Resurrecting the Wealth Effect on Consumption:

Further Analysis and Extension

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Abstract: This paper investigates whether various components of wealth affect real consumption asymmetrically through a threshold adjustment model. The empirical findings for the U.S. show that only stock market assets, financial assets including stock market assets, and household net assets exert a practical wealth effect on consumption expenditure. By contrast, financial assets excluding stock market assets, tangible assets, total assets, and the Lettau-Ludvigson measure of net assets do not exert a practical wealth effect on consumption expenditure. In addition, the empirical findings favor the presence of an asymmetric effect on real consumption for the former cases, with negative 'news' affecting consumption less than positive 'news'.

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Resurrecting the Wealth Effect on Consumption: Further Analysis and Extensions

I. Introduction

Since the seminal work by Modigliani (1971), macroeconomists generally accept the idea that consumption responds to changes in wealth – the so-called wealth effect.[1] A general consensus exists that a dollar increase in wealth generates about a 5-cent increase in consumption. Moreover, large-scale macroeconometric models of the U.S. economy incorporate wealth as an important, if secondary, variable in the determination of consumption spending. As such, significant swings in the stock market and real estate values, either positive or negative, cause serious consideration by policy makers as to the probable effects on macroeconomic activity. For example, should the Federal Reserve monitor stock market and real estate values, responding with monetary policy adjustments when swings in value not attributable to fundamentals occur?[2]

Lettau and Ludvigson (2004) aimed a "shot across the bow" at the importance of the "wealth effect." Their basic premise argued that the 5-cent rule for the wealth effect overstates the wealth-effect's importance, once they distinguish between trend (permanent) and cycle (transitory) movements in asset values. Their argument unfolds as follows. First, the variables in the standard consumption function estimation – consumption, income, and wealth – probably exhibit non-stationary time-series properties. Thus, the analysis of the consumption should employ cointegration and error-correction modeling methods. Second, cointegrated relationships

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[1] Two major, related theories of long-run consumption exist – the permanent income and life-cycle models. In the life-cycle model, changes in wealth affect consumption indirectly by altering saving. Higher wealth reduces the need to accumulate more wealth, lowers saving, and raises consumption. Stock market adjustments, as a "leading indicator," may forecast future changes in income (Morck *et al*, 1990; Poterba and Samwick, 1995; Starr-McCluer, 2002). Higher stock prices forecast higher expected future income, raise permanent income, and, thus, increase consumption.

imply that trend (permanent) consumption depends on trend income and wealth. Thus, the long-run effect of wealth on consumption depends on that trend relationship. Third, since cointegration captures trend relationships, the trend-cycle decomposition of consumption, income, and wealth may offer some information about the magnitude of the wealth effect. The cointegration relationship implies a particular error-correction model that captures the short-run adjustments of consumption, income, and wealth as they return toward the long-run trend relationship. Fourth, the error-correction specification facilitates the decomposition of measured consumption, income, and wealth into trend (permanent) and cycle (transitory) components. Finally, Lettau and Ludvigson (2004) find that the cycle (transitory) movements in wealth dominate the trend (permanent) movements, implying that the wealth effect, as captured by trend movements, falls well below standard estimates (i.e., the 5-cent rule).

Apergis and Miller (2005) consider whether the "wealth effect" exhibits asymmetry. That is, do increases and decreases in wealth associate with different magnitude effects on consumption? They find that "negative news" exhibits a larger absolute effect on consumption than "positive news." A small part of their analysis implements Lettau and Ludvigson's decomposition of consumption, income, and wealth into trend and cycle components. Apergis and Miller employ stock market value as wealth whereas Lettau and Ludvigson use net worth. That is, Lettau and Ludvigson take stock market wealth and add financial wealth, tangible assets, and deduct offsetting liabilities.[3] Apergis and Miller (2005) discover that the trend component of stock market value dominates the cyclical component, the reverse of Lettau and Ludvigson.

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[2] Of course, identifying big swings in stock market or real estate values not linked to fundamental values (i.e., bubbles) proves a most difficult exercise. For example, *The Economist* criticized the Federal Reserve during the late 1990s for ignoring asset price inflation.

[3] The asset data from both studies come from the Federal Reserve System's Flow of Funds Accounts, as do the asset data in this paper. It appears that they did not purge the information of non-profit organizations. We consider two

This paper reconsiders the Lettau and Ludvigson (2004) conclusion that "permanent changes in wealth do affect consumer spending, but most changes in wealth are transitory and are uncorrelated with consumption." (p. 294, emphasis in original) as well as the Apergis and Miller (2005) conclusion that increases in stock market wealth exert a smaller effect on consumption than decreases. We provide results for various definitions of wealth – stock market wealth, financial asset wealth (including and excluding stock market wealth), tangible asset wealth (i.e., real estate and consumer durables), total assets, and net worth, both including and excluding non-profit organizations.

Our findings include the following. First, stock market assets, financial assets including stock market assets, and household net assets, which exclude non-profit organizations, exert a significant effect on consumption. Moreover, most changes in these different measures of wealth represent trend (permanent) changes. Second, financial assets excluding stock market assets, tangible assets, total assets, and the Lettau-Ludvigson measure of net assets, which incorporates non-profit organizations, also exert a significant effect on consumption. Here, however, movements in these measures of wealth largely reflect cycle, not trend, movements. Third, for the former definitions of wealth, "negative news" exhibits a larger effect on consumer spending that "positive news."

This study reconsiders the results from Lettau and Ludvigson's paper and examines whether ratchet effects exist between the various components of wealth and real consumption in the U.S. The paper contributes to the existing literature as follows. It reverses Lettau-Ludvigson's (2004) finding that wealth does not exert an important effect on consumer spending, depending on how we measure wealth. It provides new evidence of asymmetric wealth effects on

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measures of net worth – including and excluding non-profit organizations. That distinction proves important in consumer spending, using an established, novel econometric technique of threshold regression. The rest of the paper is organized as follows. Section II provides a brief review of empirical estimates of the wealth effect in consumption and its asymmetry. Section III presents and discusses the empirical results. Section IV concludes.

II. Wealth Effects: Brief Review

High wealth may cause higher consumption expenditures and, thus, higher aggregate demand. This linkage exists when individuals consume according to the present value of their lifetime income (Mehra, 2001). Thus, the simple life-cycle model of consumption argues that anticipated changes in wealth affects consumption with a marginal propensity to consume on the order of the real interest rate.

