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THE DEMAND FOR MONEY: A HOUSEHOLD PRODUCTION FUNCTION APPROACH

by

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Sol Drescher

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CHAPTER 1

INTRODUCTION

This study will explore an alternative to the traditional approach to looking at the demand for money. Specifically, this paper will focus on that portion of the private sector, which may be described as households. The factors influencing households' demand for money will be analyzed using a household production function model. Viewing household activity in this way will provide many important insights as to how it will react to changes in its environment occurring on a macroeconomic level.

There has been much research into the role of money in economic theory. The overwhelming proportion of this work has centered on the role of money on a macroeconomic level. Some questions raised whose solutions have not fully been clarified are: How does money effect economic activity? What is the mechanism whereby money effects output? Why do people hold money? Is it to make transactions, for precautionary purposes, for speculation purposes, for liquidity, and possibly for all these reasons.

The problem with much of the past research is there has not been developed a fundamental analysis on a microeconomic level. Unrealistic situations are concocted and used to justify questionable theoretical constructs. Theoretical formulations of the demand for money, with regard to households, have been looking at the demand for this asset in

isolation. Households, it is said, demand money for transactions purposes, and a transactions demand for money function is developed. The demand for money is analogous to the demand for a consumer durable good, providing services to the owner of a stock of this asset. Money is an asset among many assets, which can be held, and the problem is one of acquiring an optimal portfolio.

All of the theories of the demand for money, especially as applied to household behavior, are isolating money from the rest of household activity to one extent or another. But households are agents in many markets. They will offer services in the labor market. They will consume goods, durable and non-durable, purchased in the product markets. They will accumulate non-human wealth, financial as well as others, and operate in markets to achieve its goal. They will invest in human capital, and activities will be undertaken in the home. To specify the demand for money to be a function of one or two of the household's many activities does not fully explain the relationship.

Money is basic to all of the household's activities, and we need to understand and to analyze its role in this expanded framework. With the explosion of research done in Monetary Theory in the past few years, the failure to provide a satisfactory framework for the household's demand for money has resulted in the difficulty in answering some of the questions previously posed.

In this study I develop a model, which is sufficiently general to encompass all motives a household may have for demanding money, and which is sufficiently specific to make several conclusions about the household's demand for money. Although new in some respects, the model developed here is really a formalization of what economists have been

saying about the demand for money for a long time. What has been done is to synthesize these theories of the demand for money into one model. The possibilities in future research for this model, I believe, will be quite fruitful.

This study proceeds in the following manner: In chapter 2, several theories of the demand for money by households are discussed, as well as some of the difficulties inherent in these theories. In the second part of chapter 2, there is an introduction into the household model, providing some justification for the development of the specific household model to be used. Chapter 3 presents the household model with real balances, discusses the important variables, and the way in which these variables are expected to influence the household's demand for money. Chapter 4 consists of several empirical tests of the demand for money. Chapter 5 presents an empirical test of the inventory approach to the transactions demand for money model of the Baumol-Tobin form. Chapter 6 contains a summary and the conclusion of the study.

CHAPTER II

THEORIES OF THE DEMAND FOR MONEY BY HOUSEHOLDS

Economists have long been aware, when comparing a barter economy to a monetary economy, of the obvious benefits that will accrue to a system where a medium of exchange is used in making transactions. This fact, something exists called money, will allow a household or a firm to acquire market goods without having to resort to a long transaction chains, i.e., the problem of double coincidence of wants, is important for economic theory. The existence of money reduces the transactions costs a household or a firm must incur to acquire its optimal bundle of goods or inputs.

The greater the degree to which interaction in the market is dominated by a medium of exchange, we call money, the lower will be the cost to the household or firm of making transactions. In addition, when this asset serves as a unit of account as well as a medium of exchange, the economic agents will benefit because of its function in providing information about price ratios in existence. Information as to the quality of market goods is also conveyed with the existence of money, as a unit of account, if the dispersion of prices due to undertainty about quality differences.[1]

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[1]Brunner and Meltzer state, "uncertainty about quality characteristics is a main reason for the dispersion of prices of any commodity and the uneven distribution of information about qualities of commodities

The availability of an asset having these characteristics will provide a household or a firm with an increase in its resources. In the case of the household, in particular, it will lead to an increase in the size of the bundle of commodities that may be consumed. Given there are benefits to the household by the mere existence of this asset called money, it becomes obvious they well be willing to hold this asset in addition to other forms of wealth available to it.[2]

How does the household benefit from holding money? What form will these benefits take? Given the benefits exist, what factors will influence the amount of money the household holds? What is the optimal quantity of money to be held? Answers to these questions will be attempted by this study, specifically from the point of view of the household.

There have been several studies that have looked at the demand for money by households. Some of these studies have looked at the consumers demand for money, where real balances enter the utility function directly.[3] Models viewing real balances entering the utility function

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increases the dispersion . . . ."

"The use of money increases the welfare of each money user by reducing uncertainty, the length of transactions chains, the variance of price ratios and by increasing expected wealth and time available for liesure." Karl Brunner and Allan H. Meltzer, "The Uses of Money: Money in a Theory of an Exchange Economy," American Economic Review 61, (December 1971), p. 786.

[2]The household does not have to hold this asset to get many of the benefits derived from a monetary economy, once one has been developed.

[3]See for example: Paul A Samuelson, Foundations of Economic Analysis (Cambridge: Harvard University Press, 1947); Don Patinkin, Money Interest and Prices, 2nd ed. (New York: Harper and Row, 1965); Brian Motley, "The Consumer Demand for Money: A Neoclassical Approach," Journal of Political Economy 77, (September 1969), pp. 817-826.

directly may be useful in expanding our understanding of money's role, however, they miss the true function money serves, and may have misled us in the approach to its analysis. Clower[4] has argued, to view money in this way does not allow money to play a role as a medium of exchange. These models do not specify that money may be exchanged for goods and goods for money but goods may not be exchanged for goods. In these models money is no different than any other good.

To avoid this problem of real balances directly entering the utility function of the household (or individual), money has been viewed as a consumer durable good providing a flow of services to the household.[5] It is these services which are said to enter the utility function directly. Another more recent development has been to apply the micro-foundation approach to demand for money, again to skirt the problem of money in the utility function.[6] In a production function of the household two forms of money are combined to produce a flow of services and these services enter the utility function.

The entire analysis of any good entering the utility function directly has been criticized by those who view household behavior in a household production function model.

> Indeed, the interpretation of consumption as both the exchange of money for market goods or services and, concomitantly, the acquisition of utility from these goods and services, has little intuitive appeal. This interpretation of consumption sheds no light on whether the utility is derived from the acquisition, possession, or

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[4]Robert W. Clower, "A Reconsideration of Micro-Foundations of Monetary Theory," Western Economic Journal 6, (December 1967), pp. 1-9.

[5]Milton Friedman, "The Optimum Quantity of Money," in The Optimum Quantity of Money and Other Essays, (Chicago: Aldine, 1969), pp. 1-50.

[6]Benjamin Klein, "Competitive Interest Payments on Bank Deposits and the Long-Run Demand for Money," American Economic Review 64, (December 1974), pp. 931-49.

> utilization of the purchased item. By emphasizing that consumption of a market good involves its use in the production of a more basic commodity, insight is provided into the nature of the usefulness of the good.[7]

It seems unreasonable to argue that people hold a stock of money and the mere possession of this stock provides utility. It is much more useful to view the holding of a quantity of money as necessary to provide more basic wants in the household. Thus, the quantity of real balances held does not depend upon the taste for this quantity, but depends on the demand for commodities which need money as an input in their production processes.[8]

Another approach to the demand for money is one that views money strictly in a transactions framework. Recently, this approach has been expanded and it has been found the household's demand for money is influenced by changes in the value of the household's time. Two papers examining the effect of the value of time on the demand for money are by Karni and Dutton and Gramm. Dutton and Gramm have come to the conclusion "not only does the demand for money depend on transactions to be undertaken and the cost of holding money but also on the valuation of resources which the use of money saves."[9] Karni works with a model based on Baumol and Tobin's inventory approach with the value of time evaluated at the wage

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[7]Robert T. Michael and Gary S. Becker, "On the New Theory of Consumer Behavior," Swedish Journal of Economics 75, (December 1973), p. 385.

[8]Michael and Becker argue, ". . . the demand for a product is considered to be derived from a desire for some more basic aims that are produced using characteristics of the product. Keynes' discussion of the demand for money being derived from speculative, precautionary, and other motives; . . . ." ibid., p. 385.

[9]Dean S. Dutton and William P. Gramm, "Transactions Costs, the Wage Rate and the Demand for Money," American Economic Review 63, (September 1973) pp. 652-65.

rate to see how the demand for transactions balances is affected.[10]

Consider for the moment a transactions demand for money model of the Baumol-Tobin form, where wealth is held in income yielding assets and converted into money as needed to make transactions. This process involved not only so called 'brokers costs' but time as well. As the cost of time rises the more expensive this conversion process becomes and there is an incentive for the household to maintain a larger stock of money balances. The rising wage will reduce the benefits to the household of holding an income yielding asset because of a rising cost of engaging in the conversion process, if not only the brokers fee but also the cost of time is included.

Karni's model developed in two papers[11] defined the cost of conversion in the Baumol-Tobin model as having two components: The first, goods used in the conversion process; the second, the time input evaluated at the wage rate. The volume of transactions (consumption) is assumed to

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[10]Edi Karni, "The Value of Time and the Demand for Money," Journal of Money Credit and Banking 6, (February 1974), pp. 45-64; William J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," Quarterly Journal of Economics 66, (November 1952), pp. 545-56; James Tobin, "The Interest Elasticity of Transactions Demand for Cash," Review of Economics and Statistics 38, (August 1956), pp. 241-47. Karni working with a Baumol-Tobin inventory model recognizes the value of time should be included in the cost of making transactions; however, he is using a model which assumes these costs only occur when converting wealth to real cash balances. He ignores the value of time as a cost in making actual market transactions when he uses the Baumol-Tobin inventory model.

[11]Karni, Time and Money, (February 1974); idem., "The Transactions Demand for Cash: Incorporation of the Value of Time Into the Inventory Approach," Journal of Political Economy 81, (September/October 1973), pp. 1216-1225.

be a constant proportion of income, where income is derived from both human and non-human wealth.[12]

One obvious result of Karni's model is the wage elasticity of real cash balances must be positive.[13] This elasticity depends upon the share of income derived from non-human wealth and the share of non-time cost in the total cost of conversion. The larger these shares the smaller will be the wage elasticity. We might expect the share of income from non-human wealth to be relatively small for most households. In any event the lower bound of this elasticity is zero, and since it is unlikely that both of these shares will ever be equal to one, the wage elasticity should always be positive.

How will variations in human capital effect the demand for money in a model of this type? Higher levels of human capital will mean greater efficiency in market and non-market activity, and therefore, we could expect households with higher levels of human capital will be more

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[12]Karni's demand for money equation becomes:

$$M^d = \left[\frac{(P'X + wt_e)(PI + wt_w)a}{2i}\right]^{\frac{1}{2}}$$

idem., Time and Money, (February 1974), p. 47.

[13]The wage elasticity of the demand for money is therefore:

$$\eta_{M,w} = \frac{1}{2}\left[2 - \frac{PI}{Y} - \frac{P'X}{b}\right]$$

where: $Y = PI + wt_w$ and $b = P'X + wt_e$. ibid., p. 47.

efficient in exchange reducing the cost of conversion.[14]

The results are somewhat rigid and given the properties of the transactions model they must be. If exchange time declines then time in work must rise, since there is no room for leisure in this model. A further criticism of models of this type results from the consideration of costs of conversion from income yielding assets to money, but they ignore the conversion costs from money to market goods.

Now consider an expanded cash inventory model developed by Feige and Parkin. This model is to be viewed as an extension of portfolio theory to household behavior. This model allows for transactions costs associated with money-goods conversion as well as the bond-money conversion costs. Households may avoid these costs by holding inventories of bonds, money, market goods, and capital. However, there are inventory carrying costs which rise as inventories increase, mitigating the benefits derived from holding larger inventories as transactions costs rise.

The optimal number of trips to the bank and store, respectively n and m, depend upon total expenditure, rates of return on bonds and money, and inventory carrying costs for money, bonds and commodities.

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[14]The elasticity of real balances with respect to time in exchange is:

$$\eta_{M,t_e} = \frac{1}{2}\left[(1 - \frac{P'X}{b}) + (1 - \frac{PI}{Y})(\frac{d\ln t_w}{d\ln t_e})\right]$$

Since $d \ln t_e / d \ln H < 0$, the reduction in time in exchange means an increase in t_w. The effect on the quantity of real balances depends on:

$$(1 - \frac{P'X}{b}) \quad \gtrless \quad (1 - \frac{PI}{Y})(\frac{d\ln t_w}{d\ln t_e})$$

Therefore, the value of η_{M,t_e} depends on whether the share of time cost in exchange is greater than the share of time cost in total income.

In addition, the number of trips depends on the costs per transaction, B_b and B_q. Feige and Parkin describe these costs as "time, brokerage fees, and delivery charges."[15] Having derived the optimal number of trips to the bank and store, they derive the optimal quantities for Bonds, money and commodity inventories.[16] Since transactions costs include time costs, we can substitute for the B's a value of time component.[17]

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[15]Edgar L. Feige and Michael Parkin, "The Optimal Quantity of Money, Bonds, Commodity Inventories and Capital," American Economic Review 61, (June 1971), p. 339.

[16]
$$\overrightarrow{M}^* = \left[\frac{\beta_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_m)}\right]^{\frac{1}{2}} - \left[\frac{\beta_b(pq)}{2(r_m-\alpha_m+\alpha_q)}\right]^{\frac{1}{2}}$$

$$\overrightarrow{B}^* = \frac{pq}{2} - \left[\frac{\beta_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_q)}\right]^{\frac{1}{2}}$$

$$p\overrightarrow{Q}^* = \left[\frac{\beta_q(pq)}{2(r_m-\alpha_m+\alpha_q)}\right]^{\frac{1}{2}}$$

ibid., p. 341

[17]Substituting wt_b for β_b and wt_q for β_q we get:

$$\overrightarrow{M}^* = \left[\frac{wt_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_m)}\right]^{\frac{1}{2}} - \left[\frac{wt_q(pq)}{2(r_m-\alpha_m+\alpha_q)}\right]^{\frac{1}{2}}$$

$$\overrightarrow{B}^* = \frac{pq}{2} - \left[\frac{wt_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_m)}\right]^{\frac{1}{2}} \qquad p\overrightarrow{Q}^* = \left|\frac{wt_q(pq)}{2(r_m-\alpha_m+\alpha_q)}\right|^{\frac{1}{2}}$$

where: w is the wage rate and t_b and t_q are time used in money-bond conversion and money-market good conversion, respectively.

