Wealth and cash asset proportions

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1. INTRODUCTION

The question of whether cash holdings will increase more than proportionally with increasing wealth has been examined using both time series and cross-sectional data.[1] The results are not mutually consistent; time series data indicate that the cash proportion rises with wealth and cross-sectional studies conclude conversely.

Section 2 of this paper brings together reasons for suspecting that the time series relation does not capture the cash-wealth relation correctly. Section 3, on the other hand, presents a case for the veracity of the cross-sectional findings of myself and others which suggest that the cash proportion of wealth declines with increasing wealth. The consistency of the cross-sectional results is invariant to (1) choice of estimation technique, (2) alternative variable definitions (in particular, of wealth), (3) inclusion or exclusion of various control variables, and (4) the particular data source employed (estate tax data in the United States and in England corroborate the survey findings). Section 4 summarizes, emphasizing the implications for certain hypotheses in monetary and portfolio theory of the correct empirical relation.

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2. TIME SERIES EMPIRICAL RESULTS

Time series analysis on average cash balances indicates a wealth elasticity (where income is taken as a proxy for wealth) of greater than unity. Hence, the cash proportion of wealth has risen over time. Since the most famous of these studies states the case by far the most strongly we will consider it in detail.

Friedman's Findings

Friedman [4] reported the following results based on a money stock series covering the years 1870–1954:[2]

1. A secular increase in real per capita income of 1 percent resulted in a 1.8 percent increase in per capita real cash balances (taken to be currency held by the public, adjusted demand deposits, and commercial bank time deposits). Hence money is a "luxury good." In getting this result, Friedman used twenty observations—an average for each cycle in the nine-decade period.
2. Allowing for secular trends, an increase of 1 percent in real income during a cycle resulted in an increase in money holdings of only one-fifth of one percent.

Friedman attempts to reconcile these results in a manner analogous to that used in his *A Theory of the Consumption Function:* "suppose that the demand for real cash balances were determined entirely by real permanent income according to the relation estimated in the secular analysis and that actual balances throughout equaled desired balances. Velocity would then fall during contractions, *provided* that it was computed by dividing *permanent income* by the stock of money. But the numbers we have been calling "velocity" were not computed in this way; they were computed by dividing measured income by the stock of money. Such a *measured* velocity would tend to be lower than what we may call *permanent* velocity at troughs, because measured income is then lower than permanent income, and would tend to be higher at peaks, because measured income is then higher than permanent income. Measured velocity might therefore conform positively to the cycle, even though permanent velocity conformed inversely." [4, p. 334]

What Friedman does, then, is operate under the notion that the secular findings are "correct" and the cyclical findings, being inconsistent with the secular "truth," must be reanalyzed to eliminate the inconsistencies.

The presumption implicit in Friedman's view is that the utility function is stable over the entire ninety-year period, for otherwise the cycles could represent the true relationship shifting over time. Friedman is, of course, aware of this: "the changes in the real stock of money and in the income velocity of circulation reflect either (a) shifts along a relatively fixed demand schedule for money produced by changes in the variables entering into that schedule; (b) changes in the demand schedule itself; or (c) temporary departures from the schedule, that is, frictions that make the actual stock of money depart from the desired stock of money. The rest of this

[2]I am only reporting on those aspects of Friedman's investigation that are of interest for the present purposes.

paper is an attempt to see to what extent we can reconcile the secular and cyclical behavior of velocity in terms of a alone without bringing in the more complicated phenomena that would be involved in b and c." [4, p. 332]

An Alternative Interpretation

It is my feeling that it is the cyclical findings that are "correct," and it is, in fact, the secular findings that need to be reexamined. Lending support to this view is the finding that "permanent per capita money balances are *negatively* related to permanent per capita income for the nine years 1950-1958." [12, p. 236] Thus, velocity is apparently rising again in contradiction to what one would expect based on Friedman's interpretation of the data.

