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A NOTE ON PHILLIPS CURVE
(The Phillips Curve was simply a set of observations in search of an expectation.)

PHİLLİPS EĞRİSİ ÜZERİNE BİR YORUM
(Phillips Eğrisi Beklentinin Araştırılmasındaki Bir Dizi Gözlemidir)

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SUMMARY

Unemployment and inflation have been the focus of macroeconomics since its birth and the Philips Curve is the result of this interest.

From the birth in 1958, the Philips Curve has been revised with new findings such as the natural rate hypothesis and the adaptive expectations hypothesis. Further the Philips Curve relationship is limited only to short-run.

Therefore in this paper the evaluation of the Philips Curve is studied. The defects of each level are given and passage among these levels is explained.

ÖZET

İşsizlik ve enflasyon makro-ekonominin doğuşundan bu yana bu bilimin odak noktalarında yer almıştır ve bu ilginin sonucu da ortaya bu iki değişken arasındaki ilişkiyi anlatmaya çalışan Phillips Eğrisi ortaya çıkmıştır.

1958'deki doğuşundan bu yana Phillips Eğrisi Doğal Oran Teorisi ve Adattif Beklentiler Teorisi gibi teorilerin bulunup eğriye uygulanması ile birçok defa değişikliğe uğramıştır. Sonunda da Phillips Eğrisinin sadece kısa dönemde anlamlı olduğu sonucuna ulaşılmıştır.

Bu çalışmada da Phillips Eğrisinin bu evrimi anlatılmaktadır. Bu evrim içerisinde eğrinin eksik yanları belirtilmiş ve son haline ulaşıncaya kadarki gelişimi anlatılmaktadır.

Philips Curve, Inflation, Unemployment, Natural Rate of Unemployment, Adaptive Expectations, Rational Expectations, Long-run Philips Curve, Accelerationist Hypothesis.
Phillips Eğrisi, Enflasyon, İşsizlik, Doğal İşsizlik Oranı, Adaptif Beklentiler, Rasyonael Beklentiler, Uzun Dönem Phillips Eğrisi, Hızlandırıcı Teorisi.

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1. INTRODUCTION

Unemployment and inflation, either separately or combination, have been the focus of macroeconomics since its birth. The nature of relationship between inflation and unemployment has been interest of economists for a long time. Although aggregate demand and supply are crucial for understanding the inflationary process, this framework does get quite complicated when inertial forces shift the curves upward each period. Economists therefore searched for a simpler device for capturing inflation theory. In the late 1950s and early 1960s, a striking innovation radically changed the way economists analysed inflation. This was the Phillips Curve.

The original and familiar Phillips Curve was drawn in an article in 1958 (Phillips, 1958). Professor Phillips has advanced the hypothesis that the percentage rate of change of money wage rates in the UK(W) can be explained to a very large extent by:1) the percentage of the labor force to unemployment (U) and 2) the rate of change of unemployed (Ü). Phillips Curve plotted inflation against unemployment and found that when inflation was high, unemployment was low and vice versa. It seemed to suggest that a government could choose to cut unemployment by tolerating a slightly higher rate of inflation.

Phillips Curve analysis has hardly stood still since its beginning in 1958. Rather it has evolved under the pressure of events and the progress of economic theorizing, incorporating at each stage such new elements as the natural rate hypothesis, the adaptive expectations hypothesis. Each new element expanded its explanatory power. But by the late 1960s that happy relationship was breaking down, although a good deal of empirical support was identified for the Phillips Curve relation in mid-1960s. The Phillips Curve seemed to shift upwards over time, so that a particular level of unemployment corresponded to ever higher inflation rates. In UK and other developed economies unemployment and inflation were seen to be increasing simultaneously.

Phillips Curve criticized by most economists in some aspects. As Friedman (1968) argued that in the short-run there may be a trade-off between the inflation and unemployment rate. Lipsey (1960) appraised it in aspect of data and econometric model. In the short-run trade-off between the inflation and unemployment rate is a temporary part of the adjustment process of the expectations to the reality. However, in the long-run, there is no trade-off between them. Friedman says that monetary policy cannot peg the rate of unemployment for more than very limited periods (Friedman, 1968, p.5)

Also natural rate of unemployment and real wage were defined by Friedman and other economists, they suggest that the only long-run equilibrium position is at the level of natural rate of unemployment.

