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THE ASYMMETRIC WEALTH EFFECT:
AMERICAN CONSUMPTION AND THE STOCK MARKET

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THE ASYMMETRIC WEALTH EFFECT: AMERICAN CONSUMPTION AND THE STOCK MARKET

Abstract

Conventional estimates of the marginal propensity to consume (MPC) out of changes in net worth average about 4 cents on the dollar. If this is true, the $14 trillion rise in household net worth between 1995 and 2000 created an additional $567 billion in household consumption. This increase in net worth was driven almost entirely by the rising values of security prices in the contemporary bull market. This study presents evidence that this "wealth effect" is in fact asymmetrical and that this asymmetry reversed some time during the 1970's or 1980's. Prior to this reversal point positive changes in stock market wealth had no statistically significant impact on personal consumption. After this reversal point, the mpc of positive changes in stock market wealth becomes positive and statistically significant in determining the rate of personal consumption growth, while negative changes show no statistically significant impact on personal consumption. This reversal was likely caused by a change in consumer expectations for stock market growth. This finding has important implications for fiscal and monetary policy; namely that neither policy stance should be changed out of fear that a bear market will cut aggregate demand through a direct wealth effect.
Introduction

At the end of the first quarter of 2000, nominal household net worth in the United States stood at $42.8 trillion; 250%, and $26 trillion higher than its nominal level at the end of 1987, just after the October 19th stock market crash. Over the same time period, household nominal financial wealth grew by $18.8 trillion, or 500% over its level after the 1987 crash. Some of this wealth was generated through active saving, or additional household investment in the stock market and other assets. Most of it was the result of rising values of existing assets and some of it contributed to a $3.4 trillion rise in consumer expenditure as households used the money to increase their consumption and presumably their quality of living.

Households who have funded increases in consumption by spending some of their gains in the stock market may be unwilling to cut back consumption in the face of falling stock market wealth because they are unwilling to reduce their standard of living. If this is true, their response to changes in wealth will be asymmetrical. Responses to changes in stock market wealth will also be asymmetrical if households see either positive or negative changes as transitory, or non-permanent. I find evidence that households behave asymmetrically with respect to changes in stock market wealth. From 1952:1 to 1976:3 I find no statistically significant role for positive increases in the rate of stock market growth in determining the rate of consumption growth. I find negative changes in the growth rate of stock market wealth to have a statistically significant role in reducing the rate of consumption growth. For the time period 1976:4 to 2001:2 this asymmetry reverses and positive changes in the stock market wealth growth rate become important in determining consumption while consumers ignore negative movements. The reversal
of asymmetry is likely due to a dramatic and realistic change in consumer expectations for stock market growth.

The Basic Theory

Increases in personal wealth must translate to increases in consumption at some point. Even if a household chooses to save all of an increase in income or net worth, the existence of budget constraints implies that the money must be spent eventually. The increase in expenditure may be contemporaneous; the recipient of an unexpected inheritance may choose to spend all of the money on a vacation home. The increase in consumption may have a significant delay; the same household may choose to save the money and leave it to a future generation (Poterba 2000, p. 103). In the first case, the increase in consumption is large and soon. In the second instance, the increase in consumption may exhibit an almost indefinite lag, leading to the conclusion that the household chose not to consume out of the wealth increase at all. Thus estimations of the "wealth effect" are concerned with how much of an increase in wealth is translated into an increase in consumption in the near term.

The propensity of households to consume out of an increase in net worth is called the "wealth effect." The percentage of an increase in net worth translated into consumption is the marginal propensity to consume (MPC) out of wealth. Most contemporary theories of consumption behavior begin with Albert Ando and Franco Modigliani's "Life Cycle Hypothesis" (Ando & Modigliani 1963). This model holds that households will attempt to smooth their consumption over time based on their expectations of future income (human wealth) and wealth (non-human wealth) levels.
Changes in income or wealth will only impact the household's consumption decision if they are permanent and unexpected. Expected changes will not change the household's consumption level because the movement will have been accounted for in the original consumption decision. The "Permanent Income Hypothesis" holds that households will also be insensitive to changes in income or wealth if they are expected to be temporary. Adjusting consumption for temporary changes would be at odds with the goal of smoothing consumption throughout the household's lifetime. Thus, changes in income or wealth must be both surprising and permanent to move the household's consumption decision.

Extensions of this model make it a bit more realistic and useful in explaining changes in consumption behavior: it is possible that household changes in consumption behavior take time to respond to changes in income or wealth; borrowing constraints may limit some household's ability to consume as much as they would like in expectation of higher future levels of income or wealth (Wilcox 1990); the desire to safeguard against "bad luck" or economic uncertainty may lead households to keep extra assets; the ability to earn interest on assets held and the need to service loans taken out could alter household responses to changes in expected wealth or income; finally the desire to leave assets to a future generation, the "bequest motive," may cause households to save rather than consume increases in income or wealth (Davis & Palumbo 2001 pg. 12).

If the Life Cycle model, and its extensions are taken as the basic underlying model of consumption, then estimates of the MPC of wealth should take into account all of a household's resources, including income and net worth. Basic portfolio theory will create differences in the MPC's of various kinds of wealth. There are, however, other
reasons to believe that different forms of income and wealth will have different MPC's. Davis and Palumbo (2001) suggest that income should be "parsed" into transfer payments and all other types of income. They do this because government transfer payments generally go to the poor and elderly who tend to consume more and save less of their income. This should yield a higher MPC for transfer income than other types of income. Almost all estimates use some measure of after-tax or disposable income since households clearly cannot consume from money owed to the government. There are many ways of dividing wealth: stock market wealth, tangible assets, bonds, real estate holdings and others. The MPC of each type of these forms of wealth may differ for a number of reasons; different assets have different levels of risk or uncertainty, there may be a bequest motive to hold certain assets until death, the accumulation of certain types of assets or wealth may be an end in itself for some households, difficulty in valuing certain assets may make it difficult for households to apply consumption preferences to that wealth, and finally, it may be that consumers hold what are known as "mental accounts" and are out of principle reluctant to consume out of certain types of wealth, like retirement funds (Case et al. 2001). All of the above channels are examples of direct wealth effects, they only impact the consumption behavior of households who possess stock market wealth.

It is, however, possible that consumption decisions of people who do not possess any stock market wealth could be impacted through an "indirect wealth effect". If consumers see the stock market as a general indicator for the economy, changes in the stock market level may impact consumer confidence and thus their consumption decisions. In 1929 under 2% of American households held any stock and thus the vast
majority of Americans simply were not subject to a direct wealth effect of any kind. Despite this, the Great Crash of 1929 occurred just before the worst depression the U.S. has ever experienced. It is possible that the two events are simply unrelated. Romer (1990), however, offers a type of indirect link between the Great Crash and the Depression that she calls the uncertainty hypothesis. Under the uncertainty hypothesis, households faced with considerable uncertainty about future income will delay decisions about the purchase of expensive and relatively permanent durable goods leaving consumers with wealth to be spent on less permanent non-durables. Empirical data from the late nineteenth and early twentieth centuries support such a negative relationship between stock market volatility and durable consumption, and Romer finds that it is sufficient to explain the decline in durable consumption in 1929 and 1930.

Romer's results suggest that volatility in the stock market after the 1929 crash contributed to considerable uncertainty about future incomes and thus a considerable delay in durables expenditure. After the 1987 market crash, which in terms of the percentage of value lost was worse than the one in 1929, the market was not nearly as volatile and consumers faced less uncertainty about future incomes. This, Romer argues, was an important difference in the two crashes and an important, although likely not primary reason, why the 1987 crash did not precipitate another depression.

