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The origins of the Phillips Curve

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1. Introduction

The Phillips curve in its various guises promotes a relationship between these macroeconomic aggregates and raises the question of the existence and nature of a trade-off between nominal and real economic outcomes. It has sometimes been cast as an empirical correlation upon which a theoretical edifice was built (Lipsey, 1978; Sawyer, 1983).¹

Sawyer (1989: 100) says, “it could be said that the discussion of inflation has been dominated by the notion of the Phillips curve, even if there were several notions of Phillips curve which were sometimes loosely related to the original concept of Phillips.” Tobin (1972: 4) considers Phillips 1958 article to be “probably the most influential macro-economic paper of the last quarter century”. Richard Lipsey (1978: 51) recalls that it was Samuelson who “coined the phrase ‘the Phillips curve’ to describe the relationship between price inflation and the unemployment rate in his “extremely influential text”.

The Phillips is, of-course, A.W. Phillips who in his 1958 *Economica* publication established a relationship between nominal wages growth and the unemployment rate. Paul Samuelson and Robert Solow (1960) were the first to explicitly build on Phillips’s 1958 work and discuss the relationship in terms of a trade-off between price inflation and the unemployment rate. There has been an industry within economic modelling and policy analysis built on these beginnings. What is curious is why it was this paper that spawned such activity given the well-established theoretical and empirical modelling of this relationship prior to Phillips’s 1958 publication (Sawyer, 1989; Leeson, 1998).

At the outset, we should be cautious with the terminology. It is typical to refer to the Phillips curve in terms of a trade-off between inflation and unemployment (for example, Gordon, 1984). In terms of modelling the reference is highly misleading. There is not a structural relationship specified in terms of a trade-off between the change in the price level and the unemployment (rate) level in any reasonable macroeconomic model. In fact, as Klein (1985: 151) says “it is the parametric relationship between two reduced form expressions – one for the rate of change of price and one for unemployment, each of which are endogenous variables in a complete system.” If the arguments in the structural relations are the same – specified in terms of initial conditions and exogenous history – then there is an implicit relationship between the two endogenous variables. Klein (1985: 151) concludes, “this is the trade-off relation between price change and unemployment.”² In this sense, the trade-off summarises the interaction of several factors within

the system. This also makes it difficult attempt to explain the Phillips curve as an optimising function. We will return to this issue presently.

The usual understanding of the relationship between inflation and unemployment, as presented in the textbooks (for example, Gordon, 1984; McTaggart, Findlay, and Parkin, 1996), ignores the long history of discussion of the relationship. The influential textbooks of the 1960s, like Samuelson's 1964 sixth edition of *Economics: An Introductory Analysis*, and Richard Lipsey's 1963 *An Introduction to Positive Economic Science*, established the Phillips curve as the centrepiece of macroeconomic policy analysis. But in doing so they stylised the relationship and blurred its history.³ In their zeal to pronounce that the neoclassical synthesis represented an end to ideological division in economics, the textbooks not only obscured critical developments in inflation-unemployment analysis but also left the door open for the subsequent monetarist takeover. Economies and economics to this day are still suffering from the policy reversals that accompanied monetarism in the 1970s.

In this paper, three interrelated issues are discussed. First, was the Phillips curve pre-Keynesian? What relevance is the literature on the relationship between inflation and unemployment, which was, published prior to Phillips (1958)? Second, we examine that the work prior to Phillips (1958) linking wage and price adjustment, which certainly considered inflationary expectations to be important. Further, in this period there was significant research published which considered that the relationship between the change in money wages (prices) and the unemployment rate was not stable over a long time period. The stability properties that Phillips (1958) claimed became the foundation of macroeconomic policy in the 1960s. The two strands of research lead naturally to a consideration of the Friedman-Phelps expectations-augmented Phillips curve, which played on the lack of an expectations term and the assumed stability of Phillips' own model. Third, is it valid to see the expectations-augmented Phillips curve, as represented in the textbooks, as a development of the work of Phillips (1958)? What was the basis of the Monetarist resurgence in the late 1960s? The textbook history of the Phillips curve usually develops five sequential versions of the relationship (Humphrey, 1985). The lack of context and history in the textbook treatment leaves it open for one to interpret the sequence as representing a paradigm with increasing theoretical and empirical content. This chapter argues that there is no such sequence. The expectations-augmented Phillips curve, in fact, represented a paradigmatic change to pre-Keynesian thinking. It also did not fully embrace the richness of pre-Keynesian discussion on the relationship between price changes and the unemployment rate. Sawyer (1989: 105) says, "there

are several distinct (and sometimes contradictory) meanings which have been attached to the term Phillips curve.”

The five models usually included in the textbook sequence are (for example, Frisch, 1983; Gordon, 1984; Wells, 1995; McTaggart, Findlay, and Parkin, 1986):

1. A model of the relationship between the change in nominal wages and the unemployment rate where excess demand in the labour market drives the price variable changes (Phillips, 1958).
2. With fixed markups over costs, the change in prices can replace the change in wages. This was the model first published by Solow and Samuelson (1960) and provided the policy menu trade-off between inflation and unemployment.
3. A range of shift-variables can be added to either model. Various variables were added to the models including trade union bargaining power and strike activity, past price inflation, unemployment dispersion, and demographic factors (for example, Hines, 1964).
4. The biggest development was seen to be the expectations-augmented Phillips curve of Friedman (1968) and Phelps (1967, 1968). This model had major policy implications and spearheaded the resurgence of pre-Keynesian macroeconomic thinking in the form of Monetarism. The concept of the natural rate of unemployment (NRU) became central to the idea that the trade-off between inflation and unemployment captured in the Phillips curve was in fact a trade-off between unemployment and unexpected inflation. Once expectations are realised as workers gain more information the trade-off vanishes. At this point there is only one unemployment rate consistent with stable inflation – the NRU.
5. The expectations-augmented Phillips curve led to the New Classical representation, which presumes that the labour market is continuously in equilibrium. The discrepancies between the actual unemployment rate and the NRU are exclusively due to misperceptions of the actual inflation rate. When expectations are realised the economy is always at the NRU and any unemployment is chosen. Combined with the assumption that expectations are formed in a rational manner (Muth, 1961), then misperceptions are only random variables. Thus, tradeoffs that are observed arise because of random shocks to the system, which are beyond the scope of policy (for example, Lucas, 1972; Sargent, 1973)

It is possible to conceive of a further development in the form of New Keynesian Macroeconomics, which emphasise “microfoundations of imperfectly competitive labour markets and product markets” (Carlin and Soskice, 1990: vi) and introduces hysteresis and feedback effects. However, in terms of the popular textbooks, this development, while welcome, has not yet become standard fare.

In terms of what we might call the “textbook treatment of inflation and unemployment” - Models 4 and 5 outlined above represent a major theoretical break from the previous three versions of the Phillips curve. The former conceptions are based on a disequilibrium notion of the relationship between inflation and unemployment in that they model the adjustment of prices and wages to some labour market imbalance between supply and demand. The causality is strictly from the labour market disequilibrium to the price adjustment function. There is no presumption that full employment is inevitable or a tendency of a capitalist monetary economy.

The Friedman-Phelps story and the later developments under the rubric of rational expectations and the New Classical School represent a major break from the previous depiction of the relationship because it is based on a market clearing relation. The causality is reversed. Unemployment is considered to be voluntary and the outcome of optimising choices by individuals between work (bad) and leisure (good). Full employment is assumed to prevail (with unemployment at the natural rate) unless there are errors in interpreting price signals. The tendency is always to restore full employment by market mechanisms. There is no discretionary role for aggregate demand management.

It is thus misleading to see these models as part of a continuous development of theory supported, in part, by empirical analysis. We argue in this Chapter that the conception, which underpinned Phillips (1958) publication, was paradigmatically different to the conception that underpinned the Friedman (1968) and Phelps (1968) publications. Far from being an augmentation of the Phillips curve, the Friedman Natural Rate of Unemployment (NRU) and inflation models were part of an on-going attempt to resurrect the neoclassical free market paradigm, which had fallen into discredit during the Great Depression. The natural rate version of the Phillips curve is traced back to Irving Fisher who was a prominent and influential exponent in this century of the neoclassical paradigm.

The paper is set out as follows. Section 2 considers the pre-Keynesian origins of the Phillips curve and discusses some of the historical contributions of the English classical economists and

their contemporaries up to Irving Fisher. The aim is to assess the extent to which the insights contained in Phillips (1958) and the subsequent textbook depictions of the Phillips curve can be labelled pre-Keynesian. Section 3 moves on to consider the contribution of the post WWI 2 econometricians and the pre-1958 Keynesians with the aim of establishing the Keynesian roots of Phillip's work and also to shed light on the stability issue. Section 4 builds on the argument and considers the macroeconomic context that prevailed at the time of the publication of Phillips (1958). The task in this section is to show that the subsequent theoretical permutations of the "Phillips curve" presented in textbooks were in fact a reversion to the pre-Keynesian period and cannot be considered a paradigmatic development, in the sense of adding knowledge to a particular paradigm. The final section 5 in the light of the discussion considers why the Phillips curve has been so influential. Concluding remarks follow.

2. Pre-Keynesian inflation and unemployment theory

2.1 The English classical economists

The background to the writings of the classical economists on inflation and unemployment centred on the convertibility of the note issue into gold, which was suspended in 1794 at the outset of the Napoleonic War and did not resume until 1819-1821. The intervening period of inconvertible paper was marked initially by rampant inflation. Subsequently, in the period between 1814-16, many country banks in England failed and this led to a destruction of country-bank paper and a sharp contraction in the money supply. The deflation had harsh effects on the poor and working class and it became worse with the resumption of cash payments (at the gold parity, which existed prior to the suspension). A fierce debate followed and the role of the Bank of England became a major issue (see O'Brien, 1975: Chapter 6).

O'Brien (1975: 162) says, "very few Classical writers ... were prepared to argue that changes in the stock ... [of money] ... did not affect the level of activity, although there were several versions of the way in which money achieved its effects." O'Brien traces the Classical thinking back to the pre-Classical writers like Cantillon, Potter and Law. The major statement of what we might now call the relationship between inflation and unemployment came, however, from David Hume.

David Hume

In 1752, Scottish economist David Hume wrote an essay entitled “Of Money” which subsequently was reprinted in “Writings on Economics” (1955). His most explicit statement of the link between money, inflation and real activity is as follows (1955: 37-40)

... though the high price of commodities be a necessary consequence of the encrease of gold and silver, yet it follows not immediately upon that encrease; but some time is required before the money circulates through the whole state and makes its effect be felt on all ranks of people. At first, no alteration is perceived; by degrees the price rises, first of one commodity, then of another; till the whole at last reaches a just proportion with the new quantity of specie... In my opinion, it is only in this interval or intermediate situation, between the acquisition of money and rise of prices, that the encreasing quantity of gold and silver is favourable to industry. When any quantity of money is imported into a nation, it is not at first dispersed into many hands, but is confined to the coffers of a few persons, who immediately seek to employ it to advantage. ... they are thereby enabled to employ more workmen than formerly, who never dream of demanding higher wages, but are glad of employment from such good paymasters. If workmen become scarce, the manufacturer gives higher wages, but at first requires an encrease of labour; and this is willingly submitted to by the artisan, who can now eat and drink better, to compensate his additional toil and fatigue. He carries his money to market, where he finds every thing at the same price as formerly, but returns with greater quantity and of better kinds, for the use of his family. The farmer and the gardener, finding, that all their commodities are taken off, apply themselves with alacrity to the raising of more; and at the same time can afford to take better and more cloths from their tradesmen, whose prices is the same as formerly, and their industry only whetted by so much new gain. It is easy to trace the money in its progress through the whole commonwealth; where we shall find, that it must first quicken the diligence of every individual, before it encreases the price of labour.

Accordingly, we find, that in every kingdom, into which money begins to flow in greater abundance than formerly, everything takes a new face: labour and industry gain life; the merchant becomes more enterprising, the manufacturer more diligent and skilful, and even the farmer follows his plough with greater alacrity and attention.

A nation, whose money decreases, is actually at that time, weaker and more miserable than another nation, which possesses no more money, but is on the encreasing hand. ... the workman has not the same employment from the manufacturer and merchant; though he pays the same price for everything in the market. The farmer cannot dispose of his corn and cattle; though he must pay the same rent to his landlord. The poverty, and beggary, and sloth, which must ensue, are easily foreseen

From the whole of this reasoning we may conclude, that it is of no manner of consequence, with regards to the domestic happiness of a state, whether money be in a greater or less quantity. The good policy of the magistrate consists only in keeping it, if possible, still encreasing; because by that means, he keeps alive a spirit of industry in the nation... There is always an interval before matters be adjusted to their new situation; and

this interval is as pernicious to industry, when gold and silver are diminishing, as it is advantageous when these metals are increasing.

The argument is illuminating and is very reminiscent of the later Phillips curve relationship. The expansionary effect begins via a rise in cash balances. There is a presumption that the economy is at less than full employment. The economy, with excess capacity in the labour market, adopts a quantity adjustment to the higher demand. The expansion lowers unemployment but eventually the excess demand in the labour market brings forth costs increases (via money wage increases) and price rises.

Is the trade-off described here transitory or permanent? Further discussion by Hume suggests that his “model” is based on two building blocks. First, disturbances to unemployment (which see it vary from its equilibrium rate) arise from price expectation errors (difference between actual and perceived prices). Second, these price expectation errors can only continue while prices are changing. We can express these ideas in the following way

$$\text{Eqn 1} \quad U = g(p - p^e)$$

$$\text{Eqn 2} \quad (p - p^e) = m \frac{\delta p}{\delta t}$$

where U is the variation in unemployment around its equilibrium value, p is the actual price level, p^e is the expected price level, $\delta p / \delta t$ is the change in the price level over time, m is the price perceptions adjustment coefficient and assumed to be positive (see Humphrey, 1985).

