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I am enclosing herewith a dissertation written by Bill L. Ballard entitled "Interest Rate Effects in Modern Industrial Economies." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Economics.

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INTEREST RATE EFFECTS IN MODERN INDUSTRIAL ECONOMIES

A Dissertation

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Bill L. Ballard
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ABSTRACT

This research attempted to ascertain the relationships between nominal interest rates, nominal spending, real output, the price level and the money supply. The essence of the study constitutes chapters three, four and five which follow a review of the literature in chapter two.

In chapter three it was found that nominal interest rates are correlated with real output but not with nominal spending. A vector autoregression (VAR) was used to empirically test these relationships.

In chapter four the cointegration technique was utilized to ascertain whether nominal interest rates and nominal spending or nominal interest rates and real output have a long term structural relationship. It was found that nominal interest rates are not cointegrated with either nominal spending or real output.

In chapter five the cointegration technique was utilized to test two opposing theories of price level determination. It was found that the M2 measure of the money supply and the GNP deflator formed a cointegrated series. It was also found that nominal interest rates, nominal wages, and the GNP deflator form a cointegrated series. Both theories thus received empirical support.

It was concluded that raising interest rates reduce output for a short time but have no long term impact.

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CHAPTER 1

INTRODUCTION

1. Introduction

The purpose of this study is to provide a systematic analysis of the effects on the aggregate economy of deliberate manipulations of nominal interest rates by the Monetary Authority. In particular, this study is concerned with changes in nominal spending (GNP minus inventory changes) and real output (Real GNP), and in their rates of growth, resultant from variations in nominal interest rates. A byproduct of this analysis, the effect on the aggregate price level, and changes in its rate of growth, that is attributable to interest rate movements, will also be of major concern. The hypotheses to be tested, and the conclusions drawn from these tests, take the form of three essays. These essays constitute chapters 3, 4, and 5 of this study and follow a review of the literature in chapter 2. Chapter 6 contains a summary of the work undertaken and limitations of the study.

Before I begin this analysis a prefatory comment is in order. It is assumed throughout this study, contrary to the accepted belief of orthodox economics, that the Monetary Authority controls the terms on which money enters the economy, not the quantity that enters. In others words it is believed that the Central Bank, the Federal Reserve, exercises its authority over the nominal rate of interest. The amount of credit extended, thus the quantity of money that enters the economy, depends upon the willingness of economic agents to borrow at that rate of interest. If the Central Bank feels that the rate of money growth is too high (low), their only recourse is to raise

(lower) the rate of interest and hope that the willingness to borrow is choked off (or spurred). Whether or not that willingness to borrow is indeed choked off depends on the change whether actual or perceived, in the ability of the credit extension to be liquidated, that results from the change in the rate of interest. This, in turn, depends on the effect on aggregate nominal spending relative to that on the costs of producing a given quantity of output, to interest rate changes. The sensitivities of nominal spending and production costs, and thus real output to interest rate movements determine the Central Bank's ability to control output, the price level, and the quantity of money. The relationships between these key variables constitute the essence of this study.

2. Statement of the Problem

Mainstream economists[1] have long argued that restrictive monetary policy, i.e. increasing nominal rates of interest, is an effective inflation deterrent. These same economists also recognize that "interest payments are a significant component to costs of many firms" (Blinder and Solow, 1974, p. 101). Therefore, in order for rising interest rates to reduce the price level, either nominal spending (PQ) must fall more than the cost induced reduction in real output (Q) or some other component of costs must fall so that total cost per unit of output remains unchanged. Since no explanation for this interest induced fall in some other cost component has been

[1]For a discussion of the make up of mainstream economics see Davidson (1978) pp. 3-9.

forthcoming, we must assume that these mainstream economists are relying on the former explanation. In other words, mainstream economists must argue that increasing nominal interest rates shifts the aggregate demand curve down in a greater magnitude than the upward shift in the aggregate supply curve due to the increase in costs. Otherwise, prices would have to rise as output fell.

Other economists, those on the, shall we say, fringes of the mainstream, suggest that it is the aggregate supply curve that shifts the most while aggregate demand is hardly affected. Therefore, restrictive monetary policy, in the short run, at least, is more likely to exacerbate inflation rather than deter it. Hotson (1976, p. 103) argues that as interest rates rise, interest incomes rise and "those receiving higher interest incomes presumably spend more, offsetting part or all of the fall in investment spending which was supposed to make the interest hike depressionary and presumably deflationary." Further, Weber, (1970, 1975) has demonstrated that aggregate consumption expenditures are in fact positively and significantly related to nominal interest rates. Therefore, since consumption expenditures account for approximately two thirds of nominal spending, one would expect that restrictive monetary policy would increase nominal spending, unless investment expenditures were extremely sensitive to interest rate movements. Previous work on investment, however, does not generally confirm this (see Eisner, 1960; Bean, 1981; Lawrence and Siow 1985).

The controversy over the relative sensitivities of nominal spending and real output to interest rate manipulations makes up the problem to be addressed in Chapter 3. The purpose there is to provide empirical evidence to support either the contention

that monetary policy, in the short run, is more appropriately represented by shifts in the aggregate demand curve, as mainstream economist suggest, or by shifts in the aggregate supply curve as numerous others imply.

Chapter 4 takes on the task of identifying the relationships among interest rates, rates of growth in nominal spending, and rates of growth in real output over the long run. Mainstream economists often admit that restrictive monetary policy may indeed increase the rate of growth in the price level for a short time. However, they contend that persistent restrictive policy will, in the long run, reduce the rate of inflation (Ritter and Silber, 1971, p. 180). In order for this to come about, nominal spending must have a long term stationary relationship with interest rates, while real output, though there may be some short run divergence, should show no long term stationary relationship to interest rates. That is, nominal interest rates and nominal spending should form a cointegrated system,[2] while nominal interest rates and real output should exhibit non-cointegrated characteristics.

Others, on the other hand, argue that, given the effect of interest rates on consumption spending and interest income, nominal interest rates and nominal spending should not be correlated in any significant degree nor should the two series exhibit a stationary, or cointegrated, relationship. Further, since the short run impact of interest hikes on prices may be positive, the incentive for workers to accept wage

[2]A cointegrated system is one in which the variables in the system, when linearly combined, form a stationary, or mean reverting, series. This ensures that the variables have a long term structural relationship (see Engle and Granger, 1987). The cointegration technique is discussed in more detail in chapter 4 below.

cuts and maintain their real wage, thus lower production costs and induce the production of real output back to its original level, or natural rate, is destroyed. Eisner (1971, p. 636) notes that "these higher prices contribute to further increases in costs as wage earners endeavor to compensate for higher costs of living". If this is true,then nominal interest rates and the rate of growth in real output should form a negatively correlated, cointegrated system. Therefore, the impact of higher nominal interest rates may be to alter the long term rate of growth in real output. However, since no evidence exists on whether wages are more responsive to unemployment or to price increases, no evidence exists for a rigid relationship between long term output growth and interest rates.

The problem addressed in the second essay, chapter 4, is thus to utilize the technique of cointegration to provide empirical support for one of the two hypotheses set forth above. Support for the mainstream notion that persistently high rates of interest will ultimately defeat inflation depends upon the finding that nominal interest rates and nominal spending are cointegrated, while nominal interest rates and real output are not cointegrated, though some correlation may exist. Support for the opposing view depends on the finding that nominal interest rates and nominal spending are not correlated and not cointegrated, while nominal interest rates and real output are correlated and may be cointegrated unless wages are affected sufficiently to offset the interest effect. This latter case would imply that nominal interest rate manipulations have a significant effect on income distribution. While this is an

important implication, it is not pursued in this study. However, avenues for further study along these lines are pointed out are chapter 6.

The final essay, chapter 5, addresses the explanation of the long term stability or instability of the aggregate price level from another perspective. In this essay, two opposing explanations of price level movements are subjected to empirical analysis. The problem addressed in the essay is to determine whether absolute prices, in the long run, depend upon the quantity of money created or on the costs of production.

Mainstream economists, whether they are left leaning "Keynesians" or right leaning Monetarist/New Classical, are virtually unanimously agreed that the aggregate price level, in the long run, depends upon the quantity of money in existence, regardless of any other influence (see Mankiw, 1991). They tend to disagree on why, if at all, velocity fluctuates in the short run, but in the long run money is all that matters for inflation.[3] A test of this hypothesis should therefore be fairly easy. The growth rate of the money supply (I test both M1 and M2) should be positively correlated with and cointegrated with the aggregate price level. A finding of cointegration indicates that the two series, despite some short run divergences, maintain a stationary long term relationship. Rejection of cointegration must be interpreted as strong evidence that money is not all that matters in the long term.

Other economists, following Keynes' contentions in The General Theory (Keynes, 1936), argue that the long term relationship between prices and the money supply is weak, at best. They argue that the price level depends upon the relationships

[3]This concept is referred to as the axiom of the neutrality of money.

between the hire prices of the various factors engaged in the production process and the productivity of these factors. As Keynes pointed out, "The long run stability or instability of prices will depend on the strength of the upward trend of the wage-unit (or, more precisely, of the cost unit) compared with the rate of increase in the efficiency of the productive system" (Keynes, 1936, p.309). A test of this hypothesis should be fairly easy as well, given the cointegration technique. The rate of growth of the nominal hire prices of the factors of production, the increase in the productivity of the system, and the aggregate price level should form a cointegrated system with the factor nominal hire prices positively correlated, and the productivity measure negatively correlated, with the price level. By definition the average money wage is the hire nominal price of the factor, labor. Perhaps not so obviously, the nominal rate of interest is used as the determining factor for the hire nominal price of non labor resources. This idea stems from Keynes' belief that the marginal efficiency of capital tends toward the market nominal rate of interest (see Keynes, 1936, p. 184). Therefore, any factor purchased and used in the production process must yield a return to the purchaser, in equilibrium, equivalent to the opportunity cost of the money used to purchase the factor, i.e. the market rate of interest, adjusted, of course, for the risk associated with the production and sale of the final good (see Davidson, 1978, p.244). This concept is further elucidated in chapter 5. Given the obvious difficulty in defining the quantity of non-labor factors actually employed, the average product of labor is used as a proxy for the productivity of all factors. Since labor constitutes

upwards of two-thirds of the costs of production, the simplification should not present a major distortion in the theory.

3. Statement of the Importance of the Problem.

The importance of the problem addressed in this study lies primarily in the conduct of monetary policy. Today mainstream economists rely almost exclusively on restrictive monetary policy to combat the persistent inflation plaguing the U.S., and virtually every other nation, since the late 1950's. The belief that monetary restriction can, if applied correctly, stem the inflationary tide, has led most economists to accept it as the only game in town, despite the ghastly consequences. Restrictive monetary policy has been the primary cause of all but one of the post WWII recessions[4] with their accompanying unemployment, (rising, in 1982, to 12.5 percent), business and bank failures, and losses in real output, which can never be recouped. Some suggest that the present recession, (1990-) now reaching world wide proportions, is also the result of the tight money policy pursued in the late 1980's. Regardless of the conclusions reached in this study, it seems that the extreme costs inflicted on society, as a result of monetary restriction, would warrant a search for a less costly prescription for controlling the relentless rise in prices. Since this search has not yet

[4]The recession of 1949-1950 can not be attributed to restrictionary monetary policy since the Federal Reserve was obligated, until the Treasury/Federal Reserve Accord of 1951, to maintain the price of Treasury securities thus eliminating their ability to raise interest rates.

begun, it is hoped that this study will at least raise questions about the effectiveness of monetary policy and suggest the direction in which the search should begin.

Of further significance is the determination of the distribution of output, or income, between labor and non labor factors of production. Mainstream economists, relying on the marginal productivity theory of distribution, contend that each factor contributing to the production of output receives exactly that portion of output which it contributes. Thus wage earners receive a real wage equal to the marginal product of labor while owners of other factors (for convenience I refer to all other factors as capital), receive a rate of return equal to the marginal product of capital. However, it is well known, given the law of diminishing marginal product, that the marginal product of any given factor depends upon the amount of that type of productive resource available for employment relative to the amount of all other types of resources. If capital is held scarce relative to labor, then the return to capital owners is enhanced at the expense of labor and vice versa. Thus, since the amount of labor available is not directly influenced by economic factors, the distribution of income depends upon the quantities of the various different types of capital which come into being. According to Keynes, the amount of investment in any particular type of capital good is pushed to the point that the expected marginal return to that capital good, i.e. the marginal efficiency of investment, is equal to the rate of interest (Keynes, 1936 p. 184). Obviously then, the maintenance of a high rate of interest, the official explanation of which is to control inflation, also serves to increase the portion of output which capital owners can call theirs at the expense of the laboring classes.

Given that a large portion of those entrusted with the carrying out of policy receive the majority of their income from the ownership of capital, (more importantly perhaps the majority of the incomes of those to whom policy makers owe their positions comes from the ownership of capital), it is not surprising that restrictive monetary policies continue to receive high acclaim in policy circles despite the fact that over two decades of restriction have failed to halt inflation. In the event that the outcome of this study questions the efficiency of restrictive monetary policy, the official explanation of the maintenance of high rates of interest will undoubtedly have to be qualified. On the other hand, the consequences for the distribution of income poses a conflict of interest on the part of policy makers regardless of the conclusion reached here.

4. Conclusions

As stated at the outset, the purpose of this investigation is to analyze the effects that manipulations of nominal interest rates have on the economy. Alternatively this study may be proposed as a test of the predictions of the Currency School against those of the Banking School. The Currency School, which rests on the quantity theory of money, is today accepted religiously by those inhabiting the mainstream of economic thought. Its basic tenets are that the economy is self correcting at full employment, regardless of the actions of the central bank. It is thus the sole concern of the authorities at the central bank to regulate the quantity of medium in circulation to ensure the value of that medium.

The Banking School, on the other hand, contends that the quantity of medium in circulation is a determinate of the economic system, not a determinant. Thus the primary obligation of the monetary authorities is to ensure an elastic supply of money to meet the demands of commerce--the "real bills doctrine." According to this school the value of the "bills" depends upon the nominal income of the participants in the economic system, which, I will argue, is determined by the nominal rate of interest, for owners of non-labor factors of production, and the nominal wage rate for laborers. Any increase in either means that more money is required to maintain any given level of economic activity. Thus the quantity of money in existence, as well as its value, is a consequent of the economic system, not an antecedent as the Currency School maintains (see Tooke, 1844).

The following chapter, chapter 2, of this dissertation traces the development of both the Currency and Banking Schools from their developments by economists from the early 1800's to the present. Following this literature review are three essays, chapters 3, 4, and 5, which utilize some of the recently developed statistical techniques to compare the explanatory powers of the competing theories. Following these is chapter 6, which summarizes these essays and draws some conclusions both for the conduct of monetary policy as well as some implications for the distribution of income. In this last chapter I will also point out some avenues for further research which beg to be explored.

CHAPTER 2

LITERATURE REVIEW

1. Introduction

The relationships between the nominal, or market, rate of interest and other economic variables, such as output, spending, the price level, and the money supply, have been the subject of debate virtually since the beginning of the discipline of economics. It is the debate over these relationships that lies at the core of the "Currency Principle" vs. the "Banking Principle" controversy or, as its generally known today, the "Verticalist" vs. the "Horizontalist" controversy (Moore, 1990). In this chapter, my purpose is to review these controversies with particular emphasis on the way each side views the flows of causation between the nominal rate of interest and the supply of money as well as the effect that movements in the interest rate should have on output and nominal spending. In effect, chapters 3, 4, and 5 are designed to empirically test these two views.

In essence, the two views may be summed up succinctly as follows. The Currency School's or verticalist's position is the view taken by the mainstream of economics today. It basically contends that it is the quantity of money in circulation that is subject to authoritative control and thus must be treated as the exogenous component. Further, the argument incorporates Say's Law and argues that there is a natural tendency toward the full employment of all productive factors, regardless of the action taken by the monetary authorities. Money doesn't matter in the determination of the level of output or employment. In other words, output is created in the exact same quantity even if producers are denied access to money. It then logically follows, given these assumptions,

that the quantity of money in circulation, as determined by the authorities, can affect only nominal variables such as nominal spending, the price level, and the nominal rate of interest. The more money allowed to circulate, the higher the level of nominal spending and thus the higher the level of prices, since the quantity of goods available to be purchased is limited by the physical abilities of the factors of production to produce. In sum, an overall rise in the level of prices is a direct result of the increased issuance of money. I should also note here that this school generally uses either specie, in earlier writings, or coin and paper in circulation and demand deposits in later years, as their definition of money.

The relationship between the nominal rate of interest, that is the rate banks charge on notes of short term maturity, e.g. 3 month Treasury bills, and the quantity of money, from the Currency School's perspective, is somewhat muddled. On this issue Keynes' noted, "The wild duck has dived down to the bottom--as deep as she can get--and bitten fast hold of the weed and tangle and all the rubbish that is down there, and it would need an extraordinarily clever dog to dive after and fish her up again" (Keynes 1936, p. 183). A perusal of the earlier literature tends to suggest that nominal interest rates and the quantity of money in circulation are inversely related. The magnitude of the interest rate being, of course, the determinate. As the authorities increase the amount in circulation, the interest rate falls and supposedly remains there until further action affecting the money supply is undertaken. Since an increase in the supply of money simultaneously reduces interest rates and raises prices, one should thus expect the nominal rate of interest and the level of prices to move in opposite directions. Unfortunately, as pointed out by

Tooke (1844) and later by Gibson (1923) the opposite is virtually always the case. As interest rates fall, prices also fall and vice versa. The indecency of the unconforming facts demanded an explanation and, after some time, proponents of the Currency School came up with at least two. The one generally accepted in mainstream economics today was put forth by Irving Fisher (1907). The explanation put forth by mainstream economists relies on the role of inflationary expectations in the determination of nominal interest rates. Thus, in the contemporary literature it is explained that monetary expansion reduces nominal interest rates in the short run. However, the monetary expansion also pulls up prices and therefore increases inflationary expectations. The increase in anticipated inflation causes savers to demand a higher nominal return on savings to maintain their real return. Borrowers are also willing to pay higher nominal rates since the real value of the money paid back is lower. Thus nominal rates are pulled up with prices in the long term (see McCulloch, 1975, p. 47--50). The implication of this scenario for the relationship between nominal interest rates and nominal spending, is forthright. Lower nominal interest rates must increase spending in the short term more than they increase output. And in the long run, nominal interest rates and nominal spending must show a structural, or stationary, relationship.

The Banking School, on the other hand, regards the nominal interest rate as the exogenous component, the quantity of money that exists being an outcome of the process. This school also usually uses a much broader, vaguely defined, measure of what constitutes money than that of the Currency School. Usually all forms of credit, including

that extended by banks as well as non-bank institutes, are included as money.[1] The flow of causation thus runs from the interest rate to the money supply. However, whether changes in the nominal interest rate actually alter the supply of money depends on numerous other factors such as the effect on nominal spending by businesses, individuals, and governments.

The relationship between the interest rate and the level of nominal spending, output, and the price level is a little more involved. This school contends that the level of production, or output, at any point in time, depends upon the interaction between the level of nominal spending and the cost of producing a given volume of output. In this scenario, the interest rate represents the governor of the cost of non-labor factors of production but does not, in the aggregate, reasons for which will be given later, affect to any significant degree the level of spending. So rising nominal rates of interest increase the cost of production without having a measurable effect on nominal spending. Thus, real output (Q) will fall, and since nominal spending (PQ) remains unchanged, the price level (P) must rise. High interest rates are thus a cause of higher price levels and reductions in output, i.e. stagflation.

Though most aspects of the Currency School were in place much earlier, this review begins with the work of David Ricardo. It was Ricardo who, to a large degree, incorporated much of the Currency School's idea into the larger discipline of classical economics. It was also the Ricardo-Malthus debates that first elucidated the difference in the two schools. Malthus, of course, along with Thomas Tooke, are credited with

[1]See the quotes of Malthus and Tooke below.

developing the ideas of the Banking School. Following Ricardo, Malthus and Tooke, the writings of Knut Wicksell starting in 1905 will be discussed. From the time Tooke publicized the schism between theory and fact in 1844 until Wicksell's Lectures on Political Economy appeared in 1905, no explanation existed for the Currency School, though it apparently didn't matter since the Currency School and classical economics dominated the thinking in economics. Much of this was probably due to the lack of publicity Tooke received as well as the virtual domination of Ricardian theory.

Later, in 1923, A. H. Gibson again called attention to the fact that interest rates and prices moved together. Keynes, in 1930, referred to this as the Gibson paradox. Keynes' explanation of the paradox paralleled that of Wicksell, rejecting the inflationary expectations explanation put forth by Fisher. In the General Theory (1936) Keynes reversed the causality arrow he had relied on earlier to explain the paradox but did not, except for a passing reference, acknowledge the implications for monetary policy. Fisher's 1907 explanation, though it had been rejected by Keynes, was overwhelmingly accepted by the mainstream and remains the orthodox position today despite repeated unsuccessful attempts to validate it empirically. There are some, those associated with the American Post Keynesians, who do not accept the Fisher's views and remain loyal to the Banking School. It is to the writings of these and other individuals who have shaped the way the economy is perceived today that I now turn. I will begin with a review of the writings of David Ricardo.

2. Ricardo and the Currency School Tradition

Deeply imbedded in the Currency School tradition is the idea that the value of the money in circulation, whether it is gold, silver, or any other type coin, or paper, depends upon the quantity in circulation. Ricardo, maintaining this tradition writes in his Principles,[2] "While the state alone coins, there can be no limit to this charge of seignorage;" (the charge of seignorage being the difference between the coin stamped by the state and "any other piece of the same metal of equal weight and fineness") "for by limiting the quantity of coin, it can be raised to any conceivable value." (Ricardo, 1817, p. 238). Ricardo sees the value of paper money being regulated by the same rule. "It is on this principle that paper money circulates. . . Though it has no intrinsic value, yet, by limiting its quantity its value in exchange is as great as an equal denomination coin, or of bullion in that coin" (Ricardo, 1817, pp. 238-239). Ricardo had thus maintained that the value of paper money, or currency, in circulation was uniquely determined by the volume of it in circulation. Keynes was later to lament that Ricardo's ideas "conquered England as completely as the Holy Inquisition conquered Spain" (Keynes, 1936, p. 32).