The Conference Board and the Bureau of Economic Analysis (BEA) both publish indexes of consumer confidence. If the indirect wealth effect is strong, then movements in the stock market, or changes in the level of variability in the stock market should drive changes in these indexes. As a result, consumer confidence indexes should be a good way of estimating future consumption behavior. Conference Board economist
Ken Goldstein argues that "when it comes to providing an overall sense of whether the consumer market is building or losing momentum, this thing [The Conference Board's index of consumer confidence] works like a charm (Liesman 2002)."

There are, however, factors that potentially influence or drive consumer confidence that may not have much impact on consumer spending. Carl Steidtmann (2002) of Deloitte Research argues that consumer confidence indices are very sensitive to political activity, which does not have much of an effect on consumer retail spending. The 1987 U.S. stock market crash and the 1998 Asian financial collapse both caused dips in consumer confidence greater than their respective impacts on spending. Instead, Steidtmann argues consumer retail spending is driven almost entirely by what he calls "fundamentals" like "income, mortgage refinancing, energy prices and taxes." While these fundamentals may move with consumer confidence, he offers persuasive, recent anecdotal evidence that they are much more important in driving retail spending than consumer sentiment.

The Potential for Asymmetry

The objective of this paper is to determine whether consumers respond asymmetrically to changes in stock market wealth. It is my hypothesis that while consumers will increase their spending in response to increases in stock market wealth, they will be reluctant or unwilling to cut their expenditure in the face of decreases in stock market wealth as they have become accustomed to a higher standard of living and level of consumption. In other words, the MPC of stock market wealth will be significant and positive during bull markets and will be zero or statistically insignificant during bear
markets. If this is true, stock market increases may be accompanied by the traditionally expected increase in consumption, but bear markets will usher in smaller or insignificant reductions in consumer expenditure. Additionally, the MPC of income should rise as households save less and consume more of their disposable income to maintain their standard of living in the face of falling stock wealth.

James Duesenberry (1949) observed a similar effect with respect to income. He described a "ratcheting effect," where personal saving rates (and thus by definition marginal propensities to consume) were determined not simply by the current level of income, but by the highest previously achieved level of income. Thus, previous levels of income heavily influenced the current MPC of income, reflecting unwillingness on the part of the consumer to lower consumption with falling income.

If consumers are less sensitive, or irresponsive to stock market wealth losses, this would further serve to isolate economic recessions from market movements. There is evidence to suggest that bear markets do not necessarily cause a sufficient dip in consumption to lead to depression or even recession. While the stock market crash in 1929 was followed by the worst depression in American history, Temin (1976) suggests that a wealth effect was not the proximal cause. As discussed above, Romer (1990) finds that an indirect channel, where stock market volatility rather than absolute losses in wealth, is more important in determining the macroeconomic fallout (or lack thereof) from a stock market crash.

Certainly our contemporary experience would tend to support the notion of an asymmetry. The worst one-day "market correction" in U.S. history saw a 22.6% drop in the value of the Dow Jones Industrials Average on Monday October 19, 1987. Real
consumer expenditure, however, never fell. In fact it went up by $8 billion during that same quarter and by another $72 billion in the first quarter of 1988. Davis and Palumbo (2001) demonstrate the strong link between recent stock market rises and increases in consumption. They estimate that rising stock market wealth over the period 1995:1 to 2000:1 contributed approximately $300 billion to aggregate demand. The recent market downturn, however, does not seem to be correlated with a significant decrease in consumption expenditure. According to the BEA’s December 3, 2001 Personal Income and Outlays Release even though consumption was buoyed by automobile sales driven by zero percent financing deals, it remained strong in the face of falling personal incomes. Steidtmann (2002) notes that despite the weakness of the stock market and the events of September 11, retail spending in October of 2001 rose at the near record rate of 6.4%. Neither of these observations is consistent with a picture of consumption expenditure that is highly sensitive to losses in the stock market.

**Literature Review and Choice of Data**

The literature on the wealth effect is extensive. Many authors have calculated MPC's of stock market wealth and the results are highly dependent on the data used and the statistical methods employed. For this reason, I will focus my review of the literature on the most relevant current work. All of the studies begin with a fundamental decision on whether to use household-level or aggregate-level data to investigate the relationship between changes in wealth and consumption. Studies using household level data rely on survey results, generally from the Consumer Expenditure Survey (CE), the Survey of Consumer Finances (SCF) or the Panel Study on Income Dynamics (PSID). All of these
surveys suffer from limitations on the amount of data they contain and the accuracy of that data, as they are based on household responses. Additionally, these surveys are all relatively recent innovations (the CE dates to the early 1980's) and thus offer a limited range of data (Dynan and Maki 2001). For this reason, the results from different studies relying on these data are highly variable and the ranges of estimated MPC’s of wealth can be quite large even within any given study based on the specification chosen. Dynan and Maki (2001) find the MPC of stock market wealth for households with “moderate levels of securities holdings,” to range from 5% to 15%. The authors recognize that this range is both large and generally higher than 4% or so estimated by most aggregate data studies, and suggest that these issues are likely due to bias in the sample of the CE survey data they draw on.

Ludvigson and Steindel (1999) use aggregate time series data in their investigation of the stock market wealth effect. They begin with a simple and traditional specification of the factors influencing consumption:

\[ C_t = \alpha + \sum_{i=0}^{3} B_1 Y_{t-i} + \sum_{i=0}^{3} B_2 SW_{t-i} + \sum_{i=0}^{3} B_3 NW_{t-i} + e \]

Where: \( Y \) is after tax labor income defined as wages and salaries + transfer payments + other labor income – personal contributions for social insurance – taxes. The data are from the Bureau of Economic Analysis (BEA). \( SW \) is stock market wealth defined as direct household holdings, mutual fund holdings, holdings in private and public pension plans, personal trusts and insurance companies. The data are from the Board of Governors of the Federal Reserve (FRBG). \( NW \) is non-stock market wealth and
is presumed to be the difference between household net wealth reported by the FRBG and the SW variable defined above.

All variables are lagged 4 periods and a correction for first order autocorrelation (AR1) is made. Despite the authors' skepticism about the simplicity of the model, the potential for aggregation and simultaneity bias, and the model's inability to reflect changes in the relationships, it does yield statistically valid results. For the entire study period, 1953:1 to 1997:4, the estimated MPC of stock market wealth is .040, a result statistically significant at the highest levels. The authors do, however, express concern over the variability of this MPC and its significance when the sample period is broken arbitrarily into thirds. Results then range from .106 to .026. Clearly this is a substantial range. If the highest and lowest estimates of this MPC are applied to the stock market rise of 1994 to 1997, it allows for a $350 billion variation in the expected impact on consumption. The method does, however, point to a moderate and statistically positive stock market wealth effect.

Ludvigson and Steindel hypothesize that because consumption, wealth and income are all time series variables, they will be subject to nonstationarity and that the high correlation between consumption and current wealth will cause "endogeneity bias," or a reverse causality between consumption and wealth. To alleviate these problems, the authors adopt more advanced statistical techniques. They also aggregate wealth into a net worth variable in which they point out almost all changes are driven by stock market appreciation or depreciation. Using the OLS variation Stock and Watson (1993) procedure, they account for both leads and lags in the right hand side variable's determination of consumption in the present period. The authors also use the logged
variable values to counter heteroscedasticity concerns, and consider only non-durables and services in their consumption measure. The elimination of durable goods from the consumption variable is a concession to the permanent income hypothesis theory that because purchases in durables are simply additions to, or replacements of capital stock, durable consumption is really a stock variable, while non-durables and services consumption is a flow concept and will be affected by permanent changes in the wealth and income.