By substitution, the familiar “Phillips curve” form is derived

$$\text{Eqn 3} \quad U = f \frac{\delta p}{\delta t}$$

Hume argued that it was necessary to continuously increase prices to keep unemployment at a desired low level. The continuous rises in the price level were required to create price-forecasting errors, which generate the “trade-off”. In modern parlance, employment can be increased to some high level (low unemployment) as a result of monetary-driven price increases.

Hume’s writings can be easily interpreted in terms that we use today. His trade-off is between unemployment and unexpected changes in prices driven by unexpected changes in money. In a fully realised economy there is no trade-off and in some sense we might consider that to place

Hume in a natural rate world. Further, if there was a once and for all increase in the price level, price expectations would adjust over time to the new actual level. The value of m in Equation (2.2) determines how quickly the expectations adjust. But to continuously achieve the trade-off, monetary authorities, according to Hume, would have to continuously increase the money stock and the price level.⁴

Despite Hume invoking surprise in price increases as a basis for real fluctuations he cannot be seen as providing the reasoning, which forms the basis of Friedman's 1968 model based on adaptive expectations. For Hume, once the monetary authority turned off the tap, inflation would stop accelerating (and the price level would become stationary), and changes in output and employment would cease. Hume clearly did not anticipate the rational expectations literature. The trade-off is possible because price expectations are lagged (implying that $0 < m < 1$) and monetary authorities can continue to drive a gap between the actual and expected price level.

Hume believed that the processes of inflation and deflation were symmetrical. A monetary authority intent on continuous deflation would generate high unemployment. So in the long run the monetary authority can choose a mix of unemployment and inflation that suits its purposes. There is thus a long-run trade-off in this conception (Humphrey, 1985: 19). Nelson (1981: 2) summarised Hume's "Phillips curve" in the following way

Hume was clearly of the opinion that the level of activity would be raised permanently by a steady increase in the quantity of money, prices, and wages. Hume was therefore a believer in a stable, long-run Phillips curve.

This interpretation is at odds with that of Gordon (1976: 191) who claims that Friedman's (1975) statement that monetary expansion could only have temporary effects was "merely restating in dynamic form Hume's original proposition that a monetary expansion could 'excite' real output only temporarily." There is nothing in Hume that indicates that he thought the trade-off was temporary and that employment would fall back to the level that prevailed before the monetary expansion. Further, Hume (in the above quotation) supported the use of inflation as good policy to increase real output and employment.

Henry Thornton

David Hume's analysis of inflation became the standard starting point for the Classical economists (O'Brien, 1975: 163). The debate tended to be about redistribution between creditors and debtors or fixed-income persons. Hume died in 1776 when British economist Henry Thornton

was 16 years of age. In 1802, Thornton wrote his major work entitled *An Enquiry into the Nature and Effects of the Paper Credit of Great Britain 1802*, which was published in modern form in 1939 with an extensive introduction written by Hayek. Hayek suggests that the publication by Thornton marked “a new epoch in the development of monetary theory. ... although ... overshadowed by the greater fame of Ricardo, it has now come to be recognised that in the field of money the main achievement of the classical period is due to Thornton” (Thornton, 1939: 36).

Thornton, in developing a theory of credit, was a forerunner of Keynesian liquidity preference theory (Hayek, 1939: 47). Thornton is what O’Brien (1975: 149) called a moderate bullionist⁵. Thornton disputed the strict concept of a unique stock of currency held by the rigid bullionists because he considered there were other factors, in addition to excess currency, which could lead to a depressed exchange (when the price of gold was higher than its mint price).⁶ The additional factors included bad harvests and remittances to foreign governments who were prosecuting wars on behalf of the England (Thornton, 1939: 156).

However, he gave particular attention in his exposition to the “extraordinary demand for metal” or what he called the internal drain. Thornton (1939: 118-119) realised that large reductions in the issue of Bank of England paper (money notes) were related to downturns in real activity. In periods of depressed exchange, when Ricardo would argue that there was excess currency that had to be reduced, Thornton argued that the contraction could be domestically disastrous. Thornton (1939: Chapter 5) argued that when there was an internal drain operating then note issue should be increased. This was in stark contrast to Ricardo and the rigid bullionists.

Hayek (1939: 49) argues that in Thornton’s penultimate chapter he reaches “the height of his intellectual power ... [and] ... breaks entirely new ground in an attempt to elucidate the effects of a credit expansion in greater detail.” It is this part of his work that Thornton provides an early analysis of the relationship between inflation and unemployment in a credit economy.⁷

He says (1939: 235)

There seems to be only two modes in which we can conceive the additional paper to be disposed of. It may be imagined either, first, to be used in transferring an increased quantity of articles, which it must, in that case, be assumed that the new paper itself has tended to create; or, secondly, in transferring the same articles at a higher price.

In modern parlance, this dichotomy is representative of what Lipsey (1978: 49) refers to as the “prevailing macroeconomic model” of the early fifties. However, Thornton sees an expansion in

terms of a mix of real and nominal effects. Thornton's transmission mechanism linking increased money to employment increases arises

When the Bank of England enlarges its paper, ... favoured persons conceive ... that they have additional ... capital. ... the antecedently idle persons to whom we may suppose the new capital to give employ, are limited in number, ... , therefore ... will set to work labourers, of whom a part will be drawn from other, and, perhaps, no less useful occupations.

Thornton clearly saw the trade-off between rising prices and falling unemployment. In this part of his work, he outlined a model very similar to that captured in Equation (2.3). He argued (1939: 237) that

... that the new circulating medium will, ... create for itself much new employment. ... Let the reader, however, take notice, that it assumes the demand both for goods and labour to become more eager than before. Now, the consequence of this increased eagerness in the demand must, unquestionably, be an enhancement of the price of labour and commodities, which is the very point for which I am contending. ... we seem obliged to admit, that, although additional industry will be one effect of an extraordinary emission of paper, a rise in the cost [i.e., price] of articles will be another. Probably no small part of that industry which is excited by new paper is produced through the enhancement of the cost of commodities.

Further Thornton (1939: 239) says that it has been "admitted that paper possesses the faculty of enlarging the quantity of commodities by giving life to some new industry." In other words, he saw that monetary growth could stimulate real activity including employment. But it is not the level of money that is important. Rather, Thornton is consistent with Hume and focuses on the stimulatory effects of changes in money and prices. He makes this point in several places. He (1939: 242) says, "... the effect produced by paper credit on the price of articles depends not merely on the quantity of paper in existence, but ... on the rapidity of its circulation." And in a later passage, Thornton (1939: 256) confirms this point

It is the progressive augmentation of bank paper, and not the magnitude of its existing amount, which gives the relief. It thus appears, that the moderation and forbearance among borrowers, which were supposed likely to restrain the too great emission of paper, are only to be excited by the means of its perpetual encrease ... (see also Humphrey, 1985: 19)

So the trade-off is driven symmetrically by continuous growth in money, pushing inflation and exploiting the Phillips curve. The split between the rate of real and nominal expansion, which results, was discussed but not analytically derived. Thornton, though, was not in a reverse-L shaped supply world.

How does the trade-off work? It is somewhat unclear from Thornton's writings about the way in which the higher prices drove higher output. There is scant reference to the labour market and no reference to the way in which the trade-off would endure. Humphrey (1986: 19) says

As for the tradeoff's source, Thornton attributed it chiefly to a tendency for money wages to consistently lag behind prices. He explicitly stated (1) that inflation stimulates activity, (2) that it does so by reducing real wages and raising real profits, (3) that this output-enhancing redistribution occurs because money wages lag behind prices, and (4) that this wage lag persists as long as inflation is sustained.

Humphrey, however, takes some liberty with his interpretation of Thornton trade-off dynamics. There is no labour market theory in Thornton. He traces the trade-off via the reaction of entrepreneurs to the rising prices. There is some inconsistency in Thornton's analysis as to whether the money wage rises or not. Thornton (1939: 237) says

the consequence of this increased eagerness in the demand, must, unquestionably, be an enhancement of the price of labour and commodities, which is the very point for which I am contending."

He suggests that in a climate of rising demand and prices, entrepreneurial activity is (1939: 237) "more than ordinarily profitable." The source of the increased activity is the time lag between purchasing inputs and/or commodities and selling final goods at the higher prices. But later on Thornton says (1939: 239)

It must be also admitted, that, provided we assume an excessive issue of paper to lift up, as it may for a time, the cost of goods though not the price of labour, some augmentation of stock will be the consequence.

It is unclear if money wages rise or not. One could build a labour market model of involuntary unemployment whereby the trade-off mechanics explicitly stated by Thornton (the increase in entrepreneurial activity) with the real wage constant. But Thornton (1939: 239) definitely believes that the real wage falls and the workers suffer a decline in purchasing power as a consequence.

Does Thornton believe the trade-off is permanent? There are two cases to consider: (a) an expansion and then a return to the previous money stock, and (b) an expansion and maintenance of the money stock at the new, higher level. He noted (1939: 239)

... soon, however, as the circulating medium ceases to increase, the extra profit is at an end; and, if we assume the augmented paper to be brought back to its ordinary quantity, we must suppose industry to languish for a time, through the ill success which will appear to attend mercantile transactions.

In other words, there are no enduring real effects if the money stock expands then contracts back to its original level. In this sense, he is not inconsistent with Hume. But he does not discuss the second case in any reasoned terms. If the money stock rises and is then maintained – does the new employment level persist? The answer is that it probably does not. A clue is in his reference to Hume’s work. Thornton (1939: 238) said

Mr. Hume has an observation in his *Essay on Money*, which, in some degree, confirms the remarks, which have been made in the text. Having represented the influx of money as exciting industry... “At first,” he says, “no alteration is perceived; by degrees the price rises first of one commodity, then of another, till the whole, at last, reaches a just proportion with the new quantity of specie which is in the kingdom. In my opinion, it is only this interval or intermediate situation between the acquisition of money and rise of prices that the encreasing quantity of gold and silver is favourable to industry.”

In a footnote to this passage Thornton (1939: 239) says that an increase in money “tends to afford temporary encouragement to industry.” He cites, as an empirical authority, the Mississippi scheme in France. Humphrey (1986: 19) supports this interpretation and argues that for Thornton the increase must be continuous or else the trade-off vanishes. It is not absolutely clear from Thornton’s own writing though that this should be the case.

Another departure from Hume’s analysis is Thornton’s distaste for a policy designed to exploit this temporary trade-off. The loss of purchasing power for workers via real wage cuts and those on fixed incomes leads Thornton to eschew the trade-off as a viable strategy for monetary authorities. Thornton (1939: 239) says

... the labourers ... may be forced by his necessity to consume fewer articles, though he may exercise the same industry. But this saving, as well as any additional one which may arise from a similar defalcation of the revenue of the unproductive members of the society, will be attended with a proportionate hardship and injustice.

Thornton’s policy advice is very clear. The Bank should let the total amount of paper issued (1939: 259)

... vibrate only within certain limits; to afford a slow and cautious extension of it, as the general trade of the kingdom enlarges itself; to allow of some special, though temporary, encrease in the event of any extraordinary alarm or difficulty, ... To suffer either the solicitations of merchants, or the wishes of government, to determine the measure of the bank issues, is unquestionably to adopt a very false principle of conduct.

Thornton also believed that the trade-off between output (employment) and inflation, if exploited, would be relatively small. In modern parlance he saw a steep Phillips curve. Thornton said (1939:

239) that while it is true that a growth in money will stimulate real activity (“giving life to new industry”), “the increase of industry will by no means keep pace with the augmentation of paper” as prices continue to rise.

The lack of a labour market model, particularly on the supply side, incorporating the way in which workers formulate their supply decisions means that Thornton did not anticipate the expectations-augmented Phillips curve developments. He is completely silent on why the workers would continue to supply more labour as they faced continuous real wage declines. Perhaps, he did not work through all the temporal considerations of this idea because he was opposed to the policy approach and did not see it as a practical alternative. In fact Thornton says (1939: 243) that the “directors of the bank have never augmented their notes in such a degree as to be likely to produce any material alteration in the general price of goods.”

Thomas Attwood

Neither Hume nor Thornton were an “unambiguous inflationist”(O’Brien, 1975: 164).⁸ However, in contradistinction, Thomas Attwood clearly wanted policy makers to use inflation to increase the level of prices and generate full employment.

Thomas Attwood, a Birmingham banker, recognised a trade-off between inflation and unemployment. His thinking was significantly influenced by the effects of the deflationary strategies of the Bank of England after the Napoleonic Wars as they sought to resume specie payments. He became a central figure in the opposition to the attempts by the Bank of England to bring the currency notes back to parity with gold at the expense of economic activity (Fetter, 1964). The Bank was trying to resume specie payments after the 1797 suspension. The suspension followed a run on specie as the public panicked early in the wars against the French.

Attwood was a monetary heretic in his times. He stood for inflationary policies because he saw they were the means to full employment. He is thus firmly in the tradition of modern economists who saw a long-run trade-off between inflation and unemployment and who may weight the costs of unemployment higher than the costs of inflation. The harsh deflationary policies adopted by the Bank of England in 1815 and 1816 saw many brass and iron workers in the Birmingham area, who were largely occupied in the armaments industry, lose their employment. Attwood stood out from the contemporary opposition to the deflation because he was not concerned with the distributional consequences (Fetter, 1964: xiii). Fetter (1964: xiv) says that

Attwood opposed deflation because of its “effect upon the willingness of business men to expand operations, to assume financial commitments, to hire labour. ... He believed that employer and employee alike were suffering from a lack of purchasing power to buy their products at remunerative prices. Unlike those who thought of heavy taxes as aggravating the problem of a falling price for debtors, Attwood thought of reduction of taxes as contributing to the distress, by curtailing government spending and hence reducing aggregate demand.

