# How Important is the Stock Market Effect on Consumption?

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Abstract

The 1990s have seen astonishing growth in the stock market portfolios of Americans, which many have argued has been a major force behind the growth of consumer spending. This paper reviews the relationship between the stock market and the consumer. Using a variety of econometric techniques and specifications, we fail to find evidence of a stable relationship between aggregate consumer spending and changes in aggregate household wealth. While stock market gains have surely provided some support for consumer spending, our hard knowledge is too limited to feel comfortable relying on estimates of the stock market effect in macroeconomic forecasts.

How Important is the Stock Market Effect on Consumption?

The 1990s have seen astonishing growth in the stock market portfolios of Americans. From 1991 through the middle of 1998, the aggregate value of household equity increased by $9.45 trillion, or 260 percent. The ratio of household equity to disposable personal income grew from a low of 0.83 in 1991 to 2.46 by mid-1998. The bulk of these gains occurred in the doubling of the value of the market from the start of 1995 through the middle of 1997-- the value of the market has been erratic since then.

The thrust of this paper is the examination of one of the possible consequences of the market rise. Other things equal, an increase in the stock market makes people richer. In general, the richer people are, the more they spend. Is it possible to quantify these banal truisms and come up with some plausible estimates of the extent to which aggregate consumer spending in the 1990s has been supported by the stock market rise? Furthermore, how much would a market correction take away from future spending?

This paper reviews the relationship between the stock market and the consumer. Our conclusions are very modest: While stock market gains surely provide some support for consumer spending, our knowledge is too limited to feel comfortable relying on estimates of the stock market effect in forecasts.

*The Stock Market and the Consumer: General Considerations and Preliminary Evidence*

Traditionally the stock market effect has been viewed as an outgrowth of a more general "wealth effect" on consumer spending. The wealth effect is the reaction of a consumer to an unexpected increase in his or her wealth.[1] A rational consumer--one who is concerned about future as well as current well-being--will probably spend such a windfall gradually. The amount that is spent in any time will depend upon such factors as the rate of return (the higher the rate of return, the more that will be spent in any time period) and the length of the consumer's planning horizon (the longer the horizon, the less will be spent in any time period)[2]. Estimates of the stock market effect have been determined by estimating aggregate time-series regressions of the form

$$C_t = a + bW_t + cYP_t. \quad (1)$$

Where *C*=consumer spending

*YP*=A measure of permanent income (usually a distributed lag on realized after-tax income)

*W*=Consumer net worth.

Derivations of such estimating equations from the underlying theory of consumer behavior may be found in Modigliani and Tarantelli (1975), Modigliani and Steindel (1977), and Steindel (1977 and 1981). The estimated coefficient, *b*, on wealth, is described as the "marginal propensity to consume out of wealth" and is interpreted as the increase in consumer spending that

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[1] The term "wealth effect" seems to be used for many different purposes. In a recent Wall Street Journal article (Wysocki, [1998]) connections appeared to be drawn between stock market movements and long-lived feelings of euphoria and despair in societies. In part, the analysts cited in the piece were focusing on the after-effects of the spending shocks supposedly induced by wealth changes, and including these in the concept of the "wealth effect." Our definition is the more modest one of the first-round consumer spending change.

[2] The life cycle hypothesis of consumer spending asserts that a consumer's planning horizon is dominated by his or her life expectancy. The fact of retirement, and the subsequent reduction in wage income, results in a sharp distinction between consumer reactions to increases in wage income and nonwage income and wealth. "Time preference"--a general tendency to prefer spending in the near term--can be viewed as a way of shortening the planning horizon or, equivalently, creating an intrinsic return from consumption.

is associated with an increase in wealth. A widespread empirical practice is to differentiate wealth into different categories, with the stock market wealth usually being one of them. A differential coefficient on stock market wealth from other types is merely viewed as an artifact of heterogeniety of consumers; stock market owners may be systematically older or younger than other wealth owners or have other characteristics which lead to a different aggregate propensity to consume out of this form of wealth. A common assumption is that b is on the order of .05 or perhaps a bit smaller; in other words, roughly 5 cents on the dollar of an increase in wealth is spent soon after it is earned. While this seems to be "small," when we are looking at gains in wealth from the stock market in the trillions of dollars, and increase in spending of 5 cents on the dollar adds up to real money!

The perspective of modern dynamic economics is to be quite dubious about the value of estimation of equations such as (1) using aggregate time series data. Aside from questions about the appropriate estimation technique given the possible presence of aggregation and simultaneity bias, and the use of largely untested simplifying assumptions to derive the estimating equation from the theory, there is the more basic issue that the underlying theory applies to comparisons across steady states--all else equal, how much more will a wealthy consumer spend than one who is less wealthy but has the same permanent income? Aggregate time series data are not drawn from steady states; they are taken from an environment where it should be assumed that consumers are adjusting their behavior to new conditions. Recognizing this reality implies very different ways to estimate the relationship between changes in wealth and changes in consumption. This has been addressed in the literature on consumer spending since at least the work of Hall (1978).

Despite the valid criticisms of equations such as (1), we begin as a reference point with the estimation of this type of model. Equations of this sort have been very influential in the literature on economic policy (for instance, Modigliani [1971]), and continue to be common in forecasting exercises.[3]

We start with a traditional consumption function. Table 1 shows estimates of a regression relating real per capita consumer spending to real per capita disposable personal income, and real per capita net worth, with net worth split into stock market holdings and other. Four lags of each of the right-hand side variables are included, in order to capture the adjustment process of consumer spending to changes in fundamentals.[4] Details about the data are provided in an appendix. The estimation of the model includes a correction for first-order autocorrelation in the error process.

Column (1) shows the estimated coefficients for the equation estimated over the 1953-1997 time period. The estimates include the sum of the lag coefficients on each of the right-hand side variables, along with the estimated standard errors. This regression is more or less consistent with traditional views of consumer behavior; the sum of the lag coefficients on income is about .7, and those on the stock market and other forms of wealth is each about .04. Each of these sums is more than twice as great as its computed standard error, which is normally interpreted as

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[3]For instance, both the Data Resources Incorporated (DRI) and Macroeconomic Advisors econometric models use equations for consumption sectors very similar in form to (1). Mosser (1992) provides some documentation of the evolution of wealth effects in the DRI model in the 1980s; a description of the model used by Macroeconomic Advisors can be found in Laurence H. Meyer & Associates (1994).

[4]A traditional interpretation of the lags on income in such an equation is to capture expectations formation. We are uninterested in the specific interpretation of the lag.

meaning that it is statistically greater than zero. The estimated coefficient of serial correlation, while substantial, appears to be less than one, suggesting that the model is a valid statistical construct.

The superficial view would be that this equation supports traditional views of the stock market: Literally, the results suggest that approximately 4% of an increase in the stock market enters the spending stream within a year of its being earned. However, this conclusion rests on some very shaky grounds.

At the simplest level, the estimated stock market effect appears to be rather sensitive to the period of estimation. Reestimating the equation over three different time periods (columns 2, 3, and 4 of Table 1) suggests that the stock market effect was larger in the late 1970s and early 1980s than either before or earlier.

Admittedly, columns 2-4 cook the books a bit to show this instability. If we split the sample in thirds (columns 5-7) rather than picking 1975 and 1985 as the break points, the coefficient estimates look stabler, though their standard errors vary. However, Chart 1 reinforces the view of a shifting model. It shows the estimated sum of the lag coefficients, along with a one-standard error band, of the wealth and income terms from regressions of the form in Table 1 estimated over 10-year periods. In particular, the remarkable thing about the chart on the stock market variable is not so much the observation that such a parameter changes over time, but that the change from year-to-year in the estimated effect can be rather large--recall that 10- year regressions estimated ending in two consecutive years will have 80% of their observations in common. Another thing to draw from the chart is that the point estimate of the sum of the lag coefficients on the stock market for the most recent 10-year period is effectively zero. If all pre-

1988 data were destroyed we would be hard-pressed to conclude that there is a linkage between the stock market and consumer spending, based on this model and estimation technique.

It is clear that the estimated marginal propensity to consume from stock market wealth is not particularly stable [5] In principle, we could present conventional stability tests to see if we could reject the hypothesis of stability in a statistical sense, or hone in on the precise break points in the structure of the regression. Such exercises are not germane to this paper--from a forecasting point of view awareness that this propensity can vary in a range from around 0 to .10 makes the wealth effect a very shaky reed to lean on . Also, as noted above, if we do not regard equations of this type as valid approximations of consumer behavior then the standard statistical tests of their structure are also not valid.