Results from this new specification confirm the results from the first. The MPC of income and wealth are estimated to be 0.72 and 0.046 respectively, for the whole period. The numbers are significant at the highest levels and slightly more stable across sub-samples of time. The estimates become even more stable if the period is truncated to begin in 1957 (this eliminates the post Korean War period), when estimates range from only 3 to 4 cents on the dollar for wealth.

Modeling short-run dynamics, the authors come to several other interesting findings. First, consumers appear to be forward looking in their choice of consumption. Lagged consumption growth predicts both labor income and household net worth, but neither is effective in predicting consumption, suggesting consumers are able to anticipate future increases in income and wealth. Second, controlling for lagged consumption growth (or an adjustment delay in consumption), fluctuations in wealth do not help predict changes in consumption growth. Finally, the consumption impact of a wealth shock is almost entirely contemporaneous. Increases in wealth will cause the consumer to adjust quickly to a higher level of consumption, a process completed within
one quarter. Thus, the authors conclude that increases in wealth today will impact consumption growth today, but not in the future.

Davis and Palumbo (2001) present an overview of the general theory behind the wealth effect and consumer determination of consumption expenditure. The increase in stock market prices from 1995 to 1999 was so dramatic and relatively unusual, it was likely unexpected by most consumers. Therefore, the authors argue that it provides a unique opportunity to test the Life Cycle hypothesis and see how consumption behavior is impacted by an unexpected increase in non-human wealth. Like Ludvigson and Steindel, they also use aggregate United States data including measures of personal consumption behavior from the National Income Product Accounts (NIPA), personal disposable income (PDI) also from NIPA and net worth from the Fed Flow of Funds accounts (FOF).

Davis and Palumbo estimate two variations of a basic consumption regression where consumer expenditure is regressed on personal disposable income (PDI) and net worth. Because consumption, income and wealth will all tend to trend upward over time, the error term will tend to do the same leading to nonstationarity. The first model also includes a division of income into transfer and non-transfer income for reasons discussed earlier, and accounts for the time trend by dividing through by non-transfer income. The second model uses only total income and takes the natural log of the variables to avoid the nonstationarity problem. Again, the Stock-Watson OLS procedure is used and the equations are fitted for the sample 1960:1 to 2000:1. The first model estimates the coefficient of net worth to be 0.039 and the translation of the log estimate in the second model gives an MPC of wealth of 0.033. Both results are significant at the highest levels.
and are consistent with Ludvigson and Steindel's findings, especially when they limit their sample period to post-1957. The authors also conduct an empirical experiment that suggests that the unusual rise in the stock market from 1995 to 2000 can account for nearly the entire drop in the personal saving rate seen during this period.

In their analysis of short-run dynamics Davis and Palumbo come to a much different conclusion than Ludvigson and Steindel. They find that only 40% to 60% of any consumption adjustments to wealth changes are completed within a year. This is a very different finding from the one-quarter, contemporaneous consumption adjustment finding of Ludvigson and Steindel. Davis and Palumbo also find that investigations of short run dynamics are much more susceptible to changes in data and model specification than estimates of long run effects. They conclude that the substantial rise in the stock market in the latter half of the 1990's is consistent with the growth in consumption expenditure during that time, and that the unexpected and sustained nature of that bull market and thus wealth growth was an important factor in driving consumption growth.

Lettau and Ludvigson (2001) provide important evidence that the conventional, .03 to .04, estimates of the MPC of stock market wealth may be too high. They estimate an MPC of .014 to .02 for permanent changes in stock market wealth. According to their calculations, 85% of the post war variation in household net worth is transitory rather than permanent. While these transitory changes can last for several years, having an average half-life of 2 years, they argue that consumers, true to the permanent income hypothesis, do not adjust their consumption based on these transitory changes. They find that aggregate consumer expenditure is unrelated to these transitory changes on any time horizon. Instead, they argue that consumption is characterized by a linear combination of...
the trend components of wealth and labor income. It follows from this finding that consumption itself will contain almost no transitory component and will have a trend whose changes are a near random walk. Their empirical evidence supports both these conclusions. It also indicates that consumption responds to permanent changes in wealth almost entirely within one quarter, suggesting there is nearly no lag in response to such changes.

Lettau and Ludvigson also note that movements in the stock market drive quarterly household changes in net worth almost entirely. They calculate a correlation coefficient between household net worth and the Center for Research on Security Prices (CRSP) value weighted stock market index of 0.87. When estimated over both the transitory and permanent components of wealth, they calculate an MPC of 0.046 for the period from 1953:1 to 2001:1. This estimate is certainly consistent with those of previous studies. However, estimation over just the permanent (trend) components of wealth yields an MPC of just 0.02. These results are considerably different from those of previous studies. They suggest that consumption is unaffected by both positive and negative transitory shocks to net worth and that the role of changes in net worth in changing consumption behavior is much smaller than otherwise thought when it is a factor at all.

While these results depart from much of the other literature, it is important to emphasize their consistency with consumption theory. Under the permanent income hypothesis individuals will adjust their consumption only in the face of unexpected and permanent changes in labor income or net worth. Expected changes will already be taken into account and transitory changes will be ignored, thus neither will change consumption
behavior. Lettau and Ludvigson’s empirical evidence is not only consistent with this hypothesis, but it suggests that households are sophisticated enough to identify transitory and permanent changes in net worth. As a result, they respond only to these permanent changes in a consistent way, and they ignore the transitory changes in net worth when setting their consumption behavior despite their sometimes persistent nature.

Lettau and Ludvigson are also quick to point out the monetary policy implications of these findings. If aggregate consumption is entirely insensitive to 85% of the changes in the stock market (the percentage that is transitory), then banks pursuing inflation targets should not abandon their target in the face of a falling stock market. The fall in the stock market is unlikely to undermine aggregate demand and thus is unlikely to ease inflationary economic conditions. For this reason, banks should stick to their inflation targets.

In a study highlighted in the November 10th, 2001 issue of the Economist, Case, Quigley and Shiller (2001) find that wealth increases from appreciation in housing market wealth are considerably more important than stock market wealth in determining changes in consumption. This conclusion is consistent with Lettau and Ludvigson’s estimation of a smaller than previously reported MPC of stock market wealth. Using household level microeconomic data, a household level extrapolation of FFA data on corporate equities holdings, and statistics on housing market wealth from the 1990 Census of Population and Housing, they estimate the MPC of housing wealth to be between 0.05 and 0.09, while the MPC of financial wealth is estimated to be only 0.02 (the same estimate Lettau and Ludvigson come to for permanent changes). Further testing indicates that the MPC of housing market wealth is statistically greater than that
of financial wealth. They conclude that housing market wealth is more important in determining changes in consumption than stock market wealth.

Englehardt (1996) supports the conclusion that housing market wealth changes are important in determining consumption behavior. He uses PSID data from 1984 and 1989 to conclude that the MPC of real housing capital gains is about 0.14 for the mean saver and 0.03 for the median saver. His most interesting finding, however, comes when he divides capital gains from housing into real gains and losses. He finds that households that experienced real capital losses in housing wealth had statistically significant marginal propensity to save (MPS), the opposite of consumption, of about 0.35 out of that loss. Households that experienced real capital gains did not change their consumption behavior in a manner that was statistically different from zero. One possible explanation for this finding is that most households expect the value of their home to increase, thus capital losses on housing market wealth come as a surprise to most households. Again, consistent with the permanent income hypothesis, households adjust their consumption patterns only in response to unexpected changes in wealth.

