The Life-Cycle Motive and Money Demand: Further Evidence

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Abstract

This study takes a closer look at the relationship between money demand and the life-cycle motive using panel data from the Survey of Income and Program Participation. Findings indicate that the life-cycle motive exerts a direct impact on household demand for interest-earning monetary assets, but not on non-interest-earning checking deposits. The strength of the relationship, however, varies among households with divergent characteristics. There is no evidence of a unitary income elasticity for both interest- and non-interest-yielding monetary assets. The demand for interest-earning monetary assets is very sensitive to changes in the own rate of interest, but the interest rate elasticity for non-interest-earning checking accounts is quite small.

1. Introduction

In the literature on money demand, past studies were mainly conducted within the theoretical framework of the transactions approach (Baumol, 1952; Tobin, 1956) and the asset approach (Friedman,1956). Prior to the mid 1970s, both approaches were employed in the cross-sectional studies by Lydall (1958), Watts and Tobin (1960), Pesek (1963), Lee (1964), and others. Since the mid 1970s, however, the discovery and collapse of the standard partial dynamic model of aggregate money demand (Goldfeld 1973; Judd and Scadding, 1982) have greatly diverted the attentions of monetary economists from cross-sectional studies. This lack of cross-sectional studies on money demand has shed little light on how life-cycle choices affect microeconomic money demand, as postulated by the life-cycle hypothesis (Modigliani and Brumberg, 1954).

Although recent cross-sectional studies by Tin (1998) show that the level of income and money demand exhibit a life-cycle relationship during various stages of an individual's life, whether the life-cycle motive has a direct impact on money demand or not remains to be investigated. This study uses panel data from the Survey of Income and Program Participation (SIPP) conducted by the U.S. Bureau of the Census to show that the life-cycle motive not only has an indirect effect but also has a direct effect on money demand. When money demand is regressed on household income, the rate of return, age, age square, and other demographics, the coefficients of age and age square are significant and opposite in sign, suggesting that the life-cycle motive has a direct effect on household demand for monetary assets, especially interest-earning monetary assets.

This paper is organized in the following manner. Section 2 explains the model. Section 3 discusses the data source and definitions. Section 4 presents empirical results. A brief conclusion is given in the final section.

2. The model

Following the literature on money demand, the log-linear money demand function is adopted:

$$\ln m_t = \alpha_1 + \alpha_2 \ln y_t + \alpha_3 \ln i_{ot} + \alpha_4 \ln i_t + \alpha_5 Age + \alpha_6 Age^2 + \theta' D_t + \epsilon_t \qquad (1)$$

where m_t is real money demand at time t, y_t is the scale variable, i_{ot} is the own rate of interest on m_t, i_t represents the cross rate of interest on alternative financial assets, Age is the age of a householder, and D_t is a set of other demographics. The restrictions, $\alpha_2 > 0$, $\alpha_3 > 0$, and $\alpha_4 < 0$, are assumed to hold. In order for the life-cycle motive to exert a direct effect on money demand, the restrictions, $\alpha_5 > 0$ and $\alpha_6 < 0$, must hold. The signs

of θ' vary with demographic variables. The error term, ϵ_t, is assumed to be normally distributed with zero mean and constant variance.

Econometrically, equation (1) can be estimated only if micro data on the dependent and independent variables are available. Since the SIPP does not collect information on the rate of return on financial assets, the rate of return is approximated by dividing the gross amount of return by the gross amount of monetary assets possessed by each household in financial institutions. This measurement, however, gives rise to an econometric problem that must be resolved before unbiased parametric estimates can be obtained. Replacing the own and cross rates of interest by the ratio of the amount of return to the amount of monetary assets, equation (1) can be expressed as

$$\ln m_t = \alpha_1 + \alpha_2 \ln y_t + \alpha_3 \ln \left(\frac{r_{ot}}{m_t}\right) + \alpha_4 \ln \left(\frac{r_{jt}}{m_{jt}}\right) + \alpha_5 Age + \alpha_6 Age^2$$
$$+ \theta'D_t + \epsilon_t \tag{2}$$

where m_{jt} represents financial assets other than m_t. The symbols, r_{ot} and r_{jt}, are the gross amounts of own and cross return on m_t and other financial assets, respectively. Equation (2) shows that regressing money demand on the own rate of return would lead to biased parametric estimates, because the own rate of return is not only correlated with the error term but also correlated with other explanatory variables. Utilizing the property of logarithm and rearranging terms, equation (2) can be rewritten as