Phillips Curve contains a basic defect- the failure to distinguish between nominal and real wages. For example when the monetary authority tries to peg the market rate of unemployment at a level below the natural rate,

if the authority increases the rate of monetary growth, this will be expansionary. Initial effects are that much or most of the rise in income will take the form of an increase in output and employment rather than in price. But even though the higher rate of monetary growth continues, the rise in real wages will reserve the decline in unemployment and then lead to a rise which will tend to return unemployment to its former level. Hence in order to keep unemployment at level below natural rate, the monetary authority would have to raise monetary growth still more. Thus, the only way the unemployment can be reduced below the natural rate is only by more inflation which implies accelerating inflation.

2. THE EARLY PHILLIPS CURVE

The Phillips Curve began as the result of an empirical investigation of UK wage behaviour by Phillips (1958) was extended and put into a theoretical disequilibrium context by Lipsey (1960) and was applied to the US and set in a policy context by Samuelson and Solow (1960).

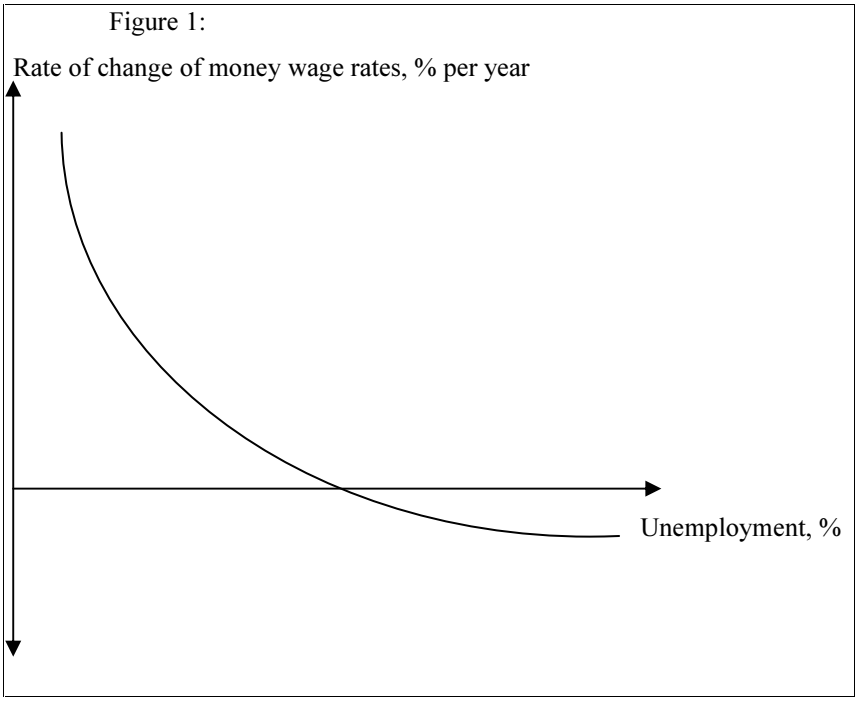
As a simply Phillips Curve is a graph first devised by A. W. Phillips showing the trade-off between unemployment and inflation, in modern mainstream macroeconomics; the downward sloping trade-off. Phillips Curve is generally held to be valid only in the short-run. In the long-run, the Phillips Curve is usually thought to be vertical at the natural rate of unemployment.

Professor Phillips has advanced the hypothesis that the percentage rate of change of money wage rates in the UK(W) can be explained to a very large extent by: i) the percentage of the labor force employed (U) and ii) the rate of change of unemployment (Ü). The principle of this hypothesis is that when the demand for good and service is high, relatively to the supply of it, we expect the price to raise, the rate of rise being greater the greater the excess demand. Conversely when the demand is low relatively to the supply we expect the price to fall, the rate of fall being greater the greater the deficiency of demand (Phillips, 1958, p.283).

This principle operates as one at the factors determining the rate of change of money wage rates, which are the price of labor services. Second factor influencing the rate of change of money wage rates might be the rate of change of the demand for labor and so of unemployment. A third factor which may affect the rates of change of retail prices operating through cost of living adjustments in wage rates.

The Phillips Curve as shown as in figure 1 established a negative relationship between the rate of change of wage rates and the percentage unemployment for the years 1861-1913.