Much of the empirical literature, beginning with Ando and Modigliani (1963), that examines the "wealth effect" largely employs stock market assets as the measure of wealth with little effort extended to consider the possible effects of the other components of wealth, such as real estate, financial assets other than stock market assets, and so on. Time-series evidence exists supporting the view that changes in stock market value (wealth) affect consumption, although that evidence does prove somewhat ambiguous. For example, Ludvigson and Steindel (1999) show that estimates of the wealth effect prove mixed and sensitive to the choice of the observation period. Further, Lettau and Ludvigson (2004) find that only a small fraction of stock market assets relates to aggregate consumption spending, where the absence of such a wealth effect reflects the transitory nature of a significant portion of the movements in stock market assets. Poterba (2000) provides a good recent survey of the effect of stock market value on consumption. Other authors consider the cross-section evidence on the effect of stock market

tipping the findings one way, or the other.

value on consumption. Starr-McClue (1998) concludes that those individuals with large holdings of stock market wealth do experience a link between changes in stock market value and consumption. Individuals with small stock market wealth do not. Similarly, Dynan and Maki (2001) conclude that households exhibit a link between stock price adjustments and consumption, only if those households own stock.

More recently, some authors consider whether evidence from stock market value and consumption studies extrapolates to other wealth measures – real estate, financial assets excluding stock market assets, and so on. Much of this effort focuses on real estate wealth. Case, Quigley, and Shiller (2005) provide a good recent review. While the original simple life-cycle mode of consumption does not distinguish between different types of wealth, implicitly assuming that the marginal propensities to consume out of wealth remains the same across different wealth types, reasons exist to suggest that this implicit assumption proves, in fact, invalid. Case, Quigley, and Shiller (2005) offer five different possible rationalizations for different marginal propensities to consume out of different types of wealth – differing perceptions about the effects of permanent and transitory components, differing bequest motives, differing motives for wealth accumulation, differing abilities to measure wealth accumulation, and differing psychological "framing" effects. Another possible rationalization, not mentioned by Case, Quigley, and Shiller, involves whether the wealth holder receives consumption services from the holding of wealth. For example, owner occupied housing and consumer durable goods provide consumption services to holders of these components of wealth. Thus, then households may not adjust their consumption of nondurables and services, the usual measure of consumption for wealth-effect studies, to changes in the market values of owner occupied housing and consumer durables.

The empirical evidence for the effect of changes in real estate and housing values on consumption also provides somewhat mixed findings, with the bulk of the results supporting a significant positive effect. For time-series evidence, Elliot (1980) does not find any significant effect. Peek (1983), Bhatia (1987), Case (1997), and Case, Quigley, and Shiller (2005) do.[4] The cross-section evidence provides similar findings. Levin (1998) finds no evidence of a real estate and housing value effect on consumption. Skinner (1989) and Engelhardt (1996) discover significant effects, although Engelhardt's findings exhibit asymmetry where by negative "news" affects consumption but positive "news" does not.

Although Case, Quigley, and Shiller (2005) discuss potential differences in effects due to temporary and permanent changes in wealth, they do not pursue this issue in their econometric analysis. This issue, however, provides the focus for Lettau and Ludvigson (2004).

Turning now to the literature on consumption and asymmetric wealth effects, Patterson (1993) finds that consumption behaves asymmetrically to wealth shocks and that this asymmetry mainly reflects the presence of imperfect capital markets (i.e., liquidity constraints). Shea (1995) shows that consumption exhibits asymmetric behavior, due to loss aversion in intertemporal preferences. That is, individuals suffer more when forced to reduce consumption standards due to diminishing marginal utility of wealth. Zandi (1999) also argues that consumers may react more rapidly to wealth contractions than to expansions. Carruth and Dickerson (2003) assess the likelihood that aggregate consumers behave differently under various disequilibrium asymmetric shocks. Their empirical findings provide strong support for this possibility. Moreover, Kuo and

[4] Case, Quigley, and Shiller (2005) consider the wealth effects of stock-market and real estate and housing values simultaneously for the U.S. states and 14 developed countries, including the U.S. They find strong evidence of a wealth effect on consumption due to real estate and housing value and a weaker effect due to stock-market value. Stock-market value achieves a stronger effect for the U.S. states, which may reflect the larger relative holding of stocks in the U.S. relative to other developed countries.

Chung (2002) show that asymmetric sensitivity of consumption to the phases of the business cycle generates asymmetric patterns. They also conclude that the consumption of liquidity-constrained consumers closely relates to the business cycles. Cook (2002) provides evidence exhibiting the highly significant asymmetric pattern of consumption, a fact mainly attributed to different consumption and savings behavior. Stevans (2004) also produces evidence in favor of a wealth effect, but only where the wealth from stock holdings rises above a critical threshold point, which is mainly based on the stock market cycle. In particular, he gives another reason why consumers react in an asymmetric fashion to changes in stock market wealth. Crashes in the stock market increase asymmetric information and interfere with the flow of funds channeled to economic activity. Increased uncertainty or price volatility leads to enhanced adverse selection, resulting in a decline in lending, borrowing, and spending. The rise in asymmetric information will also affect the time path towards the lower target spending level. Moreover, Stevans (2004) shows that during stock market downturns, more uncertainty associates with increased hysteresis in consumer spending, while during periods of rising equity prices less uncertainty results in a smoother adjustment process. Finally, Apergis and Miller (2005) find that negative 'news' affects consumption more than positive 'news'.

III. Empirical Results

Data

The empirical analysis uses quarterly data on personal consumption (C), measured as the sum of consumption on non-durables and services excluding shoes and clothing; nominal labour income, measured as wages and salaries plus transfer payments plus other labour income minus personal contributions for social insurance minus taxes; and domestic prices, measured by the personal consumption chain-type price index (1992=100), seasonally adjusted. The various components of total wealth used includes the following: stock market wealth (S), measured as stock market wealth capitalization (including direct household holdings-corporate equities, mutual funds shares, security credit, life insurance and pension fund reserves, investment in bank personal trusts, and equity in noncorporate business), financial assets minus stock market wealth (F), tangible assets minus the non-profit organizations holdings (T), financial assets (F1) where stock market wealth is also included, total assets minus the holdings of non-profit organizations (A), household net wealth (NW) excluding non-profit organizations, and Lettau-Ludvigson net wealth (NW1) including non-profit organizations over the period 1957:1-2004:3. Data for consumption and disposable income come from the US Census Bureau, while those for measuring the various components of wealth come from the Board of Governors Flow of Funds series (Table B.100 and items 2, 5, 6, 7, 8, 14, and 23 through 29). All variables are converted to *per capita* terms by dividing them by total (midyear) population. Population data come from the United Nations (United Nations, 2000). Throughout the paper, lower case letters indicate variables expressed in natural logarithms.

Integration Analysis

We first test for unit-root nonstationarity by using ADF unit-root tests proposed by Dickey and Fuller (1981) as well as the KPSS tests proposed by Kwiatkowski *et al*. (1992). We report the ADF tests with and without a trend, while we apply the KPSS tests with a trend in their levels and without a trend in their first differences. The existing literature typically follows this approach for the level test to check for trend stationarity and for the first-difference test to check for stationarity around a level. In addition, the KPSS results are reported using 0, 2, 4, and 8 lags.