Increasing the time cost will reduce the number of trips to the bank and store, but how will it effect the demand for money?[18] It will reduce average bond holdings and trips to the bank which will tend to increase money inventories. However, it will reduce trips to the store increasing market good inventories and reducing money inventories. On balance we cannot tell what the result will be, it depends upon how the time allocation is affected. Increasing time cost will always lead to increases in market good inventories and this may not be true in the real world. You must assume households will continue to undertake activities

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[18] The effect on the demand for money of changes in the opportunity cost of time is:

$$\left.\frac{\partial \bar{M}}{\partial w}\right|_{pq} = \frac{1}{2}\left[\frac{w\frac{\partial t_b}{\partial w}(pq)+t_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_m)}\right]\left[\frac{wt_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_m)}\right]^{\frac{-1}{2}}$$

$$- \frac{1}{2}\left|\frac{w\frac{\partial t_q}{\partial w}(pq) + t_q(pq)}{2(r_m-\alpha_m+\alpha_q)}\right|\left|\frac{wt_q(pq)}{2(r_m-\alpha_m+\alpha_q)}\right|^{-\frac{1}{2}}$$

this becomes:

$$\eta_{\bar{M},w} = \left[\frac{wt_b(pq)}{2(r_b-\alpha_b-r_m+\alpha_m)}\right]^{\frac{1}{2}}\left[\frac{\eta_{t_b,w}+1}{2\bar{M}}\right]-\left[\frac{\eta_{t_q,w}+1}{2}\right]\left[\frac{p\bar{Q}}{\bar{M}}\right]$$

so that

$$\eta_{\bar{M},w} \gtrless 0 \quad \text{as} \quad \eta_{t_b,w} \gtrless -1 \quad \text{and as} \quad \eta_{t_q,w} \lessgtr -1$$

The wage elasticity will be positive if money-bond conversion time is not very responsive and if money-market good conversion time is very responsive to changes in the wage rate. But without an explicit knowledge of the time used in conversion and how it is affected by changes in the opportunity cost of time, we cannot say, a priori, what the impact of changing the wage will be.

in exactly the same manner even though costs have changed. All activities involving the household's time are more costly and it seems unlikely they will not respond. But in this inventory model there is no room for consumption responses (other than more is better), since the focus is on portfolio response.

If you assume the objective of the household is to maximize utility, then the household must operate under certain constraints in its attempt to achieve this goal. One of these constraints is wealth, and the household will alter the form in which it holds its wealth through signal given to it via rates of return on various forms of wealth. The allocation of time and resources to achieving an optimal portfolio result from the constraint that wealth puts on the bundle of commodities households can produce in achieving its objective of maximizing utility.

An individual undertakes investment in himself, increasing his stock of human capital becoming more efficient in market and non-market production, increasing his real income.[19] Reducing the constraint on household activity income plays is only a first step in the process of maximizing utility. Households engage in transactions in order to purchase goods and services, limited resources are expended to find an optimal bundle of these goods and services, again to achieve its goal of maximizing satisfaction. Inventory management is more a side relation to household behavior than a theoretical foundation of household activity.

Money provides a flow of productive services. This view is not

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[19]Ignoring any utility the individual may derive from the investment process itself.

new, it has been argued by many economists that money is a producers good.[20] But the emphasis here is to view it as a producers good to the household as well as the firm.[21]

Sinai and Stokes have developed and tested a model where real cash balances appear as an input in the production function of firms. They have found that it plays a significant role in the production process and output on an aggregate level. I propose that real cash balances should be viewed in the same way when looking at household behavior. Money as an input in the production process of the household yields a flow of services in several ways: it reduces the cost that households will incur in making market transactions; it reduces the cost of storing and processing information; it provides a hedge during times of uncertainty; and it influences the productivity of other inputs in the production function.[22]

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[20]See for example: Milton Friedman, "The Demand for Money: Some Theoretical and Empirical Results," Journal of Political Economy 67, (August 1959), pp. 327-51; idem., Optimum Quantity of Money (1969), pp. 1-50; Harry G. Johnson, "Inside Money, Outside Money, Income, Wealth, and Welfare in Monetary Theory," Journal of Money Credit and Banking 1, (February 1969), pp. 30-45; Patinkin, Money Interest and Prices, (1965); Don Patinkin and David Levhari, "The Role of Money in a Simple Growth Model," American Economic Review 58, (September 1968), pp. 713-58.

[21]Nadiri states, "Real cash balances serve as productive inputs. They are part of the working capital of the firm facilitating its productive process, often by indirect means such as hedging against changes in prices of Capital, Labor, and the interest rate. Holding adequate cash balances may reduce the uncertainty of meeting current payments, thus avoiding unnecessary and unprofitable liquidation of other assets." M.I. Nadiri, "The Determinants of Real Cash Balances in the U.S. Total Manufacturing Sector," Quarterly Journal of Economics 83, (May 1969), p. 175.

[22]Allen Sinai and Houston H. Stokes, "Real Money Balances: An Omitted Variabel from the Production Function?" Review of Economics and Statistics 54,(August 1972), pp. 290-6. Patinkin and Levhari, Money in a Growth Model, (September 1968), and Johnson, Inside and Outside Money

Fischer has shown that there are specific conditions, which must be satisfied, for real balances to be included in the production function. In particular, he concludes that to include real balances in the production function is only justified based on particular exchange arrangements:

> Real balances are not described as a factor because increases in real balances directly increase physical production but rather because real balances free resources which would otherwise be tied up in transactions.[23]

This is exactly the context in which I view the role of real balances to the household, since the household's non-market time is required to make transactions. It is the non-market time which can be used to produce commodities or it may be engaged in market transactions. Holding a larger stock of real cash balances reduces the time involved in making transactions, concomitantly, increasing the time available for production or leisure. This is the justification for including real cash balances in the production function, and as Fischer has stated "that the holding of real balances economizes on the use of other factors does indeed justify putting money in the production function."[24]

This approach has money playing a critical role in the household's decision making process, it is crucial to making planning decisions in the goods market as well as in the labor market. Changes in these markets will result in a re-evaluation by the household with regard to

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(February 1969) have argued that money should be included as an input in an aggregate production function. John R. Moroney, "The Current State of Money and Production Theory," American Economic Review 62, (May 1972), pp. 335-43, criticizes this approach and argues that money should be looked at as a technological factor effecting production.

[23]Stanley Fischer, "Money and the Production Function," Economic Inquiry 12, (December 1974), p. 525.

[24]Ibid., p. 518.

its holdings of real cash balances, but equally important are changes in the household's quantity of real cash balances can effect its decisions with regard to the markets it operates, as well as the commodities it produces.

The analysis will use a household production function framework to look at money's role.[25] In this type of model the household is viewed as being analogous to a firm in that it uses inputs, market goods and time, which it combines in a production process of the household to produce commodities. It is these commodities that enter the utility function directly. The household is subject to a budget constraint which combines a time constraint as well as an income and wealth constraint. Thus the household is not only limited by its income and wealth, but it is also limited in the time available to it for the purpose of producing commodities.[26]

Households will differ in many ways such as size, age, education, or what has been called in the household models their "household specific human capital." Variations in the household specific human capital will effect: the wage rate and therefore income; the demand for goods purchased in the market as well as the type of goods demanded; the

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[25]For the development of the household production model and some applications see: Gary S. Becker, "A Theory of the Allocation of Time," Economic Journal 75, (September 1965), pp. 493-517; Kelvin J. Lancaster, "A New Approach to Consumer Thoery," Journal of Political Economy 74, (April 1966), pp. 132-57; Michael and Becker, New Consumer Theory, (December 1973), pp. 378-96; Michael Grossman, The Demand for Health: A Theoretical and Empirical Investigation, Occasional Paper 116, (New York: N.B.E.R., 1972); Robert T. Michael, The Effect of Education on Efficiency in Consumption, Occasional Paper 119, (New York: N.B.E.R., 1972).

[26]See Michael and Becker, New Consumer Theory, (December 1973) for an explanation of what commodities are.

decisions in the labor market and therefore, their allocation of time in market and non-market production.[27]

In the traditional household model market goods and non-market time are viewed as inputs in the production process and in this study real cash balances are added, as a third input, in the production function. The rationale is, since real cash balances provide a flow of productive services to the household they should be included as an input.

In an economy where transactions are made through a medium of exchange, money, households will use this asset as a substitute for time allocated to make market transactions. The existence of money reduces the cost to the household of engaging in market transactions. The price of time is evaluated at the market wage rate and as such is a shadow price; since it reflects the opportunity cost of non-market time used in household production. The more costly the opportunity cost of time, ceteris paribus, the more costly for the household to use time inputs in producing commodities.

Increasing the wage will increase the household's income. The higher income will expand the opportunity set of commodities the household can produce. Using the traditional phraseology, the household will purchase more market goods and this will increase the demand for money. Part of this increase occurs because the household can substitute market goods for time, in effect it is as if the household buys time. To illustrate this point, a dinner can be prepared at home, which is a time

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[27]"The production model . . . , also brings out the interdependence of several household decisions: decisions about family labor supply and time and goods expenditures in a single period analysis, and decisions about Marriage, Family Size, Labor Force attachment, and the expenditures on goods and Human Capital Investments in a Life Cycle Analysis." ibid., p. 388.

intensive process, or purchased in a restaurant. If money is a substitute for non-labor market transactions time, then increasing the household's average money balances increases the time available for household production of utility.[28]

In this model the demand for market goods, time, and real cash balances are viewed as derived demands for inputs in the production of commodities. These inputs do not enter the utility function directly but they are combined in household production to product commodities, and it is the commodities that enter the utility function. Holding real cash balances, by itself, does not yield utility in this model, but it is the productive services of real cash balances, just as the other inputs provide productive services, and the output resulting from these services in a production process that provides utility to the household.

In some sense we can measure the additional utility resulting from a greater output in the household due to the fact that money increases the household's productivity. The economic reality is that the household is more efficient in the use of its inputs because of the existence of money. Therefore, under a given full income constraint, a greater bundle of commodities is made available and a higher level of satisfaction attained.

Variations in the household's quantity of real cash balances due to exogenous factors will result in variations in the productivity of

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[28]Dutton and Gramm conclude, "Since an increase in leisure may be purchased by decreasing work or by increasing money balances (i.e., saving transactions time) an increase in the wage results therefore in an increase in the relative price of purchasing leisure by decreasing work. Thus it follows that an increase in the wage rate will increase the demand for money independent of any increase in transactions." Dutton and Gramm, Transactions Costs, Wage Rate and Money, (September 1973), p. 664.

the other inputs as well. The household acting as a utility maximizer will reallocate the use of its inputs to achieve this goal. Changes in the costs of holding real cash balances will also result in a reallocation of inputs in production.

There are exogenous factors whose variations will effect the other inputs, market goods and time, in the household's production function which will in turn effect the household's demand for money. Changes in the labor market, effecting the household's wage rate, will alter the opportunity cost of time in the household and therefore, there will be a change in the demand for real balances and market goods. In addition, movements in the price level will not only effect the demand for market goods and possibly the real wage, but also the stock of real cash balances, resulting in all sorts of variations in the demand for inputs.

The crucial role money plays in a model of this kind can be illustrated by the following explanation. Money provides a signal to the household as well as the firm by providing information as to what is happening in the surrounding environment. When an unanticipated rise in the price level occurs, the household realizes its money income, if unchanged, is no longer sufficient to maintain its production of the same bundle of commodities and may alter the use of inputs in production. The household will evaluate the effect on its real wage in relation to its experience with real cash balances, and any change in the real wage may alter labor market participation and the use of time in production. Its experience with real balances may also be used to evaluate its holdings of non-human wealth, possibly resulting in an alteration of the forms in which it is held.

It is in this context money is the critical link for the household. Money is important in that it provides information on a microeconomic level to the household about macroeconomic phenomenon. It provides a basis whereby, the household can evaluate its position in the surrounding environment and to changes in this environment. The reaction of the household to changes in this environment may be to alter its production processes, i.e., the mix of commodities providing it with the most satisfaction. Obviously, its ability to do so will depend upon its household specific environmental variables.

CHAPTER III

A HOUSEHOLD PRODUCTION FUNCTION MODEL WITH REAL CASH BALANCES

The previous chapter introduces a new way of viewing the household's demand for money. In this chapter a formal framework of the household production model is developed with real cash balances. The first part of this chapter develops the model, and the second part discusses the important variables in the model and the way in which they are expected to influence the demand for money.

It must be emphasized that the model developed here is a general framework in which to view the household's demand for money. The idea is to keep the model general, because the purpose of the study is to provide a satisfactory model to describe and analyze the demand for money by households, without partitioning its demand into separate models needed to explain various motives for holding and using money.

The Model

The utility function that households will maximize is assumed to take the following form:

$$U = U(Z_1, Z_2) \tag{1}$$

where: Z_1 and Z_2 are representative commodities produced by the household.

Z_1 is a commodity which is relatively market good and money intensive in production.[1] Z_2 is a commodity which is relatively time intensive in production.[2] Utility is a function of the commodity bundle produced and consumed by the household. For each commodity there is a production function using three inputs -- market goods, real cash balances, and non-market time. In addition, the production process is affected by household specific environmental variables. Thus, the typical production function for the Jth commodity will take the following form:

$$Z_j = Z_j(X_j, t_j, m_j: H) \qquad j = 1,2. \qquad (2)$$

where: X_j is a vector of market goods used in the production of Z_j.

t_j is non-market time used in the production of Z_j.

m_j is a flow of productive services proportional to the stock of real cash balances used to purchase market goods.[3]

H is a vector of household environmental variables.

The commodities produced using these inputs cannot be purchased in the market. They must be produced in the household using these

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[1]Intensity is defined as:

$$\frac{P_1X_1}{\pi_1Z_1} > \frac{P_2X_2}{\pi_2Z_2}$$

[2]Intensity is defined as:

$$\frac{wt_1}{\pi_2Z_2} < \frac{wt_2}{\pi_2Z_2}$$

[3]Strictly speaking, all of the inputs in the production function must be flow variables. Therefore, for simplicity, real cash balances (m) in the production function is to be viewed as a flow of services proportional to the stock of real balances.

inputs. It is assumed that marginal products are positive and diminishing.

At this point it is important to point out the nature of the relationship that exists betwenn the three inputs. A complementary relationship is assumed to exist between real balances (m) and market goods (X). This complementarity results from what has previously been referred to in the literature as the transactions demand for money. Therefore, one would expect the Allen partial elasticity of substitution of real balances for market goods to be less than or equal to zero. Note that if the Allen partial is equal to zero, real balances and market goods are perfect complements and money is used for transactions purposes only. If the Allen partial is less than zero, real balances and market goods are complements, but not perfect complements, and money is held for other reasons as well.

It is necessary that the substitution relationship dominate between the inputs. It does in this model because real balances and non-market time are assumed to be substitutes, and market goods and non-market time are also assumed to be substitutes for each other.

The household is subject to two constraints. The first, is an income constraint and is assumed to take the following form:

$$Y = \Sigma P_j X_j \qquad j = 1, 2. \tag{3}$$

where: Y is money income,

P_j is a vector of the prices of market goods X_j.

The second is a time constraint which takes the following form:

$$\Omega = t_w + \Sigma t_j \tag{4}$$

where: Ω is the total time available to the household,

t_w is time allocated by the household to labor market activity,

t_j is the time available to the household for the production of commodities.

The two constraints are combined into a full income constraint, and this is done by extending equation (3)

$$Y = \Sigma P_j X_j = wt_w + \rho(V - M) \qquad (5)$$

where: W is the money wage rate,

V is the nominal value of non-human wealth,

M is the nominal quantity of money held,

ρ is the nominal rate of interest.

