of the Phillips' curve, and the 'loops' perhaps reflecting the influence of rising and falling economic activity on the rate of inflation). The curve was, of course, quickly shifted to a relationship between price inflation and unemployment (Samuelson and Solow, 1960) and given a theoretical justification in terms of a Walrasian adjustment process in which wages responds to the excess demand for labour, which was proxied (negatively) by unemployment (Lipsey, 1960).

The Phillips' curve (as a term with the general significance of a relationship between inflation and the level of economic activity) has been remarkably resilient. At an empirical level, it could be described as having experienced a meteoric rise in popularity, then a fall as empirical and theoretical doubts crept in, and a subsequent renaissance to a new dominance. The decade of the 1970s saw many expressions of the disappearance of the Phillips' curve, with a variety of attempts to rescue it (e.g. in terms of alternative measures of unemployment being used), but it came fully back into popularity with the establishment of the role of expected inflation in the Phillips' curve. But whereas the Phillips curve was generally represented in the first two decades of its life in terms of a relationship between wage inflation and unemployment, in the last two decades the Phillips curve has generally been viewed in terms of a relationship between inflation and the level of economic activity (and the expected rate of inflation).

² There had been predecessors in the notion that inflation and the level of unemployment were negatively related for further discussion see Sawyer (1987).

The term Phillips curve has been remarkably flexible in the sense that a variety of relationships have been incorporated under that heading, including wage inflation related with unemployment, price inflation with unemployment and price inflation and deviations of output from trend (or similar). It also, of course, following Friedman (1968) incorporated expectations into the relationship, and different mechanisms of expectation formation used along with expectations on different variables (e.g. wage inflation, price inflation) used.

The concept of the Phillips' curve has also been flexible in two other respects. First, the nature of the mechanism by which economic activity influences the rate of inflation. Sawyer (1987) identified four alternative concepts of the mechanisms underlying the Phillips' curve when viewed as a relationship between wage change and unemployment: (i) labour market disequilibrium, (ii) trade-off between inflation and the level of economic activity, (iii) industrial reserve army arguments, (iv) the 'surprise supply function'. The first and third related to the wage inflation – unemployment links but the mechanisms would be quite different: in the first unemployment acted as a (negative) proxy for excess demand for labour whilst in the third unemployment was reflecting relative bargaining strengths of labour and capital. The second one shifts the focus onto inflation—output (though sometimes (un)employment is used) relationship, and the fourth in effect reverses the causation between inflation and economic activity such that economic activity responds to 'surprises' with regard to inflation. A more recent notion of the Phillips curve is given by : 'The inflation-unemployment trade-off is, at its heart, a statement about the effects of monetary policy. It is a claim that changes in monetary policy push these two variables in opposite directions' (Mankiw, 2001, p. C46).

Second, (at least since Friedman, 1968), the imposition of the condition of an unchanging rate of inflation as an equilibrium condition along with an assumption that the coefficient on the expectational term in the Phillips curve is unity has enabled the calculation of some (essentially supply-side) equilibrium rate of economic activity. This has ranged from the 'natural rate of unemployment' (which following Friedman we would identify as corresponding to the clearing of a competitive labour market), the non-accelerating inflation rate of unemployment (NAIRU)³ (which can be variously derived, see Layard, Nickell and Jackman, 1991) in the case of wage inflation Phillips curve to a deviation of output from trend output or some measure of output gap in the case of the price inflation Phillips curve.

³ As has been previously pointed out (e.g. Cross, 1995), this is something of a misnomer, and should refer to non-accelerating prices, and to a constant rate of inflation.

The Phillips' curve has usually (at least implicitly) linked with forces, which lead the economy to that equilibrium rate of economic activity (which can be seen as a supply-side equilibrium). The initial formulations of the Phillips curve (as, for example, in the original Phillips 1958 paper) were empirically based and not specific on the adjustment process, but with the interpretations of Lipsey (1960) and Friedman (1968), the postulated adjustment process applied to the labour market was that changes in wages in response to excess demand lead to a change in the extent of excess demand, and hence movement towards the supply-side market equilibrium.