Chart 1 also shows us that the other coefficients shift over time. The observations we make about an unstable stock market effect could be restated in terms of unstable effects from income and other forms of wealth. We emphasize the stock market in the discussion mainly because in the current environment scenarios for consumer spending are often in the form "if the stock market does ***x***, consumer spending will do ***y***." Our view is that we are not in a good position to make such a statement; instability of the stock market effect is a good shorthand way to state our ignorance, though instability of the other parameters would also contribute to these

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[5] Poterba and Samwick (1995), using somewhat different specifications than those used here, and looking at cross-sectional and well as time-series evidence (as well as attempting to correct for changing patterns of stock ownership) also failed to find evidence of a clear stable stock market effect on consumption. Mankiw and Zeldes (1991) found that the growth rate of spending on food by stockholders was sensitive to the excess return on the market, but this result does not necessarily translate into a stable propensity to consume from a change in the value of the market. Starr-McCluer (1998) found some modest evidence of life-cycle stock market wealth effects on saving from analysis of responses to the University of Michigan survey of consumers, but did not look into the issue of stability..

misgivings.

*The Wealth Effect on Consumption: Updated Statistical Approaches*

The empirical procedure above provides a descriptive summary of the relationship between aggregate consumption and wealth. This approach is useful because it furnishes a basis of comparison with earlier work by pioneers of the traditional life-cycle consumption literature. Neveretheless, modern-day econometric theory points to a number of potential pitfalls with this approach to estimating a wealth effect.

We now turn to updated statistical approaches to see if we can capture a stable well-estimated wealth effect which may be used for forecasting consumer behavior. One problem with the traditional empirical approach used above concerns its failure to correct for the time-series properties of *C, W,* and *Y*. At the least, each of these variables likely contains a stochastic trend, and the conventional analysis performed above does not take into account the econometric implications of this type of nonstationarity.

A second problem with the previous analysis pertains to the correlation between consumption and current wealth. We seek, ideally, to identify the effect an increase in financial wealth has on consumption. Yet the econometric techniques employed above ignore the possibility that the consumption-wealth correlation found, at least partially, reflects the effect of an increase in aggregate consumption on wealth. We refer to this "reverse causality" as endogeneity bias.[6] Failure to address either of these problems could skew statistical inference and

[6]Of course, traditional "Cowles Commission" econometrics was fully aware of simultaniety bias, but in practice there were few efforts to correct for it in the consumption literature (an exception is the work of Mishkin (1976, 1977) on consumer durable spending), probably because of the difficulties of finding suitable instrumental variables and perhaps a belief that the problems were not severe.

lead to inconsistent estimates of how much an increase in wealth influences consumption.

In principle, econometric methodology can handle both nonstationary regressors and endogeneity bias. In practice, addressing the range of potential problems presents a challenge because the appropriate statistical tests often depend on what theoretical model researchers assume. Thus theory plays an important role in selecting a suitable empirical specification; given a specific null hypothesis, we can attempt to estimate the true structural affect of wealth on consumption. On the other hand, theories, by construction, force us to look at a more limited set of hypotheses and therefore fail to capture every aspect of reality. Theoretical models may imply an empirical framework that is too restrictive to adequately fit the data.

To address these conflicting concerns, we make use of several empirical specifications (described below) ranging from those that are primarily atheoretical to those that are primarily theoretical. We discuss this next.

*Estimating a Marginal Propensity to Consume Out of Wealth*

To motivate our empirical approach, we begin by laying some theoretical ground work. Much recent research on consumer behavior has focused on the dynamic optimization problem of an infinitely-lived agent who faces an exogenous, stochastic labor-income process. Among the most prominent of these paradigms is the so-called modern day permanent income hypothesis (PIH), first formalized and tested by Hall (1978) and Flavin (1981). According to the PIH, consumption of nondurable goods and services is chosen (via intertemporal optimization) to match permanent income, defined as the annuity value of human and non-human wealth.[7] In

[7]Human wealth is defined as the present discounted value of expected future labor income multiplied by the annuity factor $r(1+r)^{-1}$. See Flavin (1981).

addition, if preferences are intertemporally separable, felicity functions are quadratic, and there is a constant real interest rate equal to the rate of time preference, the theory implies that consumption follows a martingale, so that the first difference of consumption should be unpredictable.

Galí (1990) extends this version of the permanent income hypothesis to allow for finite horizons, and shows that the theory implies a linear relationship between aggregate consumption, $C_t$, aggregate labor income, $Y_t$, and aggregate non-human (financial) wealth, $W_t$

$$C_t = \alpha + \beta W_t + \delta Y_t + u_t. \tag{2}$$

The error term, $u_t$, is a discounted value of expected future income increases (see Galí [1990]).[8]

Equation (2) establishes a linear relationship between aggregate consumption, labor income and wealth that is derived from the theory of intertemporal choice. Since the theory applies to total financial wealth, we focus our analysis in this section on total wealth, rather than breaking it out into stock market and non-stock market wealth. If we take this version of the permanent income hypothesis as our null hypothesis, then β gives the true structural effect of wealth on consumption and can be interpreted as the "marginal propensity to consume" out of (financial) wealth.

This equation is almost identicle to equation (1), but there are some subtle differences. The major discrepancy concerns the income and error terms.  Equation (2) uses current income,

[8]Other work attempting to combine the traditional life-cycle views with modern time-series econometrics are Blinder and Deaton (1985) and Campbell and Mankiw (1990).

while equation (1) uses permanent income.[9] Like equation (1), however, equation (2) relates consumption to permanent income (where in this case permanent labor income is defined explicitly as the annuity value of human wealth). In equation (2), permanent labor income has simply been split into current labor income, which appears as a regressor, and the present discounted value of expected future labor income increases, which appears in the disturbance term, $u_t$. The error term in equation (2) is specifically related to the consumer spending decision; the error term in equation (1) is an empirical "add-on."

*Econometric Considerations*

In order to confront the potential empirical pitfalls discussed above, several econometric considerations must be taken into account when estimating equation (2).

First notice that (2) implies the existence of at least one cointegrating relationship among consumption, labor income and nonhuman wealth, as long as at least two of the three variables are nonstationary and contain a unit root. (We refer to variables that contain a unit root as first order integrated, or *I(1)*.) If there is at least one cointegrating relation among the variables in (1), consistent estimates of the parameters can be obtained by estimating the equation with variables in levels. By contrast, if *C, Y*, and *W* are each *I(1)* but the variables are not cointegrated, the equation must be estimated with variables in first differences to avoid spurious regression (see Campbell and Perron [1991]).

A second econometric consideration concerns the error term, $u_t$. As mentioned,

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[9]There's also a distinction between the overall income measure used in (1) and the labor income measure used in (2). . See Modigliani and Tarantelli (1975), Modigliani and Steindel (1977), and Steindel (1977 and 1981) for discussions of the conceptual issues involved in using a total income measure in a consumption model including wealth.

according to the PIH, $u_t$ is the discounted value of expected future labor income increases, implying that the error term will typically be serially correlated and correlated with $W_t$ and $Y_t$. This endogeneity--or correlation between $u_t$ and included variables--can lead to biased estimates of the parameters α, β and δ. However, under the maintained hypothesis that *C*, *W*, and *Y* are *I(1)* with a *single* cointegrating relationship among them, α, β and δ can be estimated "superconsistently" by *OLS*, implying that point estimates will be robust to the presence of endogeneity of the regressors (see Hamilton [1994], ch. 19). In this case, the permanent income model can be estimated without requiring a measure of expected future income. By contrast, if there is not a single cointegrating relationship among *C*, *W*, and *Y*, *OLS* estimation of α, β, and δ is no longer robust to the presence of regressor endogeneity, and the standard errors-in-variables procedure calls for the use of instrumental variable (*IV*) estimation. If, additionally, *C*, *W*, and *Y* are all *I(1)*, *IV* estimation must be applied to the first-differenced values to avoid spurious regression.

A third consideration concerns hypothesis tests about the cointegrating relation in (1). Even if α, β, and δ can be estimated superconsistently by *OLS*, the resulting point estimates will typically have non-standard distributions.[10] Stock and Watson (1993) suggest a simple method for correcting the standard errors by augmenting the cointegrating regression with leads and lags of the first difference of each right-hand-side variable. This "dynamic" *OLS* procedure yields the same estimates of β asymptotically, as does standard *OLS*. We use this procedure below.

Finally, because the theory used to derive (2) assumes that *C* consists of goods which

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[10]These non-standard distributions for the coefficient estimates arise from the possibility of nonzero correlations between $\{\Delta W_t, \Delta Y_t\}$ and the error term $u_t$ (see Hamilton [1994], ch. 19).

depreciate entirely within the period, we use as our measure of consumption, personal consumption expenditures on nondurables and services, excluding shoes and clothing.[11] This consumption series is scaled up so that its sample mean matches the sample mean of total consumption.[12]

Taken together, these econometric considerations suggest the following empirical approach. We begin with diagnostic tests of the time series properties of *C*, *Y*, and *W*. This preliminary analysis includes unit root tests to determine whether each variable may be characterized as first-order integrated. If unit root tests indicate that these variables may be *I(1),* we can then perform tests for cointegration among the three variables. Tests for cointegration include both residual based tests (designed to distinguish a system without cointegration from a system with at least one cointegrating relationship), and tests for cointegrating rank (designed to estimate the number of cointegrating relationships). If evidence supports the hypothesis that *C*, *Y*, and *W* are all *I(1)* with a single cointegrating relationship, then the specification in (1) can be used to obtain a consistent estimate of $\beta$ by *OLS*. If, instead, *C*, *Y*, and *W* are all *I(1)* but the variables are not cointegrated, consistent estimates of $\beta$ require first differencing the variables and using *IV* estimation.

