THE EMPIRICAL QUESTION OF MONEY ILLUSION IN THE UNITED STATES: ITS IMPLICATIONS FOR A PATINKIN-TYPE MODEL

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CHAPTER I

INTRODUCTION

Background Information

Economic agents suffer from money illusion if their real expenditures are changed as a result of an equiproportionate change in all money prices, money income, and money wealth. Since these variables change equiproportionately, the result is that the real values of income and wealth remain unchanged. Real expenditures therefore remain unchanged if money illusion is absent.

If these equiproportionate changes result in expenditures changing, economic agents place undue importance on either the changes in the nominal values of wealth and income or the price level change. That is, in one case, they feel wealthier because of income and wealth changes while they do not perceive the price increase as making them poorer. Feeling more affluent, they increase their real expenditures. In this study, this is referred to as type I money illusion. On the other hand, if economic agents see only the price changes, they feel poorer. Consequently, they react to the equiproportionate changes by reducing their real expenditures. This type of money illusion is referred to as type II for the purpose of this study.

Until recently, money illusion has been discussed in the context of being completely absent or completely present in the model. In the literature, if economic agents suffered from money illusion, the

independent variables affecting their economic behavior were expressed in nominal terms. If they did not suffer from money illusion, the independent variables were expressed in real terms.

Kane and Klevorick show how the above can be avoided.[1] Essentially what they do is parameterize the price level. This allows money illusion to be represented as a misperception of the price level. The "true" price level (P_t) is unknown to the economic agents in the short run when they have to make their economic decisions. So, the price level used by consumer agents, in determining the amount of real goods and services that can be purchased with nominal income and wealth, may be something other than the "true" price index. It must be sensitive to the true price index, however, if the assumption of rationality is to be maintained.

Together Branson and Klevorick, and individually Cukierman, attempt to determine whether money illusion is present in the economy during the 1955-1965 period by confining their interest only to money illusion with respect to an aggregate consumption function. They fit a consumption function to United States quarterly data from the first quarter of this period through the last quarter.[2] If money illusion is present, the general price level has an independent effect on aggregate

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[1]Edward Kane and Alvin Klevorick, "Absence of Money Illusion: A Sine Qua Non for Neutral Money?" Journal of Finance, XXII (September, 1967).

[2]William Branson and Alvin Klevorick, "Money Illusion and the Aggregate Consumption Function," American Economic Review, LIX (December, 1969), pp. 832-849. William Branson and Alvin Klevorick, "Money Illusion and the Aggregate Consumption Function: Reply," American Economic Review, LXII (March, 1972), pp. 207-210. Alex Cukierman, "Money Illusion and the Aggregate Consumption Function: Comment," American Economic Review, LXII (March, 1972), pp. 198-206.

real consumption. Although they found evidence that money illusion existed during the period studied, the evidence which they present is slightly "tainted" by the fact that they could not separate the money illusion effect from a price expectations effect.[3] This must be done in order to accurately estimate the degree of money illusion present.[4] Thus, the currently available evidence calls for a more exhaustive study.

Statement of the Problem

The Branson and Klevorick studies and Cukierman's study cover only one ten-year time span. It would be useful to compare several such periods in order to see if real consumption expenditures are affected by changes in the price level. Repeated sampling will yield more creditable conclusions concerning the presence of money illusion.

For this study, the 1940-1969 time period is chosen. Atypically, the World War II years are included in order to see if the degree of money illusion present during a time period which includes a major war differs substantially from money illusion which exists in a predominantly peace time economy.

The purpose of this study is to estimate the extent and type of money illusion that existed in the United States for the period 1940-1969 by estimating a separate consumption function for each decade during the period studied and to discuss some of the implications these

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[3] Branson and Klevorick, "Money Illusion and the Aggregate Consumption Function," p. 837.

[4] G. W. Snedecor and W. G. Cochran, Statistical Methods (6th ed., Ames, Iowa, 1967), p. 394.

findings have for Patinkin's model. Interest is in the presence of money illusion in a short-run model, consequently long-run estimates are not within the scope of this study. The specification of a decade as the relevant time unit is made more for convenience than for theoretical niceties. A theoretical time unit, such as business cycles, conforms more closely with economic theory at a cost of less clarity as to the beginning and ending of the periods, unequal sample sizes due to varying lengths of the cycle, etc. In order to carry out this objective, several hypotheses must be made concerning the significance of money illusion and the relationship between money illusion and price expectations.

Hypotheses and Organization of the Study

It is hypothesized that (a) a measurable degree of type I money illusion existed during the period studied and (b) price expectations can be separated from money illusion. The latter is necessary in order to measure the degree of money illusion more precisely.

The thesis is organized in the following manner. Chapter II is concerned with reviewing some of the theoretical contributions concerning this topic with emphasis placed on the parameterization technique of Kane and Klevorick.[5] This chapter also deals briefly with the issue of model stability and the implications which the presence of money illusion has for Patinkin's model. Chapter III contains a review of some of the empirical evidence concerning money illusion. Chapter IV

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[5]Kane and Klevorick, "Absence of Money Illusion: A Sine Qua Non for Neutral Money?"

is devoted to a discussion of this study's empirical findings. Chapter V contains the summary and conclusions.

Methodology of the Study

The empirical work involves estimating by multiple regression a consumption function which is in keeping with Patinkin's model. The price level and expected prices are allowed to have an independent effect on the level of real per capita consumption.

This function is fitted to United States quarterly data and quarterly expected prices which are generated from United States quarterly data for the period from the first quarter of 1940 through the fourth quarter of 1969. Within this time span, the data are divided into three decades--the 1940's, 1950's and 1960's. A consumption function is separately estimated for each of these three time periods.

The equations are stated as being linear in the natural logarithms of the variables. Ordinary-least squares is used to estimate the parameters of the independent variables.

CHAPTER II

MONEY ILLUSION, STABILITY AND MODEL IMPLICATIONS

Introduction

This chapter emphasizes some of the contributions that have been made with respect to money illusion and model stability. The former is defined first. A discussion of the contribution of Kane and Klevorick follows and is accentuated since they question the stability of the model under certain conditions. Next, the question of model stability is examined. Lastly, some of the implications which the presence of money illusion has for Patinkin's model are discussed.

Money Illusion Defined

Irving Fisher coined the term "money illusion" in his book by that title.[1] He spoke of it as "the failure to perceive that the dollar, or any other unit of money, expands or shrinks in value."[2] This is the normally accepted definition of money illusion, i.e., it is normally defined ". . . as sensitivity of the individual to changes in the

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[1] Irving Fisher, The Money Illusion (New York: Adelphi Company, 1929).

[2] Ibid., p. 4.

absolute level of money prices."[3] Where money prices are ". . . 'all money prices that can change,' i.e., 'the money prices of all commodities.'"[4] That is, if economic agents are subject to money illusion, the price level enters as an independent argument in the relevant functional relationships and not just as a deflator of nominal values.

Patinkin formalized the notion by noting that a person suffers from money illusion ". . . if his excess-demand functions for commodities, . . . , do not depend solely on relative prices and real wealth, inclusive of initial real balances."[5] According to this definition, an economic agent must not change his real consumption expenditures in response to ". . . an equiproportionate change in all accounting prices--including that of paper money--. . . ; for such a change would affect neither the array of relative prices confronting him, nor the level of his wealth."[6] In Patinkin's model, accounting prices are prices expressed in terms of an abstract unit of account.[7] Consequently, ". . . the ratios of accounting prices are money prices, and the ratios of money prices relative prices."[8]

The definition of money illusion allows the price level to have an independent effect on consumption expenditures. With reference to Fisher's definition, however, one must assume that price index changes

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[3]Don Patinkin, Money, Interest, and Prices (2nd ed., New York, 1965), p. 23.

[4]Ibid.

[5]Ibid. p. 22.

[6]Ibid.

[7]Ibid. p. 15.

[8]Ibid., p. 23.

are accompanied by equiproportionate changes in all prices. As a result, relative prices are not affected. Therefore no substitution effect is generated. If the price level change is not accompanied by an equiproportionate change in all prices, relative prices are affected. Then it is exceedingly difficult to say whether the consumer agent's response is due to the fact that he suffers from money illusion or that he is responding to the substitution effect or that both are the cause of his altered consumer behavior.

The problem becomes tractable if the assumption is made that relative prices remain unchanged as the price level changes. Now, based on this assumption, economic agents suffer from money illusion if their excess-demand functions for commodities depend upon the price level as well as relative prices and real wealth. With this in mind, one can now turn to a discussion of the parameterization of money illusion.

Kane and Klevorick's Contribution

The parameterization of the price level, as shown by Kane and Klevorick, allows one to consider the degree of money illusion that is present in the economy. No longer is it necessary to assume, as had been done earlier, that money illusion must be entirely absent or present in the system.[9]

Kane and Klevorick specify money illusion to be a misperception of the price level. This misperception is introduced into the model by a parameterization of the price level. Instead of seeing the true price level, P, the illusion encumbered agent perceives the price level as

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[9]Kane and Klevorick, p. 423.

being P^{α}, with α assumed to have a value of $0 < \alpha < \infty$. Accordingly, the perceived price level may differ from the price level that actually prevails. So, the perceived price level is relevant for economic decisions.

The difference between the perceived and actual price level may be due to several things:

> . . . (1) an unreasonable weighting pattern (for example, zero weights for several relevant commodities, or even for all but one commodity), (2) lags in the processing of information on price changes, or (3) an habitual scaling up or down of the effects of proportionate price movements. The latter case, which may occur either because of difficulties in collecting or interpreting reliable information or because of an habitually pessimistic or optimistic outlook, . . .[10]

The latter is the one which is given attention in their study. That is, economic agents view proportionate price movements as not being proportionate. This misperception causes them to alter their consumption habits. Varying degrees of money illusion are permitted to exist by utilizing this technique.

With alpha, α, assumed not to be negative, $0 < \alpha < \infty$, $1-\alpha$ can represent the degree of money illusion.[11] Kane and Klevorick do not explicitly state why they measure the degree of money illusion as being the difference between unity and alpha. But, it can be assumed that the degree of money illusion is defined as being the extent to which the price-level elasticity differs from unity because the specification of a function in real terms assumes that the price elasticity of nominal values of the dependent variable is unity. This implies that

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[10] Ibid., p. 420.

[11] Ibid.

price-level changes alone cause no change in the real value of the dependent variable. That is, the demand for nominal balances is proportional to the price level.[12]

For example, compare a consumption function which is specified to be of exponential form,

$$C/P = B_o X_i^{B1} \qquad i = 1,2, \ldots,n, \tag{1}$$

where the dependent variable is expressed in real terms and is assumed to be a function of n independent variables indicated by X with a similar function where the dependent and independent variables are expressed in nominal terms

$$C = B_o (PX_i)^{B1}. \tag{2}$$

Equation (1) implies that the price elasticity for consumer goods and services is unity, and B_1 represents the elasticities of the respective independent variables. In Equation (2), B_1 is some average of the price-level elasticity and the independent variables' elasticities. As a result, if the respective elasticities are unequal, B_1 is biased and not a good estimate of the "true" elasticities of the independent variables.[13] As Boorman points out, the validity of this procedure is supported by Meltzer's work which indicates that when the price variable

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[12]John Boorman, "The Evidence on the Demand for Money: Theoretical Formulations and Empirical Results," Money Supply, Money Demand, and Macroeconomic Models, ed. John Boorman and Thomas Harilesky (Boston, 1972), p. 256.

[13]Ibid.

is included as a separate independent variable in a log linear equation, its coefficient is close to unity.[14]

Specifying the degree of money illusion as $1-\alpha = B$, where B is the degree of money illusion, has an advantage for estimating purposes. If the function is specified to be of log-linear form, the regression coefficient of the price variable is zero if money illusion is absent. If this coefficient differs from zero, money illusion is present.

Consequently, money illusion is completely absent if $\alpha = 1$ and completely present if $\alpha = 0$. If the first case prevails, $\alpha = 1$, the perceived price level equals the actual price level. As a result, economic agents do not suffer from money illusion. If the latter case exists, $\alpha = 0$, the commodity price level is eliminated from the parameters on which economic decisions are based. Then, economic decisions are based on the nominal values rather than the real values of the relevant variables. Thus, ". . . it is not the complete absence of money illusion ($\alpha = 1$), but only the absence of extreme money illusion ($\alpha = 0$) which is necessary for prices to be determinate and money neutral."[15]

If $0 < B < 1$, an equiproportionate increase in money income, money wealth, and the price level increases real consumption expenditures.[16] This is the case most generally discussed in the literature, economic

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[14]Allan Meltzer, "The Demand for Money: The Evidence from the Time Series," Journal of Political Economy, LXXI (June, 1963), pp. 219-246, "cited by" John Boorman, Money Supply, Money Demand, and Macroeconomic Models, p. 256.

[15]Kane and Klevorick, p. 423.

[16]Branson and Klevorick, "Money Illusion and the Aggregate Consumption Function," p. 834.

agents underestimating the price level, i.e., overestimating the true value or purchasing power of their nominal wealth. Conceivably alpha could be greater than unity $\alpha > 1$, i.e., the degree of money illusion would be negative in this case $B < 0$. Here, economic agents would underestimate the real value of their nominal wealth.[17] They perceive prices as being higher than they actually are. This latter case is referred to as type II money illusion in this study, and the former is type I.

A third type (type III) where alpha is negative is conceivable. But the treatment of this case, in this study, is that it is not assumed to exist except only during brief adjustment periods. As a result, it is not relevant for a comparative static model.

However, Kane and Klevorick discuss this latter type of money illusion in the context of such a model. The case of a negative alpha can be more revealingly explored if a prior discussion is devoted to Patinkin's market equilibrium curves.

Figure 1 shows these curves. For the commodity market, curve CC represents ". . . the locus of all pairs of equilibrium values of the rate of interest and price level."[18] If one assumes (as Patinkin does) that for every interest rate there exists a price level with a corresponding real-balance effect just exactly large enough to maintain the state of equilibrium in the various markets, the market-equilibrium curves take on the relationships and slopes depicted in Figure 1. In the case of CC the higher the rate of interest, r, the greater the

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[17] Kane and Klevorick, p. 420.

[18] Patinkin, Money, Interest, and Prices, p. 234.

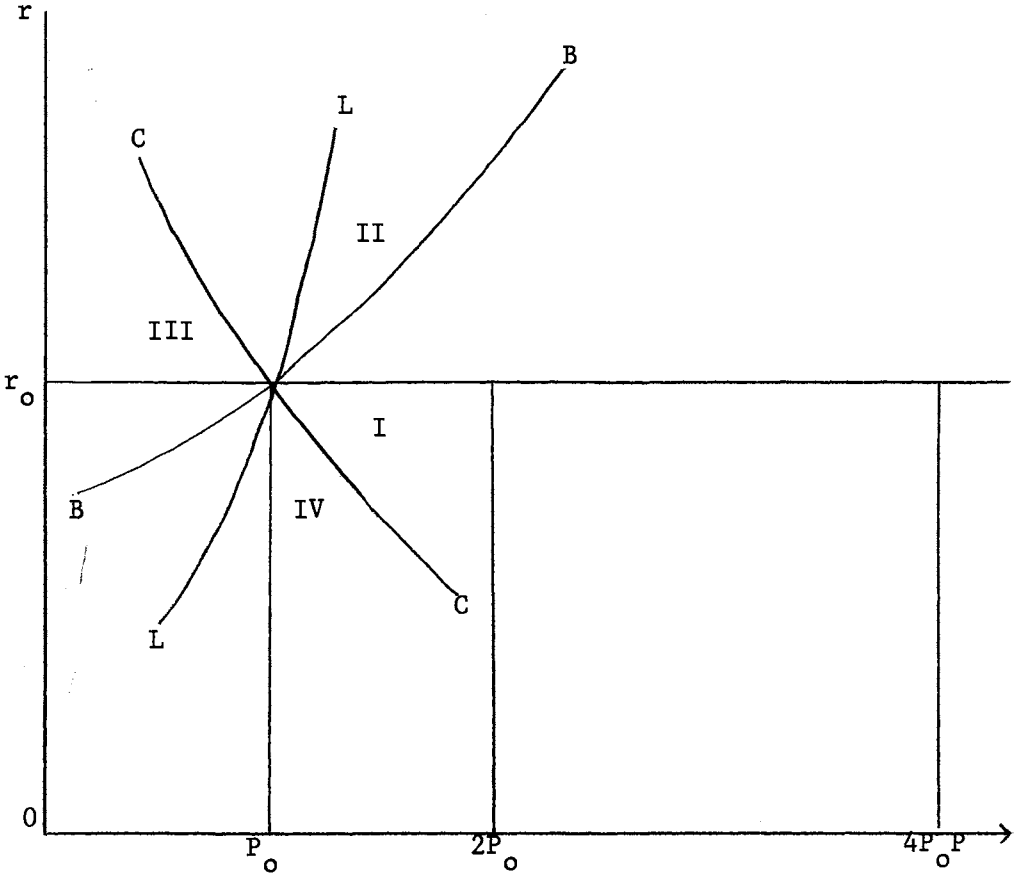

Figure 1. Market-Equilibrium Curves

real-balance effect necessary to offset its depressing effect on demand, and the lower, therefore, the price level, P, necessary to generate this effect; i.e., in the graph CC is negatively sloped throughout.[19]

The bond market's market-equilibrium curve (BB) is similarly derived. But, BB has a positive slope because as the interest rate increases, an excess demand for bonds occurs. This excess is eliminated by a price increase, i.e., by a decrease in real balances.[20] Any point to the right of BB likewise represents an excess supply in the bond market. The interest rate must be driven up (bond prices fall) in order to eliminate this excess supply. At any point above the curve, an excess demand exists for bonds. In order to eliminate this excess, interest rates must be driven downward (bond prices driven upward).[21]

The market-equilibrium curve for the money market (LL) has a positive slope which

> . . . reflects the fact that an increase in the price level shifts the demand for money . . . to the right and thus raises the level of the rate of interest necessary to maintain equilibrium in this market.[22]

Points to the right of LL represent excess demand in the money market. And, for points to the left of LL there is an excess supply. In keeping with Walras' Law, LL must pass through sectors II and IV; because in sector I, there are excess supplies. In sector III there is excess demand in both the commodity and bond markets. In sector II and IV

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[19] Ibid.