Table 1 reports the results. We cannot reject the hypothesis of a unit root for real consumption per capita, real income per capita, and all the various components of real wealth per capita at the 1-percent level in both types of tests. With first differences, we reject unit-root nonstationarity for all variables.

Cointegration Analysis: Identifying the Wealth Effect

The life-cycle theory of consumption argues that current consumption depends on current wealth and on human wealth that includes the current and future expected labor income. One complication arises, however, because we cannot directly observe the future income stream. Assuming that current income is proportionate to human wealth, then we can use current income to proxy for the human wealth. In addition, the equity share of household total wealth proves relatively small, while the presence of equity investment accounts, such as IRAs and 401(k) plans, provides limited accessibility to consumption.

Garner (1990) and Choudhry (2003) argue that household wealth includes money, government bonds, real estate, and tangible assets, in addition to equities. Nonetheless, stock market fluctuations prove the primary cause of variation in total household's wealth due to the excessive volatility of stock prices[5]. Before testing for asymmetric (threshold) cointegration, we test for the presence of standard cointegration. In particular, the empirical analysis uses a simple model that relates real per capita consumption, real per capita current income, and real per capita wealth (Cambell and Mankiw, 1989; Lettau and Ludvigson, 2001; Ludvigson and Steindel, 2002):

$$c_t = a_0 + a_1 y_t + a_2 w_t + v_t, \qquad (1)$$

where c equals real consumption spending per capita, y equals real income per capita, w equals real wealth per capita, and v equals a random term. Since the regression is linear in logarithms,

[5] Using a broader measure of wealth, Lettau and Ludvigson (2001) find that the majority of movements in wealth represent transitory (cyclical) movements, which do not correlate with consumption. Most movements in consumption reflect trend (permanent) changes.

the coefficient of real wealth per capita (a_2) measures the elasticity of consumption with respect to real wealth per capita as follows (Boone *et al.* 1998):

$$a_2 = (\Delta C_t/\Delta W_t) \text{ x } (W_{t-1}/C_{t-1}) = \text{mpc x } (W_{t-1}/C_{t-1}) \text{ or}$$

$$\text{mpc} = a_2 / (W_{t-1}/C_{t-1}), \qquad (2)$$

where mpc equals the marginal propensity to consume out of real wealth per capita and (W/C) equals the ratio of real wealth per capita to real private consumption spending per capita. For the U.S. and over the period under study, the relevant ratios are as follows: for stock market wealth = 2.25, for financial assets minus the stock market assets = 3.11, for tangible assets minus the nonprofit organizations holdings = 2.075, for financial assets including stock market = 4.01, for total assets minus the holdings of nonprofit organizations = 6.08, for household net wealth excluding non-profit organizations = 3.34, and for Lettau-Ludvigson net wealth including non-profit organizations = 4.31.

We follow the methodology of Johansen and Juselius (1990). Having identified three jointly dependent stochastic variables integrated of the same order [i.e. I(1)], we specify a vector autoregression (VAR) model to obtain a long-run relationship. Table 2 reports the tests for cointegration. Both the eigenvalue and the trace test statistics indicate that a single long-run relationship exists for real consumption per capita, real income per capita, and real wealth per capita for all measures of wealth. The methodology of dynamic least squares (DOLS), proposed by Stock and Watson (1993), yields the following cointegration equations. The methodology estimates the long-run parameters, using a linear model with leads and lags. According to Maddala and Kim (1998), this is the best way to estimate a long-run regression, since the Johansen estimator possesses large variation. Four leads and lags were included, while the results (available upon request) were not sensitive to alternative leads and lags. Newey-West corrected t-statistics are also provided along with figures in brackets denoting p-values:

$$c = 0.74\,y + 0.12\,s$$
x^2-*statistics*: 6.72[0.0] 8.41[0.0]
R-BAR^2 = 0.57

$$c = 0.87\,y + 0.18\,f$$
x^2-*statistics*: 28.60[0.0] 11.63[0.0]
R-BAR^2 = 0.62

$$c = 0.81\,y + 0.13\,t$$
x^2-*statistics*: 5.49[0.0] 7.22[0.0]
R-BAR^2 = 0.54

$$c = 0.73\,y + 0.14\,f1$$
x^2-*statistics*: 39.55[0.0] 13.68[0.0]
R-BAR^2 = 0.69

$$c = 0.79\,y + 0.25\,a$$
x^2-*statistics*: 35.25[0.0] 42.26[0.0]
R-BAR^2 = 0.52

$$c = 0.76\,y + 0.24\,nw$$
x^2-*statistics* 29.36[0.0] 14.49[0.0]
R-BAR^2 = 0.78

$$c = 0.75\,y + 0.15\,nw1$$
x^2-*statistics* 27.02[0.0] 16.42[0.0]
R-BAR^2 = 0.67

From the cointegrating vectors, the alternative components of wealth clearly exert a positive and statistically significant effect on consumption. From equation (2), the marginal propensity to consume (with respect to non-durable and service consumption) out of the alternative definitions of wealth (mpc) equals as follows: mpc_s = 0.053(0.12/2.25), mpc_f = 0.058(0.18/3.11), mpc_t = 0.063(0.13/2.075), mpc_{f1} = 0.035(0.14/4.01), mpc_a = 0.041(0.25/6.08), mpc_{nw} = 0.067(0.24/3.56), and mpc_{nw1} = 0.045(0.15/3.34). In other words, a one-dollar increase in the value of stock market wealth, financial assets wealth, tangible assets wealth, financial assets wealth with stock market wealth, total assets wealth, household net wealth without non-profit organizations, and Lettau-Ludvigson net wealth with non-profit organizations will increase consumption by 5.3 cents, 5.8 cents, 6.3 cents, 3.5 cents, 4.1 cents, 6.7 cents, and 4.5 cents, respectively, in the long run.

A Vector Error Correction Model (VECM)

In our next step, we estimate a VECM and use the results to back out the identification of permanent and transitory components of the variables under investigation. The actual estimates for consumption, income, and wealth appear in the appendix for the different definitions of wealth. Lag-length selection employed the Akaike criterion. One lag occurs for the narrower measures of wealth – stock market assets, financial assets excluding stock market assets, and tangible assets. Two lags occur for the broader measures of wealth. Diagnostic statistics display the absence of serial correlation in residuals (LM test), the acceptance of the functional form of the model (RESET test), and the absence of ARCH effects in all three EC equations in all forms of wealth.

The error correction (EC) terms in the consumption equations prove negative and statistically significant in all cases. The error-correction terms in the wealth and income equations exhibit positive and statistically significant values as well. A positive error-correction term implies that the actual consumption exceeds its predicted value based on the values of income and wealth and the estimated coefficients. Thus, the estimated coefficients of the error-correction terms all conform to stabilizing adjustments to short-run deviations from the long-run cointegrating relationship.