Attwood ‘s goal was full employment. His causal model is simple. A deflationary policy aimed at reducing prices (especially the reduction of public war expenditure) stops production and exhausts stocks.

Attwood said (1964: 59) that the depression results

in diminishing the general expenditure, until the greater part of the stocks of the country are exhausted, and until the productive industry of the country is so far diminished, as to bear no proportion to the inevitable consumption of the country. ... all classes of the community suffer, except the creditor and the money-holder; ... The rich man suffers from the difficulty of discharging his debts, and from necessity of discharging his servants, and of curtailing his expenditure in every way; and the poor man suffers more cruelly, by the consequent diminution of his wages and of his bread.

Attwood continues to outline a model of cumulative expenditure effects similar to what we think of as the multiplier. He argues that the wealth of the community is based not on money but on property (real production), money being (1964: 62) merely an invention to facilitate the exchanges of property; and is of no other use than that of effecting and promoting those exchanges.” He is somewhat contradictory in this part of his argument because he recognises the motives for holding money are to reduce uncertainty about the future, a centrepiece of Keynesian economics. While he sees the holding of money balances independent of transactions motives, as a (1964: 62) “diseased action of the mind”, he is (1964: 62) not “surprised that they should seek to relieve themselves by exchanging their property for money.” This is because Attwood recognises holding property (real stocks and the like) “subjects the holders to losses and danger.”

The solution was outlined clearly by Attwood in *The Remedy*, where he (1964: 9) says

... the natural remedy for a country to have recourse to, whose eyes are open to its own interests, is a forced creation of additional currency. After awhile, when the general consumption and prosperity of the country shall have been restored, such additional currency may be withdrawn gradually, without injury or inconvenience.

This statement clearly distinguishes Attwood’s understanding of the process from Hume and Thornton. Unlike Hume and Thornton, Attwood expressed the trade-off in terms of levels of unemployment and prices (or deviations from normal values) (Humphrey, 1985). This is clear

because both Thornton and Hume argued that a reduction in the growth of money would plunge the economy back into depression. For Attwood it is high prices (not price changes) that leads to low unemployment. The exact way in which the trade-off between price levels and unemployment work in Attwood's writings is not entirely clear. The mechanics of his expansion is the fall in value of money as the price level rises. Attwood (1964: 62-63) says

Money may fall in value, and in so doing will contribute to the prosperity of the country, by exciting and rewarding industry...By expanding the money supply, the public will demand property. Let them be glutted with money. They will then seek property; and the prosperity of the country will be restored. ... Restore the depreciated state of the currency, and you restore the reward of industry, you restore confidence, you restore production, you restore consumption, you restore every thing that constitutes the commercial prosperity of the nation.

So for Attwood it is a real-wealth effect that provides the stimulus. As long as the real value of property rises prosperity (production and employment) rises. But the expansion is also dependent on what we might now call expectations. Attwood places a strong emphasis on public confidence. He argues (1964: 69) that "the depression of prices has produced depression of mind, and both have produced very general impoverishment and distress."

Attwood pushed the inflationist position because he believed that the capitalist system had an inherent tendency to deflation, where falling prices causes stocks of goods to decline and, in turn, engendered pessimistic expectations. A downward spiral of gloom followed and the descent was only interrupted by price rises at the bottom of the trough due to stock shortages (Attwood, 1964: 60-61).

Ricardo was particularly dismissive of Attwood's ideas (Fetter, 1964: xix) and, in part, this was because Attwood was not particularly analytical. Fetter (1964: xviii) proposes that

From 1817 on Attwood had a central theme, that the test of the adequacy of the monetary supply was a state of full employment. But when faced with the necessity of saying what the monetary standard should be, he bobbed around from inconvertible paper, to silver, or to a gold standard at a price of gold that seemed to vary... without logic.

The position taken by Attwood can be expressed in modern terms as an opposition to the proposition that an unfettered market would maintain full employment. This brought him into conflict with John Stuart Mill during the 1820s.⁹

Attwood's position is characterised by the following extract (1964: 47-48)

... and whilst these poor creatures were perishing for want of bread, it would be but a little consolation to them to be told, that they must wait a few years, and then the capitalists of the country would be enable to maintain them through the medium of their private expenses, in the same way as they now maintain them through the medium of Government expenses. What a cruel mockery of sufferings is this! Nothing can feed the labourers, nothing can serve the country, unless it has the effect of creating, or *bringing into action*, an additional quantity of the currency, or circulating medium of the country. Until this object is accomplished... the consumption of the country will not be restored...

In concluding *The Remedy*, Attwood is very explicitly in favour of discretionary policy (1964: 70-71)

... In short, shall we see all the property, and all the active and vital energies of the country laid prostrate at the feet of the monied interest; or shall we use the reason which God has given us, and by one slight movement of the nation, one easy harmless exertion, shake of this ideal pressure, this night-mare of the mind, that paralyzes the sinews of our strength, and weighs heavier upon our hearts than all the terrors of Napoleon's sword?

Mill (1964) was a major critic of the position taken by Hume and Attwood and rejected the idea of a permanent trade-off between inflation and unemployment.¹⁰

John Stuart Mill

Mill approached the inflation-unemployment argument in the context of the discussion of inconvertible paper currencies, which he considers in Book 3, Chapter 13 of *his Principles of Political Economy*,¹¹ although he also broached Attwood's argument in Volume I of his *Dissertations and Discussion*. Mill has been labelled an unoriginal and inconsistent writer who largely followed Ricardo (Schwartz, 1972 debates this view with a critical perspective). On the issue of the inconvertible currencies, Mill (1964: 542-546) said that only a convertible currency could not be issued in excess. Blaug (1977: 200) considers that "This is merely a reproduction of Ricardo's argument, and a very uncritical reproduction at that."

Mill's (1964: 550) main statement on the issue is as follows:

Another of the fallacies from which the advocates of an inconvertible currency derive support, is the notion that an increase of the currency quickens industry. This idea was set afloat by Hume, in his *Essay on Money*, and has had many devoted adherents since; witness the Birmingham currency school, of who Mr. Attwood was at one time the most conspicuous representative. Mr. Attwood maintained that a rise of prices, produced by an increase of paper currency, stimulates every producer to his utmost exertions, and brings

all the capital and labour of the country into complete employment; and that this has invariably happened in all periods of rising prices, when the rise was on a sufficiently great scale. I presume, however, that the inducement which, according to Mr. Attwood, excited this unusual ardour in all persons engaged in production, must have been the expectation of getting more commodities generally, more real wealth, in exchange for the produce of their labour, and not merely more pieces of paper. This expectation, however, must have been, by the very terms of the supposition, disappointed, since, all prices being supposed to rise equally, no one was really better paid for his goods than before.

Mill at this stage believed in a model like Equation 2-1. Mill (1964: 550) says

Those who agree with Mr. Attwood could only succeed in winning people on to these unwonted exertions by a prolongation of what would in fact be a delusion ... that by a rise of money prices, every producer shall always seem to be in the very act of obtaining an increased remuneration which he never, in reality, does obtain ... It calculates on finding the whole world persisting for ever in the belief that more pieces of paper are more riches, and never discovering that, with all their paper, they cannot buy more of anything than they could before.

He differentiates Attwood and Hume by considering the former thought that a general rise in prices would occur and stimulate activity whereas Hume “thought that all commodities would not rise in price simultaneously” (Mill, 1964: 551). According to Mill, Hume thought that the increase would come from a perversion of relative prices, where for a particular seller, the sale price of their commodity would rise relative to the prices of other commodities that they purchase. Mill rejects the stimulatory potential of these inflationary effects because “for every person who thus gains more than usual, there is necessarily some other person who gains less” (Mill, 1964: 551).

Mill’s analysis is deficient because he fails to consider the context in which Attwood was proposing inflation. The tract against Attwood assumes full employment of all resources. Attwood proposed inflationary-motivated growth because he had witnessed the effects of the post-Napoleonic recession on the local Birmingham industry.

There is also some inconsistency in Mill’s writings. In the Principles (1964: 550) Mill says that, in theory, delusion that confusion between nominal and real prices could generate Attwood’s expansion. Yet, in Mill (1865: 79), he says that such a mistake “may create a false opinion of an increase of demand ... [and] ... to an increase in production” (see also Humphrey, 1977). However, Mill (1964: 550) rejects that such an error was ever made “during any of the periods of high prices” that Attwood cites as evidence. Yet, Mill knew that there had been a strong growth

during the Napoleonic Wars. There was no evidence that public armament spending had, as classical theory predicted, “crowded out” private capital investment (O’Brien, 1975).

Mill did not reject, however, that monetary expansion was neutral. He built an argument to show that monetary expansion could have real effects on the gains made by debtors in real terms. After noting that the issuer of the money levies a virtual tax on holders of the notes (with inconvertibility) because of the depreciation in the value of money, Mill (1964: 552) said

But besides the benefits reaped by the issuers, or by others through them, at the expense of the public generally, there is another unjust gain obtained by a larger class, namely those who are under fixed pecuniary obligations. All such persons are freed, by a depreciation of the currency, from a portion of the burden of their debts ... On a superficial view it may be imagined that this is an advantage to industry; since the productive classes are great borrowers, and generally owe larger debts to the unproductive ... than the unproductive owe to them ... It is only thus that a general rise of prices can be a source of benefit to producers and dealers; by diminishing the pressure of their fixed burdens.

Blaug (1977: 200) says

Without making any reference to the existence or nonexistence of idle resources, Mill suddenly introduces a new pro-inflationary argument never contemplated by 18th-century economists; a rise in prices lowers the real value of debt and hence favors debtors against creditors.

The problem is that independent of the source of the extra demand the only way it can translate into a real expansion is if there is unemployment (of labour and capital) existing prior to the monetary increase. For Mill to trace out one mechanism, which provides increased spending and production yet rejects another is inconsistent. The fact is that Mill (1964: 552) had a moral objection to the real debt route – “this might be accounted an advantage, if integrity and good faith were of no importance to the world, and to industry and commerce in particular.”

In his discussion on capital (Book I, Chapter V, Section 2), Mill acknowledged that when there is less than 100 per cent capacity utilisation, “governments may, in various ways ... bring it nearer to that limit ... They can create capital” (Mill, 1964: 65-66). He went on to recognise that government efforts to increase the productive power of capital would tend “to increase the employment for labour” (Mill, 1964: 66).¹² Blaug (1977: 199) also notes that in the sixth edition of the Principles, Mill admitted to the argument of forced saving as a means by which inflation could create capital and increase employment. Blaug (1977:200) summarises

The denial of the doctrine that ‘money stimulates trade’ is therefore allowed to stand side by side with the footnote admission of forced saving and the debtor-creditor argument without any effort at reconciliation.

Humphrey (1977) considers that Mill was a forerunner of the expectations-augmented Phillips curves and the natural rate hypothesis, because he claims that Mill saw misperceptions as the means to gain temporary expansion. It is hard to agree with this interpretation. With all the confusion and inconsistency that Mill displays in this section of his argument aside, his basic objection to the inflationist cause of Attwood is moral. It is hard to imagine that Milton Friedman would concede that the case against using monetary expansion to reduce unemployment only comes down to a moral objection. But, although Mill is inconsistent, he more typically adopts the argument that monetary expansion is undesirable.

Conclusion

This section was motivated by my search for the origins of the Phillips curve and the Monetarist revolution that followed. The relationship between inflation and unemployment was discussed by the Classical economists and there is no common thread leading to the resurgence of Monetarism. Contrary to some opinion (for example, Gordon, 1976), Hume is clearly not the foundation for the natural rate analysis and his discussion is entirely consistent with the outcomes in Phillips (1958). Thornton, despite being ambiguous on key issues, like what happens if the new, higher level of money stock is maintained, is more likely a precursor to the Monetarists but not Phillips (1958). Attwood’s analysis is also consistent with Phillips (1958) and in contradiction to the Monetarist developments. His major critic, Mill is unclear and inconsistent, although he has been interpreted as providing analysis consistent with the vertical long run Phillips curve (Humphrey, 1977).

2.2 Irving Fisher – “I discovered the Phillips Curve”

The editor of the Journal of Political Economy in the 1973 edition said

It is not generally known that the first statistical investigation of the relationship between inflation and the unemployment rate was performed not by A.W. Phillips in 1958 but by Irving Fisher in 1926.

Donner and McCollum (1972: 323) agree that the genesis of the empirical work on the trade-off between inflation and unemployment was “being carried out by Irving Fisher at least as early as 1926... Some of Fisher’s empirical results are recorded in a neglected paper of 1926 in the

International Labor Review, entitled ‘A Statistical Relation Between Unemployment and Price Changes.’” The 1973 *Journal of Political Economy* reprinted the 1926 article by Fisher under the heading “I discovered the Phillips Curve by Irving Fisher”. Gordon (1981: 212) also claims that the “curve should actually be called the ‘Fisher curve’, since the relationship between the unemployment and inflation rates had been pointed out much earlier [by Fisher 1926].” Dimand (1997: 442) says, “Fisher’s monetary theory of economic fluctuations anticipated later developments such as Phillips curves and adaptive expectations.”¹³

While superficially Fisher produced a correlation between employment and a complex lagged version of price inflation, it is difficult to argue that his model was a precursor to the type of models that eventually became embodied under the Phillips curve umbrella. Further, we have already seen that the English classical economists discussed the inflation-unemployment relationship and knew that a trade-off could be exploited, although in varying ways and with varying temporal horizons. We will argue that Fisher’s conception of the relationship is paradigmatically at odds with the stream of thinking within which Phillips is placed. Referring to the *Journal of Political Economy* title on the reprint of Fisher’s 1926 paper and considering the content of that paper (and a similar 1936 paper by Fisher), Solow (1997: 433) argues,

In that case he would have been anticipating the Phillips curve. Some readers have adopted this interpretation. Actually, he has the causality going in the other direction: the volume of employment is explained by the lagged values of the rate of change of wholesale prices.