Ricardo sees two separate forces at work causing a relationship between the nominal rate of interest and the quantity of money. On the one hand there is the rate at which banks will lend. In modern language this is the market or nominal rate of interest. On the other hand there is Ricardo's "market rate of interest". That is the "rate of profits which can be made by the employment of capital" (Ricardo, 1817, p. 246). The quantity of money in circulation depended on the relation between these two. "The applications

[2]Principles of Political Economy and Taxation, (Ricardo, 1817).

to the bank for money, then, depend on the comparison between the rate of profits that may be made by the employment of it and the rate at which they are willing to lend it" (Ricardo, 1817, p. 246). In short, if banks lent at a rate below the "market rate of interest", the quantity of money would increase, and thus prices would rise; if the bank's rate was above that "market rate of interest", the supply of medium would decline along with prices. Furthermore, the "market rate of interest" is "totally independent of the quantity or of the value of money" (Ricardo, 1817, p. 246).

Implicit in Ricardo's analysis is the idea that the rate of interest charged by banks cannot affect the quantity of output, only the nominal level of spending. For Ricardo the amount that a community produced depended on "the quantity of capital. . .employed in production. . .these can neither be increased nor diminished by the operations of the bank" (Ricardo, 1817, p. 246). With quantity fixed, any increase in the price level must coincide with an increase in nominal spending. In sum, Ricardo's analysis means that the rate of interest banks charge, the nominal rate of interest, is negatively correlated with prices and nominal spending while it has no effect on the level, or rate of growth, of output.

Ricardian theory, as is well known, dominated the profession of economics until the late 1800's and is still today a major foundation of the New Classical and Real Business Cycle theories that occupy the right wing of the profession. However, even during Ricardo's time, there were dissidents, men who distilled theory with facts. These "heretics" formulated a different view of the world than Ricardo and laid the foundations for the Banking School.

3. Malthus, Tooke, and the Banking School

At the core of the Banking School's ethos lies the idea that money, broadly defined, is a consequent of the process of commerce, not an antecedent as the Currency School propounds. In other words, the supply of money that exists is determined by, among other things, the level of prices. For any given volume of trade, a higher price on the goods traded requires a larger volume of medium in order for the trade to be carried on. The prices of the goods traded, and thus the price level in the aggregate, depends, in turn, on the interaction between the nominal incomes of those demanding the goods and the nominal cost, per unit, of producing those goods. Incomes, of course, are the result of the cost being paid out. However, since the distribution of income to the differing classes is not uniform, there is no guarantee that all of that paid out would wind up in the hands of those who would spend it; thus, the concept of effective demand along with the cost-push theory of inflation came into being.

T. R. Malthus, in a pamphlet published in 1800 entitled An Investigation of the Present High Price of Provisions earned Keynes' recognition as "the first Cambridge Economist" (Keynes, 1931, p. 107) by first putting these simple ideas into print. Malthus writes, "To Proceed to the point: I am most strongly inclined to suspect, that the attempt in most parts of the kingdom to increase the parish allowances in proportion to the price of corn, combined with the riches of the country, which have enabled it to proceed as far as it has done in this attempt, is, comparatively speaking, the sole course, which has occasioned the price of provisions in this country to rise so much higher than the degree of scarcity would seem to warrant, so much higher than it would do in any other country

where this cause did not operate" (Malthus, 1970, p. 8). In answer to those arguing that it was the increased issuance of paper money which had caused the rise in prices, Malthus responded, "To circulate the same, or nearly the same, quantity of commodities through a country, when they bear a much higher price, must require a greater quantity of the medium, whatever that may be. The circulation naturally takes up more. It is probable, therefore, that the Bank has found it necessary to issue a greater number of its notes on this account. Or, if it has not, this deficiency has been supplied by the country bankers, who have found that their notes stay out longer, and in greater quantity, than they did before the scarcity, which may tempt many to overtrade their capitals. If the quantity of paper, therefore, in circulation has greatly increased during the last year, I should be inclined to consider it rather as the effect than the cause of the high price of provision." (Malthus, 1970, p. 23).

Thus, Malthus laid the foundations of the Banking School and provided an alternative explanation to the events of the day from Ricardo. Ricardo's analysis prevailed nonetheless, and it was on his writings which future economists built. Along the way, however, commonly observed facts presented stumbling blocks. One of those to point out that the facts were at odds with Ricardo's theory was Thomas Tooke.

Tooke's primary contributions to the discipline of economics can be found in his mammoth A History of Prices and the State of Circulation, published in six volumes, the last two with E. Newmark, starting with the first two in 1838, followed by a third in 1840 and fourth in 1848, and the final two in 1857. During his earlier years, until 1840, Tooke was a follower of Ricardo and regarded the Currency School as being correct. The

constant onslaught of the data in obvious contradiction to the theory led Tooke, however, to abandon the Currency School and adopt what was to become the Banking School's tenets. In volume III of his History, Tooke seems to adopt Malthus' position. There he writes that the principle regulating prices "is not the quantity of paper money issued by the banks, but it is the quantity of money constituting the reserves of the different orders of the State, under the head of rents, profits, salaries and wages, destined for current expenditure, according to the wants and habits of the several classes, that alone forms the limiting principle of the aggregate of money prices... as the cost of production is the limiting principle of supply, so the aggregate of money income devoted to expenditure for consumption is the limiting principle of demand for commodities" (Tooke, 1840, p. 276). Tooke thus rejects the idea that it is the quantity of money which regulates prices. It is rather the relationship between income "destined for current expenditure" and the cost of production which regulates prices.

In 1840, Tooke had not completely rejected the Currency principle however. He still believed that lowering interest rates would cause an increase in the supply of money which would bid up incomes with price rises to follow. In 1844, with the publication of An Inquiry into the Currency Principle, Tooke seems to have wholeheartedly adopted the Banking Schools's ideas. In this pamphlet he argues that banks may not be able to affect the quantity of money in circulation. "That it is not in the power of Banks of Issue, including the Bank of England, to make any direct addition to the amount of notes circulating in their respective districts, however disposed they may be to do so...That neither is it in the power of banks of Issue directly to diminish the total amount of the

circulation" (Tooke, 1844, p. 122). It was obviously in their power to affect the rate of interest however. Thus it was only a small step to the idea that increasing the rate of interest, while it doesn't affect the supply of money, nominal income, or spending, it does increase the cost of production, so obviously prices must rise. "That a reduced rate of interest has no necessary tendency to raise the prices of commodities. On the contrary, it is a cause of diminished cost of production, and consequently of cheapness" (Tooke, 1844, p. 123).

Tooke's massive accumulation of data on price movements and bank lending rates had finally persuaded him to break with the Currency School. Unfortunately for Tooke, and economics in general, the analysis employed laid too much emphasis on the events of practical experience and not enough on a critique of the accepted, supply driven, Ricardian theory. Tooke failed to recognize that, not only did the level of spending relative to production cost determine prices, it also determined the level of output and employment. Malthus had proposed this earlier, but his breakthrough was overwhelmed by the victory of Ricardian theory. Tooke's analysis, since it didn't explicitly reject the notion that the long run tendency of the economy was full employment, was left open for attack. Knut Wicksell, writing in 1898, was able to exploit Tooke's open flank and provide an explanation for Tooke's data from within the Currency School.

4. Knut Wicksell

Wicksell's reconciliation of the data with the Currency School's reliance on the quantity theory of money was accomplished with a resort to the Ricardian notion of a

"market rate of interest" balanced against the bank's lending rate. Wicksell calls the former natural or real rate of interest and the latter the nominal rate of interest. Wicksell's natural rate of interest is similar to Ricardo's market rate of interest. It is the rate of return on the employment of capital, and is determined by "the efficiency of production, on the available amounts of fixed and liquid capital, on the supply of labor and land, in short on all the thousand and one things which determine the current economic position of a community; and with them it constantly fluctuates" (Wicksell, 1898, p. 106). The nominal rate of interest being, of course, that rate at which banks lend. If the nominal rate of interest was equal to the natural rate, prices would remain constant. "There is a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise or lower them...It comes to much the same thing to describe it as the current value of the natural rate of interest on capital" (Wicksell, 1898, p. 102). If, however, the natural rate of interest is above the nominal rate "entrepreneurs will in the first instance obtain a surplus profit (at the cost of the capitalist)... They will inevitable be induced to extend their business... and the number of people becoming entrepreneurs will be abnormally increased. As a consequence, the demand for services, raw materials, and goods in general will be increased and the prices of commodities must rise" (Wicksell, p. 105-106). The rise in prices is then a result of the increase in the supply of money resultant from the lending rate being below the return on money employed.

Wicksell argues that "credit institutions...are obliged sooner or later, as a result of the operation on the money market of the forces of supply and demand, to come into line

with the natural rate" (Wicksell, p. 107-108). Thus the tendency of prices and interest to rise and fall together, as Tooke had observed, was a result of the nominal rate of interest moving toward the natural rate. "The only possible explanation lies in the influence which is exerted on prices by the difference between the two rates of interest" (Wicksell, p. 110). In Wicksell's view, if the supply of money that banks were able to lend was not held in check "a fairly constant difference between the two rates could be maintained for a long time, and the effect on prices might be considerable" (Wicksell, p. 110). Thus the cure for inflation was to limit the amount of money banks could lend which would force them to maintain a rate of interest at or above the natural rate. If banks maintain a high rate of interest, "They are thus able, within certain limits, to exert a continual downward pressure on prices" (Wicksell, p. 111). Since "an increase in the supply of certain groups of commodities means an increase in the real demand for all other groups of commodities" (Wicksell, p. 105), the possibility of reduced output and increased unemployment accompanying the high nominal interest rates did not exist. Supply creates its own demand. For those willing to work and supply, a market always exist. Thus Wicksell, relying on the full employment tendencies of a supply driven theory, was able to explain away Tooke's facts. In sum Wicksell's conclusions coincide with the relationships identified earlier with the Currency School. Lowering nominal interest rates should be associated with increasing nominal spending, if the natural rate is above it. Nominal interest rates should not, however, be related to changes in real output.

5. The Gibson Paradox

The modern debate over the close positive correlation of nominal interest rates and prices centers around what is known as the Gibson paradox. As noted earlier, the mainstream view suggests that prices and market interest rates should be negatively correlated since an increase in the supply of money reduces interest rates and raises the price level simultaneously. However, again in the 1920's as it had done in Tooke's time, the ugly facts of reality intruded on the logical construct of theory. In January of 1923 and again in November of 1926, A. H. Gibson published articles in the Bankers Magazine that included series of the yield on consuls and the wholesale price index in Britain for the years 1730-1920. The close positive association of the two series was striking and demanded an explanation. Gibson's own explanation was that, "The less the cost of living the greater must necessarily be the margin available for investment."[3] Or, as the prices of consumer products fall, more money is available for investment purposes thus lowering interest rates. However, as Keynes later pointed out, when prices fall, incomes also fall thus negating any surplus available for investment. In the seventy years since the publication of Gibson's articles several explanations have been forthcoming. None of them, however, have been convincing and empirically verified.

6. Keynes in the Treatise

In the Treatise on Money (Keynes, 1930), Keynes noted that the Gibson paradox was "one of the most completely established empirical facts within the whole field of

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[3] As quoted in Keynes (1930, V. II, p. 186).

quantitative economics, though theoretical economists have mostly ignored it" (Keynes, 1930, V.II, p. 178). Keynes' own explanation of the phenomenon was along the same lines as Wicksell's. There he notes that "the market rate of interest", which is Wicksell's nominal rate, "is very "sticky" in relation to the natural rate of interest" (Keynes, 1930 V. II, p. 182). The natural rate of interest for Keynes, like Wicksell, was that rate "at which savings and the value of investment are exactly balanced" (Keynes, 1930 V. I, p. 139). And if the market rate and the bank rate were equal there would be no tendency for prices to change. Keynes further writes, "When a long-period movement in the natural rate of interest is in progress, there is, therefore, a prolonged tendency for investment to fall behind saving when this rate is falling because the market rate does not fall equally fast, and to run ahead of saving when it is rising because the market rate does not rise equally fast" (V. II, p. 182). "Granted this, it follows from our fundamental equation that when the natural rate is falling there is a long-period drag on the price level, and conversely" (Keynes, 1930 V. II, p. 183). Keynes then concludes, "If this is true, the Gibson paradox is explained. If the market rate of interest moves in the same direction as the natural rate of interest but always lags behind it, then the movements of the price level will tend, even over longish periods, to be in the same direction as the movements of the rate of interest" (Keynes, 1930 V. II, p. 184).

Thus Keynes believed that the nominal rate of interest lagged behind the natural rate and was guided by it. Bankers adjusted the nominal rate until it was brought into equality with the natural rate. In the Treatise, Keynes was still adhering to the supply driven theory of the classicals. Keynes still believed that the economy was naturally self

correcting at full employment in the long run as did Ricardo, Wicksell, and all the other classical economists. Sometime between writing the Treatise and the General Theory, Keynes' views changed. He could no longer tolerate the idea that the long term was somehow separate and distinct from a succession of short runs as the classical economists had implied. Having convinced himself of the idea that the economy did not naturally return to full employment in the long run, Keynes began looking for an explanation of what determined the level of economic activity in the aggregate in the short run. He found it in Malthus' concept of effective demand. Output, for Keynes, was no longer determined by the physical capabilities to produce but rather by the monetary inducement to produce. Supply did not create its own demand, demand tended to induce supply. With this causality arrow reversed, the causality between the nominal rate of interest and the profitability of capital must also be reversed, along with almost all of the causality flows inherent in classical economics.

7. Keynes in the General Theory

In the General Theory (Keynes, 1936), Keynes maintained the distinction between the nominal rate of interest, as determined by the banking community, and the rate of return on the money devoted to the employment of capital, which he now calls "the marginal efficiency of capital" (Keynes, 1936, p. 135). However, now it is the marginal efficiency of capital which lags the nominal rate of interest and the former is determined by the latter. "In other words, the rate of investment will be pushed to the point on the investment demand--schedule where the marginal efficiency of capital in general is equal

to the market rate of interest" (Keynes, 1936, p. 136-137). The implications of this reversal on the explanation of the Gibson paradox is obvious. If we suppose, for example, that the banking community raises the rate of interest then, in order for the return on the existing investment in real physical capital employed to rise, the prices of the final products which the capital is used in producing must rise. The products price may not rise immediately, however, as the rate of return to financial investment in physical capital falls relative to returns elsewhere, financial investment in physical capital declines, and the output of final goods declines until the prices of final goods have risen sufficiently to bring returns on financial investment in physical capital into equality with returns elsewhere. Keynes recognized this but did not pursue it. "If, however, the rate of interest exceeds zero, a new element of cost is introduced which increases with the length of the process, so that the optimum interval will be shortened, and the current input to provide for the eventual delivery of the article will have to be curtailed until the prospective price has increased sufficiently to cover the cost--a cost which will be increased both by the interest charges and also by the diminished efficiency of the shorter method of production." (Keynes, 1936, p. 216 emphasis added). Gibson's paradox is no paradox at all. Prices go up and down with interest rates because the rate of interest governs the cost of employing capital, and prices tend to reflect the cost of production.

Much of the novelty of the General Theory did not, unfortunately, get incorporated into mainstream economics. About all that did was John Hick's (1937) interpretation or Paul Samuelson's (1939) interpretation. Neither of these included the implications for interest rates, nominal spending, output, and the price level which logically follow from

the reversal of the causality arrow between profits from capital and interest rates. The mainstream maintained the initial flow of causality, begun by David Ricardo. Eventually another explanation for the Gibson paradox emerged that maintained the predominance of Ricardian Theory and the Currency School. This alternative explanation of the Gibson paradox, put forth by Irving Fisher first in 1907, is essentially the view held today by a majority of economists both in and out of the mainstream.

8. Irving Fisher

Fisher's analysis of the relationship between interest and prices began in 1907. It is the 1930 (Fisher, 1954) version, however, which is usually cited in the context of the Gibson paradox. There Fisher argues that, "In so far as the rate of interest is cause and the price movements are effect, the correspondence is just the opposite of that which occurs in so far as the price movements are cause and the interest movements effect" (Fisher, 1954, p. 444). Fisher thus rules out the cost push effect that Keynes had suggested. Fisher, like his predecessors, also divides interest into two divisions. One is the "rate of interest reckoned in terms of money" (Fisher, 1954 p. 36). This is, as we know, the nominal rate of interest. The other is the "rate of interest reckoned in terms of goods" (Fisher, 1954 p. 36), or the real interest rate. The difference between the two is the rate of appreciation or depreciation in the value of money in terms of goods. This gives the famous Fisher equation of $i = r + \dot{p}$, where i is the nominal rate, r the real rate and $\dot{p}$ the rate of change in the value of money in terms of goods, i.e. the rate of inflation or deflation. Fisher goes on to argue that, "The influence of such changes in the

purchasing power of money or the money rate of interest will be different according to whether or not that change is foreseen" (Fisher, 1954 p. 37). Since the real rate of interest, "the percentage premium on present goods over future goods" (Fisher, 1954 p. 36) or the time preference of money, is supposedly dependent on society's propensities toward saving, it is assumed to be unchanging, except possibly over long periods of time. Therefore, any fluctuation in the nominal rate is due to changes in the value of money in terms of goods which are "foreseen". Thus Fisher is able to argue, "if the price level falls in such a way that they (businessmen) may expect for themselves a shrinking margin of profit, they will be cautious about borrowing unless interest falls, and this very unwillingness to borrow, lessening the demand in the money market, will tend to bring interest down" (Fisher, 1954 p. 400). In other words, falling prices tend to breed expectations of falling prices, which in turn pull down interest rates. But, the initial fall in prices must be a result of slowed money growth brought about by higher nominal rates of interest. On the one hand banks are believed to control interest rates, on the other they are not. It would seem that Fisher's theory required contradictory assumptions in order to explain Gibson's paradox. Nonetheless this is the predominate belief today, despite the Central Bank's apparent ability to maintain short term nominal interest rates at whatever level they desire.

At the end of WWII the primary concern of economists was the return of the depression. As a result, very little was said about inflation until the late 1960's. The prevailing view on inflation in the Keynesian mainstream was that put forth by Samuelson and Solow (1960). Building on the work of A. W. Phillips, Samueleson and Solow held

that a tradeoff existed between unemployment and inflation. They maintained that lowering interest rates would induce investments and, via the mulitplier, increase aggregate demand. This, in turn, would stimulate output and employment, and in doing so, would raise prices. Thus they contended that interest rates and prices would exhibit a negative relationship. This Keynesian view largely dominated the profession until the late sixties and early seventies despite the obvious contradiction to the Gibson paradox. This contradiction helped in the demise of Keynesianism in the late 1960's.

In 1968, Friedman[4] (1968) and Phelps (1968), relying on Fisher's expectations explanation, were able to show that the inflation--unemployment tradeoff suggested by the "Phillips Curve" could not be maintained over an extended period of time because, as Fisher had noted, rising prices tended to breed expectations of rising prices. Thus the nominal interest rate could not be held at a level low enough to keep employment above its "natural" level. In order to keep unemployment below its "natural" rate indefinitely required, they argued, an ever accelerating increase in the growth rate of the supply of money. This would, however, lead to an ever accelerating increase in the rate of inflation. Largely as a result of the work of Friedman (1968), and Friedman and Schwartz (1964), the monetary authorities began in the late 1960's, to attempt to slow inflation by slowing money growth and pushing up interest rates. Curiously, at about this same time, inflation, rather than abating, began to accelerate. The onslaught of inflation sparked

[4]Friedman had been revising the Quantity Theory of Money during the 1950's and 60's. However, it was with the 1968 publication that Friedman's views began to be widely accepted in policy circles.

substantial controversy over the efficiency of restrictive monetary policies and a renewed interest in the Gibson paradox.

9. The Current Controversy

To suggest that there is a current controversy may be a bit of an overstatement since, by far, the majority of economists adhere generally to the Currency School and accept Fisher's explanation of the positive correlation between interest rates and prices. However, there are a few who stick with the Banking School. These are generally associated with the American Post Keynesian tradition. In general, those siding with the Currency School have, in recent years, attempted to empirically validate Fisher's hypothesis, while those aligned with the Banking School have relied on verbiage and casual empiricism. Hotson (1967) argues from the cost-push tradition that interest charges, by banks, like the price of any other service or good, are included in the price level. "Is it not a strange blindness to consider a rise in the price of steel, or of physicians' services, as inflationary, and a rise in the price of bankers' services as deflationary?" (Hotson, 1967, p. 38). He further argues that interest cost are incomes like any other costs and "those receiving higher interest incomes presumably spend more, offsetting part or all of the fall in investment spending which was supposed to make the interest hike depressionary and presumably deflationary." (Hotson, 1976, p. 103).

Robert Eisner also takes account of the cost push tendencies of rising interest rates "as capital costs rise, costs of service and prices of products rise... these higher prices contribute to further increase costs as wage earners endeavor to compensate for higher

costs of living" (Eisner, 1971, p. 636). Weintraub also argues that interest hikes are inflationary since utilities, and other regulated industries, look on the nominal interest rate as a fair rate of return. Increasing this obliges them to ask for rate increases which in turn wind up being pushed forward onto product prices (Weintraub, 1982, p. 81-82).

Within the mainstream recently numerous researchers have attempted either to disprove the positive correlation between interest rates and prices or to explain it away. Sargeant (1973) finds that the Gibson paradox still exists over the long term but that the flow of causation runs partially from interest to prices thus partially contradicting Fisher's hypothesis. Sargent employs a "Keynesian" type model and shows that if prices are more rigid than nominal interest rates, any increase in demand will pull up interest rates before prices rise. Shiller and Siegel (1977) argue that the Gibson paradox is a result of the income redistribution that results from unexpected inflation. Unexpected inflation redistributes income from bond demanders to bond suppliers, or from lenders to borrowers, and thus bond demanders, or lenders, are left with less income to supply to finanical markets. Their conclusion relies, however, on the shaky and unverified assumption that a fixed amount of total wealth is held in bonds. More recently researchers have attempted to show that the positive relationship between interest and prices is unstable or even "spurious". Benjamin and Kochin (1984) using British data from 1724-1931 argue that the Gibson phenomenon holds only during times of war. Benjamin and Kochin include in their analysis a variable reflecting the actual level of government spending relative to its trend and argue that it is thus "exceptional" government spending, as in time of war, that causes interest rates and prices to appear to

rise and fall together. Others have found that the paradox holds during peace times as well (Chen and Lee, 1990). Carbae and Ouliaris (1988) argue that the Gibson paradox relationship is "spurious" since interest rates and price levels don't form a cointegrated system.[5] It seems that to call a relationship which has caused controversy for over 200 years spurious might be a little far reaching. Taken as a whole, recent empirical research tends to confirm that the Gibson paradox is alive and well and "is more puzzling than ever" (Chen and Lee, 1990, p. 106).