In order to make a case for the idea that the true relationship captured in Friedman's cyclical findings has shifted upward over time, one must search for institutional changes or theoretical explanations yielding that implication. The following discussion is intended to be illustrative of the types of institutional changes which might well have caused such shifts. This list of factors is not entirely novel, but in bringing old criticisms together with some new I am attempting to demonstrate how heroic it is to postulate a stable relationship over a ninety-year period during which momentous social changes have occurred.

1. A primary reason to expect average cash balances to rise over time is that population per household has fallen quite dramatically over the time series years covered (exhibiting a steady drop from 5.28 to 3.42 during the period 1860-1957 [16, p. 16]). The reasoning here is quite analogous to the more general inventory holding problem. There would be, in effect, "increasing returns to household size," with larger households demanding average cash balances larger, but less than proportionally larger, than smaller households for both transactions and precautionary reasons.[3]

2. Also one suspects that trends toward after-tax income equality (Friedman's data are before-tax) should imply further proportional increases in money demand (for transactions demand reasons akin to those in 1).

3. Trends in population mobility provide another reason for expecting an increasing cash proportion over time. Increasing mobility results in greater demands for precautionary liquid assets (Friedman's cash) since ever fewer people have close friends at hand whom they can rely on to help them out in an emergency. Adding to this

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[3]Elaborating, consider the "pot-and-pan" holdings of a household composed of eight individuals compared to the "pot-and-pan" holdings of two households composed of four individuals each, where the per capita household incomes and wealths are the same. The larger household would have larger average "pot-and-pan" holdings than either small household, but the smaller households considered *together* would have a larger average "pot-and-pan" holding than the larger household. Substituting "cash balances" for "pot-and-pan" in this illustration yields the desired result—average cash balances would be expected to rise over time, independent of changing wealth, due to the decrease in average household size. It is clear that not everything can belong to the "pot-and-pan" category, of course, and the justification for lumping "pot-and-pan," "cash balance," and similar items is closely akin to that provided by Hicks [8] in his discussion of "desired" versus "required" holdings for transactions. Further, the smaller modern families would demand larger per capita precautionary liquid assets since they have fewer risk pooling possibilities than larger families (to the extent that things like broken arms are independent events among family members).

the increasingly impersonal modern existence (people "don't want to get involved"), the implication would seem to be a greater need for cash balances.

4. Lepper, in an analysis of the effects of various tax structures on financial asset-holding, demonstrates that increased taxation (particularly progressive) without loss offset provisions will generally affect the demand for risky assets (and, by Walras's Law, the demand for cash). She notes that "Empirical observations of a fairly casual sort, and the study by Butters, Thompson, and Bollinger seem to suggest that investors are primarily concerned with the negative, rather than with the entire, dispersion of a distribution. If this is the case, the possibility of tax-induced limitations of demand for risky assets is unequivocal." [11, p. 57] Since taxation rates have been rising over time, without loss offset provisions (until very recently) one should expect that the M_2 proportion would increase. The trend toward increased estate and gift taxation is also relevant in this context.

5. I am not the first to take exception to Friedman's interpretation of his data. Tobin [15], in a critical review of the Friedman and Schwartz (F and S) book [5], raises what are perhaps more traditional theoretical objections to the findings of Friedman:

> You have your choice. The F and S income-luxury theory seems to work up to World War II but has to rely on considerable *ad hoc* explanation since. The Keynes-Latane interest rate theory of velocity seems to work since 1909 or so, but needs help for the preceding period.
> This help is not hard to find. The downward trend in velocity coincided with a strong upward trend in the public's holdings of deposits relative to currency, the deposit-currency ratio already discussed. Neither trend started until about 1880. The correlation between these two variables before 1915 is 0.90. . . . Mutual savings banks were almost as important as commercial banks around 1880, when the decline in velocity began. Their deposits were 80 percent as large as those in commercial banks in 1887, 60 percent as large in 1880, only 25 percent as large as their rivals in 1915. . . . Perhaps 1880–1915 was the great day for commercial banking, and the decline in velocity reflects its successful spread. [15, p. 475]