Fisher’s causal train is from a money expansion to rising prices, rising profits, increasing output and then higher employment starting from a full employment level (which we would term the natural rate of unemployment now). Fisher’s explanation for the relationship is as follows (1973: 498)

... when the dollar is losing value, or in other words when the price level is rising, a business man finds his receipts rising as fast, on the average, as this general rise of prices, but not his expenses, because his expenses consist, to a large extent, of things which are contractually fixed, such as interest on bonds; or rent, which may be fixed for five, ten, or ninety-nine years; or salaries, which are often fixed for several years; or wages, which are fixed sometimes either by contract or custom, for at least a number of months. For this and other reasons, the rise in expenses is slower than the rise in receipts when inflation is in progress and the price level is rising or the dollar falling. The business man, therefore, finds that his profits increase. In fact, during such periods of rapid inflation, when profits increase because prices for receipts rise faster than expenses, we nickname the profit-taker the ‘profiteer;’ Employment is then stimulated-for a time at least.

Fisher's words are similar those used by Thornton and he also thought exploiting this trade-off was bad because longevity issues aside, the workers have more jobs but they have lower wages. In other words, the trade-off is accompanied by lower real wages (money wages rise more slowly than prices). Similar to Thornton, is Fisher's insistence that the relationship is between changes in prices and unemployment. The level of prices (1973: 499) "has ... nothing whatever to do with employment."

It is important to consider Fisher's contribution in perspective. In a later publication, *Money Illusion*, Fisher (1928) coined the term money illusion, which became a central concept in the attack on Phillips curve orthodoxy by Friedman (1968) and Phelps (1968) and with the rise of monetarism in the 1970s. In *Money Illusion*, Fisher argued that individuals regularly were confused between real and nominal values. Fisher believed that assuming rationality is a useful starting point for the economic analysis of individual behaviour. But he was aware that actual studies of human behaviour suggest that a strict adherence to rational principles "fail to describe the world we live in" (Thaler, 1997: 439). Fisher only considered models built on rational behaviour to hold in conditions of "foresight". Thaler (1997: 441) equates this with rational expectations. He argues that Fisher's theory of savings (intertemporal choice model) and the famous Fisher equation are only true if rational expectations hold.

Fisher's own empirical work in 1926, though not based on regression techniques, reflect his view that nominal amounts are slow to adjust to price level changes. He introduced the distributed lag, a dynamic structure common in econometrics from the 1950s on, to capture this notion. Fisher was also aware that his work did not establish causality. He says (1973: 502),

this relationship ...[that changes in the price level foreshadow or anticipate changes in employment] ... might ... not be causal. So far as statistics are concerned, instead of ... [price changes being the cause of employment] ... both might conceivably be caused by some third influence. Or it might be conceived that price-change simply represents a forecast of good or bad business. In fact, I have little doubt that both these views contain elements of truth.

Fisher's (1936) paper was accompanied by an incisive commentary by Morris Copeland (1936), who also questioned the causality in Fisher's work¹⁴ (see also Solow, 1997). Fisher concluded that both directions of causality, what we now term bi-directional causality, was not excluded by his work. He also challenged Copeland to test for the opposite causality – in others words, to estimate the Phillips Curve.

Another interesting aspect of Fisher's empirical work is how it stands up now. Economists have used empirical work to provide an authority to their theoretical claims. They were not the first to appeal to numbers as science. Ormerod (1994: Chapter 5) discusses the battles between the various Christian churches in the C17th which involved the "science of numerology" (Ormerod, 1994: 92). While paradigms seem to resist empirical degeneration, the influence on policy increases with factual content.¹⁵ It is interesting to see theoretical authority, however, in the context of the development of econometric techniques and knowledge. The type of modelling that we do today in terms of time series is significantly different to the work that Fisher did in 1926 and even from the work of the 1960s.

Would our view of the theoretical linkages change if the empirical authority failed to persist with the changing and improving techniques? Solow, for one, has been interested in this. In his 1997 note on Fisher he argues casts considerable doubt on the veracity of Fisher's statistical work. He says (1997: 434) after quoting Fisher's qualifications that the "correspondence between the actual and computed fluctuation in employment is naturally far from exact" that "that does not quite get it across that the model systematically understates the depth of recessions (if that is what is actually happening)".¹⁶ Solow (1997), using data very similar to Fisher's data set, regressed employment on a few lagged dependent variables and inflation (lagged one period) for the period 1919-1935. He failed to find a significant relationship supporting Fisher's model. He then reversed the causality and found a highly significant relationship between employment and price changes – a Phillips Curve.

In terms of modern econometrics, several further questions are raised by Fisher's relationship. To what extent can there be a relationship between a variable in first-difference and a variable in level terms if both are non-stationary in levels? Are the series non-stationary and if so what is the source of the non-stationarity? If we detect difference-stationarity, what are the orders of integration of the series? Can we find evidence of cointegration between the price level and the employment level (assuming both are I(1) variables)? Can we find evidence of cointegration between the inflation rate and the employment level (assuming the employment level is I(1) and the price level is I(2))? Can we detect Granger-causality between employment and inflation?

While not being able to assemble the exact data set that Fisher used, I accessed the historical database of the National Bureau of Economic Research and constructed a monthly series for Factory Employment and the Consumer Price Index for the United States between January 1889 and December 1923. This was a longer data set than that used by Fisher but essentially similar.

Using standard Dickey-Fuller and Augmented Dickey-Fuller tests, I was unable to reject the hypothesis that both series were integrated of order one (in other words they required first differencing to become stationary). This makes it very hard for there to be a relationship between inflation and the level of employment. Marginal, at best, bi-directional causality was detected between the two series in levels and first-differences using Granger-causality tests. I could not find any evidence of cointegration between the variables in any configuration. In that case, one might conclude that there is no simple error-correcting model linking the variables and it would be then be difficult to establish Fisher's outcomes.¹⁷

This is no surprise. The work of the Cowles Commission in the 1940s was also not supportive of his theory. Fisher was a critic of the Commission's work even though he was a founding member of the Econometric Society (Epstein, 1987: 103-104). He did not like the structural modelling - the heart of the Cowles work under Lawrence Klein. Epstein says that his real basis for complaint was not the structural modelling, although he couched his criticism in these terms, but rather "the detailed monetarist view of the business cycle he had developed over many years." Indeed the early work of the Cowles Commission was largely concerned with "defending a simple Keynesian macro-approach" (Epstein, 1987: 103) and "measuring the effects of policy" (Marchak, 1946)

Fisher did not discover the Phillips curve. He re-asserted the Quantity Theory of Money, with flimsy empirical work to backup his claims. Fisher's work on misperceptions certainly laid the ground for the later work of Milton Friedman, who spent much of the period leading up to the 1960s following the lead of Fisher in believing that the strongest constant in economics was the causal relationship between the stock of money and nominal income. The expectations-augmented Phillips curve did not just materialise as a response to Phillips (1958). It was just a new manifestation of the work that Fisher began in the 1920s and became Friedman's research agenda in between. Epstein (1987: 108-109) says that Friedman "believed the Keynesians models were fundamentally mistaken and he strove to prevent the use of deliberate countercyclical policies ... He went on to predict that models such as Klein's will 'in due time be judged failures'." Friedman was also a harsh critic of the structural modelling carried out at the Cowles Commission during the 1940s and 1950s. But that did not stop him attempting to establish the empirical validity of the money-income relationship. Friedman and Becker (1957), Friedman and Meiselman (1963), and Friedman and Schwartz (1963) resorted to a standard of econometric research that was, at the very least, problematic (see Desai, 1981). In summary, it is fair to interpret Fisher as the most coherent precursor to this theoretical development.

3. The Keynesian era – expectations and stability

3.1 The Econometricians

Friedman's work, which unambiguously aimed to build on the early research of Irving Fisher was up against a new macro orthodoxy, which was about to "hold fast to Okun's Law and the Phillips Curve" (Epstein, 1987: 110). The Keynesian paradigm was developing in a parallel fashion: the textbook synthesis of the linear expenditure system to a competitive labour market, and, the work of the Post World War II econometricians referred to in the last section. While the famous debate between Keynes and Tinbergen left no one unclear that Keynes didn't like the empirical work being done "in his name", the econometricians played a significant role in the development of Keynesianism at a policy level. Suffice to say, that at this early stage of econometric work there was considerable skepticism. The Keynesian models, initially were not an empirical success in terms of forecasting. Leeson says (1998: 605), that "Postwar Keynesianism *rose and fell* to the accompaniment of econometric failure, but after the first forecasting failure, the econometricians did not lose faith in their chosen strategy."

There was no doubt that the likes of Klein, a key player in establishing the ascendancy of postwar Keynesian, thought that it was better to use econometrics to assist in the process of policy making. His 1946 *Journal of Political Economy* paper, which assessed the forecasting performance of the national income modelling, makes his contempt for "armchair" commentary clear. Klein says (1985: 532)¹⁸ that there are "two possible reactions" to the failures of the models to forecast accurately. "We may now discard these new-fangled and difficult econometric methods ... and relax again into the armchair comments about the future course of economic events. ... [or] ... We may tackle the forecasting problem with renewed vigor making use of the valuable information that we have gained from this trial." The renewed vigor spawned work which, in part, led to Phillips (1958).

We now turn briefly to the work of the econometricians prior to Phillips (1958) and show that Phillips was not the first to estimate a Phillips curve. Importantly, the pre-Phillips work had incorporated the idea that the relationship between wage or price changes and the level of activity was conditioned, among other things, by the state of expectations of inflation.

Jan Tinbergen

Dutch economist Jan Tinbergen published the first econometric study of the trade-off between inflation and unemployment in 1936. Tinbergen became famous for his 1939 League of Nations project which attempted to provide empirical justification for the emerging Keynesian view that governments should intervene to stabilise business cycle fluctuations (Tinbergen, 1939). Tinbergen's work was severely criticised by Keynes himself and later Friedman, Frisch and Koopmans (see Patinkin, 1976, Stone, 1978; Hendry, 1980; Pesaran and Smith, 1985; Mitchell, 1995). In many cases, particularly the Keynes-Tinbergen interchanges, the critics showed extreme ignorance of Tinbergen's work (see Mitchell, 1995).

For our discussion, however, we begin with Tinbergen's first macrodynamic model, which was estimated as part of a Netherlands Economic Association's desire to find solutions to the malaise of the depression. The paper that resulted (Tinbergen, 1959)¹⁹ was presented to the Association in October 1936. It has been seen as a "remarkable piece of work, involving not only building and estimating a model of the whole economy but also using the model to simulate the likely impact of various policies" (Morgan, 1990: 102). The model was certainly remarkable for its time - modelling 22 relationships and 31 variables. The structure of the model distinguished between definitional relationships, technical equations, and causal equations. The equation explaining wage changes was part of the causal equation block.

In contradistinction to Fisher, Tinbergen's wage equation was the first Phillips curve if we take that to mean a model with causality running from excess demand in the labour market to wage changes. The model was thus based on price adjustment reacting to quantity disequilibrium with no presumption of full employment. It was only in the choice of the excess demand proxy that it is different from Phillips. In Tinbergen's case, the excess demand proxy was modelled using employment relative to its trend level.²⁰

Tinbergen also foresaw the nominal/real dilemma, which Friedman seems to get credit for much later, and included a price change term, lagged one period. He said it was to represent catch-up behaviour or cost of living adjustments to nominal wages. In other words, Tinbergen had a model of wage inflation dependent on excess labour market demand and a shift parameter (in his case the lagged inflation term). The estimated model clearly implied a trade-off between wage inflation and the state of the labour market.

This approach to modelling nominal wage adjustment became an integral part of his work for the next 20 years. He explained the equation in some detail in Tinbergen (1951: 50) when he stated “the theory expressed ... may be given the well-known formulation that a high unemployment figure exerts a pressure on the wage rate and that, on the other hands, a small unemployment figure causes wages to go up.” The econometric problems of Tinbergen’s model are discussed in Morgan (1990) and Mitchell (1995). But relevant here is the conclusion that there is no doubt that it was Tinbergen who began the practice of estimating wage adjustment functions using excess demand proxies and shift parameters. He understood the issues of non-linearities and the possibility that several shift factors could be present. The contribution of Phillips (1958) is part of the tradition that Tinbergen began.

Lawrence Klein and all

Lawrence Klein was another significant figure in the development of Phillips curve estimation. Klein’s early work at the Cowles Commission in the 1940s was dominated by his macromodel building. Epstein (1987: 115) says

Klein framed his own research program after leaving the Cowles Commission in 1947, which constituted still another effort to meet the basic criticisms against Tinbergen-style models leveled by Friedman, Keynes and others.

His first major article, based on his doctoral dissertation at MIT, was published in 1947 by the *Journal of Political Economy*. In that paper, “Theories of effective demand and employment”, Klein (1985: 13) constructed a labour market

in such a way that classical equations for supply and demand for labor in terms of the real wage rates were combined with a dynamic adjustment equation for the nominal wage rate as a function of imbalance in the labor market, indicated by unemployment. This was a macrotheoretical exposition of what much later came to be known as the Phillips Curve.²¹

Klein used this work as input into the 1950 Cowles Commission publication *Economic Fluctuations in the United States, 1921-41*. That work estimated wage inflation adjustment functions with unemployment and price change variables on the right hand side. Klein attributes the motivation for this modelling to Tinbergen. Klein (1985: 17) says a

statistical estimate was published in the Cowles Commission monograph describing the first models. I got my idea about this equation from Tinbergen’s works, but he formulated it in terms of wage level rather than wage change.