In the more recent literatures it has been more usual to have an adjustment process which relies on the real balance effect in the sense that the level of demand depends on the real value of the money stock, and as inflation occurs, the real value of the money stock changes until the level of demand is compatible with the supply-side equilibrium. When money is recognised as endogenous (and hence the real balance effect has no impact), and monetary policy is viewed in terms of the setting of the policy interest rate, then the adjustment process has become a policy one based on adjustments to the rate of interest.

The nature and determinants of any supply-side equilibrium become particularly important from a policy perspective. The supply-side equilibrium is viewed as an 'attractor' for the actual level of economic activity, and hence if that equilibrium position corresponds to what is seen as an unsatisfactory level of economic activity (say involving too high a level of unemployment) the policy question is what measures could be taken to improve that supply-side equilibrium, and to answer that question needs some insights into the determinants of that equilibrium. But when used in macroeconomic models, the theory behind the Phillips' curve and specifically the factors determining the supply-side equilibrium position are generally ignored, and to some degree this is a consequence of the use of a highly reduced form of the Phillips' curve. Although the supply-side can be interpreted as all-encompassing, there are though distinct views as to the particularly relevant aspects – notably those who have emphasised the labour market and its institutions and those who have focused on the output markets and capacity.

The general formulation of the Phillips' curve involves two significant features, which are rarely remarked on. First, it clearly relates a *rate of change* (inflation) with a *level* (unemployment, deviation of output from trend etc.). It is much more usual to think in terms of the level of one variable being associated with the levels of some other variables. In the case of the Phillips' curve with expectational variables included matters go, in effect, further since it is something approaching the second derivative of prices (actual inflation minus

expected inflation), which is related to the level of economic activity. It is, of course, this second derivative of price being linked with the level of economic activity which generates the accelerationist view on inflation in the sense that slight departures of economic activity from the equilibrium level send inflation spiralling upwards or downwards. In microeconomics it is much more usual to think in terms of the level of price being a function of the level of output (e.g. via marginal costs) or the level of demand. It is interesting to note that the notion that the degree of market power influenced the rate of inflation was dismissed by some by the argument that market power may influence the level of prices (relative to costs) but not the rate of change in prices. Yet, the notion that the level of economic activity influences the rate of change of prices is accepted without further thought.

One answer to this question of how rate of change of prices can be linked with level of economic activity appears to come from invoking the Walrasian adjustment mechanism whereby the level of excess demand influences the rate of change of prices. But that adjustment process assumes that the cause of excess demand is price departure from the equilibrium level, and that as price adjusts the market moves towards equilibrium, thereby eliminating any excess demand. Specifically it rules out any role for aggregate demand. But further it invokes a particular adjustment mechanism, namely that changes in prices in response to excess demand would lead the market concerned to the equilibrium position. This adjustment process stands in some contrast to that which is usually invoked. For the economy to move towards the supply-side equilibrium, some adjustment of aggregate demand is required, and this may come through a real balance effect or interest rate adjustment. In the Walrasian adjustment mechanism there is no such adjustment of aggregate demand but rather it is assumed that the level of aggregate demand could somehow underpin the 'natural rate of unemployment'.

Authors such as Laidler and Parkin (1975) have made the link between price change and the level of excess demand a central feature of the inflationary process. They point to some who have postulated the rate of price change as depending on *changes* in excess demand. 'This is an incorrect specification: it is at odds with the usual theory of price setting and with earlier empirical work which had found the *level* of excess demand to be important' (Laidler and Parkin, 1975, p. 768). Further 'it is worth noting that the United States literature abounds with arbitrarily mis-specified price equations in which *levels* of price rather than rates of change of price are regressed on the level of excess demand' (p.768), where, as least in some case, excess demand have been measured by variables such as capacity utilisation or output gap.

However when consideration is given to prices set in imperfectly competitive markets (for extensive discussion see Sawyer, 1983) then price (relative to costs) may be viewed as related to the level of output, but not price changes to the level of output. The New Keynesian Phillips' curve does seem to manage to 'square the circle' and we return to that approach in section 5 below. It can further be argued that under imperfect competition the relationship between costs (average or marginal) and output may well be not be monotonic, with unit costs initially decreasing with output and then increasing. This can be supported on both theoretical grounds and on empirical ones (given the evidence on the relationship between costs and output). But it does mean, of course, that over some range an increase in output will be associated a decline in costs, and potentially a decline in prices (depending on the mark-up).