[20] Ibid., pp. 233-234.

[21] Ibid.

[22] Ibid., p. 258.

there is excess demand for one of the two goods and excess supply of the other.[23] CC, BB, and LL are graphs of the following equations.

$$E(Y_o, r, M_o/P^{\alpha}) - Y_o = 0,$$
$$B(Y_o, r, M_o/P^{\alpha}) = 0,$$
$$L(Y_o, r, M_o/P^{\alpha}) - M_o/P^{\alpha} = 0.$$

These equations are identical to Patinkin's market-clearing equations if $\alpha = 1$. In the model, Y_o, M_o, and α are exogenous. The signs of the partial derivatives of these equations are as follows:[24]

$$0 < \partial E/\partial Y_o < 1, \quad 0 > \partial E/\partial r, \quad 0 < \partial E/\partial (M_o/P^{\alpha}) < 1,$$
$$0 \lesseqgtr \partial B/\partial Y_o, \quad 0 < \partial B/\partial r, \quad 0 < \partial B/\partial (M_o/P^{\alpha}) < 1,$$
$$0 < \partial L/\partial Y_o, \quad 0 > \partial L/\partial r, \quad 0 < \partial L/\partial (M_o/P^{\alpha}) < 1.$$

With alpha nonnegative, suppose that the money stock is doubled. A doubling of the quantity of money shifts all three curves. The money stock increase creates an excess demand in the commodity market and an excess supply in the money market. This causes the price level to rise and the interest rate undergoes a transitory decline.

The magnitude of the price change depends upon the magnitude of alpha. The relationship between the two is[25]

$$P_e = 2^{1/\alpha} P_o$$

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[23] Ibid.

[24] Ibid., pp. 480-487.

[25] Kane and Klevorick, p. 422.

where P_e is the new equilibrium price level, P_o is the original equilibrium price level.

Now, money illusion can coexist with the real-balance effect. That is, economic agents can misperceive the real value of their nominal income and wealth while at the same time real balances are pertinent for economic decisions. However, it is the economic agents' perception of real balances that is the independent variable--not the actual real balances that prevailed during the period. The former is sensitive to the latter. Accordingly, the presence of money illusion does not require the absence of the real-balance effect.

The real-balance effect is crucial to Patinkin's model. He states:

> . . . , the assumption that there exists a real-balance effect in the commodity markets is the sine qua non of monetary theory. For as we shall see . . . , in the absence of this effect the absolute level of money prices in such an economy is indeterminate: that is, no market forces exist to stabilize it at a specific level.[26]

If money illusion is constrained entirely to being either present or absent, its absence is required in order for the real-balance effect to be operative. And, a doubling of the quantity of money shifts all three of the above curves so that the new equilibrium corresponds to the interest rate r_o and to the price level 2P in the Patinkin model, i.e., $\alpha = 1$. In the parameterized model the dynamic pressures mentioned above push the system toward equilibrium at $(r_o, 2^{1/\alpha} P_o)$ instead of $(r_o, 2P)$.

This is because the parameterization of the price level requires that the relevant variables for economic activity by economic agents

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[26]Patinkin, Money, Interest, and Prices, p. 21.

are not the actual variables which prevail, but instead their perception of these variables. Consequently, in order for market disequilibria to be eliminated while maintaining the interest rate at r_o, it is necessary for the price level to rise to a new level which is $2^{1/\alpha}$ times the old level. Only such a price level restores the initial level of perceived balances. And, perceived balances rather than actual balances are germane for economic decision marking. Notice that if $\alpha = 0$, the relevant variables are the nominal values of the variables and not the real values. The extreme money illusion case exists. The price level is $P^{\alpha} = 1$. Therefore, the real-balance effect is not operative.

If alpha is negative, a doubling of the money stock causes CC, LL, and BB to shift to the left. Consequently, the new equilibrium price level is less than the original, $2^{1/-\alpha}P_o < P_o$. According to Kane and Klevorick, this equilibrium is unstable because economic agents ". . . fail even to appreciate the true direction of commodity-price changes. Higher prices would increase the perceived value of real balances, while lower prices would decrease this quantity."[27] This misreading of the price changes, according to them, produces unstable equilibria because the "auctioneer" responsible for conducting the tâtonnement does not suffer from money illusion.[28] As a result, the auctioneer does not view the new price level as being the equilibrium price level. Rather, it is some intermediate price level which is too low. "Hence,

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[27] Kane and Klevorick, p. 420.

[28] Ibid., p. 422.

. . . the rules of tâtonnement call for an increase in P and cumulatively more-severe disequilibria.[29]

Kane and Klevorick's reasoning seems to be that an increase in the money stock generates a real-balance effect which in turn creates an excess demand which drives the price level upward. This higher price level increases the perceived value of real balances which in turn creates another round of excess demand. Thus the price level rises again; and again, the misperceived real balances seem to rise above the desired level. Consequently, increasingly-severe disequilibria are the result.

In light of this, the stability question should be examined more thoroughly to see what conditions are necessary and sufficient for stability. This is the task of the next section.

Model Stability

Branson and Klevorick contend if alpha is negative, the case where the degree of money illusion is greater than unity, $B > 1$, a money stock change causes increasingly severe disequilibria. This raises the question: does a negative alpha necessarily mean that the model is unstable? It is to this question that the study now turns. Briefly the tâtonnement mechanism is discussed and equilibrium and the conditions necessary for stability are defined.

It is assumed that a Walrasian-Patinkinian-type auctioneer conducts the tâtonnement. The transactions take place within the framework of a short-time interval such as a Marshallian day or Hicksian week.

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[29] Ibid., p. 423.

The auctioneer raises or lowers respective market prices according to either the presence of excess demand or excess supply in the respective markets. These excesses are created by economic activities of economic agents who may suffer from money illusion. Hence, the auctioneer's activities are affected by the presence of money illusion. Then the equilibrium values of the model's variables may very well be affected by the presence or absence of money illusion.

Equilibrium, here, is defined by Hansen in the following manner.

> . . . we can say that if we have an economic model that explains certain variables, and if there is no tendency for these variables to change, given the data of the model, then the system of variables is in equilibrium.[30]

There is no tendency for the variables to change if there is no excess demand. That is, if excess demand is zero in a market, then this market is in equilibrium. If all the market excess demands equal zero, then the model is in general equilibrium.

In keeping with Hicks, two types of equilibrium are distinguished with respect to time--temporary equilibrium and equilibrium over time.[31] The former is confined to the short planning interval. The latter refers to equilibrium over several periods. Equilibrium over time is important when comparisons are made between periods.

As Hicks points out, if a changing economy is to be in equilibrium, the changes in prices which occur must be those which are expected.[32]

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[30] Bent Hansen, A Survey of General Equilibrium Systems (New York, 1970), p. 4.

[31] J. R. Hicks, Value and Capital (Oxford, England; 1946), p. 132.

[32] Ibid.

This is expanded upon later in reference to the formation of price expectations which is hypothesized for this study.

With these definitions of equilibrium in mind, one can now consider the definitions of stability. As noted, it is not enough just to define equilibrium. Rather, one should go even further and see if the equilibrium is restored if it is disturbed. In order to do this, one must know what conditions are necessary for the restoration of this equilibrium.

An equilibrium is stable if a movement away from the equilibrium position should set up forces tending to restore equilibrium.[33] An equilibrium is dynamically stable if equilibrium tends to be restored over time.[34] Static stability, on the other hand, involves no explicit reference to time.

Also, a useful framework for analysis is to distinguish between local and global stability. Local dynamic stability exists if a slight movement away from equilibrium brings into existence forces which tend to restore equilibrium over time. Global stability exists if any movement away from equilibrium brings these equilibrium-restoring forces into existence. Global stability implies the existence of local stability.[35]

Two stability conditions which should be explained are perfect and imperfect stability.[36] If perfect stability exists, the following

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[33]Ibid., p. 62.

[34]James Quirk and Rubin Saposnik, Introduction to General Equilibrium Theory and Welfare Economics (New York, 1968), p. 150.

[35]Ibid., p. 162.

[36]Quirk and Saposnik, p. 153 and Hicks p. 67.

conditions must be met. A price increase makes the supply of that commodity exceed the demand (a) if all other prices are given, (b) if some other prices adjust as to maintain a zero excess demand in their respective markets, (c) if all other prices adjust.[37]

If (c) is not satisfied, then the system is unstable. One or both of the others could not be satisfied but the system itself could still be stable. If this is the case, the system is imperfectly stable. The imperfectly stable system is stable in the end, but this stability is maintained by indirect repercussions, i.e., by adjustments in other markets.[38] In Hicks' terminology, the only possible source of instability is from asymmetric income effects. If the income effects due to a price change are self-cancelling or if they reinforce the substitution effect, then a stable equilibrium is possible. However, if there is a strong income effect in the opposite direction, instability exists.

For the single-market model, equilibrium is restored after a disturbance if the presence of excess supply (negative excess demand) and excess demand causes economic agents to behave in such a way so as to eliminate the excess. For example, stability requires that for prices lower (greater) than the equilibrium prices, the quantities which sellers are willing to sell are less (greater) than those which buyers are willing to buy. Market equilibrium calls for a price increase (decrease) for equilibrium restoration.

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[37] Hicks, p. 248.

[38] Ibid., p. 67.

What about the multiple-market model? Hicks' contribution in this area is applying the Walrasian stability concept to multiple markets.[39] If all the markets are interrelated, i.e., an excess demand in one market affects the excess demands of the other markets, the model is stable if the income effects are symmetric. That is, if the income effects, which are generated by a price change on buyers and sellers are self-cancelling or reinforce the substitution effect.

If the income effects, in at least one market, are asymmetric and if system stability is maintained by indirect repercussions, then imperfect stability exists. If all prices are flexible, the only relevant assumption is that all the other markets adjust. That is, the other market excess demand curves are downward sloping.[40]

For this paper's purpose, it is not necessary to present the mathematical proofs concerning dynamic stability although such an approach is more necessary than for the static cases. Instead, one can succinctly describe these conditions as follows.

For the single-market model, the well known result is that stability in the dynamic sense depends not only on the slopes of the respective supply and demand curves but also on the extent to which economic agents adjust to the excess demand. Dynamic stability adds another dimension in that it additionally depends on the extent to which the market adjusts to a discrepancy between the quantities

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[39]Hicks, Value and Capital.

[40]Quirk and Saposnik, p. 156.

demanded and supplied.[41] This "degree or speed of adjustment," then, affects the amplitude of the price oscillations. If the amplitude of the oscillations decreases over time, the time path approaches the equilibrium price level. If the amplitude of the oscillations increase over time, then the price level does not approach the equilibrium level.[42] Both static and dynamic stability depend upon the slopes of the demand and supply curves.

Dynamic stability conditions of the multimarket system are an extension of single-market stability. The assumed behavior of the price variables is made explicit, enabling the time paths of these variables to be examined. Once again, the presence of excess demand in at least one market calls for price adjustments and stability depends upon the speed of adjustment as well as the coefficients of the market equilibrium equations. Perfect stability exists if the excess demand curve for each market slopes downward.[43]

The model is imperfectly stable if, as was pointed out above, despite the presence of asymmetric income effects all prices are flexible and if all the other markets adjust.

Once again, the "speed of adjustment" is important. But, in the multiple-market system, the speed of adjustment need not be equal for all markets. If it is, however, the results are not altered.[44]

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[41] James Henderson and Richard Quandt, Microeconomic Theory (New York, 1958), p. 115.

[42] Ibid., pp. 113-115.

[43] Quirk and Saposnik, p. 156.

[44] Henderson and Quandt, pp. 151-152.

An additional point or two should be made concerning global stability before concluding this discussion. Quirk and Saposnik note that, according to Arrow, Block, and Hurwicz's Theorem 11, if all commodities are gross substitutes for one another, then equilibrium is unique and globally stable.[45] Even if asymmetrical income effects cause one or more markets to be unstable, the system as a whole is not necessarily unstable. In both cases, global and local, Walrasian stability characterizes equilibrium if, as Hicks puts it, "a moderate degree of substitutability among the bulk of commodities will be sufficient to prevent this cause [asymmetric income effects] being effective."[46]

With respect to time, the temporary equilibrium system is most likely to be imperfectly stable.[47] But, the presence of type III money illusion, i.e., $\alpha < 0$, does not necessarily preclude model stability. The model could be imperfectly stable, in this case, if indirect repercussions operate to prevent the occurence of the ever increasing disequilibria which, according to Kane and Klevorick, results if equilibrium is disturbed. The question is: can a model which contains a negative alpha reach equilibrium by its "normal functioning"?

In order to consider this question, assume that wages and prices are flexible so that the full-employment output level is maintained throughout the analysis.

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[45] Kenneth Arrow, H. Block, and Leonid Hurwicz, "The Stability of the Competitive Equilibrium II," Econometrica, XXVII (1959), pp. 82-109, "cited by" Quirk and Saposnik, Introduction to General Equilibrium Theory and Welfare Economics, p. 184.

[46] Hicks, pp. 72-73.

[47] Ibid., p. 248.

Now suppose that the money stock doubles. A doubling of the money stock creates an excess demand for goods and services due to economic agents' wishes to get rid of their excess balances. Since full employment exists, a doubling of the money stock causes the price level to increase in an attempt to restore the equilibrium level of real balances. This price level movement, however, is misperceived. Economic agents respond as if prices have fallen. Thus, they perceive this reduction in real balances as an increase which leads to another round of expenditures, which leads to another misperceived price increase, etc. This according to Kane and Klevorick leads to increasingly severe disequilibria.[48] Their contention is that since the economy is already at full employment, the misperception of the direction in which the price level changes creates an ever-widening inflationary gap. This is not necessarily the case.

Consider the usual macroeconomic model where, at the equilibrium level of output, income (Y) equals expenditures ($\overline{E}$).

$$Y = E = c + I + G \tag{3}$$

I and G respectively represent autonomous investment and government expenditures. Consumption, c, is specified as being a linear function of misperceived real balances, m, and misperceived income, y, or

$$c = f + gm + by \tag{4}$$

Substituting the latter equation into the former, one gets

$$Y = f + gm + by + I + G \tag{5}$$

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[48] Kane and Klevorick, pp. 422-423.

If this equilibrium is disturbed by a misperceived change in real balances, then an inflationary gap is created since the full-employment level is fixed in the short run. Figure 2 shows this if the consumption function's intercept is respecified as $a = f + gm$, so that

$$c = a + by \tag{6}$$

If Y_E is the full-employment level, then EE' is the inflationary gap created by the change in misperceived real balances $a' = f + g(m + \Delta m)$. EE' is due to prices being bid upward which under normal circumstances would reduce the excess aggregate demand. This is not the case if economic agents misperceive price increases as price decreases. The price rise then is viewed as a price decrease which shifts E' up to E'' which causes the price level to rise again with the inflationary gap increasing E''E. What forces are operative to bring the inflation to a halt which, in turn, curbs the spending out of real balances?