$$\ln m_t = \beta_1 + \beta_2 \ln y_t + \beta_3 \ln r_{ot} + \beta_4 \ln \left(\frac{r_{jt}}{m_{jt}}\right) + \beta_5 Age + \beta_6 Age^2 + \rho'D_t + \mu_t \tag{3}$$

where

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$$\beta_1 = \frac{\alpha_1}{1+\alpha_3}$$

$$\beta_2 = \frac{\alpha_2}{1+\alpha_3}$$

$$\beta_3 = \frac{\alpha_3}{1+\alpha_3}$$

$$\beta_4 = \frac{\alpha_4}{1+\alpha_3} \qquad (4)$$

$$\beta_5 = \frac{\alpha_5}{1+\alpha_3}$$

$$\beta_6 = \frac{\alpha_6}{1+\alpha_3}$$

$$\rho' = \frac{\theta'}{1+\alpha_3}$$

$$\mu_t = \frac{\epsilon_t}{1+\alpha_3}$$

Equation (3) shows that, in order to resolve the measurement error associated with the own rate of return, the demand for interest-earning monetary assets can be expressed as a function of the scale variable, amount of own return, cross prices, age, age square, and other demographic variables. Equation (4) indicates that the reduced-form parameters are smaller than their structural counterparts in absolute terms due to the discounter factor $1/(1+\alpha_3)$. Nevertheless, when non-interest-earning monetary assets such as non-interesting-earning checking accounts are defined as the dependent variable, the own rate of return can be omitted and equation (2) is appropriate for regression analysis. Rearranging terms in equation (4) yields

$$\alpha_1 = \beta_1(1+\frac{\beta_3}{1-\beta_3})$$

$$\alpha_2 = \beta_2(1+\frac{\beta_3}{1-\beta_3})$$

$$\alpha_3 = \frac{\beta_3}{1-\beta_3}$$

$$\alpha_4 = \beta_4(1+\frac{\beta_3}{1-\beta_3}) \qquad (5)$$

$$\alpha_5 = \beta_5(1+\frac{\beta_3}{1-\beta_3})$$

$$\alpha_6 = \beta_6(1+\frac{\beta_3}{1-\beta_3})$$

$$\theta' = \rho'(1+\frac{\beta_3}{1-\beta_3}).$$

which shows that, given knowledge of the reduced-form estimates, all structural long-run parametric estimates can be identified and calculated.

3. Data source and definitions

All data are obtained from the third wave of the 2001 panel of the Survey of Income and Program Participation conducted by the U.S. Bureau of the Census. The primary focus of the SIPP is on individuals who are 15 years of age or older and are members of the civilian noninstitutional population of the United States or members of the Armed Forces living off post or with their families on post. Data in wave 3 were collected from October 2001 to January 2002 by interviewers from respondents who owned financial assets in their own names or jointly with spouses. The 2001 SIPP contains cross-sectional information not only on non-interest-earning checking accounts but also on such interest-earning monetary assets as interest-earning checking accounts, regular or passbook savings accounts, money market deposit accounts, and certificates of deposit. In this study, household income is defined as the sum of labor and nonlabor incomes. Labor income consists of wages, salaries, and self-employment income, while nonlabor income consists of interests and dividends from financial assets, retirement incomes, Social Security income, government transfers, and other types of income. As mentioned before, the SIPP does not gather information on the rate of return. The rate of return is estimated by taking the ratio of the amount of return on interest-earning assets to the total amount of monetary assets.

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Throughout this study, a householder is defined as a reference person in whose name the residence is owned, bought, or rented. As with past studies on the life-cycle behavior of household saving (Browning and Lusardi, 1996), the direct effect of the life-cycle motive on money demand is captured by age and age square. Other demographic variables included in each regression are education, marital status (Married=1, 0 otherwise), number of children (with children=1, 0 otherwise), race (African American=1, 0 otherwise), and gender (female=1, 0 otherwise).

4. Empirical evidence

Ordinary least square (OLS) results for all sample households with interest- and non-interesting-yielding monetary assets are presented in table 1. The first regression contains findings for households with both interest- and non-interest-earning monetary assets as the dependent variable. The second regression is conducted for households possessing interest-earning monetary assets, regardless whether or not they possess non-interest-earning checking accounts. The third regression is conducted with non-interest-earning checking accounts as the dependent variable and the rate of return on interest-earning monetary assets as the cross rate of return.