Data

Household level data are not easily obtained and suffer from the limitations discussed earlier. For these reasons, this study utilizes aggregate level economic data readily available, free of charge from the BEA and the Federal Reserve Board of Governors (FRBG). The data can be downloaded from both organizations’ web sites in multiple formats. I have constructed a data set much like the one used by Ludvigson and
Steindel (1999). The full sample period is quarterly, stretching from the first quarter of 1952 to the second quarter of 2001.

Personal consumption expenditure data were obtained from the BEA's National Income and Product Accounts (NIPA) Tables, table 2.2. This table includes data on total personal consumption expenditure, and personal consumption expenditure by major type of product; allowing a distinction between personal expenditure on durables and non-durable goods. The data in the table are seasonally adjusted at annual rates and expressed in billions of nominal dollars.

Income data were also obtained from the NIPA tables, table 2.1. In this study, income refers to total personal disposable income. These data are non-seasonally adjusted, in billions of chain-weighted 1996 dollars.

Net worth data were obtained from the FRBG Flows of Funds Accounts (FFA) balance sheet B.100. Stock market wealth was defined as the sum of household holdings of corporate equities, mutual fund shares, life insurance reserves, pension fund reserves, and holdings of corporate equities and mutual fund shares in bank personal trusts\(^1\); tables L.100 and L.116. Non-stock market wealth was defined as the difference between net worth and stock market wealth. The data are in billions of outstanding non-seasonally adjusted nominal dollars.

\(^1\) Data on holdings in Bank personal trusts and estates is supplied to the FOFA by the Federal Financial Institutions Examination Council. Unlike the rest of the FOFA data employed in this study, which reaches back to 1952, it does not begin until 1969. As a result, the period 1952 to 1969 is simply unadjusted for these holdings (Guide to the Flow of Funds Accounts 2000).
Nominal data, including consumption, net worth, stock market wealth and non-stock market wealth were all deflated to chain-weighted 1996 dollars using the personal consumption expenditure quarterly price deflator from the BEA.

Consumption, income, stock market wealth and non-stock market wealth all rise strongly in both nominal and real terms over course of the sample period. A look at the plots of the data (Appendix A) illustrates this trend quite clearly. Table 1 shows that consumption and income both approximately sextupled in real terms over the sample period. Household stock market wealth grew even faster, rising from $1.3 trillion to $17.8 trillion between 1952 and 2001. It is not surprising that each of these series rose steadily over the time period considering the population of the United States grew considerably. The 1950 U.S. Census estimated total U.S. population at 151 billion. The 2000 Census counted 281 billion people living in the U.S (www.uscensus.gov). Such population growth would predict a considerable increase in aggregate income, consumption and wealth even if these measurements do not rise on a per capita level.

<table>
<thead>
<tr>
<th></th>
<th>Trillions of Real $</th>
<th>Consumption</th>
<th>Income</th>
<th>Stock Market Wealth</th>
<th>Non-stock Market Wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952:1</td>
<td>1.1</td>
<td>1.24</td>
<td>1.3</td>
<td>4.8</td>
<td></td>
</tr>
<tr>
<td>2001:2</td>
<td>6.4</td>
<td>6.7</td>
<td>17.8</td>
<td>19.0</td>
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</tr>
</tbody>
</table>

While the sheer magnitudes of the increases in consumption, income, stock market wealth and non-stock market wealth are important, there are a few other features of the way these variables rose over the time period which bear mentioning here. Nominal consumption rose smoothly over the full sample period, and decreases only twice, during the 1950's. Real consumption falls 17 times over the course of the full
sample, but nine of these dips occur between 1970 and 1983, a period of historically high inflation.

Stock market wealth is considerably more volatile than consumption. Real stock market wealth falls 70 times over the full sample period and appears to show a fundamental shift in the underlying function that explains its growth occurring around 1986. From 1952 to about 1986, growth in stock market wealth appears to be linear (chart A7). After 1986, stock market growth rises much more rapidly and seems better described by an exponential function. While real net worth only falls 49 times over the full sample period, it exhibits a growth pattern very similar to that of stock market wealth. This is not surprising considering the correlation coefficient between the two is .95. The correlation between movements in the S&P 500 index and both stock market wealth and net worth are also predictably high at .987 and .916 respectively. This will be an important consideration when analyzing the public policy implications of bull markets, bear markets and "market crashes." Movements in the market that are not tied to significant changes in wealth are clearly of much less concern that movements which create or destroy vast sums of wealth.

Despite the differences mentioned above, consumption, income, stock market wealth and non-stock market wealth all exhibit strong upward trends over time, a feature that is common among time series data. Series that share a strong trend, in this case growth over time, will tend to be highly correlated even though there may not be any causal underlying relationship between them. Stock market wealth and non-stock market wealth both trend upward over time and are highly correlated; however, one is not a cause of the other, their correlation is potentially spurious. A series whose mean or
variance is not constant over time, or whose autocorrelation function depends on something other than the length of the lag between the contemporaneous and previous period's value is called nonstationary. A strong upward time trend will cause the mean of a series to rise over that time, and make the series nonstationary. Spurious correlation, like that which potentially occurs in a regression involving several nonstationary variables, will lead to inflated R2's and inflated t-scores for the nonstationary series (Studenmund 2001, pp. 424-427).

Model 1

My first model was simply an attempt to replicate the work done by Ludvigson and Steindel (1999). In doing this I hoped to confirm that I had created an appropriate data set and that it could be used for the same type of analysis. I estimated the same equation presented in the literature review with slight modifications in notation:

\[ C_t = \alpha + \sum_{i=0}^{3} B_1 Y_{t-i} + \sum_{i=0}^{3} B_2 SW_{t-i} + \sum_{i=0}^{3} B_3 NSW_{t-i} + e \]

Where the summation indicates that the model includes the contemporaneous value and three lags of each independent variable. Here again C is total consumer expenditure, Y is disposable household income, SW is my definition of stock market wealth and NSW is non-stock market wealth. Therefore, \( \beta_1 \) will be the MPC out of income, \( \beta_2 \) will be the MPC out of stock market wealth and \( \beta_3 \) will be the MPC out of non-stock market wealth. The coefficients for the lags of each variable were summed and the Wald Coefficient Restriction Test was used to calculate an F statistic and probability for the null hypothesis that the sum of all the coefficients is not different from zero.
I ran the regression for my full sample period and for each of the sample periods run in the article. Full results for both studies are reported in table B1. For the full sample period, 1953:1 to 2001:2 (one year is lost to adjust the data for the lag structure of the specification), I obtained MPC’s of income, stock market wealth and non-stock market wealth of .8, .037 and .019 respectively. The MPC’s of income and stock market wealth were both significant at the highest levels. The MPC of non-financial wealth was not statistically significant at even the 20% level. These results imply that 80 cents of each additional dollar in real disposable income and 3.8 cents of each additional dollar in stock market wealth are consumed rather than saved. With F statistic probabilities of 0%, the null hypothesis that either summation of β’s is equal to 0 can be rejected. Nothing of statistical significance is to be said about the coefficient of non-financial wealth. The R² is very high at .999.