Under present assumptions, economic agents are trying to purchase more than 100 percent of the output. The inflationary gap can be reduced if the slope of the total expenditures curve is less than unity and if the effect of real balances is offset. Since b is assumed to be constant, the burden of curbing the change in m_t falls on f, I, and G, i.e., on autonomous consumption expenditures, investment and government.

During the period of disequilibrium, the interest rate rises due to any attempt to acquire funds for purchases and to any expectations concerning future inflation. This interest rate increase serves to reduce f, I, and G. The reduction in consumption expenditures due to the increase in the interest rate reduces f. Investment also falls. Some government expenditures may also be sensitive to interest rate

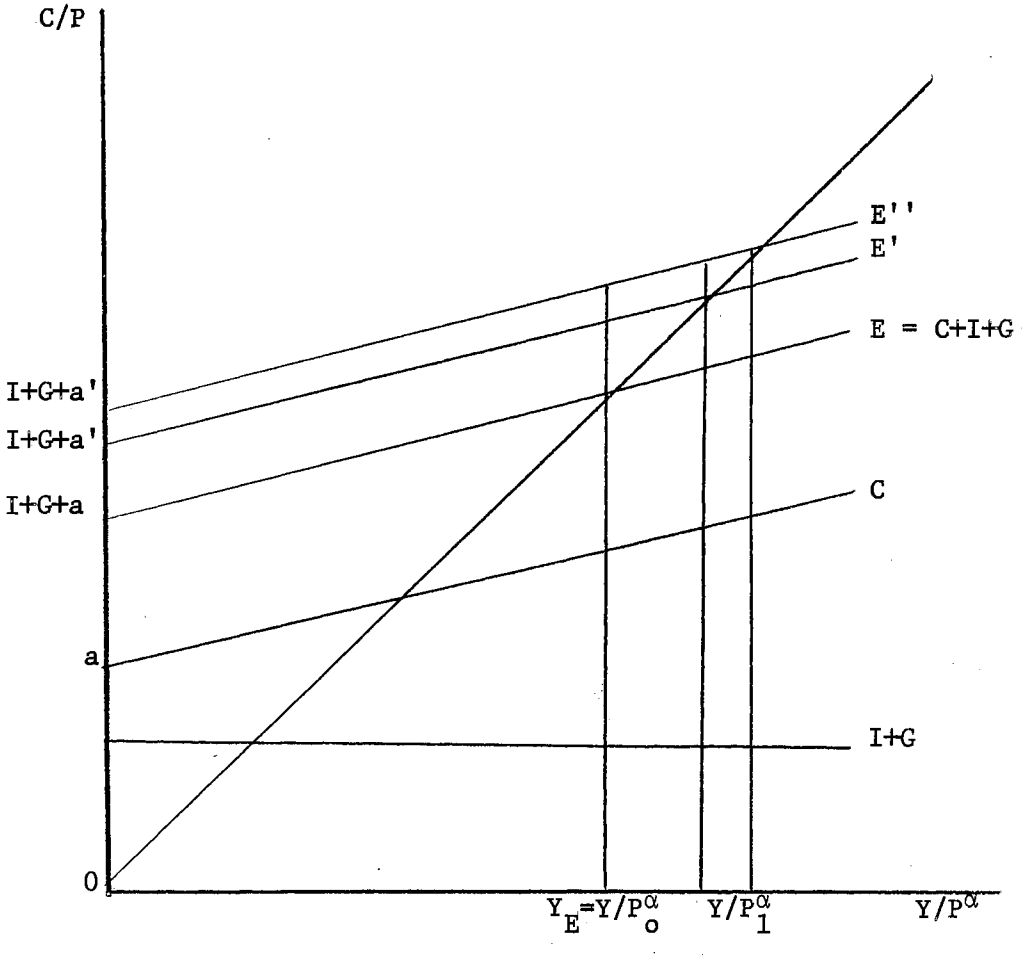

Figure 2. A Macroeconomic Model with Money Illusion

changes. State and local governments are often constrained as to the maximum interest rate they are permitted to pay. If the interest rate rises above the maximum amount, social investment by these levels of government is reduced.

The reduction of f, I, and G offset the increase in m, reducing the excess demand and dampening the inflationary fires. The reduction in the rate of inflation is misperceived to be a reduction in the rate at which the price level is falling. Consequently, this lessens the desire to spend out of perceived real balances. With the abatement of inflation, the real rate of interest is restored to the equilibrium level.

There are other stabilizers which serve to restore equilibrium in addition to the interest rate. Some of these are the tax and transfer payments effects and foreign-trade effects if the economy is an open one. A progressive tax structure and a transfer payments system such as the United States' tend to reduce disposable income as gross income rises with inflation, thereby reducing the inflationary pressures. Also if the domestic inflation is relatively greater than that of other economies, net exports are decreased, consequently exerting a dampening influence on inflation.

The presence of type III money illusion does not necessarily mean that the model is unstable. There are a number of potentially stabilizing exogenous and endogenous forces available to prevent this.

Thus, stability in Patinkin's model can exist if the above stabilizers offset the disturbance caused by the presence of type III money illusion. This situation has no special implication for Patinkin's

model because he assumes imperfect stability anyway.[49] It is only necessary to assume that the stabilizers' coefficients sum to a magnitude such that increasingly severe disequilibria do not result. Now, what implications does the presence of money illusion have for Patinkin's model?

Implications for Patinkin's Model

The indicated presence of a "degree" of money illusion in the economy has some profound implications for a Patinkin-type model which relies on monetary policy as its tool for achieving macroeconomic objectives.

Kane and Klevorick show that the absence of money illusion is no longer a conditio sine qua non. Instead, only the absence of "extreme" money illusion is required; i.e., the requirement is that $\alpha \neq 0$.[50]

If this is the case, $\alpha \neq 0$, money illusion is still neutral respectively to relative prices and output. That is, the supply and demand equations and the equilibrium conditions still determine the relative prices and the quantities exchanged at these prices.

To see the difference between the model without money illusion and the model which is assumed to have a "degree" of money illusion present, a review of the workings of the real balance effect is of aid.

An increase in the money stock, at the old price level and unchanged relative prices, throws the model out of equilibrium. Economic agents have excess real balances. In their attempt to rid

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[49] Patinkin, Money, Interest, and Prices, pp. 235-236.

[50] Kane and Klevorick, p. 420.

themselves of these excess balances, economic agents bid the price level up. Tastes and preferences remain the same, thus economic agents bid up the prices in all markets. Relative prices, consequently, remain unchanged by the presumption that individual prices move in the same proportion to each other.

In Patinkin's model, the price level continues to rise until it has increased equiproportionately to the increase in the money stock. This is no longer the case if money illusion is introduced via parameterizing the price level. The price level change is still in proportion to the change in the quantity of money, but it does not change equiproportionately. This is the critical difference.

If type I money illusion exists, $0 < \alpha < 1$, the price level will rise more than in proportion to exogenous changes in the money stock. If type II prevails, the resulting price change is less than proportional to exogenous monetary changes.

Patinkin's introduction of money illusion into his model does not reach this conclusion however. In fact, if one allows Patinkin's money illusion to exist simultaneously in the bond, money, and labor markets, general equilibrium is unachievable at an interest rate and price level which is consistent for all four markets, i.e., the labor, commodity, bond, and money markets. This is not obvious from his text because he introduces money illusion independently into each market and does not discuss the simultaneous existence of money illusion in all of the markets. In order to see this discrepancy, Patinkin's discussion of this topic is succinctly presented and the money illusion type implied to exist in each market is pointed out.

Suppose that money illusion exists in the bond market. That is, in keeping with Patinkin, suppose that the bond demand and supply curves are not affected by price level changes but are affected by changes in nominal money balances.[51] An equiproportionate increase in the money stock and the price level causes the demand for bonds to rise. This increase, however, is not in proportion to the money stock increase. The bond-supply curve is also affected, i.e., it shifts leftward. At the old equilibrium rate of interest there is now an excess demand for bonds. This excess demand causes the interest rate to decline. No force is operating to reverse this movement because the real-balance effect is not operative and the bond market is not responsive to the reduction in real balances caused by the price rise in the commodity market. Consequently, bond-market equilibrium is restored at a lower interest rate. The interest rate must fall in order for the excess demand to be eliminated. As a consequence of the lower rate of interest, prices in the commodity market must increase more than proportionately in order to offset the effect of the lower rate of interest on the aggregate demand for goods and services. The more than proportionate price increase necessary for equilibrium in the commodity market is indicative of type I money illusion in the parameterization model. That is, the new equilibrium resulting from a doubling of the money stock is consistent with an interest rate which is less than the previous equilibrium rate and a price level greater than twice the previous equilibrium rate.[52]

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[51] Patinkin, Money, Interest, and Prices, p. 275.

[52] Ibid., p. 277.

The same conclusion is reached if money illusion is allowed to exist in the money market. Patinkin's method of introduction is to specify the speculative demand for money as being independent of the price level. This is the ". . . obverse side of the assumption that the demand for bonds is so independent."[53] A doubling of the quantity of money and the price level does not affect the demand for speculative balances. The price level increases more than proportionately until the transactions demand absorbs all the increased money supply. The rate of interest must decline in order for equilibrium to be maintained in the commodity market. Real balances are below the desired level at the initial equilibrium rate. Hence a deflationary gap would develop. The gap reacts back on the other markets and drives the interest rate down. As can be seen, the presence of money illusion in the bond and money markets calls for a decline in the rate of interest and a more-than-proportionate increase in the price level in order for equilibrium to be restored after an increase in the money stock.

This is not the case for the labor market. Assume, as does Patinkin, that the demand for labor is a function of real wages, but its supply is a function of nominal wages.[54] As before, an increase in the money stock puts upward pressure on the price level in the other markets. This causes a rightward shift of the demand curve for labor. The labor-supply curve is left unaffected. Consequently, real wages fall; and the number of workers employed increases. As a result real output increases.

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[53] Ibid., p. 278.

[54] Ibid., p. 281.

The increase in real output has repercussions in the bond market. Both the demand and supply curves for bonds shifts to the right. Prior to the real-balance effect, it is assumed by Patinkin that these curves shift in such a way that the rate of interest is left unaffected.[55] When the real-balance effect is accounted for, however, the bond-demand curve shifts rightward and the bond-supply curve shifts leftward, resulting in a decline in the interest rate.

The excess supply which is created by the increase in employment cannot cause the price level to fall because the real wage rate would rise, reducing employment and output. On the other hand, a price reduction reinforces the initial downward pressure on the interest rate, and consequently creates an excess demand for commodities. The new equilibrium price level must be greater than the original. But the price level cannot double because the commodity market would not be in equilibrium. Real balances would be restored to the original level. Consequently, aggregate demand is restored to the old full-employment level. Output, however, has increased. So, the price level must increase less-than-proportionately in order for equilibrium to be restored.[56]

Patinkin's treatment puts one in a difficult situation. The presence of money illusion in the bond and money markets calls for a greater-than-proportionate price increase. On the other hand, the presence of money illusion in the labor market calls for a less-than-proportionate increase in the price level. As shown previously, the

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[55] Ibid., p. 282.

[56] Ibid., pp. 283-285.

existence of money illusion in the commodity market renders the real-balance effect ineffectual.

If one follows Patinkin's logic, the presence of money illusion in all the markets prohibits the achievement of general equilibrium. And, it does not seem logically consistent to allow money illusion to exist in one market while, at the same time, requiring its absence in other markets. One can avoid this dilemma by introducing money illusion via the parameterization technique.

The Patinkin situation only presents itself if alpha equals zero. If this is not the case, the presence of money illusion only alters the conclusions reached by Patinkin concerning the magnitude of the new equilibrium price level. The only difference the parameterization of the price level makes is that the proportional relationship between the price level and the money stock is changed. If the general price level is defined as a weighted average of all prices of commodities and services, then the choice of weights is arbitrary. What really matters is that the general price index be a linear combination of the individual prices. If $P = a + b(p)$ where P is the general price level and p is the vector of all the prices of goods and services, then it makes little difference if b takes on different values.[57]

There are implications for monetary policy as well. For example, the type of money illusion present affects the response of the price level. If type I money illusion is present, changes in the money stock bring about greater-than-equiproportionate changes in the price level. Inflation is less tractable. Friedman's suggestion for a constant

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[57]Hansen, A Survey of General Equilibrium Systems, p. 79.

growth rate of the money stock is strengthened if this is the case. In order for monetary policy to be more effective, it would be useful to know more about the money illusion parameter, the demand for real balances, and their respective distributions.

Summary

As shown in this chapter, Kane and Klevorick show that it is no longer necessary to assume that money illusion is either completely absent or present in the economy. Degrees of money illusion can be present. Kane and Klevorick specify the degree of money illusion as $1 - \alpha$.

Type I money illusion exists if economic agents overestimate the purchasing power of their nominal balances--that is if $0 < \alpha < 1$. Type II exists if economic agents underestimate the purchasing power of their nominal balances. The presence of this case exists when alpha is greater than unity, $\alpha > 1$. A negative value of alpha ($-\alpha$) indicate an unstable case according to Kane and Klevorick.[58]

However, as shown in this chapter, a negative alpha does not mean cumulatively more-severe disequilibria if substitution exists between the various markets. The system is both locally and globally stable if the aforementioned conditions are met.

Even if one of the markets is unstable, system stability can be maintained by indirect repercussions. These indirect repercussions, as well as the rest of the model variables, should be examined to see if they behave in accordance with economic theory. Some indirect

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[58]Kane and Klevorick, pp. 420-423.

repercussions can act within the theoretical framework to stabilize equilibrium if alpha should happen to be negative. In this study, a negative alpha is assumed to be a temporary phenomenon if it exists at all.

Parameterizing money illusion, in order for degrees of money illusion to exist, allows this concept to be included in Patinkin's model. Also, its inclusion avoids an inconsistency which exists if Patinkin's treatment is followed. That is, if money illusion is allowed to exist in all markets simultaneously, general equilibrium is unachievable. This can be avoided by the use of the parameterization technique.

The empirical question which remains is whether money illusion exists in the economy, and if so, what type? It is to these questions that this study now turns.

CHAPTER III

MONEY ILLUSION: EMPIRICAL FINDINGS

Introduction

In the preceding chapters the theoretical basis for money illusion was discussed, as was its implications for stability and Patinkin's model. When one talks in terms of "degrees of money illusion" and its "types," the presence of money illusion only alters the conclusions reached by Patinkin concerning the magnitude of the new equilibrium price level. The proportional relationship between the price level and the money stock depends upon the "type" of money illusion present. This is an empirical question with which this chapter deals.

In this chapter the empirical evidence concerning the presence of money illusion is discussed. However, permanent income and distributed lags are discussed first because these topics are relevant for some of the articles discussed.

Permanent Income and Distributed Lags

Consumption expenditures are seldom hypothesized to be function solely of current income. Instead, some estimate of permanent income or permanent wealth is used.

One of the more important advantages of the use of permanent income is that consumers are allowed to consider more than the immediate variables. If the permanent income hypothesis is introduced, it allows the

"planning horizon" to be extended. The consumer agent considers his future income prospects as well. This hypothesis is even more important when the data are quarterly data. As the time period over which expenditures are made is shortened, the dependency of current consumer expenditures on current income becomes more difficult to support. One method by which permanent income can be introduced is to make permanent income a function of past income, which can be accomplished by use of a distributed lag technique such as Koyck's[1] or Almon's.[2]

Liu and Chang's Findings

In their attempt to measure the extent of money illusion present in the economy, Liu and Chang estimate and compare two consumption functions.[3]

$$c = ay + b \tag{1}$$

$$C = a'Y + b'P + c' \tag{2}$$

where c and y are real consumption and real income respectively. C and Y are the same variables expressed in nominal terms. The coefficients a, b, a', b', and c' are the usual linear coefficients. In estimating these coefficients, C is annual consumption expenditures in billions of

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[1] L. M. Koyck, Distributed Lags and Investment Analysis (Amsterdam, 1954).

[2] Shirley Almon, "The Distributed Lag Between Capital Appropriations and Expenditures," Econometrica, XXXIII (January, 1965).

[3] Ta-Chung Liu and Ching-Gwan Chang, "U. S. Consumption and Investment Propensities: Prewar and Postwar," American Economic Review, XL (September, 1950), p. 574.

current dollars, Y is annual gross national product in billions of current dollars, and P is the Consumer Price Index.