With regard to the Friedman interpretation of the cyclical findings, Tobin notes that "in boom times deposits lose out to other thrift accounts, to securities, including equities, and to real investments, while in recessions these alternatives become relatively less attractive. When a phenomenon is so simply explained, is it necessary to construct an elaborate theory, in which estimates of unobserved variables like permanent income and permanent prices are invested with an altogether spurious reality?" [15, p. 478]

6. Further, in a stimulating recent analysis of the stochastic structure of the Friedman and Schwartz velocity series, Gould and Nelson make a strong case for the notion that there is no significant correlation between successive changes in velocity. In their words, "the velocity series constructed by Milton Friedman and Anna Schwartz is well characterized as a simple random walk." [6, p. 405] This is actually more a criticism of time series generally in testing the behavioral relations investigated here than of the Friedman velocity finding per se. One suspects that a

TABLE 1

Test of Portfolio Implications of Increasing Wealth Using SFCC*
Data As of Dec. 31, 1962

(1) Liquid proportion = 0.6258 − 0.00120 (W) $R^2 = 0.063$
               (0.00010)

(2) ln (liquid assets) = 7.888 + 0.69217 (ln W) $R^2 = 0.705$
               (0.00947)

where W is total financial wealth in ten thousands of dollars.

*Survey of Financial Characteristics of Consumers.
Note: Standard errors are in parentheses below the respective coefficients. Number of observations = 2239 (zero wealth sample units were omitted).

broad range of cash holding-wealth relations over time, including those with wealth elasticities less than unity, could also be so characterized.

7. Finally, data measurement errors are likely to be troublesome in Friedman's time series observations. He was forced to employ *NNP*, money stock, and price index estimates whose reliability, particularly for the earlier years (which did not fit the Tobin interpretation), is questionable.

Although I would not like to give undue stress to any one of the foregoing alternative explanations of Friedman's findings, these arguments taken together provide a convincing argument that the true relationship between cash proportion and wealth in Friedman's data might well be the cyclical findings and not the secular. This is particularly likely in light of the fact that other authors working with time series data find wealth elasticities much closer to unity.

3. CROSS-SECTIONAL AND OTHER FINDINGS

Clearly, potential problems akin to those of the time series data must be avoided in dealing with cross-sectional data. Merely regressing the liquid asset or cash proportion on wealth and observing the sign of the wealth variable could result in bias due to the nonoffsetting effects of omitted variables. In this section, then, an attempt is made to study the cross-sectional relationship between wealth and the liquid asset proportion within homogeneous groups. The data employed in this study are from the Federal Reserve's *Survey of Financial Characteristics of Consumers.*[4]

I have reported in Table 1, nonetheless, on the relationship between liquid asset proportion and wealth by itself because I do not want to give the impression that many qualitative and demographic variables *must* be included in order to get a result inconsistent with the time series findings of Friedman and others. Indeed, the inconsistency will be shown to be notably insensitive to how the cross-sectional data are handled.

It will be noted in equation (1) of Table 1 that the liquid asset proportion actually

[4]See [12] for greater detail. Briefly these data are cross-sectional (as of December 31, 1962) and are nonrandom in that areas expected to have higher wealth individuals were sampled at higher rates.

decreases with wealth, with the t statistic being greater than 12. Liquid assets are here taken to be the sum of checking accounts, savings accounts of all kinds, and U.S. Savings Bonds. Similar results obtain for stricter definitions of "cash."