These MPC’s largely confirm the results of Ludvigson and Steindel (1999) who find an MPC’s of income and stock market wealth of .73 and .04 respectively for their full sample period, 1953:1 to 1997:4. I also estimated their model, with my data over each of their smaller sample period divisions. My results are generally consistent with theirs. I find the results for different time periods to be similarly volatile. My estimates of the MPC of stock market wealth range from .029 to .096, of income to be .42 to .87. Equation 2, 1953:1 to 1975:4, is the only sub-period where we both find statistical significance for the MPC of non-stock market wealth. Places where substantial differences in estimated coefficients occur are mostly where statistical power is low and the coefficients are of little or no statistical significance. Equation 6, 1968:1 to 1982:4 is a bit of an outlier. My results are quite different from those achieved by Ludvigson and
Steindel. Most noticeably, my estimated MPC of income is the lowest of the sample periods at .42 while theirs is second highest at .83. My results are significant at the 10% level, theirs at the 1% level.

The equations and time periods estimated were exactly the same in the two studies, therefore differences in the coefficients should owe entirely to differences in the data sets used. There are two important differences in the data sets. First, Ludvigson and Steindel include all holdings in bank personal trusts in their stock market wealth variable. This means that in addition to corporate equities and mutual funds; bank deposits, credit market instruments and miscellaneous assets held in personal trusts were included in their definition of stock market wealth, even though they were left to non-stock market wealth when not held within bank personal trusts. My data set includes only bank personal trust holdings in corporate equities and mutual fund shares in the stock market wealth variable. Deposits, credit market instruments and miscellaneous assets are all incorporated in non-stock market wealth, amounting to a difference of about 30% of bank personal trust holdings. Secondly, my data set is in real, chain weighted 1996 dollars. Ludvigson and Steindel deflate their data using chain weighted 1992 dollars.

Both of these differences have the potential to explain the differences in the estimated coefficients of equation 6. The data for assets held in bank personal trusts begins in 1969, thus this difference in the data sets would not have any impact on the estimations until just after the start of the sample period of equation 6. Perhaps more importantly, however, inflation during the 1970’s and early 1980’s was very high by United States historical standards; annualized monthly inflation for the period averaged 7.4%. This likely exaggerated the differences between the 1992 and 1996 price deflators.
during the period 1968:1 to 1982:4 causing the data sets during this time period to differ more from each other than they were during periods of lesser inflation.

Model 2

The second model I estimate is designed to test asymmetrical consumption responses to changes in stock market wealth using levels data. The model estimated is:

\[ C = \alpha + \sum_{i=0}^{2} B_{1} Y_{t-i} + \sum_{i=0}^{2} B_{2} SW_{t-i} + \sum_{i=0}^{2} B_{3} NSW_{t-i} + \sum_{i=0}^{2} B_{4} Y_{t-i} + \sum_{i=0}^{2} B_{5} SW_{t-i} + \sum_{i=0}^{2} B_{6} NSW_{t-i} + e \]

The equation again contains a correction for first order serial autocorrelation, and is estimated for the contemporaneous and two lagged values of each independent variable. \( Y, SW \) and \( NSW \) are each continuous values of income, stock market wealth and non-stock market wealth. \( Y', SW' \) and \( NSW' \) are each equal to the levels value of the variable if the first difference of the \( SW \) is negative and zero otherwise. In doing this, differences in the MPC of each variable during quarters where stock market wealth has gone down over the previous quarter will be picked up in the coefficients of \( Y', SW' \) and \( NSW' \). The MPC of income will be \( \beta_{1} \) when stock market wealth is going up and the sum of \( \beta_{1} \) and \( \beta_{4} \) when the market is going down. Likewise, the MPC of stock market wealth will be equal to the value of \( \beta_{2} \) when the stock market is going up, and equal to the sum of \( \beta_{2} \) and \( \beta_{5} \) when the market is going down. The MPC of non-stock market wealth will be \( \beta_{3} \) and \( \beta_{3} + \beta_{6} \) during bull and bear markets respectively. For this reason, \( \beta_{4} \) is not a measure of the difference in the MPC of income when the level of income goes down, it is a measure of the adjustment of the MPC of income to falling stock market wealth.
If consumers respond asymmetrically to changes in stock market wealth, and they do not lower consumption when the value of their stock market holdings go down, then $\beta_3$ is expected to be negative and statistically significant. If $\beta_3$ is negative, then the sum of $\beta_2$ and $\beta_3$ will be smaller than $\beta_2$ indicating a smaller MPC for negative changes in stock market wealth. If the $\beta_3$ is sufficiently negative, it will bring the sum close to zero and indicate no MPC for negative changes in stock market wealth. If there is an asymmetric response, $\beta_4$ is expected to be positive and statistically significant indicating the MPC of income will be greater during times of falling stock market wealth as households look to maintain their prior level of consumption by consuming more out of income. This rise in the MPC of income is synonymous with a falling personal saving rate; clearly households cannot save money they are spending. The expected sign or significance of $\beta_6$, the change to the MPC of non-stock market wealth resulting from falling stock market wealth is uncertain.

The results of estimations of this model for the full sample period and for a sub-samples running from 1986:2 to 2001:2 are reported in table B2. The MPC of income for the full period, and 1986:2 and beyond sub-sample are 0.77 and 0.83 respectively. They are both significant at the 1% level and the estimates are consistent with those from the first model, where the MPC of income for the full sample was 0.80. The MPC of stock market wealth is 0.038 and 0.030 in the full and sub-sample respectively. Both estimates are again significant at the 1% level. The estimate of the MPC of non-stock market wealth is only significant at the 10% level in the full sample where it is 0.027.

The coefficients of $Y^*$ and $SW^*$ both have their expected signs; $\beta_4$ is positive and $\beta_5$ is negative, but neither is significant at even the 20% level in either sample period.
The coefficient of NSW is also negative in both samples but is not statistically significant. Thus, there is no evidence that the MPC's of income, stock market wealth or non-stock market wealth are any different when the stock market wealth is going up than when it is going down and the model fails to provide evidence of an asymmetry in the household response to changes in stock market wealth.

Model 3

While the second model shows no evidence of an asymmetry in the MPC of stock market wealth in levels terms, I use an adaptation of the equation used by Mory (1993) to look for an asymmetry in the rate of growth of consumption with respect changes stock market wealth. Mory estimates the following equation to demonstrate the asymmetric impact of oil price changes on GNP:

\[ Y = \alpha + B_1 G + B_2 M2 + B_3 P^{+\_1} + B_4 P^{-\_1} + e \]

All variables are expressed in logarithmic first differences (\( \Delta \log \)), and so they represent the growth rates where \( Y \) is GNP, \( G \) is government purchases, \( M2 \) is the money supply and \( P^{+\_1} \) and \( P^{-\_1} \) are changes in the price of oil such that \( P \) is the \( \Delta \log \) of the price of oil and:

\[ P^+ = P \text{ if } P > 0, \text{ and } 0 \text{ otherwise and } \]
\[ P^- = P \text{ if } P < 0 \text{ and } 0 \text{ otherwise,} \]

lagged one period.

Mory finds that positive price shocks, or spikes in the price of oil have a significant retarding effect on the growth of GNP. He finds that negative price shocks, or
drops in the price of oil do not have a statistically significant impact on the growth rate of GNP.