The household's money income is derived from its labor market income (wt_w) and income from its non-human wealth (ρV). If non-human wealth is defined to be only bonds the formulation is correct as shown i.e., $\rho(V-M)$. But if assets other than bonds are included in non-human wealth -- equities for example -- then the formulation must be modified: $rV_e + \rho(V_b - M)$ would be correct. The rate of return on equities is a real rate of return (r), while the rate of return on bonds, a fixed price and fixed income asset, is the nominal rate of interest (ρ). Non-human wealth in this model can be extended to include all possible assets, however, for simplicity the model will be kept in the form shown in equation (5).

The proportion of its non-human wealth the household keeps in the form of money reduces the flow of money income evaluated at the

nominal rate of interest. The opportunity cost of money must be evaluated at the nominal rate of interest, which has two components. The first, foregone real rate of interest. The second, the expected depreciation (appreciation) resulting from inflation (deflation). Holding a proportion of its wealth in money, exposes the household to possible capital gains (losses) due to price level changes. Rearranging equation (4) and substituting into equation (5) gives:

$$\Sigma P_j X_j = w(\Omega - \Sigma t_j) + \rho V - \rho M = w\Sigma t_j + w\Omega + \rho V - \rho M \qquad (6)$$

Rearranging terms yields:

$$F = w\Omega + \rho V = \Sigma P_j X_j + w\Sigma t_j + \rho M \qquad (7)$$

and since there are only two commodities, this equation can be further extended to:

$$F = w\Omega + \rho V = P_1 X_1 + P_2 X_2 + wt_1 + wt_2 + \rho M_1 + \rho M_2 \qquad (8)$$

This is the full income constraint. If we deflate by a general price index we get the real full income constraint.[4]

$$\frac{F}{P_o} = \frac{w}{P_o}\Omega + \rho\frac{V}{P_o} = \frac{P_1}{P_o}X_1 + \frac{P_2}{P_o}X_2 + \frac{wt_1}{P_o} + \frac{wt_2}{P_o} + \rho\frac{M_1}{P_o} + \rho\frac{M_2}{P_o} \qquad (9)$$

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[4]If the general price index used to deflate the full income constraint is identical to the P_j vector, then the X's will appear in the full income constraint alone. This is an unlikely result. The method of constructing a general price level is such that it is unlikely any particular household will purchase an identical set of market goods, and the

Thus, the opportunity cost of the household's non-market time is evaluated at the real wage rate and the opportunity cost of the household's real cash balances is evaluated at the nominal rate of interest.

Combining the utility function and the full income constraint will allow us to look at the conditions for utility maximization in the household. The following Lagrangian equation is formed:

$$L = U(Z_1, Z_2) + \lambda\left[\frac{F}{P_o} - \Sigma\frac{P_j}{P_o}X_j - \frac{w\Sigma t_j}{P_o} - \rho\frac{M}{P_o}\right] \qquad (10)$$

where: λ is the Langrangian multiplier.

In order to derive the first order conditions for utility maximization, subject to a full income constraint, the partial derivatives of L with respect to Z_j, X_j, t_j, m_j, and λ. Letting:

$$u_j = \frac{\partial U}{\partial Z_j}; \quad f_x = \frac{\partial Z_j}{\partial x_j}; \quad f_t = \frac{\partial Z_j}{\partial t_j}; \quad f_m = \frac{\partial Z_j}{\partial m_j}$$

we get the following first order conditions:

$$\frac{\partial L}{\partial Z_j} = u_j - \lambda\left[\frac{P_j}{P_o}\frac{dX_j}{dZ_j} + \frac{w}{P_o}\frac{dt_j}{dZ_j} + \rho\frac{dm_j}{dZ_j}\right] = 0 \qquad (11a)$$

$$\frac{\partial L}{\partial X_j} = u_j f_x - \lambda\frac{P_j}{P_o} = 0 \qquad (11b)$$

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expenditure shares (even if it does purchase an identical set) will probably be different.

$$\frac{\partial L}{\partial t_j} = u_j f_t - \lambda \frac{w}{P_o} = 0 \qquad (11c)$$

$$\frac{\partial L}{\partial m_j} = u_j f_m - \lambda \rho = 0 \qquad (11d)$$

$$\frac{\partial L}{\partial \lambda} = \frac{F}{P_o} - \frac{P_1 X_1}{P_o} - \frac{P_2 X_2}{P_o} - \frac{wt_1}{P_o} - \frac{wt_2}{P_o} - \rho m_1 - \rho m_2 \qquad (11e)$$

We have here the familiar first order conditions for utility maximization, the marginal rate of substitution in consumption is equal to the price ratio:

$$\frac{u_1}{u_2} = \frac{\frac{P_1}{P_o}\frac{dX_1}{dZ_1} + \frac{w}{P_o}\frac{dt_1}{dZ_1} + \rho\frac{dm_1}{dZ_1}}{\frac{P_2}{P_o}\frac{dX_2}{iZ_2} + \frac{w}{P_o}\frac{dt_2}{dZ_2} + \rho\frac{dm_2}{dZ_2}} = \frac{\pi_1}{\pi_2} \qquad (12)$$

where: π_j is the shadow price of Z_j.

To minimize the cost of producing a given commodity you must satisfy the following familiar condition:

$$\pi_j = \frac{\frac{P_j}{P_o}}{f_x} = \frac{\frac{w}{P_o}}{f_t} = \frac{\rho}{f_m} \qquad (13)$$

Inputs are used up to the point where the price ratios are equal to the ratios of their marginal products. In addition, we would expect the marginal products of any input to be equalized in the two

commodities. Assuming the second order conditions for a maximum hold, it would be useful to outline the cost functions for commodities to see the influence of real balances on the cost side.

Let the total cost of producing any commodity be given by:

$$TC_J = \frac{P_j}{P_o} X_j + \frac{w}{P_o} t_j + \rho m_j \qquad (14)$$

Therefore, the average cost of producing any commodity will be:

$$AC_j = \frac{\frac{P_j}{P_o} X_j + \frac{w}{P_o} t_j + \rho m_j}{Z_j} \qquad (15)$$

The marginal cost of producing any commodity will be:

$$MC_j = \frac{P_j}{P_o} \frac{dX_j}{dZ_j} + \frac{w}{P_o} \frac{dt_j}{dZ_j} + \frac{dm_j}{dZ_j} \qquad (16)$$

The demand function for a commodity will take the following general form:

$$Z_j^d = Z_j^d\left(\frac{F}{P_o}, \frac{\pi_j}{P_o}, \ldots\right) = Z_j^d\left(\frac{F}{P_o}, \frac{w}{P_o}, \frac{P_j}{P_o}, \rho, \ldots\right) \qquad (17)$$

The demand for an input used in the production of the Jth commodity, particularly, the demand for money will be:

$$m_j^d = m_j^d\left(\frac{P_j}{P_o}, \frac{w}{P_o}, \rho, \frac{F}{P_o}, \ldots\right)^5 \qquad (18)$$

Aggregating the demand for money for the two commodities appearing in the utility function we get:

$$m^d = m^d\left(\rho, \frac{w}{P_o}, \frac{\Sigma P_j}{P_o}, \frac{F}{P_o}; H\right) \qquad (19)$$

The demand for real cash balances in the household will depend upon the interest rate, the wage rate, the prices of market goods, full income, and other household environmental variables influencing the demand function.

The demand for money in this model is not strictly limited to a transactions demand for money, even though a major justification for including money in the production function is due to the existence of transactions costs. The model, as formulated, is sufficiently general to include all motives the household may have for demanding real cash balances. Other motives, for example precautionary and speculative,

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[5]It would be difficult to partition a dollar held by the household for use in the production of Z_1 or Z_2 or any other possible commodity for that matter. But we are not looking at the demand for money in the production of any particular commodity. If we were there would be problems of joint production and possibly others. The model is to be viewed as providing a framework for analyzing the demand for money in general, and not as an analysis of its impact on specific commodities contained in the utility function. The actual commodities appearing in the utility function are not important to the analysis.

for demanding real cash balances could be introduced into the utility function as commodities. These commodities must be produced by the household and we would expect the money input to play a significant role in the production process.

Clearly, this demand function is different than the traditional demand for money function. It is a derived demand for an input in household production, and it is expected to be affected by its own price ($\partial m/\partial p < 0$), as well as the prices of the other inputs ($\partial m/\partial \frac{P_1}{P_o} < 0; \partial m/\partial \frac{w}{P_o} > 0$) in production. The wage rate, which is the shadow price of non-market time, traditionally leisure, has not been considered, until recently, a relevant argument in the demand for money.

The Important Variables

The nominal interest rate is the opportunity cost of using real cash balances in household production. One part of this cost is the income foregone by holding money rather than shorter securities, time deposits, or any other form of income yielding asset. A second part of this cost is the depreciation resulting from a reduction in the purchasing power of money due to expected increases in the general price level.

What will be the effect of variations in the interest rate on the demand for money? An increase in the rate of interest will raise the cost of this input relative to other inputs in the production of any commodity using this input, and therefore, will increase the marginal cost of producing any commodity using money as an input. Assuming the demand for these commodities is normal, there will be a reduction in the quantity demanded of all commodities, Let's leave this

aspect aside for the moment.

When the price of money has risen relative to the other inputs in production, ther will be a tendency to substitute in production away from money into those inputs which have become relatively less expensive. However, it is expected, a priori, money and market goods are complementary inputs in production. Therefore, an increase in the interest rate will result in substitution away from market goods and money into time in the production function. One possibility, the household will wish to hold less money for production pruposes, preferring to hold income yielding assets when the interest rate rises, and it will substitute time for money and market goods in production. Another possibility, the household could substitute time for moeny in a conversion process holding the expenditures on market goods constant. The household could use time to convert income yielding assets into money as purchases of market goods are required.[6]

But the above analysis is only substitution in production, and we would expect substitution to occur in the consumption of commodities as well. Those commodities which are relatively money and market good intensive in production (Z_1) will experience a proportionately larger increase in their marginal cost, as compared to those commodities which are relatively time intensive in their production (Z_2). We would expect

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[6]A process of this type may, in addition, involve brokers costs, which result from purchase and sale of income yeilding assets.

the household to substitute in consumption away from Z_1 into Z_2.[7]

If the higher interest rate increases the household's income from non-human wealth there could be an income effect. On balance, we would expect the substitution effects to dominate, resulting in an inverse relationship between the demand for money and the rate of interest.

In addition, the proportion of full income derived from non-human wealth will be a significant determinant of the household's behavior with regard to a change in the rate of interest. For example, suppose there are two households having the same full income. The first has a higher proportion of its full income derived from non-human wealth, while the second has a relatively high wage rate and a relatively smaller proportion of full income derived from non-human wealth. Assuming both households are equally efficient in production, then the household with the higher wage (a higher opportunity cost of non-market time) will produce commodities which are relatively more market good and money intensive, since these are relatively less costly to produce. The household with the relatively lower wage will produce commodities which are relatively time intensive. We might expect a rise in the rate of interest to have a greater impact on those households whose wage rate makes up a greater proportion of its full income. Therefore, we would expect the effect of the interest rate on the demand for money

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[7] From the first order conditions:

$$\frac{u_1}{u_2} = \frac{\pi_1}{\pi_2}$$

The marginal cost of Z_1 goes up relative to the marginal cost of Z_2 and the right hand side of the equation rises, so you must substitute in consumption.

to be smaller, ceteris paribus, for those households having a greater proportion of their full income derived from non-human wealth.

The wage rate, the opportunity cost of the household's non-market time, is used to evaluate this input in the production process of the household. Variations in the wage rate, ceteris paribus, will have several effects. An income compensated increase in the wage increases the relative cost of this input in production, and we could expect substitution away from this input toward market goods and money in the production of any commodity.

In addition, the household will substitute among commodities in consumption as the wage rate rises. The household will substitute out of the time intensive commodity (Z_2) into the market good and money intensive commodity (Z_1). This is because of the rise in the marginal cost of producing (Z_2) is greater than the rise in the cost of (Z_1), resulting in substitution in consumption from the former into the latter.

The increase in the price of the time input raises the household's price level or the cost of production, although this is somewhat mitigated via substitution in production and consumption. However, an increase in the wage will increase the household's full income, increasing the demand for all commodities. Therefore, a priori, we expect the demand for money to be positively related to the wage rate.

The emphasis of the household model as developed, here and elsewhere, is to view the household as a unit, and not look at individuals behavior in isolation. The model is easily expanded to a two person household. Although an expanded model will not be elaborated upon, some implications are worthwhile looking into.

Consider a household with two adults and suppose one of the adults is not in the labor force, i.e., the home person. Although the home person does forego a potential wage by not being in the labor force, assume there are infants which preclude the possibility of working in the market. This will effectively reduce the cost of the home person's time. It is expected that households with one non-working spouse, as compared to households where both adults work, will hold on an average less money balances. It is not unrealistic to assume that in households where there is a non-working spouse there is a bias toward commodities, which are time intensive in their production processes. If we assume the non-working spouse to be specializing in transactions due to the relatively low price of time, this will further reduce the households average money holdings. This will, especially, be true if specialization increases the efficiency of engaging in transactions.

Now consider the case where both adults are in the labor force. It is possible that the wife may only be employed part-time, however, the wife will still have a higher price of non-market time, evaluated at the market wage, than in the previous case where the home person was not in the labor force. A priori, it is expected in households where there are two working adults, ceteris paribus, the average holding of money balances will be higher than in those households where there is only one working adult. In general, holding family income constant and taking the ratio of the wife's to husband's wage, it is expected a rise in this ratio will increase the households demand for money.

The price of market goods, as the third input in the production function, is expected to be negatively related to the demand for real

cash balances. Obviously, an increase in the price level will reduce the quantity of real cash balances held by the household, and therefore, a given nominal quantity of money will not be able to purchase the same quantity of market goods. However, this issue will be left aside, for the moment.

As the price of market goods rises, the cost of this input increases relative to the others in production. Since real balances and market goods are complements in production, the household will substitute away from market goods as the price level rises, and will substitute away from real balances. There will also be substitution in consumption out of Z_1 into Z_2, since the marginal cost of Z_1 rises more than the marginal cost of Z_2.[8] This substitution will reduce the demand for money.

There is still the income effect to deal with, since an exogenous increase in the price of market goods will increase the cost of production in the household, reducing the real full income and the demand for commodities in general.[9] A given quantity of money the household holds will decline in real value, reducing wealth. The household's real wage may decline and not only will the relative price of the household's time decline, but it will decline in absolute terms. The substitution effects previously discussed will be enhanced, further

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[8]Even if the prices in the P_1 and P_2 vectors rise by the same proportion, the marginal cost of Z_1 will rise relative to the marginal cost of Z_2. This results from the expenditure share of market goods in Z_1 being greater than in Z_2.

[9]A rise in the general price level not resulting from a proportionate rise in all prices.

reducing the real full income.

The effect on the household's non-human wealth is not obvious. It will depend on the forms of wealth held in the household's portfolio and this cannot be determined, a priori. The rising price level will reduce the value of those assets fixed in nominal terms, increase the value of those whose prices rise at the same rate. Taking all of these effects into consideration, it is believed that an inverse relationship exists between the prices of market goods and the demand for money.