Another way of depicting the findings which were contrary to the time series relation would be to fit the following equation:

$$\ln (\text{Liquid assets}) = a + b (\ln W), \tag{1}$$

where W is total financial wealth (the sum of liquid and investment assets). The coefficient of the $\ln W$ term in equation (1) (see equation (2), Table 1) may be interpreted as the wealth elasticity of demand for liquid assets. Since one would from time series findings expect this coefficient to be greater than unity (1.8 in Friedman's study), a one-tailed test of whether the $\ln W$ coefficient is significantly less than 1 was set up:

<div align="center">

Null hypothesis $\qquad b = 1$,

Alternative hypothesis $b < 1$,

$t = (0.69217 - 1)/0.00947 = 32.5$.

</div>

Since the odds of drawing a coefficient 32.5 standard deviations below the assumed true value of 1 are less than one in a trillion, the time series contention that the true value is *greater* than one appears quite suspect.

The results depicted in Table 1 are, of course, open to question since many things, such as age, education, and occupation, should correlate with wealth. It will be shown, however, that the results shown in Table 1 do not change in any essential way when other variables are included in the regression.

In particular, including age and education in the regression yields the following:

$$\text{Liquid prop.} = 1.4785 - 0.02015 \text{ (ed.)} - 0.00787 \text{ (age)} - 0.0011 \text{ } (W) \qquad R^2 = 0.21$$
$$\phantom{\text{Liquid prop.} = 1.4785 - } (0.00143) \qquad (0.00066) \qquad (0.00013)$$

$$\tag{2}$$

Age and education could have been handled in many ways. Dummy variables (as well as age-education interaction dummies) were employed, but seemed to add nothing to merely treating age and education as ordinary quantitative variables. Education, in equation (2), is the sum of the years of formal education of the household head and spouse.[5]

Education, age, and wealth were the three principal variables influencing asset proportions, but two other explanatory variables were uncovered in attempting to obtain the homogeneous groups necessary to properly examine the cash-wealth relation:

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[5]The impact of education was quite similar for either sex separately, however treating them together reduced a slight multicollinearity problem. Examination of the Beta coefficients for equation (2) yields the interesting finding that education has a larger relative impact on the portfolio decision than either wealth or age.

Liquid prop. = $1.211 - 0.01564$ (ed.) $- 0.00612$ (age) $- 0.00108$ (W)
    (0.00146) (0.00067) (0.00012)

    $+ 0.14651$ (no inheritance) $- 0.14178$ (self-employed).
    (0.02019) (0.01964)

    $R^2 = 0.251$ $F = 118.98$ 1778 observations.   (3)

If one has *not* inherited a significant portion of his present assets, the proportion of his liquid financial assets is seen to be higher. This likely reflects either that those receiving inheritances are more familiar with various assets or just that they tend to inherit noncash assets (e.g. stocks, which save the giver capital gains taxes) and just keep them in that form. Also, employment status seemed to make an important difference; a self-employed man has a lower proportion of his financial assets in liquid or cash form. This could be partially misleading if an individual has access to liquid funds that are technically owned by his business, but, at any rate, the result will not surprise anyone who believes that the entrepreneur is a "different sort of animal."

A partial list of variables examined during this study would include age, education, occupation, sex, race, number of children, region of the country, urban classification, marital status, inheritance, and employment classification. Most of these variables had little independent impact on the portfolio decision and the sign and significance of the wealth coefficient was in no case materially affected. Other authors, referred to below, introduced some of these, and other (attitudinal, etc.) controls and found that the wealth effect on the portfolio decision was substantially unaffected.

The choice of estimation technique may be criticized in that I employ asset proportions as dependent variables in an otherwise ordinary least-squares framework. Projector and Weiss [13, pp. 90–91] employ three different functional forms; two of these involved logarithmic transformations and the third was somewhat more complicated. Other authors (e.g. [3, 10]) arrive at identical conclusions with a mixture of tables, graphs, scatter diagrams, and so on.

Similarly, one may criticize the wealth definition employed here (financial assets). However, in preliminary work, in most of the references above, and in one to follow, more inclusive wealth definitions were employed with no qualitatively different results.