In the next section we discuss diagnostic tests on the order of integration of each variable, and on the degree of cointegration among the variables. We find that the results of some of these

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[11]The older literature referenced also often drew this distinction as well. Our estimation used total consumer spending since that may be more directly related to forecasting and policy concerns.

[12]The ratio of nondurables and services to total personal consumption expenditure has experienced very little change over the last forty five years, declining only slightly from about 92 percent of total in 1947 to about 88 percent of total in 1998.

tests--particularly the cointegration tests--are inconclusive. Instead of taking a firm stand on the degree of cointegration among the variables, we employ several specifications for estimating the relationship between consumption and wealth that would be appropriate under alternative assumptions about the extent of cointegration. Using each of these specifications, we investigate whether a reasonable empirical relationship between consumption and wealth can be found.

*Empirical Results*

We begin with tests designed to determine whether each variable contains a unit root. Table 2 presents Dicky-Fuller tests for the presence of a unit root in *C*, *Y*, and *W*. The Dicky-Fuller procedure tests the null hypothesis of a unit root against the alternative hypothesis that the series is stationary around a trend. Although standard Dicky-Fuller tests presume a first order autoregressive (AR(1)) structure, some allowance may be needed for possible additional serial correlation in the time series. Thus, the table presents "Augmented" Dicky-Fuller test statistics which allow for higher-order autoregressive structures in addition to the standard tests based on a first order lag structure.

As the table shows, the tests statistics for *C*, *Y*, and *W* fall within the 95 percent confidence region are therefore consistent with the hypothesis of a unit root in those series.[13] The evidence suggests that *C*, *Y*, and *W* are well characterized as *I(1)* processes. The second panel of Table 2 shows that the log values of these variables can also be well characterized as *I(1)* processes.

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[13]There is one case for which the test statistic for consumption is right on the boarder of the 5% significance level. This occurs for the level of consumption, when we assume four lags; in this case the critical value is -3.45, less in absolute terms than the value of the test statistic, equal to -3.478. By contrast, we never reject the null hypothesis of a unit root for the log of consumption.

Since the results in Table 2 suggest that each variable follows an *I(1)* process, we can now carry out tests for cointegration. Table 3 reports statistics corresponding to the Phillips-Ouliaris (1990) residual based cointegration tests. This test is designed to distinguish a system without cointegration from a system with at least one cointegrating relationship.[14] The approach applies the augmented Dicky-Fuller unit root test to the residuals of (2).[15] If the variables in (2) are cointegrated, the error term is stationary, and we may reject the hypothesis of a unit root in $u_t$. The table shows both the Dicky-Fuller *t*-statistic from the residual based unit root test, and the relevant 5 and 10 percent critical values. As the table shows, these tests do not reject the null hypothesis of a unit root in $u_t$, and therefore do not establish evidence in favor of cointegration.

Next we consider testing procedures suggested by Johansen (1988, 1991) that allow the researcher to estimate the number of cointegrating relationships. This procedure presumes a *p*-dimensional vector autoregressive model with *k* lags and Gaussian errors, where *p* corresponds to the number of stochastic variables among which the investigator wishes to test for cointegration. For the application above, $p = 3$. The procedure allows one to test the null hypothesis of one cointegrating relationship against the alternative that there are two or three cointegrating relationships, the latter conforming to the hypothesis that all series are trend-stationary. The critical values obtained using the Johansen approach depend on the trend characteristics of the data.

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[14]Phillips and Ouliaris (1990) tabulate critical values for the augmented Dickey-Fuller *t* test applied to residuals of a cointegrating equation with up to five variables.

[15] When unit root tests are applied to the estimated residuals of a cointegrating relationship, the critical values depend on whether a constant and/or a time trend are included in the regression; Table 3 reports results assuming there is both a constant and a linear time trend present.

The Johansen procedure provides two tests for cointegration: under the null hypothesis, $H_0$, that there are exactly *r* cointegrating relations, the 'Trace' statistic supplies a likelihood ratio test of $H_0$ against the alternative, $H_A$, that there are *p* cointegrating relations, where *p* is the total number of variables in the model. We report this test-statistic under the columns headed 'Trace' in the tables below. A second approach tests the null hypothesis of *r* cointegrating relations against the alternative of *r+1* cointegrating relations. We report this test-statistic under the columns headed 'L-max'.

The Johansen procedure applies maximum likelihood to an vectorautoregressive (VAR) representation for the series being investigated, hence the test procedure depends the number of lags assumed in the VAR structure. Since it is difficult to determine the appropriate lag structure for this procedure, the table presents the test results obtained under a number of lag assumptions.[16]

Like the residual based tests for cointegration, the Johansen tests fail to establish evidence of a single cointegrating relationship among the variables in (2). Moreover, the results are not sensitive to the lag specification in the model. Table 4 shows that, although we cannot reject the null hypothesis of one cointegrating relationship against the alternative that all variables are trend stationary (Trace statistic, middle row of each panel), or against the alternative that there are two cointegrating vectors (L-Max statistic, middle row of each panel), we also cannot reject the null

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[16]Tests for the appropriate lag length in this case require estimation of the autoregressive model in its vector error correction form. This in turn requires the researcher to specify the number of cointegrating relationships in the error correction model. Since the number of cointegrating relationships cannot be determined without first using the Johansen procedure (which itself requires an assumption about lag length), we therefore perform the Johansen procedure under several assumptions about the number of lags in the VAR.

hypothesis that there is no cointegration against the alternative that all variables are trend stationary, or against the alternative that there is a single cointegrating relation (top row of each panel) Similarly, we cannot reject the hypothesis that there are two cointegrating vectors against the alternative that there are three (bottom row of each panel). Thus, the data do not provide evidence of a single cointegrating relation among *C*, *W*, and *Y*.

The cointegration test results weaken the evidence in favor of the permanent income hypothesis since the model implies the existence of a single cointegrating relationship.[17] Although the test results do not provide evidence in favor of cointegration, they also do not provide evidence against cointegration, and so the findings do not imply a formal rejection of the model. In practice, cointegration may be very difficult to formally establish simply because, in finite samples, every cointegrated process can be arbitrarily well approximated by a non-cointegrated process (Campbell and Perron [1991]).

In summary, preliminary diagnostic tests suggest that each variable in (2) can be characterized as nonstationary, and first order integrated, or *I(1)*. Diagnostic tests about the order of cointegration, however, are less conclusive. Since the appropriate empirical procedure depends, not only upon whether the variables are nonstationary, but also upon whether the variables contain a single cointegrating relationship, we employ empirical specifications that would be suitable under a variety of  assumptions.

We begin by estimating equation (2) using *OLS* with the variables in either first differences or in log first differences. Recall that unit root tests suggest each variable is nonstationary and integrated of order one. If the variables are not cointegrated, then first differencing eliminates the

[17]This statement assumes that labor income is *I(1)*.

possibility of finding a purely spurious correlation between wealth and consumption. Tables 5 and 6 present the results for specifications that use the first difference of variables, and the log first difference, respectively.[18]

We then move on to take into account the possibility of endogenous regressors: we estimate equation (2) on the first differenced variables using *IV* estimation. This specification would be appropriate in the presence of endogenous regressors if the variables are not be cointegrated. These results are given in Tables 7 through 10.

Finally, our most theoretical specification assumes that the PIH is correct, so that there is one cointegrating vector describing the relationship among *C*, *Y*, and *W* given in equation (2). Note that if the PIH is true, $u_t$ is a present discounted value of future labor income growth--and will therefore be correlated with the right hand side variables--but in this case, the parameter vector can be estimated superconsistently by *OLS.* As already noted, even though this procedure yields consistent point estimates, statistical inference cannot be carried out using the conventional standard errors since the resulting parameter estimates have non-standard distributions. Thus, we instead use the Stock and Watson (1993) dynamic *OLS* which includes leads and lags of the right hand side variables as additional regressors.[19] This output is contained in Table 11.

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[18]In Table 5, we perform *OLS* regressions in first differences to provide a basis of comparison with earlier literature. In most of our analysis, however, we use log first differences instead of level first differences. Aggregate time series on consumption and income appear to follow loglinear processes since the mean change of the series and the variance of the innovation of the first difference grow with the level of the series. See Campbell and Mankiw (1989). Note however, when variables are expressed in logs, the coefficient on wealth no longer can be interpreted as the marginal propensity to consume out of wealth, as defined above.