Lettau and Ludvigson (2004) appear to employ net wealth that includes non-profit organizations. Comparing our VECM to theirs generates the following observations. All coefficients of the error-correction term in our VECM prove significant where as Lettau and Ludvigson find only the coefficient of the error-correction term in the net wealth equation prove significant. Moreover, they report only one lag in their VECM where as we employ two lags. What can account for those differences? The only major difference relates to sample period. Our sample runs from 1957:1 to 2004:3 while their sample runs from 1951:4 to 2003:1.

Identifying the Permanent and the Transitory Component of Consumption, Wealth, and Income

In this section, we show whether consumption and wealth correlate, if we decompose them into permanent and transitory components. Following the methodology of Lettau and Ludvigson (2004), we derive the permanent-transitory decomposition of the three variables under study under the definitions of various components of wealth. With three variables and a single cointegrating vector, we assume two permanent shocks and one transitory shock exist. We also use the previously estimated VECMs to obtain variance decompositions that determine the fraction of total variance in the forecast error of Δc, Δs (or Δf or Δt or $\Delta f1$ or Δa or Δnw or $\Delta nw1$), and Δy due to the two permanent shocks combined and to the one transitory shock. We also do not restrict the coefficients of the error-correction terms to zero, since they statistically differ from zero.

Table 3 reports the (orthogonalized) decomposition results. They show that the variation of growth for all three variables primarily reflects permanent shocks only for the cases of stock market wealth, financial assets with the stock market wealth included, and net wealth with non-profit organizations excluded. These findings imply that the variability of consumption, driven by permanent shocks, closely associates with the variability in wealth, driven also by permanent shocks only for these three cases. For the cases of financial assets minus stock market wealth, tangible assets, total assets, and net wealth with non-profit organizations included, our results support those reached by Lettau and Ludvigson (2004), where most movement in wealth reflected transitory shocks. In sum, depending on the definition of wealth, we do and do not support the finding of Lettau and Ludvigson (2004) that transitory changes in wealth dominate permanent changes in wealth.

What explains the different findings? We begin by hypothesizing that households hold different assets for different reasons. For example, tangible assets include consumer durable goods and real estate, largely owner occupied homes. Households implicitly consume the services from these two assets. We use the consumption of nondurable goods and services in our regression analysis, as do Lettau and Ludvigson (2004), which explicitly exclude the consumption of services from durable goods and housing. Thus, we do not anticipate that tangible assets should affect our measure of consumption.[6] Further, stock market assets comprise the largest share and a majority of financial assets. Conversely, non-stock market assets – deposits and credit market instruments – represent a small share of financial assets. Moreover, deposits make up the bulk of non-stock market financial assets. Deposits may play the role of the medium of exchange, rather than the store of value, function in household minds, leading to no wealth affect when non-stock market financial assets change.

Some inexplicable results still remain, nonetheless, assuming that we accept the rationalizations of the prior paragraph. First, stock market assets comprise the bulk of total assets, yet transitory movements in total assets dominate permanent movements. Finally, the inclusion or exclusion of non-profit organizations involves small adjustments to net wealth.

Nonetheless, the relative importance of permanent and transitory movements in net wealth reverses when we include or exclude non-profit organizations.

Following Lettau and Ludvigson (2004), we also report (unorthogonalized) variance decompositions. In this case, Table 4 reports the variance-covariance decompositions of the h-step ahead forecast errors attributable to the permanent and transitory shocks as well as twice the covariance between the permanent and transitory shocks. Our basic conclusions continue to hold.

The permanent components of our wealth measures prove more important than transitory components in explaining overall movements in wealth for stock market wealth, and financial wealth including stock market wealth. Now, however, the permanent component of net wealth excluding non-profit organizations explains slightly less than 50 percent of its overall movements beyond the one-quarter horizon. The other four wealth measures still get more explanation for the transitory components, similar to Table 3. The explanatory contribution from the permanent components generally falls between tables 3 and 4, and by larger amounts at longer time horizons. Moreover, the permanent and transitory components generally exhibit positive correlation.

Table 5 reports the correlations between the growth rates of each variable and its permanent (trend) component – consumption, income and various wealth measures. The correlations for consumption, income and the Lettau-Ludvigson wealth measure fall close to the values reported by Lettau and Ludvigson (2004) (i.e., 0.911, 0.871, and 0.182, respectively). Our three wealth measures for which the permanent component explains a majority of the variance decomposition in Table 3 exhibit relatively high correlations in Table 5. The other wealth measures exhibit relatively low correlations.

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[6] Of course, some durable good and housing purchases may reflect speculative behaviour, especially when run-up in

An Asymmetric Wealth Effect is Present?

Given the permanent effect of the stock market wealth, financial market wealth that includes stock market wealth, and net wealth that exclude non-profit organizations, we next proceed to investigate whether the association between these three alternative definitions of wealth and consumption follows an asymmetric pattern. To this end, we adopt the methodology suggested by Enders and Siklos (2001) to examine the presence of asymmetric responses of consumption to changes in wealth.

Next, we use the residuals (μ) from the cointegration equations and we assume that they follow a momentum threshold autoregressive (M-TAR) model:

$$\Delta\mu_t = \rho_1 M_t \mu_{t-1} + \rho_2 (1\text{-}M) \mu_{t-1} + \sum_{i=1} \gamma i \, \Delta\mu_{t-i} + \varepsilon_t$$

where ε_t is a sequence of zero-mean, constant-variance iid random variable, such that ε_t is independent of μ_j, $j<t$, and M_t is an indicator function defined as:

$$M_t = \begin{cases} 1 & \text{if } \Delta\mu_{t-1} \geq \tau \\ 0 & \text{if } \Delta\mu_{t-1} < \tau \end{cases}$$

where τ is the threshold value. We test the null hypothesis of symmetric adjustment (ρ_1=ρ_2) using a standard F distribution. Using the method proposed by Chan (1993), we get consistent estimates. We also assume that for consumption the threshold equals zero. The Akaike criterion selects a lag order of two for the $\Delta\mu$ polynomial for stock market wealth and household net wealth, but a lag order of one for financial assets with stock market assets included. Consistent estimates of the M-TAR model yield the following results:

Consumption and s (γ=2)

$$\Delta\mu_t = -\ 0.035\ M_t\ \mu_{t-1} - 0.028\ (1\text{-}M_t)\ \mu_{t-1} + 0.179\ \Delta\mu_{t-1} + 0.042\ \Delta\mu_{t-2}$$

their prices occur.

$$(-4.17)^* \quad (-3.62)^* \quad (2.97)^* \quad (3.36)^*$$

$F_{\rho 1=\rho 2}$ = 10.61 [p-value=0.00]

Consumption and f1(γ=1)

$$\Delta\mu_t = -\ 0.096\ M_t\ \mu_{t-1} - 0.046\ (1\text{-}M_t)\ \mu_{t-1} + 0.127\ \Delta\mu_{t-1}$$
$$(-4.17)^* \quad (-3.64)^* \quad (3.70)^*$$

$F_{\rho 1=\rho 2}$ = 12.48 [p-value=0.00].