The inconsistency of the sign of the wealth variable with that expected from time series studies is certainly not unique to survey data. Among the male federal estate tax data [9] the results were:

    Liquid prop. = $0.069 + 0.00817$ (age) $- 0.00265$ (net worth).   (4)
    (0.00128) (0.00053)

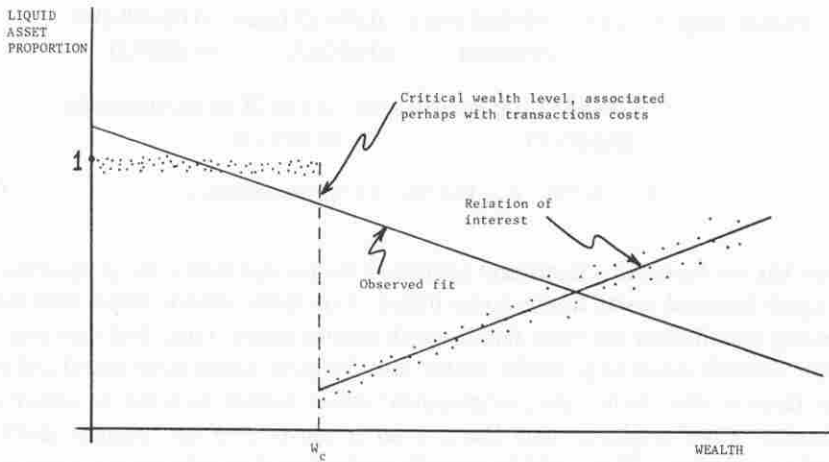It should be noted that, when age was not controlled for, the time series conclusion

Fig. 1. A Possible Specification Error

appeared to hold for these data:

$$\text{Liquid prop.} = 0.12001 + 0.00336 \text{ (net worth).} \qquad (5)$$
$$(0.00014)$$

While most of the raw data for the studies referred to above came from surveys, Lampman's [10] estate tax multiplier method provides a source, not subject to survey bias, that substantiates the survey findings. For England, similar results conflicting with the time series results were found by Spraos [14].

The above findings might come under question should the appropriate specification of the model be nonlinear. That is, as depicted in Figure 1, the relation above some low wealth level could support the time series implications, even though the observed fit did not. Wealth cohorts were formed, as were wealth-age-education cohorts, to test for this possibility. The analysis of these cohorts, too lengthy for inclusion here, strongly supports the contention that average cash balances (and liquid assets generally) rise proportionately less than wealth.

4. CONCLUSIONS AND IMPLICATIONS

If one can regard wealth and income as proxies for one another, as seems reasonable, the analysis presented here casts doubt on the empirical validity of two hypotheses in the monetary and portfolio literature.

First, Arrow [1, 2] employs the time series data as empirical verification for his "increasing relative risk aversion hypothesis." Under this hypothesis, doubling one's wealth will result in a *more* than doubled riskless asset holding (taken to be cash by Arrow).[6] The rising cash proportion and rising income (wealth) over time depicted

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[6]In a world of uncertain inflation there are no riskless assets. Since the data for this study are as of December 31, 1962, this point may not be as disturbing as it would be for more recent data.

in Friedman's findings support Arrow's hypothesis. However, the robust opposite result for cross-sectional data, when combined with the weaknesses outlined here in the time series analysis,[7] cast strong doubt on the validity of this hypothesis.[8]

A more specifically policy-oriented question relates to the steady-state inflation to be expected in a growing economy from any given rate of increase in the money supply. This will clearly depend on the wealth-cash proportion relationship. That is, if velocity is in fact rising with wealth, the amount of inflation resulting from any given percentage increase in the money supply over time will be larger than that expected under the assumption of a falling velocity.[9]

Other practical considerations no doubt hinge critically on whether the cash proportion rises or falls with increasing wealth. In such situations it seems that the latter assumption is the more empirically tenable.