Figure 1:



Phillips divided the whole periods into three stages which are 1861-1913, 1913-1948, 1948-1957, to see whether statistical evidence supports the hypothesis that the rate of change of money wage rates in the UK can be explained by the level of unemployment and the rate of change of unemployment (Phillips, 1958).

Phillips gives some statistical evidence to support his hypothesis that the rate of change of money wage rates can be explained by the level of unemployment and the rate of change of unemployment, except in or immediately after those years in which there is sufficiently rapid rise in import prices to offset the tendency for increasing productivity to reduce the cost of living.

3. PHILLIPS' CONTRIBUTION

Phillips did not describe the construction of the curve which is called with his name until 1958. Though he had used the same relationship between inflation and unemployment without discussion in his earlier work on the stabilisation of dynamic system, most economists such as Fisher (1926), Timbergen (1933), Klein and Goldberger (1955), Brown (1955), worked on this relationship. Also Dunlop (1938) had rejected the dependence of wage inflation on unemployment long before Phillips' article had been written. Hence, Phillips might have never

written his article in 1958 which provided statistical support for the existing of a stable trade-off between the rate of change of money wage and the level of unemployment, if he had made even a tentative foray into the already extensive literature. (Summer, 1984).

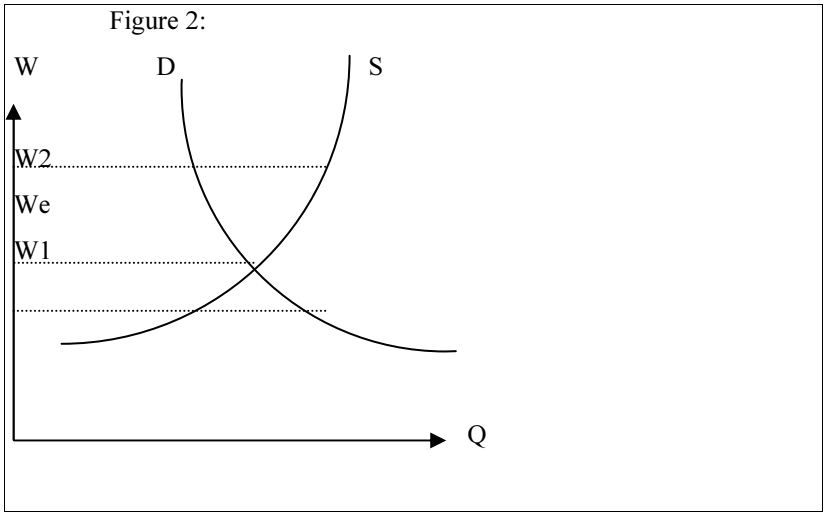
But although many of Phillips' subsidiary hypotheses are rejected, the data are shown to support Phillips' main contention that there is a significant relationship between the rate of change of money wage rates and the level and the rate of change of unemployment (Lipsey, 1960). The theoretical foundation of Phillips Curve was simply the hypothesis that the price of a commodity changes at rate determined by excess demand for it. The labor market was selected for analysis because the unemployment rate is a readily observable proxy for excess demand, but this relationship was casually asserted without elaboration.

4. THEORITICAL UNDERPINNING = EXCESS DEMAND

The theoretical foundations of Phillips Curve were rather sketchy. But Lipsey (1960) developed its theoretical explanation of the inverse relationship. Phillips' own explanation is that given a stable rate of change of labor productivity and the absence of sizable import price fluctuations, money wages raise more rapidly the greater the amount of excess demand in the labor market. Lipsey who attempts to explain with Phillips why the Phillips Curve should have a negative slope concentrated on the level of excess demand in the labor market at any time.

The usual argument merely states that when there is excess demand as shown in figure 2, wage rate will rise, while when there is excess supply, wage rates will fall.

Figure 2:



Nothing is said about the speed at which the adjustment takes place. The commonly-accepted law of demand on supply states that the rate of price change is proportional to excess demand. Thus Lipsey expresses the labor market dynamics as $w = \alpha ((d-s) /s)$, where w equals to the rate of change in the money wage, d and s are the demand and supply for labor respectively and $\alpha > 0$ is the adjustment parameter. This relationship which says that the speed at which wages change depends on the excess demand as a proportion of the labor force might be non-linear, indicating that w increased at either an increasing or a decreasing rate as excess demand increased. Lipsey notes data on excess demand are unavailable, requiring the use of proxy.