The reported estimates are

$$c = 0.539y + 0.181 \qquad (1')$$

$$R_{c.y} = 0.99$$

for equation (1) and

$$C = 0.535Y + 0.214P - 3.06 \qquad (2')$$

$$R_{C.YP} = 0.99$$

for the second equation.[4] The R's are the correlation coefficients of the equations adjusted for degrees of freedom. The time period which these data represent is 1930-1940 inclusive.

To make equation (1) comparable with (2), they multiply (1) by P:[5]

$$cP = C = 0.539yP + 0.181P \qquad (3)$$

Using these estimates to predict consumption expenditures from 1930-1948, they compare these estimates with the actual consumption expenditures for this period.

More relevant for this study, however, is their attempt to estimate the extent to which money illusion existed during 1948. Using the price propensities to consume from (2') and (3), they estimate the price elasticity of demand for 1948 in the usual manner--

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[4] Ibid.

[5] Ibid.

$$n = -\frac{P}{C} X \frac{\Delta C}{\Delta P}$$

The price elasticity of demand for consumer goods and services is n, $\frac{\Delta C}{\Delta P}$ is the price propensity to consume, and P and C have the aforementioned definitions.

The elasticities obtained in this manner are 0.795 and 0.827 for equations (2) and (3) respectively.[6] Liu and Chang use the percentage difference between these elasticities as their measure of the extent of money illusion present in the economy during 1948--[7]

$$\frac{0.827 - 0.795}{0.827} = 4\%$$

Liu and Chang conclude that ". . . the demand for consumption goods and services as a whole is rather [price] inelastic."[8] Another conclusion reached by them is that the influences of 'money illusion' are statistically discernible but are less important than would be expected on theoretical grounds."[9]

This first, albeit crude, attempt to estimate the degree of money illusion in the economy indicates the presence of money illusion. Later attempts are more sophisticated pieces of work. Before discussing these, consider another study which attempts to estimate the effect prices and price expectations have on saving and consumption. This study also submits "outside" evidence concerning the effect of prices

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[6] Ibid., p. 575.

[7] Ibid.

[8] Ibid.

[9] Ibid., p. 566.

and price expectations on consumption because the estimates are made from India's data.

Diwan's Study

In a study more recent than the Liu and Chang study, Romesh Diwan estimates a saving function of the form

$$S_{pt} = a_o + a_1 Y_{pt} + a_2 P_t + a_3 (P_t - P_{t-1}) + u_t \qquad (4)$$

using annual Indian data for the 1950-1952 period.[10]

For estimating ease he respecifies (4) as[11]

$$S_{pt} = a_o + a_1 Y_{pt} + b_1 P_t + b_2 P_{t-1} + u_t \qquad (4')$$

where

$$b_1 = a_2 + a_3 \text{ and } b_2 = -a_3.$$

His reason for this respecification is that it is easier to get estimates for P_t and P_{t-1} than for $(P_t - P_{t-1})$ because the latter has little variation and given the small sample size, its influence is not easily determined.[12] "It is important to choose units of measurement for the variables . . . , especially in cases of three or more variables in

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[10] Romesh K. Diwan, "The Effect of Prices on Savings," Economic Development and Cultural Change, XVI (October, 1967-July, 1968), p. 431.

[11] Ibid.

[12] Ibid., p. 434.

order to avoid having too few significant figures in some of the calculations."[13]

In both equations, S_{pt} is the saving of urban households during time period t, Y_{pt} is the disposable income, P_t is the wholesale price index during time period t, P_{t-1} is the price index of the past period, and u is the random error term.

Estimating by least squares, Diwan obtains the following estimates.

$$\underset{}{S_{pt}} = \underset{(1.7084)}{6.8489} + \underset{(0.0249)}{0.1908}Y_{pt} - \underset{(0.4164)}{0.9067}P_t - \underset{(0.4062)}{0.9189}P_{t-1} \qquad (5)$$

$$\bar{R}^2 = 0.84 \qquad DW = 1.81$$

The standard errors are in parentheses under the respective estimates. $\bar{R}^2$ has its usual meaning, coefficient of multiple determination adjusted for degrees of freedom. DW is the Durbin-Watson statistic.

Using these data to estimate the coefficients of equation (4), Diwan finds $a_1 = 0.19$, $a_2 = -1.82$, $a_3 = 0.92$, the income elasticity of demand equal to 3, and the price elasticity of demand for consumer goods and services equal to -2. Diwan expected a price increase to increase saving (i.e., decrease consumption) because housing is included as part of saving.[14]

In the above equation, price expectations are based on changes in the price level. Diwan also obtains estimates of a saving function of the following form.[15]

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[13] J. Johnston, Econometric Methods (2nd ed.; New York, 1972), p. 17.

[14] Diwan, pp. 431-432.

[15] Ibid., p. 432.

$$S_{pt} = \alpha_o + \alpha_1 Y^*_{pt} + \alpha_2 P^*_t + u$$

Saving is now hypothesized as being a function of permanent income and expected prices where these variables are estimated via Koyck-type distributed lag functions:[16]

$$Y_{pt} = \sum_{i=o}^{\infty} \lambda i \, Y_{pt-1} \text{ and } P^*_t = \sum_{i=o}^{\infty} \lambda i \, P_{t-1} \qquad (6)$$

That is, both income and expected prices are hypothesized to be a weighted average of past income and prices respectively with the weights declining geometrically with the passage of time.

Under these assumptions, the estimating equation becomes

$$S_{pt} = \alpha_o + a_1 Y_{pt} + a_2 P_t + a_3 S_{p_{t-1}} + u_t$$

after reducing the distributed-lag function.[17] In this form, the equation is statistically more tractable.

His estimates for this equation are

$$\underset{}{S_{pt}} = \underset{(32.1949)}{5.0344} + \underset{(0.0364)}{0.1272} Y_{pt} - \underset{(0.3752)}{1.2370} P_t + \underset{(0.1858)}{0.3988} S_{p_{t-1}} \qquad (7)$$

$$R^2 = 0.83 \qquad DW = 1.94$$

Working backwards, Diwan's estimates are:[18]

$$\alpha_1 = 0.21 \text{ and } \alpha_2 = 2.06$$

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[16] Ibid., p. 434.

[17] Ibid., and Thomas Dernberg and Judith Dernberg, Macroeconomic Analysis (Reading, Massachusetts; 1969), p. 86.

[18] For details as to how this is done see Dernberg and Dernberg, pp. 84-86.

His conclusion is that both regression equations indicate that saving is sensitive not only to income but to prices as well.

Branson and Klevorick's Results

Branson and Klevorick use distributed lags in their attempt to measure the degree of money illusion. Their proposed function is[19]

$$c_t = b_o'(Y_t)^{b_1}(w_t)^{b_2}(P_t)^{b_3} \qquad (8)$$

The lower case letters c, y, and w are respectively consumption, income, and wealth expressed in real per capita terms. The consumption variable is composed of expenditures for nondurable goods and services plus estimated depreciation of durable goods plus imputed interest on durable goods. The income variable, y, is aggregate employees' compensation plus an imputed portion of proprietors' income plus transfer receipts less employees' social insurance contributions and state, local, and federal tax liabilities on labor income. The wealth variable, w, is the aggregate net worth of households, including liquid assets, consumer durables, and housing.

Branson and Klevorick do not explicitly so state, but one has to suppose that the net worth variable is computed at current market prices since this series is an updated version used by Ando and Modigliani.[20] This allows for the recognition of a "physical asset" effect which Patinkin ignores because his analysis deals with a very short period of time during which ". . . net investment in such assets

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[19] Branson and Klevorick, p. 834.

[20] Ibid., pp. 847-848.

is small relative to their existing stock."[21] That is if the price of capital alone increases or if the prices of other goods fall relative to the price of capital, economic agents' stock of wealth is larger. Consequently, more consumption takes place.[22]

Returning to the explanation of the regression variables, the population deflator is total U. S. population in millions. The consumption data, (c), income data, (y), and consumption deflator, (p), are from an unpublished series by Harold Shapiro.[23]

Using this function, Branson and Klevorick propose that consumer agents do not react instantaneously to changes in these variables. By hypothesizing a distributed-lag model in logarithmic form, their equation becomes:[24]

$$\ln c_t = B_o + \sum_{i=o}^{I} \alpha_1 \ln y_{t-1} + \sum_{j=o}^{J} \alpha_J \ln w_{t-j} + \sum_{k=o}^{K} n_k \ln P_{t-k} + \varepsilon_t \quad (10)$$

Each of the independent variables was entered in distributed-lag form. The distributions of the coefficients of the lagged independent variables were estimated by using the Almon lag. This technique, which is subject to the constraint that the coefficients are interpolated from Lagrange polynomials of a given degree, estimates the shape of response of the dependent variable to changes in the independent variables.

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[21] Patinkin, Money, Interest, and Prices, p. 200.

[22] John Arena, "The Wealth Effect and Consumption: A Statistical Inquiry," Yale Economic Essays, No. 3 (1963), p. 293.

[23] Branson and Klevorick, p. 835.

[24] Ibid., pp. 847-848.

Branson and Klevorick use third-degree polynomials in estimating the coefficients of the distributed lags of the independent variables. This allows the ". . . coefficient distributions, whatever their shapes, to approach zero gradually rather than abruptly, as the relevant variable values recede into the past, ..."[25]

The length of the lags for income, wealth, and prices in the above equation are respectively represented by I, J, and K. If the Branson and Klevorick technique is used, the best lag lengths are difficult to find because changing the lag length of one variable often affects the coefficients of all the terms. Also, there can be a conflict between criteria for determining the best lag length.[26]

For the period studied (1955-1965), they found that with income lagged seven quarters, I = 7, the lag was positive and monotonically declining.[27] Lagged coefficients of the wealth variable were not statistically significant. And, omission of these lags did not significantly alter the rest of the regression estimates.[28] The wealth variable, then, enters the regression equation unlagged, J = 1.

The price variable had a lag of seven quarters, K = 7. Lengthening this lag to seven quarters left the income and wealth coefficients virtually unchanged and raised the Durbin-Watson statistic from 1.73 to 1.76.[29]

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[25] Ibid., p. 838.

[26] Ibid.

[27] Ibid., p. 839.

[28] Ibid., p. 840.

[29] Ibid.

Branson and Klevorick decide that the following equation is best.

$$\ln c_t = \underset{(0.114)}{-1.953} + \underset{(0.043)}{0.661} \ln y_{t-i} + \underset{(0.036)}{0.127} \ln w_t + \underset{(0.036)}{0.418} \ln P_{t-k} \qquad (11)$$

$$R^2 = .9984 \qquad SE = .002964 \qquad DW = 1.76$$

where the regression coefficients listed here are the sum of the coefficients in the lag distribution for that variable:

$$\sum_{i=o}^{7} \alpha_i = 0.661 \text{ and } \sum_{k=o}^{7} n_k = 0.418 \qquad (12)$$

The standard error of each sum is below its respective coefficient. The standard errors are likewise the sum of the standard errors in the lag distribution for that variable. $R^2 = 0.9984$. The standard error equaled 0.002964, and the Durbin-Watson statistic was 1.76.[30]

Branson and Klevorick state that the equation is

> . . . only marginally superior . . . in a statistical sense, [but] it does have more significant coefficients in both the income and price lags, a lower standard error . . . , and a higher Durbin-Watson statistic.[31]

Also, the income lag and the price lag were of the same length. One would think that this would be the case if consumption is a function of misperceived income. Additionally, when the lags for these two variables were extended beyond seven quarters, the standard error rises again. The value of the Durbin-Watson statistic decreases. And, the significance of both the income and the price lags falls.[32]

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[30] Ibid., pp. 839-841.

[31] Ibid., p. 840.

[32] Ibid.

The "best fitting estimate" of the equation yielded an equation with an eleven-quarter income lag and a seven-quarter price lag. But, its standard error was nearly twice that of the chosen equation. In addition, the Durbin-Watson statistic was less than unity. Its F-test performance was relatively worse.[33]

The coefficient for the price term is statistically significant at the 0.05 level. Does the significance of the price term mean that money illusion is present along with a price expectations mechanism or does it exist concurrently with a price expectations mechanism? Branson and Klevorick show that if price expectations are based on past price experience, the weights relevant for the vector of past price experience must sum to zero. This is because in a stationary state past prices equal current prices, and price expectations must not have an effect on consumption decisions. If there is no money illusion, no unchanging prices, nor a pure price expectations mechanism, the value of the regression coefficient is zero,

$$\sum_{k=o}^{K} n_k = 0 \qquad (13)$$

If money illusion exists, the price variable is statistically different from zero and the sum of the price coefficients is positive,

$$\sum_{k=o}^{K} n_k > 0 \qquad (14)$$

They stress, however, that they could not distinguish between a model in which money illusion is present with a price-expectations mechanism

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[33] Ibid., p. 843.

at work and a model in which money illusion is present without the price-expectations mechanism.[34] The sum of the price coefficients in their regression equation is positive and significantly different from zero. They could not, consequently, conclude that a pure price expectations mechanism is operative.

If economic agents respond to past prices when they form their price expectations and if the money illusion effect is due to a distributed-lag adjustment to the price level, then one cannot distinguish between them completely.

Feige has shown how one can distinguish between adaptive expectations and partial adjustment processes.[35] The difficulty in the Branson and Klevorick case, nonetheless, is that both the price effect and the price expectations effects both manifest themselves through a lagged adjustment to the price level.

There are alternative ways of forming price expectations nevertheless. Perhaps one of these could provide a way out of this impasse.

Cukierman's Comment

In a comment concerning Branson and Klevorick's test for the existence of money illusion, Alex Cukierman observes that the Branson and Klevorick specification of money illusion implicitly assumes that relative prices are unchanged when the aggregate price index changes.[36]

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[34] Ibid., p. 837.

[35] Edgar L. Feige, "Expectations and Adjustments in the Monetary Sector," American Economic Review, LVII (May, 1967).

[36] Alex Cukierman, "Money Illusion and the Aggregate Consumption Function: Comment," American Economic Review, LXIII (March, 1972,) p. 198.

The Branson and Klevorick attempt to estimate the degree of money illusion present in the economy might have been affected by their failure to take this into consideration.[37]

With the exception of the price variable and lag lengths, Cukierman's hypothesized consumption function is identical to Branson and Klevorick's. He uses the same time period and data except for the price variable. Cukierman disaggregates the price index in order to ". . . introduce individual prices into the money-illusion consumption function and test whether the result obtained by Branson and Klevorick is thereby substantially changed."[38]

The price indexes used by Cukierman are CPI components for apparel, food, housing, recreation (it is assumed that he means health and recreation), and transportation.[39]

Using Branson and Klevorick's notation, Cukierman's specification of the consumption equation is:[40]

$$\ln c_t = b_o + \sum_{i=o}^{I} \delta \ln y_{t-i} + \sum_{j=o}^{J} \alpha \ln w_{t-j}$$

$$+ \sum_{s=o}^{T1} n^1_s \ln P_{1,t-s} + \ldots + \sum_{s=o}^{Tn} n^n_s P_{n,t-s} \qquad (15)$$

where the price variables are one through n, n = 5. The following equation is representative of Cukierman's work because of the relatively

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[37] Ibid., pp. 198-201.

[38] Ibid., p. 201.

[39] Ibid., pp. 201-202.

[40] Ibid., p. 201.

high Durbin-Watson statistic and the fact that the R^2 and the standard error are almost as good as any of the other equations.[41]

$$\ln c_t = \underset{(0.538)}{0.042} + \underset{(0.050)}{0.599} \ln y_{t-i} + \underset{(0.039)}{0.136} \ln w_{t-j}$$

$$- \underset{(0.180)}{0.482} \ln P_{A,T_A} + \underset{(0.066)}{0.202} \ln P_{F,T_F} + \underset{(0.166)}{0.700} \ln P_{H,T_H}$$

$$+ \underset{(0.141)}{0.146} \ln P_{R,T_H} - \underset{(0.060)}{0.184} \ln P_{T,T_T} \qquad (16)$$

$$R^2 = 0.998 \qquad \text{S.E.} = .003190 \qquad \text{D.W.} = 1.88$$

The price variables are for apparel (P_A), food (P_F), housing (P_H), health and recreation (P_R), and transportation (P_T) respectively. The regression coefficients are

$$\sum_{i=o}^{3} \gamma_i = 0.599, \qquad \sum_{j=o}^{o} \delta_j = 0.136, \qquad \sum_{S=o}^{2} n^A{}_S = -0.482,$$

$$\sum_{S=o}^{2} n^F{}_S = 0.202, \qquad \sum_{S=o}^{2} n^H{}_S = 0.700, \qquad \sum_{S=o}^{2} n^R{}_S = 0.146,$$

$$\sum_{S=o}^{2} n^T{}_S = 0.184 \qquad (17)$$

The sum of the price coefficients, $\Sigma\Sigma\ n_i$, equals $\Sigma\Sigma\ n_i = 0.382$.