The Cowles work on wage adjustment led to Klein's cooperation with Arthur Goldberger and between 1951-3 they constructed the Klein-Goldberger model, published in 1955. The model was designed for public policy analysis, which had become an industry after World War II, as governments around the world assumed the goals of full employment and price stability (Klein 1985:16). The wage adjustment function in that model confirmed his desire to include a price change term on the right hand side (Klein and Goldberger, 1955).

The equation published expressed the annual change in money wages (first-difference annual data) on a time trend, the unemployment rate (in linear form), and the annual change in prices (lagged one period). The model is one where disequilibrium in the labour market drives the annual growth in wages. Unemployment increases reduce annual wage inflation. The model is clearly not homogenous (the coefficient on the price change variable had a coefficient of 0.52 with unity not included in the 95 per cent confidence interval). The justification for the model is (Klein and Goldberger, 1955: 18)

... the main reasoning behind this equation is that of the law of supply and demand. Money wage rates move in response to excess supply or excess demand in the labour market. High unemployment represents high excess supply, and low unemployment below customary frictional levels represents excess demand.

The Klein-Goldberger model marked a turning point in the rise in importance and acceptance of econometrics. The forecasting performance of the model was significantly better than earlier models although there will still debates about the "economic meaning of the estimated structure" (Epstein, 1987: 117). The model was published in the same year that James Tobin assumed the role of director of the Cowles Commission (replacing Koopmans) and the Commission moved from Chicago to Yale. Tobin was responsible for a reemphasis on structural modelling and the liaison with Arthur Okun, who was working at Yale at the time. The link between the wage adjustment estimation (the Phillips Curve) and Okun's own work (which became Okun's Law) was the foundation stone for the 1960s Keynesians – these became the centrepiece of macroeconomic orthodoxy in place of the Quantity Theory of Money (Lodewijks, 1988).

Klein thus, extended the work on wage adjustment that Tinbergen had started before Phillips had turned to his own research.²² Klein considers himself to be working on wage adjustment functions contemporaneously to Phillips. He describes how Jim Ball and himself worked together on building a United Kingdom version of his US model while he was at Oxford in the 1950s. The contribution to this work, which was not part of Phillips' more simplistic excess-demand story,

was the inclusion of wage drift (the difference between earnings and wage rates). The work was published in the *Economic Journal* in 1959, after Phillips, but Klein (1985:17) says that the work was “completed in 1957”. Apparently, the authors had several editorial discussions with the editor, Roy Harrod, which delayed publication for 2 years.

The work with Ball was significant. They noted that (1959: 467) that “Economic theory has given us no reason to say whether dynamic movements of *relative* or *absolute* prices are associated with market clearing. We assume that money wages move over time in response to excess supply or demand in the labor market.”²³ However, unlike a crude interpretation of this as assuming agents suffer from money illusion (a vital part of the Friedman-Phelps critique of Phillips), Klein and Ball (1959: 467) said, “both sides are only too aware of the ‘real’ nature of economic affairs. Movements in the cost of living are prominent facts at the bargaining table.” From this they conclude (1959: 467)

Instead of saying that dynamic movements in real wage rates are functionally related to unemployment, we take the somewhat more general and more realistic view that the time rate of change in money wage rates is a function of the level of unemployment and the time rate of change of the price level.²⁴

In other words, the economy could undergo nominal wage inflation independent of the state of the labor market if bargaining agents formed expectations that the inflation rate was rising. The term used to capture this shift parameter was the actual inflation rate. The question then arises as to how agents form these expectations. Klein and Ball (1959) explicitly modelled the change in money wages as a function of lagged inflation because they considered it took time for real wage aspirations to feed into bargained outcomes. It makes you wonder, however, why Friedman and Phelps have been given so much attention in terms of “adding expectations to the Phillips Curve”. In the technical sense, with causality running from labour market disequilibrium to wage/price adjustment, the nominal-real issue was modelled long before the publication of Friedman (1968). The important point to which we turn later is that the monetarist counterattack in the late 1960s merely used the naïve Phillips curve to force a paradigm change.

In summary, the work by Tinbergen and later Klein and his cohort advanced the Keynesian paradigm by giving it empirical authority, even though at times, this authority was rather sketchy. Importantly, the econometricians had estimated “Phillips curves” with expectations variables included. They did not, however, provide a strong theoretical basis for their models nor did they embrace the stability issue. Klein *et al* were not the only economists working on inflation and unemployment, either before Phillips or contemporaneously with Phillips. Another significant,

yet virtually unknown work was that by Leeds economist Arthur Joseph Brown published in 1955. Before we consider that work, a reflection of Phillips' own 1954 work is fruitful.

3.2 Phillips (1954)

Phillips had laid out the theoretical basis for his later empirical work in an article published in 1954. Lipsey (1978: 49) says

the now-famous curve made its debut in 1954 in Phillips' first major published paper, 'Stabilization in a Closed Economy'. In fact, this relationship was between the derivative of the price level and the level of production (a proxy for the level of economic activity). Sawyer (1989: 126) points out that "there is some confusion in the argument over the changes in the level of production and differences in the level of production.

A close reading suggests that it is the difference in the level of production that sends the demand signal. He considers both fix-price systems driven by mark-ups on unit costs and flex-price systems driven by moving factor prices. Phillips (1954: 307) says,

...there will be some level of production and employment, which, given the bargaining powers of the different groups in the economy, will just result in the average level of factor prices remaining constant, this level of production and employment being lower, the stronger and more aggressive the organization of the factors of production. If aggregate real demand is high enough to make a higher level of production than is profitable, entrepreneurs will be more anxious to obtain (and to retain) the services of labour and other factors of production and so less inclined to resist the demands for higher wages and other factor rewards. Factor prices will therefore rise. The level of demand being high, the rising costs will be passed on in the form of higher product prices. Factor and product prices will continue to rise in this way so long as the high level of demand and production is maintained, the rate which they rise being greater, the higher the level of demand and production....

Phillips went on to assert the symmetry of the relationship when the level of demand was below what we might call the steady-state level. Further on he says (1954: 309) "If prices... are flexible, the error in production will also cause prices to change at a rate proportional to production." This led Lipsey (1978: 50) to formalise his interpretation of Phillips (1954), as a relationship between the rate of change of the price level to the deviation of actual production from the "full employment level" of production. Phillips clearly had a notion of what we would call the NAIRU although he pitched the steady-state in terms of the level of output and employment. Desai (1975) would probably disagree with this claim given that he pictures the Phillips (1958) exercise as modelling a series of long-run equilibrium points.

Importantly, in terms of the claim by Fisher (1973) that he discovered the Phillips curve, Phillips (1954) was articulating a process where disequilibrium in the real sector caused changes in nominal aggregates. We saw that Fisher's version of the relationship between price changes and employment (real activity) levels was cast in terms of the reverse causality and considered to be an equilibrium relation. Phillips published two further papers before 1958 on time-forms in dynamic economic models and stabilisation policy. The lineage is clear – and culminated in the famous 1958 publication in *Economica*.

3.3 Arthur Joseph Brown (1955)

Tony Thirlwall (1972: 325) stated in a short historical note, published in *Economica*, that

as a matter of historical fact, A.J. Brown's *The Great Inflation*, published in 1955, antedates both Sultan and Phillips. Brown not only discusses in some detail the theoretical and institutional reasons why one might expect an inverse relation between the percentage level of unemployment and the percentage rate of increase of wages and prices, but, more significantly, he plots a Phillips-type relation for the United Kingdom for the periods 1880-1914 and 1920-51, and for the United States for the period 1921-48. I have often thought that the "Phillips" Curve ought to be called the "Brown" Curve – unless, of course, Brown himself had precursors.

While A.J. Brown published his major work *The Great Inflation, 1939-51* in 1955, well before the 1958 Phillips publication in *Economica*, it is hard to argue that he anticipated the Phillips curve in the way Thirlwall imagines. The published work of Phillips between 1954 and 1958 (Phillips, 1954, 1956, 1957) was already pointing to the Phelps-Brown inspired empirical study published in 1958. It is easier to argue the case that Brown provided an account of the role of expectations and real wages in the determination of the trade-off between inflation and unemployment, thus adding theoretical substance to the estimation that Tinbergen and Klein *et al* in this regard. Brown was firmly in the Keynesian mould and his discussions of expectations and real wage resistance was not an anticipation of the later work of Friedman and Phelps in the 1960s.²⁵ It is also important to note that Brown was the first to talk about the instability of the wage change-unemployment relationship.

Again, we can argue that the introduction of the expectations-augmented Phillips curve was not about a sudden discovery that expectations of inflation in wage adjustment were important. Rather, the model was part of a long campaign by Friedman and others to restore the Quantity Theory to the position it had prior to the Keynesian revolution. The Phillips curve was merely the vehicle that was used to pursue those aims. If this was not so, then it would raise the question of

why Friedman and Phelps have been given the credit for the introduction of expectations into the Phillips curve and raising the issue of its stability?

Brown also outlined the relationship between the price-wage spiral mechanism, which can drive inflation and the distributional struggle over available real income. In this sense, he anticipated a competing claims explanation of inflation, which became popular in the 1970s among Post-Keynesians and Marxists (see Goodwin 1967; Tobin 1972; Desai 1973; and Rowthorn 1977).

This is not to say that the work of Brown and Phillips was equivalent. Sawyer (1989: 102) says,

The approach of Brown can be contrasted to that of Phillips in three respects. First, Brown places the statistical relationship into a much fuller discussion of the process of inflation.... Second, Brown did not attempt to draw any curve through his data. ... Third, Brown did not argue that the wage change-unemployment relationship observed for pre-First World War period held thereafter.

Brown seeks at the outset to explain the underlying causes of the inflationary gap, which he (1955: 16) says “is in principle a good measure of the pressure making for inflation in the market or set of markets in question.” He argues that to merely characterise the inflationary gap as “a propensity of the community to spend more than its current income... does not throw much light upon the causes of inflation” (1955: 16). Brown wants to investigate “the reason for this propensity” (1955: 16)

In pursuing this explanation he says (1955: 17) that

... though it may be possible to give a generally valid formal description of what constitutes inflation, the causal mechanisms by which it happens are various and their roots may go deep into the market institutions and the social and political structures of the communities concerned. For this reason it is not profitable to approach the events of the inflationary-period treated in this book with a single theoretical scheme into which they must be fitted.

Brown assumes an open economy where price setting power is used and fixed contracts are common. He also recognises the costs of price adjustment (1955: 80). Prices are (1955: 80) “fixed by producers in relation to costs of production (which depend on factor prices), and for wages to be fixed either automatically or by bargaining in relation to the prices of consumers’ goods.” The wage-price dependency is “principally responsible for giving the process of adjustment and inflationary power of its own” (1955: 81). Brown sees the changes in real income shares as being a crucial determinant of inflation.

Brown (1955: 100-101) produced two “Phillips curve” scatter plots showing the relationship between the rate of unemployment (on the horizontal axis) and the percentage change in wage rates (on the vertical axis), in one case, and the percentage change in hourly earnings (1920-51), in the second diagram (1920-1948). The data was for the United Kingdom. He is motivated by Abba Lerner (1951) to explore the inverse relationship between the changes in wages and prices and the level of unemployment. Brown (1955: 90) says²⁶

It seems, however, that empirical investigation has not hitherto been directed towards verifying the existence of such a relation, or to finding the level of unemployment beneath which the price-wage spiral seems to come strongly into operation in any one economy.

He excludes pre-World War I data on the grounds that (1955:90) the particular events between 1880 and 1914 “reduces the probability that experience over these years will throw light on the present problem.” We will return to Brown’s belief that the inflation-unemployment relationship was unstable.

The causality underlying the scatter plots is Keynesian. He sees the business cycle as being driven by fluctuations in effective demand (1955: 91). Labour market disequilibrium in an expansion increases bargaining power of unions and reduces unemployment and (1955: 91) “the *rate* at which it can raise wages is increasing.” When the expansion ceases there is a (1955: 91) “sudden fall in the rate of wage increase.” During expansion and contraction, expectations of the movement in the cycle also drive the wage changes in both directions.

Brown also articulated a non-linear relationship between wage changes and the unemployment rate. He notes that wage changes are larger when the unemployment rate is low than when the unemployment rate is high. The curve implied is very flat at high unemployment rates and then becomes very steep, if not vertical, at low unemployment rates. Brown (1955: 92) attributes this to “the belligerence of organized labour and the employers’ fears of provoking disastrous conflicts ... there is probably an absolute limit to the rate at which wage rates can be reduced.” There is no such limit in an upward direction when the economy and labour market is strong.

In Chapter 5, entitled “The Price-Wage Spiral and Income Distribution”, Brown develops a rich analysis of the role of distributional changes in conditioning the wage-price spiral. He argues (1955: 104) that the motives for demanding “wages increases and price increases are connected to distribution.” An important consideration not often explicitly stated is Brown’s recognition that in

a world of contractual or fixed wages and prices (in the Keynesian mould) there has to be some model explaining how and when these rates change. Brown says (1955: 104)

It would be hardly surprising if, in a world where both prices and wages were contractual (at any rate, possessed some rigidity), entrepreneurs and wage earners respectively customarily sought all the time to raise them.