There is still some difference of opinion as to whether income, wealth or both income and wealth are the relevant constraint on the demand for money. The demand for money function formulated here includes full income as an argument, where full income is income from human and non-human wealth.

Wealth is an important constraint on the household's utility function, and since the income from non-human wealth appears in the full income constraint, the household production model treats the wealth constraint explicitly. The household's wealth will be affected by capital gains (losses), inheritances and gifts, as well as numerous other events, which can influence wealth. Increases in the household's non-human wealth will increase the household's full income and, therefore, increase the demand for commodities. The impact of changes in non-human wealth on the demand for inputs in production will depend upon the wealth elasticities of demand for the commodities produced by the household. An increase in the household's non-human wealth is expected to increase the demand for real balances.

Consider the proportion of full income derived from non-human wealth (ρV), since money is one form of holding non-human wealth the larger is the proportion of non-human wealth held in money, the smaller the income from non-human wealth (since $\rho(v-m)$). As the ratio of money to non-human wealth rises the income from non-human wealth declines, however, this does not necessarily mean full income will decline. Increasing the household's money holdings will reduce time needed for transactions, increasing time available for producing commodities.

The household model clearly illustrates the role of wealth in the demand for money. Total wealth or full income will constrain the utility function, however, the ratio of human to non-human wealth will influence the type of commodities produced, and therefore, the derived demand for money. As $w\Omega / \rho V$ rises, it is relatively more costly for the household to produce time intensive commodities, and relatively less costly to produce goods intensive commodities, increasing the demand for money.

The demand for real cash balances will be affected by both human and non-human wealth, but the model emphasizes that income from human wealth will be important, not as total labor market income, but as represented by the wage rate. This is not to say total labor market income is not important. As the wage rate increases there is an income effect, but the rising shadow price of time results in a change in the commodities produced by the household: the demand for money must rise.

An important variable appearing in the household production literature is human capital. It is argued, the greater the quantity

of human capital, the more efficient the household will be in market as well as non-market production. The effect is manifested in the production function by increasing the marginal products of the inputs. The effect can be analogous to a neutral technological change on the inputs in production, i.e., increasing all of the marginal products by the same proportion.

Increasing the marginal products of all the inputs reduces the marginal cost of producing each commodity and increases the household's real full income by reducing the cost of production. There will be an increase in the demand for commodities due to a rise in real full income, resulting from an increase in human capital. If the increase in the demand for a commodity is greater than the productivity effect, there will be an increase in the demand for factors of production used in the production of that commodity.[10]

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[10] $\hat{Y}_c = \hat{MP}^E = -\hat{\pi}$

$\hat{Z}^d = \hat{\eta}_j(\hat{Y}_c)$

since: $\hat{X}_j = \hat{Z}_j^d - \hat{MP}^E = \hat{Y}_c(\eta_j - 1)$

then: $\hat{X}_j \gtrless 0$ as $\eta_j \gtrless 1$

where: η_j is the income elasticity of demand for Z_j.

$\hat{X}_j$ is the percentage change in demand for X_j an input in the production of Z_j.

$\hat{MP}^E$ is the percentage change in the marginal product due to changes in human capital

$\hat{Y}_c$ is the percentage change in consumption income

Michael, Efficiency in Consumption (1972), p. 19.

Assuming the income elasticity of demand for Z_1 is greater than one, and the income elasticity of demand for Z_2 is less than one, the effect of an increase in human capital would be to increase the demand for Z_1 proportionately more than the demand for Z_2. This will result in a proportionate increase in the demand for money and market goods, which are relatively intensive inputs in Z_1, and a proportionate decrease in the demand for non-market time, which is the relatively intensive input in Z_2.[11]

If higher levels of human capital increase the efficiency of market and non-market production, we might also expect it to increase the efficiency of the household in the management of its portfolio. Having higher levels of human capital would make the household more efficient in acquiring and processing information about the environment in which it operates. Therefore, we would expect households to be more efficient in anticipating changes in the prices in the securities market, in the goods market, as well as finding the best forms in which to hold its wealth.

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[11]Note that if:

$$\eta_1 > 1 \text{ than } X_1,\ t_1,\ m_1 > 0$$

$$\eta_2 < 1 \text{ than } X_2,\ t_2,\ m_2 < 0$$

Since the share in production of Z_1 is greater for X and m and the share in production of Z_2 is relatively greater for t, there will be a proportionate increase in the demand for money and market goods and a proportionate decrease in the demand for t. However, if the magnitudes of the income elasticities are reversed, i.e., $\eta_1 < 1$ and $\eta_2 > 1$, then the impact on the inputs will be reversed. Since either of these alternatives is possible, a priori, the effect of education in ambigous.

CHAPTER IV

EMPIRICAL TESTS OF THE HOUSEHOLD'S DEMAND FOR MONEY

In this chapter empirical tests of the demand for money are presented. The demand for money tested here is a cross sectional one using the Consumer Union Panel Survey. The focus of this chapter will be to test empirically the value of time hypothesis as well as the effect of other household variables on the demand for money.

It will be shown that the demand for money is positively related to the wage rate and, in addition, which family member's time is more relevant in determining the demand for money in the household. The thrust of the empirical analysis is to view the household as a unit with both adults' behavior determining the demand for money. This differs from previous work on household money functions, especially, the time series analysis which glosses over these differences.

The Data

The data base used for the empirical analysis is the Consumer Union Panel Survey (CUP) of 1958-60.[1] The CUP data is not a random sample, it is not even a random sample of the members of Consumer Union, however, it is an extremely rich data source and is well suited to testing a household demand for money function. Questionnaires were sent to those members of Consumer Union who expressed a willingness to

[1]The Consumer Union Panel Survey was conducted under the supervision of Professor Albert G. Hart of Columbia University.

provide detailed information about their finances and income. There were four waves of questionnaires sent and received but the empirical work of this study is based almost entirely on the fourth wave of information.

The data consists of 6227 households with 265 items of information per household. The characteristics of the households in this sample are not representative of the population as a whole. The respondents are highly educated , as can be seen from appendix table A.1, 61.8% of the heads of households had four or more years of higher education. From Appendix table A.2 we can see that 37.7% of the wives had attained a college degree or more and an additional 20.1% had attended college for some period of time. As members of consumer union these people are information seekers and their behavior, we would expect, comes much closer to the rational economic man that economists talk about.

These respondents represent an over income and an over wealth distribution as compared to the general population.

Median family income after tax in 1959, appendix table A.3, was almost $9,000, high for that year. Median income for the husband before tax was about $9,000, and the median income for the wife between $2,000 - $3,000, appendix tables A.4 and A.5. The median wage of the wife in 1959, appendix table A.6, was between $2 - $3. From appendix table A.7 we see that the median net worth was about $25,000. Table 4.1 contains the means and standard deviation of several variables contained in the data.

Some further interesting characteristics of this sample are: 80% of the respondents owned their own home; 45% owned some common

TABLE 4.1

MEANS AND STANDARD DEVIATIONS OF
VARIABLES USED IN REGRESSIONS

	MEANS	ST. DEV.
CHECKING ACCOUNT	810.97	1,420.29
SAVINGS ACCOUNT	2,321.97	5,089.24
BONDS	2,833.31	21,979.77
BONDS + SAVINGS ACCOUNT	5,154.87	23,426.91
FAMILY INCOME 1959	11,490.42	7,796.54
PERMANENT FAMILY INCOME	11,963.94	7,440.90
HUSBANDS INCOME 1959	10,171.80	7,429.50
HUSBANDS PERMANENT INCOME	10,335.27	6,818.87
WIFES INCOME 1959	1,032.61	2,762.10
WIFES WAGE 1959	3.50	13.35
RATIO OF WIFES WAGE TO HUSBANDS INCOME	.001	.002
REGIONAL PRICE LEVEL(1947-49=100)	126.86	3.24
REGIONAL INTEREST	.033	.002
TOTAL ASSETS	54,913.47	109,619.00
NETWORTH	45,700.95	106,625.00
FAMILY SIZE	3.95	1.49
AGE OF HEAD	42.72	8.83
WIFES NOT IN LABOR FORCE	.725	.447
HUSBANDS EDUCATION	.618	.486
WIFES EDUCATION	.377	.485
PRICE EXPECTATIONS	.577	.494
HOME OWNER	.819	.385
OCCUPATION OF HEAD	.714	.452
RESIDENCE IN URBAN AREA	.627	.484
OWNS COMMON STOCK OR MUTUAL FUND	.483	.500

TABLE 4.1 (cont.)

MEANS AND STANDARD DEVIATIONS OF
VARIABLES USED IN REGRESSIONS

	MEANS	ST. DEV.
OWNS PREFERRED STOCK OR CORPORATE BONDS	.096	.294
RECEIVED A GIFT OR A BEQUEST	.571	.495
HOUSEHOLDS EXPECTATION OF BUSINESS CONDITIONS	.167	.373
EXPECTATION OF HOUSEHOLDS FINANCIAL CONDITION	.072	.259
HOUSEHOLD EXPERIENCED A CAPITAL GAIN	.159	.365
HOUSEHOLD EXPERIENCED A CAPITAL LOSS	.045	.208

stock; 48% owned common stock and/or mutual fund shares; 10% of the respondents owned corporated bonds or preferred stock; 519 of the households had a net worth of $100,000 or more and several over $1 million. The sample is also unusual in that there are many wealthy households who are willing to provide detailed information about their finances. In addition, given the detailed nature of the questions many of the respondents used their records in providing information.

There have been numerous empirical studies of the demand for money by households, several take the form of cross sectional analysis[2] but the majority have been aggregate time series.[3] Before a discussion of which variables are significant in determining the household's demand for money, one must deal with the problem of what is the appropriate definition of money? There is still no concensus of opinion as to whether money should be defined as: currency plus demand deposits; currency plus demand demand deposits plus time deposits; or expanded even further to include other relatively liquid assets.

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[2]See for example: Edgar L. Feige, The Demand for Liquid Assets: A Temporal Cross-Sectional Analysis (Englewood Cliffs: Prentice Hall, 1964); Harold W. Guthrie, "Consumers Propensity to Hold Liquid Assets," Journal of the American Statistical Association 55 (September 1960), pp. 469-89; Mordechai E. Krenin, "Analysis of Liquid Asset Ownership," Review of Economics and Statistics 43 (February 1961), pp. 76-80; Tong H. Lee, "Income, Wealth, and the Demand for Money: Some Evidence from Cross-Section Data," Journal of the American Statistical Association 59 (September 1964), pp. 746-62; Richard E. Peterson, A Cross-Section Study of the Demand for Money: The United States, 1960-62," Journal of Finance 29 (March 1974), pp. 73-88.

[3]See for example: Michael J. Hamburger, "The Demand for Money by Households, Money Substitutes, and Monetary Policy," Journal of Political Economy 74 (December 1966), pp. 600-23; Robert J. Barro and Anthony M. Santomero, "Household Money Holdings and the Demand Deposit Rate," Journal of Money Credit and Banking 4 (May 1972), pp. 397-413; Dutton and Gramm, Transactions Costs, Wage Rate and Money, (September 1973), pp. 652-65; Karni, Time and Money, (February 1974), pp. 45-64.

The issue of what is the appropriate definition of money can possibly be illuminated by the household model. If money is a substitute for time in household production, then currency plus demand deposits may be the most appropriate definition. This results from the characteristics of other relatively liquid assets which require an input of household time to make them truly liquid. As the definition of money is expanded to encompass additional relatively liquid assets, the time input required to actually make them liquid increases.

In this chapter the regressions use demand deposits as the definition of money in testing the value of time hypothesis. Currency is not included in the regressions tested since information about the household's currency holdings were not included in the data.[4]

In previous studies the definitions of wealth used as an explanitory variable differed. Some studies have used total assets and others have used net worth. Limitations in the data have precluded using both. All regressions were tested first using total assets and were then retested using net worth. This will give us an indication of which of the two is the better empirical proxy for non-human wealth.

As a result of the way in which income was reported by the respondents it is not possible to fully test the value of time hypothesis. This is particularly a problem because the husband's income is reported but there is no information provided about hours worked or weeks worked. The husband's income variable also includes income from non-human wealth. It is impossible, therefore, to compute a wage for the husband and thus

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[4]Many previous studies also did not include currency in the dependent variable because it was not available in the data. Peterson, Demand for Money, (March 1974), pp. 73-88, finds that there is an upward bias in the income elasticity estimates due to omission of currency.

no way to directly evaluate the opportunity cost of his non-market time. The income variable for the husband can only be a proxy for what is believed to be the more significant variable, the wage rate.

No problem exists with the information provided by the respondents about the wife. Wife's income, average hours per week, and average number of weeks per year worked were reported. Therefore, it was possible to compute the wife's wage directly.

To test the effect of the price level on the household's money holdings, a variable was created to get an estimate of the regional consumer price index.[5] Since households were only identified by region, it is not possible to refine the price level variable to more narrow geographical locations. Regressions were specified in three different ways to test this variable's impact on money holdings. In the first specification, all the variables were deflated by the price level. In the second, the dependent variable was not deflated but the relevant independent variables were deflated. In the third, all of the variables were in nominal terms.

The inclusion of a price level variable is a test for homogeniety of the demand for money. Theoretically, the demand for nominal moninal money balances is homogenious of degree one in money income and prices, or the demand for real balances is homogenious of degree zero in money income and prices. We would expect, a priori, that the coefficient of the log of the price index to be zero for the regression were all the variable are in real terms, and to be one were the dependent variable is nominal and the independent variables are

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[5]This variable was constructed using data contained in the U.S. Department of Labor, Monthly Labor Review vol. 83 (May 1960), p. 556

real.[6]

A regional interest rate variable was constructed using dividends on Saving and Loan shares to test for the influence of the interest rate on the demand for money.[7] There are problems with the construction of this variable. First, there are only seven observations for this variable.[8] Second, dividends on Saving and Loan shares are reported by state, and in order to construct a regional variable it was necessary to average the interest rates of several states in the region. This could be a problem since all the states in any region did not have the same interest rates, and it is possible that in those states with a low interest rate is where most of the respondents live, while the regional rate is higher.

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[6]The test for homogeniety can be performed two ways:

[A] $\ln\frac{M}{P} = a_o + a_1 \ln \frac{Y}{P} + a_2 \ln r + a_3 \ln P$

[B] $\ln M = b_o + b_1 \ln \frac{Y}{P} + b_2 \ln r + b_3 \ln P$

for homogeniety:

$a_3 = 0$; $b_3 = 1$ or $b_3 - 1 = 0$.

See: Stephen Goldfeld, "The Demand for Money Revisited," Brookings Papers on Economic Activity 3 (1973), pp. 577-646; Allan H. Meltzer, "The Demand for Money: Evidence from the Time Series," Journal of Political Economy 17 (June 1963), pp. 219-46; David E. W. Laidler, The Demand for Money: Theories and Evidence (Scranton: International Textbook, 1969). These works discuss the test for homogeniety.

[7]This variable was constructed using data contained in U. S. Federal Home Loan Bank Board, Saving and Home Financing Sourcebook (Washington D.C.: U. S. Government Printing Office, 1960.

[8]Peterson, Demand for Money (March 1974), pp. 73-88, used the same technique.