As shown in the first regression, the reduced-form coefficients of age and age square are significant and opposite in sign, suggesting that a direct relationship exists between the life-cycle motive and the demand for interest- and non-interesting-earning monetary assets as a whole. At lower levels of aggregation, the coefficients of age and age square in the second regression indicate that the life-cycle motive and the demand for interest-earning-monetary assets are directly related. However, findings in the third regression reveal that a direct relationship does not exist between non-interest-earning checking accounts with high degrees of liquidity and the life-cycle motive. In comparison with past findings (Tin, 1999), the inclusion of age square as an explanatory variable in microeconomic money demand has provided further evidence that the strength of the relationship between the life-cycle motive and money demand is influenced by the attribute of the monetary asset under investigation.

The reduced-form and implied long-run elasticity of income is positive and significant in the first and second regressions. For non-interest-earning checking accounts, the long-run elasticity of income is 0.31. The reduced-form elasticity of own return is positive and significant in the first and second regressions. Given estimates of the reduced-form elasticity of income for interest-earning monetary assets, Table 2 shows that the corresponding estimates of the structural long-run elasticity of income are 0.73 and 0.64. Likewise, the corresponding estimates of the implied long-run interest rate elasticity are 1.17 and 1.83, respectively. However, the third regression in Table 1 shows that the elasticity of the cross rate of return for non-interest-earning checking accounts is negative and significant with a magnitude of -0.08 only. These findings suggest that the long-run elasticity of income is not unitary and the magnitude of the long-run elasticity of interest rate for non-interest-earning checking account falls far short of the value of -0.5 found by Hoffman (1991) and Lucas (1988). These results,

however, are consistent with the postwar findings by Ball (2001).

Other findings in Tables 1 and 2 show that householders with more education save more in monetary assets than those who are less educated. Married people tend to save more in interest-earning monetary assets but less in non-interest-earning checking accounts than those who are separated, divorced, widowed, or never married. Households with the presence of children spend more and save less than those with no children at home. By race and gender, households maintained by women or African Americans spend more and save less than men or Whites. In comparison, these findings reinforce past findings by Tin (1998, 1999) that human capital and family formation variables play a significant role in determining microeconomic money demand.

It ought to be mentioned that the aforementioned analysis reflects the net effect of the life-cycle behaviors of money holders as a whole and does not necessarily imply that the strength of the life-cycle motive is constant across all underlying households. Dis-aggregating the total number of households possessing both interest- and non-interest-yielding monetary assets by educational level, marital status, number of children, gender, and race reveals that the strength of the life-cycle motive varies substantially among heterogeneous households. As shown in Table 3, the coefficients of age and age square indicate that more educated householders tend to have a stronger life-cycle motive than those who are less educated. Married people have a stronger life-cycle motive than those who are separated, divorced, widowed, or never married. Households with the presence of children have a stronger life-cycle motive. Men have a stronger life-cycle motive than women, and African Americans have a weaker life-cycle motive than White Americans. Likewise, the magnitudes of the long-run coefficient estimates of income, own rate of return, and demographic variables also differ considerably among households with divergent characteristics.

5. Conclusion

Findings in this study show that the direct life-cycle motive, as captured by age and age square, has a significant impact on the demand for monetary assets, especially interest-earning monetary assets. For non-interest-earning checking accounts with high degrees of liquidity, however, no such direct relationship can be detected. Judging from the relatively magnitudes of the elasticity of income and the coefficients of age and age square, the strength of the life-cycle relationship between income and money demand appears to be stronger than the strength of the direct relationship between the life-cycle motive and money demand. The coefficients of other demographic variables also show that life-cycle choices about marriage and child-bearing and differences in gender and racial compositions of the population also have large impacts on money demand. Nevertheless, the strength of the life-cycle motive does not stay constant across households. There is no evidence of a unitary or extremely large long-run elasticity of income, and the long-run interest rate elasticity of non-interest-earning checking accounts is relatively small.

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Table 1. Empirical findings for households possessing monetary assets

Explanatory variable	Interest- and non-interest-earning monetary assets	Interest-earning monetary assets	Non-interesting-earning checking accounts
Constant	-1.2103	1.0878	-3.5338
	(4.09)	(4.00)	(7.13)
Real income	0.3375	0.2264	0.3107
	(18.36)	(13.40)	(9.89)
Own return	0.5402	0.6461	
	(53.37)	(69.46)	
Cross rate of return			-0.0781
			(4.60)
Age	0.0781	0.0307	-0.0264
	(12.38)	(5.33)	(2.36)
	0.1699	0.0867	
Age square	-0.0006	-0.0001	0.0004
	(10.76)	(2.09)	(3.67)
Education	0.0841	0.0461	0.0931
	(14.18)	(8.45)	(9.11)
Married	0.3003	0.5697	-0.4899
	(7.66)	(15.81)	(7.00)
	0.6531	1.6098	
Children	-0.1196	-0.1285	-0.1440
	(2.89)	(3.37)	(2.04)
Female	-0.2924	-0.0666	-0.2648
	(8.44)	(2.09)	(4.45)
Black	-0.8055	-0.8203	-0.4848
	(12.18)	(13.44)	(3.89)
R square	0.375	0.4609	0.1039
Sample size	10926	10871	3090

Note: T-statistics are in parentheses.