[19]The Stock-Watson dynamic *OLS* procedure for estimating the coefficients in (2) gives the same parameter estimates, asymptotically, as conventional *OLS*. In finite samples, however, the two procedures could produce different estimates. In the Table, we report the point estimates

Table 5 shows the results of estimating equation (2) with the variables in first differences. Although each table reports the estimate of both β, the coefficient on $W_t$, and δ, the coefficient on $Y_t$, we focus our discussion on β, the parameter of interest.

As panel A of Table 5 shows, the parameter, β, is estimated to be around 0.01 in the full sample, a small magnitude but statistically significant. The coefficient is about the same in the earlier two subsamples, but drops to essentially zero in the later subperiod and is not statistically different from zero.

Although equation (2) establishes the formal relationship linking contemporaneous values of *C*, *Y*, and *W* that is implied by the PIH, this specification may be too restrictive to be useful as a description of actual consumption dynamics. The series on personal consumption expenditure is quite persistent and may display much richer dynamics than that implied the model's solution given in (2). A straightforward extension of the model that has become common for providing a better fit with the data, assumes that consumption is partially adjusted in each period to eliminate a fraction of the gap between last period's consumption and its current optimal level.[20] This extension requires that we include the one-period lagged value of the dependent variable on the right hand side of the estimating equation. Panel B of Table 5 therefore includes the lagged dependent variable on the right-hand side as an additional regressor. This inclusion has only one

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obtained using dynamic *OLS* since we also use this output to correct the standard errors. See Hamilton (1994, ch. 19).

[20]See Clarida, Galí, and Gertler (1997). We follow these authors by assuming that there are costs to adjusting the level (or log level) of consumption. This assumption implies that the lagged level (log level) of consumption should appear on the right hand side when the regression in equation (2) is run in levels (logs), or that the lagged first difference (log difference) of consumption should appear as an additional explanatory variable when the regression is run in first (log) differences.

notable impact on the results reported in panel A: the marginal propensity to consume out of wealth is no longer significant at the five percent level in the middle subperiod.

Table 6 gives results analogous to those in Table 5, but uses log differences instead of first differences in levels. For the full sample period, the estimate of $\beta$ is about 0.05, while for the subperiod extending from the first quarter of 1968 to the fourth quarter of 1982, the coefficient estimate is about 0.06. These are the only periods of estimation for which the estimate is statistically significant at the five percent level. Results do not vary much in panel B of Table 5 where the lagged value of the dependent variable is included as an additional regressor; in either panel, there does not appear to be a stable relationship between consumption and wealth over subsamples of the data.

As already noted, if the variables in (2) are not cointegrated but each variable is individually *I(1)*, *OLS* is not consistent and *IV* estimation must be applied with variables in first differences. In performing instrumental variable estimation, we must first decide on appropriate instruments. Appropriate instruments are those that are both correlated with the explanatory variables and uncorrelated with the error term. To begin, we use lags of the right-hand-side variables as instruments. These variables would be appropriate as instruments if we interpret the error term, $u_t$, as a "consumption innovation", where consumption depends only on fundamentals and a shock, so that the error term is uncorrelated with any variable dated at *t-1* or before.[21] As an alternate instrument, we compute an average corporate tax rate variable (TAX), and include its

[21]This assumption is not consistent with the PIH, since that model implies that the error term consists of expected future income growth, and is therefore stationary, but serially correlated. Thus, this specification only provides an atheoretical benchmark. We relax this assumption below.

current and past values in the set of instruments. This variable may be reasonable instrument because corporate tax rates directly affect the profitability of firms (and therefore the value of equity), but are less likely to influence the consumption decisions of households. Thus, the instrument is likely to be correlated with $W_t$ (and possibly $Y_t$) but uncorrelated with $u_t$.[22] We show below that both $Y_t$ and $W_t$ are well forecast by TAX in the full sample.[23] The results in Tables 7 and 8 were obtained using lagged values of the right hand side variables and TAX as instruments; output presented in tables 9 and 10 were obtained from regressions using only TAX and its lags as instruments.

Compared to the results obtained with *OLS* estimation in Tables 5 and 6, the results in Table 7 displays less evidence of a significant wealth effect. In only one subperiod do we find the point estimate of $\beta$ significant at the five percent level (panel A). Moreover this period is not one of those subperiods for which we previously found a consistently significant wealth effect over several specifications using *OLS* estimation: in Table 7, $\beta$ is statistically significant at the 5 percent level in the period from the first quarter of 1953 to the fourth quarter of 1967, but not in the full sample or in the other subsamples. Note also that the overall magnitude of the point estimates is not robust across the two forms of estimation; estimates presented in Table 7 indicate that $\beta$ may be as high as 0.09, whereas the analogous point estimate given in Table 5 is around 0.01.

One possible reason the estimates obtained with the *OLS* procedure diverge from those

[22]We also considered government expenditures as an instrument for aggregate output, but found that it had virtually no explanatory power in the first stage regressions.

[23]In fact, lagged values of the right hand side variables have far less predictive power for either the first difference, or the log first difference, in wealth than does TAX; thus we always include TAX in the instrument set. Tables 9 and 10 show the results when the lagged explanatory variables are eliminated from the instrument set.

obtained with the *IV* procedure is that the instruments could have weak predictive power for the right-hand-side variables. Panel B of Table 7 gives some indication of how well the instruments predict the right hand side variables in each subperiod. As the table shows, the instruments are jointly significant at better than the five percent level over the full sample, and at better than the 10 percent level in the last two of the three subsamples. By contrast, the instruments have very weak predictive power for the right-hand-side variables over the subperiod 1953 first quarter to 1967 fourth quarter--the only subsample for which we obtain a significant wealth effect. Thus, the bulk of the predictive power displayed by the instruments is derived from subsamples of the data for which wealth shows no significant relation to consumption. Since instrumental variable estimates can be very misleading when the instruments have weak forecasting power for the right-hand-side variables, the significant wealth effect found in the first subsample must be viewed with skepticism.[24]

Table 8 shows results obtained using the same instruments as in Table 7, but including the one-period lagged dependent variable as an explanatory variable.[25] The resulting estimate of $\beta$ in the first subperiod is similar to that obtained in Table 7, when the lagged dependent variable was excluded from the equation, but it is no longer statistically significant at the 5 percent level.

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[24]We also conducted tests of the over-identifying restrictions implied by each *IV* regression. An LM test statistic is formed by regressing the residual from the *IV* regression on the instruments, and taking $T$ times $R^2$ from this regression, where $T$ is the sample size. This statistic is distributed $\chi^2$ with $K$ - $N$ degrees of freedom, where $K$ is the number of instruments and $N$ is the number of independent variables. The overidentifying restrictions were not rejected at the 5 percent critical level any subperiods for any *IV* specification, though this acceptance of the restrictions was marginal in the results presented in Table 8 when using the full sample, and the subsample from 1968 first quarter to 1982 fourth quarter.

[25]The lagged dependent variable is included as both a regressor and an instrument.

Unlike the results presented in Table 7 there are no estimation periods for which the wealth coefficient is statistically significant at the five percent level. In the full sample, the point estimate of $\beta$ is now statistically significant at the ten percent level, equal to about 0.07. Note, however, the first stage results in panel B indicate that the instruments only have significant predictive power for the explanatory variables in the full sample.

The procedure used to obtain the results in Tables 7 and 8 required the assumption that consumption is solely a function of fundamentals and a shock, implying that the error term is uncorrelated with explanatory variables dated at *t-1* or before. Nevertheless, there are plausible circumstances under which this assumption would not be reasonable. As a notable example, $u_t$ will likely be correlated with the included variables if the PIH is true, since in that case the error term consists of expected future income growth. If income growth is serially correlated, lagged values of income and wealth will be correlated with $u_t$.

We next present results from *IV* estimation when we include only the average corporate tax rate variable (TAX) and its lags in the instrument list. Even if the PIH is true, this instrument may be correlated with $W_t$ (and possibly $Y_t$) but is less likely to be correlated with $u_t$ than are lagged explanatory variables.[26] Tables 9 and 10 present these results (with variables in log first differences) using current and lagged values of TAX as instruments.

The table shows that the coefficient on wealth, $\beta$, is not statistically significantly different from zero in the full sample estimation, or in the subperiods 1968 first quarter to 1982 fourth quarter, and 1983 first quarter to 1997 fourth quarter. Note that the instruments have significant

[26]We also considered government expenditures as an instrument for aggregate output, but found that it had virtually no explanatory power in the first stage regressions. Thus, we dropped it from the instrument list.

predictive power for wealth in each of these periods. By contrast, estimation over the first subperiod, extending from the first quarter of 1953 to the last quarter of 1967, yields a significant coefficient on wealth, but the first stage results do not reveal a significant correlation between the instruments wealth. The results are very similar in Table 10 where we include the lagged dependent variable as an additional explanatory variable. In short, the *IV* results do not yield a significant wealth effect over any subperiod of the data for which the instruments have significant predictive power for the right hand side variables.