The effect of human capital has been extensively analyzed in the household literature and this study will also look at its impact on the demand for real cash balances. Education is used as a proxy for human capital in the regression specifications. There are two education variables in the CUP data and both of them are used. The education variables are included as dummy variables because information about the education of the husband and wife were coded, actual years of schooling not being available. A value of one was assigned if the respondent had at least a college degree and zero otherwise. People who are more educated are more efficient in the labor market, and since this efficiency is embodied in the individual, they should be more efficient in non-market activity. Hopefully, this variable will indicate how efficiency effects the demand for real cash balances.

Family size was also included in the regression specifications. This household specific environmental variable is supposed to be representative of inefficiency in the household, i.e., larger families tend to be less efficient in production. A large family also means the wife is limited in her labor force participation, which may bias the household to time intensive production. We expect that larger families, ceteris paribus, will reduce the demand for real balances.

Included in the data are a series of responses that provide information about the household's expectations. To test the influence of these expectations on the demand for real balances two dummy variables were created. One of these variables reflects the household's expectation as to future changes in the price level. A second indicates how the household views its future financial condition. Economic theory predicts that if the household expects prices to rise it should reduce

its holdings of real cash balances. The household suffers a capital loss from the depreciation of its real cash balances as the price level rises. The impact of this variable should be negative.

If the household anticipates its financial condition will deteriorate, we might expect that it will increase its holdings of real cash balances. This can be thought of as reflecting the precautionary motive for holding money. Increasing its liquidity in this situation reduces the possibility of suffering a capital loss in the future, when converting a non-money asset to real balances.

My first specification of the demand for money is of the following form:

$$M^d = f(\, i,\ P,\ Y_p,\ NHW:\ H\,)^9$$

where:

NHW is non-human wealth.

H represents a vector of household environmental variables.

The results of testing this specification are presented in table 4.3. Equations [1] and [2] have the dependent variables adjusted for the price level and the independent variables are also adjusted. Equations [3] and [4] have nominal dependent variables and real independent variables. Equation [5] and [6] have all variables in nominal terms. All equations tested are in double log form, since it was found the explanitory power was significantly improved as compared to using natural numbers.

From table 4.3, we see the coefficients of the husband's and wife's education are positive and significant in all six of the

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[9] See table 4-2 for the definitions of the symbols.

TABLE 4.2

DEFINITIONS OF THE VARIABLES
USED IN THE REGRESSIONS

FAMINC (Y_f)	The household's family income
PFAMINC(Y_{pf})	Permanent family income computed as follows: $(.4)(Y_t) + (.3)(Y_{t-1}) + (.2)(Y_{t-2}) + (.1)(Y_{t-3}) + (.02)(Y_{t-1} + Y_{t-2} + Y_{t-3})$
HUSINC (Y_h)	Husband's Income
PHUSINC (Y_{ph})	Husband's permanent income computed as above
WIFINC (Y_w)	Wife's income
WAGE (W_w)	Wife's hourly wage
REDD	Checking account balance adjusted for the regional price level
NOMDD	Checking account balance unadjusted
SAVACC	Savings account balances
BOND	Bond holdings in dollars
BDSSAV	Bonds plus savings accounts
TOTASS(TA)	Total assets of the household
NETWOR(NW)	Household's net worth
REGPRI (P)	A regional consumer price index 1947-49=100
REGINT (i)	A regional interest rate on Savings and Loan shares
RATWGINC	The ratio of the wife's wage to the husband's income
AGE (A)	Age of the head of the household
FAMSIZ (N)	Family size
WNILF	A dummy variable equal to one if the wife is not in the labor force

TABLE 4.2 (cont.)

DEFINITIONS OF THE VARIABLES
USED IN THE REGRESSIONS

EDHUS (E_h)	A dummy variable for the husband's education equal to one if the husband has a college degree or more.
EDWIF (E_w)	A dummy variable for the wife's education equal to one if the wife has a college degree or more.
OCCUP (O)	A dummy variable for the husband's occupation equal to one if the husband is a manager, supervisor or professional.
OWNHOM (H)	A dummy variable equal to one if the respondent owns their own home.
URBAN (U)	A dummy variable equal to one if the respondent lives in the city.
PRIEXP (P_e)	A dummy variable for the respondent's price expectations equal to one if the respondent expects prices to rise.
EXBUSCON	A dummy variable equal to one if the respondent expects business conditions to deteriorate.
EXFINCON	A dummy variable equal to one if the respondent is uncertain or expects the household's own financial condition will deteriorate.
COMMUT	A dummy variable equal to one if the respondent owns common stock or mutual funds.
PREFBD	A dummy variable equal to one if the respondent owns preferred stock or corporate bonds.
GIFBEQ	A dummy variable equal to one if the respondent received a gift or a bequest.
CAPTG	A dummy variable equal to one if the respondent experienced a capital gain.
CAPTL	A dummy variable equal to one if the respondent experienced a capital loss.

TABLE 4.3

DEMAND DEPOSIT REGRESSIONS I

	(1) REDD	(2) REDD	(3) NOMDD	(4) NOMDD	(5) NOMDD	(6) NOMDD
AGE	.019 (12.0)[b]	.016 (9.8)	.019 (12.1)	.016 (9.9)	.019 (12.0)	.016 (9.8)
FAMSIZ	-.072 (-7.8)	-.063 (-6.7)	-.074 (8.0)	-.064 (-7.0)	-.064 (-7.0)	-.054 (-5.9)
WNILF	.16 (5.2)	.16 (5.4)	.15 (5.1)	.16 (5.3)	.13 (4.5)	.14 (4.7)
EDHUS	.21 (7.1)	.22 (7.5)	.20 (6.8)	.21 (7.2)	.24 (8.5)	.25 (9.0)
EDWIF	.13 (4.5)	.12 (4.4)	.14 (5.1)	.13 (4.8)	.14 (5.0)	.13 (4.7)
REGPRI(ln)	-1.532 (-2.6)	-1.505 (-2.5)	-.4658 (-.78)[c]	-4393 (-.74)[d]	-1.374 (-2.3)	-1.320 (-2.2)
REGINT	.9328 (4.0)	1.078 (4.7)	.8884 (3.9)	1.032 (4.5)	.8323 (3.6)	.9725 (4.2)
FAMINC(ln)[a]	.69241 (20.3)	.6907 (20.7)	.6906 (20.3)	.6899 (20.7)	.6201 (20.1)	.6181 (20.4)
TOTASS(ln)[a]	.3393 (20.0)		.3380 (20.4)		.3536 (21.3)	
NETWOR(ln)[a]		.3304 (21.6)		.3294 (21.6)		.3150 (22.8)
$\bar{R}^2$	.3505	.3586	.3508	.3587	.3401	.3483
F	281.5	291.7	281.9	291.8	305.9	317.2

[a]The variables in equations (1) through (4) are deflated by the regional price level and in equations (5) and (6) they are not.

[b]The 't' values are in parenthesis.

[c]The standard error is .5966.

[d]The standard error is .5929.

regression equations. There are several possible explanations for this result. The first, it confirms the hypothesis of Michael: people with higher levels of education are more efficient, and therefore, act as if they had a higher level of real income. It is possible that education reflects a higher opportunity cost of the household's non-market time. People with more education may, in addition, have a bias against time intensive production, which would increase their demand for money. A bias against time intensive production may be, especially, reflected by the wife's education variable.

It has been posited that people who are more educated will hold less real balances, because they are more efficient in being able to take advantage of higher returns from income yielding assets. The results of table 4.3 and of subsequent regressions does not seem to bear out this hypothesis.

The age of the head of the household has a positive and significant effect in all the equations. The family size variable is negative and significant, which means larger families hold smaller quantities of real balances.[10] Larger families may also mean time intensive production, reducing the household's demand for real balances.

There are two proxies for non-human wealth in the CUP data total assets and net worth. Equations [1], [3], and [5] use total assets as a measure of the household's non-human wealth, whereas, equations [2], [4], and [6] use net worth. The elasticities are similar for total assets and net worth but the explanatory power of the regressions are

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[10]Krenin has found "Ownership of liquid assets declines as people establish and raise their families, but subsequently rises as children leave home." Krenin, Liquid Asset Ownership (February 1961), p. 77.

improved when net worth is used.

The family income elasticity is positive and significant in all equations and is about twice the size of the wealth elasticity. The sum of the income and wealth elasticities is approximately equal to one as postulated by Meltzer.

The dummy variable for the wife not being in the labor force is positive and significant. This is not an expected result, and the reason for the opposite sign could be the equation is misspecified. The sign should be negative as postulated previously.

The price level elasticity is negative and significant fo. all the equations in table 4.3. In the equations [1] and [2], the coefficient of the ln P should not be significantly different than zero, if the homogeniety postulate is to hold. However, the coefficient is larger than the absolute value of -1.5 and significant at the 99% level. For equations [3] and [4] the dependent variable is in nominal terms, and the coefficient of ln P should not be significantly different than plus one.[11] These results seem to confirm the prediction of the model, i.e., there is a complementary relationship between money and market goods in the production function. Increasing the price of market goods reduces the household's demand for money.

Empirically, the price level variable reflects differences in the prices among the regions. Although the inter-regional variation is not extensive, this influence could be a result of the differences in the relative prices of the vector of market goods that make up the

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[11]Subtracting one from the coefficient gives:
in equation [3] -1.4658 [t=-2.46]
[4] -1.4393 [t=-2.43]

price index. These differences result in different types of production that occur in the different regions.[12]

The coefficient of the regional interest rate does not have the expected negative sign. This variable is supposed to represent a regional interest rate, and it seems that there are regional differences for which we cannot control. Partly, this could result for the way in which this variable was constructed as mentioned earlier. An attempt to control for regional factors, using a series of regional dummy variables, was unsuccessful. Differences in state banking laws, usuary laws, and local supply conditions cannot be controlled. This period is prior to Regulation Q, and in addition, states offering high interest rates advertised in states where the rates were lower to attract deposits. Recall, this is a sample of households, who would be the most likely members of the society to take advantage of higher rates by depositing funds in other states.

The regression equations were respecified to separate family income into husband and wife's income. The results of this specification are presented in table 4.4. Notice, the education variables are still positive and significant, both for the husband and for the wife. Age, family size, regional interest, and regional price also show similar results. Net worth continues to perform better than total assets as a

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[12]There are only seven different observations for the independent variable, while there are several thousand for the dependent variable.

[13]Even though the interest rate and price level variables were constructed using a similar method, the resulting signs are not affected by including both variables in the equation at the same time. When these two variables were tested separately the results were not significantly different from those shown.

TABLE 4.4

DEMAND DEPOSIT REGRESSIONS II

	(1) REDD	(2) REDD	(3) NOMDD	(4) NOMDD	(5) NOMDD	(6) NOMDD
AGE	.02 (12.5)[b]	.017 (10.3)	.02 (12.6)	.017 (12.5)	.24 (15.1)	.02 (12.3)
FAMSIZ	-.07 (-7.5)	-.06 (-6.5)	-.073 (-7.8)	-.063 (-6.8)	-.067 (-6.5)	-.061 (-6.5)
WNILF	.067 (1.3)	.052 (1.02)	.038 (.74)	.022 (.45)	.0005 (.001)	-.031 (-.41)
EDHUS	.19 (6.5)	.20 (6.9)	.18 (6.2)	.19 (6.6)	.18 (6.1)	.19 (6.6)
EDWIF	.15 (5.3)	.14 (5.1)	.16 (5.8)	.16 (5.6)	.16 (5.6)	.15 (5.4)
REGPRI(ln)	-1.398 (-2.3)	-1.371 (-2.3)	-.3354[c] (-.56)	-.3308[d] (-.52)	-1.332 (-2.2)	-1.265 (-2.1)
REGINT(ln)	.8638 (3.7)	1.024 (4.4)	.8318 (3.6)	.9862 (4.4)	.8240 (3.5)	.9620 (4.2)
HUSINC(ln)[a]	.6085 (19.9)	.6102 (20.3)	.6092 (20.0)	.6113 (20.5)	.5576 (18.6)	.5576 (19.1)
WIFINC(ln)[a]	.0433 (2.6)	.0354 (2.2)	.0329 (2.01)	.0251 (1.5)	.0130 (1.4)	.0072 (.78)
TOTASS(ln)[a]	.3504 (20.85)		.3493 (20.86)		.3497 (20.94)	
NETWOR(ln)[a]		.3407 (22.41)		.3391 (22.36)		.3449 (22.85)
$\bar{R}^2$	.3488	.3574	.3494	.3578	.3320	.3427
F	249.0	258.5	249.6	258.9	236.2	247.6

[a]The variables in equations (1) through (4) are deflated by the regional price level and in equations (5) and (6) they are not.

[b]The 't' values are in parenthesis.

[c]The standard error is .6009. [d]The standard error is .5970.

Separating family income into husband and wife's income shows mixed results. The wife's income is significant in equations [1] to [3], but is insignificant in equations [4] to [6]. Notice, the not in labor force variable for the wife which was positive and significant before, now is still positive in equations [1]-[5] but is insignificant and starts turning negative in equation [6].

The results for the wife's income variable seems to suggest that the family income variable may not be the proper specification of the demand for money, and the income of both adults should be considered separately. Furthermore, the income variable itself may not be the proper variable to include in testing a demand for money function. The household model focuses on the value of time as being a significant determinant of the demand for money, where the value of time is evaluated at the wage rate. As has been previously elaborated, the wage rate is expected to have a positive influence on the demand for money.

The equations were again respecified and the wife's wage was substituted for the wife's income, as it is believed to be the correct relationship and the results are presented in table 4.5. In all the regression equations the elasticity of the wife's wage is positive and it is significant in all equations but [4]. The WNILF variable is insignificant in all equations, but it shows the expected sign in equations [3] and [4].

The husband's permanent income[14] was substituted for his measured income and the regressions were retested. The results presented in table 4.6 are similar to table 4.5. There is a slight improvement

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[14]The method of constructing permanent income appears in Table 4.2.

TABLE 4.5

DEMAND DEPOSIT REGRESSIONS III

	(1) REDD	(2) REDD	(3) NOMDD	(4) NOMDD	(5) NOMDD	(6) NOMDD
AGE	.02 (12.6)[b]	.07 (10.4)	.021 (12.7)	.017 (10.5)	.021 (12.8)	.017 (10.6)
FAMSIZ	-.072 (-7.7)	-.062 (-6.6)	-.074 (-7.9)	-.064 (-6.9)	-.069 (-7.5)	-.060 (-6.5)
WNILF	.011 (.29)	.010 (.27)	-.0036 (-.09)	-.0045 (-.12)	.033 (.76)	.032 (.73)
EDHUS	.19 (6.4)	.20 (6.7)	.18 (6.1)	.19 (6.5)	.18 (6.2)	.20 (6.7)
EDWIF	.15 (5.1)	.14 (4.9)	.16 (5.6)	.15 (5.4)	.15 (5.4)	.14 (5.1)
REGPRI(ln)	-1.432 (-2.4)	-1.400 (-2.3)	-.3615 (-.60)[c]	-.3290 (-.55)[d]	-1.291 (-2.2)	-1.234 (-2.1)
REGINT(ln)	.8990 (3.9)	1.050 (4.5)	.8550 (3.7)	1.005 (4.4)	.8060 (3.5)	.9468 (4.1)
HUSINC(ln)[a]	.6026 (19.7)	.6052 (20.2)	.6046 (19.9)	.6077 (20.4)	.5698 (19.1)	.5727 (19.6)
WAGEW(ln)[a]	.0886 (2.3)	.0795 (2.1)	.0695 (1.8)	.0605 (1.6)	.0914 (2.4)	.0855 (2.3)
TOTASS(ln)[a]	.3527 (21.1)		.3510 (21.0)		.3554 (21.5)	
NETWOR(ln)[a]		.3426 (22.6)		.3403 (22.6)		.3438 (23.0)
$\bar{R}^2$	.3486	.3574	.2493	.3578	.3404	.3489
F	248.7	258.4	249.5	258.9	245.3	254.7

[a]The variables in equations (1) - (4) are deflated by the regional price level and in equations (5) and (6) they are not.