On the supply side, wage earners demands (and their successes) are seen as a function of income distribution (the size of profits and the level of real wages). Brown develops an early real wage resistance theory. On the demand side, it is the observation that many industries maintain a fixed percentage profit margin that provides the link between price setting and income distribution. In addition, firms often enter contractual arrangements (or are otherwise bound by regulation) to keep profit margins fixed absolutely or proportionately to costs. Labour costs tend to be a major part of total costs and thus the link between wage movements and price movements in both directions is established. Brown thus introduces the notion of the wage-price spiral in a period when the predominant emphasis of economists at the time was on demand-pull concepts of inflation either derived from the Quantity Theory of Money or from Keynes' inflationary gap (see Samuelson and Solow, 1960: 177-180).²⁷

He also recognises that the development of a wage-price spiral is dependent on the (1955: 105) "aims of the two parties who are competing for the real income of the country or their success in achieving those aims." This is very reminiscent of the competing claims literature, which depicts the inflation process as resulting from incompatible claims on total nominal income by workers, and firms exceed the total available. Workers negotiate real wage targets via money wage demands on firms, who in turn pursue some target markup (as a vehicle for a desired rate of return). Prices may be slow to adjust in a time of rising costs due to the costs of price adjustment. If the sum of the claims exceeds national income, either or both parties may use their price-setting power to achieve their targets. Inflation is the outcome of the distributional conflict (see Goodwin 1967; Tobin 1972; Desai 1973; and Rowthorn 1977).

Brown would thus have violated Milton Friedman's (1976: 218) requirement that "the vertical axis should refer not to the nominal wage rate but to the real wage rate." Tobin's (1972: 3) insight that "Keynes emphasised the institutional fact that wages are bargained and set in the monetary unit of account" applied equally to Brown's model even though Brown recognised that ultimately distribution was a real phenomenon and the aspirations were pitched in real terms. Thus Brown

anticipated the expectations-augmented Phillips curve in the sense that he explicitly included inflationary expectations in his wage-price spiral. He (1955: 5) says

Once prices have been given a sufficiently strong upward push by any cause whatever, it is possible that further increases may be expected, and the automatic fulfillment of this expectation, in advance of the time at which the further increase was anticipated, may then cause a further upward revision of prices expected to rule in the future. A mechanism of this kind can, clearly, produce an indefinitely accelerating price increase, provided that certain requirements are met.

The conditions outlined by Brown (1955: 5-6) whereby expectations of inflation can drive price increases independent of excess demand factors are:

- Prices have to be flexible enough to change when expectations change
- Money supply growth must be sufficient to match price inflation or else real demand falls.²⁸

The speed of adjustment of price changes to changes in price expectations does not rely on perfect flexibility. It can take some time for expectations to work their way through the price change process without negating their influence.

Another important aspect of Brown's work, which was swamped by the 1960s interpretation of Phillips (1958), was his insistence that the relationship between wage changes and the unemployment rate was not stable. He argued convincingly that the relationship went through several discrete periods – Pre World War I, between the wars, then Post World War II. Brown noted (1955: v) that

the institutional machinery by which prices and wages have been determined and changed have been quite largely different during the period of inflation from what had been assumed in the theoretical formulations; most of the theorists have not caught up with actuality.

Moreover, his motivation, expressed in his Preface (1955: vi-vii) was to counter the “analyses which are currently put forward by economists and taught to students are still quite largely based upon the very different world economy which existed (or was supposed to exist) before 1939...”

This discussion of instability is linked to the development of administered prices. His discussion aimed to explain movements in what he termed (1955: 93) “the critical unemployment rate”, which is the tantamount in modern language to the NAIRU or steady-state unemployment rate. The discussion is very modern in tone. Brown (1955: 94) asks, “Can this very large apparent rise in the critical unemployment rate since before 1914 be attributed simply to the increased bargaining power of organized labour?” Cornwall (1983) would refer to this argument as an

increase in the inflationary bias in capitalist economy, although he would include large corporations and government among the unions as being implicated in the process. Brown, however, also notes the rise in structural unemployment after 1920 as compared to before 1914 due high unemployment in localized industries that subdue wage rises in those industries and immobility, which prevents labour movements suppressing wage rises elsewhere. A more even “distribution ... [of unemployment] ... will mean that the critical level of unemployment below which there is a rise in average labour costs to industry as a whole will be lower than when a large part of unemployment is of a structural character (1955: 94).”

Brown, thus provided a very full treatment of the inflation emphasising institutional structure in the labour and product markets as well as incorporating inflationary expectations into his analysis. He also was fully cognisant of way in which the wage and price setting changed over the course of his analysis. Sawyer (1989: 103) said

In contrast, an implication of the work of Phillips (1958) was that the relationship between wage changes and unemployment held for nearly a century across many social and political changes. This could be seen as asserting the importance of the operation of underlying economic forces through varying institutional arrangements.

Once again it raises the question of why it was Phillips (1958) work, which became the model, given that it was based on questionable econometrics (see Desai, 1975), simplistic economic theory, and a questionable assertion of stability. This is especially when one considers the depth of analysis provided by A.J. Brown.

3.4 Paul Sultan (1957) – “I discovered the Phillips curve”!

In the same way that the *Journal of Political Economy* in the 1973 edition reprinted Fisher (1926) under the heading “I discovered the Phillips curve”, some economists (Amid-Houzier, Dick and Luchter, 1971) have attributed the same discovery to an American text-book writer, Paul Sultan (1957). While Brown went within one stroke of producing the graphical Phillips curve, Sultan (1957: 555) is the first person to publish a “Phillips curve” graph. Amid-Houzier, Dick and Luchter (1971: 320) argue “that Phillips’ work was an independent empirical verification of the hypothetical relationship which, unknown to him, had been earlier postulated explicitly by Sultan.”²⁹ Their understanding of history is a bit amiss because they claim (1971: 319) that “Phillips produced the first empirical work on the relationship between inflation and unemployment.” We have shown that this perception is false. Further, Sultan’s graph is in terms of the annual percentage change in the price level and the rate of unemployment, which is not the

relationship that Phillips modelled. The errors are illustrative of the way textbook writers and others have started history with Phillips (1958) and confused the Phillips curve (Phillips, 1958) with the textbook versions of the same (in terms of price inflation) (Sawyer, 1989: 110-113).

Sultan's theoretical justification for the curve, which he called "The Hypothetical Relationship of the 'Fullness' of employment to Annual Price Changes, was firmly within the prevailing Keynesian orthodoxy of his day. Sultan writes (1957: 555)

... the line relating unemployment to inflation ... [reference to his Figure 24] ... is strictly hypothetical, but it suggests that the tighter the employment situation the greater the hazard of inflation. ... Assuming that a fairly precise functional relationship exists between inflation and the level of employment, it is possible to determine the 'safe' degree of full employment. In our hypothetical case, we are assuming that when unemployment is less than 2 per cent of the work force, we face the dangers of inflation. And when unemployment is larger than 6 per cent, we face the problem of serious deflation.

There is no discussion of the work of the Keynesians before him on the role of expectations and the question of stability. In effect, the textbook version of the Phillips curve was born in Sultan's exposition.

3.5 Conclusion

Neither Sultan nor Brown had the subsequent influence on the profession that Phillips (1958) had. Sawyer (1989: 102) says,

In terms of the textbook and policy discussion the advantage of an estimated curve is that it can be used, without the accompanying data and caveats, to illustrate general relationships. Further, a loose statistical relationship was in effect translated into what appeared to be a precise empirical relationship.

The profession was probably not yet ready for the work of Klein *et al.* Phillips (1958) was published at a time when a number of related developments occurred. Each may help to explain the reason the previous work on inflation and unemployment was supplanted by the Phillips curve. Not only did the sophistication of national income data improve in the 1950s, but it coincided with the introduction of larger and more powerful computers which made regression analysis more accessible (see Lucas and Sargent, 1978; Friedman, 1991). It was also a period when macroeconomic modelling was increasingly seen as an "essential ingredient" in the debates between Monetarists and Keynesians (Leeson, 1998: 608-609).³⁰ In the next section, we

place the developments discussed to date within an overall macroeconomic context in order to better understand the contribution of Phillips (1958) and also the later Monetarist developments that attempted to regain the ground lost since the publication of the General Theory in 1936.

4 The macroeconomic context

Any discussion of the Phillips curve necessitates an analysis of the context within which it was placed. At the time Phillips published his work there was a major debate proceeding concerning the microfoundations of macroeconomics. The neoclassical paradigm hardly considered macroeconomics to be a separate conceptual structure to microeconomics. The emergence of Keynesian economics in the 1930s had coincided with “the emergence of macro as an enquiry separable from microeconomics.” (Dow, 1985: 82-83).

The break with neoclassical thinking came with the failure of markets to resolve the persistently high unemployment during the 1930s. The debate in the ensuing years is consistent with the issues that surround the development of the Phillips curve from 1958 through to the early 1970s. The issues, in part, were about the existence of involuntary unemployment. The 1930s experience suggested that Say’s Law, which was the macroeconomic component and closure of the neoclassical system based on the optimising behaviour of individuals, did not hold. The neoclassical economists continued to assert that unemployment was voluntary and optimal but that some factors not previously included in the model prevented Say’s Law from working. Keynes, following Marx and Kalecki, adopted the distinctly anti-orthodox approach and refuted the basis of Say’s Law entirely.

The Friedman-Phelps challenge to the Phillips orthodoxy in the late 1960s can be seen in this light. Prior models of the wage/price adjustment process, like that of Tinbergen (1936), Klein (1947), Klein and Goldberger (1955), Klein and Ball (1959), including Phillips’s own model (1958) were in the tradition of Keynes and saw price adjustment as a response to disequilibrium arising from the labour market. Unemployment in this type of model could be involuntary.³¹

The emergence of Friedman (1968) and Phelps (1967, 1968) was really an expression of this neoclassical discontent with the lack of optimising microfoundations in Keynesian macroeconomics.³² They reasserted neoclassical microfoundations and were then left to explain why Say’s Law did not work all the time. To overcome that problem they followed Irving Fisher and identified misperceptions of inflation as the factor that prevented Say’s Law from working

according to the market-clearing model. Ultimately, under their natural rate hypothesis, Say's Law imposed itself in the long run. They assumed an adaptive expectations mechanism for the purposes of exposition but this meant that in times of ever-increasing inflation, economic agents would always be lagging behind. Why would the agents not learn from the mistakes and adopt better prediction mechanisms? In part this question was superseded by the addition of rational expectations to the misperceptions-type of story. Under extreme versions of rational expectations, Say's Law always holds.

To put a finer point on this argument it should be noted that there was no association between the emergence of the natural rate hypothesis (and its implications for the Phillips curve) and the observed instability of the inflation-unemployment relationship in the 1970s after the first OPEC oil price hike. As Okun (1981: 237) notes

Milton Friedman and Edmund Phelps independently attacked the logic of the Phillips curve at a time when that approach was scoring empirical successes. Basically their message was a pessimistic forecast – not an interpretation or explanation of experience – that inflation would accelerate if the unusually low unemployment rates of the mid-sixties were maintained.

Although the accelerationist theory is defective in many ways, the prophetic accuracy of its pessimism must be admired.

The theoretical push to reassert Say's Law by neoclassical economists was severely dented by the work of Robert Clower (1965) and Axel Leijonhufvud (1968). They had demonstrated, in different ways, how neoclassical models of optimising behaviour were flawed when applied to macroeconomic issues like mass unemployment. Clower (1965) showed that an excess supply in the labour market (unemployment) was not usually accompanied by an excess demand elsewhere in the economy, especially in the product market. Excess demands are expressed in money terms. How could an unemployed worker (who had notional or latent product demands) signal to an employer (a seller in the product market) their demand intentions? Leijonhufvud (1968) added the idea that in disequilibrium price adjustment is sluggish relative to quantity adjustment. Tobin (1972: 4) notes

Axel Leijonhufvud's illuminating and perceptive interpretation of Keynes argues convincingly that, in chapter 1 as throughout the *General Theory*, what Keynes calls

equilibrium should be viewed as persistent disequilibrium, and what appears to be comparative statics is really shrewd and incisive, if awkward, dynamic analysis. Involuntary unemployment means that labor markets are not in equilibrium. The resistance of money wage rates to excess supply is a feature of the adjustment process rather than a symptom of irrationality.

In other words, the basis on which Friedman and Phelps constructed their natural rate re-interpretation of the Phillips curve was already flimsy and unconvincing.

Friedman's emphasis on expectations in 1968, which changed the direction of policy in the 1970s, was rooted in developments a long time before this. It was already recognised that the Quantity Theory of Money was a long-run theory, which allowed for non-neutrality in periods of adjustment between equilibrium. Friedman (1956b) revitalised the Quantity Theory, as did Patinkin (1956). The former restated the Quantity Theory in terms of a demand for money function, which included an expected inflation term. In the long run, all analysis could be conducted in real terms because the price level was proportionate with the stock of money. At this level of analysis, a larger money stock does not mean a larger real output level. Output is independent of the price level and the stock of money. But changes in the money stock cause changes in the price level, and on-going monetary expansion creates inflation. Friedman saw that expectations of inflation in disequilibrium then had to be formally incorporated into the money demand function.