10. Conclusions

Since the beginning of the discipline of economics, probably since the beginning of the existence of market economics, the debate has raged over whether or not a market economy has a "natural" tendency toward full employment. Largely, the position one takes on this issue determines one's stance regarding the role that money plays. Those who believe in the self-regulating-at-full-employment scenario, such as Ricardo, Wicksell, Fisher, and the large majority of modern orthodox economist, also tend to adhere to the Currency School. For them, money is no more than "grease" on the wheels of commerce. It facilitates exchange, but may, if overissued, blur, or veil, the underlying real exchange, supply driven, barter economy. In the "long run," however, the veil, or "money illusion" as this veil is often referred to lifts, and the guiding forces inherent in a real exchange economy guide producers and consumers alike along a vector of continuous equilibration.

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[5]A conintegrated system is one in which the variables in the system form a stationary relationship. The cointegration technique is discussed in chapter 4 below.

Relative prices, including the hire prices of productive factors, adjust so that all products are absorbed as all income is spent. Those wishing to work, and thus supply, may do so with the assurance that "the market" will provide them an income exactly equal to their contribution to output. Unemployed resources, therefore, choose their own lot, regardless of the actions of the monetary authorities. Bankers, driven by the profit maximization motive, and subject to perfect competition, likewise adjust lending rates so that all that's saved makes its way into investment, with the knowledge that all investments in capital stock are self liquidating; loan defaults, like involuntary unemployment, simply have no place in the logical construct of classical, or neo-classical, theory. It must, therefore, be admitted by those adhering to this school of thought, that nominal interest rate manipulations have no impact on real output and can only affect nominal spending and the price level in the long run. In the short run, however, actions by the central bank may affect output, owing to the concept of "money illusions" or "noisy price signals." However, even in the short run, nominal interest rate changes must affect nominal spending and prices negatively. Otherwise the chain of events leading to the long term equilibrium will be interrupted.

If one rejects the assumption that a market economy is self regulating at full employment, the role that money plays is radically different. Those who have rejected this, e.g. Malthus, Tooke, Keynes, and the Post Keynesians, tend to believe that it is the propensity to spend income, along with the costs of production, that determine the level of economic activity, while prices tend to be based on cost. This, I think, is the scenario that most appropriately fits the Banking School. Now, rather than the quantity of money

entering the economy, it is the terms on which money enters the economy, i.e. the nominal rate of interest, that matters. Since investment in any particular type of capital good is pushed to the point that the return on that investment is equal to the market rate of interest, the cost of employing any particular type of capital must reflect the rate of interest. As interest rates rise, the cost of production rises, and so prices must rise on the final products if they are to be produced. Further, if the same volume of products is to be produced and sold at higher prices, more money is required to consummate the transactions. The quantity of money in existence is then an effect of the process. Any attempt to reduce the supply of money can only result in higher interest rates, higher costs, and higher prices.

Looking at the same process from the other side, incomes, to the various groups involved in production, are the costs of production. As interest rates rise, those who receive income from capital also receive a higher income. If all of this income is spent, aggregate nominal demand will increase, not decrease, thus allowing producers to sell their products at higher prices. However, due to the tendencies of the populace not to spend non-wage income, aggregate demand is likely not to change, thus the quantity of output must be reduced otherwise it will go unsold. Essentially, then, the predictions of this group must be that manipulating nominal interest rates reduce output, while at the same time leave aggregate nominal spending in tact, thus prices must rise.

These are the two scenarios suggested by the Currency School and the Banking School respectively. In the next three chapters, these differences will be elucidated in more detail and subjected to empirical testing. The most striking conclusion one can

draw from this review of the economic literature is that the questions today are the same as they have been for many decades. Progress, in economics, is slow indeed.

CHAPTER 3

SHORT TERM EFFECTS OF MONETARY POLICY

1. Introduction

A cursory examination of virtually any textbook in macroeconomics, whether at the introductory, intermediate, or graduate level, leaves one with the mainstream idea that monetary policy affects output and the price level via shifts in the aggregate demand (AD) curve. However, if, as some members of the Banking School suggest, movements in the nominal interest rate primarily affect costs, with little affect on aggregate spending, then monetary policy would, more appropriately, be depicted as shifts in the aggregate supply (AS) curve. The purpose of this essay is, thus, to conduct an empirical test to see which of these scenarios is more accurate. The study begins in section 2, by arguing that, regardless of one's adherence, in practice the nominal rate of interest is affected by the actions of the Central Bank. In section 3, the transmission mechanisms that have been discussed in the literature by various groups within the mainstream are traced, with emphasis on the predicted movements in output (Q) and nominal spending (PQ) resulting from a manipulation of the nominal interest rate. In section 4, the expected effects on Q and PQ from interest rate movements derived from the Banking School's analysis are elucidated. In section 5, the vector autoregression (VAR) technique is utilized to ascertain empirically the actual short run effects on Q and PQ from interest rate changes, using data on the U.S. economy for the entire period 1959-1991. In section 6, an interpretation of the results is offered with respect to the opposing views. In section 7,

the years of the oil price shocks (1973-1975 and 1978-1980) are eliminated from the data period and the results compared with those from section 5. Finally, in section 8, conclusions are drawn from the test results and the implications expounded.

2. Money Creation

It is common current practice to analyze discretionary monetary policy as if the Central Bank loaded bundles of money on a helicopter and dropped these bundles, at random, on the economy (Friedman, 1969, p. 4): this technique is also often referred to as "the airplane technique," or "money rain." The effects, in the short term and then the long term, on the price level, spending, and output are then traced given differing assumptions about the actions and expectations of the economic agents who receive the money. In reality this assumption is unrealistic, and therefore potentially misleading. A true account of how money enters the economy is required for an accurate representation of its effects.

Money, and thus purchasing power, come into being in the U.S. economy through the extension of credit (Weintraub, 1981, p. 63-64). Actions by the Federal Reserve (Fed), whether through open market operations, lending to banks through the discount window, or altering reserve requirements, affect only the monetary base. In order for an increase in the quantity of purchasing power to be created, individuals must demand, and receive, additional credit extensions. This fact was recognized by Ricardo (1917, p. 240) Wicksell (1905, p. 189), and Keynes (1930, p. 189). In order for the Fed to increase or decrease the supply of medium without altering the price of that medium--the nominal

rate of interest--requires that the interest elasticity of the demand for credit money be infinite. It further requires that the ability of commercial banks to create credit on request does not exist. Empirical research almost unanimously rejects both of these assumptions. Studies indicate that money demand is sensitive to the interest rate (Goldfeld, 1973). Numerous studies have also found that banks create new financial assets which are not subject to the Fed's reserve requirements or other regulation, whenever the Central Bank attempts to control existing assets (Lindsey, 1982; Hester, 1981; Serletis, 1987). At present, most economists, in and out of the mainstream, recognize that any discretionary move on the Fed's part requires an alteration in the nominal rate of interest.

In reality, it is clear that credit is not extended, and thus money is not created, unless someone stands ready to accept the use of that money at the stated nominal rate of interest. In order for the Central Bank to alter the quantity of money in existence, an alteration of the market rate of interest must occur, given that the Fed has no direct control over the numerous non-price determinants of the demand money schedule. The quantity of credit extended, thus the amount of money created, at any given rate of interest is more a consequence of the expectations regarding the profitability of "employing" the money rather than any discretionary move on the part of the Central Bank[1]

[1]For a discussion of the circumstances under which the Central Bank can affect spending, output, employment and the price level see Davidson and Weintraub (1973).

3. Mainstream Transmission Mechanisms

It is generally agreed today that the "mainstream" of the economics profession belongs to those purporting to be either "Keynesians" or non-Keynesians (e.g. Monetarist and New Classicals). The predictions of the short term impacts on Q and PQ emanating from either camp are, however, virtually identical as we shall see. It is only the reasons underlying these predictions that separate the groups. In this section, I describe these predictions and the differing reasons given.

The "Keynesians" contend that, for example, a lowering of the nominal rate of interest will stimulate investment expenditures. The increase in investment spending itself increases aggregate demand, but it also has a multiplier effect on income, thus increasing consumer spending, and further stimulating aggregate demand. In essence, the lower interest rate, and the accompanying increase in the supply of money shifts the AD curve upward but has no effect on the position of the short run AS curve. Obviously then, Q must increase. The affect on PQ, beyond the affect on Q depends on the shape of the short run AS curve (SRAS).

The shape of the SRAS curve depends on the degree of price rigidities inherent in the economy. The Keynesians contend that prices and wages are "sticky" or rigid due to wage and price contracting, menu costs, and various other reasons (see Blinder, 1991). The slope of the SRAS curve depends on how often these wage and price contracts are subject to renegotiation. The more often they are renegotiated the steeper the SRAS curve will be since more of the change in PQ can be absorbed by prices (P) and thus less by real output (Q) (see Hall and Taylor, 1991, chapter 16, or Mankiw and Romer, 1991).

The Keynesian scenario is depicted in Figure 1, which shows the price level (P) measured on the vertical axis and real output (Q) measured on the horizonal axis. LRAS is the long run aggregate supply curve and is vertical at the full employment level of output Q^*. The AD curve is also the money supply times velocity curve. Thus, MV is a rectangular hyperbola since MV=PQ at all points along AD. Any change in MV is thus depicted as a shift in the AD curve. $SRAS^1$ is the short run aggregate supply curve assuming a fairly long period between wage and price negotiations, e.g. three years. $SRAS^2$ is the short run aggregate supply curve assuming a fairly short period between wage and price adjustments, e.g. three months.

If we assume an initial long run equilibrium exists with equilibrium output at Q^* and equilibrium prices at P^*, the Keynesian scenario may be depicted. The Keynesians predict that a lowering of the nominal interest rate, to continue with the example, will shift AD to AD^1. If prices and wages are adjusted slowly, $SRAS^1$ is the appropriate

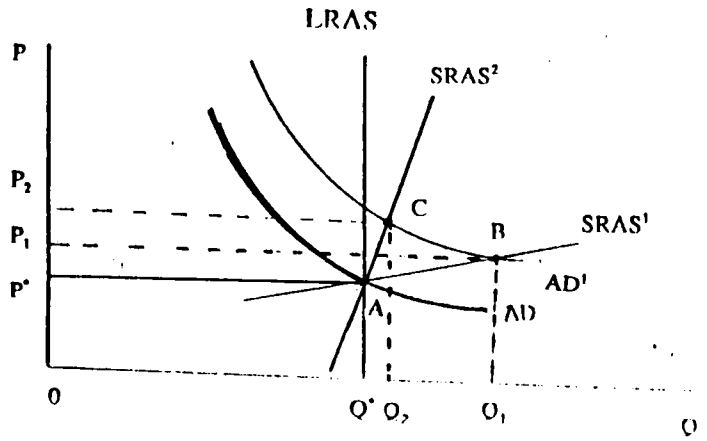


Figure 1 Mainstream Scenario

supply curve and the economy will move to a new short run equilibrium position, form A to B. Notice that both P and Q rise; thus, PQ must rise more than Q. If prices and wages adjust fairly quickly, $SRAS^2$ is the appropriate supply curve and the new short run equilibrium position is now C. Notice again both P and Q rise, thus PQ is still larger than Q. In either case the Keynesians predict that nominal interest rate movements will affect PQ in a larger magnitude than Q. Or, if we move to a dynamic framework, the Keynesians predict that lowering interest rates will result in an increase in the rates of growth of both spending (PQ) and output (Q) in the short run. However, the increase in the growth rate of PQ must exceed the increase in the growth rate of Q.

The "non-Keynesians," including both "Monetarist" and "New Classicalists," argue that the initial monetary expansion-and accompanying interest rate reduction-will stimulate both Q and PQ as well, thus resulting in an increase in AD. Again, any effect that this might have on SRAS is disregarded. The non-Keynesians, however, argue that the slope of the SRAS curve, and thus the composition of the increase in PQ between P and Q, depends upon the degree of "money illusion" that exists (see Friedman, 1968), or the extent of "noisy price signals" present (see Lucas, 1973) in the economy. If either phenomena exist to a significant degree, then the SRAS curve will be fairly flat, as shown in Figure 1 by $SRAS^1$. The monetary stimulation will result in the change in PQ being mostly attributable to Q rather than to P. If the degree of money illusion or noisy price signals is small, then the SRAS curve will be fairly steep as in Figure 1 $SRAS^2$, and the monetary stimulation results in a large change in PQ but little change in Q. Again, in

either case, the change in the nominal interest rate must accompany a larger change in PQ than in Q.

For empirical purposes, the above may be summarized as follows: A reduction in the nominal rate of interest should be negatively correlated with PQ and Q in the short run. In addition, in the case of an interest rate reduction (increase), the affect on PQ must be of greater magnitude than the affect on Q if the price level is to increase (decrease). The relative magnitudes of the effect on PQ and Q are vital, also, if the longer term effects predicted by the mainstream, and embodied in the Fisher effect,[2] are valid. At present, however, our concern is with the initial affects. The long run implications are examined in the next chapter.

4. The Banking School Scenario

Members of the Banking School, who are today predominately Post Keynesians, have no qualms with the idea that it is the nominal rate of interest that is subject to the control of policy makers. However, their predictions of the effect that interest rate manipulations have on Q and PQ are in direct contradiction with those of the mainstream positions. This school, in general,

contends that nominal interest hikes, for example, increase the cost of production and will therefore cause an upward shift in the AS curve. The interest hike will have little, if any, effect on AD however, since it tends to have offsetting effects on investment, consumption, and government spending. Therefore, interest increases tend to increases

[2]The Fisher effect was discussed in Chapter 2 above.

prices, and reduce output in the short term. The reasons put forth for these predictions are explained in this section.

Interest rate hikes tend to increase the costs of production in several ways. First, the U.S. economy, as well as many other economies, is a monetary production economy (see Keynes, 1933). That means production and delivery of a final product requires access to money, or credit, since the process of production takes time. The price of the final product must include, therefore, the costs charged to the producer of "employing" that money during that time. Any time the cost of borrowing money, i.e. the nominal rate of interest, is increased, if the efficiency of the factors of production along with the cost of employing them to the producer are unchanged, the price of the product must rise. Otherwise, the loan will likely be default, the producer put out of business, and the product will go unproduced. It is possible for the profits of the producer to decline for a short time, while the product's price goes unchanged. However, continued production of any good which does not cover the cost of production will eventually be curtailed until the price rises sufficiently to cover the increased cost of production or until the other costs of production are reduced enough to offset the interest increase.

Second, it is unlikely that the hire prices of the various factors employed in the production process will not rise. Laborers, seeing the rise in prices and thus a reduction in their standard of living due to the interest increase, demand wage increases to keep pace with the rise in the cost of living (Eisner, 1969, p. 171). Those who provide non-labor factors of production, even if the producer owns those non-labor factors, will also demand higher hire prices because: 1)their standard of living is being reduced as well,

2) the replacement cost of non-labor factors will have increased since they are also the outcome of a production process similar to the one in which they are employed, and 3) the monetary outlay required to acquire any particular piece of capital will have a higher opportunity cost. Or, to paraphrase Keynes, investment in real physical capital will be curtailed until the return to that capital rises equivalently with the rise in the nominal rate of interest (Keynes, 1936, chapter 11).

Third, as Keynes suggested (1936, p. 216), producers will attempt to reduce their interest cost by decreasing the time between initiating production and the final sale of the product. The reduced production time will, therefore, result in a decreased efficiency of the system. In sum, the interest hike not only increases the cost of production directly in a monetary economy, but it also sets in motion various other tendencies which put upward pressure on the cost of production. Therefore, a small interest increase will set in motion a series of events that lead to a relatively large increase in the cost of production, thus a significant upward shift in the AS curve.

The interest increase need not, however, according to Post Keynesians, substantially reduce nominal spending, and may even increase it. First of all, any increase in the producers costs is an increase in factor incomes. Those providing money, or credit, to the producer will receive a boost in their income when interest rates are increased and presumably they will increase their spending (Hotson, 1976, p. 103). This increase in spending serves to put upward, not downward, pressure on the AD curve. It is likely, however, that the increase in spending from the income increase, i.e. the marginal propensity to consume (MPC), of this group will not be as prolific as the spending

increase would be from an equal increase in wage income. In general, those who earn income lending money are in a higher income quintile than those who earn wage income, and higher income groups tend to have higher savings propensities and lower spending propensities (Kaldor, 1956; Keynes, 1936, chapter 22 and 24; Kalecki, 1971).

Second, since people usually try to maintain their standard of living at a fairly constant level, it is widely believed (see Ando and Modigiliani, 1963 and Friedman, 1957) that the rise in prices, due to the interest hike, will induce people to increase their nominal consumption spending and reduce their saving. The fact that saving now earns a higher rate of return also fortifies this argument. One is able to maintain a constant living standard for now, and for the future, by spending more and saving less now. Weber, (1970, 1975), found that this was indeed the case. The income effect from a higher rate of return on savings swamped the substitution effect due to the decline in the price of future consumption relative to present consumption, so "The overall effect of the [interest rate] increase would be to increase total expenditure" (Weber, 1975, p. 857). This also serves to put upward pressure on AD.

Those adhering to the Banking School do contend, however, that increases in the nominal rate of interest will reduce investment spending-but not drastically. It is commonly believed, and empirically verified, that residential investment is sensitive to interest rate changes (see Bean, 1985). Small changes in the rate of interest can have a large impact on the monthly payments on a house which has been financed long term. This tends to reduce the demand for housing and all residential investments, such as

refrigerators, washers and dryers, etc. associated with housing demand. The reduction in residential investment demand, therefore, tends to put downward pressure on AD.

Business fixed investment, however, is much less sensitive to nominal interest rate movements and may in fact, be positively correlated with them (see Eisner, 1971). One explanation for this is found in the investment accelerator hypothesis (Clark, 1917). According to the accelerator hypothesis, investment is primarily dependent on final sales. So, if an interest increase tends to increase nominal consumption spending, as Weber found, then the increase in consumption spending, or sales, may tend to increase investment spending even in the face of a higher cost of borrowing. Since, however, fixed investments tend to be long lived, the demand for fixed investments tends to depend largely on the expectations of businessmen which are themselves given to substantial fluctuation. Because of this, most Post Keynesians are hesitant about formulating a rigid association between nominal interest rate and total nominal investment (Davidson, 1978, chapter 13).

Finally, since interest rate hikes do tend to reduce output according to this scenario, and thus increase unemployment, Government spending also tends to increase. The increased spending on unemployment benefits, welfare payments, etc. also puts upward pressure on the AD curve. With all these things in mind, the Post Keynesians find it hard to believe that AD will automatically fall. Thus they contend, that probably, the effects will cancel each other out leaving AD largely unaffected.

To sum up, for future reference, the Banking School's predictions are as follows: Any increase in the nominal rate of interest should put upward pressure on the AS curve

while having a negligible, and erratic affect on AD. Therefore, as Figure 2 illustrates, the interest increase should be associated with a reduction in Q and little if any change in PQ. Certainly the affect on PQ will be much smaller than on Q and may even be of opposite sign. Obviously, then, raising the interest rate should accelerate inflation, at least in the short term.[3]

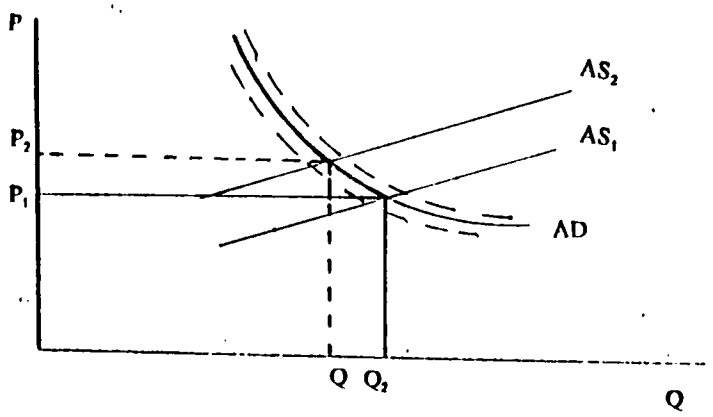


Figure 2 Banking School Scenario

5. The VAR Technique

Whenever conducting an empirical test of competing theories, use of a structural model designed to reflect one of the competing theories would obviously bias the results in favor of that theory. On the other hand, conducting tests utilizing structural models designed to reflect each theory separately would thwart attempts at comparison. What is needed is a non-structural or atheoretical model which will allow the data to define the

[3]As stated earlier, the AD curve is the MV curve. Therefore, since MV=PQ, the AD curve in Figure 2 must be a downward sloping rectangular hyperbola. The AS curve, on the other hand, may be downward sloping, upward sloping or horizontal. Either way, the predictions on PQ and Q are the same since AS is shifting along AD. AS was chosen to be upward sloping in Figure 2 to avoid any irrelevant arguments.

dynamic structure of the model. Vector autoregressions (VARs) provide the means to do just that (Sims, 1980a). VAR's require the specification of only two things: the set of variables of concern, both endogenous and exogenous, and the number of lags needed to capture the effects that the variables have on each other. The equations in the VAR system are constrained to be linear, so we need not worry about functional form. The model that is tested here consists of the three equations that follow:

$$\Delta FFR_t = \alpha_1 + \sum_{i=1}^{10} \beta_i \Delta \ln PQ_{t-i} + \sum_{j=1}^{10} \phi_j \Delta \ln Q_{t-j} + \sum_{k=1}^{10} \partial \Delta_k FFR_{t-k}$$

$$\Delta \ln PQ_t = \alpha_2 + \sum_{i=1}^{10} \beta_i \Delta \ln PQ_{t-i} + \sum_{j=1}^{10} \phi_j \Delta \ln Q_{t-j} + \sum_{k=1}^{10} \partial_k \Delta FFR_{t-k}$$

$$\Delta \ln Q_t = \alpha_3 + \sum_{t=1}^{10} \beta_t \Delta \ln PQ_{t-i} + \sum_{j=1}^{10} \phi_j \Delta \ln Q_{t-j} + \sum_{k=1}^{10} \partial_k \Delta FFR_{t-k}$$

Here FFR stands for the federal funds rate, or whichever interest rate is being used, ΔlnPQ is the growth rate in nominal spending, ΔlnQ is the growth rate in real output, i,j,k are the lags, α, β, ϕ, and ∂ are the parameters to be estimated and Δ stands for the first difference of the series, i.e. $\Delta FFR_t = FFR_t - FFR_{t-1}$. In this model all of the variables are considered endogenous. The nominal interest rate measure is considered endogenous because of the Fed's feedback rule. That is, whenever nominal spending accelerates, the Fed, in an effort to prevent the economy from overheating, pushes up the federal funds rate. Thus, the nominal interest rate is endogenous because of the policies the Fed follows, not because of anything inherent in the economic system. The other interest rate measures are also considered endogenous, since they typically respond to movements in the federal funds rate. This equation system is estimable by simple OLS since there are no unlagged endogenous variables in the system. Further, since the right hand side variables are the same in all three equations, OLS provides consistent and efficient parameter estimate. (Gordon and King, 1982, p. 209).[4] The right hand side variables are the same in all three equations, so the $(X^1 X)^{-1}$ matrix used to calculate the t test on a particular coefficient estimate is the same in all three equations. This allows a direct comparison of the effect that one variable's lag has on the other three variables. In other words, the affect that the multicollinearity has on the significance tests is sterilized.