Consumption and nw (γ=2)

$$\Delta\mu_t = -\ 0.046\ M_t\ \mu_{t-1} - 0.035\ (1\text{-}M_t)\ \mu_{t-1} + 0.218\ \Delta\mu_{t-1} + 0.069\ \Delta\mu_{t-2}$$
$$(-4.16)^* \quad (-4.72)^* \quad (3.86)^* \quad (4.25)^*$$

$F_{\rho 1=\rho 2}$ = 21.73 [p-value=0.00]

T-statistics appear in parentheses. An asterisk indicates significance at the 1-percent level. The empirical findings show that in all cases, ρ's exhibit a negative sign, indicating convergence. In addition, we can reject the null hypothesis of symmetric adjustment at the 1-percent level in all cases. Moreover, the estimates indicate that the speed of adjustment is more rapid for positive than for negative discrepancies. In other words, consumers respond more strongly to favorable news than to unfavorable news. The results differ from those reached by Kahneman *et al.* (1991) and Shea (1995) who conclude that strong loss aversion exists.

IV. Conclusions and Policy Implications

This paper searches for asymmetric effects of various components of wealth on real consumption per capita in the U.S., using a threshold model. The empirical results show that when wealth equals financial assets minus stock market wealth, tangible assets, total assets, and net wealth with non-profit organizations included, then wealth adjustments largely reflect transitory adjustments, implying a much smaller effect on consumption than indicated by the coefficient of wealth in the consumption cointegration regression. When wealth equals stock market wealth, financial assets including stock market wealth, and household net wealth with non-profit organizations excluded, then wealth adjustments largely reflect permanent changes, implying much smaller reduction in the effect exhibited by the coefficient in the consumption cointegration regression.

In these latter cases, wealth possesses an asymmetric effect on real consumption per capita. To wit, higher wealth increases consumption significantly more than lower wealth. Moreover, given the asymmetric effect of financial wealth on total consumption, how should monetary policy respond to increases and decreases only in the permanent component in the prices of assets included in this definition? That is, should the monetary authorities react more quickly and strongly to price appreciations (e.g., under inflation targeting regimes, do policy makers wish to prevent strong inflationary pressures or bubbles?) than to price declines? If yes, then which wealth components should receive priority from the monetary authorities to affect more efficiently and more rapidly the course of the business cycle? Our findings suggest that the priority should rest on those of components of wealth, displaying a permanent relationship with consumption (i.e., stock market wealth, financial assets with stock market wealth included, and household net wealth with non-profit organizations excluded).

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Table 1: Unit root tests

ADF tests

	without trend		with trend	
Variable	Levels	First differences	Levels	First differences
c	-1.37(4)	-6.04(3)*	-1.32(3)	-7.05(2)*
y	-1.97(3)	-5.64(2)*	-2.12(3)	-5.86(2)*
s	-2.18(3)	-7.34(2)*	-2.41(3)	-7.69(2)*
f	-1.67(2)	-7.10(1)*	-1.75(3)	-5.61(2)*
t	-1.19(2)	-4.40(1)*	-2.17(2)	-5.11(1)*
f1	-2.14(2)	-7.07(1)*	-2.36(4)	-7.38(2)*
a	-2.57(3)	-6.75(1)*	-2.79(4)	-7.44(3)*
nw	-1.79(3)	-5.82(1)*	-2.11(3)	-6.25(2)*
nw1	-1.48(3)	-4.91(2)*	-1.69(2)	-5.19(1)*

KPSS tests

	Levels-with trend				First differences-without trend			
Variables / Lags:	0	2	4	8	0	2	4	8
c	1.54	1.11	0.98	0.74	0.19#	0.17#	0.14#	0.19#
s	1.45	1.09	0.79	0.52	0.18#	0.13#	0.14#	0.08#
y	1.37	1.11	0.86	0.59	0.15#	0.07#	0.05#	0.09#
f	1.62	1.38	1.11	0.62	0.19#	0.12#	0.04#	0.02#
t	1.95	1.52	1.29	1.18	0.17#	0.11#	0.01#	0.04#
f1	1.49	1.31	1.13	0.92	0.18#	0.10#	0.02#	0.06#
a	1.69	1.20	0.93	0.79	0.20#	0.09#	0.01#	0.02#
nw	1.24	1.15	0.93	0.77	0.21#	0.15#	0.09#	0.14#
nw1	1.21	1.13	1.02	0.82	0.18#	0.14#	0.11#	0.12#

Note: The figures in parentheses denote the number of lags in the tests that ensure white noise residuals. They were estimated through the Akaike criterion.

* significant at the 1% level; # accepts the null hypothesis of stationarity at the 1% level

Table 2: Cointegration tests

r	n-r	m.λ.	95%	Tr	95%
Stock Market Assets (s):					
(Lags=2)					
r=0	r=1	40.4430	15.8700	42.3491	20.1800
r<=1	r=2	8.6122	10.5700	8.9431	9.1600
r<=2	r=3	1.7627	6.3600	1.7627	6.3600
Financial Assets, excluding stock market assets (f):					
(Lags=2)					
r=0	r=1	34.0556	15.8700	47.9909	20.1800
r<=1	r=2	9.1088	10.5700	9.0022	9.1600
r<=2	r=3	2.8255	6.3600	2.8255	6.3600
Tangible Assets, excluding non-profit organizations (t):					
(Lags=2)					
r=0	r=1	21.4090	15.8700	35.3988	20.1800
r<=1	r=2	9.7389	10.5700	8.9898	9.1600
r<=2	r=3	3.2509	6.3600	3.2509	6.3600
Financial Assets, including stock market assets (f1):					
(Lags=3)					
r=0	r=1	76.2910	15.8700	96.8633	20.1800
r<=1	r=2	10.2240	10.5700	9.0031	9.1600
r<=2	r=3	4.6483	6.3600	4.6483	6.3600
Total Assets, excluding non-profit organizations (a):					
(Lags=3)					
r=0	r=1	69.4979	15.8700	90.3863	20.1800
r<=1	r=2	8.2603	10.5700	8.8883	9.1600
r<=2	r=3	2.6280	6.3600	2.6280	6.3600
Net Wealth, excluding non-profit organizations (nw):					
(Lags=?)					
r=0	r=1	83.5841	17.6800	95.2298	24.0500
r<=1	r=2	7.3095	11.0300	9.0992	12.3600
r<=2	r=3	0.8821	4.1600	0.8821	4.1600
Net Wealth, including non-profit organizations (nw1):					
(Lags=?)					
r=0	r=1	117.1172	17.6800	123.2819 2	24.0500
r<=1	r=2	4.4561	11.0300	6.1647	12.3600
r<=2	r=3	1.7086	4.1600	1.7086	4.1600

Note: r = number of cointegrating vectors, n-r = number of common trends, m.λ.= Maximum eigenvalue statistic, Tr = Trace statistic.