The income variable had a lag of three periods, I = 3. The wealth variable entered unlagged, J = 0. The apparel price index had a lag of only one period, $T_A = 1$. That of food had a lag of two periods, $T_F = 2$. Housing also entered with a two-period lag, $T_H = 2$. The price index

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[41] Ibid., pp. 204-205.

for health and recreation had a two-period lag, $T_R = 2$. Transportation entered unlagged, $P_T = 0$.[42]

In summary, Cukierman concludes that (a) the degree of money illusion, as measured by the sum of the price coefficients, remains within the range of Branson and Klevorick's findings and (b) food, housing, and transportation price coefficients' sums are statistically significant at the 0.01 level, while those for apparel and health and recreation are not.[43]

Branson and Klevorick's Reply

In replying, Branson and Klevorick note that in Cukierman's representative equation, the lag on income is shortened to four quarters from a previous seven quarters and the lags on prices vary from one to three quarters while their price index had a seven-quarter lag.[44]

Also, Cukierman's sum of the income coefficients and the sum of the price coefficients are smaller than Branson and Klevorick's. His wealth coefficient is a little larger than theirs.[45]

As Branson and Klevorick see it, the Cukierman study raises two questions. First, are his results due to the change in lag lengths? Second, what is the best way to interpret his results?[46]

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[42] Ibid., p. 204.

[43] Ibid., p. 205.

[44] William Branson and Alvin Klevorick, "Money Illusion and the Aggregate Consumption Function: Reply," American Economic Review, LXII (March, 1972), p. 207.

[45] Ibid.

[46] Ibid.

In order to examine the first question, they respecify their consumption function so that it corresponds to Cukierman's except for the price variable. They use the aggregate price index rather than his disaggregated series.

They estimate several versions of their new equations, finding that disaggregation of the price variable reduces the income and wealth coefficients a little. Disaggregation leaves the sum of the price coefficients almost unchanged.[47]

One of their estimated equations is of particular interest to them. It is as follows.[48]

$$\ln c_t = \underset{(0.102)}{-2.024} + \underset{(0.035)}{0.602} \ln y_{t-i} + \underset{(0.035)}{0.146} \ln w_t + \underset{(0.034)}{0.430} \ln P_{t-k} \qquad (18)$$

$$R^2 = 0.9980 \qquad SE = .003107 \qquad DW = 1.61$$

The sums of the respective coefficients are

$$\sum_{i=o}^{4} \gamma i = 0.602, \quad \sum_{k=o}^{3} n_k = 0.430 \qquad (19)$$

The income coefficients are estimated using the Almon-lag technique with a third-degree polynomial and the last coefficient constrained to zero. Due to the shortness of the wealth and price lags, the coefficients of these lags are not constrained, including the relevant

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[47] Ibid., p. 208.

[48] Ibid.

current and lagged values of these independent variables. The price lag is also estimated using the Almon technique.[49]

Branson and Klevorick are most concerned with the fact that there is a large discrepancy between their estimate of the standard error of the sum of the price coefficients and Cukierman's estimate.[50] The Branson-Klevorick standard error of the sum of the price coefficients is 0.034 which is calculated from the variance-covariance matrix of the estimated price coefficients.[51] Cukierman's estimate of this standard error is 0.134.[52]

Branson and Klevorick attribute this discrepancy to several factors. For one, as recognized by Cukierman, the large number of price coefficients leads to a multicollinearity problem because the price indexes tend to move in the same direction.[53] Also, Cukierman's procedure may assign weights to the several price series which introduce ". . . a trend factor in his equations, leaving price deviations from trend to explain consumption deviations from trend."[54]

All in all, Branson and Klevorick conclude that Cukierman's work supports their thesis of the presence of type I money illusion in the economy. In support of this they offer as evidence the fact that

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[49] Ibid.

[50] Ibid.

[51] Ibid.

[52] Cukierman, p. 204.

[53] Ackley and Suits ran into this very same problem. Gardner Ackley and Daniel Suits, "Relative Price Changes and Aggregate Consumer Demand," American Economic Review, XL (December, 1950), pp. 785-804.

[54] Branson and Klevorick, "Money Illusion and the Aggregate Consumption Function: Reply," p. 209.

Cukierman's best income lag equals the best price lag (four quarters as opposed to the Branson-Klevorick seven-quarter lag), suggesting that the income and price lags should be approximately the same length. This supports their contention that the variable moving consumption is incorrectly deflated income.[55] That is, misperceived income rather than correctly perceived income is the correct independent variable.

Before offering the empirical findings of this study, comments concerning price expectations are discussed.

Price Expectations

Frequently a naive approach is used in forming an expected price series by the use of distributed lags. A number of writers such as Nerlove and Cagan have shown how economic agents can modify their future expectations when they see that expectations which were formed in the past differ from the actual events that occurred.[56] However, these techniques would not allow the "money illusion" effect to be separated from the "expectations" effect if the consumption function is specified in order to allow for the possibility of distributed-lag adjustment to the actual price level and to the expected price level. As a consequence, their consumption function specifications prevent the separation of money illusion from price expectations. One can avoid this problem if some technique other than one which uses past prices is utilized by economic agents to formulate their expected prices.

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[55] Ibid., p. 210.

[56] Marc Nerlove, "Distributed Lags and Unobserved Components in Economic Time Series," Ten Economic Studies in the Tradition of Irving Fisher, ed. William Fellner, et al., (New York, 1967) and Phillips Cagan, "The Monetary Dynamics of Hyperinflation," Studies in the Quantity Theory of Money, ed. Milton Friedman (Chicago, 1956).

Cagan, more recently, mentions another method of forming price expectations. The growth rate of expected prices, G_p^*, can now be hypothesized to equal the growth rate of the money supply, G_m, less the growth rate of real output: $G_p^* = G_m - G_q$.[57]

The theoretical underpinning has a quantity theory orientation. It asserts that any growth rate of the money stock in excess of the growth rate of output should bring about an equiproportionate growth rate in the price index. This hypothesis is subject to a number of criticisms. One of these is especially important given the context of this study, it being that the expectations forming procedure is short run in nature. In this study, money illusion is treated as a short-run phenomenon. Its effects are assumed to be small in the long run when economic agents have had time to gather pertinent data and modify their decisions and activities.

However, Cagan's "quantity theory" method of forming price expectations is a long-run formulation. In the short run, autonomous disturbances disrupt this direct relationship so that this quantity theory approach might overestimate or underestimate actual prices in the short run. In the long run, these random events are self-cancelling and one gets $G_p^* = G_m - G_q$. So, in order to adapt this price expectations formulation technique to a short run, economic agents modify it in order to take into account these exogenous random effects which might not be self-cancelling in the short run. A method whereby this can be accomplished is discussed in the next chapter.

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[57]Phillip Cagan, "The Non-Neutrality of Money in the Long Run," Journal of Money, Credit, and Banking, I (May, 1969), p. 213.

The quantity theory method of forming price expectations is used to separate the money illusion effect from that of price expectations. For model consistency, the method is modified to make it more short run in nature.

Another question is how do economic agents acquire information concerning the size of the money stock and the level of output? It is assumed that economic agents' holdings of cash balances are some stable proportion of income. If these balances grow more rapidly than their income, economic agents attempt to rid themselves of these excess balances by spending. Of course, in the aggregate, they all cannot rid themselves of their excess balances simultaneously. Inflation results. Thus, each agent forms his expectations concerning future prices by comparing the growth rate of his real balances with the growth rate of his real income. In the aggregate one gets the above formulation. The application of this technique is discussed in the next chapter where the model to be estimated is developed.

Summary

Crude as well as sophisticated studies indicate the presence of money illusion in this economy since the 1940's. Diwan's study also offers evidence of money illusion's presence in India's economy. Moreover, the "degree" of money illusion present can now be estimated due to the suggestion of Kane and Klevorick.

Branson and Klevorick estimate the degree of money illusion present in the economy by estimating a logarithmic linear consumption function for the period 1955-1965. Their findings indicate the presence of type I money illusion during this period. Cukierman,

using their data and model, attempted to see if disaggregation of the price level would alter the conclusions. This does not seem to be the case.

Neither study could separate money illusion and price expectations effects because both the current price variable and the expected price variable were hypothesized to be functions of prices which actually prevailed in the past.

An attempt needs to be made to separate the two effects. It would be interesting to extend the time period of the study in order to include a greater variety of economic experience. Various events might affect the type of money illusion present as well as its significance. The next chapter attempts to shed some light on these questions.

CHAPTER IV

A MONEY-ILLUSION MODEL: ITS DEVELOPMENT AND ESTIMATION

Introduction

In the previous chapter, some of the existing evidence concerning the presence of money illusion was examined and compared. There, considerable evidence indicates that economic agents have suffered from money illusion. But, none of the studies examined several periods of time. This should be accomplished by examining successive short-run periods because money illusion is assumed to be a short-run phenomenon in this study. The reason being that economic agents have time to gather information and modify their behavior in the long run but not in the short run.

In this chapter a Patinkin-type model is developed and estimated. The second section consists of the ordinary least squares estimates of the regression equations. The data are transformed to correct for autocorrelation and these results are presented in the third section. The fourth section contains the summary.

Before progressing further, a review of type I money illusion is in order. This type of money illusion exists when economic agents overestimate the purchasing power of real income and related variables. For equiproportionate changes in, say, income, wealth, and the price

level they feel better off. They do not see the price increase as clearly as they see the increased wealth and income.

The degree of money illusion is specified as being $1 - \alpha$ with the magnitude of alpha specified as having a value of $0 < \alpha < 1$. That is, the test is to see if type I money illusion prevailed during the time period of this study.

The Model

The specification of the model is

$$(C/PN)_t = B_o'(Y^*/PN)_t^{B_1}(M/PN)_{t-1}^{B_2}(r)_t^{B_3}(P)_t^{B_4}(P^*)_t^{B_5} \qquad (3.1)$$

The specified form of this model is theoretically justified on several points. The model, if theoretically sound, yields partial derivatives which have the theoretically proper signs and magnitudes. Plus, of course, it should fit the data well. Justification of the model depends upon the results obtained from estimating the parameters of the model.

The dependent variable, $(C/PN)_t$, is real per capita consumption expenditures of time period t. C is nominal consumption expenditures made for durable goods, non-durables, and services.

The price series used is the 1913-1969 annual and monthly Consumer Price Index with 1957-1959 as the base period. Quarterly price indexes were compiled by averaging the monthly figures that compose the respective quarters. N is the population of the United States including armed forces overseas. This latter component of the population is included because it is supported and maintained by this nation's output. Their expenditures are included in consumption. The inclusion of this

segment of the population gives a more realistic presentation of consumption expenditures, personal disposable income, and per capita wealth.

The income variable is permanent permanent personal disposable income represented by Y*. This variable, permanent income, is estimated by using Friedman's geometrically declining weights.[1] Permanent income was chosen over measured income because it is assumed that economic agents do not consume solely out of current income when the time period is as short as a quarter. Rather, their "planning horizon" extends beyond the current period, and they spend out of expected or permanent income. Consequently, permanent income gives a better estimate of the influence income has on consumption. Of course Y* is deflated by the population and price variables in order to express permanent income in real per capita terms.

The interest rate is the average rate of return on capital--Moody's Aaa bond yield in this study. These quarterly data are averages of the monthly data.

The real-balance effect is introduced in the form of real per capita liquid balances which are defined as

> . . . the net obligation of the [central] government to the private sector of the economy. That is, it consists of the sum of interest and non-interest bearing government debt held outside the treasury and central bank. Thus, by excluding demand deposits and including government interest-bearing debt, it differs completely from what is usually regarded as the stock of money.[2]

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[1]Milton Friedman, A Theory of the Consumption Function (Princeton; Princeton University Press for the National Bureau of Economic Research, 1957), p. 147.

[2]Don Patinkin, "Price Flexibility and Full Employment," American Economic Review, XXXVII (September, 1948), p. 55.

Only that portion of the public debt which is held by private investors is considered relevant. The portion held by Federal Reserve Banks, agencies of the United States government, and trust funds are excluded because the assets of one governmental agency are the liabilities of another governmental agency and are thus self-cancelling.

Pesek and Saving do not agree with the above definition. To them money is whatever serves as a medium of exchange because

> . . . , only a medium of exchange has the technical property of yielding real income that is completely independent of the resource content of this good and that changes not only with the physical quantity but also with the price of this good. As a result, the wealth of society may be changed through no expenditure of resources; also, the wealth of society may be changed merely through a change in the price of this good.[3]

Demand deposits are included in their definition of money because they serve as a medium of exchange. But government bonds ". . . are by law precluded from serving as a medium of exchange and are merely debt in its purest form."[4]

It is beyond the scope of this paper to enter into the debate concerning what should or should not be defined as money. Rather, the above definition of liquid balances is taken to be an index of wealth upon which economic agents base their decisions. The most "accurate" index is a field which is not explored in this study--liquid balances are taken as defined in the above manner.

Real balances of the past period, $(M/PN)_{t-1}$, are considered to be relevant for consumer decisions. A Robertsonian-type lag is assumed with respect to real balances. Consumer agents begin the period with

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[3]Boris P. Pesek and Thomas Saving, Money, Wealth and Economic Theory (New York, 1967), p. 170.

[4]Ibid., p. 185.

a given stock of real balances and these balances are relevant for expenditures in the current period. Contributions to the stock of real balances are assumed to be periodic rather than continuous, and real balances cannot be spent before they are received. The effect of these assumptions is that the average lag of consumption change behind the corresponding real-balance change is one period. Income is assumed to accrue on a continuous basis. Consequently, the current estimate of permanent income affects current consumption.

The series of data for expected prices, P^*, was generated by a modification of Cagan's "quantity theory" method discussed in Chapter III. There, it was stated that in the long run, economic agents expect the growth rate of the price level to equal the difference between the growth rate of the money stock and the growth rate of income. Each economic agent makes his individual comparison. And, aggregating their responses the above formulation is derived.

One would expect this technique to be more accurate for the long run than for shorter periods. The reason is that price expectations ". . . may be divided into two components: (1) autonomous and (2) induced."[5] The autonomous forces can be assumed to be self-cancelling in the long run and the induced relationship discussed above is assumed to be relevant.

The autonomous forces can often yield a rather erratic series. Nonetheless, these forces should have no consistent impact on the process. A technique needs to be adopted which yields a series from which most of the short-run erratic movements have been removed. Also, an

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[5]Marc Nerlove, Distributed Lags and Demand Analysis for Agricultural and Other Commodities, Agriculture Handbook 141 (Washington, 1958), p. 29.

error-learning corrective factor should be included in order to make the hypothesis more appealing. That is, an allowance should be made for economic agents to adjust their expectations upon learning that expected prices differed from actual prices. For instance, assume that the long-run relationship between expected prices, the money stock, and output is

$$\frac{P^*_{t+1} - P^*_t}{P^*_t} = \frac{m_t - m_{t-1}}{m_{t-1}} - \frac{gnp_t - gnp_{t-1}}{gnp_{t-1}}$$

That is, the percentage change in expected prices equals the percentage change in the money stock minus the percentage change of real output. The money stock series and output series are both expressed in real per capita terms. Solving for P^*_{t+1}, one gets

$$P^*_{t+1} = \left[\left(\frac{m_t - m_{t-1}}{m_t} - \frac{gnp_t - gnp_{t-1}}{gnp_{t-1}} \right) + 1 \right] P^*_t$$

This hypothesis must be modified for short-run analysis, however, in order to account for the random-autonomous forces which are not self-cancelling in the short run. An error learning factor needs to be introduced. If, for instance, actual prices are consistently less than they were expected to be, then economic agents would take this into consideration and scale down their future expectations. If they scale their expectations down "too much", future prices will then be higher than the prices that were expected to prevail during the period. This calls for price expectations to be scaled upward again.

In this paper, it is assumed that they make this modification by multiplying the indicated percentage change of the expected prices by

a sign parameter $\lambda = \pm 1$. If the vector of expected prices is consistently greater than the vector of actual prices and if the percentage change of the money stock and output indicate that expected prices are to be even higher, it is hypothesized that economic agents multiply the percentage change in expected prices by minus one in order for expected prices to fall. They realize that, in the short run, exogenous forces are causing expected prices to be greater than actual prices. They, therefore, use the sign parameter to scale their expectations down.