We now turn to estimating our most theoretical specification, that which would be appropriate if the PIH were valid. Given that the evidence in Table 2 supports an *I(1)* characterization for *C, W*, and *Y*, the PIH implies that the variables also have a cointegrating relationship given by equation (2). As already noted, *OLS* estimation can then be applied with variables in levels yielding consistent estimates of $\beta$. Table 11 presents the results of estimating (1) using the dynamic *OLS* procedure discussed above, with the variables in levels, over the full sample period.[27]

The point estimate of the marginal propensity to consume out of wealth, $\beta$, is about 0.03 and statistically significant at the ten percent level. This figure is slightly smaller than found in the early life cycle literature. Note also that Tables 5 through 10 show that estimates of $\beta$ obtained

[27]We apply the dynamic *OLS* to equation (2) in order to correct the standard errors for a possible correlation between the error term and the first difference of the right hand side variables (See Hamilton [1994]). This procedure is only valid asymptotically, however, so that reliable estimates of the marginal propensity to consume, or its standard error, cannot be obtained over small subsamples of the data. Consequently, we only perform dynamic *OLS* over the full sample period. Moreover, no theory has currently been developed to asymptotically correct the standard errors when there are lagged dependent variables appearing as right hand side variables; thus we do not include $C_{t-1}$ as an additional explanatory variable when performing this form of estimation.

from other empirical specifications are smaller in the last subperiod than they are in the first subperiod, suggesting that the marginal propensity to consume out of wealth may be declining in recent years. We investigated this possibility more formally by plotting estimates of $\beta$ taken from a rolling regression over the period extending from the first quarter of 1987 to the fourth quarter of 1997.[28] The results are similar to those presented in Chart 1 regardless of whether dynamic *OLS* or standard *OLS* estimation is used: the marginal propensity to consume out of wealth rose from a low of about 0.02 in the beginning of 1987, to about .034 in the early 1990s, but has declined precipitously since 1995 and has fallen back to 0.02 in 1997. Thus, the most recent period of rapid growth in stock market wealth is also a period during which households appear to be consuming a declining amount out of any given increase in wealth.

In summary, the results presented above do not uncover a robust wealth effect on consumption. The degree to which financial wealth is correlated with consumer expenditure varies according to what estimation technique is employed, what instruments are used, and what variables are included on the right hand side of our estimating equation. Results using *OLS* estimation generally suggest that the wealth effect is small, not stable across subperiods of the data, and declining in recent years. Indeed, in all of our *OLS* regressions, the correlation between financial wealth and consumer expenditure is not statistically different from zero in data after the first quarter of 1983. Instrumental variables estimation does not produce dramatically different results. In particular, *IV* estimation typically does not reveal a robust wealth effect in any subperiod of the data for which the instruments have significant predictive power for the right

[28]Estimates of $\beta$ in the figure are obtained by first estimating equation (2) over the period 1953 first quarter to 1987 first quarter, and then incrementally adding one data point on the end of the sample and reestimating.

hand side variables.

*Conclusion*

This paper investigates the relationship between aggregate consumer expenditure and financial wealth. Our results show that the correlation between wealth and consumption appears to be declining in recent years, and is not stable across subsamples of the data.

The question of how much a large movement in financial wealth would affect consumer expenditure is an important policy issue. This issue has become one of immediate concern due to the widespread belief that U.S. stock markets have recently surged to levels that may be inconsistent with market fundamentals, and therefore unsustainable over the long run. Monetary policy makers who seek to dampen large fluctuations in output and consumer prices need to be informed about how much a significant swing in the value of financial wealth could influence real variables. At one extreme, some commentators have suggested that a prolonged downturn in stock prices could so depress consumer spending as to result in a recession (for example, The Economist [1998]).

Despite the pressing importance of these issues, and despite the fact that practitioners and forecasters continue to base their predictions on a presumed correlation between wealth and consumption, virtually no work has set out to quantify the relationship between wealth and consumer expenditure since several authors undertook this task in early life-cycle consumption research. In this paper, we provide an updated estimate of how much a change in the value of wealth might affect consumer expenditure.

The evidence presented here provides little support for the hypothesis that we have a good idea of the effect of any given change in wealth on consumer demand-- the relationship between wealth and consumer expenditure is not stable over time.

Why have we failed to uncover a stable wealth effect? One distinct possibility is that we have not taken into account all the major factors impacting the interaction between consumer spending and the stock market. For instance, one important missing factor is uncertainty about the market's rate of return. Merton (1971) described the theoretical relationship between the levels of consumer spending and wealth in the presence of uncertainty about the rate of return on one asset; while the analytical formula he derived is quite complex and not susceptible to a simple interpretation, his work does suggest that the marginal propensity to consume from wealth is sensitive to changes in perceptions of the volatility of the market. It is, of course, very reasonable to believe that market valuation is also sensitive to volatility. Failing to correct for changes in volatility could lead to fluctuating estimates of the marginal propensity to consume out of market changes. Unfortunately, it is not clear how Merton's steady-state model could be extended to a dynamic framework (including uncertainty about future labor income as in the PIH) nor how precisely perceived market volatility would be measured, though data from derivatives markets is an obvious possibility.[29]

We also would like to note that we are addressing the pure wealth effect--the effect of any given or observed change in the value of the stock market on consumer spending. Much of the

[29]Another missing factor which may suggest itself are changes in the structure of stock market holdings from direct household ownership to pension fund and mutual fund holdings. Poterba and Samwick (1995) found that such corrections were of little help in isolating a clear wealth effect. Our view is that the change in ownership patterns has been rather gradual (see Steindel (1993) as well as Poterba and Samwick ), suggesting that this mechanism--however, specifically, it may affect consumer behavior--is unlikely to account for the sometimes abrupt changes we have observed in the estimated marginal propensities.

earlier literature on the wealth effect dealt with changes in the stock market as a transmission mechanism for monetary policy (most notably, Modigliani [1971]). In that literature, the assumption is that the force moving the stock market are changes in the rate of return induced by monetary policy. The theoretical and empirical implications of such changes on consumer spending are different than the generic stock market change we examined in our empirical work. While our purely technical critique of the earlier consumption literature also applies to the policy literature, our empirical results do not necessarily suggest that the consumption effect of a policy-induced change in the value of the stock market is volatile or even different than the earlier results--we simply didn't address that point.

How important is the stock market effect on consumption? Our results suggest that this question is very difficult to answer. Although existing consumer theory provides a framework for estimating the structural relationship between wealth and consumption, our estimates reveal no stable association between these variables. The instability in our parameter estimates suggests that forecasts of consumer spending which rely on wealth effects are likely to be unreliable. One possible reason for the instability we find is that existing theory provides us with the wrong null hypothesis. In particular, because existing theory provides us with no well developed explanation of stock market behavior, we may not be able to capture truly structural effects of a "wealth shock" on consumption. Rather than answering the question posed above, our findings bring into question the notion that observations of aggregate stock market movements--independent of any informed view of the causes of the market's move--can provide reliable information about the current and future course of consumer spending.

## Data Appendix

This appendix provides a description of the data used in the empirical analysis.

Consumption

Consumption is measured as either total personal consumption expenditure, or expenditure on nondurables and services excluding shoes and clothing.  The quarterly data seasonally adjusted at annual rates (SAAR), in billions of chain-weighted 1992 dollars.

Source: Bureau of Economic Analysis (BEA).

Labor Income

Labor income is defined as wages and salaries plus transfers minus personal contributions for social insurance.  The quarterly data are in current dollars. The nominal data is deflated by the PCE chain-type price deflator. The components are from the National Income and Product Accounts.

Price Deflator

PCE chain-type price deflator (1992=100), seasonally adjusted (SA)

Source: BEA.

Population

A measure of population is created by dividing real total disposable income by real per capita disposable income. Both measures of income is in SAAR and chain-weighted 1992 dollars (total income is in billions of chain-weighted $1992).

Source: BEA

Wealth

Total wealth is household net wealth in billions of current dollars.

Source: The quarterly data is provided by the Board of Governors of the Federal Reserve.

Tax

Tax is the tax liability of corporations as a share of their profits (profits tax liability/corporate profits). Profits tax liability is SAAR, in billions of current dollars. Corporate profits is defined as profits with inventory valuation and capital consumption adjustment. The quarterly data is SAAR and billions of current dollars.

Source: BEA.