[b]The 't' values are in parenthesis.

[c]The standard error is .6009.

[d]The standard error is .5970.

TABLE 4.6

DEMAND DEPOSIT REGRESSIONS IV

	(1) REDD	(2) REDD	(3) NOMDD	(4) NOMDD	(5) NOMDD	(6) NOMDD
AGE	.02 (12.0)[b]	.017 (9.9)	.02 (12.1)	.017 (10.0)	.02 (12.4)	.017 (10.3)
FAMSIZ	-.075 (-7.7)	-.065 (-7.7)	-.077 (-7.9)	-.067 (-7.0)	-.074 (-7.8)	-.064 (-6.8)
WNILF	.0027 (.01)	-.0009 (-.01)	-.0144 (-.37)	-.0160 (-.40)	.016 (.35)	.014 (.32)
EDHUS	.17 (5.7)	.19 (6.1)	.17 (5.4)	.18 (5.8)	.16 (5.5)	.18 (5.9)
EDWIF	.15 (4.9)	.14 (4.7)	.16 (5.4)	.15 (5.2)	.15 (5.3)	.15 (5.1)
REGPRI(ln)	-1.503 (-2.4	-1.473 (-2.4)	-.4330 (-.70)[c]	-.4030 (-.65)[d]	-1.453 (-2.4)	-1.400 (-2.3)
REGINT(ln)	.9292 (3.8)	1.074 (4.5)	.8852 (3.7)	1.209 (4.3)	.8570 (3.7)	.9900 (4.2)
PHUSINC(ln)[a]	.6947 (20.0)	.6957 (20.5)	.6969 (20.1)	.6985 (20.6)	.6824 (20.3)	.6832 (20.7)
WAGEW(ln)[a]	.0826 (2.1)	.0736 (1.9)	.0635 (1.6)	.0546 (1.4)	.0810 (2.1)	.0751 (1.96)
TOTASS(ln)[a]	.3365 (19.1)		.3347 (19.1)		.3342 (19.6)	
NETWOR(ln)[a]		.3290 (20.8)		.3267 (20.7)		.3259 (21.2)
$\bar{R}^2$	.3543	.3631	.3550	.3636	.3483	.3569
F	243.9	244.1	235.6	244.6	243.5	252.8

[a]The variables in equations (1) - (4) are deflated by the regional price level and in equations (5) and (6) they are not.

[b]The 't' values are in parenthesis.

[c]The standard error is .6230.

[d]The standard error is .6190.

in the explanitory power of the regressions with the permanent income variable. There is a reduction in the significance of the wage variable for the wife, but it remains significant in four of the six equations. These results confirm the value of time hypothesis, in that the opportunity cost of the household's time is a significant determinant of the household's demand for money.

It might be useful at this point to determine whose time has more influence in determining the household's demand for money? It was postulated in previous chapter: the wife's value of time may be a more important influence than the value of the husband's time, holding family income constant, in determining the household's money holdings. Behind this is the argument that the value of wife's time may be the more relevant in determining the type of household production that would take place.

To test this hypotheisis the regression equation was respecified to include family income and the ratio of the wife's wage to the husband's income. The husband's wage not being available, his income is a good proxy if the husband worked full time, which we can expect to be the case for this sample. The results of this specifications are presented in table 4.7. The ratio of the wife's wage to husband's income is posititive and significant in all of the equations. An increase in the value of the wife's time relative to the husband's time will increase the household's money holdings. Notice the WNILF variable is negative in all the equations and increasing in significance, which starts to reflect the a priori expectation.

The income-wealth elasticity estimates in the regressions tested are approximately one, tables 4.3-4.7. Regression equations

TABLE 4.7

DEMAND DEPOSIT REGRESSIONS V

	(1) REDD	(2) REDD	(3) NOMDD	(4) NOMDD	(5) NOMDD	(6) NOMDD
AGE	.02 (12.0)[b]	.016 (9.9)	.02 (12.1)	.016 (10.0)	.02 (12.3)	.017 (10.1)
FAMSIZ	-.065 (-6.9)	-.054 (-5.9)	-.066 (-7.1)	-.056 (-6.1)	-.064 (-6.9)	-.054 (-5.8)
WNILF	-.257 (-1.34)	-.205 (-1.1)	-.325 (-1.7)	-.274 (-1.5	-.304 (-1.6)	-.253 (-1.4)
EDHUS	.20 (6.9)	.22 (7.4)	.19 (6.7)	.21 (7.1)	.19 (6.6)	.21 (7.1)
EDWIF	.13 (4.5)	.12 (4.3)	.14 (4.9)	.13 (4.7)	.14 (4.8)	.13 (4.6)
REGPRI(ln)	-1.515 (-2.5)	-1.485 (-2.5)	-.4530 (-.76)[c]	-.4230 (-.71)[d]	-1.385 (-2.3)	-1.330 (-2.2)
REGINT(ln)	.9244 (4.0)	1.072 (4.6)	.8821 (3.8)	1.029 (4.5)	.8431 (3.7)	.9797 (4.2)
FAMINC(ln)[a]	.63371 (20.1)	.63213 (20.3)	.63387 (20.1)	.63296 (20.4)	.64205 (20.1)	.62203 (20.3)
RATWGINC(ln)[a]	.05279 (2.2)	.04696 (2.0)	.0609 (2.6)	.0552 (2.3)	.0577 (2.5)	.0518 (2.2)
TOTASS(ln)[a]	.3514 (21.0)		.3499 (21.0)		.3476 (21.0)	
NETWOR(ln)[a]		.3404 (22.5)		.3381 (22.4)		.3359 (22.4)
$\bar{R}^2$	.3496	.3575	.3502	.3577	.3443	.3518
F	250.3	259.1	250.9	259.4	249.5	257.97

[a]The variables in equations (1) - (4) are deflated by the regional price level and in equations (5) and (6) they are not.

[b]The 't' values are in parenthesis.

[c]The standard error is .5997.

[d]The standard error is .5962.

tested, where the income variable was included but no wealth variable, the income elasticity of demand deposits was also not significantly different from one.[15] If time deposits are included in the dependent variable, the income elasticity is significantly greater than one.[16] These results are important because for the education effect to be positive, theoretically and empirically, the full income elasticity of demand should be greater than one. The empirical estimates of the income or income-wealth elasticities do conform to this requirement in one of two ways. First, the measured income or income-wealth is less than full income and, therefore, the full income elasticity is greater than one.[17] Second, time deposits should be included in the definition of money.

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[15] See appendix tables B1 and B2, NM regressions for the CUP data.

[16] See appendix tables B1 and B2, PM regressions for CUP data.

[17] Let the full income elasticity equal:

$$\frac{\partial \ln m}{\partial \ln F} = \frac{\partial \ln m}{\partial \ln Y_f} \frac{dY_f}{dF} \frac{F}{Y_f}$$

Let: $dF = dY_f$

So that: $\eta_{mF} = \frac{F}{Y_f} \eta_{mY_f}$ and $\frac{F}{Y_f} > 1$

CHAPTER 5

AN EMPIRICAL TEST OF THE CASH INVENTORY APPROACH TO THE HOUSEHOLD'S DEMAND FOR MONEY

The objective of this chapter is to test, empirically, whether or not the transactions demand or cash inventory model is capable of explaining the household's behavior. In chapter 4 it was shown, the demand for money is positively related to the wage rate, a measure of the value of the household's time. In particular, it was shown in a two adult household the relevant cost of time may be that of the wife.

These results confirm the findings of others, that have posited the value of time will be a significant determinant of the demand for money. This is not to say, these results confirm that a transactions model is the proper theoretical foundation of household behavior. Karni has stated that the value of time hypothesis of the demand for money does not necessarily mean an acceptance of the inventory approach to the demand for money.[1]

Evidence is presented that will attempt to show whether or not the transactions demand for money model as postulated by Baumol, Tobin, Karni, and Feige and Parkin is capable of explaining household behavior. The results appear to be inconsistant with the transactions model, although the tests performed are not the absolute proof needed to reject

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[1]Karni admits that even though the value of time hypothesis is borne out empirically, "does not indicate, . . ., that the inventory model is the relevant theoretical framework for the presentation of the value of time hypothesis," Karni, Time and Money (February 1974), p. 49.

these models. The results, however, do cast doubt as to the usefulness of describing the household's behavior using a transactions framework.

Cash inventory models, in general, postulate that the household could increase its income by holding income yielding assets and converting these assets to money as needed to make transactions. The income yielding asset alternative is normally defined as a bond or sometimes as a savings account. This approach is less of a transactions approach and is really an attempt to extend portfolio theory to household behavior. Thus, the household is viewed as acting to optimize income form portfolio management. Extensions have been developed to allow for commodity and capital inventories as well.

The value of time hypothesis states: the more costly is the household's time the larger will be its money balances. If the alternative to money is bonds, as it is in a Baumol-Tobin transactions model, as the value of the household's time rises the more costly it becomes to engage in this process of converting bonds to money. Therefore, we would expect, a priori, the more costly is the household's time ceteris paribus, the smaller will be the household's average bond holdings.

The functional form of the regression to be tested is based on Feige and Parkin's equation for the optimal average bond holdings for the household.[2] If we assume the volume of transactions to be

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[2] Feige and Parkin's actual equation is:

$$\bar{B}^* = \frac{pq}{2} - \left[\frac{\beta(pq)}{2(r_b - a_b - r_m + a_m)}\right]^{\frac{1}{2}}$$

where $\bar{B}^*$ is the optimal average bond holdings.

pq is the volume of transactions.

r_b is the interest paid on bonds.

r_m is the interest paid on money.

proportion to income, the regression equation in general form is:

$$B^d = f(Y_f, NHW, WNILF, E_h, E_w, A, N)^3$$

The transactions model of bond-money conversion is tested, specifying the dependent variable alternatively in the regressions as bonds, savings accounts, and bonds plus savings accounts. The alternative to money has been described as savings accounts as well as bonds, and it was thought worthwhile to use all three forms as dependent variables. Table 5.1 presents the results of this specification. All equations were tested in double log form, since this form was found to significantly improve the explanitory power of the results.

Net worth performs better as an indicator of non-human wealth than total assets, as the explanatory power of the equations is increased where net worth is used. Both the husband and wife's education variables have a positive impact on the dependent variables. The impact of the wife's education seems to be stronger than the husband's. The education variables may be a reflection of the fact that people with more education are more efficient, and therefore, spend less time in transactions. Alternatively, the education variable may mean people with more education are more aware of alternatives available in which to put their non-human wealth and take advantage of them.

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a_b is the cost of holding bond inventories.

a_m is the cost of holding money inventories.

β is the cost of bond-money conversion.

Feige and Parkin, Money, Bonds and Capital (June 1971), p. 341

[3]Since the data is cross-sectional the interest rate on bonds was not included in the regressions tested.

TABLE 5.1

BOND REGRESSIONS I

	(1) SAVACC[a]	(2) SAVACC	(3) BOND	(4) BOND	(5) BDSSAV	(6) BDSSAV
AGE	.03 (10.4)[b]	.02 (6.8)	.03 (8.8)	.02 (5.6)	.03 (10.9)	.014 (6.1)
FAMSIZ	-.15 (-9.6)	-.14 (-9.3)	-.12 (-5.9)	-.10 (-5.5)	-.15 (-10.3)	-.13 (-9.7)
WNILF	.10 (2.1)	.06 (1.3)	.04 (.62)	.03 (.58)	.11 (2.3)	.07 (1.6)
EDHUS	.08 (1.7)	.09 (2.0)	.07 (1.1)	.09 (1.6)	.09 (2.0)	.11 (2.6)
EDWIF	.13 (2.9)	.12 (2.6)	.14 (2.5)	.10 (1.8)	.15 (3.6)	.13 (3.1)
FAMINC(ln)	.3891 (7.5)	.2633 (5.3)	-.0111 (-.18)	-.0489 (-.82)	.2279 (4.7)	.1135 (2.5)
TOTASS(ln)	.4469 (14.9)		.8443 (22.9)		.7044 (25.2)	
NETWOR(ln)		.5869 (22.2)		.8724 (26.7)		.8251 (34.2)
$\bar{R}^2$	.1987	.2461	.2680	.3056	.2654	.3316
F	146.2	191.7	157.9	189.5	247.3	338.4

[a]Table 4.2 has the definitions of the variables.

[b]The 't' values are in parenthesis

The family income variable is positive significant in equations [1], [2], [5], and [6], but for equations [3] and [4] it is negative and not significant in determining bond holdings. We would normally expect this variable to have a positive sign, however, the fact that income is not significant in determining bond holdings is revealing. The most significant determinant is its net worth but not its income. From this we can infer that households may not be viewing bonds as a viable alternative to money as a temporary abode of its income as specified by the transactions demand or cash inventory model. This is to be expected if we view household behavior realistically. The cost of engaging in a conversion process of this nature for the average household are for too great--even if we do not include the value of time as a cost--and the net benefits are marginal.[4]

The WNILF variable has a positive significant effect in equations [1], [2], [5], and [6], but not in equations [3] and [4]. This coefficient reflects the low cost of time to the non-working wife resulting in an increase in savings account holdings, since the wife can go to the savings bank to withdraw funds as needed for transactions. But this variable is insignificant of the bond regressions. The wife not working does not have an impact on the household's bond holdings.

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[4] Using Feige and Parkin's equation for optimal bond holdings, where income (expenditures) is predetermined, and assume that a family receives $10,000 in disposable income. The household plans to save nothing and receives income monthly of $833. Using Feige and Parkin's estimates of the likely values of the variables in their bond equation: r_b =.06; r_m=0; β=$15; a_b=.005; a_m=.01. By substituting these values into their optimal bond equation we get average bond holding of $106. Given their 6% interest paid on bond, the yearly income form a conversion process of this kind is $6.36. It does not seem likely that households will engage in this process for such a miniscule sum.

An alternative explanation is suggested by the WNILF result in table 5.1. If the wife does not work the household has one income earner and this variable could reflect to some extent the demand for a riskless and liquid asset. In those households where the wife does not work and the regression is tested with total assets, the WILF variable has a larger impact than when the regression is tested with net worth. Households with large total assets and large mortgage payments, car payments, and other debts and therefore, a smaller net worth may wish to hold more in a savings account as a precaution against unemployment, than those households where there are two employed adults.

The regressions were respecified with the husband's and wife's income separately and the results are shown in table 5.2. Net worth still performs better than total assets. Again both education variables are significant and positive. The husband's income is positive and significant in all but the BOND equations. The wife's income is positive in all equations and significant in all but equation [2].