Table 2. Implied long-run parametric estimates of interest-yielding monetary assets

Explanatory variable	Interest- and non-interest-earning monetary assets	Interest-earning monetary assets
Real income	0.7340	0.6397
Own rate of return	1.1749	1.8257
Age	0.1699	0.0867
Age square	-0.0013	-0.0003
Education	0.1829	0.1307
Married	0.6531	1.6098
Children	-0.2601	-0.3631
Female	-0.6359	-0.1882
Black	-1.7518	-2.3179

Life-cycle money demand	Education		Marital status		Children		Gender		Race	
	No college	College	Married	other	None	1 or more	Female	Male	African American	White
Constant	-2.6182	1.8548	-1.7618	-0.1109	-0.2743	-3.6503	-0.9356	-1.5717	-4.6669	-0.9916
	(8.36)	(8.86)	(4.69)	(0.23)	(0.77)	(6.19)	(1.97)	(4.15)	(3.50)	(3.26)
Real income	0.3939	0.3485	0.4062	0.2883	0.3225	0.3791	0.3389	0.3396	0.3818	0.3337
	(12.26)	(15.73)	(15.49)	(10.90)	(14.95)	(10.80)	(12.03)	(14.00)	(4.69)	(17.74)
Implied long-run elasticity	0.9359	0.7603	0.8844	0.6234	0.7017	0.8163	0.7443	0.7352	0.5689	0.7484
Own return:	0.5791	0.5416	0.5407	0.5375	0.5404	0.5356	0.5447	0.5381	0.3289	0.5541
	(33.42)	(43.93)	(43.58)	(31.20)	(46.00)	(26.97)	(35.72)	(39.71)	(7.33)	(53.41)
Implied long-run elasticity	1.3759	1.1815	1.1772	1.1622	1.1758	1.1533	1.1964	1.1650	0.4901	1.2427
Age	0.0491	0.1046	0.0941	0.0609	0.0658	0.1291	0.0752	0.0804	0.0527	0.0793
	(4.49)	(13.21)	(10.69)	(6.63)	(9.23)	(6.95)	(8.27)	(9.24)	(1.94)	(12.36)
Age square	-0.00036	-0.0009	-0.0007	-0.0005	-0.0005	-0.0011	-0.0006	-0.0007	-0.0003	-0.0006
	(3.72)	(12.01)	(8.70)	(6.22)	(8.21)	(5.48)	(7.25)	(8.05)	(1.37)	(10.77)
Education			0.0856	0.0725	0.0705	0.1088	0.0738	0.0908	0.1411	0.0796
			(11.80)	(7.10)	(10.00)	(9.83)	(7.78)	(11.88)	(5.72)	(13.05)
Married	0.3102	0.3037			0.3175	0.2978	0.2231	0.3997	0.2748	0.3076
	(4.61)	(6.25)			(7.14)	(3.45)	(3.86)	(7.18)	(1.70)	(7.62)
Children	-0.1821	-0.1403	-0.0023	-0.3294			-0.1881	-0.1019	-0.1313	-0.1204
	(2.25)	(2.87)	(0.05)	(3.82)			(2.94)	(1.85)	(0.80)	(2.81)
Female	-0.1784	-0.3527	-0.3605	-0.1116	-0.2404	-0.3811			-0.2595	-0.2991
	(2.90)	(8.36)	(8.47)	(1.82)	(5.76)	(6.12)			(1.71)	(8.43)
Black	-0.8653	-0.7979	-0.8565	-0.7523	-0.8415	-0.6997	-0.7502	-0.8638		
	(7.93)	(9.51)	(9.21)	(7.74)	(10.01)	(6.41)	(8.14)	(8.96)		
R square	0.3601	0.3572	0.3861	0.3231	0.3699	0.3768	0.3558	0.3706	0.2501	0.3702
Sample size	3689	7237	6739	4187	7354	3572	4857	6069	729	10197

Note: T-statistics are in parentheses.