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## Table 1: OLS Estimation

$$\text{Model: } C_t = \sum_{i=0}^{3} \delta_i Y_{t-i} + \sum_{i=1}^{4} \xi_i SW_{t-i} + \sum_{i=1}^{4} \mu_i NW_{t-i} + \epsilon_t$$

| | Estimation Period | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1<br>1953:1-1997:4 | 2<br>1953:1-1975:4 | 3<br>1976:1-1985:4 | 4<br>1986:1-1997:4 | 5<br>1953:1-1967:4 | 6<br>1968:1-1982:4 | 7<br>1983:1-1997:4 |
| Income* | 0.731<br>(0.067) | 0.711<br>(0.059) | 0.568<br>(0.195) | 1.015<br>(0.077) | 0.684<br>(0.091) | 0.832<br>(0.141) | 0.822<br>(0.074) |
| Stock Wealth* | 0.040<br>(0.009) | 0.026<br>(0.010) | 0.106<br>(0.041) | 0.021<br>(0.011) | 0.030<br>(0.018) | 0.023<br>(0.019) | 0.042<br>(0.010) |
| Non-Stock Wealth* | 0.038<br>(0.017) | 0.043<br>(0.015) | 0.069<br>(0.048) | -0.027<br>(0.017) | 0.049<br>(0.020) | 0.012<br>(0.036) | 0.016<br>(0.018) |
| Serial Correlation Coefficient | 0.937<br>(0.030) | 0.781<br>(0.090) | 0.937<br>(0.069) | 0.755<br>(0.097) | 0.800<br>(0.094) | 0.886<br>(0.069) | 0.809<br>(0.091) |
| Standard Error of Regression | 70.7 | 59.8 | 86.7 | 65.7 | 41.4 | 84.7 | 76.2 |
| Sum of Squared Residuals of Regression | 830835 | 279012 | 202961 | 150994 | 78739 | 336836 | 272807 |

* Real per-capita terms.

Notes: Standard errors in parentheses. Y is personal income, SW is stock market wealth, NW is non-stock market wealth.

## Table 2: Dickey-Fuller Test for Unit Roots

| | Dickey-Fuller t-Statistic | | | |
|---|---|---|---|---|
| | Lag=1 | Lag=2 | Lag=3 | Lag=4 |
| Total Wealth* | 0.082 | -0.697 | -0.617 | -0.779 |
| Labor Income* | -1.564 | -1.588 | -1.906 | -2.184 |
| Consumption (excl shoe & clothes)* | -1.939 | -2.572 | -2.718 | -3.478 |

| | Dickey-Fuller t-Statistic | | | |
|---|---|---|---|---|
| | Lag=1 | Lag=2 | Lag=3 | Lag=4 |
| Log (Total Wealth*) | -2.417 | -3.067 | -2.880 | -3.077 |
| Log (Labor Income*) | -0.889 | -1.183 | -1.330 | -1.290 |
| Log (Consumption - excl shoe &clothes*) | -0.363 | -0.812 | -0.944 | -1.280 |

*Real, per-capita terms. The model includes a time trend.

## Table 3: Phillips-Ouliaris Test for Cointegration

| | Dickey-Fuller t-Statistic | | | | Critical Values | |
|---|---|---|---|---|---|---|
| | Lag=1 | Lag=2 | Lag=3 | Lag=4 | 5% Level | 10% Level |
| No Trend | -1.019 | -0.969 | -1.242 | -1.491 | -3.77 | -3.45 |
| Trend | -0.837 | -0.719 | -0.957 | -1.203 | -4.16 | -3.84 |

Note: Dickey-Fuller test statistic applied to the fitted residuals from the cointegrating regression. Using consumption for nondurables and services, excluding shoes and clothes, as the dependent variable.

## Table 4A: Cointegration Test: I(1) Analysis with Unrestricted Constant and Trend in Cointegration Space

### Endogenous Variable: Total Wealth, Labor Income, Consumption (Nondurables and Services, excl. Shoes & Clothing)

| | | |
|---|---|---|
| Lag in VAR-model=1 | | |
| L-max | Trace | $H_0 = r$ |
| 14.52 | 22.68 | 0 |
| 5.69 | 8.16 | 1 |
| 2.47 | 2.47 | 2 |
| Lag in VAR-model=2 | | |
| L-max | Trace | $H_0 = r$ |
| 8.56 | 17.10 | 0 |
| 4.84 | 8.53 | 1 |
| 3.69 | 3.69 | 2 |
| Lag in VAR-model=3 | | |
| L-max | Trace | $H_0 = r$ |
| 8.70 | 15.16 | 0 |
| 3.92 | 6.46 | 1 |
| 2.54 | 2.54 | 2 |
| Lag in VAR-model=4 | | |
| L-max | Trace | $H_0 = r$ |
| 10.89 | 18.19 | 0 |
| 4.86 | 7.30 | 1 |
| 2.44 | 2.44 | 2 |

## Table 4B: Cointegration Test: I(1) Analysis with Unrestricted Constant

**Endogenous Variable: Total Wealth, Labor Income, Consumption (Nondurables and Services, excl. Shoes & Clothing)**

| Lag in VAR-model=1 | | |
|---|---|---|
| L-max | Trace | $H_0 = r$ |
| 8.03 | 14.46 | 0 |
| 4.05 | 6.42 | 1 |
| 2.37 | 2.37 | 2 |
| Lag in VAR-model=2 | | |
| L-max | Trace | $H_0 = r$ |
| 4.92 | 8.97 | 0 |
| 3.91 | 4.05 | 1 |
| 0.14 | 0.14 | 2 |
| Lag in VAR-model=3 | | |
| L-max | Trace | $H_0 = r$ |
| 4.27 | 6.90 | 0 |
| 2.61 | 2.63 | 1 |
| 0.02 | 0.02 | 2 |
| Lag in VAR-model=4 | | |
| L-max | Trace | $H_0 = r$ |
| 5.03 | 7.71 | 0 |
| 2.44 | 2.68 | 1 |
| 0.24 | 0.24 | 2 |

## Table 5A: Effect of Wealth on Consumption, OLS

Model: $\triangle C_t = \alpha + \beta \triangle W_t + \delta \triangle Y_t + \epsilon_t$

| Sample Period | $\beta$ | $\delta$ |
|---|---|---|
| 1953:1-1997:4 | 0.009* (2.484) | 0.300* (3.027) |
| 1953:1-1967:4 | 0.009* (2.120) | 0.394* (6.916) |
| 1968:1-1982:4 | 0.014* (2.873) | 0.407* (3.859) |
| 1983:1-1997:4 | 0.003 (0.743) | 0.192 (1.595) |

## Table 5B: Effect of Wealth on Consumption, OLS

Model: $\triangle C_t = \alpha + \beta \triangle W_t + \delta \triangle Y_t + \gamma \triangle C_{t-1} + \epsilon_t$

| Sample Period | $\beta$ | $\delta$ |
|---|---|---|
| 1953:1-1997:4 | 0.009* (2.794) | 0.267* (3.202) |
| 1953:1-1967:4 | 0.009** (1.717) | 0.395* (5.182) |
| 1968:1-1982:4 | 0.014* (3.076) | 0.355* (3.078) |
| 1983:1-1997:4 | 0.002 (0.808) | 0.199** (1.879) |

*Coefficients significant at the 5% or better level.
**Coefficients significant at the 10% or better level.

## Table 6A: Effect of Wealth on Consumption, OLS

Model: $\triangle \ln C_t = \alpha + \beta \triangle \ln W_t + \delta \triangle \ln Y_t + \epsilon_t$

| Sample Period | β | δ |
|---|---|---|
| 1953:1-1997:4 | 0.051*<br>(3.290) | 0.291*<br>(4.650) |
| 1953:1-1967:4 | 0.051**<br>(1.891) | 0.305*<br>(6.755) |
| 1968:1-1982:4 | 0.066*<br>(3.030) | 0.372*<br>(3.812) |
| 1983:1-1997:4 | 0.018<br>(0.912) | 0.173<br>(1.618) |

## Table 6B: Effect of Wealth on Consumption, OLS

Model: $\triangle \ln C_t = \alpha + \beta \triangle \ln W_t + \delta \triangle \ln Y_t + \gamma \triangle \ln C_{t-1} + \epsilon_t$

| Sample Period | β | δ |
|---|---|---|
| 1953:1-1997:4 | 0.055*<br>(3.551) | 0.256*<br>(4.392) |
| 1953:1-1967:4 | 0.047<br>(1.512) | 0.321*<br>(5.047) |
| 1968:1-1982:4 | 0.068*<br>(3.012) | 0.318*<br>(3.001) |
| 1983:1-1997:4 | 0.015<br>(0.968) | 0.180**<br>(1.953) |

*Coefficients significant at the 5% or better level.
**Coefficients significant at the 10% or better level.

## Table 7A: Effect of Wealth on Consumption from Instrumental Variable Regressions

Model: $\Delta \ln C_t = \alpha + \beta \Delta \ln W_t + \delta \Delta \ln Y_t + \epsilon_t$

| Sample Period of IV Regression | $\beta$ | $\delta$ |
|---|---|---|
| 1953:1-1997:4 | 0.061<br>(1.399) | 0.442*<br>(4.703) |
| 1953:1-1967:4 | 0.095*<br>(2.107) | 0.455*<br>(5.317) |
| 1968:1-1982:4 | 0.037<br>(1.049) | 0.496*<br>(5.627) |
| 1983:1-1997:4 | 0.069**<br>(1.866) | -0.015<br>(-0.265) |

Notes: t-statistic in parentheses. Instruments: Constant, $\Delta \ln W_t$\{1 to 3\}, Tax\{0 to 3\} and $\Delta \ln Y_t$\{1 to 3\}

## Table 7B: First Stage Regressions of Included Variables on Instruments

| Sample Period of IV Regression | Adjusted $R^2$ from regressing total wealth on instruments | Adjusted $R^2$ from regressing labor income on instruments |
|---|---|---|
| 1953:1-1997:4 | 0.100* | 0.128* |
| 1953:1-1967:4 | 0.025 | 0.351* |
| 1968:1-1982:4 | 0.122** | 0.373* |
| 1983:1-1997:4 | 0.136** | 0.135** |

*Instruments jointly significant at the 5% or better level.