Patinkin (1956) was also instrumental in the resurgence of Quantity Theory when he showed that one could analyse the adjustment between two long-run equilibrium positions by focusing on the real balance effects that occur. This allowed him to argue that the long run conditions – Quantity Theory, neutrality and Walras' Law – could not all hold when the money supply changed. With disproportionate movements between the money stock and the price level generating real balance changes, aggregate demand could rise in the short-term. The exact way in which real balance effects influence output in disequilibrium was a topic of debate but the introduction of disequilibrium adjustment processes allowed the neoclassical economists to embrace short-term departures in unemployment from the natural rate.³³

By extending the role of inflation expectations to the labour market, Friedman was able to solve the problem that Phillips's 1958 model and subsequent developments (like Samuelson and Solow, 1960) presented for neoclassical monetary theory. Phillips's model clearly refuted long-run neutrality. Lipsey (1978: 56) argues that the "famous prediction" that the government could

maintain a given disequilibrium in the labour market and thus choose, indefinitely, a combination of real output and inflation defined by the Phillips curve was firmly embedded in the consciousness of policy makers in the 1960s.³⁴

While the development of what is called the Expectations-Augmented Phillips Curve (EAPC) was not based on empirical grounds, the cost instability after the first OPEC oil shock in 1974 and the resulting inflation was very fortuitous indeed. It gave the Monetarist developments a credibility that it could not get in terms of the theoretical debate. Clower and Leijonhuvud had exposed significant flaws in the monetarist conceptual structure. But the Monetarist challenge to what was called the Neo-classical synthesis, which had relied on the notion of a stable Phillips curve to justify their demand management and stabilisation policy stance, was given an open slate by the price chaos in that period. The Monetarist explanation seemed almost self-evident, especially when the Keynesian approach to inflation and unemployment seemed to be inapplicable when both were present. Skidelsky (1977) termed this period the end of the Keynesian era. Lucas (1981) claims that the simultaneous rise in both inflation and unemployment in the 1970s destroyed the illusion of an exploitable trade-off and ended the period of stabilisation policy.

One must be very careful in attributing cause and effect though. The Keynesian policies since World War II had delivered unprecedented stability and strong growth and rising living standards for 25 years. In Australia, for example, inflation began to rise before unemployment in the early 1970s. The unemployment started to rise as the Government began to adopt harsh aggregate policies. The inflation rate in Australia, for example, rose in 1974 prior to the unemployment rate rising. The latter increased as Monetarist macroeconomic policies started to impact. A similar experience occurred in other countries (see Dow and Earl, 1982).

The Phillips curve became the vehicle for the paradigmatic battle between the dominant Keynesians and the Monetarists led by Friedman. Solow (1997: 433) says

Monetarists interpreted the correlation as Fisher did, with changes in prices eliciting, one way or another, opposite changes in unemployment. On the whole, Keynesians thought they were seeing a disequilibrium relationship, with high or low unemployment eliciting small or large changes in wages and prices. In this they were closer to Phillips, not to Fisher.

Of-course, we could also say that Fisher considered the relationship between unemployment (factory employment) and the rate of changes in wholesale prices, whereas, Phillips was concerned with the labour market relation more directly and substituted money wage changes for the price change variable. Sawyer (1989: 103) agrees and says “the implied causation [in Fisher] runs from inflation to employment... Indeed, the explanation given by Fisher is along the lines of what later became known as the ‘surprise supply function’.”

In the Keynesian strand, the issues were the existence of involuntary unemployment and, as Coddington (1983: 39) says, “the extent to which, and the speed with which, an increase in real demand engineered by the authorities may be offset by a rising wage and price level.” It is here that the Phillips curve was a great development for a Keynesian (as opposed to a Keynes) perception of the economy. The prevailing macroeconomic model in the 1950s was closed by two conditions where output was either at full employment or below full employment as determined by the intersection of the IS-LM relations, and inflation was either zero or a function of the inflationary gap (see Lipsey, 1978). Accordingly, demand expansion had clear, dichotomised effects on the real and nominal variables in the system. When output was below full employment, any demand expansion was translated completely into real effects. Once the economy reached full employment, the expansion only had nominal effects. This was the reverse-L shaped model common in textbooks at the time (see Okun, 1981).

Economists knew that the real world did not accord to this dichotomised behaviour. The econometricians clearly modelled the nominal-real split.³⁵ A.J. Brown (1955) also saw the imperative of understanding the way in which a nominal expansion is split between real and nominal effects. Lipsey (1978: 49) considers Phillips also saw it as an imperative to “remove this dichotomy”. He says “It was obvious to him ... [Phillips] ... that any disturbance to the system had both real and monetary effects in the short term.”

Lipsey (1978: 54) concludes

What Phillips does for the model is to provide a possible explanation, absent from the dichotomised model, of the division of impact effects between real and monetary variables when the model is in disequilibrium.

The Phillips curve became the missing equation in the Keynesian macroeconomic model (Desai, 1981: 4).³⁶ But, Sawyer (1985: 63) says that the

Phillips curve should be regarded as essentially non-Keynesian. By Keynesian we simply mean an approach which emphasises the role of aggregate demand in the determination of the level of output and downgrades the importance of relative prices.

Sawyer's argument is based on the expectations-augmented Phillips curve, which he believes is inconsistent with Keynes (Sawyer, 1985: 65), who "was concerned with money wage movements" not real wage movements. The point is mitigated, however, when we consider that the Phillips curve is not an optimising relationship (see endnote 29). Importantly, the Keynesian developments leading up to the Phillips curve had formally addressed this issue by adding variables (or theoretical discussion), that captured the real aspirations of agents who bargain in nominal terms.

However, despite the rich Keynesian history discussed earlier, it was easy for Friedman and others to hijack the debate. The Keynesians, like Lipsey (1960), were operating in a dichotomised framework – at the macroeconomic level they had adopted the Phillips curve, yet they were tense about the microeconomic underpinnings of the relation. Lipsey (1960) tried to justify the Phillips curve as a Walrasian adjustment process. It was easy for Friedman (1968) to then assert that if it was a Walrasian mechanism then it "contains a basic defect – the failure to distinguish between *nominal* and *real* wages." If Lipsey and others had have followed the theoretical work of Brown, for example, then the pedigree of the Phillips curve would have been completely in the spirit of Keynes (and Kalecki).

The Phillips curve was susceptible to a sudden and/or large increase in inflation in the same way that the aggregate consumption functions that excluded inflation terms were. The work of Davidson *et al* (1978) showed that the failure of the large-scale econometric models to forecast such variables as savings and consumption in the early 1970s could be traced to the misspecification (via omitted variables) of the structural relationships. The breakdown of the Phillips curve was another function that was misspecified.

The work of Fisher reemerged, after the Keynesian period, in the work of Friedman (1968) and Phelps (1967), although Friedman had been pursuing the case against stabilisation policy throughout the 1940s and 1950s. The publications were prior to the empirical problems that the Phillips curve encountered due to its misspecification. Taken in one way, their work can be easily incorporated into the Keynesian Phillips curve paradigm. Thus, the short-run Phillips curve is

inevitably unstable and is highly likely to shift outwards in a period of sustained expansion (tight labour markets). Accordingly, inflation will accelerate if people build the history of inflation into their bargaining behaviour and attempt to maintain a constant real wage or real profit margin (Okun, 1981). Tinbergen, Klein and Brown all understood this proposition well.

But this would be trivial and misses the fundamental issue that Friedman and Phelps were pursuing. Accompanying their attack on the prevailing view that there is a stable trade-off between inflation and unemployment was an attempt to reclaim the terrain that Neo-classical monetary theory had lost after the Great Depression. Friedman's 1968 paper "The Role of Monetary Policy" argued that monetary policy could only have real effects in the short-run, at an increasingly worse trade-off. The starting point was classical monetary theory, which suggests that monetary policy cannot have real effects. All that it does is alter prices and nominal incomes in a proportionate way. To gain a short-run trade-off in this paradigm Friedman had to appeal to the notion of expectational errors and adaptive learning behaviour. Accordingly, when labour markets tighten and demand pressure pushes money wage rates up, workers supply more labour because they mistake the rise in money wages for a rise in real wages. Information is assumed to be asymmetric so firms do not make these relative price mistakes. As workers realise their errors they withdraw the extra labour and the economy's output and employment levels fall again – to their natural levels.

The unemployment rate that is commensurate to these natural output levels was termed the natural rate of unemployment and is sensitive in the long run to monetary policy. The only way the workers can be induced to supply higher hours than are implied by the natural rate of unemployment is for the monetary authority to maintain ever-increasing money wage rate inflation.

There were many versions of the way misperceptions worked and on what variables they worked (see Phelps, 1970; Okun, 1981). The crucial point of the exercise was not related to the research program of Phillips. It was to restore classical monetary theory to the dominant position by way of reconciliation between its neutrality properties and the empirical finding of a short-run trade-off between inflation and unemployment. The economy oscillates around a natural rate of unemployment (which is invariant (neutral) to monetary and aggregate fiscal policy), because economic agents make expectational errors. The errors cannot be exploited permanently without ever-accelerating inflation.

The model they introduced can be written as:

$$\text{Eqn 4} \quad U_t = U_t^* - \alpha(\dot{P}_t - \dot{P}_t^e)$$

where U is the unemployment rate, U^* is the natural unemployment rate, P is the price level, and P^e is the expected price level, the time subscripts indicate the period, and the dot on the price variable indicates a time-derivative. So the actual unemployment rate is equal to the natural unemployment rate if expected inflation equals actual inflation. The only way the economy can deviate from the natural rate of unemployment is for expected inflation to be in discord with actual inflation. The short-run trade-off is then between unexpected inflation and unemployment and the extent of it is determined by the magnitude of α .

This conception of the economy is at odds with the Keynesian model. The textbook representation of the history of the inflation-unemployment trade-off from Phillips to Friedman and then onto rational expectations with complete short-run and long run neutrality is thus misleading. First, it ignores what went before Phillips, and, second, the movement from Phillips to Friedman was a paradigm shift rather than an extension of the model.

5 The success of the Phillips curve

Several writers have tackled the question as to why the Phillips curve was so successful and became the “textbook” model (Lipsey, 1978; Sawyer, 1989; Leeson, 1998 among others). We should note that the Phillips curve was not the relationship that became popular. The turning point was the estimation of the price inflation-unemployment rate relationship by Samuelson and Solow (1960). In their paper for the American Economic Association annual meeting, they examined the various explanations for inflation in the USA since the end of World War II. Their paper was very influential because it was able to show that the existing debate about demand-pull and cost-push inflation suffered from observational-equivalence. Both influences delivered a similar outcome captured in the “Phillips curve”. The estimated model they presented was an excellent aid to economic policy makers and thus united academe and the bureaucracy. Samuelson and Solow (1960) showed that for zero inflation, the unemployment rate had to be kept between 5 to 6 per cent. If the economy wanted full employment, then considered to be around 3 per cent, they would have to bear an inflation rate of between 4 and 5 per cent.

The implications were profound. The policy-making bureaucracy now seemed to be in control of both aggregates – the twin evils. As long as the relationship estimated was stable then the government could choose what inflation rate they would have by an appropriate mix of fiscal and monetary policy operating on unemployment. The “Phillips curve” of Samuelson and Solow (1960) thus mapped perfectly into the existing set of aggregate demand management tools (Ormerod, 1994).

The period also saw the “blossoming of the applied econometrician as an expert consultant to government” (Epstein, 1987: 130). Epstein (1987: 130) says

The fascination with attempts to estimate an aggregate Phillips curve, the level of many econometric policy discussions during the 1960s, was symptomatic of a major change in research emphasis compared to the early work by Tinbergen and the Cowles Commission. It marked the extreme concern with model *estimation* as distinct from model *evaluation*. The Phillips curve was actually a prime example of all the conceptual difficulties encountered in estimating structural relations: autonomy, exogeneity, structural change, aggregation and expectations. The enormous number of different curves that were estimated ... would indicate that multiple hypotheses and costs of model misspecification were still pressing problems. As a general matter, however, most studies hardly seemed aware of these issues and they seldom indicated the robustness of their results or the (true) levels of the reported significance tests.

In fact, if we take Brown’s work into account, one of the major hypotheses that we would have tested in these equations would have been the homogeneity of the estimates over the sample. While the debate between Keynes and Tinbergen, for example, and the earlier exchanges between Schultz (1928), Ezekial (1928) and Robbins (1932), show that economists were well aware of structural instability in statistical models of economic behaviour, the mainstream tests did not emerge until much later. However, in this new era of estimation in place of testing, researchers rarely reported evidence that they had tested for structural stability (even if they had used, for example, a Chow (1960) test).

In the same way that the authority of Fisher (1926) is based on statistical relations that are unlikely to be robust, Phillips work does not stand empirical scrutiny (see Desai, 1975; Gilbert, 1976). The same can be said for the work of Tinbergen and Klein among others (see Epstein, 1987: 146). But it remains that the econometrician had become an essential part of the process of economic policy making.

The lack of scrutiny and testing by applied econometricians was complemented by the way the textbooks treated the Phillips curve. Sawyer (1989) surveyed the major textbooks and concludes

that the Phillips curve is often “presented as a well-established fact (Sawyer, 1989: 110). There is very little doubts cast on the empirical validity of the relationship. Leeson (1998: 609) also discusses the “authority of the textbook”. Leeson (1998: 609-10) says, “these textbooks have tremendous power to propagate myths and distortions ... Samuelson, and to a lesser extent Lipsey, were *content makers*; the other textbook writers were largely *content takers*.” Leeson concludes that the popularity of the Phillips curve was strongly influenced by the way the key textbooks promoted it. More work needs to be done on the role of textbooks in influencing the way economist thinking develops.

It is clear that the period immediately after the publication of Phillips (1958) was a fertile time for Keynesian economists and the applied econometricians who supported this theoretical edifice. Leeson (1998: 612) says

the 1960s were, at least for a while, a golden age, when economists – and one strand of Keynesian economists in particular – were generally held in high esteem. Many economists ... concluded that the business cycle had been tamed, if not completely eliminated ... The Phillips curve captured many of the confident intellectual currents of the period.