I estimate the following adaptation of this model:

\[
C_t = \alpha + \sum_{i=0}^{1} B_i Y_{t-i} + B_2 SW^*_{t-1} + B_3 SW^-_{t-1} + B_4 NSW + e
\]

Where all variables are expressed as Δlog and C is consumption, Y is personal disposable income and includes contemporaneous and one period lagged values, SW^*_{t-1} and SW^-_{t-1} are the Δlog values of stock market wealth (SW) lagged one period such that:

\[
SW^* = \text{SW if } \Delta SW > 0 \text{ and 0 otherwise and } SW^- = \text{SW if } \Delta SW < 0 \text{ and 0 otherwise.}
\]

Here, the values of the coefficients represent the percentage change in the growth rate of personal consumption expenditure caused by a percentage change in the growth rate of the dependent variable, in effect an elasticity. Because the coefficients represent changes and impacts in growth rates, actual dollar for dollar MPC's must be calculated using average values of consumption and the dependent variable over the sample estimated. Minor algebraic manipulation of the equation allows estimation of percentage change in the level of consumption caused by a percentage change in dependent variable. This equation is:

\[
\log C_t = \log C_{t-1} + B_1 + \sum_{i=0}^{1} B_i Y_{t-i} + B_2 SW^*_{t-1} + B_3 SW^-_{t-1} + B_4 NSW_t + e
\]

where all variables are Δlog except consumption (C) which is simply the log of its level.

In this model, \( \beta_2 \) is expected to be positive and significant as it was in the previous models suggesting that an increase in the rate of growth of income will cause an
increase in consumption. If there is evidence of an asymmetry in response to changes in the rate of growth of stock market wealth, then $\beta_3$ is expected to be positive and significant, while $\beta_4$ is expected to be both positive and insignificant or simply insignificant. The coefficient is not expected to be negative because the values of $SW$ are themselves negative and so a negative coefficient would suggest that decreases in the growth rate of stock market wealth cause increases in the level of consumption; a result at odds with the life cycle hypothesis theory. $\beta_5$ is expected to be positive, however, based on the results from the previous models its expected significance is uncertain.

The results for the coefficients of the five estimations of this equation are reported in table B4. The extrapolated MPC's are reported in table B3. There is no evidence of an asymmetry in the MPC of stock market wealth in the estimation over the full time period, 1952:2 to 2001:2. $\beta_2$ is positive and significant as expected, although the extrapolated MPC is lower than expected at .53. $\beta_3$ and $\beta_4$ are both positive and significant at the five percent level and are not statistically different from each other. The extrapolated MPC's for $SW^*$ and $SW'$ are .014 and .021 respectively. These estimates are considerably lower than the conventional estimate of .04, but in line with the .02 found by Lettau and Ludvigson (2001) and Case et al. (2001). The coefficient of non-stock market wealth is not statistically significant beyond the 10% level in any of the estimations and so will not be discussed further. A dramatic asymmetry does emerge, however, when the model is estimated over two different time periods.

I broke the time period into two sections at two different points. The first break is based on the observation made earlier, that the function underlying stock market wealth changes around 1986 and separates the sample after the first quarter of 1986; the model is
estimated for the sub-samples 1952:2 to 1986:1 and 1986:2 to 2001:2. Addressing the second sub-sample first, $\beta_2$ is positive and significant at the 1% level, the extrapolated MPC of income is again low at .34. $\beta_3$ is significant at the 5% level and the extrapolated MPC of $SW^*$ is .02. $\beta_4$ is negative, but it is statistically insignificant at any level, thus it is of little concern that it does not have the expected sign. These results point to a significant asymmetry in consumer responses to stock market wealth changes. They indicate that consumers do not change their rate of consumption growth in the face of decreases in the rate of stock market wealth growth. They also suggest, as is consistent with theory, that increases in the rate of growth of stock market growth will increase the rate of consumption growth. While these results support the hypothesis of this paper, that consumers are reluctant to reduce their level of living on account of decreases in stock market wealth, the results for the other sub-sample are far more surprising.

When the equation is estimated for the sub-sample 1952:2 to 1986:1, the results reverse completely. The MPC of income, at 0.55, is slightly higher than the estimate for the entire time period. The coefficient of $\beta_3$ becomes statistically insignificant and the coefficient of $\beta_4$, is statistically significant at the 1% level. The extrapolated MPC of stock market wealth decreases is .042. These results point to a complete reversal of consumer behavior over the two time periods. Between 1952:2 and 1986:1 consumers do not change their consumption behavior in response to increases in the growth rate of stock market wealth and are more sensitive to decreases in said growth rate than they are to increases in the later time period. Consumers are also sensitive to changes in non-stock market wealth in the second period, where they were not in the first sub-sample.
This relationship among the results persists if the break in sub-samples is pushed back into the mid 1970's. If the equation is estimated over the sub-samples 1952:2 to 1976:3 and 1976:4 to 2001:2 the results demonstrate the same reversal of statistical significance. The extrapolated MPC's of income in first and second sub-samples is .61 and .41 respectively; both estimates are significant at the 1% level. The extrapolated MPC of positive changes in stock market wealth growth is insignificant in the first period but is equal to .025 in the second period and is significant at 1%. The extrapolated MPC of negative changes in stock market wealth growth is .030 in the first period and while it is significant at 2%, the coefficient in the second period is insignificant at even 20%.

Possible Causes of the Shifting Asymmetry

The hypothesis that households will react asymmetrically to changes in stock market wealth out of a desire to maintain a current level of consumption might explain the results reported above for the later sub-samples. It does not, however, offer any insight into the asymmetry observed in the early sub-samples or the apparent switch in the direction of the asymmetry. If the permanent income hypothesis assumption that consumers will only alter their consumption behavior in the face of unexpected permanent changes in wealth is true, then this switch in the direction of the asymmetry may indicate a switch in consumer expectations for stock market wealth.

Insensitivity to increases in stock market wealth in the early part of the sample period suggests consumers did not expect these changes to be permanent. That they responded to negative changes in the growth rate of stock market wealth suggests that they did expect these changes to be permanent and adjusted their consumption
expenditure accordingly. The reversal in the asymmetry in the mid-1970's indicates that these expectations changed. After 1976, consumers did not react in a statistically significant way to negative changes in the growth rate of stock market wealth and did react to positive changes. This points to a household expectation that positive changes in the growth rate of stock market wealth will be permanent and negative changes will be transitory; just the opposite outlook displayed in the early sample period.

Such a switch in expectations is consistent with the aforementioned change in the apparent function underlying stock market wealth growth. Between 1952 and the 1986 stock market wealth grew slowly, consistently and linearly. In this case, consumers might well expect constant moderate growth from the market and be surprised by dips in stock market wealth. Additionally, because their expectations for positive growth are modest, they will expect dramatic positive changes in the growth rate to be transitory. True to the permanent income hypothesis, these positive shocks, which are perceived to be transitory, will be ignored and the estimated consumption response to them will be insignificant. Consumers will, however, respond to the surprising negative shocks that are believed to be permanent.

After 1986 stock market wealth began to rise much more rapidly, and its rate of growth continued to grow until the first quarter of 2001. This growth may well have changed consumer expectations about the rate of stock market wealth accumulation. Consumers, expecting an ever-increasing rate of stock market wealth growth, will perceive negative changes in the growth rate to be transitory and will not adjust consumption in response to those changes. Correspondingly, consumers will expect positive changes in the growth rate of stock market wealth to be lasting movements and
will significantly adjust their consumption behavior. This reversal in expectations is only warranted if there is, in fact, a fundamental change in the transitory component of stock market growth.