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[4]Sims (1980a, p. 19) notes that the joint probability distributions "are, of course, not actually distributed as F here because of the presence of lagged dependent variables". (see note to table 1). However it is usually assumed, and is assumed here, that the joint probability distributions are multivariante normal (see Todd, 1984, p. 23) thus the F test of joint significance are applicable. Indeed, Sims reports the F test in his study.

It should also be noted that the variables used in the VAR are all in first differences. First differences are used to avoid any criticisms associated with using undifferenced data which have random walk components (see Dickey et.al., 1985). As will be shown in later chapter 4, the variables used in this analysis appear to be random walks. Therefore, first differences of the series are used since they are stationary (as demonstrated in chapter 4) and do not produce the "spurious" results that random walks tend to produce (see Stock and Watson 1988).[5]

All the data used in this investigation are on the U.S. economy and were gathered by the author. For nominal interest rates, the Federal Funds Rate, FFR, rates on 91 day Treasury bills, STR, and rates on Long Term treasury bonds, LTR were all used in the analysis. The FFR is from Business Conditions Digest (BCD) series 114, STR from BCD series 116 and LTR from BCD series 119. Updates for all three were taken from International Financial Statistics (IFS). Constant (1982) dollar GNP was used for real output, Q. Q was obtained from the Survey of Current Business (SCB) table 2. Nominal GNP minus inventory changes---final sales---was used for nominal spending, PQ. Both were obtained from the SCB, tables 1 and 9 respectively. All data are quarterly from 1959 quarter 1 through 1991 quarter 1. Table 3.1 presents the parameter estimates obtained from subjecting the data described here to the VAR system described above

[5]Also, using first differences eliminates the autocorrelation in the data which allows for the use of t tests on the individual coefficients. Sims (1980a, p. 18, footnote 19) notes that in VAR estimation the "estimated AR coefficients are so highly correlated, standard errors on the individual coefficients provide little of the sort of insight into the shape of the likelihood we ordinarily try to glean from standard errors of regression coefficients." Use of first differences substantially reduces the AR correlation.

using the FFR as the short term interest rate variable. Table 3.2 substitutes rates on 91 day T bills for the FFR. Table 3.3 uses rates on long term Treasury bonds as the nominal interest rate. If the mainstream's predictions are correct, the parameter estimates on the interest rate variable should be negative and significant when nominal spending is the dependent variable. Further, these parameter estimates should be greater than the estimates on nominal interest rates when real output is the dependent variable.

If the Post Keynesian's predictions are correct the parameter estimates on the interest rates in the spending equation should be less than interest rate parameters in the real output equation. Interpretation of the test results follow Table 3.3.

6. Interpretation

In Tables 3.1, 3.2, and 3.3 the dependent variable is listed in column one, the number of quarters lagged in column two, and the parameter estimates for ΔlnPQ, ΔlnQ, and the interest rate measure in columns 3, 4, and 5 respectively. Table 3.1 shows the regression results using the federal funds rate, FRR, while Tables 3.2 and 3.3 report the results using short term rates, STR and long term rates LTR, respectively. The level of significance of any parameter estimate is denoted by asterisks. It seems clear, from observing the first nine rows in the fifth column under ΔFFR, ΔSTR, or ΔLTR of all three tables, that manipulations of the nominal interest rate do not affect the rate of growth in nominal spending in any significant manner. These parameter estimates show the effect that nominal interest rates have on the growth rate of nominal spending. Only one of these parameter estimates is significant at the 10% level, that is the estimate on the ten

Table 3.1 Fed Funds Correlations I

Dep Var	Qtrs. lagged	Ind Vars			D.W.	R^2
		Δln PQ	Δln Q	ΔFFR		
Δln PQ	1	.069	.130	-.001	1.93	.068
	2	.310**	-.070	-.001		
	3	.086	-.071	.001		
	4	.127	.052	-.001		
	5	.044	-.089	.000		
	6	.170	-.073	-.001		
	7	.134	.046	-.001		
	8	-.123	-.075	-.001		
	10	-.025	.138	-.002*		
		F=2.59**	F=.57	F=1.50		
ΔlnQ	1	.205	-.057	-.000	2.00	.282
	2	.190	.073	-.003***		
	3	-.197	.033	-.000		
	4	-.007	.082	-.003***		
	5	.123	-.095	-.001		
	6	-.037	.002	-.002**		
	7	-.064	.285**	-.001		
	8	-.384***	.124	-.001		
	10	.120	-.010	-.000		
		F=1.34	F=1.11	F=2.83***		
ΔFFR	1	39.422**	25.101*	.090	1.96	.428
	2	2.245	18.430	-.270***		
	3	-8.224	11.244	.284***		
	4	-14.137	-7.335	-.167		
	5	28.975*	12.299	.172		
	6	14.310	.843	-.054		
	7	-10.107	7.791	-.036		
	8	-37.068**	-7.798	.047		
	10	39.554*	21.677*	-.121		
		F=2.95***	F=1.63	F=2.36**		

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

Table 3.2 Short Term Rate Correlations I

Dep Var	Qtrs Lagged	Ind Vars ΔlnPQ	ΔlnQ	ΔSTR	D.W.	R^2
ΔlnPQ	1	.085	.086	-.000	1.94	.038
	2	.298**	-.102	-.001		
	3	.080	-.103	.001		
	4	.109	.039	-.001		
	5	.029	-.084	-.001		
	6	.196	-.061	-.001		
	7	.101	.035	-.001		
	8	-.117	-.046	-.000		
	10	-.015	.123	-.002*		
		F=2.35**	F=.48	F=1.15		
ΔlnQ	1	.211	-.058	.000	1.98	.244
	2	.155	.856	-.002**		
	3	-.250*	.033	-.001		
	4	.036	.113	-.003**		
	5	.099	-.097	-.003**		
	6	.025	.065	-.001		
	7	-.112	.230**	-.001		
	8	-.382***	.116	-.000		
	10	.136	-.055	.001		
		F=1.37	F=1.05	F=2.19**		
ΔSTR	1	28.178**	18.635*	.066	1.73	.434
	2	13.580	16.125	-.378***		
	3	-8.742	-.561	.270***		
	4	-10.370	4.456	-.176		
	5	10.443	7.805	.106		
	6	13.056	-.141	.013		
	7	-8.165	9.078	-.109		
	8	19.770*	-7.207	.069		
	10	29.746**	23.604***	-.045		
		F=2.66***	F=2.25**	F=3.66***		

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

Table 3.3 Long Term Rate Correlations I

Dep Var	Qtrs lagged	Ind Vars ΔlnPQ	ΔlnQ	ΔLTR	D.W.	R^2
ΔlnPQ	1	.054	.133	-.002	1.95	.000
	2	.235*	-.045	-.002		
	3	.092	-.077	.001		
	4	.148	-.004	-.000		
	5	.063	-.104	-.000		
	6	.201	-.104	-.001		
	7	.071	.004	-.001		
	8	-.084	-.024	-.002		
	10	.010	.051	-.003		
		F=2.18**	F=.53	F=.70		
ΔlnQ	1	.198	.023	.000	1.98	.169
	2	.128	.162	-.003		
	3	-.274*	.032	-.001		
	4	.024	.031	-.002		
	5	.115	-.172	-.002		
	6	.013	-.045	.002		
	7	-.183	.141	.002		
	8	-.405***	.085	-.003		
	10	.165	-.119	.000		
		F=1.51	F=.58	F=1.08		
ΔLTR	1	15.31**	-1.460	.119	1.97	.094
	2	.954	-.406	-.003		
	3	-1.599	.314	.129		
	4	-3.497	3.501	-.033		
	5	.669	.471	-.216**		
	6	13.778*	-.804	-.059		
	7	.198	-3.695	-.030		
	8	-7.899	-3.297	.018		
	10	8.210	10.735**	-.100		
		F=1.52	F=.55	F=1.01		

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

quarter lag. Further, the F test of the joint significance of all the lags, reported in the 11th row, fifth column is also not significant. The data thus appear to indicate that manipulations of nominal interest rates do not affect nominal spending at all, either initially or cumulatively over two and one half years. Thus, the Banking School's prediction holds here, while the Currency School's does not. According to the data, it is not appropriate to analyze monetary policy graphically by shifting the AD curve since PQ is not affected.

The parameter estimates showing the effect on the growth rate of real output from nominal interest rate changes are reported in the middle nine rows of the fifth column in all three tables. In all cases the estimated parameters are either statistically zero or negative and several are significantly negative. Further, the F test of the cumulative effect is significant at the 1% level in Table 3.1, using the FFR, and at the 5% level in Table 3.2, using STR. It thus appears, according to the regression results, that increasing the nominal interest rate will significantly reduce the rate of growth of real output, at least for eight quarters. As a result, it appears that, at least in the short run, a "tight" money policy is more likely to increase inflationary pressures rather than cause them to abate. Since nominal spending is not affected, while output falls, either inventories must decrease or prices must rise. Since it would seem that an eight quarter successive decline in inventories is unlikely, it is clear that it is indeed prices that respond. This finding, it would seem, leaves the Monetarist/New Classical position virtually untenable since it is an unnoticed fall in prices, when interest rates rise, that constitute their explanation of the business cycle. The "Keynesians" may, however, be able to salvage their theory by arguing that the increased unemployment that accompanies the fall in output has a

stronger affect on wages than would the price increases. They then might be able to argue that, in the long term, prices will fall due to wage declines. However, they still must be able to justify the cost of the output loss, especially when an incomes policy alternative exists (see Wallich and Weintraub, 1971).

Another interesting phenomena that the data appears to document is the persistence with which the FED has adhered to its feedback rule of leaning against the wind. The last nine rows of column two in Table 3.1 shows the estimates of the effects of spending on the federal funds rate. After one quarter lag, about the time it takes the Fed to get data on spending, the Fed tries to offset the spending increase as shown by the estimate of 39.422 which is significant at the 5% level. The interesting part is that while the Fed adjusts the fed funds rate in response to spending, the movement in the growth rate of spending does not respond to the Fed's intervention. In a sense, then, it appears that the Fed responds to the economy, and the economy does not respond to the Fed, at least in the short run.

7. Test Excluding the Oil Price Shocks

The results reported above, using data for the entire period 1959 quarter 1 through 1991 quarter 1, suggest that a "tight" money regime will not reduce inflationary pressures, at least in the short period. The data used does, however, contain the years of both the first and second oil price shocks, years 1973-1975 and 1978-1980. During both these periods the price of oil almost tripled, thus putting an obvious upward pressure on prices irrespective of the actions of the Fed. One group within the mainstream, the Keynesians, consequently argue that restrictive monetary policy is an inappropriate means of affecting

the inflationary impact of oil price shocks (see Blinder and Mankiw, 1984). Their analysis argues that the oil price shock itself will shift the SRAS curve upward, thus reducing output and increasing prices. They further argue that any monetary policy action would have to be substantial in order to offset the price increase. The monetary policy would be too substantial, in fact, to stay within a politically acceptable decline in output and employment. In effect, then, the Keynesian argue that data inclusive of the oil price shock years will show a negative relationship between interest rates and output of greater magnitude than the relationship between interest rates and nominal spending simply because the oil price increases reduce output and increase prices. In this section this proposition is subjected to empirical analysis.

The test performed here utilizes the VAR system, developed in section 5, along with the data set identified there except for the observations from 1973 quarter 1 through 1975 quarter 4 and 1978 quarter 1 through 1980 quarter 4. With the observations containing the oil price shock years eliminated, the Keynesians' proposition implies that the effect on real output from nominal interest rates manipulations should be lessened. They should be reduced enough so that the nominal interest rates' effect on nominal spending should be of greater magnitude than the effect on real output. Table 3.4 contains the results of this test using the FFR as the nominal interest rate, Table 3.5 using the STR and Table 3.6 the LTR. Interpretation of the test results follows Table 3.6.

Table 3.4 Fed Funds Correlations II

Dep Var	Qtrs lagged	Ind Vars ΔlnPQ	ΔlnQ	ΔFFR	D.W.	R^2
ΔlnPQ	1	.028	.322	-.015	2.09	.514
	2	-.008	-.207	.025		
	3	.071	.460	-.022		
	4	-.149	1.006*	-.021		
	5	.157	-.775	.017		
	6	.195	-1.613**	.001		
	7	-.016	-.417	.020		
	8	.725***	1.215**	-.110***		
	10	-.095	.995*	-.045**		
		F=4.772***	F=2.653**	F=6.732***		
ΔlnQ	1	.120	-.014	-.004	2.08	.527
	2	-.025	.240	-.003		
	3	-.012	.140	-.008*		
	4	-.449	.229	-.012**		
	5	.053	-.225	-.000		
	6	.071**	-.299**	-.008*		
	7	-.088***	.248*	.002		
	8	.134***	.386**	-.025***		
	10	.021	.000	0.006		
		F=4.124***	F=2.409**	F=5.706***		
ΔLTR	1	-1.005	5.993	.179	1.65	.553
	2	-1.243	4.015	.024		
	3	.166	-3.478	-.285**		
	4	-.608	4.078	.176		
	5	.025	4.153	-.008		
	6	.299	-7.569*	-.148		
	7	-.493	4.364	-.044		
	8	6.507***	-2.279	-.551***		
	10	-.670	8.423**	.225		
		F=6.287***	F=2.070**	F=3.766***		

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

Table 3.5 Short Term Rate Correlation II

Dep Var	Qtrs lagged	Ind Vars ΔlnPQ	ΔlnQ	ΔSTR	D.W.	R^2
ΔlnPQ	1	-.010	-.054	.006	2.02	.432
	2	-.043	.134	.022		
	3	.052	.260	-.015		
	4	-.145	.980*	-.018		
	5	.116	-.468	-.002		
	6	.204	-1.317	.000		
	7	-.014	-.086	.019		
	8	.700***	-1.149*	-.121***		
	10	-.087	.753	-.032		
		F=3.586**	F=1.568	F=4.685***		
ΔlnQ	1	.004	-.096	-.000	2.08	.468
	2	-.033	.319**	-.003		
	3	-.017	.103	-.007		
	4	-.042	.245	-.013**		
	5	.052	-.130	-.007		
	6	.073**	-.245	.007		
	7	-.083**	.289*	.001		
	8	-.134***	.351**	-.026***		
	10	.005	-.037	-.001		
		F=1.51	F=2.196**	F=4.265***		
ΔLTR	1	-.784	2.432	.202*	1.72	.562
	2	-1.221	4.906	.026		
	3	-.153	-3.189	-.190**		
	4	-.631	4.387	.192		
	5	-.477	4.481	-.048		
	6	.563	-4.201	-.198		
	7	.205	3.189	-.081		
	8	5.224***	-.752	-.481***		
	10	-.409	5.653*	-.096		
		F=6.525***	F=.55	F=3.235**		

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

Table 3.6 Long Term Rate Correlations II

Dep Var	Qtrs lagged	Ind Vars ΔlnPQ	ΔlnQ	ΔLTR	D.W.	R^2
ΔlnPQ	1	-.172	.149	-.048	1.99	.233
	2	-.079	.828	-.027		
	3	.010	.558	-.034		
	4	-.125	1.108*	.000		
	5	.130	-.257	-.019		
	6	.211	-1.173*	.015		
	7	-.064	.080	.044		
	8	.737***	.650	-.140***		
	10	.025	-.103	-.000		
		F=2.607**	F=.962	F=1.570		
ΔlnQ	1	-.072*	.025	.018*	2.08	.386
	2	-.062	.531***	-.016		
	3	-.028*	.197	-.015		
	4	-.021	.244	-.013		
	5	.063	-.104	-.012		
	6	.081*	-.373**	.003		
	7	-.098**	.216	.017		
	8	.152***	.227	-.029***		
	10	.033	-.198	.002		
		F=3.519***	F=2.949***	F=2.708***		
ΔLTR	1	-.876	.939	.358**	1.97	.094
	2	-.177	.932	-.115		
	3	-.442	.316	.032		
	4	.022	3.435	-.054		
	5	-.135	2.025	-.163		
	6	.262	-1.092	-.057		
	7	-.181	-.328	-.095		
	8	3.097***	-.671	-.313**		
	10	.809	.325	-.010		
		F=4.007***	F=.555	F=2.229**		

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

In Table 3.4 the parameter estimates on the lags of the FFR in the nominal spending equation are reported in the first nine rows of column five. None of the parameter estimates are significant at the 10% level except the estimates on the eight and ten quarter lags.[6] It thus appears that increasing the nominal interest rate will significantly reduce nominal spending after two years. The F statistics of the joint significance of all the lags of the FFR is also significant. Comparing the results in Table 3.4 with those in Table 3.1, where the FFR had only a slight affect on nominal spending at ten quarters and the F statistic was not significant, it would seem as though the oil prices shocks must have actually increased nominal spending enough to almost offset any interest impact. Much the same interpretation can be applied to the results using the STR in Table 3.5 or the LTR in Table 3.6.

The parameter estimates on lags of the FFR in the output equation are reported in the middle nine rows, fifth column of Table 3.4. Here all of the parameter estimates, except two, are negative and some are significantly negative. The F statistic of the joint significance of all the lags is also significant. It thus appears that, even without the inclusion of the oil price shock years, increasing the FFR will significantly reduce output for two years. When compared with Table 3.1, which includes the oil price shock data, even though the F's are significant in both, if the individual parameter estimates can be believed, it appears that increasing the FFR will have a greater negative impact on output when the oil price shock years are eliminated. In Table 3.1 the largest impact, an estimate of -.003***, is recorded on the fourth lag. In Table 3.4 the impact after four

[6]A 16 quarter lag VAR was also estimated and none of the parameter estimates beyond the 10th quarter were significant at the 10% level.

quarters is -.012** and after ten quarters, -.025***. It appears as though an oil price shock and a interest increase has an lesser impact on output than does an interest increase alone.

When considering the estimated effect of interest rate changes on output and nominal spending together, it appears as if the Keynesians are correct in arguing that restrictive monetary policy is effective in combating inflation in the absence of an oil price, or any other, supply shock. The cumulative effect of an FFR increase is -.15 on nominal spending and -.068 on output. However it appears as though the affect on output is much quicker (a significant parameter estimate of -.008* is recorded after three quarters in the output equation; significance is not reached in the nominal spending equation until -.110*** after eight quarters).

The Keynesians are apparently wrong, though, in arguing that the oil price shocks reduced output more than increasing interest rates alone. The results obtained from these test indicate that the oil price shocks actually increased nominal spending and output.

8. Conclusion

In this essay two hypotheses of the effect that manipulations of nominal interest rates have on spending and output have been subjected to a non-theoretical empirical test. The mainstream hypothesis, that interest hikes tend to decrease spending more than they decrease output and thus put downward pressure on the price level, is not supported by the data. When the entire test period 1959 quarter 1-1991 quarter 1 is considered these test results tend to suggest that interest increases have little, if any, affect on spending but do tend to, at least initially, reduce output. Thus the data lend some support to the

Banking School's hypothesis that higher nominal interest rates tend to exacerbate inflation in the short term. When the oil price shock years, 1973-1975 and 1978-1980, are excluded from the data, nominal interest hikes reduce output more than spending for only the first eight quarters following the interest hike. After eight quarters the effect on nominal spending kicks in and overtakes the effect on output, thus reducing the inflationary pressure. One explanation for this is that the reductions in output and employment cause wage increases to be moderated, thus reducing income and spending. Essentially, restrictive monetary policy may be no more than a "pseudo incomes policy" (see Weintraub, 1978, p. 104). More testing would be required to substantiate this explanation however.

The estimation technique, VAR, utilized in this chapter tends to capture, after several lags, only trends in the movements in the variables tested. (Pindyck and Rubinfeld, 1991). Usually after usually six months, the short run fluctuations in the variables are not captured, thus the VAR technique is useful only for short-term predictions. Since the purpose of this chapter was, essentially, to test the short run predictions of the competing hypothesis, the VAR procedure was appropriate. However, when the relationships between variables over long periods of time are at issue, some other technique is required. Usually, though, hypotheses formulated about the long term relationships between variables are based either on assumptions or apriori knowledge about the short term effects that the variables have on each other. This chapter was designed to provide that apriori knowledge.

CHAPTER 4

LONG-TERM EFFECTS OF MONETARY POLICY

1. Introduction

Economists, particularly today, seem to be more concerned with the long-term effects of monetary policy on spending, real output, and the price level, rather than the short term impacts (see New York Times, Jan. 21, 1992, pg. 1). This chapter, similar to the last, compares, empirically, the longer-term effects of monetary policy predicted by two competing paradigms. Section 2 outlines the mainstream, or Currency School's, analysis of the impact, over the long term, of interest rate manipulations on nominal spending, real output, and the price level, and documents their predictions. In section 3, the Banking School's, otherwise known as the American Post Keynesian's, analysis of the effect of interest rate movements on the same three variables, over the long term, is explained and their predictions noted. In section 4, the cointegration technique which tests for long run structural stationarity is discussed and used to document the actual movements in the levels of nominal spending and real output resultant from interest rate manipulations. In section 5, an interpretation of the results is made. Some conclusions are drawn in section 6.