Higher levels of excess demand are associated with faster rates of change of money wage rates. Thus, excess demand in labor market will be signalled by a fall in unemployment rate and will push up the rate of increase in money wage which in turn push up the rate of price inflation.

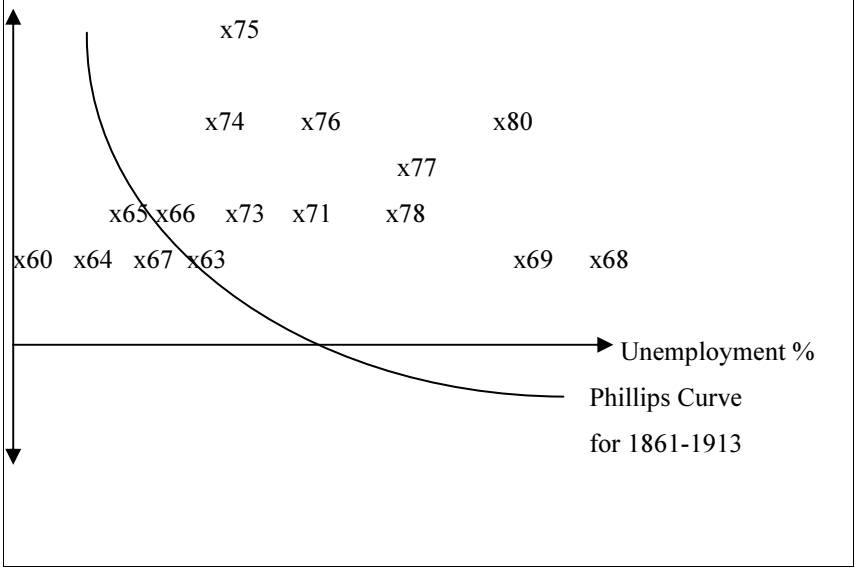
When labor supply equals demand, the employment rate will be positive with frictional and structural unemployment at non-zero levels, when demand exceeds supply, the unemployment rate falls and when supply exceeds demand, the unemployment rates rise. Thus, unemployment should be negatively related to w, it must be true that the unemployment rate is negatively related to w. Thus, this explanation given by Lipsey supports that the Phillips Curve has a negative slope.

5. EXPECTATION – AUGMENTED

The original Phillips Curve equation gave way to the expectation-augmented version in the late 1960s. The economics profession was slow to appreciate the implications of elementary theory for the Phillips Curve. Shortly before the collapse of the original Phillips Curve and of its relative became apparent. Phelps (1967) and Friedman (1966, 1968) independently resolved the Phillips Curve trade-off.

Friedman was the first to state clearly that "There is no long-run trade-off between inflation and unemployment." Figure 3 shows that the Phillips Curve has not been a stable relationship; over the last fifteen years, inflation and unemployment have both shown a market secular increase. Also although the level of inflation and unemployment of some industrialised economies have remained below British rates, they have displayed a similar tendency.

Figure 3: The Phillips Curve Relation in the UK, 1960-81



Friedman and Phelps denied the existence of a permanent trade-off between inflation and unemployment with new theoretical work and argued that Phillips Curve did not represent a stable long-run relationship that could be used by policy makers.

Friedman's labor market analysis is that both the demand for and supply of labor depended on the real wage rather than on the nominal wage. Since the nominal wage was evaluated by employers in terms of the current actual product price and by workers in term of the expected average consumer price level, employment could increase only as long as the expected price level lagged behind the actual level. In equilibrium the expected and actual price level were equal and so in equilibrium only one level of employment rate as the natural rate of unemployment (Gordon, 1976).

The essence of Friedman's analysis is a modification of $w = f(u) + p^e$,

This becomes:

$w = f(U) + P^e$, where P^e is the expected rate of change of price.

When the actual and expected rates of price change are zero, unit labor costs are constant and nominal and real wage are increasing at the rate of productivity growth (q). If there is a demand expansion which reduces unemployment and increases the rate of wage inflation, the economy move from point A to B as wages rise as shown in figure 4. So price will start to rise as result of unit labor cost is no longer constant.