The results of table 5.2 are somewhat similar to table 5.1. The husband's income having a significantly positive effect on savings account holdings but insignificant on bond holdings. Whereas, the wife's income has a positive and significant effect on both. This could mean that when the wife's income rises there is a smaller possibility of being affected by a total loss of income if one of the spouses loses their job. Therefore the household is willing to hold a riskier asset or at the same time it may reflect the fact that families with more income save more.

To test the value of time hypothesis we substituted the wife's

TABLE 5.2

BOND REGRESSIONS II

	(1) SAVACC	(2) SAVACC	(3) BOND	(4) BOND	(5) BDSSAV	(6) BDSSAV
AGE	.03 (10.4)[a]	.02 (6.8)	.03 (8.6)	.02 (5.6)	.03 (10.8)	.015 (6.1)
FAMSIZ	-.15 (-9.5)	-.14 (-9.2)	-.11 (-5.6)	-.10 (-5.2)	-.14 (9.9)	-.13 (-9.5)
WNILF	.24 (1.9)	.12 (.97)	.45 (3.1)	.34 (2.6)	.46 (4.1)	.32 (2.9)
EDHUS	.09 (1.8)	.10 (2.2)	.08 (1.2)	.10 (1.9)	.10 (2.1)	.12 (2.8)
EDWIF	.14 (3.1)	.12 (2.7)	.13 (2.2)	.09 (1.9)	.15 (3.5)	.12 (3.1)
HUSINC(ln)	.3026 (5.8)	.1861 (3.8)	-.0552 (-.92)	-.0796 (-1.4)	.1490 (3.1)	.0516 (1.2)
WIFINC(ln)	.0336 (2.2)	.0171 (1.1)	.0539 (3.1)	.0387 (2.3)	.0566 (4.0)	.0376 (2.8)
TOTASS(ln)	.4626 (15.3)		.8425 (22.8)		.7156 (25.5)	
NETWOR(ln)		.6015 (22.6)		.8691 (26.5)		.8329 (34.4)
$\bar{R}^2$	.1951	.2435	.2705	.3070	.2656	.3318
F	124.8	156.1	139.5	166.5	216.2	295.8

[a]The 't' values are in parenthesis.

wage for her income and the resulting regressions appear in table 5.3. The variables appear, basically the same in their impact, but notice, the wage variable is positive and significant in the SAVACC equations, insignificant in the BOND equations and barely insignificant in the BDSSAV regressions. This result is extremely interesting, for it seems to show a contradiction between the value of the time hypothesis and the transactions demand for money model. If the two were consistant we would expect the impact of the wage rate to be negative and significant, especially for equations [3] and [4]. The positive or insignificant effect of the wage argues against the transactions model.

At the very least it can be argued based on these results, if we believe households behave as posited by the transactions model, the definition of the income yielding asset alternative must be redefined. These results imply that savings accounts or bonds are not the alternative. In fact, the positive effect of wages in the SAVACC equation might be an indication that savings accounts would better be included in the definition of money. The effect of the independent variables in the SAVACC equations is similar to their impact on demand deposit regressions, although the explanatory power is significantly reduced for these regressions.

As a further test, the same basic equation was tested but with family income and the ratio of the wife's wage to the husband's income. This ratio [table 5.4] is significant only in equations [1] and [5] but positive in all cases. This is further evidence that either the value of time hypothesis is inconsistant with the transactions demand for money model or the definition of the income yielding asset, which is an alternative to money, must be redefined.

TABLE 5.3

BOND REGRESSIONS III

	(1) SAVACC	(2) SAVACC	(3) BOND	(4) BOND	(5) BDSSAV	(6) BDSSAV
AGE	.03 (10.5)[a]	.02 (6.8)	.03 (8.6)	.02 (5.6)	.03 (10.4)	.014 (6.1)
FAMSIZ	-.15 (-9.6)	-.14 (-9.2)	-.11 (-5.8)	-.10 (-5.5)	-.15 (-10.1)	-.13 (-9.6)
WNILF	.12 (1.7)	.10 (1.4)	.05 (.56)	.04 (.48)	.14 (2.0)	.11 (1.5)
EDHUS	.08 (1.7)	.10 (2.2)	.08 (1.3)	.10 (1.7)	.10 (2.2)	.12 (2.8)
EDWIF	.13 (2.8)	.11 (2.5)	.14 (2.5)	.10 (1.8)	.15 (3.5)	.12 (3.0)
HUSINC(ln)	.2939 (5.7)	.1809 (3.7)	-.0660 (-1.1)	-.0873 (-1.5)	.1363 (2.9)	.0428 (.98)
WAGEW(ln)	.1412 (2.5)	.1208 (2.2)	-.0042 (-.05)	-.1994 (-.28)	.0980 (1.7)	.0733 (1.4)
TOTASS(ln)	.4657 (15.4)		.8594 (23.4)		7626 (25.9)	
NETWOR(ln)		.6022 (22.8)		.8818 (27.2)		.8400 (34.9)
$\bar{R}^2$	.1953	.2441	.2680	.3058	.2656	.3310
F	124.9	165.6	137.8	165.5	216.2	294.7

[a]The 't' values are in parenthesis

TABLE 5.4

BOND REGRESSIONS IV

	(1) SAVACC	(2) SAVACC	(3) BOND	(4) BOND	(5) BDSSAV	(6) BDSSAV
AGE	.03 (10.4)[a]	.02 (6.7)	.03 (8.6)	.02 (5.6)	.03 (10.4)	.015 (6.2)
FAMSIZ	-.14 (-9.5)	-.14 (-9.1)	-.12 (-5.9)	-.10 (-5.5)	-.15 (-10.1)	-.13 (-9.7)
WNILF	-.52 (-1.8)	-.37 (-1.3)	-.13 (-.37)	-.05 (-.14)	-.43 (-1.5)	-.28 (-1.01)
EDHUS	.08 (1.6)	.09 (2.0)	.07 (1.1)	.09 (1.6)	.09 (2.0)	.11 (2.6)
EDWIF	.12 (2.7)	.11 (2.6)	.14 (2.4)	.10 (1.8)	.15 (3.4)	.12 (2.9)
FAMINC(ln)	.4126 (7.7)	.2793 (5.5)	-.0053 (-.08)	-.0460 (-.76)	.2456 (4.9)	.1247 (2.7)
RATWGINC(ln)	.0784 (2.1)	.0538 (1.5)	.0227 (.47)	.0109 (.24)	.0679 (1.9)	.0439 (1.3)
TOTASS(ln)	.4411 (14.7)		.8430 (22.8)		.7001 (24.9)	
NETWOR(ln)		.5831 (21.9)		.8719 (26.6)		.8225 (33.9)
$\bar{R}^2$	.1994	.2463	.2678	.3054	.2658	.3317
F	128.6	168.1	138.1	165.7	216.9	296.4

[a]The 't' values are in parenthesis.

It should be remembered this is a sample of members of Consumer Union, and if any household engages in a money-bond conversion process it is most likely to be these households. Members of Consumer Union are the most likely households to be aware that they can increase income by holding bonds until needed to convert to money as transactions are to be made.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In this study a model of the household's demand for money has been developed. This model uses the new theory of consumer behavior or household production theory to describe the role of money in household behavior. Using this new approach to the demand for money has many advantages. Money need no longer appear in the utility function as is the case with traditional demand for money functions. Real cash balances are unique and separate from other goods, and are to be viewed as an input in the household's production process.

Many of the traditional motives for the holding of real cash balances by households can be incorporated into this model. Speculative, precautionary and liquidity motives for holding real balances can easily be explained by the model, if we include them in the utility function as commodities. Concomittantly, the relatively recent value of time hypothesis of the demand for money is incorporated into this model, since it is the foundation of the household production function model's full income constraint.

The household model is a realistic paradigm as compared to many unrealistic ones describing and justifying the households demand for money.

What conclusions can be drawn from the model and empirical tests contained in this study? The demand for real cash balances does depend

upon the value of time. It has been shown, theoretically and empirically, that the demand for real cash balances is positively related to the opportunity cost of the household's time, evaluated at the real wage rate. In addition, it has been shown that the value of the wife's time may be more important than the value of the husband's time in determining the demand for real cash balances. This result is derived from the assumption that the wife will have more of an impact on the type of production the household will undertake.

Education of both husband and wife has a positive impact on the demand for real cash balances. From this we can infer that people with more education act as though their real income is higher and therefore, they demand more real balances. One can also infer that more educated people may have a bias away from time intensive production.

The effect of a change in the price level on the demand for real balances is an inverse one, holding all other things equal. A change in the price level will alter the relative prices of commodities in household production, resulting in a reallocation of inputs used in the production of these commodities. There will also be substitution away from market good intensive commodites in consumption. These two substitution effects combine to reduce the demand for real cash balances.

Non-human wealth, theoretically and empirically, is a significant factor in determining the household's demand for real balances. On a theoretical level, non-human wealth appears directly in the model as part of the full income constraint. At the empirical level, non-human wealth is highly significant in all cases and improves the explanitory power of the equations tested. It has also been shown that the

appropriate empirical proxy for non-human wealth is net worth of the household.

An empirical test of the inventory or portfolio approach to the transactions demand for real cash balances has shown that this is not the relevant framework in which to describe household behavior. Households do not hold bonds as a temporary abode for their income receipts until needed to make transactions. The cost of undertaking such a process to the household is too high, and the returns too low, making the net benefit marginal.

Should time deposits be included in the definition of money? The empirical results are somewhat contradictory on this point. Using the value of time test, one would have to say yes, since a positive relationship exists, empirically, between the wage rate and savings account balances. However, when savings account balances are added to demand deposits as the dependent variable, the explanatory power of the equation is significantly reduced for the CUP data. Further research is required before one can make a conclusive statement on this question.

The empirical results indicate that there does exist, what may be labelled, a precautionary demand for money. When tests were conducted with several expectations variables [appendix table C.1] they were found to have a significant impact on the household's demand for money. Household's expecting their own financial or general business conditions to deteriorate, will increase their holdings of money.

APPENDIX A

FREQUENCY DISTRIBUTIONS OF SELECTED VARIABLES FROM THE CONSUMER UNION SURVEY

APPENDIX TABLE A.1

EDUCATION LEVEL OF HEAD OF HOUSEHOLD

	Absolute Freq.	Relative Freq.	Cum. Freq.
NO RESPONSE	25	0.4	0.4
HIGH SCHOOL OR LESS	1029	16.5	16.9
SOME COLLEGE	1243	20.0	36.9
FOUR YEARS COLLEGE	1612	25.9	62.8
GRADUATE TRAINING	2236	35.9	98.7
OTHER EDUCATION	82	1.3	100.0
TOTAL	6227	100%	

APPENDIX TABLE A.2

EDUCATION LEVEL OF SPOUSE

	Absolute Freq.	Relative Freq.	Cum. Freq.
NO RESPONSE	15	0.2	0.2
LESS THAN HIGH SCHOOL GRADUATE	484	7.8	8.0
HIGH SCHOOL GRADUATE	1383	22.2	30.2
SECRETARIAL OR BUSINESS SCHOOL	745	12.0	42.2
SOME COLLEGE	1250	20.1	62.3
COLLEGE GRADUATE	1301	20.9	83.2
SOME GRADUATE SCHOOL	512	8.2	91.4
GRADUATE DEGREE	537	8.6	100.0
TOTAL	6227	100%	

APPENDIX TABLE A.3

FAMILY INCOME AFTER TAX 1959

	Absolute Freq.	Relative Freq.	Cum. Freq.
4,000 or less	172	2.6	2.6
4,001 - 5,000	295	4.7	7.3
5,001 - 6,000	527	8.5	15.8
6,001 - 7,000	758	12.2	28.0
7,001 - 8,000	835	13.4	41.4
8,001 - 9,000	796	12.8	54.2
9,001 - 10,000	735	11.8	66.0
10,001 - 12,000	816	13.1	79.1
12,001 - 20,000	955	15.3	94.4
20,001 and higher	258	4.2	98.6
Other	90	1.4	100.0
TOTAL	6227	100%	

APPENDIX TABLE A.4

HUSBAND'S INCOME BEFORE TAX 1959

	Absolute Freq.	Relative Freq.	Cum. Freq.
4,000 or less	237	3.8	3.8
4,001 - 5,000	287	4.6	8.4
5,001 - 6000	562	9.0	17.4
6,001 - 7,000	683	11.0	28.4
7,001 - 8,000	752	12.1	40.5
8,001 - 9,000	668	10.7	51.2
9,001 - 10,000	655	10.5	61.7
10,001 - 12,000	840	13.5	75.2
12,001 - 20,000	1011	16.3	91.5
20,001 and higher	360	5.7	97.2
other	172	2.8	100.0
TOTAL	6227	100%	

APPENDIX TABLE A.5

WIFE'S INCOME BEFORE TAX 1959

	Absolute Freq.	Relative Freq.	Cum. Freq.
1 - 1,000	489	7.9	7.9
1,001 - 2,000	278	4.4	12.3
2,001 - 3,000	228	3.7	16.0
3,001 - 4,000	265	4.3	20.3
4,001 - 5,000	266	4.3	24.6
5,001 and higher	391	6.2	30.8
other	4310	69.2	100.0
TOTAL	6227	100%	

APPENDIX TABLE A.6

WIFE'S HOURLY WAGE 1959

	Absolute Freq.	Relative Freq.	Cum. Freq.
0	4515	72.5	72.5
0.01 - 1.00	103	1.7	74.2
1.01 - 1.25	106	1.7	75.9
1.26 - 1.50	125	2.0	77.9
1.51 - 2.00	357	5.7	83.6
2.01 - 3.00	531	8.5	92.1
3.01 - 4.00	321	3.7	95.8
4.01 and higher	258	4.2	100.0
TOTAL	6227	100%	

APPENDIX TABLE A.7

HOUSEHOLD NET WORTH END 1959

	Absolute Freq.	Relative Freq.	Cum. Freq.
0.0 - 7,500	499	8.0	8.0
7,501 - 10,000	328	5.3	13.3
10,001 - 15,000	807	13.0	26.2
15,001 - 20,000	822	13.2	39.4
20,001 - 25,000	695	11.2	50.6
25,001 - 50,000	1723	27.7	78.3
50,001 - 100,000	802	12.9	91.2
100,001 and higher	519	8.3	99.5
other[a]	32	0.5	100.0
TOTAL	6227	100%	

[a]These are households with a negetive net worth.

APPENDIX B

A COMPARISON OF THE CONSUMER UNION PANEL AND THE SURVEY OF CONSUMER FINANCES

Typical of previous cross-sectional demand for money functions is the work done by Peterson. He specified a demand for money function of the following form:

$$M^d = f(i, Y_f, E_h, P_e, N, A, O, H, R, U)^1$$

Where M^d took the following forms:

1. Narrow money (NM) - checking accounts
2. Broad money (BM) - NM + savings accounts
3. Liquid assets (LA) - BM + U.S. Savings Bonds

To see how the CUP data compares with other data sets, Peterson's regression specifications were tested using the CUP data and the results are compared [tables B.1-B.4]. Notice in table B.1, home ownership has an opposite sign in all forms of the regressions. The regional interest rate[2] has the opposite sign for NM and LA regressions. Occupation has an opposite sign for the BM and LA regressions. The income elasticity was lower in all three forms of the regression specification for the CUP data, as compared to the SCF data.