Table 3: Variance Decompositions for Consumption, Income, and Wealth

	Consumption		Income		S	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.92	0.08	0.97	0.03	0.68	0.32
4	0.90	0.10	0.96	0.04	0.65	0.35
8	0.87	0.13	0.94	0.06	0.61	0.39
12	0.85	0.15	0.94	0.06	0.61	0.39
20	0.85	0.15	0.94	0.06	0.61	0.39
	(0.80, 0.97)-	(0.06, 0.19)	(0.89, 0.99)-	(0.02, 0.09)	(0.57, 0.71)-	(0.29, 0.43)

	Consumption		Income		F	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.87	0.13	0.84	0.16	0.37	0.63
4	0.88	0.12	0.88	0.12	0.39	0.61
8	0.90	0.10	0.89	0.11	0.41	0.59
12	0.91	0.09	0.89	0.11	0.41	0.59
20	0.91	0.09	0.89	0.11	0.41	0.59
	(0.82, 0.95)-	(0.05, 0.17)	(0.81, 0.94)-	(0.07, 0.20)	(0.31, 0.47)-	(0.53, 0.67)

	Consumption		Income		T	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.90	0.10	0.86	0.14	0.33	0.67
4	0.92	0.08	0.89	0.11	0.37	0.63
8	0.93	0.07	0.90	0.10	0.40	0.60
12	0.94	0.06	0.90	0.10	0.41	0.59
20	0.94	0.06	0.90	0.10	0.41	0.59
	(0.86, 0.98)-	(0.04, 0.14)	(0.85, 0.95)-	(0.08, 0.19)	(0.29, 0.46)-	(0.54, 0.70)

	Consumption		Income		F1	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.94	0.06	0.93	0.07	0.71	0.29
4	0.95	0.05	0.95	0.05	0.75	0.25
8	0.97	0.03	0.96	0.04	0.76	0.24
12	0.97	0.05	0.96	0.04	0.77	0.23
20	0.97	0.05	0.96	0.04	0.77	0.23
	(0.91, 0.99)-	(0.03, 0.09)	(0.90, 0.99)-	(0.02, 0.10)	(0.67, 0.80)-	(0.20, 0.34)

Table 3: Variance Decompositions for Consumption, Income, and Wealth (continued)

	Consumption		Income		A	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.75	0.25	0.82	0.18	0.41	0.59
4	0.78	0.22	0.86	0.14	0.45	0.55
8	0.81	0.19	0.89	0.11	0.47	0.53
12	0.82	0.18	0.90	0.10	0.48	0.52
20	0.82	0.18	0.90	0.10	0.49	0.51
	(0.71, 0.86)-(0.14, 0.29)		(0.79, 0.94)-(0.06, 0.23)		(0.37, 0.54)-(0.47, 0.62)	

	Consumption		Income		NW	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.89	0.11	0.88	0.12	0.59	0.41
4	0.85	0.15	0.84	0.16	0.58	0.42
8	0.84	0.16	0.83	0.17	0.56	0.44
12	0.84	0.16	0.81	0.19	0.55	0.45
20	0.84	0.16	0.81	0.19	0.55	0.45
	(0.80, 0.92)-(0.07, 0.19)		(0.78, 0.92)-(0.09, 0.22)		(0.52, 0.63)-(0.38, 0.48)	

	Consumption		Income		NW1	
Forecasting horizon	**P**	**T**	**P**	**T**	**P**	**T**
1	0.94	0.06	0.94	0.06	0.34	0.66
4	0.92	0.08	0.93	0.07	0.30	0.70
8	0.92	0.08	0.93	0.07	0.29	0.71
12	0.87	0.13	0.90	0.10	0.28	0.72
20	0.85	0.15	0.87	0.13	0.28	0.72
	(0.81, 0.96)-(0.04, 0.18)		(0.84, 0.98)-(0.03, 0.16)		(0.24, 0.39)-(0.60, 0.76)	

Notes: P stands for the permanent shock, while T stands for the transitory shock. Figures in parentheses show bootstrapped 95-percent confidence interval for the 20 quarters forecasting horizon case.

Table 4: Variance Decompositions for Consumption, Income, and Wealth (unorthogonalized)

	Consumption			Income			S		
Forecasting horizon	P	T	P,T	P	T	P,T	P	T	P,T
1	0.79	0.15	0.06	0.91	0.05	0.04	0.63	0.48	-0.11
4	0.72	0.11	0.17	0.86	0.04	0.10	0.60	0.46	-0.06
8	0.69	0.08	0.23	0.82	0.04	0.14	0.57	0.39	0.04
12	0.68	0.07	0.25	0.80	0.03	0.17	0.54	0.37	0.09
20	0.68	0.07	0.25	0.80	0.03	0.17	0.54	0.36	0.10

	Consumption			Income			F		
Forecasting horizon	P	T	P,T	P	T	P,T	P	T	P,T
1	0.67	0.18	0.15	0.80	0.11	0.09	0.41	0.68	-0.09
4	0.62	0.14	0.24	0.75	0.08	0.17	0.36	0.64	0.00
8	0.58	0.10	0.32	0.71	0.06	0.23	0.31	0.60	0.09
12	0.56	0.06	0.38	0.67	0.06	0.27	0.27	0.57	0.16
20	0.55	0.06	0.39	0.66	0.05	0.29	0.25	0.56	0.19

	Consumption			Income			T		
Forecasting horizon	P	T	P,T	P	T	P,T	P	T	P,T
1	0.86	0.17	–0.03	0.78	0.11	0.11	0.42	0.72	-0.09
4	0.82	0.14	0.04	0.74	0.10	0.16	0.36	0.70	-0.06
8	0.76	0.11	0.13	0.70	0.09	0.21	0.34	0.66	0.00
12	0.71	0.07	0.22	0.63	0.07	0.30	0.31	0.61	0.08
20	0.71	0.06	0.23	0.62	0.07	0.31	0.30	0.61	0.09