It may be interesting to note in this connection that the text book presentations of the Phillips' curve often do not provide any theoretical justification for the curve⁴. One textbook which provides a justification is Mankiw (2002). 'From where does this equation for the Phillips curve come from. Although it may not seem familiar, we can derive it from an equation for aggregate supply' (Mankiw, 2002, p. 359). The aggregate supply curve is taken to be $Y = Y^+ + \alpha(P - P^e)$ where Y^+ is equilibrium level of output. Then the implied causation is reversed to give $P = P^e + (1/\alpha)(Y - Y^+)$. Subtracting $P(-1)$ from each side, and using $\pi = P - P(-1)$ and $\pi^e = P^e - P^e(-1)$, then $\pi = \pi^e + (1/\alpha)(Y - Y^+)$, and an appeal to Okun's Law yields $\pi = \pi^e - \beta(U - U_n)$. This relies on a quick flip over of causation, and that price surprises have a positive rather than negative effect on output decisions. One minor change, that is defining expected inflation as $\pi^e = P^e - P^e(-1)$ yields the result of $\pi = \pi^e + (1/\alpha)(Y - Y(-1))$, bringing the role of changes in output.

In textbooks, the presentation often begins with mention of the original paper by Phillips (1958) in terms of its empirical contribution followed by an indication that some relationship between inflation and the level of economic activity is empirically plausible (with suitable mention of shifts in the relationships through changes in expectations on inflation). There is little attempt to justify the Phillips curve in theoretical terms.

The second (and related) feature of the Phillips' curve is that there are no 'catch-up' elements (or in more recent parlance error correction mechanisms) by which wages or prices move towards their desired ('optimal') level. Price changes respond to expected price changes and economic activity, but subject to some random shocks or errors and expectational errors.

⁴ See, for example, Abel and Bernanke (2005) Chapter 12, Froyen (2005) Chapter 11.

Within the Phillips' curve, there is no mechanism by which the effects of past errors or shocks can be corrected.

3. Notes on the wage inflation Phillips' curve

In this section we briefly review some of the issues which arise with the formulation of the Phillips' curve when that curve is viewed in terms of a relationship between the rate of wage change and the level of unemployment.

The Phillips' curve began life (in Phillips 1958) as an empirical generalisation of the form

$\dot{w} = f(U)$ where w is log of money wages, U the level (or rate) of unemployment and a dot over a variable indicates rate of change of the variable. The empirical relationship was given a theoretical interpretation by Lipsey (1960) in terms of unemployment being a (negative) proxy for excess demand for labour and wage change responding to excess demand for labour. Friedman (1968) argued that real wage adjustment rather than money wage

adjustment should be involved, leading to the formulation of $\dot{w} = \dot{p} + f(U)$ with p log of some measure of price. Hence unemployment is a (negative) proxy for excess demand for labour, which in turn is deemed to be $D_l(w - p) - S_l(w - p)$, then the underlying equation would be :

$$(1) \quad \dot{w} - \dot{p} = D_l(w - p) - S_l(w - p) = G(w - p)$$

with $G' < 0$. This would suggest that it would be appropriate to estimate the equation in terms of the level of real wages without invoking the level of unemployment. It would then be the case that there is no rationale for the appearance of the level of unemployment U in this equation.

This approach faces a number of difficulties. First, the mapping from excess demand for labour to unemployment is problematic, and only operates fully if it is assumed that the actual level of employment is always determined by the demand for labour (Sawyer, 1995). When real wage is below the equilibrium level, the level of employment would usually be viewed as constrained by the supply of labour, but, of course, if suppliers of labour are on their supply curve there would be full employment.

Second, it is based on a real wage adjustment process, such that the level of employment depends on the real wage, and not on, e.g., the level of aggregate demand. A Keynesian approach would view employment as set by aggregate demand (at least in the short run, which is what the Philips curve relates), with the real wage following as a consequence.