I should note that in this chapter, as in the last, it is assumed that discretionary monetary policy, in practice, is manifested as movements in the nominal rate of interest. Given this, it is apparent that the interpretations and conclusions drawn depend primarily on the estimation using the federal funds rate. The federal funds rate is, clearly, the most

closely controlled interest rate, since actions by the Fed (whether they are open market operations, discount rate manipulations, or reserve requirement adjustments) directly affect the funds available to banks and the federal funds rate is the rate banks pay for borrowed funds. However, manipulations of the federal funds rate does, to some degree, affect the values of other short term rates, and ultimately, long term rates (see Engle and Granger, 1987, p. 274). Therefore measures of both short and long-term rates are used in the estimations.

2. Mainstream Theory

Mainstream economic theory is usually, as was noted in the last chapter, divided into two groups, the "Keynesians" and the "Monetarist." In general, their predictions of the long term impact of discretionary monetary policy are the same. Restrictive policy, which is manifested as an increase in the nominal rate of interest, in the long run should affect only the price level and not real output. It follows, therefore, that interest increases must reduce nominal spending in the long run, or have a "persistent" effect on spending but not on output. The two groups differ, however, in their explanations of how this comes about. I begin by reviewing the "Keynesian's" analysis.

The Keynesians contend that raising the nominal rate of interest will, in the short term, reduce spending and real output. The reduction in real output, however, is presumed to be only transitory. That is, real output will eventually, in the long run, return to its original trend. The short term impact, according to the Keynesians, is a result of exogenous wage and price contracting, whether implicit or explicit, which keeps

wages and prices from adjusting immediately, and thus allowing all markets to clear at their long term equilibrium rates of growth. Further, the length of the short term depends upon the length of the contracting period. A long (three year) contracting period implies a "long" short run and a short contraction period (one month) implies a "short" short run. (see Mankiw, 1990). Once contracts expire, they are renegotiated at market clearing rates, thus allowing real output to return to its long term growth path. In effect, any manipulation of the nominal rate of interest should have no effect on the long term path of real output.

The effect on nominal spending, however, must be persistent according to the Keynesians. In other words an increase in the nominal rate of interest in period *t* should have an effect on spending in periods t through infinity. Stated differently, nominal interest rates should be correlated with the secular, as well as the cyclical, component of nominal spending (see Tobin, 1974 and Mankiw and Romer, 1991, Chapter eight). The Keynesians usually explain this by arguing that the reduction in output, and thus the increase in unemployment, in the short term, causes economic agents to negotiate lower wages and prices in future contracts, thus the costs of production as well as the spending required to purchase the same amount of goods is lowered in the long run. In essence, future nominal spending is reduced because of the present nominal interest increase. Further, the lower nominal spending, and prices, in the future pull down, via the Fisher equation, nominal interest rates and leaves them at a lower level than before the initial interest increase (see Tobin, 1974). Thus nominal interest rates and nominal spending exhibit a structural relationship. It should also be noted that the initial reduction in prices,

as is usually suggested, need not come about in order for the long term solutions to manifest themselves. Under Keynesian analysis it is the reduced employment that results in the lowered wages and prices and spending, over the long term. Thus, the finding in chapter three that interest hikes cause price hikes in the short term, does not negate the Keynesians long term conclusions (see Mankiw and Romer, 1991 chapters seven and eight and Mankiw, 1990).

The monetarist and new classicals, or rational expectations monetarists (see Sims, 1980b), also contend that interest hikes may reduce output and spending in the short term. The reduction in output, however, will only happen if "money illusion", or "noisy price signals" exist. The concept of both money illusion, and noisy price signals, relys on the belief that prices in the short term fall. If workers don't see the price reduction -- money illusion (see Friedman, 1968 or 1974) -- or producers mistake the fall in the aggregate price level for a reduction in their relative demand thus a fall in relative prices -- noisy price signals (see Lucas, 1973) -- then they withhold their services and thus output falls. In the long term, however, the illusion disappears, workers and producers see that the aggregate price level has fallen and thus return to their original service offering levels. The economy is left with lower prices, the same level of output, thus lower spending. The lower future nominal spending also, via the Fisher equation pulls down nominal interest rates. Again a structural relationship is envisaged. Exactly how this group deals with the fact that prices tend to rise, certainly not fall, immediately after the interest hike, is not quite clear. It requires that rising prices induce expectations of falling prices. Nonetheless, in order for their long term predictions to hold, the monetarist, like the

Keynesians, must predict that nominal interest increases have a persistent impact on nominal spending but not on real output (see Friedman, 1968 or 1974; Lucas, 1973).

3. Post Keynesian Theory

The Post Keynesians, as the modern day descendants of the Banking School are called, have a different view of the economy than mainstream economists. Therefore, their predictions of the effect on nominal spending and real output of nominal interest rate manipulations will also be different. In general, the post Keynesians contend that interest movements, by themselves, should have no long term impact on spending or output. This is because any effect that interest manipulations may have immediately are likely to set in motion forces that reverse that initial effect (see Weintraub, 1978). A closer inspection of the Post Keynesians' analysis will shed some light on the origins of these predictions.

Interest movements have no impact on aggregate spending according to the Post Keynesians because they tend to induce movements in the various components of aggregate spending in offsetting directions. Interest increases may tend to actually increase consumption spending slightly, primarily because they increase the return to savings and thus increase expected future income (Weber, 1970, and 1975). These same nominal interest increases cause a reduction in spending on residential investments because the interest costs included in the monthly payments on the investments is such a large component of the total monthly payment, and usually expenditures on residential investments are financed over several months, or years (see Pozdena, 1989). Consumption spending and residential investments thus tend to offset each other.

Business expenditures on fixed investments depends on the expected profitability of those investments over several years, even decades (Davidson, 1973, chapter 11). Movements in nominal interest rates in any one period, therefore, do not affect business fixed investments much at all. If, however, consumption spending increases, and this increase increase in consumption spending leads to an increase in the expected future profits of fixed investments, then the interest increase may lead to increases in fixed investment expenditures. However, if the increases in consumption spending are not enough to offset the increase in the cost of financing fixed investments, then fixed investment expenditures will decline in the face of interest hikes. In general this school does not offer any a priori predictions on the magnitude of any of the movements in the components of aggregate spending. Thus, total spending cannot be predicted to increase or decrease on a consistent basis.

As noted in the last chapter, interest hikes, for various reasons, do tend to increase the cost of production in the short term. However, over extended periods, the increase in the total average cost of production due to the interest increase may be offset by reductions in other components of production costs due to an increase in unemployment resulting in a long term impact which is nil, or negligible. Since the interest increase has no long-run impact on spending or costs, then the impact on real output should also not be persistent.

For example, suppose the interest increase results, initially, in a decrease in output and an increase in the price level, as was demonstrated in the last chapter. Obviously, then, there will be an increase in the level of unemployment. This unemployment

increase will tend to put downward pressure on nominal wages, or at least slow nominal wage growth. However, the price increase will tend to put upward pressure on nominal wages. In the first period, or so, the price and unemployment increases will probably tend to cancel each other out, thus leaving the wage unchanged. However, after several periods, if the interest rate is held constant at the higher rate the productivity of labor will increase relative to the wage, thus lowering the cost of production and allowing real output to increase again and unemployment to fall. Then wages will tend to rise as productivity rises until the real wage is restored to its original level. Thus, over the long term, the interest increase does not impart a persistent affect on real output (see Keynes, 1936, chapters 19 and 20). To the extent that wages do not respond accordingly, or if productivity increases are not in the offing, output will be affected in the long term. My intention in the present chapter is to focus on the effects of the interest rate alone, however.

To summarize, the Post Keynesian analysis leads to the conclusion that discretionary monetary policy, by itself has no long term, or persistent, impact on either spending or output (see Keynes, 1936, chapter 12; Hotson et.al. 1976). I now turn to an empirical analysis of nominal interest rates, spending, and real output in the U.S.

4. Estimation and the Theory of Co-integration

My purpose here is to conduct an empirical test of the effect that nominal interest movements have on both real output, Q, and nominal spending, PQ. From these results, of course, the effect of interest rates on prices may also be extracted.

The data used are all published and were gathered by the author. For nominal interest rates, the federal funds rate, FFR, rates on 91 day Treasury bills, STR, and rates on long term Treasury bonds, LTR, are all used in the analysis. The FFR is from Business Conditions Digest (BCD) series 114, STR from BCD series 116, and LTR from BCD series 119. Updates for all three were gleaned from International Financial Statistics (IFS). Constant (1982) dollar GNP is used for real output, Q. Real GNP was obtained from the Survey of Current Business (SCB) table two. Nominal GNP minus inventory changes--final sales--was used for nominal spending, PQ. Both were obtained from the SCB tables one and eight respectively. All the data encompass the period 1959, quarter one through 1991, quarter one.

The simplest method for estimating the effect that nominal interest rates have on Q and PQ would be to regress Q and PQ on FFR respectively, and use the estimated correlation coefficients as measures of the respective impacts. Unfortunately, as Nelson and Plosser (1982) have pointed out, many macroeconomic time series, in levels, tend to behave like random walks. Therefore, regressing any one or the other will tend to yield "spurious" results. In other words, ordinary OLS regressions involving random walk variables tend to lead to the conclusion that a relationship exists between the two variables when, in fact, none does. One way to eliminate this problem is to first difference the variables before using them in a regression equation. First differencing a random walk yields a stationary series which is compatible with the usual OLS assumptions, but results in a loss of information. In particular, since the first difference

is stationary and trend reverting,[1] or "deterministic", the OLS parameter estimate can only show the transitory effects, or the deviations from trend (see Nelson and Plosser, 1982). In order for two series to have a long run equilibrium, their secular components must be related. One method of testing whether or not two random walk time series have a secular relationship is the "cointegration" technique. Engle and Granger (1987) show that it is possible for a linear combination of two random walk series integrated of order 1, I(1), to be stationary, or integrated of order O, I(O). If in fact the two I(1)'s do form an I(O) then the series are said to be co-integrated. And, since it is not generally true that two I(1)'s will form an I(O), the finding of cointegration provides empirical support for the existence of a secular relationship between the series. The ability to first difference a pair of I(1) data series and test for cyclical correlation along with the co-integration technique provides an analysis of secular correlating. Thus, together these two techniques provide a method of systematically analyzing the relationship between two variables moving through time. They also provide, for my purposes, a method of differentiating between the two competing theories, as will be shown. The first step, then, is to determine whether or not the three series measuring nominal interest rates, FFR, STR, and LTR, and PQ and Q, both in logs, are integrated of order 1. That is, are they random walks in levels but stationary when first differenced?

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[1]The idea that a data series is trend reverting means that if the variable is shocked or forced to depart from its trend, observations on its historical series suggest that it will return to its original trend (see Nelson and Plosser, 1982, pp. 141-146 or Engle and Granger, 1987, p. 252).

Testing a data series to see if it is I(1) is the same as testing for a unit root (see Dickey and Fuller, 1981), and the procedure is outlined in Engle and Granger (1987). The augmented Dickey-Fuller (ADF) tests on FFR, STR, and LTR were conducted by regressing the first difference in the series on a lagged value of the level of the series and four lags of the first differences. Then the Dickey-Fuller (DF) test was conducted on the natural logs of PQ and Q by regressing the first difference in the series on a lag of the level. Finally the ADF test was conducted on the first difference of the interest rate series by regressing the second difference of the original series on the first lag of the first difference and four lags of second differences. The series ln PQ and ln Q were subjected to the DF test by regressing their second difference on a lagged first difference, and time. When time is included the 1% critical value is 3.45 (see Carbae and Oulavaris, 1989). The null hypothesis is that of a random walk, or that a unit root is present in the autoregressive scheme. The results of the test are presented in Table 4.1.

Table 4.1 Unit Root Tests

Variable in levels	ADF or DF	variable in first differences	ADF
ln pq	-2.8	ln pq	-4.76***
ln q	-1.19	ln q	-6.46***
FFR	-.767	FFR	-3.96***
STR	-.473	STR	-3.81***
LTR	-.027	LTR	-5.02***

test stats are compared with the critical values in Engle and Granger (1987) Tables II and III. The 1% critical value is 3.77 for the ADF and 4.17 for the DF.

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

As can be seen from the statistics presented in Table 4.1, all of the series appear to be I(1). The first column of ADF or DF statistics are those obtained from performing either an ADF or DF test on the original series. In all cases, the hypothesis of a random walk, or the existence of a unit in the AR scheme, cannot be rejected at even the 10% level. This test alone provides sufficient, but weak, evidence of a unit root. To bolster the findings, the first difference of each series was also subjected to DF or ADF test. The statistical results obtained from performing this test are presented in Table 4.1 in the second column under ADF. In all cases we can reject the null of a random walk at the 1% level. In other words the findings suggest that the series are stationary when first differenced. The results obtained from the tests and presented in Table 4.1 thus confirm the findings in Nelson and Plosser (1982), Engle and Granger (1987), and numerous others. Having found that the relevant series appear to be random walks, or that they behave like random walks, the next step is to determine whether or not PQ, or Q, both in logs, is cointegrated with one, or all, of the nominal interest rates.

The test for cointegration is simple to perform. It requires a simple OLS regression on the two variables believed to have a long run, or secular, relationship. A positive finding of cointegration is believed to be strong evidence that the two variables do indeed have a structural relationship. Engle and Granger (1987) show that two I(1) series, X_t and Y_t, may have a linear combination, $Z_t = Y_t - bX_t$, which is stationary or I(0). Obviously an estimate of the linear combination Z_t in Engle and Granger (1987) is equivalent to the residuals, E_t, from a simple OLS regression. Therefore, the test of cointegration is simply applying OLS to the two series under examination and subjecting

the estimated residuals to the ADF test, or something similar. If the estimated residuals are stationary, then the two variables X_t and Y_t are said to be cointegrated, with $Y_t = \alpha + \beta X_t$ being the "cointegrating regression" and β the "cointegrating parameter" (Engle and Granger, 1987, p. 264). Furthermore, it doesn't matter which variable series is regressed on which. "In fact the reverse regression of X_t on Y_t has exactly the same property and thus gives a consistent estimate of $1/\beta$" (Engle and Granger, 1987, p. 264). Thus, one need not specify the direction of causality when performing the test. Cointegration is not a test of cause and effect but rather a simple test for long run correlation in the structure of two variables.

Tests for cointegration were performed on the I(1) series, ln PQ, ln Q, FFR, STR, and LTR, first by regressing ln PQ, then ln Q, on each of the interest rate series separately and independently. Then the reverse regressions of the nominal interest measure on ln PQ, then on PQ were run, each with a constant term. All the regressions were also run with a time trend, as well as, a constant in the regression. The time trend was included to remove all of the "deterministic" non-stationarity from the data. It is possible that the null of non-cointegration will be accepted simply because the co-integrating parameter failed to take out all of the deterministic non-stationarity in the system (Corbae and Ouliaris, 1988, p. 300). The next step involves testing the residuals from the cointegrating regressions for stationarity. This was done by regressing the first

difference of the residuals on a lagged past value and four lags of first differences.[2] The results from all these tests are presented in Table 4.2.

The statistical results reported in Table 4.2 suggest that there is no long term structural relationship between lnPQ and any of the interest rate measures or between lnQ and any of the measures of nominal interest rates. In other words, I cannot reject the null of non cointegration in any of the regressions run even at the 10% level of significance. From Engle and Granger (1987) table II, the ADF statistic at the 10% critical value is 2.84. All of the ADF statistics from the regressions are below that (in absolute values). The Durbin-Watson (D.W.) statistics are also all extremely low suggesting that the residuals are not stationary. It also does not seem to alter the tests substantially when the time trend is included in the regressions. Obviously, then neither nominal spending or real output, is cointegrated with nominal interest rates. Thus, any relationship between them must be interpreted as spurious so that any short run effect that one has on the other must be only transitory and dissipates after a relatively short period of time.

The final step in the systematic analysis of the relationships between spending, output, and interest rates is to estimate the short term, transitory effect that the nominal interest rates have on spending and output. This task is accomplished by first regressing the first difference in lnPQ, i.e. the rate of growth of spending, on the first difference in the nominal interest measures and a vector of lags of nominal interest rate differences, and then by regressing the first difference in lnQ, i.e. the rate of growth in output, on the

[2]The particular lag structures used here where chosen because these are the lags structures for which ADF statistics are provided in published literature.

Table 4.2 Cointegration Tests

Dep Var	Ind Var	β	∂	DW	ADF on residuals
ln PQ	FFR	.148***		.080	-1.26
	FFR	.008***	.020***	.046	-1.83
	STR	.188***		.080	-1.09
	STR	.012***	.020***	.054	-1.88
	LTR	.249***		.070	-1.37
	LTR	.024***	.019**	.070	-2.67
ln Q	FFR	.051***		.073	-1.529
	FFR	.003**	.007***	.065	-2.40
	STR	.064***		.070	-1.36
	STR	.002	.007***	.064	-2.35
	LTR	.082***		.050	-1.688
	LTR	-.005**	.007***	.082	-2.154
FFR	lnPQ	2.859***		.190	-2.69
	lnPQ	19.268***	-.346***	.206	-2.81
STR	lnPQ	2.422***		.176	-2.32
	lnPQ	17.717***	-.322***	.200	-2.55
LTR	lnPQ	2.885***		.097	-2.02
	lnPQ	17.536***	-.309***	.135	-2.79
FFR	lnQ	8.083***		.182	-2.69
	lnQ	13.537**	-.041	.179	-2.72
STR	lnQ	6.768***		.166	-2.31
	lnQ	8.262	-.011	.164	-2.32
LTR	lnQ	7.786***		.076	-2.09
	lnQ	-8.097**	.118***	.100	-1.83

note: ∂ is the parameter estimate on time
D.W. is the Durbin-Watson statistic

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

note 2: the ADF critical value is 2.84 at 10% from Engle and Granger (1987) Table II

first difference of the nominal interest rates and a vector of the lags of the first difference of the nominal interest rate. Lags of first differences were included until they fell below the 10% significance level. This should show the length of time between the effect and the dissipation of that effect. Recall that, since the first differences are stationary, and cointegration isn't present, the effect must be transitory and should dissipate after a relatively short number of lags. The results from these regressions are reported in Table 4.3

The results reported in Table 4.3, in general, confirm the results obtained in the last chapter. The growth rate of nominal spending does not seem to be affected at all by changes in any of the interest rates except during the current quarter, and then the effect is positive. In other words, pushing up the FFR, for instance, appears to accelerate the rate of growth in spending by .18%.[3] But, it has the same effect on the growth rate of real output, so the effect on the rate of inflation must be nil. A one quarter lag shows no significant effect on either spending or output. After one quarter, however, the effect on the rate of growth of output turns negative and remains negative, and significant, through eight quarters, except for the third quarter lag which is still negative but not significant at the 10% level. Virtually the same scenario is true for all interest measures. Although the evidence is weaker for the longer rates. In sum, it appears that interest changes have no correlation with spending behavior, but are, after one quarter, linked to inverse changes in the rate of growth in output. The effect on output appears to dissipate after eight

[3]The direction of causality suggested here comes from my initial assumption that the Fed controls interest rates. In other words interest rates are assumed exogenous while output and spending are assumed endogenous.

Table 4.3 Short Run Correlations

Dep Var.	# of lags	Ind. Var.	β	D.W.	adj R^2
$lnPQ_t$ - $lnPQ_{t-1}$	0	FFR_t-FFR_{t-1}	.0018***		
	1		.0000	1.66	.047
	2		.0003		
$lnPQ_t$ -$lnPQ_{t-1}$	0	STR_t - STR_{t-1}	.0030***		
	1		-.0001	1.70	.070
	2		.0006		
$lnPQ_t$ - $lnPQ_{t-1}$	0	LTR_t - LTR_{t-1}	.0057***		
	1		-.0002	1.65	.077
	2		-.0002		
lnQ_t -lnQ_{t-1}	0	FFR_t - FFR_{t-1}	.0018***		
	1		.0006		
	2		-.0026***	2.09	
	3		-.0002		.284
	4		-.0027***		
	6		-.0021***		
	8		-.0018**		
	10		-.0007		
lnQ_t - lnQ_{t-1}	0	STR_t - STR_{t-1}	.0028***		
	1		.0008		
	2		-.0025**		
	3		-.0001	2.14	.240
	4		-.0037***		
	6		-.0032**		
	8		-.0024*		
	10		-.0003		
lnQ_t - lnQ_{t-1}	0	LTR_t - LTR_{t-1}	.0038**		
	1		.0005		
	2		-.0047**		
	3		-.0027	1.71	.140
	7		-.0032*		
	6		.0023		
	8		.0046**		
	10		-.0005		

quarters as the rate of growth in real output returns to its previous trend. The dissipation of the effect on real output further confirms the previous finding that co-integration, among interest rates and output, does not exist. The effect on output is purely transitory.

5. Interpretation

Overall, the test results presented in the prior section tell us several things about the behavior of the data series in question. All the series under investigation appear to behave as random walks, integrated of order 1, I(1). That is, the series themselves have no affinity for a mean, or they are not trend reverting (see footnote 1), but their first differences are. In other words, the series themselves are non-stationary, while their first differences are stationary about a mean, or deterministic. This tells us that when the series themselves are "shocked", the shock does not dissipate, or the series has no tendency to return to its initial trend, or to any trend. The first differences of the series, however, do tend to return to their initial mean after being shocked. The effects of the shock wear off after a short period and have no effect after that.

The finding of non-cointegration between the lnPQ series and any of the interest series and between the lnQ series and the interest series suggest that there is no structural, or secular relationship between them. Stated differently, there is nothing inherent in the structure of the economy that tends to keep the means of interest rates and the means of either lnPQ or lnQ from drifting infinitely apart. If, for example, interest rates are shocked upward, then, though there may be a short run impact on lnQ, there is no long term impact, or there is no effect imparted on the drift of lnQ. After the short term effect

has dissipated, lnQ will continue to drift randomly, oblivious to the drift in the interest rate.