With prices rising (at rate x-q) the expectations of price stability embodied in the short-run Phillips Curve must sooner or later be revised. When the expectations have adjusted fully to this experience of inflation, the relevant Phillips Curve will be upwards by the change in the expected inflation arte. When the unemployment rate below Uo, wages will rise at a rate in excess of x percent and process of adjustment to changed experience will be repeated. The Phillips Curve will continue to shift vertically upwards as log as unemployment remains below Uo and the actual inflation rate will continue to increase, dropping the anticipated rate upwards with it.

The analysis of the Phillips Curve with inflationary expectations suggest that under the assumptions that the prices are set as a mark-up on wages and that productivity change is zero and there is money illusion.

Expectations-augmented Phillips Curve is shown as the following by adding expectations of inflation to the Phillips Curve:

$$W = f(U) + \alpha P^e \; ; \; P = E(P'/P)$$

In the Friedman-Phelps analysis of the long-run, defined as the period over which expectations are fulfilled, the absence of money illusion implies $\alpha = 1$, in which given arte of unemployment, workers completely adjust their money wage to compensate for expected inflation and so there is no possibility of trading-off unemployment against inflation. As long as the evidence continues to show $0 < \alpha < 1$ which implies that workers only partially adjust their money wage, aggregate demand can be managed so as to maintain the authorities preferred position on the steep, but not vertical long-run trade-off. The original Phillips Curve relationship did not contain the αP term, since it was based on the implicit assumption of a zero expected rate of inflation.

6. THE NATURAL RATE OF UNEMPLOYMENT

Unemployment is the state of searching for a job while not having one. Unemployment always is positive because of market frictions and structural change. There will be unemployment even when economy is in general equilibrium, defined as the absence of excess demand in each market or as the realization of all expectations. The equilibrium rate of unemployment, commonly called the natural rate is determined by real phenomena such as market frictions, real income, tax rates and unemployment compensation.

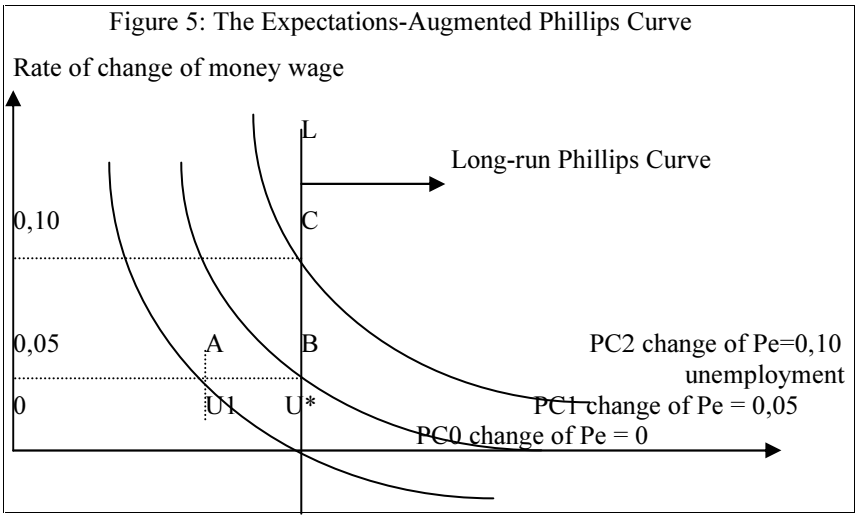
The fundamental idea of the natural rate hypothesis is that the natural rate of unemployment is a real phenomena determined by other real phenomena. Purely nominal forces such as anticipated inflation can not change the natural rate. The implication for Phillips Curve analysis is most striking. According to natural rate hypothesis,

there is no long-run trade-off between inflation and unemployment since real economic variables tend to be independent of nominal ones in steady-state equilibrium. Trade-offs may exist in the short-run. In the long-run when inflationary surprises disappear and expectations are realized such that wages re-establish their pre-existing levels relative to product prices. Unemployment returns to its natural equilibrium rate. This rate is compatible with all fully anticipated steady-state rates of inflation, implying that the long-run Phillips Curve is a vertical line at the natural rate of unemployment

$P - P^e = a (U_N - U)$ states that the trade-off is between unexpected inflation and unemployment. This equation shows that inflation-unemployment trade-off cannot exist when inflation is fully anticipated.

Friedman (1968) proceeded to argue that the expectations-augmented Phillips Curve would shift in such a way that in the long-run a higher rate of inflation would result in no change in unemployment. This argument is illustrated in figure 5 (Levacic, 1989, p.344).