	Consumption			Income			F1		
Forecasting horizon	P	T	P,T	P	T	P,T	P	T	P,T
1	0.90	0.17	-0.07	0.90	0.27	-0.17	0.79	0.33	-0.12
4	0.86	0.12	0.02	0.87	0.25	-0.12	0.77	0.30	-0.07
8	0.82	0.10	0.08	0.86	0.20	-0.06	0.71	0.25	0.04
12	0.79	0.06	0.15	0.83	0.18	-0.01	0.64	0.22	0.14
20	0.79	0.06	0.15	0.82	0.18	0.00	0.62	0.21	0.17

Table 4: Variance Decompositions for Consumption, Income, and Wealth (unorthogonalized) (continued)

	Consumption			Income			A		
Forecasting horizon	**P**	**T**	**P,T**	**P**	**T**	**P,T**	**P**	**T**	**P,T**
1	0.68	0.39	-0.07	0.79	0.24	-0.03	0.35	0.64	0.01
4	0.63	0.36	0.01	0.76	0.21	0.03	0.31	0.60	0.09
8	0.61	0.30	0.09	0.72	0.17	0.11	0.27	0.55	0.18
12	0.57	0.27	0.16	0.70	0.14	0.16	0.24	0.52	0.24
20	0.56	0.27	0.17	0.70	0.14	0.16	0.23	0.50	0.27

	Consumption			Income			NW		
Forecasting horizon	**P**	**T**	**P,T**	**P**	**T**	**P,T**	**P**	**T**	**P,T**
1	0.83	0.13	0.04	0.83	0.08	0.09	0.52	0.46	0.02
4	0.80	0.18	0.02	0.80	0.10	0.10	0.47	0.49	0.04
8	0.75	0.19	0.06	0.73	0.14	0.13	0.41	0.53	0.06
12	0.74	0.21	0.05	0.71	0.15	0.14	0.38	0.55	0.07
20	0.71	0.21	0.08	0.69	0.15	0.16	0.38	0.56	0.06

	Consumption			Income			NW1		
Forecasting horizon	**P**	**T**	**P,T**	**P**	**T**	**P,T**	**P**	**T**	**P,T**
1	0.85	0.14	0.01	0.89	0.10	0.01	0.29	0.75	-0.04
4	0.82	0.18	0.00	0.85	0.13	0.02	0.25	0.79	-0.04
8	0.78	0.21	0.01	0.81	0.17	0.02	0.19	0.81	0.00
12	0.71	0.24	0.05	0.79	0.20	0.01	0.17	0.81	0.02
20	0.70	0.25	0.05	0.79	0.23	-0.02	0.16	0.81	0.03

Notes: P stands for the permanent shock, T stands for the transitory shock, and P, T stands for the two times the covariance between the permanent shock and the transitory shock.

Table 5: Correlation of Growth Rates of Measured and Permanent Component

Variable	Correlation
Δc	0.885
Δy	0.837
Δs	0.796
Δf	0.241
Δt	0.277
$\Delta f1$	0.855
Δa	0.324
Δnw	0.814
$\Delta nw1$[a]	0.192

a. Lettau and Ludvigson's measure of wealth.

Appendix: Vector Error-Correction Regressions

Stock Market Assets (s):

$$\Delta c_t = -\ 0.039\ EC_{t-1} + 0.197\ \Delta c_{t-1} + 0.046\ \Delta s_{t-1} + 0.072\ \Delta y_{t-1}$$

t-statistics: (-4.52)* (3.17)* (3.48)* (4.11)*

$\text{R-BAR}^2 = 0.19$ LM = 5.09[0.21] RESET = 0.0593[0.94] ARCH(8) = 12.91[0.07]

$$\Delta s_t = 0.158\ EC_{t-1} + 0.251\ \Delta c_{t-1} + 0.638\ \Delta s_{t-1} + 0.135\ \Delta y_{t-1}$$

t-statistics: (3.51)* (3.20)* (6.58)* (4.11)*

$\text{R-BAR}^2 = 0.26$ LM = 5.76[0.32] RESET = 0.0673[0.93] ARCH(8) = 4.26[0.84]

$$\Delta y_t = 0.046\ EC_{t-1} + 0.460\ \Delta c_{t-1} + 0.039\ \Delta s_{t-1} + 0.136\ \Delta y_{t-1}$$

t-statistics: (3.57)* (4.14)* (4.03)* (3.61)*

$\text{R-BAR}^2 = 0.23$ LM = 7.48[0.14] RESET = 2.39[0.29] ARCH(8) = 3.13[0.73]

Financial Assets, excluding stock market assets (f):

$$\Delta c_t = -\ 0.041\ EC_{t-1} + 0.372\ \Delta c_{t-1} + 0.017\ \Delta f_{t-1} + 0.064\ \Delta y_{t-1}$$

t-statistics: (-4.48)* (3.87)* (6.91)* (4.89)*

$\text{R-BAR}^2 = 0.24$ LM = 2.99[0.56] RESET = 1.27[0.26] ARCH(8) = 3.09[0.93]

$$\Delta f_t = 0.044\ EC_{t-1} + 0.276\ \Delta c_{t-1} + 0.529\ \Delta f_{t-1} + 0.211\ \Delta y_{t-1}$$

t-statistics: (3.28)* (5.99)* (3.53)* (4.31)*

$\text{R-BAR}^2 = 0.26$ LM = 5.76[0.32] RESET = 0.0673[0.93] ARCH(8) = 4.26[0.84]

$$\Delta y_t = 0.024\ EC_{t-1} + 0.539\ \Delta c_{t-1} + 0.036\ \Delta f_{t-1} + 0.455\ \Delta y_{t-1}$$

t-statistics: (5.23)* (6.51)* (6.87)* (4.19)*

$\text{R-BAR}^2 = 0.17$ LM = 0.25[0.99] RESET = 0.28[0.59] ARCH(8) = 3.36[0.62]

Tangible Assets, excluding non-profit organizations (t):

$$\Delta c_t = -\ 0.022\ EC_{t-1} + 0.452\ \Delta c_{t-1} + 0.029\ \Delta t_{t-1} + 0.084\ \Delta y_{t-1}$$

t-statistics: (-4.23)* (4.77)* (3.65)* (3.72)*

$\text{R-BAR}^2 = 0.15$ LM = 8.18[0.11] RESET = 2.93[0.10] ARCH(8) = 3.01[0.93]

$$\Delta t_t = 0.032\ EC_{t-1} + 0.364\ \Delta c_{t-1} + 0.529\ \Delta t_{t-1} + 0.145\ \Delta y_{t-1}$$

t-statistics: (3.89)* (4.91)* (5.78)* (3.09)*

$\text{R-BAR}^2 = 0.42$ LM = 5.28[0.37] RESET = 0.0644[0.91] ARCH(8) = 10.84[0.21]

$$\Delta y_t = 0.076\ EC_{t-1} + 0.382\ \Delta c_{t-1} + 0.049\ \Delta t_{t-1} + 0.534\ \Delta y_{t-1}$$

t-statistics: (3.72)* (3.55)* (4.17)* (4.22)*

$\text{R-BAR}^2 = 0.37$ LM = 6.44[0.17] RESET = 2.18[0.37] ARCH(8) = 1.34[0.98]