The Phillips curve also became a tool in the hands of the Monetarists to regain the ground they had lost to the Keynesians. With the support of the textbooks the model endured even though the original model was lost in the process.

Phillips’ (1958) model was ideal for the way in which economics was being taught in universities around the world. The simplistic graphical and algebraic representation of the textbooks within an IS-LM framework made it a popular vehicle for introducing inflation into the Keynesian model. The work of Brown, for example, was richer and more insightful but, perhaps, too ground in the institutional literature to be acceptable for textbook representation. It is probable that had Brown’s work on instability and the way changes in the institutions of wage and price determination change the trade-off between inflation and unemployment and the steady-state unemployment rate been more recognised, the subsequent history of the Phillips curve might have been different.

6 Conclusion

The chapter has shown that the Phillips (1958) was hardly a path-breaking piece theoretical and empirical development. Humphrey (1985: 23) concluded

Phillips was far from the first to postulate an inflation-unemployment tradeoff or to draw the curve bearing his name. Even the econometric wage-price equations employed in modern Phillips curve analysis together with their excess demand and alternative market clearing interpretations long predate Phillips. In short, Phillips and his successors inherited ... these concepts; they did not invent them.

We have shown that the history of the “Phillips curve” is an example of the discontinuity and opportunism in the development of macroeconomic thinking. There was some discussion of the so-called trade-off between inflation and unemployment among the classical economists. By the 1920s, Irving Fisher (1926) was setting the groundwork for what became Monetarism some 42 years later (Friedman, 1968). The work of Fisher was obscured by the rise of Keynesian macroeconomic orthodoxy. The Phillips curve, reflecting the adjustment of nominal magnitudes to real disequilibrium in the labour market, was a central expression of the confidence that policy makers had acquired with respect to eliminating the business cycle during the 1960s. However, Friedman with others was working on the foundations of a resurgence of neoclassical macroeconomics based on the Quantity Theory of Money during the 1950s and 1960s. The Phillips curve became their opportunity and the empirical havoc that the 1970s oil price shocks created among macroeconomic time series seemed to add weight to their (flawed) arguments. Nothing had really changed in the modern statement of Monetarism that had not been shown to be deficient, albeit in different terms, by Keynes and others.

This opportunism by Friedman and others exploited the vulnerability of the prevailing Keynesian paradigm, which had conducted successful policy throughout the Post World War II period up until the late 1960s with largely misspecified models. The Phillips curve was just one of a number of macroeconomic equations that ignored inflationary expectations. The misspecification was not significant while inflation was negligible. Once the inflation rates soared throughout the world in the early 1970s after the oil price rises, all these misspecified relations broke down and the theoretical edifice that was erected upon them also fell into disrepute. Monetarist thought emerged from this wreckage as being eminently plausible. It was a serendipitous period for the neoclassicals because they had actually reasserted the issue of real wage bargaining before the empirical relations broke down. The shift in the Phillips curve was interpreted as validating their theoretical structure, which had undergone harsh criticism from economists like Robert Clower and Axel Leijonhufvud.

An examination of the literature between Fisher (1926) and Phillips (1958) has shown that the Keynesians exploring the relationship between inflation and unemployment clearly knew about

the role of inflation expectations and in one case the problem of instability in the relationship (Brown, 1955). How the Phillips (1958) model became the exemplar is then the interesting question. If the work of Brown (1955), for example, had have gained more prominence, the subsequent development of macroeconomic theory and policy may have been quite different.

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Notes:

¹ Leeson (1998: 599) notes that "In the absence of firm theoretical foundations, a large amount of intellectual effort was expended to locate respectable empirical foundations for this relationship." Leeson argues that the theoretical legitimacy of the Phillips curve can be traced to its patrons (1998: 603) the "seven leading Phillips-curve Keynesians ... Paul Samuelson, Robert Solow, Franco Modigliani, James Tobin, and Lawrence Klein, ... the acknowledged intellectual leaders of an elite community."

² The price and unemployment equations, which form part of the macroeconomic model can be written (following Klein, 1985: 151) as

$$(\Delta p / p)_t = f(\text{initial conditions, exogenous history})$$

$$U_t = g(\text{initial conditions, exogenous history})$$

Given that f and g have the same arguments, a trade-off between the two can be expressed.

³ Leeson (1998: 609) says, "these textbooks have tremendous power to propagate myths and distortions." Samuelson (1983: 216) noted "the fiction that Keynes assumed rigid money wages was found to be a useful fiction."

⁴ O'Brien (1975: 163) says, "the effect is only transitional and does not continue once prices have adjusted to the new money supply."

⁵ O'Brien (1975: 148-49) compares Thornton to Ricardo, who he terms a rigid bullionist. He (1975: 148) says that Ricardo believed that "if currency was in excess, it must be contracted." In other words, the rigid bullionists in the period of convertibility believed in a "uniquely correct stock of currency" at any point in time.

⁶ Thornton refers to exchange as the relative premium or discount on bills of exchange drawn on different financial markets (see O'Brien, 1975: 148).

⁷ Despite the praise by Hayek, Thornton's analysis in this section is seriously compromised because he did not seem to understand the difference between a flow and a stock. He considered increases in bank deposits to be increases in the velocity of circulation rather than an increase in the money stock. Further, he did not consider bills of exchange or bank cheques when he analysed the relationship between money and the price level (see O'Brien, 1975: 143).

⁸ O'Brien (1975: 164) explains that "the reason for this is clear enough. Without a continual increase in world gold production ... inflation must, under a gold-standard system, soon be checked and indeed reversed. Since convertibility was a major objective ... this rules out inflation."

⁹ O'Brien (1975: 165) does not classify Attwood among the Classical economists, although he recognises that his analysis was derived from classical thought. He believes Attwood is distinct because his primary aim was full employment and he didn't care much for the convertibility issue. He also thought that the economy was inherently unstable in a deflationary direction.

¹⁰ Care must be taken here to associate the meaning of trade-off in the way the author discussed it. There is a fundamental difference between the trade-off in price level terms and the trade-off in terms of the derivative of the price level, and further, in terms of the second derivative of the price level. There are several interesting interchanges between economists about the meaning of the term inflation (see Solow, 1975; Tobin, 1966; and Leeson, 1996).

¹¹ The version of Mill's *Principles of Political Economy* referred to in this essay is the Kelley Publisher's *Reprints of Economic Classics* edition edited by W.J. Ashley and published in 1964. It is the text of the seventh edition (1871), the last one that Mill revised.

¹² Blaug (1977: 183) notes that in this section Mill is in stark contrast to Ricardo.

¹³ Barber (1997: 447) believes that Fisher was obscured, unjustly, by the "Keynesian ascendancy ... it meant that some of his achievements were overlooked and literally had to be rediscovered. In 1926, Fisher ... anticipated by more than three decades the essential insight contained in what was later to be labelled the Phillips curve."

¹⁴ Solow (1997: 433) refers to Fisher's remark "that if Copeland thinks there may be a relationship between changes in the price level and a distributed lag of employment then Copeland should go and look for it. If only he had!"

¹⁵ In relation to the Phillips curve, Leeson (1998: 605) considers the role of the econometricians was essential in it becoming the dominant model of inflation and unemployment in the 1960s. He says that "Samuelson and Solow's casual empiricism had been rapidly transformed into high theory, high-powered technical econometrics, and high-level policy advocacy."

¹⁶ Solow doubts whether Fisher actually performed any regression analysis so the graphs he produced showing actual and predicted employment were based on some other (spurious) means. The fit implied is extremely poor. For a young econometrician, the failure of Fisher to report accurately how he did things is frustrating.

¹⁷ All results are available from the author on request.

¹⁸ Klein (1985) is a collection of his famous papers, including the 1946 *Journal of Political Economy* article.

¹⁹ The original article was published in Dutch in 1936. It was reprinted in Tinbergen (1959).

²⁰ Tinbergen (1951) raised the issue that the wage equation (in this case for the United Kingdom) could be improved by replacing the employment term with the inverse of the unemployment rate to capture for non-linearities.

²¹ Klein (1985: 17) says that as part of his work in developing the theoretical aspects of the Keynesian model which prevailed in the 1940s, he "formulated an expression for the wage-rate determination that was the same thing as the Phillips Curve, back in the 1940s, when I was at the Cowles Commission."

²² In 1956, Bent Hansen and Gosta Rehn published a study of wage drift and money wage dynamics in the Swedish economy. Their model assumes that market forces determine the drift (the difference between earnings and wage rates, the latter being fixed by institutional forces). They also used a proxy term for excess demand based on the difference between vacancies and unemployment.

²³ Compare this to Friedman's (1975: 217-19) statement that

Phillips's analysis seems very persuasive and obvious. Yet it is utterly fallacious. ... because no economic theorist has ever asserted that the demand and supply of labour are functions of the *nominal* wage. Every economic theorist from Adam Smith to the present would have told you that the vertical axis should refer not to the *nominal* wage rate but to the *real* wage rate.

Klein and Ball (1959) were modelling disequilibrium phenomenon where the appropriate adjustment may be a function of the money wage rate. Phillips (1958) model was also in this spirit. They added (1959: 322)

[the wage change equation] is a key equation in the UK model because it displaces, in a sense, the money balance equation for the absolute determination of prices and wages. It is difficult, again following the Walrasian idea, to say what determines what is a truly interrelated system, but the main function of [the wage change equation] is to complete the system in respect of the determination of absolute wages and prices, while the cash-

balance equation has the main function of completing the system in respect of the determination of the interest rate. The state of the labour market displaces the state of the money market in determining the course of absolute prices or wages.

This fundamental shift in causality in the macroeconomic model is also developed in Klein and Goldberger (1955) and in Klein (1954). The recognition of the role of the wage equation by Klein clearly distinguishes the different schools of thought.

²⁴ In fact the estimating equation also contained a political factor (a step dummy variable taking the value of unity post 1952) to capture the change in behaviour of the trade unions when the Conservative Government was elected in 1952.

²⁵ Brown (1955: v) says

One of the main difficulties encountered by anyone trying in the last five or six years to understand the inflationary processes which had been going on since 1939, and were still very much in progress, arose from the unsatisfactory and rapidly changing nature of the theoretical framework at his disposal. Modern dynamic economics is a young subject, and the process of price increase under the pressure of excess demand or under the influence of expectations, after having attracted very interest in the years before 1939, have been discussed in considerable detail since then and especially since the war.”

²⁶ Brown makes no reference in his book to any of the econometric work that had been done on this question, specifically, Tinbergen and Klein *et al.*

²⁷ There were some early cost-push theories even as far back to Thomas Tooke (1844), but the demand-side explanations were by far the dominant viewpoint.

²⁸ Before we conclude that Brown would have supported a Quantity Theory notion of inflation it should be noted that he thought people would economise on idle cash balances and this leads to interdependence between the supply of money and the total value of transactions. Brown (1955: 6) says that “a great deal of inflation of prices is generally possible without any increase in the quantity of money – a revision of expectations may bring it about.”

²⁹ Amed-Houzier, Dick and Luchter (1971: 319-320) say, “While the general relationship between price changes and unemployment had been recognised earlier, Sultan was the first to show explicitly the trade-off between percentage changes in price level and unemployment in diagrammatic form.”

³⁰ Here we are using the term Monetarist to describe the work of economists like Friedman who were attempting to re-establish the Quantity Theory of Money as the centrepiece of macroeconomics.

³¹ Dow (1985: 83) says

The predominant macro problem was persistent unemployment, the inability of the labour market to clear. This contrasted with the market clearing framework of neo-classical macro. It became conventional, as a result, to view macroeconomics as dealing with co-ordination failures and microeconomics with co-ordination successes.

³² It is interesting to note that the Phillips curve is not an optimising function that is derived from rational, maximising behaviour. Klein (1985: 151) says

It is simply a market clearing relation. On the one hand, there are optimizing decisions of households (and trade unions) about labor supply and, on the other hand, optimizing decisions of firms about labor demand. When employee and employer representatives come to the bargaining table, with all the institutional apparatus that such a process entails, a wage bargain is struck on the basis of labor market and other economy-wide considerations. It is surely an accepted part our subject’s view of the working of markets that wages move in response to excess supply or demand in order to set up a tendency towards restoration of equilibrium. It is just a way of introducing dynamic adjustment

processes into the reconciliation of two optimising decisions, and it is fruitless to look about for some optimizing explanation of the Phillips curve.”

³³ The October 1960 edition of the Review of Economic Studies concentrated on the mechanisms that operate in disequilibrium and how the Quantity Theory reasserts homogeneity and Walras’ Law.

³⁴ Lipsey (1978: 56) does not believe the idea of a permanent trade-off was a prediction that Phillips made. He recognises that it was a controversial proposition even before Friedman (1968). Lipsey, himself (1960: 31-32), cautioned against assuming the money wage inflation-unemployment rate relationship would be stable in the face of a long period of tight labour markets. Yet, he writes (1978: 56-57) , by way of self-confession, that these “warnings were, ... , quickly forgotten, and many economists, including myself ... were soon plotting Phillips curves ...[with inflation against unemployment] ... , along with policy makers’ indifference curves, and determining the optimal combinations of ...” inflation and unemployment.

³⁵ Epstein (1987, Chapter 4, Section 3) argues that the early work of the Cowles Commission “retreated from structure” and it was not until Tobin took control that macroeconomic theory and microeconomic underpinnings became more important. Certainly, the Klein and Goldberger (1955) model made attempts to add theoretical sophistication to the econometric model.

³⁶ Desai (1981: 4) says the Phillips curve “seemed to most economists ... to provide the missing element in the Keynesian model. Now there was a theory of inflation which could be integrated into the IS-LM framework and the Keynesian edifice was complete.”