## Table 8A: Effect of Wealth on Consumption from Instrumental Variable Regressions

Model: $\Delta \ln C_t = \alpha + \beta \Delta \ln W_t + \delta \Delta \ln Y_t + \gamma \Delta \ln C_{t-1} + \epsilon_t$

| Sample Period of IV Regression | $\beta$ | $\delta$ |
|---|---|---|
| 1953:1-1997:4 | 0.072** (1.794) | 0.332* (3.390) |
| 1953:1-1967:4 | 0.094** (1.832) | 0.509* (4.912) |
| 1968:1-1982:4 | 0.046** (1.934) | 0.370* (4.648) |
| 1983:1-1997:4 | 0.041 (1.272) | 0.021 (0.386) |

Notes: t-statistic in parentheses. Instruments: Constant, $\Delta \ln W_t$\{1 to 3\}, Tax\{0 to 3\}, $\Delta \ln Y_t$\{1 to 3\} and $\Delta \ln C_{t-1}$\{1\}.

## Table 8B: First Stage Regressions of Included Variables on Instruments

| Sample Period of IV Regression | Adjusted $R^2$ from regressing total wealth on instruments | Adjusted $R^2$ from regressing labor income on instruments |
|---|---|---|
| 1953:1-1997:4 | 0.095* | 0.156* |
| 1953:1-1967:4 | 0.021 | 0.356* |
| 1968:1-1982:4 | 0.110 | 0.386* |
| 1983:1-1997:4 | 0.119** | 0.117** |

*Instruments jointly significant at the 5% or better level.

## Table 9A: Effect of Wealth on Consumption from Instrumental Variable Regressions

Model: $\Delta \ln C_t = \alpha + \beta \Delta \ln W_t + \delta \Delta \ln Y_t + \epsilon_t$

| Sample Period of IV Regression | $\beta$ | $\delta$ |
|---|---|---|
| 1953:1-1997:4 | 0.009 (0.173) | 0.439* (3.294) |
| 1953:1-1967:4 | 0.478* (2.341) | 0.206 (1.261) |
| 1968:1-1982:4 | 0.049 (1.060) | 0.589* (4.277) |
| 1983:1-1997:4 | -0.029 (-0.269) | 0.339 (0.789) |

Notes: t-statistic in parentheses. Instruments: Constant and Tax{0 to 3}.

## Table 9B: First Stage Regressions of Included Variables on Instruments

| Sample Period of IV Regression | Adjusted $R^2$ from regressing total wealth on instruments | Adjusted $R^2$ from regressing labor income on instruments |
|---|---|---|
| 1953:1-1997:4 | 0.108* | 0.064* |
| 1953:1-1967:4 | -0.011 | 0.233* |
| 1968:1-1982:4 | 0.174* | 0.206* |
| 1983:1-1997:4 | 0.200* | 0.014 |

*Instruments jointly significant at the 5% or better level.

## Table 10A: Effect of Wealth on Consumption from Instrumental Variable Regressions

Model: $\Delta \ln C_t = \alpha + \beta \Delta \ln W_t + \delta \Delta \ln Y_t + \gamma \Delta \ln C_{t-1} + \epsilon_t$

| Sample Period of IV Regression | $\beta$ | $\delta$ |
|---|---|---|
| 1953:1-1997:4 | 0.016<br>(0.339) | 0.381*<br>(2.709) |
| 1953:1-1967:4 | 0.421*<br>(2.228) | 0.151<br>(0.700) |
| 1968:1-1982:4 | 0.045<br>(1.019) | 0.571*<br>(4.076) |
| 1983:1-1997:4 | 0.072<br>(0.738) | -0.067<br>(-0.219) |

Notes: t-statistic in parentheses. Instruments: Constant, Tax{0 to 3} and $\Delta \ln C_{t-1}${1} .

## Table 10B: First Stage Regressions of Included Variables on Instruments

| Sample Period of IV Regression | Adjusted $R^2$ from regressing total wealth on instruments | Adjusted $R^2$ from regressing labor income on instruments |
|---|---|---|
| 1953:1-1997:4 | 0.103* | 0.141* |
| 1953:1-1967:4 | 0.008 | 0.327* |
| 1968:1-1982:4 | 0.159* | 0.253* |
| 1983:1-1997:4 | 0.187* | 0.001 |

*Instruments jointly significant at the 5% or better level.

## Table 11: Dynamic OLS Estimates of MPC out of Wealth and Labor Income

Model: $C_t = \alpha + \beta_1 W_t + \beta_2 \Delta W_{t-1} + \beta_3 \Delta W_t + \beta_4 \Delta W_{t+1} + \delta_1 Y_t + \delta_2 \Delta Y_{t-1} + \delta_3 \Delta Y_t + \delta_4 \Delta Y_{t+1} + \lambda_1 T + \epsilon_t$

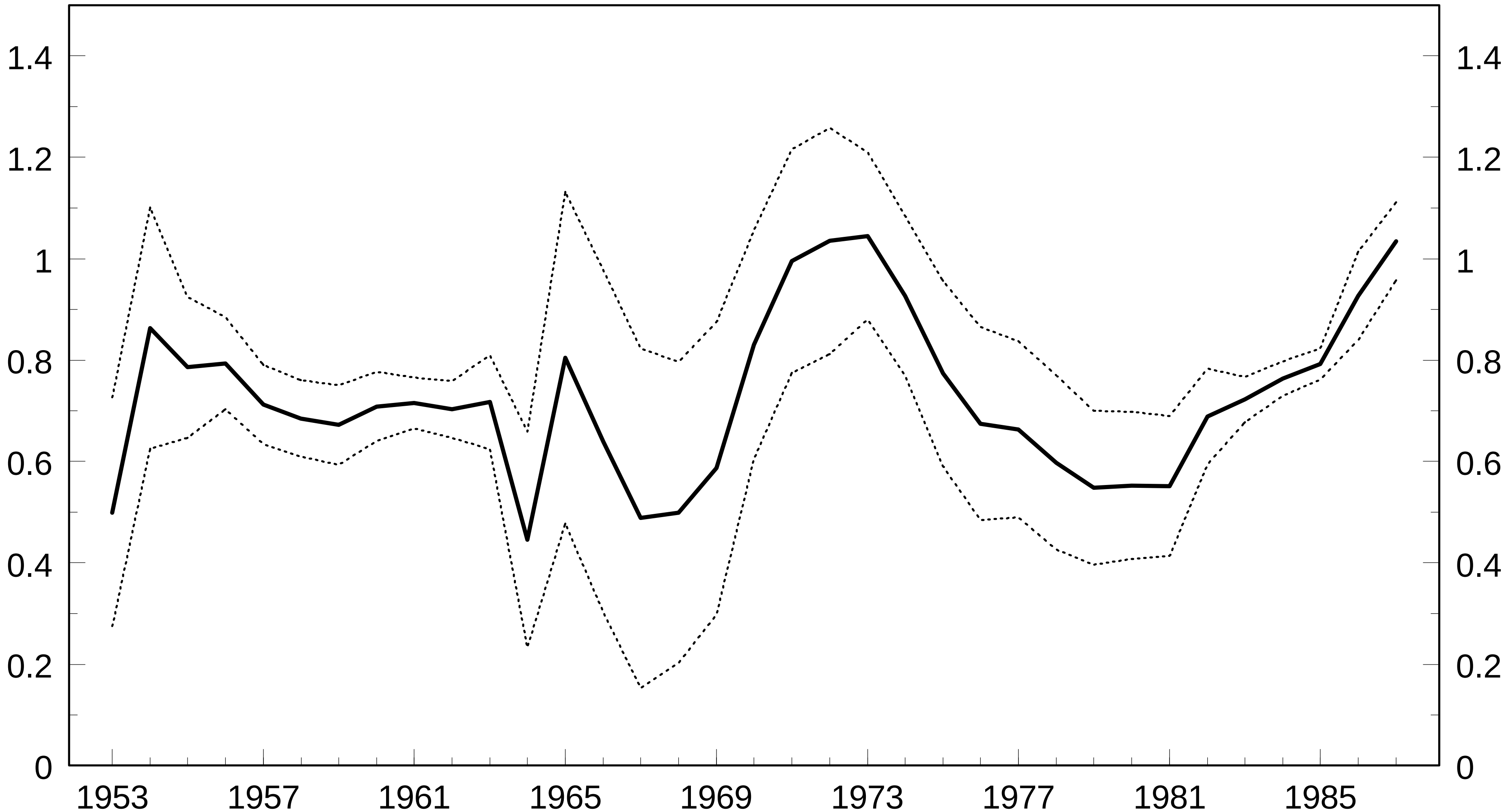
| Sample Period | $\beta_1$ | $\delta_1$ |
|---|---|---|
| 1953:1-1997:4 | 0.029**<br>(1.893) | 0.516*<br>(3.923) |

*Significant at the 5% or better level; **Significant at the 10% or better level.
Notes: T denotes a linear time trend. The *t*-statistics reported in parenthesis have been corrected for the possibility of nonzero correlations between $u_t$ and $\{\Delta W_t, \Delta Y_t\}$.