This adjustment specification requires an additional assumption, namely, that at the end of each time period, t, economic agents are cognizant of the price level which prevailed during that period, P_t. The periods' expenditures have been made by the time they are aware of the true magnitude of P_t, so P_t^{α} is still the relevant price variable for expenditures during time period t. So, then, it takes the consumer most of the period to collect and analyze the price data. If the direction of the price change he predicted to prevail during the period is different from the direction which actually prevailed, he alters his prediction for the next period.

If $P_t^* < P_t$ and if the percentage change in expected prices is positive, economic agents then multiply by + 1; that is, the sign remains unchanged. In short, as long as the sign of the growth rate of expected prices is such that it causes the vector of expected prices to change in the same direction as does the vector of actual prices, + 1 is the multiplier. If the indicated percentage change diverges, however, minus one is the multiplier. The short-run percentage change of expected prices is then

$$\frac{P^*_{t+1} - P_t}{P^*_t} = \lambda\left(\frac{m_t - m_{t-1}}{m_t} - \frac{gnp_t - gnp_{t-1}}{gnp_{t-1}}\right)$$

If the rate of inflation is small or nonexistent, the price prevailing during period t-1 is the expected price of period t.

A series of expected prices was generated by the technique discussed above for the respective quarters from 1938 until 1969. The series was initiated in 1938 by assuming that the percentage change in the money stock and output determine the expected growth rate of the price level. The year 1938 was selected so that the adjustment parameter would be operative by the time the period of interest, 1940-1969, was reached. This process was used as long as it achieved reasonable results. In the latter part of 1942, however, this technique indicated that prices should be much higher than they actually were. Price controls, rationing, etc. served to keep prices down; therefore, it seems logical that economic agents would expect the price level of the past period to prevail during the current period as well. This assumption was followed until it no longer proved feasible. It was abandoned in the second quarter of 1946. The original method was then used to complete the series.

The incorporation of expected prices into the model raises another point concerning equilibrium. As Hicks noted, "In equilibrium, the change in prices which occurs is that which was expected."[6] So, the expected price series should closely approximate the actual price series that prevailed in order for equilibrium to have existed.

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[6]J. R. Hicks, Value and Capital (2nd ed. reprinted; Oxford: Oxford University Press, 1962), p. 132.

Additionally, it is hypothesized that economic agents want their forecasting technique to yield a series of expected prices which closely approximates the actual prices which prevailed. If the technique they are using does not yield this close approximation, then they abandon it in an attempt to obtain a better one.

One technique which can be used to compare the forecasted prices to the actual prices is Theil's U statistic. This statistic is used to measure the goodness of fit of a set of predicted values with the actual values and is defined as

$$U = \frac{\sqrt{\Sigma(P_t^* - P_t)^2}}{\sqrt{\Sigma P_t^{*2}} + \sqrt{\Sigma P_t^2}}$$

where P_t^* and P_t have the usual meanings. U must have a value between zero and unity. A value of zero denotes a perfect forecast, while a value of unity denotes the other extreme.[7] If U = 0, $P_t^* - P_t = 0$ for all t. That is for U to equal zero, the economic agents' point estimates would have to be correct each time. To demand this kind of rigor in a system without perfect foresight is unrealistic. However, the method should yield reasonably good results.

The expected price series was generated by the above technique and the CPI series was actual prices. The data were quarterly data. For the 1940-1969 period U equals 0.015. As a result, it is believed that the P^* series can be used to approximate consumer price expectations because the U statistic results indicate that the P^* series

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[7] Roger K. Chisholm and Gilbert R. Whitaker, Forecasting Methods (Homewood, Illinois; 1971), p. 162.

closely approximates the prices that actually prevailed during the period.

An advantage of this "quantity theory" hypothesis is that it does not depend explicitly on past prices. For instance, one way of forming price expectations is to expect the past average rate of change to prevail in the future--a simple average or a weighted average of past price changes. If a form of this method is used and if money illusion is a response to the current and past price levels as well, then one has the unpleasant situation in which Branson and Klevorick found themselves. That is, they could not separate the money-illusion effect entirely from the price-expectations effect.

The appropriate linearizing transformation of equation (3.1) is

$$c_t = B_o\, B_1 y_t^* + B_2 m_{t-1} + B_3 r_t + B_4 p_t + B_r p_t^* \qquad (3.2)$$

where c_t, y_t^*, m_{t-1}, r_t, p_t, and p_t^* represent $\ln(C/PN)_t$, $\ln(Y^*/PN)_t$, $\ln(M/PN)_{t-1}$, $\ln(r)_t$, $\ln(P)_t$, and $\ln(P^*)_t$ respectively.

The model is specified to be rectangular hyperbolic. One characteristic of this type model is that the respective partial elasticities are constant and are estimated at the geometric mean of the data points. Consequently, the estimated coefficients are estimates of the elasticity of real consumption demand with respect to changes in income, the interest rate, real balances, and actual and expected prices.

All of the elasticities are expected to be positive except for the interest rate elasticity. Increases in the rate of interest cause consumption expenditures to decline unless consumers are target savers. Then, they can increase their expenditures if the rate of interest increases because they can now save at a lower rate and still accumulate

the target amount. In this case, the sign of the coefficient would be positive. In fact, this is the finding of Weber.[8]

The anticipated value of the permanent income coefficient is $0 < B_1 < 1$ which is the normal consumption-function specification. That is, the percentage change in consumption which is due to the percentage change in permanent income is expected to be positive but less than the percentage change in permanent income.

The value of the real-balances coefficient is also expected to be positive but less than unity. This specification likewise holds for both price variables. The case of B_4, the price variable, has been discussed extensively previously. Due to the specification of money illusion, its absence is indicated by alpha having a value of unity, $\alpha = 1$, so that the partial regression coefficient of the price variable is not statistically significant, $B_4 = 0$. The presence of money illusion is indicated by $B_4 \neq 0$. Type I money illusion is indicated by $0 < B_4 < 1$.

The expected price elasticity of demand is expected to be positive and less than unity. If future goods are expected to be more expensive, consumer agents increase their current consumption expenditures. The percentage change in these expenditures is not anticipated to be greater than the percentage change in expected prices.

Perhaps a point should be reiterated before the empirical evidence is discussed. In this study, it is hypothesized that money illusion is in response to a misperception of the current price level. At the end of the period, economic agents have knowledge of the "true" price

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[8]Warren E. Weber, "The Effect of Interest Rates on Aggregate Consumption," American Economic Review, LX (September, 1970).

variable. It is, however, too late for them to adjust their expenditures for that period. They can only modify their expectations concerning the next period's price if an adjustment is necessary.

Then, it is only the misperceived current price level which causes the real values of variables to be misperceived. The misperception is not assumed to hold true for past prices. These are economic data which are now more accessible. The agent now has had time to become more clearly aware of the magnitude of those prices which are relevant for his economic decisions. For the current period, however, he has to calculate a "mental" index for those items which he consumes or plans to consume. The degree to which the perceived price differs from the actual price is due to money illusion. The relevant price variable is, then, the current variable rather than a vector of past price experience.

In addition to the two price variables there are three other independent variables for which coefficients must be estimated plus the intercept term. Ordinary least squares estimation procedures are used to first estimate an equation for each of the three decades, the 1960's, the 1950's, and the 1940's. Since the model is short run in nature, it would be inappropriate to estimate a function for the entire period. Admittedly, the decade specification of the time periods is an arbitrary choice. It would be more economically meaningful to measure the period as a theoretically defined series such as the business cycle rather than some standard measure of time.[9] But, time periods are more chronologically distinguishable and money illusion more effectively

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[9]John Boorman, "The Evidence on the Demand for Money: Theoretical Formulations and Empirical Results," Money Supply, Money Demand and Macroeconomic Models, ed. John Boorman and Thomas Harilesky (Boston, 1972), pp. 268-269.

discussed if standard time is used as a measure rather than if one talks in terms of business cycles. It is not believed that the degrees of precision that would be gained by this respecification would compensate for the loss of clarity.

Using the estimates for the periods, then corrections are made for autocorrelation. Lastly, the model is altered to see if the results are sensitive to model specifications.

The Ordinary Least Squares Estimates

In this section, the results of using ordinary least squares regression techniques to estimate the parameters of equation (3.1) are presented. Quarterly data for the 1940-1969 time period were used and are presented in Appendix A. Appendix B contains the sources of these data.

Most studies of this nature disregard the World War II years. Even though it is atypical, this study includes them in order to include as much economic experience as possible.[10] Also, the war years are included because it is not at all clear which years should be excluded and which should be included. The economy was affected by the threat of war before it was declared, and its aftermath had an effect long after the peace treaty was signed. As is shown shortly, those periods for which there existed a negative MPC, $\Delta C/\Delta Y < 0$ could have been eliminated, but this would not yield results which depict the period accurately.

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[10] Milton Friedman, The Optimum Quantity of Money and Other Essays (Chicago, 1969), pp. 157-158.

In the following, the estimates for the 1960's are presented first, followed by those for the 1950's, with those for the 1940's being presented last. Let c_t, y^*_t, m_{t-1}, r_t, p_t, and p^*_t represent $\ln(C/PN)_t$, $\ln(Y^*/PN)_t$, $\ln(M/PN)_{t-1}$, $\ln(r)_t$, $\ln(P)_t$, and $\ln(P^*)_t$ in the following estimated regression equations. The respective standard errors are in parentheses below the coefficients.

1960-1969

$$c_t = \underset{(0.089)}{-4.734 + 0.817\ y^*_t} + \underset{(0.154)}{0.294\ m_{t-1}} - \underset{(0.056)}{0.194\ r_t} + \underset{(0.266)}{0.800\ p_t} + \underset{(0.145)}{0.106\ p^*_t} \qquad (3.3)$$

$R^2 = 0.990$ SE = 0.014 DW = 1.65

1950-1959

$$c_t = \underset{(0.103)}{0.396 + 0.763\ y^*_t} + \underset{(0.152)}{0.178\ m_{t-1}} + \underset{(0.048)}{0.102\ r_t} + \underset{(0.291)}{0.069\ p_t} - \underset{(0.111)}{0.099\ p^*_t} \qquad (3.4)$$

$R^2 = 0.945$ SE = 0.019 DW = 0.768 $\rho = 0.532$

1940-1949

$$c_t = \underset{(0.088)}{7.106 - 0.221\ y^*_t} + \underset{(0.037)}{0.184\ m_{t-1}} - \underset{(0.152)}{0.612\ r_t} + \underset{(0.149)}{0.067\ p_t} + \underset{(0.168)}{0.159\ p^*_t} \qquad (3.5)$$

$R^2 = 0.974$ SE = 0.024 DW = 0.693 $\rho = 0.473$

Equation (3.3) indicates that all the independent variables' regression coefficients have the expected signs and magnitudes. The variables which are not statistically significant at the 0.01 level are

real balances and the expected price variable, P_t^*. The real balances variable has a calculated t value of 1.903 which is not significant at the 1 percent level. The corresponding t value for the price expectations coefficient is 0.727.

Permanent income exerted a strong influence on consumption during this period with a regression coefficient of 0.817 and a related t value of 9.214. Friedman's findings indicate that the ratio of aggregate consumption to aggregate income is also within this range.[11] So, this finding is not inconsistent with his.

The regression coefficient of the price variable, with a value of $B_4 = 0.80$, indicates that type I money illusion was present during the 1960's. With a calculated t value of 3.013 this variable is statistically significant at the 0.01 level. The presence of money illusion was not accompanied by a significant price expectations effect however.

The interest rate coefficient has a negative sign, indicating that target saving did not dominate the more conventional consumption-interest rate relationship. Interest rate increases brought about reductions in consumer spending.

For the 1950-1959 period, however, permanent income is the only variable significant at the 1 percent level. Of the other variables, the interest rate is the closest to being significant with a calculated t value of 2.140. The absolute value of the magnitude of its coefficient approximates that which existed during the 1960's. During the 1950's, target saving predominated over the more conventional type; although, it was not statistically significant. The positive sign of

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[11]Friedman, A Theory of the Consumption Function, p. 228.

the interest rate variable indicates this target saving. Perhaps economic agents were not as optimistic concerning future economic prospects as they were during the 1960's. After all, a good portion of the 1960's was largely a period of economic prosperity, especially the latter part. Economic optimism could have been greater during this period than it was during the 1950's. Supporting this speculation is the fact that for the 1960's, the income coefficient is greater than that for the 1950's. The same is true for the real balances variable.

Neither money illusion nor price expectations was significantly present during the 1950's. To the extent that price expectations were present, they had a negative effect on consumption expenditures. Contrary to conventional theory, consumer agents did not increase their expenditures in response to their price expectations. Instead, they resented the expected price increases and reduced their consumption.[12]

Equation (3.5) yields startling results for the 1940's. The permanent income coefficient is not significant at the 0.01 level. In addition, it has a negative value. Perhaps the use of past income to estimate permanent income is an improper specification for this time period. This would be the case if economic agents regarded income earned during the 1930's as a poor estimate of future income. They perhaps viewed the income levels of the 1940's as more near normal levels than income earned during the 1930's. Consequently, Friedman's technique of estimating permanent income on the basis of past income

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[12]Gardner Ackley, Macroeconomic Theory (New York, 1961), p. 294.

might yield poor results. However, more evidence should be considered before additional comments are made.

The equation for the 1940's was reestimated using current income instead of permanent income as the income variable. The result is the same, a negative propensity to consume. Taking the simple change in consumption per unit change in income, $\Delta C/\Delta Y$, one finds that this computation yields a negative value for 15 of the 40 quarters with negative MPC's appearing as early as the third and fourth quarters of 1941 and as late as the first quarter of 1949. Other variables were exerting strong influences on consumption during this period.

Real balances and the interest rate are statistically significant for the 1940's. The real balances' coefficient is lower than that of interest rate's. However, the former's relatively low standard error yields a higher computed t value. The interest rate again exerts a negative influence on consumption.

The price level and expected prices did not have a significant effect on consumption expenditures during the 1940's. The magnitudes of these variables are within the expected range. Their low values combined with relatively high standard errors do not yield statistically significant t values.

Money illusion was statistically significant only during the 1960's. That is, the price variable's regression coefficient is statistically significant only for this period. Its magnitude is consistent with the hypothesis of the presence of type I money illusion. The expected price variable is not statistically significant for either of the three periods studied.

If expected prices closely approximate actual prices, it seems that both variables should be statistically significant if one is. Perhaps expected prices did not closely approximate actual prices during the 1960's since the price variable is significant and the expected price variable is not. If this is the case, the model is unstable as is pointed out by Hicks above.[13] The calculated U statistic for the 1960-1969 period, U_{60}, suggests that expected prices closely approximated actual prices, $U_{60} = 0.01$. Therefore the possibility of price expectations causing instability is ruled out.

Alternatively, the short-run nature of the specified method of formulating price expectations may be in error. Friedman states that economic agents may look back as far as 10-20 years in forming their expectations.[14] Hence, expected prices were estimated by using Friedman's weights. And, the expected (or permanent) price series generated in this manner was used as the expected price variable in the consumption function. The re-estimated equations do not conflict with any conclusions concerning the presence of money illusion during the periods examined. Also, this technique of using the sum of weighted past prices as a proxy of expected prices places one in the same dilemma from which Branson and Klevorick were unable to free themselves. This dilemma is unavoidable if money illusion and price expectations are a function of past prices. With price expectations constrained to be P^*, the inclusion of this variable as an independent

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[13] Hicks, Value and Capital, p. 132.

[14] Milton Friedman, "Factors Affecting the Level of Interest Rates," Money Supply, Money Demand, and Macroeconomic Models, ed. John Boorman and Thomas Harilesky (Boston, 1972), p. 256.

variable eliminates the price-expectations effect from the money-illusion effect.[15]

Before any final conclusions are reached concerning these data, however, two other statistical problems should be considered--autocorrelation and multicollinearity. For the 1960's the Durbin-Watson statistic of 1.65 indicates that the residuals are not autocorrelated at the 1 percent level. For the 1950's and 1940's, however, low Durbin-Watson statistics of 0.768 and 0.693 respectively indicate the presence of positive autocorrelation. The presence of autocorrelation and multicollinearity could distort these results. Corrections are made for these to insure that these results are not seriously affected. The first correction is made for autocorrelation and then for multicollinearity.