The fact that the first difference of nominal interest rates and the rate of growth in real GNP are correlated tells us that a shock to interest rates will cause a deviation in the rate of growth of real output from its mean. However, after approximately eight quarters it appears that the growth rate of output will return to its original mean even though the mean of the interest series is forever altered. The finding that the first differences in interest rates are not substantially correlated with the rate of growth of final nominal sales suggests that a shock to interest rates will not even cause the growth rate in final sales to deviate from its mean. These findings have implications for the theories that motivated this study as well as for the Gibson paradox.

The Gibson paradox, as Keynes called it (Keynes, 1930 V. II, p. 189), refers to the fact that nominal interest rates and the price level are positively correlated, while mainstream economic theory suggests that they should be negatively correlated. As the test results reported in the previous section show, the Gibson paradox exists because nominal interest rate increases tend to reduce the rate of growth in output while having no substantial impact on the growth in nominal spending. Thus, the rate of inflation will tend to accelerate following an interest rate increase. However, since the impact on the growth rate of output tends to wear off after approximately two years, the rate of inflation declines back to its original level, leaving the price level at a higher level than it would have been. If, for example, the rates of growth in both spending and output were initially equal, then the rate of inflation would be zero. Then about one quarter after nominal

interest rates were increased, the rate of growth of output would decline, and the rate of inflation would rise above zero. Thus, the price level would move up in tandem with the interest rate. It is therefore the impact that interest rates have on the costs of production, and thus on output, coupled with the non-effect on nominal spending, that accounts for the Gibson paradox. Further, since the first difference in the interest rate is correlated with the rate of growth of output, but the original two series, in levels, are not co-integrated, the interest rate should be correlated with the price level, both in first differences, but these two series should not be cointegrated in levels either. The findings by Corbae and Ouliaris (1989) that interest rates and price levels are correlated but not cointegrated, thus, lends support to the results obtained in this study.

Another way of showing the affects that nominal interest rate manipulations have on output, spending, and the price level is through the use of a simulated response function as in Figure 4.1.

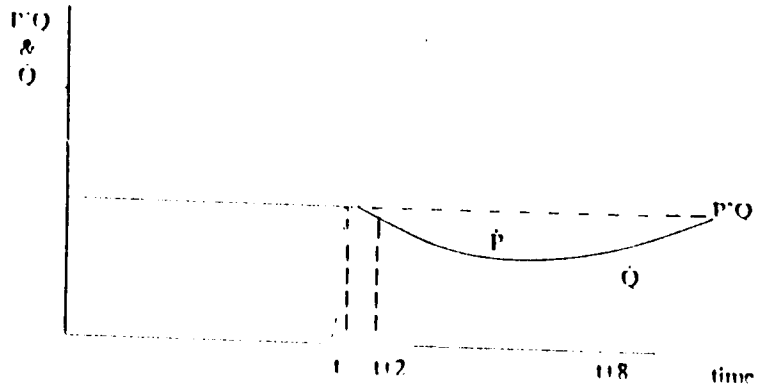


Figure 4.1 The Simulated Response Function

If we suppose that both PQ and Q are growing at an equivalent rate, i.e. 3% as shown in Figure 4.1, then obviously the rate of inflation, $\dot{P}$, will be zero. Now suppose at time t, the Central Bank decides to push up the federal funds rate. As is shown in Figure 4.1, after about two quarters, the rate of growth of Q begins to decline while the rate of growth of PQ is unaffected. The difference between the two rates of growth, the rate of inflation, will then increase and continue to do so for six more quarters. After six quarters, i.e. at period $t + 8$, the affect on the growth rate of $\dot{Q}$ will dissipate and $\dot{Q}$ will return to its previous drift. As $\dot{Q}$ returns to its previous drift, the rate of inflation will subside and return to its previous level. The effect of the interest rate increase, in the long run, is thus nil. However, during the two year interim the economy will suffer stagflation as output falls and the price level rises.

Regarding the theoretical comparisons, the empirical evidence supports the Banking School's analysis at the expense of the mainstream. Both theories suggest that nominal interest rates and output should not be cointegrated, as was found. Only the Banking School, however, predicts that nominal interest rates and nominal spending will not be cointegrated. The mainstream prescription for reducing inflation relies on the belief that pushing up interest rates will, in the long run, reduce the rate of growth in nominal spending. This is simply not the case. Movements in nominal interest rates does not appear to affect nominal spending in either direction in the short or long term.

Since policymakers at the Federal Reserve adhere to mainstream theory, the empirical facts do explain the persistence of inflation in the U.S. In the late 1960's, primarily in response to the criticism of Milton Friedman (see Silk, 1984), the Federal

Reserve began to push up the federal funds rate in a misguided effort at curtailing inflation. The result was, of course, to which the results obtained in this chapter will attest, an acceleration of inflation. Little harm would have been done had the Fed stopped there, since the rate of inflation would have declined in a little over two years. However, the Fed in response to the inflation acceleration, again jacked up interest rates, and, predictably, inflation accelerated further. Again the Fed responded by pushing up interest rates, blinded by the theory entrenched amongst mainstream economists, and again inflation accelerated and again the Fed responded and on and on. This vicious cycle finally reached disastrous proportions in the late 1970's and early 1980's when, in response to Paul Volker's great experiment, the rate of inflation reached heights not seen since the months immediately following WWII, and output and employment fell by proportions not seen since the Great Depression.[4] Obviously much of the economic pain suffered during this period could have been eliminated had the Banking School's hypothesis been accepted.

6. Summary and Conclusions

My purpose in this chapter has been to empirically test two competing theories of the long-term effects of monetary policy. It was found that the mainstream's prediction that a "tight" money policy will reduce inflation in the long run is <u>not</u> supported by the

[4]Obviously the oil price shocks of 1973-1975 and 1978-1980 also contributed to the inflation of this period. However, even when this data is eliminated, since raising interest rates reduce output for almost two years before having an effect on nominal spending, as was found in Chapter 3, the scenario described here still holds.

data. It appears that when the Fed pushes up nominal interest rates, the rate of growth of nominal spending is not affected, either in the short or long run. In other words nominal interest rates and nominal spending are not significantly correlated nor cointegrated. Nominal interest rates and the rate of growth of real output are also not cointegrated, but they are, however, significantly negatively correlated in the short run. Thus, restrictionary monetary policy tends to decrease the rate of growth of output in the short run, i.e. for approximately eight quarters, but has no long term impact. This implies that raising the interest rate may force a postponement of investment projects, and may temporarily reduce capacity utilization, but has no impact on long term capital formation. Thus, raising the nominal interest rate tends to incite short term stagflation, but has no long term affect on output, spending or prices.

Regarding the recent economic history of the U.S., this study, it seems, does have one primary conclusion: To a large degree, the acceleration of inflation, along with the slowdown in the rate of growth of output in the U.S., since at least the mid 1960's, was severely exacerbated by the policies undertaken by the Federal Reserve.

CHAPTER 5

DETERMINANTS OF THE PRICE LEVEL

1. Introduction

Within the discipline of economics, especially since the mid-1960's, there has been a debate over whether inflation is more appropriately characterized as cost push or demand pull. By and large the mainstream of the profession, following the classical Currency School, has settled on the demand pull explanation. They contend that inflation is primarily, certainly over the long run, due to the overcreation of money. On the other side, the descendants of the Banking School, which I refer to as Post Keynesians, feel that increasing costs contribute the primary driving force behind inflation while money supply increases are merely a consequence of that inflation. This chapter provides an empirical investigation of the debate.

Section 2 presents an evaluation of the mainstream's analysis. There both the "Keynesians" and the Monetarist/New Classical characterizations of the inflation process are reviewed. Both lead to the same long term conclusions: Since the economy is always tending toward full employment equilibrium, over the long term, inflation persists because the monetary authority consistently over creates money in an attempt to maintain employment above its full employment or natural level. Consequently, the money supply and the price level should have a long term, structural relationship. Section 3, subjects this proposition to empirical analysis utilizing the technique of cointegration developed

by Engle and Granger (1987). Section 4 offers some interpretations of the test results along with some tentative conclusions.

Section 5 is devoted to a development of the Post Keynesian's cost push approach. There it is argued that, in the aggregate, costs of production are determined by the money wage, the nominal rate of interest, and the productivity of the system, for which Q/N (real output divided by the total number of hours worked) will be used as a proxy. This leads to the empirical proposition that these components and the price level should have a long term, structural relationship. In section 6 the cointegration technique is discussed and used to test this proposition. Some interpretations and tentative conclusions are offered in section 7. In section 8 a vector auto regression (VAR) is developed in an effort to uncover the causal sequence between inflation and the money supply, in other words, to see if money growth is an antecedent or a consequent of the inflation process. Finally, in section 9, some overall conclusions are drawn and some recommendations offered.

2. Mainstream Theory

Within the mainstream of economics, at least since the late 1960's, the debate over the potency of monetary policy has been carried out between the "Keynesians" on one side and the "Monetarist/New Classicals" on the other. These two schools differ over the tendency of the Federal Reserve (Fed) to promote short term stability or instability, and they also disagree about the reasons that monetary policy is effective in the short term. These two groups, however, do basically agree that inflation, in the long term, is due solely to overextension of the money supply. "Keynesians", whether they be of the older

tradition following Samuelson (1939) and Hicks (1937), or of the "New Keynesian" variety (Mankiw and Romer, 1991), essentially contend that the Fed has the ability to alter the level of output in the short run because wages and prices are sticky, or fixed in the short run. Without this price fixity assumption, these Keynesian models revert back to that of the automatically self regulating at full employment model of the pre-Keynes neoclassicals. Despite the fact that Keynes, in the General Theory, (see Keynes, 1936, p. 27, and Chapter 21) explicitly denied it, the "Keynesians" still maintain that it is the stickiness of prices that results in a short term, temporary equilibrium at less than full employment.

This "Keynesian" concept can be demonstrated graphically as follows: An increase in the supply of money results in an upward shift in the aggregate demand curve, AD, from AD to AD′ in Figure 5.1. The result is an increase in the price level to P_2 and an increase in output to Q_2 in the short run. The reason output increases, and thus the reason the short run aggregate supply (SRAS) is upward sloping, not vertical, is because wages and prices are contractually fixed. Since contracts expire in some industries and not in others, so some prices are changed in response to the increased derived demand for factor inputs while others are not, Thus SRAS curve is also not flat, but upward sloping, implying, in the aggregate, that the price level is sticky. Once enough time is allowed for all contracts to expire, and be renegotiated at higher prices and wages, the economy will have moved to its long run market clearing position. The increase in wages causes the SRAS curve to move upward to SRAS.[1] Thus, the final equilibrium position, point C, is then reached. The long term result, then, is an increase in the price level, and no

change in output. Equilibrium, at point B, is merely a short term, temporary resting point for the economy, the result of the inability to adjust wages and prices in some industries due to legally binding contracts. If no other change is made in the supply of money, after the short term impact passes, the economy will move naturally back to its "natural rate of output" at Q^* as all of the increase in the supply of money is imparted on the price level. Thus, in the long run, the supply of money and the price level must move together. Thus, in the jargon of econometrics, the price level and the money supply are positively correlated and co-integrated.

The monetarist/new classical explanation of the effects of an increase in the supply of money is much the same, with the exception that the upward slope of the SRAS curve is due to "money illusion" (see Friedman, 1968 or 1974) or "noisy price signals" (see Lucas, 1973), both of which amount to the same thing once its recognized that the

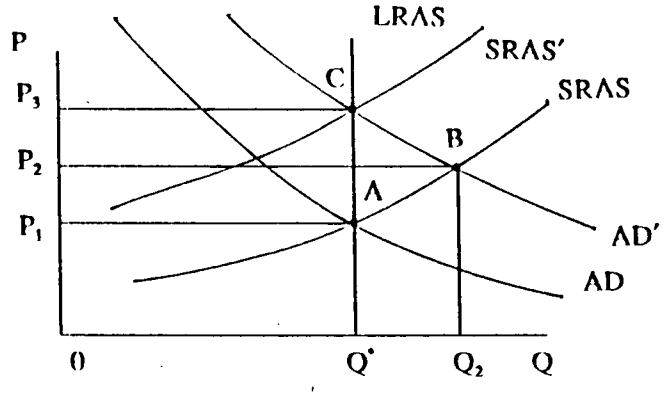


Figure 5.1 Mainstream Theory

nominal wage is an aggregate price level. According to Friedman (1974), or Lucas (1973), an increase in the stock of money shifts the AD curve upward, thus raising prices

and output. Output increases because workers, or producers in Lucas' case, perceive the price increase as a relative demand increase in their favor. Each producer or worker then responds by producing more or offering more labor services, thus an increase in output in the aggregate. However, once workers, or producers, realize that the aggregate price level has risen and that relative demand is unchanged, they withdraw the increase in their services and settle for a higher nominal wage, thus shifting the SRAS curve upward. Therefore, in the long run, the increase in the supply of money exerts its full impact on the price level while leaving output at its "natural" level. Again in the jargon of econometrics, the supply of money and the price level are positively correlated and cointegrated. Given the simplicity of these predictions, an empirical test should be relatively easy to perform. The task at hand is to test the predictions.

3. An Empirical Test of the Mainstream's Predictions

The most obvious and straightforward method of testing the predictions of the mainstream would be to simply regress, using the ordinary least squares method (OLS), the price level measure on the money supply and note the estimated parameter. Unfortunately, as Nelson and Plosser (1982) have shown, the price level and the money supply, along with most other macroeconomic time series, are non-stationary. That is, they behave like random walks. Therefore, OLS estimation results may be spurious, at best, and often lead to the conclusion that significant correlation exist when in fact none does (Dickey, et. al. 1986, p. 13). In other words, OLS regressions involving two non-stationary series, or one non-stationary and one stationary series for that matter, may

suggest that a structural relationship exists between the two variables when in fact both are responding to some unobserved force independently, or when both series simply happen to be drifting together for a short time. In the latter case the OLS regression will imply a structural relationship from a statistical anomaly. In the former case the OLS parameter estimates cannot be relied upon to provide consistent predictors of the co-movements between the two series when the unobserved driving force is subjected to an exogenous shock. In sum, simple OLS estimation alone does not provide reliable evidence of a structural relationship between two non-stationary time series.

One method of avoiding many of the problems that non-stationarity presents in regression analysis is to difference the series until stationarity is achieved. In practice, especially using economic variables, first differencing is sufficient, since explosive behavior on the part of these series is not observed (Dickey, et. al, 1986, p. 13). The problem with first differencing the relevant time series is that, in doing so, much of the structural information is lost. As Nelson and Plosser (1982) point out, "The first differences of the observed series will consist of the sum of the first differences of both secular and cyclical components. . .the problem of inferring the behavior of each unobserved component from the sum remains" (p. 161). Therefore, though OLS estimation will consistently and efficiently capture the short run correlations between the transitory, or deterministic, (i.e. mean reverting) components. The existence of correlation between the secular or stochastic components cannot be guaranteed. Stated differently, the affirmation of correlation between nonstationary times series in first differences only allows one to say that a shock to one of the variables will coincide with a temporary

deviation in the other. It does not guarantee that the two series will not drift infinitely away from one another (Engle and Granger, 1987, p. 253). In order for this to be insured requires that a linear combination of the two random walks, in levels, be stationary. If this occurs then the two series are said to be "cointegrated".

The concept of cointegration, developed by Engle and Granger (1987), allows for the testing of the existence of a long run, structural, relationship between two non-stationary time times. It is thus exceptionally well suited for testing the hypothesis that inflation, over the long term, is predominantly a result of excessive money creation, as most economists today profess. A finding for cointegration, however, does not "prove" this hypothesis, since the relationship may be due to money growth being a determinate rather than a determinant. However, the rejection of cointegration would impart some doubt of the explanatory power of the theory and would thus mandate a convincing explanation.

The test for cointegration is quite simple to perform. According to Engle and Granger (1987), two series which are integrated of order 1, i.e. I(1), that is two series that are nonstationary in levels but stationary in first differences, are said to be cointegrated if a linear combination of the two series results in a series which is stationary in levels, without differencing. For instance, assume the two series X and Y are I(1). If $e_t = Y_t - \beta X_t$ is I(0), or stationary, then X and Y are said to be cointegrated, with β being the "cointegrating parameter". It is obvious that e_t, in this example, is identical to the vector of error terms obtained when Y is regressed on X. Therefore, the test for cointegration

simply amounts to regressing, in the case relevant here, the price level on the money supply, then testing to see if the residuals are stationary.

The first step in systematically conducting a test for cointegration is to confirm that the original series are indeed I(1). This was done by conducting a unit root test (see Dickey and Fuller, 1981: Said and Dickey, 1984; Dickey, et.al. 1986 or Dickey et.al. 1991) on the four series M1, M2, the GNP deflator, and the consumer price index (CPI). M1, M2, and the GNP deflator data are from 1959 QI-1991 QI. All were obtained from International Financial Statistics. The CPI is from 1959 QI-1987 QIV and was obtained from Business Conditions Digest series 320. The test was conducted on the levels of all four series by regressing the first difference of the series on a lag level, a constant, a time trend, and four lagged differences. This test is referred to as the augmented Dickey-Fuller (ADF) test (Engle and Granger, 1987, p. 266). Next the unit root test was performed on the first differences by regressing the second difference on a lagged first difference and a constant. This is referred to simply as the Dickey-Fuller test (Engle and Granger, 1987, p. 266). The results of this test are presented in Table 5.1. The null hypothesis in both the ADF and DF tests is that a unit root exists in the autoregressive scheme, and thus the series is nonstationary. An indication of significance therefore means that the null hypothesis can be rejected at the designated level. Column two in Table 5.1, under ADF, shows the ADF statistic obtained from the ADF test on the levels. In all cases the null hypothesis cannot be rejected at the 5% level (From Dickey, et.al. (1986), the critical values are -3.51, -2.89, and -2.58 at the 1, 5, and 10% levels respectively). The DF

Table 5.1 Unit Root Tests on M and P

Var	ADF	ΔVar DF
ln M1	-.801	-6.419***
ln M2	-2.148	-5.40***
ln GNP defl.	-2.757*	-4.210***
ln CPI	-2.564	-3.54**

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

statistic from the DF test on the first differences are reported in column three of Table 5.1 under Δ Var DF. The null hypothesis is rejected here at the 5% level. Therefore, the test results indicate that all four series are indeed I(1). These results are consistent with the findings of Nelson and Plosser (1982).

Since the relevant series are I(1), the next step is to test for cointegration; i.e., to test whether or not one of the two measures of the money supply and one of the two measures of the price level, when combined linearly, form a stationary series. According to Engle and Granger (1987, p. 253), it is not generally true that two I(1)'s will form an I(0). Therefore, a finding for cointegration is evidence that a long term structural relationship exists between the two series.

To conduct the test for cointegration the following equation was subjected to OLS estimation:

$$P_t = \alpha + \beta M_t + e_t$$

where P is the price level measure and M is the money supply measure. This equation was also estimated with the inclusion of a time trend as a regressor. The time trend was

included because it is necessary to remove all of the deterministic nonstationarity from the data before the test is conducted. Otherwise the null of noncointegration may be accepted simply because the cointegration parameter failed to take out this deterministic nonstationarity (Corbae and Ouliaris, 1988, p. 300). The equation was also estimated with M as the dependent variable and P as the independent variable. Engle and Granger (1987) note that the reverse regression will give the same result in a bivariate system. However, when the time trend is included, the results may be affected. There also may be some indication of causality associated with the reverse regression and a time trend. Next, an ADF test for a unit root was performed on the estimated residuals, e. This was done by regressing the first difference in e on a constant, a lag e level, and four lags of first differences. The results of these tests are presented in Table 5.2 with interpretations in section four.

4. Interpretation of the Cointegration Test on M and P.

In Table 5.2 the parameter estimates on the independent variable (i.e. either M or P) and time are in the second and third columns under Ind Vars. The results of the ADF test on the residuals are in column four under ADF and the Durbin-Watson statistics and Pearson correlation coefficients are the last two columns respectively. The tests indicate that M1 is not cointegrated with either the CPI or the GNP deflator, regardless of which way the regression is run or whether a time trend is included. M2 is, it seems, cointegrated with the GNP deflator, with or without the time trend. M2 is also cointegrated with the CPI when a time trend is included but is not when the time trend

Table 5.2 Cointegration of M and P

Dep Var	Ind Vars		ADF	DW	R^2
ln GNP	ln M1	time			
	.876***		-1.654	.020	.979
	.515***	.006***	-2.104	.014	.982
	ln M2				
	.655***		-3.06**	.021	.987
	1.385***	-.015***	-3.496**	.080	.992
ln CPI	ln M1				
	.941***		-2.319	.032	.977
	.954	-.000	-2.312	.032	.977
	ln M2				
	.667***		-2.630	.018	.973
	1.896***	-.026***	-4.016***	.098	.986
ln M1	ln GNP diff				
	1.117***		-1.588	.020	.979
	.525***	.008***	-1.495	.022	.986
	ln CPI				
	1.039***		-2.29	.032	.977
	.531***	.007**	-1.570	.042	.988
ln M2	ln GNP diff				
	1.508***		-3.215**	.021	.988
	.494***	014**	-3.22**	.103	.999
	ln CPI				
	1.459***		-2.796*	.018	.973
	.367***	.016***	-4.176***	.121	.999

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

is eliminated. The tests thus strongly indicates that M2, at least, does have a long term structural relationship with the GNP deflator measure of the price level and with the CPI measure. Hence, at this point, the mainstream prediction is validated by the empirical tests. In other words, the tests do not indicate any reason for rejection of the mainstream's hypothesis. There is no indication of the flow of causality, however, since there is cointegration regardless of which way the regression is run. At this point the question is whether or not an alternative explanation, such as that put forth by the Post Keynesians, is also valid. The task now, then, is to test the Post Keynesian's hypothesis.

5. The Post Keynesian Hypothesis

The Post Keynesian proposition is drawn primarily from Keynes' statement that "the long-run stability or instability of prices will depend on the strength of the upward trend of the wage-unit (or, more precisely, of the cost unit) compared with the rate of increase in the efficiency of the productive system" (Keynes, 1936, p. 309). Essentially this position may be summarized by saying that prices depend upon the cost per unit of output. These per-unit output cost, in turn, consists mainly of three components: money wages, nominal interest rates, and productivity.