LITERATURE CITED

1. Arrow, Kenneth J. "Aspects of the Theory of Risk-Bearing," Lecture 2, *Yrjo Jahnsson Lectures.* Helsinki: The Yrjo Jahnsson Foundation, 1965.

2. _____. *Essays in the Theory of Risk-Bearing,* Chapter 3. Chicago: Markham Publishing Company, 1971.

3. Claycamp, Henry J. *The Composition of Consumer Savings Portfolios.* Urbana: University of Illinois, 1963.

4. Friedman, Milton. "The Demand for Money: Some Theoretical and Empirical Results." *Journal of Political Economy,* 67 (1959), 327–51.

5. Friedman, Milton, and Anna J. Schwartz. *A Monetary History of the United States 1867-1960.* Princeton: Princeton University Press, 1963.

[7]The weakness of the empirical support would not be so damaging if Arrow's hypothesis were more theoretically compelling. See [7] for greater emphasis on the theoretical implausibility of the increasing relative risk aversion hypothesis.

[8]I am indebted to an anonymous referee for noting that the existence of negative assets (liabilities) in investor portfolios suggests that total risky assets rather than cash balances, as used here and in most other studies, is more appropriate to the examination of Arrow's hypothesis. It seems unlikely, however, that this modification would materially alter the results.

[9]This is easy to show more formally. Let $MV = PQ$ be defined in the usual manner, but where we assume $V = V(Q)$. Then, log differentiating,

$$d\ln M + d\ln V = d\ln P + d\ln Q,$$

which may, in light of (2) be written,

$$d\ln M + \eta_{V,Q} \, d\ln Q = d\ln P + d\ln Q.$$

Collecting terms we arrive at

$$d\ln P = d\ln M + (\eta_{V,Q} - 1) \, d\ln Q.$$

Supposing, for illustrative purposes, $d\ln M = 6$ percent per year and $d\ln Q = 2$ percent per year, then if

$$\eta_{V,Q} = 0, \qquad d\ln P = 4 \text{ percent},$$
$$\eta_{V,Q} = -0.25, \quad d\ln P = 3.5 \text{ percent},$$
$$\eta_{V,Q} = 0.25, \quad d\ln P = 4.5 \text{ percent}.$$

Hence, the steady-state level of inflation forthcoming from any given growth rate of the money supply depends on the wealth-cash proportion relationship as outlined in the text.

6. Gould, John P., and Charles R. Nelson. "The Stochastic Structure of the Velocity of Money." *American Economic Review*, 64 (1974), 405-18.

7. Graves, Philip E. "The Increasing Relative Risk Aversion Hypothesis." Ph.D. dissertation, Northwestern University, 1973.

8. Hicks, John R. *Critical Essays in Monetary Theory*. London: Oxford University Press, 1967.

9. Internal Revenue Service, Treasury Department. *Statistics of Income . . . 1962 Supplemental Report, Personal Wealth*. Washington, D.C., 1962.

10. Lampman, Robert J. *The Share of Top Wealth-Holders in National Wealth*. Princeton: Princeton University Press (NBER), 1962.

11. Lepper, Susan. "Effects of Alternative Tax Structures on Individuals' Holdings of Financial Assets." In *Risk Aversion and Portfolio Choice*, edited by Donald Hester and James Tobin. New York: Wiley, 1967.

12. Meltzer, Allan H. "The Demand for Money: The Evidence from Time Series." *Journal of Political Economy*, 71 (1963), 219-46.

13. Projector, Dorothy, and Gertrude Weiss. *Survey of Financial Characteristics of Consumers*. Washington, D.C.: Federal Reserve Technical Papers, 1966.

14. Spraos, John. "An Engel-Type Curve for Cash." *Manchester School*, May 1957, 183-89.

15. Tobin, James. "The Monetary Interpretation of History." *American Economic Review*, 60 (1965), 464-85.

16. U.S. Bureau of the Census. *Historical Statistics of the United States, Colonial Times to 1957*, Washington, D.C., 1960.