There would not then be a real wage adjustment process, though there may be an aggregate demand adjustment process (e.g. by government policy).

This formulation of the Phillips' curve has gone out of fashion even though it provided the initial theoretical justification for the Phillips' curve. Even then it suggests that the Phillips' curve involving unemployment is a poor representation of the excess demand of inflation view since unemployment and excess demand for labour are not uniquely related. Further, it imposes a particular adjustment mechanism in respect of real wages adjusting to clear the labour market. In general we would conclude that it does not provide a firm basis for concluding that there is a (negative) relationship between rate of change of wages (whether money or real) and the level of unemployment.

4. Notes on the price inflation Phillips' curve

Many macroeconomic models contain an equation of the following form:

$$(2) \quad \dot{p} = \dot{p}^e + g(y)$$

where y is a measure of output gap or deviation of output from trend. Samuelson and Solow (1960) ended their contribution with a translation from the original Phillips' curve into one that related price inflation with unemployment. This in effect appealed to some form of mark-up pricing so that price inflation was closely linked with (and followed) wage inflation. In doing so it makes it appear that inflation is an unemployment-related issue, rather than say an issue related with the product market and the exercise of market power. But further there is the question of the compatibility of mark-up pricing with the wage inflation Phillips' curve. If that latter curve is viewed (as in the previous section) in terms of an excess demand adjustment process, then when there is excess demand in the labour market, by appeal to Walras' Law, there would be excess supply of output in the product market. Mark-up pricing arises in the context of imperfect competition and cannot readily be fitted into the excess demand/supply framework. On the other hand if the wage inflation Phillips' curve is viewed in terms of struggle over wages cum reserve army arguments then a similar view could be taken of the price determination process, that is in terms of firms seeking to secure profits with their ability to do constrained by the level of demand.

The translation from the wage inflation Phillips' curve to the price inflation one has also involved the shift from the rate of unemployment to some measure of output gap or capacity utilisation. This may be done by appeal to some form of Okun's Law. But Okun's Law is a thoroughly Keynesian notion with aggregate demand determining both unemployment and capacity utilisation. In a neo-classical framework, Okun's Law would not operate for the

reasons indicated above; and the translation from a wage-unemployment relationship to an inflation-unemployment relationship is predicated on the neoclassical-model notions.

It may be argued that the price inflation Phillips' curve can be directly derived from considerations of excess demand in the product market. Hence:

$$(3) \quad \dot{p} = \dot{p}^e + g(EDQ) = \dot{p}^e + h(y)$$

with a mapping from excess demand for output (EDQ) to output gap y . But again the mapping from excess demand to an observable output gap is problematic. The excess demand for output and any measure such the output gap based on the deviation of actual output from some predetermined level will only be positively and uniquely related if actual output is determined by the *level* of demand. In the case where the short side of the market determines the level of output, then for price below equilibrium, excess demand and actual output will be negatively related. When price is below equilibrium, output is seen to be supply-determined. As an aside it can be noted that this is the assumption made in the aggregate supply approach whereby output is positively related with unanticipated inflation.

The brief review in these two sections is designed to indicate that the excess demand foundation of a relationship between inflation and the level of economic activity is problematic, and does not provide a secure basis for the Phillips' curve. The excess demand approach is based on a perfectly competitive approach in which demand and supply curves are defined and in which excess demand has some meaning. Under imperfect competition firms are price makers and are usually seen to set prices at which they are prepared to supply. In setting price and the associated output firms are in effect eliminating any excess demand: the price and output set by firms is intended to fall on the demand curve, and hence be associated with zero excess demand. Under imperfect competition, the level of price (relative to cost) is related (though not monotonically) with output, and hence it appears that the rate of change of price will be related with the rate of change of output under imperfect competition. However, the new Keynesian approach based on imperfect competition appears to come to a different view and it is to that we now turn.