The price expectations of the household does not have a

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[1] See table 5.2 for definitions of symbols.

[2] Peterson had only four observations on his regional interest rate variable, the CUP data allows for seven.

APPENDIX TABLE B.1

COMPARASON OF SURVEY OF CONSUMER FINANCES AND CONSUMER UNION DATA I

	NM		BM		LA	
	CUP	SCF[a]	CUP	SCF	CUP	SCF
FAMSIZ	-.047 (-5.0)[b]	(-5.5)	-.130 (-9.8)	(-6.3)	-.125 (-9.6)	(-6.4)
AGE	.027 (16.6)	(5.2)	.034 (14.9)	(8.2)	.040 (17.7)	(8.1)
OCCUP	.06 (1.8)	(4.7)	-.098 (-2.1)	(2.5)	-.094 (-2.1)	(2.3)
EDHUS	.229 (7.3)	(6.0)	.157 (3.6)	(6.9)	.156 (3.6)	(6.9)
OWNHOM	-.062 (-1.8)	(5.0)	-.147 (-3.0)	(2.6)	-.169 (-3.5)	(3.2)
URBAN	-.051 (-1.9)	(-3.7)	.82 (2.1)	(-.50)	.08 (2.1)	(-.50)
PRIEXP	.043 (1.6)	(-.70)	.016 (.44)	(1.0)	-.008 (-.22)	(1.5)
REGINT(ln)	.7171 (3.6)	(-2.6)	-1.344 (-4.8)	(1.3)	-1.580 (-5.7)	(.90)
FAMINC(ln)	.9933 (31.8)	1.18 (10.2)	1.116 (25.3)	1.54 (13.1)	1.068 (24.8)	1.56 (13.3)
RACE		(4.3)		(7.2)		(7.5)
$\bar{R}^2$	.2759		.1950		.2078	
Sample Size	4958	1051	5518	1051	5518	1051
F	210.7	47.2	149.4	66.0	160.6	69.0

[a]The coefficients were not reported by Peterson for the SCF data.

[b]The 't' values are in parenthesis.

significant impact on the household's money holdings for both samples. The signs are opposite in all but the broad money regressions. The fact, that the price expectation variable does not perform as predicted by theory, is understandable because of the period in which the information was collected. Recall, during this period there were relatively minor rises in the price level and although households may have expected higher increases, they did not react to these expectations because experience was different.

An alternative specification of Peterson's was to include permanent income[3] instead of measured income as an independent variable. This alternative specification was tested on the CUP data and the results compared in table B.2. The use of permanent income improves Peterson's results with the SCF data but the inclusion does not improve the explanatory power and in fact decreases it for the CUP data. Using permanent family income increases the income elasticity estimates for both data sets.

A third specification of Peterson's included a measure of non-human wealth in addition to permanent income. Peterson also included a variable for common and preferred stock ownership in this specification. This new specification was also tested on the CUP data and the results compared in tables B.3 and B.4. Total Assets, the proxy for non-human wealth, has a much higher elasticity in the CUP data than for the SCF data, this is true in both table B.3 and in table B.4. When wealth is

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[3]Permanent income was constructed in the following manner:

$$Y_p = .4Y_t + .3Y_{t-1} + .2Y_{t-2} + .1Y_{t-3} + .02(Y_{t-1}+Y_{t-2}+Y_{t-3})$$

APPENDIX TABLE B.2

COMPARASON OF SURVEY OF CONSUMER FINANCES AND CONSUMER UNION DATA II

	NM		BM		LA	
	CUP	SCF	CUP	SCF	CUP	SCF
FAMSIZ	-.048		-.13		-.13	
	(-4.9)[a]	(-6.2)	(-9.4)	(-7.2)	(-9.2)	(-7.3)
AGE	.027		.03		.04	
	(15.8)	(5.5)	(14.2)	(8.4)	(16.9)	(8.3)
OCCUP	.064		-.09		-.09	
	(1.9)	(4.1)	(-1.9)	(1.4)	(-1.8)	(1.6)
EDHUS	.22		.15		.16	
	(6.9)	(5.1)	(3.3)	(5.9)	(3.5)	(5.9)
OWNHOM	-.054		-.14		-.16	
	(-1.5)	(4.2)	(-2.7)	(1.8)	(-3.1)	(2.4)
URBAN	-.053		.08		.08	
	(-1.9)	(-4.5)	(2.0)	(-1.2)	(2.0)	(-1.3)
PRIEXP	.041		.014		-.008	
	(1.5)	(-1.1)	(.17)	(.70)	(-.22)	(1.1)
REGINT(ln)	.758		-1.300		-1.540	
	(3.6)	(-2.8)	(-4.4)	(1.8)	(-5.3)	(1.0)
PFAMINC'ln)	1.019	1.59	1.362	1.99	1.0697	2.00
	(29.7)	(12.1)	(23.5)	(14.9)	(22.5)	(15.1)
RACE		(1.7)		(6.6)		(6.9)
$\bar{R}^2$	.2694		.1894		.1999	
Sample Size	4574	1051	5059	1051	5059	1051
F	188.2	52.8	132.1	73.1	141.3	76.1

[a]The 't' values are in parenthesis.

APPENDIX TABLE B.3

COMPARASON OF SURVEY OF CONSUMER FINANCES AND CONSUMER UNION DATA III

	NM		BM		LA	
	CUP	SCF	CUP	SCF	CUP	SCF
FAMSIZ	-.048 (-5.4)	(-5.2)	-.13 (-10.4)	(-6.2)	-.124 (-10.2)	(-6.2)
AGE	.02 (12.6)	(4.3)	.024 (10.4)	(7.2)	.029 (13.5)	(7.1)
OCCUP	.085 (3.8)	(4.1)	-.063 (-1.4)	(2.0)	-.061 (-1.4)	(1.7)
EDHUS	.18 (6.2)	(5.2)	.09 (2.1)	(6.3)	.08 (2.0)	(6.4)
OWNHOM	-.385 (-10.8)		-.610 (-12.1)		-.624 (-12.7)	
URBAN	-.03 (-1.2)	(-3.8)	.11 (3.0)	(-.02)	.108 (3.0)	(.05)
PRIEXP	.022 (.87)		-.014 (-.39)		-.039 (-1.1)	
REGINT(ln)	.719 (3.8)	(-2.2)	-1.322 (-5.0)	(1.8)	-1.538 (-5.9)	(1.5)
FAMINC(ln)	.6159 (18.6)	.98 (8.4)	.5590 (11.9)	1.4 (11.7)	.5077 (11.1)	1.42 (11.9)
TOTASS(ln)	.4160 (22.8)	.110 (5.7)	.5943 (23.1)	.06 (3.2)	.5834 (23.2)	.08 (3.9)
STOCK CMPR		(4.8)		(4.6)		(4.4)
COMMUT	.106 (3.99)		.192 (5.1)		.235 (6.4)	
PREFBD	-.072 (-1.67)		.009 (.14)		.027 (.46)	
$\bar{R}^2$	.3556		.2822		.2986	
R^2		.3352		.3978		.4069
F	228.9	52.44	181.7	68.69	196.6	71.34

APPENDIX TABLE B.4

COMPARASON OF SURVEY OF CONSUMER FINANCES AND CONSUMER UNION DATA IV

	NM		BM		LA	
	CUP	SCF	CUP	SCF	CUP	SCF
FAMSIZ	-.048 (-5.1)	(-5.97)	-.13 (-9.9)	(-6.99)	-.12 (-9.7)	(-7.1)
AGE	.02 (12.1)	(4.5)	.02 (10.2)	(7.5)	.03 (12.9)	(9.9)
OCCUP	.09 (2.8)	(3.7)	-.055 (-1.2)	(1.5)	-.050 (-1.1)	(1.3)
EDHUS	.18 (5.9)	(4.5)	.09 (2.0)	(5.6)	.09 (2.0)	(5.6)
OWNHOM	-.38 (-10.2)		-.61 (-11.5)		-.62 (-12.1)	
URBAN	-.031 (-1.1)	(-4.4)	.11 (2.9)	(-.70)	.11 (3.0)	(-.62)
PRIEXP	.021 (0.8)		-.014 (-.36)		-.04 (-1.1)	
REGINT(ln)	.7417 (3.1)	(-2.4)	-1.307 (-4.7)	(1.7)	-1.531 (-5.6)	(1.4)
PFAMINC(ln)	.6123 (16.8)	1.38 (10.1)	.5341 (10.4)	1.83 (13.1)	.4605 (9.4)	.185 (13.2)
TOTASS(ln)	.4205 (21.9)	.09 (4.9)	.6029 (22.3)	.05 (2.4)	.5967 (9.1)	.06 (.06)
STOCK CMPR		(4.0)		(3.8)		(3.6)
COMMUT	.112 (4.1)		.20 (5.1)		.24 (6.4)	
PREFBD	-.073 (-1.6)		.009 (.14)		.026 (.42)	
$\bar{R}^2$	.3506		.2787		.2944	
R^2		.3533		.4163		.4247
F	206.7	51.61	163.9	67.36	176.8	69.72

included there is not much improvement in using permanent income rather than measured income for the CUP data. The sum of the income and wealth elasticities is larger for SCF than for the CUP data.

The coefficient of the common stock-mutual fund dummy has a similar effect to Peterson's common and preferred stock dummy. The preferred stock-bonds dummy has a negative impact but not significant in NM regression, positive and insignificant in the BM and LA regressions.

It is also interesting to note that the explanatory power of the regressions improves for the SCF data as broader definitions of money are included as the dependent variable. However, as broader definitions of money are included in the dependent variable for the CUP data, the explanatory power of the regressions declines. Although not all of the variables in these samples perform exactly in the same manner, there is a strong similarity in the results. This is true even though the CUP data contains such unusual characteristics.

APPENDIX C

In this appendix results are presented of tests performed on several additional variables which were included in the specification of the demand for money. In the CUP data, there are a series of expectation variables which were coded into dummy variables: If the household expected business conditions to deteriorate, a one was assigned and zero otherwise; if the household expected its own financial condition to deteriorate, a one was assigned and a zero otherwise; if the household expected prices to increase, a one was assigned and a zero otherwise.

The results of testing these three variables are presented in appendix table C.1. Expecting business conditions to deteriorate has a significantly positive impact on the households demand for money. Notice also if the household expects its own financial condition to deteriorate, there will be a significantly positive impact on its holdings of money. Both of these variables can be viewed as reflecting the precautionary motives for holding real balances. Households will increase their holdings of real balances when they expect that they can suffer from future events.

The test of the price expectations variable does not have the expected result. The a priori expectation of this variable is that it should have a negative and significant impact on the holding of money.

APPENDIX TABLE C.1

DEMAND DEPOSIT REGRESSIONS VI

	(1) NOMDD	(2) NOMDD	(3) NOMDD
FAMSIZ	-.043	-.043	-.043
	(-4.6)	(-4.6)	(-4.6)
AGE	.017	.017	.017
	(10.4)	(9.9)	(10.5)
WNILF	-.21	-.20	-.21
	(-1.11)	(-1.06)	(-1.14)
EDHUS	.20	.20	.19
	(6.8)	(6.8)	(6.7)
EDWIF	.12	.12	.12
	(4.4)	(4.5)	(4.4)
REGPRI(ln)	-1.202	-1.198	-1.195
	(-2.04)	(-2.1)	(-2.1)
REGINT(ln)	1.054	1.054	1.045
	(4.6)	(4.6)	(4.5)
NETWOR(ln)	.3616	.3620	.3617
	(23.6)	(23.6)	(23.6)
FAMINC(ln)	.6277	.6305	.6269
	(20.6)	(20.7)	(20.6)
RATWGINC(ln)	.0471	.0462	.0476
	(2.02)	(1.99)	(2.1)
OWNHOM	-.25	-.25	-.25
	(-7.3)	(-7.3)	(-7.3)
EXBUSCON	.063		
	(1.88)		
EXFINCON		.112	
		(2.29)	
PRIEXP			.025
			(1.001)
$\bar{R}^2$	.3594	.3596	.3591
F	222.3	222.6	222.02

However, the results show a positive and insignificant impact. Recall, this is a period of relatively small changes in the price level and since their experience was of this type, households do not act on their expectations. It has been argued that it would require much greater increases in the price level before households react.

A dummy variable included in these specification is home ownership. If the respondent owns his own home a value of one was assigned and a zero otherwise. As can be seen from tables C.1 and C.2, this variable has a significantly negative impact on the households holdings of money, and this could be a reflection of several things. First, home ownership may mean more time intensive production in the household, reducing the demand for money. Second, it could result from the fact that people who own their own homes put a significant share of their liquid assets into the purchase of a home, as well as a significant proportion of their income into the mortgage payments. This causes them to be, what is typically referred to as, house poor, i.e., they do not have much left over for purchasing market goods and therefore undertake time intensive activities. A third explanation is a portfolio one, in that the house may be the alternative to holding money as postulated in a portfolio approach to asset management. Those households, which do not own a home, will hold more money, whereas, buying a home is an alternative to holding liquid assets in the household's portfolio.

There exists in the CUP data information provided by the households concerning changes in wealth due to capital gains, capital losses, and receipts of gifts or bequests. If the household

APPENDIX TABLE C.2

DEMAND DEPOSIT REGRESSIONS VII

	(1) NOMDD	(2) NOMDD	(3) NOMDD
FAMSIZ	-.043	-.043	-.042
	(4.7)	(4.6)	(4.6)
AGE	.017	.017	.017
	(10.6)	(10.5)	(10.5)
WNILF	-.22	-.19	-.20
	(-1.15)	(-1.01)	(-1.07)
EDHUS	.19	.19	.19
	(6.6)	(6.5)	(6.6)
EDWIF	.12	.12	.12
	(4.3)	(4.2)	(4.4)
REGPRI(ln)	-1.175	-1.169	-1.156
	(1.99)	(1.99)	(1.96)
REGINT(ln)	1.055	1.028	1.020
	(4.6)	(4.5)	(4.5)
NETWOR(ln)	.3569	.3454	.3591
	(23.1)	(22.04)	(23.4)
FAMINC(ln)	.6333	.6172	.6235
	(20.8)	(20.3)	(20.5)
RATWGINC(ln)	.0481	.0441	.0460
	(2.1)	(1.9)	(1.98)
OWNHOM	-.25	-.24	-.25
	(-7.3)	(-7.1)	(-7.3)
GIFBEQ	1.01		
	(2.7)		
CAPTG		.179	
		(4.99)	
CAPTL			.232
			(3.8)
$\bar{R}^2$	.3599	.3623	.3609
F	222.8	225.11	223.8

experienced one of these events, a one was assigned and a zero otherwise. The results of testing these three variables are presented in table C.2. An increase in the households wealth due to the receipt of a gift or a bequest will have a positively significant impact on the household's money balances. If the household experienced a capital gain it will increase its money balances. Both of these variables could be reflecting a wealth effect on the household's money balances. But it could also be a reflection of the fact that the gift or bequest could have been received in the form of money. Also a household will not actually receive a capital gain until an asset is sold which means it will have an increase in its money holdings from the sale. This is, especially true for a capital loss, since the loss will not be realized until the household sells its non-monetary asset, and this would account for the significantly positive impact of the capital loss variable.

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