# Chart 1

## Marginal Propensity to Consume From Disposable Income

Ten Year Samples

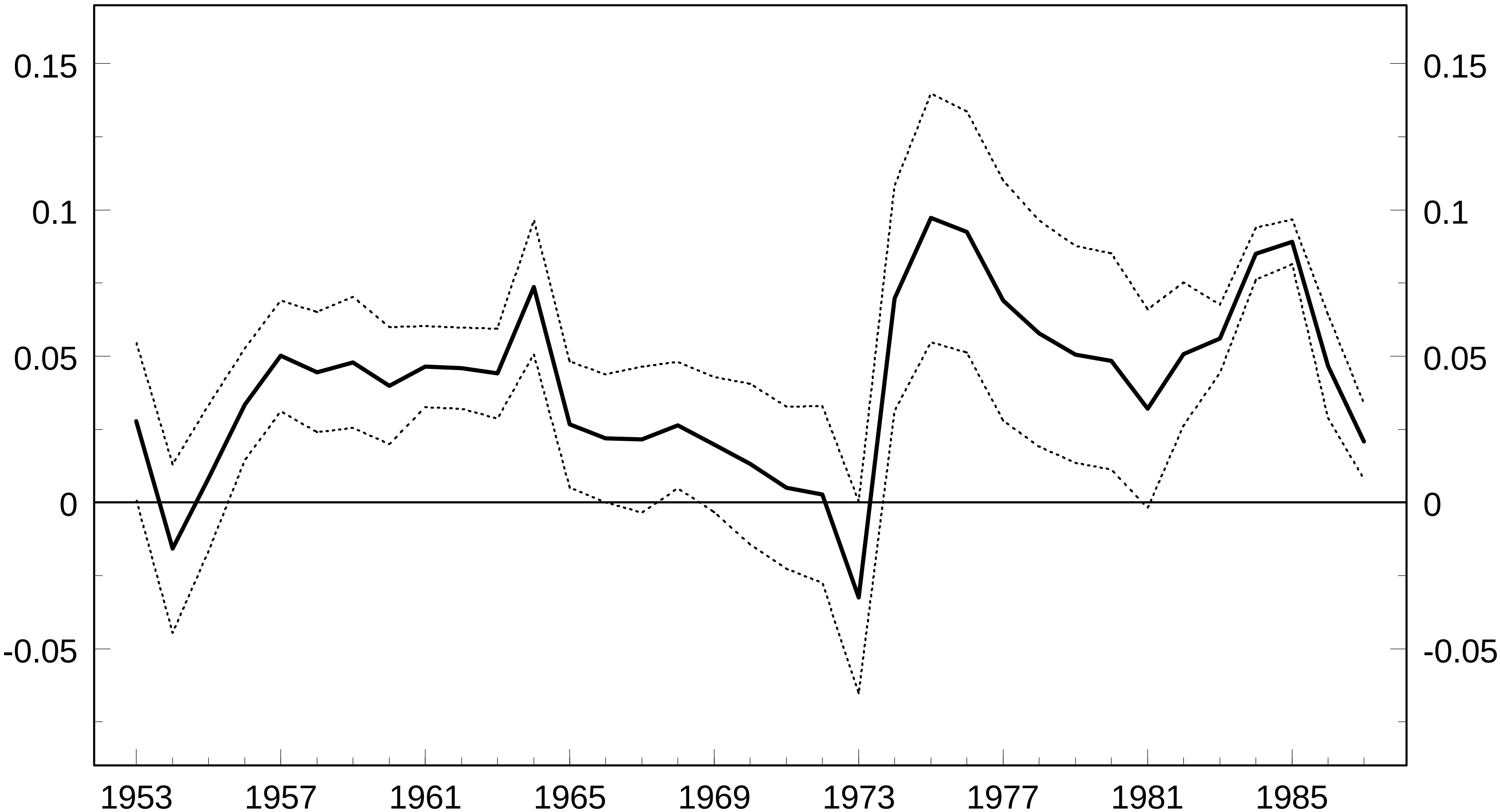



Starting Quarter

Dotted lines indicate one-standard error band.

# Marginal Propensity to Consume From Stock Market Wealth

Ten Year Samples

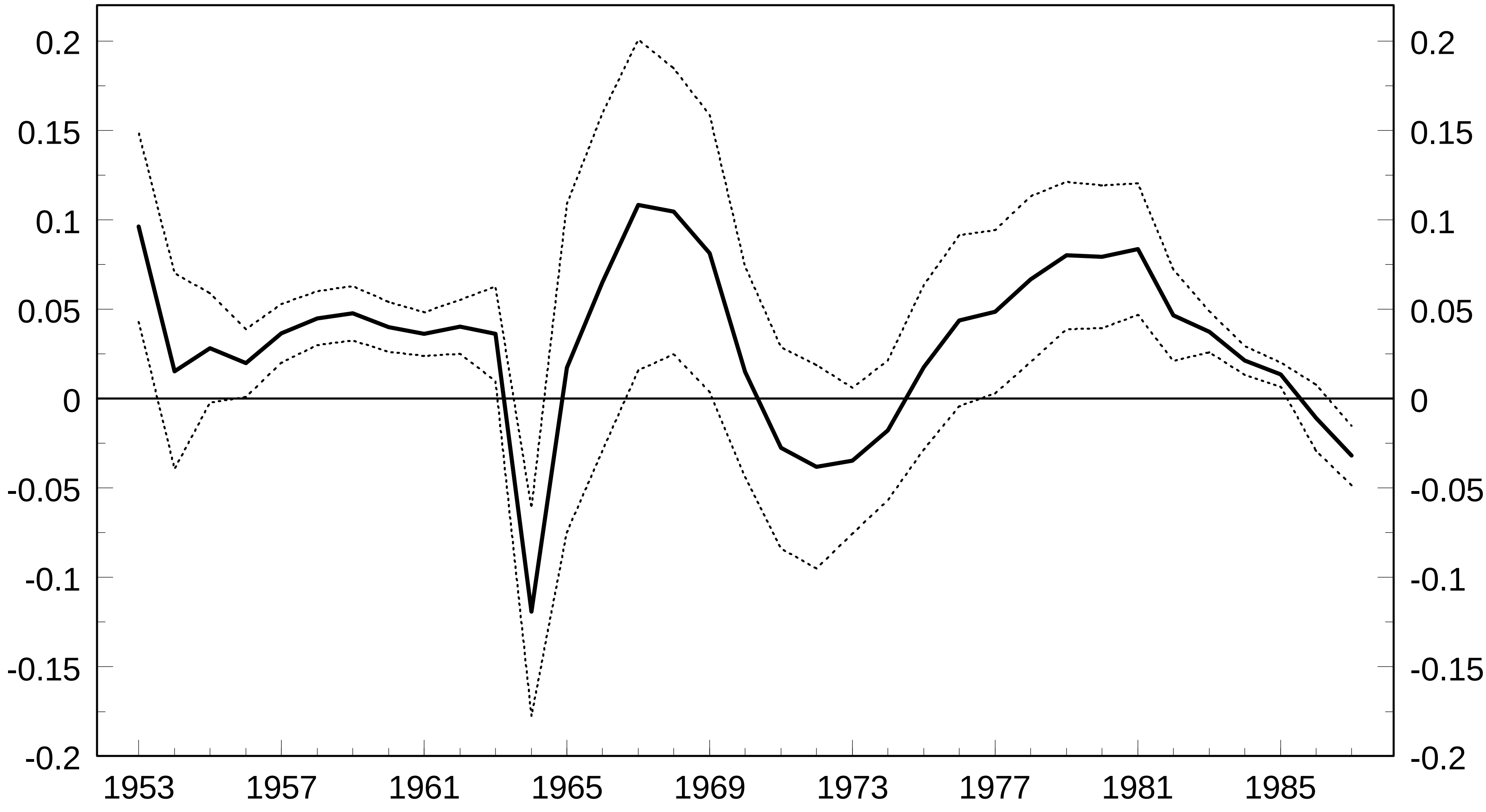



Starting Quarter

Dotted lines indicate one-standard error band.

# Marginal Propensity to Consume From Non-Stock Market Wealth

Ten Year Samples




Starting Quarter

Dotted lines indicate one-standard error band.