Figure 5: The Expectations-Augmented Phillips Curve



Suppose the economy is initially at the rate of unemployment U* with zero inflation and constant real and money wages. We are simplifying by assuming no growth in labor productivity. The short-run Phillips Curve for a zero rate of expected inflation is Pco. Suppose the monetary authority or government which has been told that there is a trade-off between unemployment and inflation raises the rate of inflation to 5% by expansionary policies which increase the money supply. An expansionary demand policy to keep the economy at point A of the short-run Phillips Curve PCo will lead to an increase in the demand for goods and services then employers anticipating higher prices for their goods, increase their demand for labor. This excess demand for labor causes the money

wages to rise by 5%, unemployed workers, interpret this as an increase in real wage because of zero inflation expectation.

According to the standard interpretation of the Phillips Curve which is static in nature rate, the economy would move along curve Pco until unemployment fell U1 at point A when the economy would stop. Thus there would be more inflation and less unemployment, a clear trade-off.

In the neo-classical interpretation of the Phillips relationship, this occurs only because the inflation is unanticipated. Since demand has increased, firms start raising prices and bidding up the money wage rate to attract more labor, because workers expectations of inflation are below the actual rate of inflation, they think that the higher money wage now being offered means that real wages have risen. The supply of labor therefore increases.

According to Friedman's dynamic view, however, as soon as inflation begins to rise, people begin adjusting their expectation of it, causing the Phillips Curve to shift upward. As expectations adjust towards the actual rate of inflation, workers realise that real wages are lower than they had anticipated and therefore require a more rapid increase in the money wage rate and when this realised the newly employed workers will no longer to remain in their jobs. So that unemployment will rise back to U*. Thus the economy would begin moving out along the initial Phillips Curve Pco, but at the same time the Phillips Curve itself would begin shifting up from Pco because of the expected rate of inflation is rising.

Ultimately, once inflation has reached its final level 5% and expected inflation has fully adjusted to this new higher rate of inflation. Unemployment is back at its natural rate U* and the economy is now at point B, on the new short-run Phillips Curve, PC.

The idea that there is no way in which the rate of unemployment can be permanently held at a different level to the natural rate of unemployment is known as the natural rate hypothesis. Another way of stating the same point is that the long-run Phillips Curve is vertical.

7. THE ACCELERATIONIST HYPOTHESIS

A corollary of the natural rate hypothesis, mentioned by Friedman but first demonstrated by Phelps, is the accelerations hypothesis. This hypothesis states that since there exists no long-run trade-off between unemployment and inflation, attempt to peg the former variable below its natural level must produce ever-increasing inflation (Humphrey, 1985). If the raising the rate of inflation once and for all only lowers the unemployment rate temporarily, than the only way to keep the unemployment rate permanently below the natural rate is by continuously increasing the rate of inflation by accelerating prices.

If the government wishes to maintain unemployment below its natural level, then it has to make sure that price expectations do not catch up with actual inflation. In other words the government has to make sure that the newly employed do not appreciate the full neutralizing effect of inflation on their money wage increase. In the next time period, hence, the government must increase the money supply and raise aggregate demand so that wages increase by more than the expected inflation of 5%.

Since the adjustment of expected to actual inflation works to restore unemployment to its natural equilibrium level U* at any steady rate of inflation, the authorities must continuously raise (accelerate) the inflation rate, if they wish to peg unemployment at some arbitrarily low level such as U1 in figure 5. As monetary authority tries to reduce unemployment, Phillips Curve and its policy fail. The monetary authority now tries to get to U1 by raising inflation to 10%. This policy fails, too, for expectations adjust again. The Phillips Curve shifts out to PC2 and economy eventually moves to point C as shown in figure 5. Each time the monetary authority raise the inflation rate, it buys a temporary decrease in unemployment. To make this decrease permanent, the authority must increase continuously the rate of inflation.

The authorities could either peg unemployment or stabilize the arte of inflation, but not both. If they pegged unemployment, they would lose control of the rate of inflation, because the latter accelerates when unemployment is held below its natural level. Alternatively, if they stabilized the inflation, they would lose control of unemployment since the latter returns to its natural level at any steady rate of inflation. Thus, contrary to the original Phillips hypothesis, they could not peg unemployment at a given constant rate of inflation. The expectations-augmented Phillips Curve therefore presents the authorities with rather painful policy choices.