5. The new Keynesian approach

The more recent derivation of a relationship between price inflation and the level of output has been that associated with the New Keynesian Phillips Curve (NKPC), which can be seen to have its origins in the staggered price setting model of Calvo (1983). The key elements of

this approach are as follows⁵. Each firm produces a differentiated product, faces a constant price elasticity of demand curve for its product. In each period some firms change price (but others do not). The set-up is that in each period a proportion α of firms change period, and the probability of a firm changing its price in the period in question is independent of whether it had changed price in the preceding period. The aggregate price level can then be constructed as a weighted average of lagged price level and the optimal price set by those changing price. With the price level (log form) denoted p and optimal price (again log form) p^* , the equation is :

$$(4) \quad p_t = \alpha p_{t-1} + (1 - \alpha) p_t^*$$

The optimal price p^* is derived from profit maximising calculations in a forward-looking context. The firm takes into account that its (marginal) costs will change in the future and that it may or may not change price in any period. These considerations provide the following :

$$(5) \quad \sum_{T=t}^{\infty} (\alpha\beta)^{T-t} E_t [p_t^* - p_T - \lambda(Y_T - Y_T^n)] = 0$$

where β is the subjective discount factor, Y_T and Y_T^n are output and ‘normal’ output respectively and λ arises from the sensitivity of marginal cost to output. The mark-up of price over marginal cost also impacts on the size of λ . It should specifically be noted that the relationship between marginal cost and output is assumed to be a monotonic and positive one. Often a Cobb-Douglas production function is assumed which ensures a positive relationship between marginal cost and output⁶

Manipulation of equations (4) and (5) then yields:

$$(6) \quad p_t^* - p_t = [\alpha\beta E_t \pi_{t+1} + (1 - \alpha\beta)\lambda(Y_T - Y_T^n)] + \alpha\beta E_t (p_{t+1}^* - p_{t+1})$$

and also:

$$(7) \quad \pi_t = \frac{1 - \alpha}{\alpha} (p_t^* - p_t)$$

$$(8) \quad \pi_t = \kappa(Y_t - Y_t^n) + \beta E_t \{\pi_{t+1}\}$$

$$\text{where } \kappa = \frac{(1 - \alpha)(1 - \alpha\beta)}{\alpha} \lambda$$

⁵ This derivation is based on Woodford (2003) Section 2.1 pp. 177-196 and pp.661-2: see, for example, Gali and Gertler (1999) for a similar derivation albeit implicitly based on perfect competition with price equal to marginal cost.

⁶ In the case of a Cobb-Douglas production function this equilibrium level of output clearly would not correspond to any physical capacity output nor to a level of output at which average costs are minimised. It could be taken as the level of output which firms would choose to produce given relative prices.

Equation (8) can be iterated forward to yield:

$$(9) \quad \pi_t = \kappa \sum_{k=0}^{\infty} \beta^k E_t [Y_{t+k} - Y_{t+k}^n]$$

One set of criticisms which has been directed at the NKPC is that it fails empirically. A few examples of this come from the following. ‘Although the new Keynesian Phillips curve has many virtues, it also has one striking vice: It is completely at odds with the facts’ (Mankiw, 2001, p.C52). ‘Attractive though the need to establish a direct inflation-output link may be, as an empirical framework for explaining inflation over the business cycle, the New Keynesian Phillips’ Curve (NKPC), in inflation-output space has not been particularly successful’ (Chadra and Nolan, 2004, p. 271). Galí and Gertler (1999) have noted that “it is often difficult to detect a statistically significant effect of real activity on inflation using the structural formulation implied by the theory, when the measure of real activity is an output gap (i.e., real output relative to some measure of potential output). Failure to find a significant short-run link between real activity and inflation is unsettling for the basic story” (p.196).

Although the empirical results (or lack of) work is significant, our main focus here is on the theoretical aspects as we are particularly interested in the theoretical underpinnings of a Phillips curve type relationship.

There are some rather surprising implications which come from the NKPC. First, as often noted (Galí and Gertler, 1999, for example) equation (7) implies that the current *change* in inflation should depend negatively on the lagged output gap (with $\beta \approx 1$, and the difference between expected inflation and actual inflation a random error term). Although β , being the discount factor is likely to be close to unity, the NKPC strictly does not involve a vertical long-run Phillips curve. Further, it can be seen by reference to equations (5) and (6) that the rate of inflation depends on expected future real variables, and variables which can be anticipated to have a zero mean. This could be interpreted as indicating that inflation itself will always be close to zero. An alternative interpretation is that variables have been expressed relative to a steady state inflation rate, and hence π would then be interpreted as deviation of inflation from steady state rate, leaving the steady state rate of inflation unexplained.