Data Transformation

It is postulated that the residuals follow a first-order linear autocorrelation scheme, $u_t = \rho u_{t-1} + v_t$ where positive autocorrelation is assumed, $|\rho| < 1$. Rho is estimated in the usual manner by regressing u_t on u_{t-1}. The resulting estimate of ρ is used to transform the original variables as follows:[16]

$$Y_t' = Y_t - \rho Y_{t-1}$$

$$X_t' = X_t - \rho X_{t-1}$$

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[15] G. W. Snedecor and W. G. Cochran, Statistical Methods (6th ed.; Ames, Iowa; 1967), p. 394.

[16] J. Johnston, Econometric Methods (2nd ed.; New York, 1972), pp. 244-245.

In the regression equations the transformed variables are weighted differences of the original variables. Estimates of the parameters of the transformed equations for the 1950's and 1940's are as follows:

1950-1959

$$c_t' = \underset{}{-0.839} + \underset{(0.131)}{0.839}\, y_t^{*\prime} + \underset{(0.149)}{0.274}\, m_{t-1}' + \underset{(0.039)}{0.054}\, r_t' + \underset{(0.324)}{0.384}\, p_t' - \underset{(0.101)}{0.201}\, p_t^{*\prime} \qquad (3.6)$$

$$R^2 = 0.875 \qquad SE = 0.104 \qquad DW = 1.61$$

1940-1949

$$c_t' = \underset{}{3.504} - \underset{(0.090)}{0.179}\, y_t^{*} + \underset{(0.036)}{0.184}\, m_{t-1}' - \underset{(0.130)}{0.0379}\, r_t' - \underset{(0.132)}{0.010}\, p_t' + \underset{(0.149)}{0.216}\, p_t^{*\prime} \qquad (3.7)$$

$$R^2 = 0.950 \qquad SE = 0.017 \qquad DW = 1.30$$

The results are not altered by the corrections for autocorrelation. Permanent income is still the only statistically significant variable for the 1950's. Real balances, the interest rate, the price level, and expected prices all have calculated t values which are less than 2.0. The sign of the partial regression coefficient of the interest rate remains positive.

Economic agents did not have sufficient reason to alter their consumer expenditures in light of expected future prices. Expected prices closely approximated actual prices prevailing during the period of the 1950's. But, the expected price changes were so small, economic agents did not bother to alter their consumption pattern.

For the 1940's, permanent income still has a negative effect on consumption expenditures, and it still is not statistically significant. The real balances variable is still significant as is the interest rate. But, once again, the price variables are not statistically significant. As is the case for the 1950's, conclusions concerning money illusion are not altered after corrections were made for autocorrelation. Money illusion was not present during the 1940-1959 period to a significant degree.

For the transformed data of the 1950's, the Durbin-Watson statistic is statistically significant at the 1 percent level. For the 1940's the Durbin-Watson statistic is between the upper and lower bounds of significance at the 1 percent level; the test for positive autocorrelation is inconclusive.

There is also evidence indicating the presence of multicollinearity in the above equations. For example, in the data for the 1960's, the squared simple correlation coefficient between permanent income and real balances is 0.904, that between permanent income and the interest rate is 0.798. The squared simple correlation coefficients between the price variable and respectively permanent income, real balances, the interest rate, and expected prices are 0.911, 0.924, 0.930, and 0.940.

For equation (3.6) the squared simple correlation coefficients are not as high as those for equation (3.3), the highest being between the price variable and real balances--0.75. For equation (3.7) the highest is between the two price variables--0.95.

A test should be conducted to see if the presence of multicollinearity has an undue distorting influence on the conclusions concerning the presence or absence of money illusion during the respective periods.

As Edward Kane puts it:

> Multicollinearity results in parameter estimates that are (1) discomfortingly sensitive to changes both in the precise model specification and the precise data set being employed, and (2) possessed of inordinately high standard errors.[17]

One can allow multicollinearity to exist in the model if its presence does not affect the conclusions concerning the variables of interest. Or, as Farrar and Glauber point out, "multicollinearity, . . ., constitutes a problem only if it undermines that portion of the independent variable set that is crucial to the analysis in question."[18] That is, harmful multicollinearity is defined ". . . as to cause wrong signs or other symptoms of nonsense regression."[19]

The relatively high standard errors of the partial regression coefficients estimated during the course of this study could cause the affected variables not to be statistically significant. This could explain why real balances, income, etc. were not statistically significant during one period while the opposite was the case during another period. Or, their significance was sensitive to the specification of the model. One suggested correction for multicollinearity is to use a combination of multicollinear variables as an independent variable.[20]

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[17] Edward J. Kane, Economic Statistics & Econometrics (New York, 1968), p. 278.

[18] Donald E. Farrar and Robert Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited," Review of Economics and Statistics, IL (February, 1967), p. 95.

[19] Ibid., p. 98.

[20] Kong Chu, Principles of Econometrics (Scranton, Pennsylvania; 1968), p. 119.

In order to see if the presence of multicollinearity has distorted the conclusions concerning the money-illusion variable, a new regression equation is specified. In the following regression equations, the independent variables are the natural logs of current income, y_t, the rate of interest, r_t, the product of current income and real balances lagged one period, $(y_t m_{t-1})$, and the price variable, p_t.

Permanent income is eliminated to see if the results are sensitive to the distributed-lag specification of the income variable. Of main interest, here, are the results of the 1940's. The negative elasticity of current consumption expenditures with respect to income may be due to an improper specification of permanent income. If this is the case, the current income elasticity should yield the expected sign and be statistically significant.

The proxy of real balances is now the interaction between income and wealth. That is, it is now assumed that consumers consider the relationship between income and wealth when they make their consumption expenditures.

The interest rate is still considered to be relevant for consumer decisions. This variable is unaltered from the previous specification.

Price expectations are eliminated because a high degree of multicollinearity exists between this variable and the price variable if price expectations are accurate. The purpose of the following estimates is to see if altering the model affects the conclusions concerning the significance of money illusion during the periods examined. By deletion of the price expectations variable, the money-illusion effect cannot be distinguished from the price-expectations effect. This lack of distinction is not a problem if the presence or absence of money

illusion is unaffected by the deletion of the price expectations variable. Concern, here, is not with the magnitude of the price coefficient but with its significance.

The parameters of this regression equation are estimated for the 1960's, 1950's and 1940's. The data are corrected for autocorrelation by first estimating the parameters of the assumed first-order autoregressive process. The estimates of ρ are used to transform the original variables discussed above. For the sake of brevity the uncorrected estimates are not presented. Rather, the following estimates are derived from the transformed variables.

1960-1969

$$c_t' = -4.677 + \underset{(0.095)}{0.436}\, y_t' + \underset{(0.103)}{0.330}\, (y_t m_{t-1})' - \underset{(0.043)}{0.105}\, r_t' + \underset{(0.158)}{0.850}\, p_t' \qquad (3.8)$$

$R^2 = 0.990$ SE = 0.010 DW = 2.36 $\rho = 0.292$

1950-1959

$$c_t' = 1.611 + \underset{(0.163)}{0.500}\, y_t' + \underset{(0.167)}{0.120}\, (y_t m_{t-1})' + \underset{(0.058)}{0.125}\, r_t' - \underset{(0.271)}{0.022}\, p_t' \qquad (3.9)$$

$R^2 = 0.840$ SE = 0.024 DW = 1.84 $\rho = 0.357$

1940-1949

$$c_t' = 4.030 - \underset{(0.259)}{0.180}\, y_t' + \underset{(0.093)}{0.252}\, (y_t m_{t-1})' - \underset{(0.613)}{0.064}\, r_t' - 0.037\, p_t' \qquad (3.10)$$

$R^2 = 0.563$ SE = 0.095 DW = 1.51 $\rho = 0.569$

For the 1960's current income, the real-balances variable, and the price level are all statistically significant at the 0.01 level. With a calculated t value of 2.44 the interest rate is not statistically significant.

Current income is the only statistically significant independent variable for the 1950-1959 period. During this time money illusion, the rate of interest, and the price level were not significant.

The coefficient of the real-balances variable is the only statistically significant coefficient for the 1940's. Current income, the interest rate, and the price variable are not significantly different from zero.

For the entire period of this study, the coefficients of all the statistically significant independent variables have the anticipated signs. For the 1940's the income variable's coefficient is still negative, but this variable is not statistically different from zero. Consumption therefore is independent of income.

Summary

The results, as presented in this chapter, indicate that type I money illusion was present to a significant degree during the 1960's. That is, economic agents tended to misperceive equiproportionate increases in income and the price level. As a consequence, they felt wealthier than they really were.

Money illusion was not present to a statistically significant degree during the 1940-1959 time span. Economic agents foresaw perceived price movements as clearly as they did income movements.

With money illusion specified to be due to a distortion of the current price level, past prices are known data, the price-expectations effect can be eliminated from the money illusion effect. Even when allowed to be present, in the last set of estimated regression equations, the price expectations effect did not distort the conclusions concerning money illusion.

Why were economic agents unable to clearly distinguish price changes during the 1960's? It is to this and similar questions that the next chapter is devoted. The last chapter contains the summary and conclusions.

CHAPTER V

CONCLUDING COMMENTS

Summary

Prior to Kane and Klevorick's work,[1] money illusion was assumed to be either completely absent or completely present in the economy. No allowance was made for the presence of a degree of money illusion. Now, one can measure the degree of money illusion present rather than assume its complete absence or presence. By considering the degrees of money illusion, one can ascertain whether economic agents overestimate the real value of their nominal balances.

The Branson and Klevorick study introduces the degrees of money illusion by parameterizing the price level. The type of money illusion is determined by the magnitude of the price parameter. A parameter magnitude of $0 < \alpha < 1$ indicates the presence of type I money illusion. Type I is the case where economic agents overestimate the real values of their nominal balances. If $\alpha > 1$, economic agents underestimate the real values of nominal balances.

Branson and Klevorick question the stability of a model which contains a negative price parameter. As was discussed, the stability or instability of the model depends upon the specification of the model

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[1] Kane and Klevorick, "Absence of Money Illusion: A Sine Qua Non for Neutral Money?"

which includes the economic behavior of economic agents. Cumulatively more-severe disequilibria do not present a problem if substitution exists between the various markets. In fact, general equilibrium can be maintained by indirect repercussions even if one of the markets is unstable.

So, indirect repercussions can act within the model's framework to stabilize the equilibrium. Here a negative alpha is assumed to be the result of a disruptive event which is momentarily disorientating. Shortly, however, economic agents are assumed to regain their economic composure and resume their normal economic activity. Consequently, the presence of a negative alpha is temporary at most.

Available empirical evidence suggests that type I money illusion was the type present when money illusion was statistically significant. This is the finding not only of this study but earlier studies as well.

The price expectations effect can be separated from the money illusion effect if neither effect is a function of past prices. This is achieved by assuming price expectations are based on the difference between the percentage growth rate of the real per capita money stock and real per capita output. The money illusion present in the economy is due to a misperception of the current price level. Economic agents are assumed to be aware of the true value of past prices because these data are now a matter of public record. This technique is realistic to the extent that this procedure yields a very good approximation of the actual prices that prevailed.

With these two specifications, a price expectations variable can exercise an independent effect on consumption as can the misperceived price index. Even though the price-expectations effect was not

statistically significant during the entire period of this study, its effect was still removed from that of the price variable's.

The real-balance effect was operative during the 1960's and 1940's, but the evidence does not indicate that it had an effect on consumption that was of statistical importance during the 1950-1959 period. This does not necessarily mean that the real-balance effect was absent. It can be present but not operative. The two terms are not synonymous if economic agents calculate interval estimates for the amount of real balances they desire to hold rather than make point estimates. For example, if they wish to hold an average stock of real balances rather than a specific amount, then consumption is not affected by real balances as long as the value of these balances lies between the two points specified by the interval. This interval could be calculated in the usual manner by using the sample standard deviation. Economic agents could have used a larger deviation but the sample estimate would yield a minimum estimate of the perceived standard deviation which can be defined as a measure of the dispersion of permissible quantities around the mean quantity.

Economic agents could base their estimate of the perceived standard deviation on many things. For one, Tobin treated the perceived standard deviation as a measure of risk.[2] More empirical evidence needs to be sought concerning this matter.

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[2] J. Tobin, "Liquidity Preference as Behavior Towards Risk," Readings in Macroeconomics, ed. M. G. Mueller (New York, 1971), p. 182.

Conclusions

From this study it can be concluded that Patinkin and Kane and Klevorick are guilty of the same mistake concerning the stability of their models. Patinkin assumed that the presence of money illusion precludes the presence of the real-balance effect. In the absence of this effect the absolute level of money prices is indeterminate. No market forces exist to stabilize the price level at a specific level.[3] Kane and Klevorick show that this is true only if extreme money illusion is present, $\alpha = 0$. In their model, degrees of money illusion can exist and the real-balance effect is still operative. It is only inoperative if $\alpha = 0$. Their model, however, is unstable if $\alpha < 0$. In fact, the instability is due to economic agents' perceiving higher prices as increasing the perceived value of real balances.[4]

Patinkin, Branson, and Klevorick point out that the stability of equilibrium depends upon the dynamics of the model. Dynamic behavior depends upon the response of the market participants. Thus, any instability generated by the presence of extreme money illusion or the absence of a real-balance effect could be offset by indirect effects as Hicks shows.[5] This could have been the case during the 1950's when money illusion was absent and the real-balance effect was inoperative. Despite the non-functioning of the real-balance effect, economic activity during the 1950's was not stable. True, cyclic behavior existed, but real world cycles were not unstable.

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[3]Patinkin, Money, Interest, and Prices, p. 21.

[4]Kane and Klevorick, p. 420.

[5]Hicks, p. 67.

The statistical evidence of this study indicates that type I, $0 < \alpha < 1$, money illusion existed to a significant extent only during the 1960's. It was of no important consequence during the 1940's and 1950's.

Economic agents did not have sufficient reason to alter their consumer expenditures in light of expected future prices. Expected prices closely approximated actual prices prevailing during the entire period of this study. The expected price changes were so small that economic agents did not bother to alter their consumption pattern. Existing money illusion was due to the fact that actual price data were not available when expenditures were made. Instead, economic agents became aware of actual prices at the end of the period only in time to formulate their price expectations concerning the next period's prices. These findings have some interesting implications for a Patinkin-type model.

The evidence of this study indicates that money illusion was not present in the economy during the 1940's and 1950's. As a consequence, an increase in the money stock would bring about an equiproportionate increase in the price level. Type I money illusion was present during the 1960's. Correspondingly, an increase in the money stock caused the price level to increase more-than-equiproportionately.

The real-balance effect is the transmission mechanism in both cases. The increase in the nominal money stock creates a disequilibrium situation. Temporarily, at the old price level, economic agents are holding more real-balances than they wish. They attempt to reduce their real-balances holdings by making expenditures. Since full employment is assumed, economic agents succeed only in bidding the price

level up. When money illusion was statistically absent, real balances were not misperceived. As a result, the price level rises equiproportionately. Real balances are restored to the old equilibrium level. Money illusion during the 1960's caused economic agents to misperceive the price level. They saw it as being much smaller than it actually was. They felt wealthier than they actually were. Expenditures, consequently, increased more-than-equiproportionately. Economic agents continued to spend until perceived real balances were restored to the equilibrium level. In actuality, however, true "real balances" were below the equilibrium level because of the more-than-equiproportionate price increase.

The real-balance effect can be present but not operative. The two terms are not synonymous if, as discussed above, economic agents calculate interval estimates for desired real balances rather than point estimates. Then the real-balance effect is operative only if the stock of real balances differs significantly from the upper or lower limit of the confidence interval. So, the economic agent does not respond to changes in the stock of real balances as long as the new magnitude lies within the confidence interval. This could have been the case for the 1950's. For some reason the variance of desired real balances could have been greater for this period than for the other two decades. Consequently, if the "interval estimate of real balances" is incorporated into Patinkin's model, something should be known about what determines the size of the variance.

Also, if price expectations are incorporated into Patinkin's model, the stability of the model requires that a check must be conducted to see if expected prices closely conform to the prices which actually

prevail. In short, more attention should be paid to the indirect repercussions in order to get a better insight into the workings of the model.