The major component of production costs is money wages. Wage costs account for approximately two thirds of total production cost; thus, it has received the most attention of all the components. Keynes believed wages to be the determining factor of the price level, as is apparent from his use of the "wage unit" in the above quote. Weintraub (1958, 1961, 1978) also believed that wages were the determining factor. He

presented evidence indicating that the markup above wage cost was constant. Thus, any movement in prices could be attributed to either the nominal wage and/or labor's productivity, over which policy had no control. His championing of an incomes policy was based on this belief. In fact virtually all economists will agree that prices are affected by wage movements. Therefore a measure of unit labor cost is included in the structural equation.

A virtually ignored component of production cost is the nominal interest rate. Nonetheless, since it takes money and time to produce anything, the cost of employing money over time in the production process must be covered if the product is to be produced. As a result Post Keynesians find it strange that the mainstream believes increasing this component will somehow bring down prices (Hotson, 1967). It also seems inconsistent that mainstream economists have developed theories that show why investors arbitrage bond, stock, and currency markets in an effort to glean the best possible return on their financial investments, but contend that output, and the financial investment in production, is not affected by these other markets. The Post Keynesians contend that prices must adjust so that the returns to financial investment in production is brought into equality with returns elsewhere (Keynes, 1936, chapter 11, chapter 16, Davidson, 1978, chapter 11). Therefore, a measure of the interest rate must also be included in the structural equation.

The final component is the productivity measure. Obviously, if labor becomes more productive, while wages and interest costs are held constant, prices may fall and leave the returns to the producer constant. As Keynes pointed out, as long as productivity

was advancing, wages could rise with no affect on prices (Keynes, 1936, p. 271). This is also the idea behind an incomes policy. If wage increases are kept in line with productivity increases then prices will be stable, as long as interest rates are held constant as well (Wallich and Weintraub, 1971). In effect, the cost push proposition holds that prices respond to the movements in the hire prices of production factors, which are governed by wages and nominal interest rates, relative to movements in the productivity of these factors. Thus, a productivity measure must be included in the structural equation as well, if it is I(1). In the case that productivity is stationary, then the price level, labor cost, and the interest rate alone should be in the test equation.

In sum, then, the Post Keynesian proposition is that in the long run, prices are governed by wages, nominal interest rates, and productivity. The task now is to test this proposition.

6. An Empirical Test of the Cost-Push Proposition.

The Post Keynesian, or cost-push, proposition may be summed up by saying that prices, labor cost, interest rates, and productivity form a cointegrated system. This proposition is thus subjected to empirical analysis.

The first task in conducting the test of cointegration on this proposition is to verify that all of the components are I(1). It has already been shown, in section three, that prices are indeed I(1). Therefore, I only need to perform the test on interest rates, labor cost, and the productivity measure. The method for conducting the unit root test was

described earlier and was conducted in the same manner here. The results of these tests are reported in Table 5.3.

The data used in the test are all from 1959 QI-1987 QIV and were taken from Business Conditions Digest. For labor cost the index of unit labor cost was used, series 63. The nominal interest rate measures are the federal funds rate, series 119, 91 day T-bill yields, series 116, and long term bond yields, series 117. The productivity measure is real GNP, series 50, divided by total employment. Total employment is the total civilian employed, series 442, multiplied by the average hour of the work week, series one. Logs of all the variables except the interest rates are used.

In Table 5.3, the results of the ADF test on the variables in levels are reported in column 2 under ADF. It appears that all of the series, except the productivity measure, are indeed non-stationary. All of the values, except productivity, are below the 10% significance level of -2.51. I thus cannot reject the null of a random walk at the 10% level on any of the variables except the productivity variable. The results of the DF test on the first differences are reported in column three under Δ Var DF. In all cases it

Table 5.3 Unit Root Tests on i, W, and Q/N

Var	ADF	Δ Var DF
FFR	-.767	-8.966***
STR	-.473	-9.105***
LTR	-.027	-8.733***
ULC	-2.436	-6.198***
Q/N	-4.316***	-18.770***

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

appears that the series are stationary in first differences. Therefore it appears that all of the series except the productivity measure are indeed I(1).

The task now is to test if prices, interest and labor cost form a cointegrated system. Including the productivity measure in the cointegration test should not affect the test. Since Q/N is an I(0), if prices, labor cost, and interest rates form an I(0) then the sum of these two I(0)'s should still be I(0) (Engle and Granger, 1987, p. 253). On the other hand, if prices, labor cost, and interest form an I(1), then the sum of this I(1) and the Q/N I(0) should also be I(1) (see Engle and Granger, 1987, p. 253).

The next step in determining whether or not a long term structural relationship exists between prices, interest, and labor cost is the cointegration test itself. This test was performed by running an OLS regression on the following equation.

$$P = \partial + \beta_1 \, ULC + \beta_2 \, i + \beta_3 t + e$$

where P is the price level measure, ULC is the index of unit labor cost, and i is the nominal interest rate measure. Time is again included in the cointegrating equation to ensure that all deterministic nonstationarity is removed.

The cointegration test was also performed on prices and interest rates only, as well as on prices and unit labor cost only. Corbae and Ouliaris (1989) found that prices and interest are not cointegrated and Engle and Granger (1987) found that prices and wages were also not cointegrated. These tests were duplicated in order to confirm these findings.

Once the cointegrating regression was run the estimated residuals from these regressions were subjected to the ADF test for stationarity as described earlier. The results of these tests are reported in Table 5.4.

7. Interpretation of the Cointegration Test on the Cost-Push Proposition

Equation one, in Table 5.4, shows the results from the cointegration test of prices and unit labor cost only. The ADF statistic of -3.579 exceeds the 5% level of -3.17 given in Engle in Granger (1987) and exceeds the 1% critical value of -3.51 given in Dickey et.al. (1986). However it does not exceed the 1% critical value of -3.77 in Engle and Granger (1987). The results, at this point, must thus be considered ambiguous. I emphasis that Engle and Granger (1987, p. 273) find wages and prices not to be cointegrated at the 10% level.[1]

Equation two shows the results of the cointegration test on prices and interest alone. The ADF statistic of -2.183 is below the 10% critical values in all tables. Thus, I find interest and prices not to be cointegrated. This confirms the finding of Corbae and Ouliaris (1989). I should also note that the coefficient estimate on interest rates is positive and significant, implying that nominal interest increases are positively correlated with price level increases. Since they are not cointegrated, however, they must be interpreted as being correlated in the short term only.

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[1]Engle and Granger (1987, p. 273) used "production worker wage in manufacturing" for the wage measure, however. Here the index of unit labor cost is used.

Table 5.4 Cointergration of i, W, P and Q/N

Dep Var		Ind Vars			ADF	DW	R^2
GNP defl		ULC	FFR	time			
equation							
	1	.864***		.002***	-3.579**	.312	.999
	2		.005**	.0135***	-2.185	.012	.973
	3	.877***	-.002***	.002***	-4.223***	.449	.999
			STR				
	4	.878***	-.002***	.002***	-4.213***	.423	.999
			LTR				
	5	.888***	-.003***	-.002***	-4.078***	.376	.999
			FFR				
	6	.874***	-.002***	.002***	-4.162***	.479	.999
CPI	7	1.075***	-.003***	-.000	-1.740	.257	.998
			STR				
	8	1.069***	.003***	-.000	-1.731	259	.998
			LTR				
	9	1.069***	-.002***	-.000	-1.496	.213	.998

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

Note: Equation 6 also contains productivity (Q/N) as a regressor. The parameter estimate on productivity is -.007 and significant at the 1% level.

Equation three, four and five show the results of the cointegration test on prices, interest, and labor cost using the federal funds rate, 91 day T-bill yields, and long term treasury bond yields for interest rates respectively. Time is also included in these equations as well as equation one and two. In equation three, four and five, the ADF statistics indicate that the null hypothesis of no cointegration can be rejected at the 1% critical level. Prices (using the GNP deflator), unit labor cost, and interest rates form a cointegrated system, regardless of which interest measure is used (according to the test results). The coefficient estimate on the interest rate measure, however, turns negative when labor cost are included. This implies that the reduction in output due to interest rate increases, as indicated in chapter three, must cause labor cost to fall enough to more than offset the positive interest cost effect on prices. It thus seems that a tight money policy is no more than an indirect wage control policy (Weintraub, 1978, 1982).

The finding that the system yields a stationary, or I(0), series when interest rates are included with price and labor cost also serves to confirm Engle and Granger's (1987) finding that prices and wages are not cointegrated. If prices and labor cost formed an I(0), then the combination of that I(0) and interest, which is an I(1) would have formed an I(1) (Engle and Granger 1987, p. 253). Equation 6 shows the effect of including the productivity measure, which was shown to be an I(0), with prices, interest, and labor cost. The finding that this system is still I(0), as indicated by the ADF statistic of -4.162, further confirms that prices, interest, and labor cost are cointegrated, i.e. they form an I(0). If they were an I(1) then including the productivity measure would have also formed an I(1) (see Engle and Granger, p. 253). The negative coefficient estimate on the

productivity measure also confirms the hypothesis that labor cost and productivity have offsetting effects on prices.

Equations seven, eight, and nine show the results of the cointegration test of prices, labor cost, and interest rates using the CPI as the price measure and the fed funds rate, short term bond yields, and long term bond yield respectively. In all of these tests, the null of no cointegration cannot be rejected at the 10% level of significance. It thus appears that a long term relationship between these variables does not exist. If some measure reflecting the weight differentials on the composition of output between the CPI and GNP deflator was available, and was I(1), then this system might be cointegrated as well.

In sum, I must conclude that the cost push explanation of the long term determination of prices is also valid, at least when the GNP deflator is used as the price level measure. Thus the results indicate that two explanations for prices exist and are empirically verifiable. This, in part, explains why neither of these explanations has prevailed in over 200 years of economic theorizing. My purpose now is to attempt to show the causal sequence between money and prices in a further effort to differentiate the two competing theories. Cointegration, as was noted, does not imply causality one way or the other.

8. A VAR Analysis of M2 and the GNP Deflators

At this point it seems that one method of deciding which of the two theories is correct would be to determine which comes first, money supply increases or price

increases. The mainstream hypothesis, that excess money creation leads to inflation obviously assumes that money supplies must be increased first. On the other hand, the cost push explanation suggests that price increases lead while the money supply responds to those price increases. In this section, I will develop and test a vector outregression (VAR) (see Sims, 1980a) using M2 for the money supply measure and the GNP deflator for the price level measure. These measures were chosen because M2 is cointegrated with both the GNP deflator and the CPI while M1 is not, and the GNP deflator is cointegrated with interest and labor cost while the CPI is not.

A VAR is quite easy to develop since it requires no a priori structure. It only requires the specification of the variables and the number of lags of each to be used. In this case both M2 and the GNP deflator are assumed to be endogenous variables while the number of lags chosen is 10. Making both variables endogenous makes it a strict VAR (see Sims, 1980a).[2] Ten lags were chosen because in chapter three, it was shown that after ten lags, real GNP becomes insensitive to interest rate movements. The test was performed using the first differences in logs of both variables to avoid any spuriousness associated with regression analysis on random walks. The results of the VAR are shown in Table 5.5. The results from the F test of the joint hypothesis that all the lags in the particular series cumulatively are zero are shown in Table 5.6. Table 5.5 shows the individual coefficient estimates from the VAR test and asterisks denote the individual probability values (P-values) of each coefficient. Except for the coefficient on the first

[2]The VAR method was described in Chapter 3. The VAR used here is a bivariate VAR with M2 and GNP deflator as the two variables. Again the joint probability distributions are assumed to be multivariate normal thus allowing use of the F test.

Table 5.5 VAR Tests on ΔM and ΔP

Dep Var	# of Lags	Ind Vars	
Δ ln M2		Δ ln GNP defl.	Δ ln M2
	1	-.319*	.481***
	2	.063	-.137
	3	-.129	.039
	4	.148	-.109
	5	.069	.159
	6	.178	-.093
	7	.049	.056
	8	.119	-.135
	10	.205	.099
Δ ln GNP defl.			
	1	.447***	.032
	2	.147	.055
	3	.124	-.080
	4	.175	.038
	5	.017	-.092
	6	-.139	.087
	7	.091	-.037
	8	-.003	.145
	10	-.028	.006

Table 5.6 F Tests on ΔM and ΔP

Dep Var	Ind Vars	
Δ ln M2	Δ ln GNP defl.	Δ ln M2
	1.756*	2.524**
Δ ln GNP defl.		
	16.409***	1.289

* implies significance at the 10% level
** implies significance at the 5% level
*** implies significance at the 1% level

lag none of the individual coefficients of the GNP deflator are significant and the first lag is negative in sign. The same is true of the coefficient estimates of M2 on the GNP deflator. Thus, an analysis of the individual P-values does not indicate causality in either direction. This test does not help in distinguishing the flow of causality between money and prices.

Table 5.6 shows the results of the F test on the joint hypothesis that the coefficient estimates on all the lags jointly is zero. Here it is found that the F test of the cumulative effect of GNP deflator lags on M2 is significant at the 10% level. The reverse F test, that of the lagged effects of M2 on the GNP deflator, is not significant even at the 10% level. The results of this test indicate that there is weak evidence that price movements precede increases in the money supply, but no evidence of the reverse. I must conclude, then, that since price level increases come before money supply increases, the cost-push hypothesis appears to be slightly more convincing than the excess money creation explanation.[3]

9. Summary and Conclusion

The purpose of this chapter has been to empirically test two competing hypotheses of the determination of the price level in the long run. The mainstream hypothesis that inflation is a result of excess money creation was shown to be contradictory to the data while the Post Keynesian's cost push hypothesis received weak support. Overall the cost push explanation did prove more convincing.

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[3] Mehra (1991) uses this exact methodology to show causality between wages and prices.

The test was conducted in the following manner. First the price level and the money supply were subjected to the test for cointegration. Two measures of the price level, the GNP deflator and the CPI, were used as well as two measures of the money supply M1 and M2. It was found that M2 is cointegrated with both the CPI and GNP deflator however M1 was not cointegrated with either.

Next the cost push hypothesis was tested by subjecting prices, labor cost, and interest rates to the cointegration test. A productivity measure was found to be stationary and was thus not included in the cointegrating equation. The two measures of the price level were again used, as were three measures of nominal interest rates, the federal funds rate, the yield on 91 day T-bills, and the yield on long term Treasury bonds. It was found that this system is cointegrated with the GNP deflator but not with the CPI regardless of which interest rate measure was used.

The final step was estimating a VAR on first differences in logs of both the GNP deflator and M2 in an attempt to determine causality. It was found that weak evidence exists for the cost push hypothesis of movements in the deflator preceding movements in the money supply. No evidence could be found of movements in M2 preceding movements in the price level.

My overall conclusion must be that, given the test in this chapter, that the Post Keynesians cost-push explanation is more convincing.

CHAPTER 6

SUMMARY AND CONCLUSION

1. Introduction

This treatise has subjected to empirical analyses two competing hypotheses about the effects of changing nominal interest rates on nominal spending and real output. This chapter provides a summary of the work undertaken, along with the conclusions drawn and some further notes that seem appropriate. Section 2 provides a brief recapitulation of the two competing hypotheses. In section 3 a summary of the three chapters which contain the empirical tests, chapters 3, 4 and 5, is presented as well as the conclusions that were drawn from each of the three tests. Section 4 presents some obvious limitations to the type of analysis undertaken in the preceding chapters. Some suggestions for future research in this general area are pointed out in section 5 along with a final note.

2. Two Hypotheses

The two hypotheses that were subjected to empirical analyses in this study stem from two distinct schools of thought regarding monetary policy. These schools of thought are known as the Currency School and the Banking School or, in modern terms, the verticalists and the horizontalist. Further, each view is associated with a contemporary economic paradigm. The mainstream of the economics profession, which was argued to encompass the Keynesians, as well as the Monetarist/New

Classicals, have, for the most part, embraced the Currency School's or verticalist's view. A smaller segment of the profession known as the American Post Keynesians have followed the Banking School's tradition and adhere, for the most part, to the horizontalist view. Each of these views has a unique vision of the interrelationships between nominal interest rates, nominal spending, real output, growth of the money stock, and the rate of inflation.

The mainstream of the economics profession today, like their Currency School predecessors, regard the money supply, or the rate of growth of the money supply, to be the variable directly affected by monetary policy. Further, this group maintains that the rate of growth of real output, at least in the long run, is determined exogenously via natural forces in existence. In other words, the rate of growth of real output tends toward some natural rate, regardless of the actions taken by the monetary authorities on monetary policy. It thus logically follows that any alteration in the growth rate of the money supply that the monetary authorities deem appropriate will only affect nominal variables, e.g. nominal spending and nominal interest rates, in the long term. In the short run real output will, it is argued, be affected but only because of some institutional rigidities, as the Keynesian argue, or because money illusion or noisy price signals are present, according to the Monetarist/New Classicals. The divergence in the affects on real output in the short and long run also leads to different predictions of the affect on nominal interest rates and nominal spending between the short and long runs.

A typical mainstream scenario of movements in nominal and real variables resultant from the monetary policy initiative runs as follows. If we suppose, for example, that the monetary authority decides to increase the growth rate of the money supply, in the short run, nominal spending will increase while nominal interest rates fall. The growth rate of real output will also be increased in the short run due to the inability of economic agents to adjust their wages and prices. Thus, in the short term nominal interest rates and nominal spending, as well as nominal interest rates and real output, will exhibit negative correlations.

In the long run, however, once economic agents are able to adjust their wages and prices, real output will return to its original, natural, rate of growth. Nominal spending, on the other hand, will have its rate of growth permanently increased, thus prices will rise. The rise in prices, it is said, will cause economic agents to adjust their expectations about future rates of inflation and this will, via the Fisher equation, pull up nominal interest rates to a level higher then their original position. Therefore, in the long term nominal interest rates and real output will have no relationship. Or, the short term, cyclical, correlation between nominal interest rates and real output will dissipate leaving no long term, structural correlation. Nominal interest rates and nominal spending must, however, manifest a structural relationship since it is the permanent affect on nominal spending that induces the eventual rise in nominal interest rates to a level higher than originally existed. Further, since the acceleration of the rate of inflation is a result of the initial money supply growth rate increase, these two must also exhibit a structural correlation.

The Post Keynesians, on the other hand, like their Banking School forefathers, contend that the monetary authority exercises control over the nominal rate of interest and that nominal variables, including the growth rate of the money supply, as well as real variables, respond to changes in this strategic variable. However, nominal spending in the aggregate is not likely to change significantly since nominal interest rate changes induce offsetting effects on the various components of aggregate nominal spending.

A typical Post Keynesian scenario runs as follows. Suppose, or example, that the monetary authority decides to lower the nominal rate of interest. This will reduce the cost of producing a given volume of output since nominal interest changes themselves constitute a significant component of production cost. Further, nominal interest rates provide a governor for the required rate of return on fixed capital assets used in the production process. The reduction in costs allows prices to fall without affecting profit margins. If nominal spending remains unchanged, then real output will rise since the same amount of spending at lower prices necessitates more output. Nominal spending in the aggregate will not change, much anyway, since the largest component of nominal spending, consumer purchases, may in fact fall while residential investment rises. If consumers tend to maintain a relatively stable standard of living, then a fall in prices means less nominal consumption spending. Residential investment will, however, rise, since lower nominal interest rates mean lower monthly house payments. Government spending may also fall if the higher rate of output and production leads to higher employment and thus less unemployment benefits paid out.

Business fixed investment is not likely to change significantly since investment decisions are dependent on a morass of other considerations. All in all, in the short term, the nominal interest rate reduction will be correlated with a higher rate of growth of output but will not be significantly related to nominal spending changes.

The long term predictions of the Post Keynesians are much more ambiguous, but, since this school views the long run as a succession of short runs, the long term, or secular, correlations should be the same as the short term, or cyclical, correlations. However, in the event that the initial interest cost reductions are offset by other cost increases over time, such as wages, then the cyclical correlation between nominal interest rates and real output will dissipate into an insignificant secular correlation. Further, since this school believes prices are subject to cost, not money supply increases, any correlation, whether cyclical or secular, between inflation and the rate of growth of the money supply will have causation that flows from prices not the reverse.

The bulk of the study undertaken in the previous chapters is the empirical analysis of the predictions associated with each school of thought just described. The findings from the study are next.

3. Empirical Tests Summaries and Conclusions

Following a review of the historical literature in chapter 2, tests of the competing hypotheses were conducted. In chapter 3 a tests of the short term predictions of the relationships between nominal interest rates and nominal spending and nominal interest rates and real output, were conducted. A vector autoregression

(VAR) was set up with nominal interest rates (the federal funds rate, 91 day Treasury bill rates and long term bond rates were all used), real output and nominal spending as the only variables. The VAR had ten lags of each variables and all the variables were in first differences to avoid the spuriousness associated with using random walks in regression analysis. It was found that nominal interest rates and nominal spending were not significantly related. However, nominal interest rates and real output were negatively and significantly correlated. It was thus concluded that the Post Keynesians' predictions were supported by the data while the mainstream's were not. Raising interest rates, it was found, tended to increase inflationary pressure rather than cause it to abate. Even when the oil price shock years were excluded from the data, inflationary pressure was increased for two years after the interest rate rise before spending responded enough to reverse the pressure.

In chapter 4 the long term predictions between nominal interest rates and nominal spending and nominal interest rates and real output put forth by the two schools was empirically tested. The technique of cointegration was employed there to ascertain any long term, structural relationships between the afore mentioned variables.

First each variable series was tested, using the augmented Dickey-Fuller test, for the presence of a unit root. All the series were found to possess unit roots, or were found to be random walks. Next, tests for cointegration between the nominal interest rate and nominal spending and between the nominal interest rate and real output were conducted. It was found that the nominal interest rate was not cointegrated with either nominal spending or real output. In other words the test

suggested that the nominal interest rate did not have a secular correlation with either spending or output. Again it was concluded that the Post Keynesians' predictions were more in line with the test results than were the mainstream's. A reinterpretation of recent U.S. economic history, based on the results of the empirical analyses in chapters 3 and 4, was also presented in chapter 4.