8. RATIONAL EXPECTATIONS

The recent theoretical work on the unemployment-inflation trade-off concludes with very strong policy implications. First, a policy of inflationary expansion to reduce unemployment below some equilibrium level U*, will ultimately be accomplished only at the cost of increasing inflation and continuous disequilibrium. Second, in the long-run, there is no trade-off.

The rational expectations hypothesis is a new alternative method for modelling expectations formation which implies that agents base their expectations on all the relevant information available to them including the economic theory. A criticism of the adaptive-expectations hypothesis is that it assumes people keep basing their expectations on the value of lagged variables and fail to learn from their past error. This error is repeated on so is called systematic. But according to the rational expectations

hypothesis, people will tend to exploit all available, permanent information about the inflationary process when making their price forecasts and do not make systematic mistakes in the sense that as soon as individuals see the government increase the money supply, they anticipate the price inflation and immediately revise their wages upward and price expectations. If true, this means that forecasting errors ultimately could arise only from random shocks occurring to the economy.

Price forecasting errors might also arise, because individuals initially pose limited or incomplete information about an unprecedented new policy regime, economic structure or inflation generating mechanism.

As incorporated in natural rate Phillips Curve models the rational expectations hypothesis implies that price expectations would always be correct and economy would always be at its long-run steady-state equilibrium (Humphrey, 1985, p.17). If all rational policy actions by government are anticipated, so that price expectations no longer lag behind inflation.

The application of rational expectations therefore leads to the conclusion that there is not even a short-run trade-off between inflation and unemployment. The government can only secure a short-run decrease in unemployment, if it makes surprise increases in the money supply (Levaci, 1989, p.353). Under the rational expectations, systematic policy can not induce the expectation errors that generate short-run Phillips Curve. Systematic monetary policy can not affect real variables (Seater, 1978). To have an impact on output and unemployment the authorities must be able to create a divergence between actual and expected inflation. This follows from the proposition that inflation influences real variables only when it is unanticipated.

Although the instantaneous rate of adjustment derived from the full-information application of rational expectations may seem unrealistic, its basis, that people will make use of all the available information when forming expectations and not make correctable error.

9. CONCLUSION

Inflation trade-off suggested that by expectations-augmented Phillips Curve has been subject to much criticism, not only by Keynesian economists who reject the idea that demand management is only able to affect the real variables of output and unemployment in the short-run. But there also have been a number of area in which monetarist view of inflation embodied in the vertical Phillips Curve has been challenged.

The Phillips Curve concept has changed radically over the past 25 years as the notion of a stable enduring trade-off has given way to the policy ineffectiveness view that no such trade-off exist

for the policy makers to exploit. Although much of the early empirical literature is weak because of inadequate data, methodological problems, sensitivity of estimating techniques, the evidence for a short-run trade-off is mixed. Some economists tested the hypothesis that the relationship between unemployment and the rate of change of money wages is only temporary.

Interest has cantered on the value of the price expectations adjustment coefficient (α) in determining whether or not the long-run Phillips Curve is vertical. The absence of a long-run trade-off requires that $\alpha = 1$, as earlier studies such as Lipsey's tented to produce value of α well below 1, indicating a long-run trade-off later studies in corporate adaptive expectations.

The existence and nature of a trade-off between inflation and unemployment is still an open issue. It seems to exist a great debate on this relationship. As on the negative side, natural rate and rational expectations hypothesis imply that systematic demand management policies are incapable of influencing real activity, contrary to the predictions of the original Phillips Curve analysis, on the positive side, these two hypothesis do imply that the government can contribute to economic stability by policies to minimize the expectational errors that cause output and unemployment to deviate from their normal full-capacity level.

As in most areas of economics, judgements about empirical evidence are coloured by their policy implications. Those who accept the lock of any trade-off have used it to support quite divergent policy conclusion. For neo-classical and monetarist economists it implies the futility of active, discretionary stabilization policy while some Keynesians say that the government can expand demand and so increase output without incurring any more inflation of all that implies a horizontal Phillips Curve with the absence of any connection between excess demand and inflation, less extreme Keynesians such as Tobin, maintain that price-adjustment lags give rise to some long-run trade-off which can be exploited by active government policy in order to improve the trade-off.

After all these explanations, my overall view are that the Phillips Curve was simply a set of observations in search of an explanation.

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