It can be readily seen from the above derivation that the assumption of rising marginal costs is crucial to the derivation of equation (4). The assumption of a Cobb-Douglas production function, which has often been used in this context, may be questioned on grounds of its empirical relevance (cf. Rowthorn, 1999). It is, of course, the case that any positive

monotonic relationship between marginal cost and output would be sufficient in this context. However, the notion that firms always operate where marginal costs are rising with output is of dubious empirical relevance. ‘Also relevant to the interpretation of all the empirical work on price determination is the fact that actual unit costs changes fall during booms and rise in recessions’ (Laidler and Parkin, 1975, p. 768). Downward (1999) reports some 19 per cent of UK firms agreeing that costs increase with output but 65 per cent agreeing that costs decrease with output.

However, it seems that the traditional U-shaped costs curves are dismissed, which in the context of an imperfect competition approach is surprising. The notion of a pricing decision made by a firm (rather than dictated by the market) is closely linked with imperfect competition, and indeed the NKPC is based on firms producing differentiated products. It has been known since Chamberlin (1933) that under conditions of imperfect competition firms may well be operating along the declining portion of their cost curves. It would also follow that for those firms where marginal costs and output were negatively related, a NKPC would be derived in which price inflation was negatively related to the level of output.

The NKPC approach is heavily dependent on the notion that price setting is staggered as can be readily seen by taking the case where firms change price every period, i.e. $\theta = 1$, when from equation (4) it can be seen that inflation would not depend on output gap (since the first term in that equation would have zero coefficient) and inflation is solely driven by expected inflation (and then with a coefficient of below unity).

The length of the ‘period’ for which this analysis is intended then may become significant. If the period is a calendar year, then causal observation may suggest that all firms consider their prices at least once a year. Hall, Walsh, and Yates (1997), in a survey of 654 UK companies, found some 27 per cent of firms reviewed their prices annually, and all of the others more frequently. In this case, the NKPC would not apply for estimation of an equation based on annual observations. If in addition to the formal price review we add in considerations of price adjustments, special promotions etc., then the frequency of price changes would clearly be increased, and may be such as to cast doubt on the usefulness of the above approach for equations based on quarterly data.

In Gali and Gertler (1999) real marginal costs are taken as proportional to share of labour income in national income (again by appeal to the Cobb-Douglas production function). An alternative interpretation of equation (3) then becomes that inflation arises when labour share deviates from ‘trend’ value. Specifically when labour’s share is relatively high, the rate of

price inflation is relatively high, and firms could be seen as seeking to restore their profit margins by raising prices (faster than otherwise).

6. Summary and Conclusions

This paper has sought to suggest that the notion of a Phillips curve has played, and continues to play, a central role in macroeconomic analysis. Yet, the term Phillips curve is used to cover a range of different relationships (e.g. sometimes wage inflation, sometimes price inflation, sometimes unemployment, sometimes output gap), and even within a single relationship (such as wage change as function of unemployment) the theoretical background can be very different. The reduced form Phillips curve tells us little on the underlying mechanisms but knowing those mechanisms is rather important for policy purposes. From the Phillips curve it is generally possible to calculate some supply-side equilibrium position, but for policy purposes it becomes significant to understand the determinants of that equilibrium position and whether there are forces which make that position a ‘strong attractor’.

We have considered the general notion of Phillips curve in terms of some measure of inflation as a function of expected inflation and some measure of the level of economic activity. Starting from the observation that relating a rate of change (inflation) with a level (economic activity) is rather unusual, we have argued that the various attempts to provide a theoretical underpinning for such a relationship should be regarded as failures. If we are correct this should lead to a re thinking of much macroeconomic analysis and many policy conclusions which have relied on the notion of a trade-off between inflation and the level of economic activity.

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