Chapter 5 contains two explanations of the role of inflation and presents empirical tests intended to establish which received empirical support. First the mainstream hypothesis that inflation is the result of excessive money creation was tested using the cointegration technique. It was found that prices and the money supply were cointegrated, at least using M2 as the money series variable. Thus the mainstream hypothesis received empirical support.

Next the Post Keynesians hypothesis that inflation is the result of increasing cost was tested again utilizing the technique of cointegration. It was found that prices, nominal interest rates and wages, by themselves, a cointegrated system, thus the Post Keynesian hypothesis also received empirical support. A measure of productivity was found to be stationary and was thus not included in the cointegrating equation.

Finally, a VAR was set up with only money and prices as variables and F tests were conducted to ascertain the flow of causation. It was found that price changes preceded money supply changes and thus the Post Keynesians' predictions received empirical support.

4. Limitations

There are several limitations to empirical studies using economic data such as this one. The first, and probably most important, of these is the thousand and one implicit assumptions made. This study assumes that a developed financial system exists in the economy under study, developed at least to the point that arbitrage is sufficient to ensure the nominal rates of return to financial investment in the myriad of investment opportunities are brought to a reasonable degree of equality. This assumption is required if whatever nominal interest rate is used is a reasonable guide to nominal interest rates elsewhere and thus may be considered a determinant of economic behavior in general. Any attempt at duplicating this study in an economy in which this assumption does not hold, such as many less developed countries today, would probably be in vain.

It is also assumed in this study that economic actors, consumers and producers, respond to market signals. This often overlooked assumption probably holds true in the U.S. as well as most developed market economies, but may not in areas where markets are few and/or new.

An additional assumption made here is that international conditions do not substantially affect production and spending decisions. Because international trade is a relatively less important component of the U.S. economy, this assumption is probably valid for the study undertaken. This does, however, severely limit the areas where this study, without some alterations for international considerations, may be duplicated.

In effect, the assumptions implicitly made by a researcher immersed in the subject matter on which the research is done, probably biases the research. Unfortunately, for economist, this hazard is simply impossible to avoid.

A second limitation of this study is that the methodology and data employed restrict the inferences drawn from being applied to time periods other than the data period used. In other words, forecasts of future behavior alterations in response to nominal interest rate movements based on the findings of this study may prove useless unless the institutions of society are confined to be reasonably close to those that existed during the data period in this study. These behavioral institutions are probably fairly stable over short time periods thus allowing limited short run forecasting, however, long term forecasting may prove treacherous.

Ultimately, regardless of the protestations of many empirical practitioners to the contrary, inferences from empirical studies of economic behavior are limited, to a large degree, to the time and place of the study. The future is simply unknown and unknowable.

5. Suggestions for Future Research

The findings presented in this dissertation raise several questions for which future research is required to address adequately. One concerns the question of income distribution. It was found in this study that raising nominal interest rates lowers output but does not significantly alter spending, at least for about two years. After two years, however, spending does tend to decline. The question is why? It

was suggested in chapter 3, that the reduced output resulting from the nominal interest increase increased unemployment, which in turn put downward pressure on nominal wages, and the wage decline was responsible for the belated spending decrease. Whether or not this is indeed the case may be found if further research is directed in this area. The answer would also provide some idea of the effect on the distribution of income between wage and non-wage income resulting from monetary policy.

Another interesting finding, in chapter 5, was that price increases tend to precede money supply increases. However, it has also been suggested that money supply increases are required to precede output increases (Davidson, 1965). An interesting research project to undertake would be to devise some empirical test for both of these simultaneously. The results may also suggest an alternative explanation for the so called missing equation for how a money supply increase is divided between output and prices (see Gordon, 1974, pp. 31-40).

Prior research, especially in monetary economics, has tended to begin with some basic assumption, (such as assume the Fed loaded bundles of money on a helicopter and dropped them on the economy when it wants to increase the money supply (see Friedman, 1969, p. 4) then proceed to analyze economic behavior in response. If progress is to be made in economics this method of analysis will have to be altered. To a large degree the assumptions determine the results. This treatise, it is hoped, will show that realistic assumptions can provide results that are meaningful and not simply logical extensions of absurd assumptions.

BIBLIOGRAPHY

BIBLIOGRAPHY

Akerloff, G. & J. Yellen, "A Near-rational Model of the Business Cycle with Wage and Price Inertia", Quarterly Journal of Economics, 100 (5) supplement, (1985).

Ando, A. and Modigliani, F., "The 'Life Cycle' Hypothesis of Saving", American Economic Review, (March 1963), pp. 55-84.

Arnon, Arie, Thomas Tooke: Pioneer of Monetary Theory, Edward Elgar, Worchester, England.

Bean, C. R. "An Econometric Model of Manufacturing Investment in the UK", Economic Journal, (91, 1981), pp. 106-121.

Blinder, A. S. "Why are Prices Sticky" Preliminary Results from an Interview Study" American Economic Review (May 1991), pp. 89-100.

Blinder, A. S. and Solow, R. M. "Analytical Foundations of Fiscal Policy", in The Economics of Public Policy, Washington: Brookings Institution, (1974).

Business Conditions Digest, Department of Commerce, Washington, D.C.

Chamberlin, E. The Theory of Monpolistic Competition. New York: MacMillan, (1933).

Corbae, D. and Ouliaris S. "A Random Walk Through the Gibson Paradox" Journal of Applied Econometrics, Vol. 4. (1989) pp. 295-303.

Clark, J. M., "Business Acceleration and The Law of Demand: A Technical Factor in Economic Cycles," Journal of Political Economy, March, pp. 217-235 (1917).

Clower, R. "Keynes and the Classics REvisited", in Hamouda and Smithin (eds.) Keynes and Public Policy after Fifth Years, New York: Edard Elgar, (1988).

Cyert, R. and March, J.G. A Behavioral Theory of the Firm, New York: Prentice-Hall, (1963).

Dabbs, R. E. and Smith, K. and Brocato, J. "Tests on Rationality of Professional Business Forecasts", Quarterly Journal of Business and Economics, forthcoming.

Darrity, W. "The Simple Analytics of Aggregate Demand Price and Aggregate Supply Price Analysis", in Kregel, J. A. ed. Inflation and Income Distribution in Capitalist Crisis, London: Macmillan, (1989).

Davidson, P. "Keynes' Finance Motive", Oxford Economic Papers, 17, (1965) pp. 47-66.

_____. Money and the Real World, 2nd ed. London: Macmillan (1978).

_____. Congressional Testimony before the Subcommittee on Domestic Monetary Policy, House Banking Committee, U.S. Congress, March (1979).

_____. International Money and the Real World, London: MacMillan (1982).

_____. "Post Keynesian Economics" in Bell and Kristol eds. The Crisis in Economic Theory, New York: Basic Books, (1981).

Davidson, P. and Smolensky, E. Aggregate Supply and Demand Analysis, New York: Harper, (1964).

Davidson, P. and Weintraub, S. "Money as Cause and Effect", Economic Journal, (December, 1973).

Deprez, J. "Mark-up Pricing in a Monetary Economy: A Extension of Eichner's Megacorp", Review of Radical Political Economy, (Summer-Fall 1988).

Dickey, D. A. and Fuller, W. A. "The Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", Econometricia, (1981) pp. 1057-1072.

Dickey, D. A., Bell, W. R. and Miller, R. A. "Unit Roots in Time Series Models: Tests and Implications", The American Statistian, Vol. 40, (February 1986), pp. 12-26.

Eichner, A. The Megararp and Oligpoly: Micro Foundations of Macro Dynamics, NewY ork: Cambridge Unviersity Press.

_____. "A Theory of the Determination of the Mark-up under Oligopoly", Economic Journal. (December 1973).

Eisner, R. "Fiscal and Monetary Policy Reconsidered", American Economic Review, (December 1969), pp.897-905.

Eisner, R. & Pieper, P.J. "A New View of the Federal Debt and Budget Deficits," American Economic Review, (March, 1984), pp. 11-29.

_____. "What Went Wrong?", Journal of Political Economy, (May/June 1971), pp.629-641.

Eisner, R. and Nadiri, M. I. "Investment Behavior and Neo-classical Theory", Review of Economics and Statistics, (50 1968), pp. 369-382.

Engle, R.F. and Granger, C. W. J., "Co-integration and Error Correction: Representation, Estimation, and Testing," Econometricia, (55 1987), pp. 251-276.

Estenson, P. S., "The Keynesian Theory of the Price Level: An Econometric Evlauation Using a Vector Autoregression" Journal of Post Keynesian Economics, (Summer 1992), forthcoming.

Fisher, I. The Theory of Interest, Kelley and Maillman, Inc., New York (1954) first printed (1930).

Friedman, M. "The Role of Monetary Policy", American Economic Review, (March 1968), pp. 1-17.

_____, The Theory of the Consumption Function, National Bureau of Economic Research, Cambridge, USA.

_____, The Optimum Quantity of Money and Other Essays, University of Chicago Press, (1969).

Gayer, A.D. (ed.) The Lessons of Monetary Experience Rhinehart and Co., Inc., (1937).

Goldfeld, S. M. "The Demand for Money Revisited", Brookings Papers on Economic Activity, (1973), pp. 577-638.

Gordon, R. J. "What is New-Keynesian Economics?", Journal of Economic Literature, (September 1990).

_____, ed. Milton Friedman's Monetary Framework: A Debate with his Critics Chicago: University of Chicago Press, (1974).

Gordon, R. J. and King, S. R., "The Output Cost of Disinflation in Traditional and Vector Autoregressive Models." Brookings Papers in Economic Activity, (1 1982).

Hall, R. and Hitch, C. "Price Theory and Business Behavior", Oxford Economic Papers, (No. 2 1939).

Hall, R. E. and Taylor, J. B., Macroeconomics, 3rd edition, W. W. Norton and Co., New York, (1991).

Hansen, A. Monetary Theory and Fiscal Policy, New York:McGraw-Hill Book Company, (1949).

Harcourt, G. C. (ed.) The Microeconomic Foundations of Macroeconomics, London: MacMillan (1977).

Harris, S.E. (ed.) The New Economics, New York: Alfred A. Knopf, Inc. (1947).

Harrod, R. F. Economic Essays, New York: Harcourt, Brace (1952).

_____. "An Essay on Dynamic Theory," Economic Journal, (March 1939).

_____. "Replacements, Net Investment, Amortisation Funds", Economic Journal (March 1970).

Hay, D. and Morris, D. Industrial Economics, Oxford: Oxford University Press, (1979).

Hester, D. D., "Innovations and Monetary Control", Brookings Papers on Economic Activity, (1981), pp. 141-144.

Hicks, J. "Mr. Keynes and the Classics: A Suggested Interpretation", Econometrica, (1937).

Hirtle, Beverly and Kelleher, Jeanette, "Financial Market Evolution and the Interest Sensitivity of Output," Quarterly Review, Federal Reserve Bank of New York, (Summer 1990), pp. 56-70.

Hotson, J. H. "Neo-Orthodox Keynesianism and the 45° Heresay", Nebraska Journal of Economics and Business, (Autumn 1967), pp. 34-49.

_____. "Monetary and Wage Mark-up Theories of the Price Level: Some Data", International Economic Review II, (February 1970), pp. 53-76.

_____. "Fiscal and Monetary Policy Reconsidered: Comment", American Economic Review, (June 1971), pp. 448-450.

Hotson, J., Habibagahi, H. and Lermer, G. Stagflation and the Bastard Keynesians, University of Waterloo Press, (1976).

Kahn, George A. "The Changing Interest Sensitivity of the U.S. Economy," Economic Review, Federal Reserve Bank of Kansas City, (November 1989), pp. 13-34.

Kahn, R. F. "Exercises in the Anlysis of Growth" Oxford University Papers (1959).

_____. "The Relation of Home Investment to Unemployment" Economic Journal, (1931).

_____. "Some Notes on Liquidity Preference" The Manchester School (1954).

Kaldor, N. A Keynesian Theory of Employment Growth, and Income Distribution, Philadephia: Chilton, (1966).

_____. "A New Model of Economic Growth", Review of Economic Studies (1962).

_____. "Economic Growth and the Problems of Inflation," Economica (1959).

_____. Essays on Economic Stability and Growth. London: Duckworth (1900).

_____. "Marginal Productivity and Macroeconomic Theories of Distribution", Review of Economic Studies (1966).

_____. "Market Imperfection and Excess Capacity", Economics, (February 1935).

_____. "Speculation and Economic Stability" Review of Economic Studies, (October 1939).

_____. "A Model of the Trade Cycle," Economic Journal, (March 1940).

_____. "The New Monetarism", Lloyds Bank Review, (July 1970).

_____. "Alternative Theories of Distribution", Review of Economic Studies, (No. 2 1955-56).

Kalecki, M. Theory of Economic Dynamics. London: Allen and Unwin, (1965).

_____. "A Theory of the Business Cycle," Review of Economic Studies, (February 1937).

_____. Studies in the Theory of the Business Cycle, Oxford: Blackwell (1966).

_____. Selected Essays on the Dynamics of the Capitalist Economy, Cambridge: Cambridge University Press, (1971).

_____. "A Macrodynamic Theory of Business Cycles", Econometrica, (Vol. 3 1935).

Keynes, J.M. The General Theory of Employment, Interest and Money, New York: Harcourt, Brace (1936).

_____. A Treatise on Money, London: MacMillan, (1930).

_____. "On the Theory of a Monetary Economy" (1933) reprinted in Nebraska Journal of Economics (1963).

_____. "The General Theory of Employment", Quarterly Journal of Economics (1937).

_____. "The Ex-ante Theory of the Rate of Interest", Economic Journal (1937).

_____. "Alternative Theories of the Rate of Interest, Economic Journal (1937).

_____. "Relative Movements of Real Wages and output", Economic Journal, (March 1939).

_____. The General Theory and After: A Supplement, Collected Works, Vol. 29, London: MacMillan, (1979).

_____. The General Theory and After: Part II Defense and Development, Collected Works, Vol. 14, London: MacMillan (1973).

_____. The Collected Writings of John Maynard Keynes, Vol. X, Essays in Biography Moggridge, London: MacMillan (1971).

Koutsayiannis, A. Modern Micoreocnomics 2nd ed., New York: MacMillan, (1980).

Lawrence, Colin and Siow, Aloysius, "Interest Rates and Investment Spending: Some Empirical Evidence for Postwar U.S. Producer Equipment, 1947-1980," Journal of Business, (Vol. 58 1985), pp. 359-375.

Lerner, A.P. Economics of Unemployment, McGraw-Hill Book Co., Inc. (1951).

_____. "The Essential Properties of Interest and Money", Quarterly Journal of Economics (May 1952).

_____. "Employment Theory and Employment Policy", American Economic Association Papers and Proceedings (May 1967).

_____. "Mr. Keynes' 'General Theory of Employment, Interest, and Money'," International Labour Review, (October 1936).

_____. "Interest Theory- Supply and Demand for Loans or Supply and Demand for Cash", Review of Economics and Statistics, (May 1944).

_____. "On the Marginal Product of Capital and the Marginal Efficiency of Investment" Journal of Political Economy, (February 1953).

_____. "On Generalizing the General Theory", American Economic Review, (March 1960).

_____. "From the Treatise on Money to the General Theory", Journal of Economic Literature, (March 1974).

_____. "On Some Recent Developments in Capital Theory", American Economic Review (May 1965).

_____. "The Concept of Monopoly and the Measurement of Monopoly Power", Review of Economic Studies, (Vol. 1 1934).

Lindsey, D. E., "Recent Monetary Developments and Controversies", Brookings Papers on Economic Activity (1 1982), pp. 245-268.

Lucas, R. E., "Some International Evidence of Output-Inflation Tradeoffs," American Economic Review, (December 1973) pp. 326-334.

Lucas, R.E. and Sargent, T.J., "After Keynesian Macroeconomics" in After the Phillips Curve: Persistence of High Inflation and High Unemployment, Federal Reserve Bank of Boston, (1978), pp. 44-72.

Mankiw, N. G. "Small Menu Costs and Large Business Cycles: A Macroeconomic Model", Quarterly Journal of Economics, (May 1985).

_____. "A Quick Refresher Course in Macroeconomics" Journal of Economic Literature, (December 1990) pp. 1645-1660.

Mankiw, N. G. and Romer, D., New Keynesian Economics, Cambridge: MIT Press, (1991).

Malthus, T.R., The Pamphlets of Thomas Robert Malthus, August M. Kelley, New York, (1970).

McCulloch, J. Huston, Money and Inflation, A Monetarist Approach, New York: Academic Press, (1975).

Mehra, Y., " Wages and Prices: An Empirical Note", American Economic Review, (September 1991), pp. 931-937.

Millar, J. R., "The Social Accounting Basis of Keynes' Aggregate Supply and Demand Functions", Economic Journal, (82, 1972), pp.600-611.

Minsky, H.P. John Maynard Keynes, New York: Columbia University Press, (1975).

_____., "The Financial Instability Hypothesis" Nebraska Journal of Economics and Business, (16 1977).

Mitchell, D. W., "Macro Effects of Interest-Sensitive Aggregate Supply", Journal of Macroeconomics, (Winter 1984), pp. 43-56.

Nelson, C. and Plosser, C. I., "Trends and Random Walks in Macroeconomic Time Series", Journal of Monetary Economics, (10 1982), pp. 139-162.

Pasinetti, L.L., "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth" Review of Economic Studies (1962).

Phillips, A. W., "The Relationship Between Unemployment and the Rate of Change in Money Wages in the United Kingdom 1861-1957", Economica, (November 1958), pp.283-299.

Pindyck, R. S. and Rubinfeld, D. L., Econometric Models and Econometric Forecasts, 3rd edition, McGraw-Hill Inc., New York, (1991).

Pozdena, R. J., "Housing and Interest Rates: A Weaker Link?" JRBSF Weekly Letter, Federal Reserve Bank of Boston (August 1989).

Ricardo, D., Principles of Political Economy on Taxation, Cambridge, (1817).

Robertson, J. C. and Orden D., "Monetary Impacts on Prices in the Short and Long Run: Some Evidence from New Zealand", American Journal of Agricultural Economics, (February 1990).

Robinson, J. Essays in the Theory of Economic Growth. London: MacMillan (1963).

_____. "Michael Kalecki on the Economics of Capitalism," Oxford Bulletin of Economics and Statistics, (Vol. 39 1977).

_____. The Economics of Imperfect Competition. London: MacMillan, (1933).

Samuelson, P. "A Synthesis of the Principle of Accerlation and the Multiplier", Journal of Political Economy, (December 1939).

Samuelson, P. and Solow, R. "Analytical Aspects of Anti-Inflation Policy", American Economic Review, (May 1960), pp. 177-194.

Sawyer, M. Business Pricing and Inflation, New York: MacMillan, (1983).

Seelig, S. "Rising Interest Rates and Cost Push Inflation." The Journal of Finance, 29 (September 1974), pp. 1084-1061.

Serletis, Apostolas, "The Demand for Divisia M1, M2, M3 in the United States", Journal of Macroeconomics, (1987), pp. 567-591.

Shove, C. F. "The Imperfection of the Market" Economic Journal, (March 1933).

Silk, Leonard, Economics in the Reald World, New York: MacMillan, (1984).

Sims, C., "Macroeconomics and Reality", Econometrica, (January 1980a), pp. 1-48.

_____, Comparison of Interwar and Postwar Business Cycles: Monetarism Reconsidered" American Economic Review, (May 1980b), pp. 250-257.

Stock, J.H. and Watson, M. W., (1988), "Variable Trends in Economic Time Series", Journal of Economic Perspective (Summer 1988), pp. 147-174.

Survey of Current Business, Department of Commerce, Washington, D.C.

Tobin, J., "Friedman's Theoretical Framework", in R.J. Gordon ed. Milton Friedman's Monetary Framework: A Debate with his Critics, Chicago: University of Chicago Press, (1974).

Tooke, Thomas, An Inquiry into the Currency Principle. 2nd editon. London: Longman, Brown, Green and Longmans, (1844).

_____, History of Prices and the State of the Circulation, Vol. I-IV, Adelphi Co., New York (1838), (1846), (1848).

Tooke, T. and Newmark, E., History of Prices and the State of the Circulation, Vol. V-VI, Adelphi Co., New York (1856).

Vickers, D., "Aggregate Supply and the Producers' Expected Demand Curve: Performance and Change in the Macroeconomy", Journal of Post Keynesian Economics, (Fall 1987), pp.84-104.

Wallich, H. and Weintraub, S., "A Tax-Based Incomes Policy", Journal of Economic Issues, (June 1971) pp. 1-19.

Weber, W. E. "The Effect of Interest Rates on Aggregate Consumption", American Economic Review, (September 1970), pp. 591-600.

_____. "Interest Rates, Inflation, and Consumer Expenditures", American Economic Review, (December 1975), pp. 843-858.

Wicksell, K. Interest and Prices (1898) Translated by R. F. Kahn. London: Macmillan, (1936).

_____, Lectures on Political Economy Vol. II. Money (1905) Translated by E. Classen. Edited by L. Robbins. London: Routledge and Kegan Paul (1956).

Weintraub, S. "Micro-Foundations of Aggregate Demand and Supply", Economic Journal (1957).

_____. A General Theory of the Price Level, Output, Income Distribution, and Economic Growth, Philadelphia: Chilton, (1959).

_____. Price Theory. New York: Pitman (1949).

_____. An Approach to the Theory of Income Distribution. Philadephia: Chilton (1958).

_____. "The Keynesian Theory of Inflation: the Two Faces of Janus?", International Economic Review, (1 1960), pp. 143-155.

_____. Classical Keynesianism, Monetary Theory, and the Price Level, Philadelphia: Chilton, (1961).

_____. Capitalism's Inflation and Unemployment Crisis, Reading, Massachusetts: Addison-Wesley, (1978a).

_____. Keynes, Keynesians, and Monetarist, Philadelphia: University of Pennsylvania Press, (1978b).

_____. Our Stagflation Malaise, Westport Connecticut: Quorum Books (1981).

Wells P. "Aggregate Supply and Demand: An Explanation of Chapter 3 of The General Theory", Canadian Journal of Economics and Political Science, (1962), pp. 585-590.

_____. "Keynes' Dynamic Disequilibrium Theory of Employment", Quarterly Review of Economics and Business, (January 1974), pp. 89-92.

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