Lettau and Ludvigson (2001) present evidence that 85% of changes in stock market wealth are transitory. In the appendix to their study they include a graph that charts the transitory components of stock wealth and net worth between 1953 and 2001 (chart A12). A visual analysis of the graph shows that the majority of the transitory component of stock wealth and net worth prior to about 1975 lay above trend. After 1975, the majority of this transitory component lies below trend. I have added boxes to the chart to highlight these regions. These data indicate that consumers were right to ignore positive and negative changes in the rate of stock market wealth growth in the first and second sub-samples respectively. According to Lettau and Ludvigson's graph, the majority of positive changes in the growth rate of stock market wealth in the period 1953 to 1975 were in fact transitory. Conversely, the majority of negative changes in the growth rate since 1975 have been transitory. Thus, a shift in consumer expectations is completely justified as the component of stock market wealth growth most likely to be transitory, did in fact change.

These results also correspond well with my findings of extrapolated MPC's of stock market wealth that are lower than conventional estimates, but in line with those found by Lettau and Ludvigson. This suggests that separating stock market wealth into a positive and negative change component, allows model 3 to account for the same asymmetrical reaction to transitory and permanent wealth shocks found in Lettau and Ludvigson's study.
Policy Implications

Lettau and Ludvigson (2001) rightfully note the importance of their findings for monetary policy. Inflation targets currently being pursued by the Federal Reserve should not be abandoned in response to market movements, because they are for the most part transitory. My work suggests that since 1986 bull markets do in fact increase the rate of consumption growth and thus are likely to create inflationary pressure, underscoring the need to heed inflation targets. However, there will be little, if any, need to abandon such targets in favor of expansionary policy simply to protect aggregate demand during bear markets. While Lettau and Ludvigson do not address fiscal policy, the lesson here is essentially the same. Government spending should not be altered to boost consumption during periods of falling asset values. For this reason, fiscal stimulus packages like the one passed by congress and signed by President Bush on March 9, 2002 should not be justified with bear markets. This is not to say, however, that monetary and fiscal policy should never be changed in response to market movements.

If the transitory component of stock market growth shifts again, such that it is largely negative or neutral, then consumer expectations will need to be reevaluated. Lettau and Ludvigson's results would suggest that there is never a reason to abandon inflation targets in response to market movements because most are transitory. However, if expectations for stock market growth reverse again, and consumers begin to respond to negative shocks in asset values it may be advisable to change monetary or fiscal policy in response to bear markets. It is unlikely that consumers will ever expect negative changes in the level of asset values to be permanent. However, it is not impossible that
expectations for the growth rate of the stock market will change. Another period of
linear-type stock market growth may cause consumers to change their consumption
patterns in response to slowing growth.

Romer (1990) presents another legitimate reason to alter monetary policy in
response to the stock market. Her “Uncertainty Hypothesis” suggests that adjusting fiscal
policy to stabilize the stock market in response to unusual variability is not only
justifiable, but advisable. For this reason, The Federal Reserve’s October 20, 1987
announcement that “consistent with its responsibilities as the nation’s central bank [it]
affirmed today its readiness to serve as a source of liquidity to support the economic and
financial system” was entirely appropriate given the market collapse the day before
(Beckner 1996). This commitment may have significantly limited stock market volatility
thereby supporting durables purchases, which in turn supported aggregate demand and
helped keep the economy out of recession.

With the qualification that fiscal or monetary policy changes in response to stock
market movements should be considered in the face of changing consumer expectations
or excess stock market volatility, my results reinforce the suggestion that neither policy
should be changed during a bear market to bolster consumer expenditure. This, however,
is not a recommendation that such policies should not be changed during recession; as
bear markets and recessions are not always concurrent or causally related.

Conclusions
In this study, I find the marginal propensity to consume out of stock market wealth to be both lower than the conventional estimate of .04 and asymmetrical. I find no evidence of an asymmetry in consumer expenditure in response to changes in the level of stock market wealth. However, consumer responses to changes in the rate of stock market wealth growth are asymmetrical and this asymmetry reverses sometime in the mid to late 1970's.

Over the full sample period from 1952:2 to 2001:2 I find the MPC of positive shocks to stock market wealth to be .014 and the MPC of negative shocks to be .021. These MPC's are not statistically different from each other suggesting that the MPC is not asymmetrical. However, when the sample period is broken into two sub-samples from 1952:2 to 1986:1 and from 1986:2 to 2001:2 the MPC's reflect an asymmetry. The MPC of positive shocks to stock market wealth during the first sub-sample is not statistically significant while the MPC of negative shocks is .042 and statistically significant. For the second sub-sample, the MPC of positive shocks is a statistically significant .02 while the MPC of negative shocks is not significant at any level.

These results reflect a fundamental change in the aggregate consumer expenditure response to changes in the value of stock market assets that is consistent with a change in consumer expectation for the rate of stock market growth. Prior to 1986 growth of the stock market is generally linear. After 1986 growth of the stock market is more closely described by an exponential function. This change in the function suggests that before 1986 consumers expected slow and steady growth in the stock market and were surprised by negative shocks to stock market wealth growth. After 1986, consumers came to expect an ever-increasing rate of stock market growth and so negative shocks were
viewed as transitory, while positive shocks to the growth rate were perceived to be permanent increases in stock market wealth growth.

This change in consumer expectations is consistent with Lettau and Ludvigson's (2001) findings that 85% of changes in the growth rate of stock market wealth are transitory. Their chart of the transitive components of stock market wealth growth indicates that transitory changes in stock market wealth were largely positive prior to the 1970's and negative since then. Thus, consumers were justified in ignoring positive changes in stock market wealth in the first sub-sample and negative changes in the second sub-sample, as they were largely transitory. These findings are highly consistent with the Permanent Income Hypothesis, which holds that individuals will only adjust their level of consumption based on unexpected and permanent changes in income, of which stock market wealth is a component.

If consumers do not change their consumption in response to negative shocks to stock market wealth, neither monetary nor fiscal policy should be altered out of fear that a bear market will undermine aggregate demand by lowering consumer expenditure. However, if consumer expectations for stock market wealth growth shift again and consumers begin to respond to negative shocks to stock market wealth, this lesson could change.
Works Cited


Appendix A: Data

Consumption

Changes in Real Consumption

Chart A 1

Chart A 2
Chart A 3

Chart A 4
Chart A 9

Chart A 10
Changes in Real Non-Stock Market Wealth

Chart A 11
Definition of variables

Consumption:
National Income Product Accounts, table 2.2 Personal Consumption Expenditures by Major Type of Product
Line 1 Personal consumption expenditures

Income (Y):
National Income Product Accounts, table 2.1 Personal Income and Its Disposition
Line 31 Disposable personal income: Total, billions of chained (1996) dollars

Net Worth:
Federal Reserve Flow of Funds Accounts, B.100 Balance Sheet of Households and Nonprofit Organizations
Line 43 Net Worth

Stock Market Wealth (SW):
Federal Reserve Flow of Funds Accounts of the United States
Levels Outstanding table L.100 Households and Nonprofit Organizations
Line 17 Corporate Equities
Line 18 Mutual fund shares
Line 20 Life insurance reserves
Line 21 Pension fund reserves
Levels Outstanding table L.116 Bank Personal Trusts and Estates
Line 14 Corporate equities
Line 15 Mutual fund shares

Non-stock Market Wealth (NSW):
Net Worth less Stock Market Wealth.

Personal Consumption Deflator:
Bureau of Economic Analysis, Chain-type price index table 7.4: Chain-Type Price Indexes for Personal Consumption Expenditures by Major Type of Product.
Nominal = (real/deflator) * 100
Note: The transitory component of wealth is defined as the difference between the actual value and the random walk component. The transitory component of stock wealth is the transitory component of wealth divided by the share of stock wealth in asset wealth in the sample, 0.208.