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APPENDIX A

REGRESSION DATA

REGRESSION DATA

Time	C/PN	r	M/PN	Y/PN
694	2,276	7.47	1,099	2,432
693	2,277	7.06	1,100	2,441
692	2,287	6.89	1,128	2,416
691	2,289	6.70	1,175	2,416
684	2,211	6.24	1,181	2,426
683	2,218	6.08	1,181	2,416
682	2,192	6.25	1,214	2,428
681	2,182	6.13	1,221	2,411
674	2,133	6.03	1,207	2,376
673	2,128	5.62	1,182	2,362
672	2,131	5.26	1,187	2,356
671	2,111	5.12	1,126	2,347
664	2,090	5.38	1,214	2,302
663	2,097	5.32	1,206	2,285
662	2,083	5.00	1,235	2,272
661	2,096	4.81	1,273	2,275
654	2,069	4.61	1,265	2,261
653	2,040	4.50	1,259	2,241
652	2,008	4.44	1,276	2,177
651	1,992	4.42	1,306	2,161
644	1,948	4.43	1,303	2,141
643	1,950	4.41	1,295	2,126
642	1,921	4.41	1,302	2,106
641	1,903	4.37	1,314	2,059
634	1,864	4.33	1,307	2,023
633	1,861	4.27	1,305	2,002
632	1,850	4.22	1,322	1,992
631	1,842	4.20	1,335	1,984
624	1,826	4.26	1,332	1,966
623	1,807	4.34	1,324	1,957
622	1,795	4.30	1,334	1,960
621	1,791	4.41	1,345	1,948
614	1,773	4.41	1,344	1,937
613	1,751	4.44	1,333	1,908
612	1,744	4.28	1,329	1,892
611	1,731	4.27	1,342	1,869
604	1,736	4.32	1,350	1,863
603	1,744	4.31	1,361	1,884
602	1,756	4.45	1,387	1,886
601	1,747	4.55	1,413	1,886

REGRESSION DATA

Time	$(Y/PN)_t$	$(M/PN)_{t-1}$	P
694	2,675,200		130.5
693	2,753,448		128.7
692	2,838,800		126.9
691	2,853,296		124.8
684	2,865,106		123.3
683	2,933,024		121.9
682	2,964,588		120.4
681	2,910,077		119.0
674	2,808,432		117.8
673	2,803,694		116.8
672	2,888,456		115.6
671	2,849,258		114.8
664	2,776,212		114.6
663	2,821,975		113.7
662	2,892,256		112.7
661	2,877,875		111.5
654	2,846,599		110.7
653	2,859,516		110.1
652	2,843,162		109.7
651	2,815.783		108.9
644	2,772,595		108.7
643	2,768,052		108.3
642	2,767,284		107.9
641	2,691,113		107.7
234	2,640,015		107.4
633	2,646,644		107.1
632	2,659,320		106.4
631	2,642,688		106.1
624	2,602,984		105.9
623	2,610,638		105.7
622	2,636,200		105.2
621	2,618,112		104.8
614	2,582,021		104.6
613	2,535,732		104.4
612	2,539,064		103.9
611	2,523,150		103.9
604	2,535,543		103.8
603	2,613,108		103.2
602	2,664,918		103.0
601	2,685,664		102.3

REGRESSION DATA

Time	Y*/PN	P^*
694	2,648.82	128.9
693	2,367.45	127.7
692	2,411.89	130.1
691	2,409.82	123.0
684	2,406.62	124.1
683	2,397.00	121.6
682	2,387.55	120.6
681	2,367.51	119.3
674	2,345.93	116.7
673	2,331.13	117.0
672	2,314.59	113.9
671	2,296.04	112.5
664	2,270.84	111.8
663	2,255.40	114.0
662	2,240.76	111.3
661	2,225.36	110.9
654	2,200.87	110.4
653	2,169.68	107.3
652	2,136.77	110.0
651	2,116.78	108.1
644	2,094.95	106.4
643	2,072.27	107.5
642	2,045.80	109.6
641	2,016.11	107.7
634	1,995.00	106.6
633	1,981.21	105.3
632	1,907.98	103.9
631	1,962.52	103.6
624	1,948.99	103.6
623	1,940.55	103.5
622	1,932.41	102.1
621	1,918.79	101.1
614	1,904.45	106.6
613	1,888.43	108.3
612	1,878.78	102.3
611	1,872.27	101.5
604	1,873.89	104.6
603	1,879.25	104.4
602	1,876.91	107.2
601	1,872.38	101.3

REGRESSION DATA

Time	C/PN	r	M/PN	Y/PN
594	1,732	4.57	1,424	1,874
593	1,743	4.47	1,425	1,870
592	1,732	4.35	1,427	1,889
591	1,713	4.13	1,434	1,867
584	1,675	4.09	1,563	1,847
583	1,660	3.87	1,535	1,829
582	1,643	3.58	1,538	1,798
581	1,644	3.61	1,547	1,804
574	1,673	4.00	1,433	1,826
573	1,677	4.07	1,441	1,840
572	1,675	3.77	1,467	1,843
571	1,686	3.70	1,507	1,848
564	1,677	3.68	1,517	1,849
563	1,665	3.42	1,525	1,833
562	1,674	3.26	1,568	1,841
561	1,676	3.97	1,614	1,832
554	1,671	3.12	1,623	1,817
553	1,657	3.10	1,621	1,801
552	1,646	3.33	1,635	1,775
551	1,618	2.98	1,646	1,738
544	1,584	2.87	1,539	1,719
543	1,555	2.88	1,524	1,686
542	1,546	2.88	1,527	1,678
541	1,536	2.96	1,574	1,687
534	1,527	3.13	1,557	1,630
533	1,540	3.27	1,558	1,606
532	1,553	3.32	1,533	1,582
531	1,554	3.07	1,551	1,577
524	1,528	2.99	1,557	1,570
523	1,479	2.95	1,550	1,555
522	1,486	2.93	1,537	1,565
521	1,468	2.96	1,550	1,541
514	1,483	2.95	1,553	1,631
513	1,479	2.87	1,541	1,626
512	1,471	2.90	1,546	1,619
511	1,533	2.70	1,550	1,597
504	1,516	2.67	1,579	1,639
503	1,586	2.63	1,604	1,621
502	1,517	2.61	1,613	1,602
501	1,496	2.58	1,613	1,609

REGRESSION DATA

Time	$(Y/PN)_t$	$(M/PN)_{t-1}$	P
594	2,670,450		102.4
593	2,668,490		101.8
592	2,708,826		101.2
591	2,918,121		100.8
584	2,835,145		100.9
583	2,813,002		100.9
582	2,781,506		100.7
581	2,585,132		100.0
574	2,631,266		99.0
573	,2699,280		98.6
572	2,777,401		97.6
571	2,803,416		96.6
564	2,819,725		96.0
563	2,874,144		95.3
562	2,971,374		94.1
561	2,973,336		93.5
554	2,945,357		93.6
553	2,944,635		93.5
552	,2921,650		93.1
551	2,865,962		93.2
544	2,795,094		93.3
543	2,751,552		93.7
542	2,770,378		93.6
541	2,800,420		93.7
534	2,710,690		93.8
533	2,646,688		93.7
532	2,649,850		93.0
531	2,636,744		92.6
524	2,614,050		93.1
523	2,592,185		93.1
522	2,641,720		92.2
521	2,607,372		91.8
514	2,772,700		91.8
513	2,785,338		90.6
512	2,823,536		90.2
511	2,925,704		89.3
504	2,110,822		86.2
503	3,165,813		84.5
502	3,151,134		82.6
501	3,092,498		82.0

REGRESSION DATA

Time	Y^*/PN	P^*
594	1,865.62	101.1
593	1,861.45	99.0
592	1,857.23	97.2
591	1,841.56	108.2
584	1,829.00	108.9
583	1,820.08	111.6
582	1,815.61	112.0
581	1,824.25	100.1
574	1,834.13	98.3
573	1,838.04	99.3
572	1,837.04	100.0
571	1,834.03	100.8
564	1,827.06	101.4
563	1,816.18	96.5
562	1,807.83	94.3
561	1,791.47	95.0
554	1,771.52	95.6
553	1,749.14	93.4
552	1,723,59	91.0
551	1,698.24	94.5
544	1,678.67	93.2
543	1,658,81	93.7
542	1,645.38	93.0
541	1,629.32	92.6
534	1,600.85	94.6
533	1,586.45	91.6
532	1,576.86	93.1
531	1,574.35	95.2
524	1,573.05	92.9
523	1,574.51	92.5
522	1,584.09	92.5
521	1,593.46	91.8
514	1,619.31	90.6
513	1,613,52	89.2
512	1,607.30	87.5
511	1,601.50	86.5
504	1,603.72	85.4
503	1,586.47	82.8
502	1,569.47	85.7
501	1,553.82	82.2

REGRESSION DATA

Time	C/PN	r	M/PN	Y/PN
494	1,441	2.60	1,589	1,525
493	1,421	2.63	1,609	1,515
492	1,428	2.71	1,628	1,521
491	1,421	2.71	1,643	1,531
484	1,416	2.82	1,624	1,558
483	1,402	2.83	1,635	1,551
482	1,416	2.77	1,654	1,540
481	1,414	2.85	1,672	1,507
474	1,420	2.78	1,680	1,491
473	1,429	2.57	1,703	1,519
472	1,446	2.54	1,707	1,502
471	1,438	2.56	1,733	1,549
464	1,495	2.60	1,772	1,576
463	1,537	2.52	1,820	1,640
462	1,571	2.49	1,873	1,727
461	1,541	2.50	1,923	1,713
454	1,676	2.62	1,851	1,676
453	1,702	2.61	1,822	1,702
452	1,758	2.61	1,717	1,758
451	1,780	2.65	1,661	1,780
444	1,354	2.71	1,569	1,764
443	1,334	2.72	1,523	1,734
442	1,315	2.73	1,407	1,743
441	1,289	2.73	1,344	1,729
434	1,270	2.72	1,270	1,629
433	1,258	2.69	1,156	1,594
432	1,234	2.74	1,075	1,628
431	1,235	2.77	938	1,620
424	1,224	2.80	836	1,659
423	1,195	2.81	722	1,581
422	1,179	2.84	726	1,476
421	1,181	2.85	646	1,403
414	1,203	2.75	568	1,399
413	1,229	2.74	546	1,383
412	1,217	2.80	524	1,334
411	1,185	2.78	504	1,280
404	1,151	2.75	481	1,233
403	1,121	2.85	470	1,182
402	1,117	2.90	460	1,152
401	1,099	2.86	448	1,150

REGRESSION DATA

Time	$(Y/PN)_t$	$(M/PN)_{t-1}$	P
494	2,960,025		82.6
493	2,967,885		82.9
492	3,033,975		83.1
491	2,945,644		83.2
484	2,983,570		84.4
483	3.077,184		85.3
482	3,136,980		83.4
481	3,133,053		82.1
474	3,230,997		80.8
473	3,388,889		78.6
472	3,451,596		76.5
471	3,714,502		75.4
464	4,084,994		73.9
463	4,769,120		70.2
462	5,237,991		64.4
461	4,017,377		63.4
454	4,840,288		63.2
453	4,673,692		63.1
452	4,716,714		62.5
451	4,510,520		61.9
444	4,353,552		61.9
443	3,989,240		61.7
442	3,872,946		61.0
441	3,617,068		60.5
434	3,117,906		60.7
433	2,818,192		60.4
432	2,580,380		60.8
431	2,318,220		59.2
424	2,090,340		58.4
423	2,031,585		57.3
422	1,731,348		56.5
421	1,487,180		55.1
414	1,473,147		53.6
413	1,441,086		51.9
412	1,366,016		50.3
411	1,258,240		49.2
404	1,212,039		48.9
403	1,114,626		48.8
402	1,058,688		48.8
401	1,029,250		48.7

REGRESSION DATA

Time	Y^*/PN	P^*
494	1,526.65	81.4
493	1,527.50	81.2
492	1,533.75	81.1
491	1,540.03	80.9
484	1,544.51	80.2
483	1,537.91	7918
482	1,531.52	77.5
481	1,527.45	77.4
474	1,537.47	75.3
473	1,560.32	73.8
472	1,580.66	71.7
471	1,619.25	71.1
464	1,653.82	70.0
463	1,692.16	69.3
462	1,717.73	66.4
461	1,713.00	63.2
454	1,&12.(0	63.2
453	1,730.93	62.5
452	1,744.97	61.9
451	1,738.35	61.9
444	1,717.66	61.7
443	1,694.79	61.0
442	1,675.43	60.5
441	1,642.06	60.7
434	1,599.45	60.4
433	1,584.07	60.8
432	1,579.06	59.2
431	1,554.94	60.2
424	1,521,89	60.2
423	1,455.79	56.4
422	1,394.04	60.0
421	1,353.61	52.0
414	1,329.26	51.5
413	1,294.91	51.3
412	1,251.74	51.9
411	1,210.94	49.8
404	1,176.89	48.9
403	1,163.30	49.3
402	1,132.99	48.4
401	1,123.58	48.9

APPENDIX B

SOURCES OF THE REGRESSION DATA

APPENDIX B

SOURCES OF THE REGRESSION DATA

Variable	Source
P	Quarterly data computed from monthly data provided by the U. S. Department of Labor, Bureau of Labor Statistics, Consumer Price Index for Urban Wage Earners and Clerical Workers, U. S. City Average: All Items--Series A (1957-59 = 100) unpublished data series, annual and monthly price index 1913-1970. Quarterly data computed by averaging the monthly data for the respective quarters.
N	Population of the United States including Armed Forces overseas, from various issues of Survey of Current Business, Economic Report of the President, and Statistical Abstract of the United States.
C	Personal consumption expenditures, from various issues of Survey of Current Business and Business Statistics.
C/PN	Computed from the data obtained from the above sources.
r	Quarterly data computed by averaging monthly data in various issues of the Federal Reserve Bulletin and Business Statistics.
GNP	1940-1969, quarterly data obtained from various issues of Business Statistics and the Survey of Current Business.
GNP/PN	Computed from the data obtained from the above relevant sources.
G_q	Computed by calculating the growth rate of GNP/PN; the data were obtained from the above relevant sources.
K	1940-1959, currency data are averages of monthly data provided by Friedman and Schwartz, Table A-1, pp. 714-722. 1960-1969 data computed from various issues of the Federal Reserve Bulletin.
R	R = V + B. Reserves which are averages of the 1940-1959 monthly data provided by Friedman and Schwartz, Table A-2, pp. 735-748. Consists of vault cash plus bank deposits at Federal Reserve Banks. 1960-1969 data from various issues of the Federal Reserve Bulletin, except nonmember bank clearing balances. See NBC below for this reference.

Variable	Source
B	Bank deposits at Federal Reserve Banks. Sum of member bank deposits (D) minus float (F) plus nonmember bank clearing balances (NBC). 1940-1959 data from Friedman and Schwartz, Table A-2, pp. 735-748. 1960-1969 data are sums of D - F + NBC.
D	Member bank deposits in Federal Reserve Banks. 1960-1969 data obtained from various issues of the Federal Reserve Bulletin. For the 1940-1959 data source, see Friedman and Schwartz in R.
F	Float. 1960-1969 quarterly data computed by averaging monthly data from various issues of the Federal Reserve Bulletin. For 1940-1959 data, see Friedman and Schwartz in R for reference.
NBC	Nonmember clearing balances from various issues of the Annual Report of the Board of Governors of the Federal Reserve System. Estimated for the respective quarters by dividing nonmember bank clearing balances by total other deposits, and then using the resulting figure to estimate quarterly nonmember bank clearing balances as a fraction of total other deposits which are available on a quarterly basis.
V	Vault cash. For 1940-1959 data, see R for source. For 1960-1969 data, see various issues of the Federal Reserve Bulletin. Quarterly data are averages of the monthly data.
GD	U. S. Government debt privately held. It excludes that portion held by U. S. Government agencies and trust funds and Federal Reserve Banks. Various issues of the Federal Reserve Bulletin. Quarterly data are averages of the monthly data.
M	Nominal money balances equal K + R + GD, computed from the data obtained from the above relevant sources.
M/PN	Real balances, computed from the data obtained from the above relevant sources.
G_m	Growth rate of real balances, computed from the data obtained from the above relevant sources.
P^*	Computed by a modified version of the technique provided by Cagan, Journal of Money, Credit, and Banking (May, 1969), p. 213.

Variable	Source
G_p^*	Growth rate of expected prices, computed from the data obtained from the above relevant sources.
Y	Personal disposable income from various issues of the Survey of Current Business and Business Statistics.
Y/PN	Computed from the data obtained from the above relevant sources.
Y^*	Permanent income was computed from personal disposable income with the aid of permanent income weights provided by Milton Friedman, A Theory of the Consumption Function (Princeton: Princeton University Press for NBER, 1957), p. 147.
Y^*/PN	Computed from the data obtained from the above relevant sources.

VITA

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