Appendix B: Estimation Results

Model 1

\[ C_t = \alpha + \sum_{i=0}^{3} B_{1i} Y_{t-i} + \sum_{i=0}^{3} B_{2i} SW_{t-i} + \sum_{i=0}^{3} B_{3i} N SW_{t-i} + \varepsilon \]

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<td>0.937</td>
<td>0.755</td>
<td>0.800</td>
<td>0.886</td>
<td>0.809</td>
<td></td>
</tr>
</tbody>
</table>

Note: L&S's coefficients are reported with t scores, the results of this study are reported with F probabilities in italics.
Source: Ludvigson and Steindel (1999)

Table B 1
Model 2

\[ C = \alpha + \sum_{i=0}^{2} B_i Y_{t-i} + \sum_{i=0}^{2} B_j Y_{t-i} + \sum_{i=0}^{2} B_3 Y_{t-1} + \sum_{i=0}^{2} B_4 Y_{t-i} + \sum_{i=0}^{2} B_5 Y_{t-i} + \sum_{i=0}^{2} B_6 Y_{t-i} + e \]

Estimated Coefficients of Model 2

<table>
<thead>
<tr>
<th></th>
<th>YPDH</th>
<th>SW</th>
<th>NSW</th>
<th>YD2</th>
<th>SW1</th>
<th>NSW2</th>
<th>AR(1)</th>
<th>R2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952:4 to 2001:2 Coef.</td>
<td>0.768</td>
<td>0.038</td>
<td>0.027</td>
<td>0.047</td>
<td>-0.001</td>
<td>-0.014</td>
<td>0.923</td>
<td>1.000</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.080</td>
<td>0.281</td>
<td>0.752</td>
<td>0.239</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>1986:2 to 2001:2 Coef.</td>
<td>0.834</td>
<td>0.030</td>
<td>0.040</td>
<td>0.027</td>
<td>-0.003</td>
<td>-0.006</td>
<td>0.933</td>
<td>0.999</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.138</td>
<td>0.727</td>
<td>0.735</td>
<td>0.788</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Note: F probabilities in italics.

Table B 2

Model 3

\[ C_t = \alpha + \sum_{i=0}^{1} B_i Y_{t-i} + B_2 Y_{t-1} + B_3 Y_{t-1} + B_4 Y_{t-1} + e \]

Extrapolated MPC's from Model 3

<table>
<thead>
<tr>
<th></th>
<th>Y</th>
<th>SW+</th>
<th>SW-</th>
<th>NSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1952:2 to 2001:2</td>
<td>0.526119</td>
<td>0.01397</td>
<td>0.021419</td>
<td>0.014218</td>
</tr>
<tr>
<td>1952:2 to 1986:1</td>
<td>0.554791</td>
<td>0.010168</td>
<td>0.041573</td>
<td>0.00395</td>
</tr>
<tr>
<td>1986:2 to 2001:2</td>
<td>0.343818</td>
<td>0.019991</td>
<td>0.005967</td>
<td>0.039067</td>
</tr>
<tr>
<td>1952:1 to 1976:3</td>
<td>0.616352</td>
<td>2.96E-05</td>
<td>0.30158</td>
<td>0.00536</td>
</tr>
<tr>
<td>1976:4 to 2001:2</td>
<td>0.40972</td>
<td>0.024588</td>
<td>0.012085</td>
<td>0.029806</td>
</tr>
</tbody>
</table>

Notes: Italicized coefficients are statistically insignificant at the 10% level.

*Wald* test for Ho SW+ = SW- in estimation 1: Fstat=.163389, Fprob = .68651

Table B 3
Estimated Coefficients of Model 3

<table>
<thead>
<tr>
<th>time period</th>
<th>C</th>
<th>Y</th>
<th>SW+</th>
<th>SW-</th>
<th>NSW</th>
<th>aR2</th>
<th>n+</th>
<th>n-</th>
<th>total n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1952:2 to 2001:2</td>
<td>0.003</td>
<td>0.586</td>
<td>0.027</td>
<td>0.037</td>
<td>0.050</td>
<td>1.000</td>
<td>127</td>
<td>70</td>
<td>196</td>
</tr>
<tr>
<td></td>
<td>0.000</td>
<td>0.000</td>
<td>0.056</td>
<td>0.009</td>
<td>0.375</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 1952:2 to 1986:1</td>
<td>0.004</td>
<td>0.628</td>
<td>0.015</td>
<td>0.060</td>
<td>-0.015</td>
<td>1.000</td>
<td>82</td>
<td>54</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>0.002</td>
<td>0.000</td>
<td>0.437</td>
<td>0.001</td>
<td>0.849</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 1986:2 to 2001:2</td>
<td>0.003</td>
<td>0.376</td>
<td>0.045</td>
<td>-0.012</td>
<td>0.127</td>
<td>0.999</td>
<td>45</td>
<td>16</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>0.012</td>
<td>0.011</td>
<td>0.022</td>
<td>0.544</td>
<td>0.106</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 1952:1 to 1976:3</td>
<td>0.004</td>
<td>0.693</td>
<td>0.000</td>
<td>0.049</td>
<td>-0.020</td>
<td>1.000</td>
<td>61</td>
<td>37</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>0.009</td>
<td>0.000</td>
<td>0.998</td>
<td>0.012</td>
<td>0.831</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 1976:4 to 2001:2</td>
<td>0.003</td>
<td>0.454</td>
<td>0.051</td>
<td>0.022</td>
<td>0.102</td>
<td>0.999</td>
<td>66</td>
<td>33</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>0.015</td>
<td>0.000</td>
<td>0.009</td>
<td>0.315</td>
<td>0.149</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Probabilities reported in italics.

Table B 4

Extrapolation of Levels MPC's From Model 3

To convert the coefficients from model 3 into levels MPC's, the following formula was used (this example uses income, however the equation is the same for all the variables):

$$ \text{MPC}_Y = B_1 \cdot \frac{\bar{C}}{\bar{Y}} $$

Where $\text{MPC}_Y$ is the MPC of income, $B_1$ is the summated coefficient from the estimation and $\bar{C}$ and $\bar{Y}$ are the mean values of consumption and income over the estimation period respectively.

Table B 5

Mean Values in Billions of 1996 $

<table>
<thead>
<tr>
<th>time period</th>
<th>Cons</th>
<th>Y</th>
<th>SW+</th>
<th>SW-</th>
<th>NSW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 1952:2 to 2001:2</td>
<td>3110.412</td>
<td>3461.518</td>
<td>6077.122</td>
<td>5365.996</td>
<td>10974.74</td>
</tr>
<tr>
<td>2 1952:2 to 1986:1</td>
<td>2280.74</td>
<td>2579.655</td>
<td>3260.701</td>
<td>3283.251</td>
<td>8654.144</td>
</tr>
<tr>
<td>3 1986:2 to 2001:2</td>
<td>4973.772</td>
<td>5442.095</td>
<td>11209.27</td>
<td>12395.26</td>
<td>16186.57</td>
</tr>
<tr>
<td>4 1952:1 to 1976:3</td>
<td>1877.667</td>
<td>2111.168</td>
<td>2985.351</td>
<td>3066.57</td>
<td>7055.989</td>
</tr>
<tr>
<td>5 1976:4 to 2001:2</td>
<td>4343.156</td>
<td>4811.869</td>
<td>8934.669</td>
<td>7944.141</td>
<td>14893.49</td>
</tr>
</tbody>
</table>

Table B 5