Financial Assets, including stock market assets (f1):

$$\Delta c_t = -\,0.025\,EC_{t-1} + 0.462\,\Delta c_{t-1} + 0.324\,\Delta c_{t-2} + 0.024\,\Delta f1_{t-1} + 0.016\,\Delta f1_{t-2}$$
t-statistics: (-3.21)* (3.72)* (3.94)* (3.15)* (4.11)*
$$+\,0.056\,\Delta y_{t-1} + 0.041\,\Delta y_{t-2}$$
(3.56)* (4.26)*

$\text{R-BAR}^2 = 0.12$ LM = 2.94[0.47] RESET = 1.81[0.63] ARCH(8) = 1.22[0.97]

$$\Delta f1_t = 0.039\,EC_{t-1} + 0.304\,\Delta c_{t-1} + 0.125\,\Delta c_{t-2} + 0.784\,\Delta f1_{t-1} + 0.121\,\Delta f1_{t-2}$$
t-statistics: (3.14)* (4.41)* (3.73)* (4.19)* (3.52)*
$$+\,0.184\,\Delta y_{t-1} + 0.085\,\Delta y_{t-2}$$
(3.58)* (3.22)*

$\text{R-BAR}^2 = 0.28$ LM = 2.81[0.59] RESET = 0.0505[0.82] ARCH(8) = 3.58[0.91]

$$\Delta y_t = 0.078\,EC_{t-1} + 0.282\,\Delta c_{t-1} + 0.103\,\Delta c_{t-2} + 0.067\,\Delta f1_{t-1} + 0.025\,\Delta f1_{t-21}$$
t-statistics: (3.46)* (3.64)* (4.41)* (3.96)* (3.07)*
$$+\,0.451\,\Delta y_{t-1} + 0.238\,\Delta y_{t-2}$$
(3.84)* (3.58)*

$\text{R-BAR}^2 = 0.35$ LM = 5.14[0.29] RESET = 2.41[0.33] ARCH(8) = 1.68[0.96]

Total Assets, excluding non-profit organizations (a):

$$\Delta c_t = -\,0.024\,EC_{t-1} + 0.551\,\Delta c_{t-1} + 0.248\,\Delta c_{t-2} + 0.022\,\Delta a_{t-1} + 0.019\,\Delta a_{t-2}$$
t-statistics: (-3.10)* (3.61)* (3.74)* (4.07)* (3.81)*
$$+\,0.071\,\Delta y_{t-1} + 0.062\,\Delta y_{t-2}$$
(3.47)* (3.29)*

$\text{R-BAR}^2 = 0.09$ LM = 3.15[0.36] RESET = 3.02[0.31] ARCH(8) = 1.22[0.98]

$$\Delta a_t = 0.019\,EC_{t-1} + 0.105\,\Delta c_{t-1} + 0.078\,\Delta c_{t-2} + 0.402\,\Delta a_{t-1} + 0.237\,\Delta a_{t-2}$$
t-statistics: (5.16)* (3.66)* (3.93)* (4.28)* (3.19)*
$$+\,0.116\,\Delta y_{t-1} + 0.074\,\Delta y_{t-2}$$
(3.41)* (3.67)*

$\text{R-BAR}^2 = 0.14$ LM = 5.15[0.27] RESET = 2.31[0.13] ARCH(8) = 3.22[0.93]

$$\Delta y_t = 0.071\,EC_{t-1} + 0.249\,\Delta c_{t-1} + 0.211\,\Delta c_{t-2} + 0.089\,\Delta a_{t-1} + 0.049\,\Delta a_{t-21}$$
t-statistics: (3.47)* (3.59)* (3.75)* (4.88)* (3.72)*
$$+\,0.449\,\Delta y_{t-1} + 0.257\,\Delta y_{t-2}$$
(3.82)* (3.26)*

$\text{R-BAR}^2 = 0.36$ LM = 7.69[0.18] RESET = 2.43[0.31] ARCH(8) = 1.74[0.98]

Net Wealth, excluding non-profit organizations (nw):

$$\Delta c_t = -\ 0.047\ EC_{t-1} + 0.372\ \Delta c_{t-1} + 0.208\ \Delta c_{t-2} + 0.049\ \Delta nw_{t-1} + 0.026\ \Delta nw_{t-2}$$
t-statistics: (-6.18)* (4.52)* (4.71)* (3.93)* (3.97)*
$$+\ 0.119\ \Delta y_{t-1} + 0.086\ \Delta y_{t-2}$$
(4.39)* (4.77)*
$\text{R-BAR}^2 = 0.34$ LM = 1.18[0.64] RESET = 1.21[0.69] ARCH(8) = 1.07[0.97]

$$\Delta nw_t = 0.259\ EC_{t-1} + 0.104\ \Delta c_{t-1} + 0.076\ \Delta c_{t-2} + 0.282\ \Delta nw_{t-1} + 0.141\ \Delta nw_{t-2}$$
t-statistics: (5.38)* (3.94)* (3.79)* (4.48)* (4.92)*
$$-\ 0.107\ \Delta y_{t-1} - 0.055\ \Delta y_{t-2}$$
(-4.19)* (-3.58)*
$\text{R-BAR}^2 = 0.28$ LM = 4.84[0.29] RESET = 0.17[0.72] ARCH(8) = 2.18[0.89]

$$\Delta y_t = 0.024\ EC_{t-1} + 0.628\ \Delta c_{t-1} + 0.139\ \Delta c_{t-2} + 0.079\ \Delta nw_{t-1} + 0.047\ \Delta nw_{t-2}$$
t-statistics: (6.12)* (4.55)* (3.73)* (3.40)* (4.48)*
$$+\ 0.248\ \Delta y_{t-1} + 0.153\ \Delta y_{t-2}$$
(4.72)* (4.51)*
$\text{R-BAR}^2 = 0.32$ LM = 1.58[0.51] RESET = 1.28[0.57] ARCH(8) = 2.11[0.83]

Net Wealth, including non-profit organizations (nw1):

$$\Delta c_t = -\ 0.032\ EC_{t-1} + 0.281\ \Delta c_{t-1} + 0.138\ \Delta c_{t-2} + 0.041\ \Delta nw1_{t-1} + 0.014\ \Delta nw1_{t-2}$$
t-statistics: (-7.89)* (3.64)* (4.54)* (3.44)* (4.15)*
$$+\ 0.059\ \Delta y_{t-1} + 0.037\ \Delta y_{t-2}$$
(5.69)* (5.04)*
$\text{R-BAR}^2 = 0.19$ LM = 1.61[0.58] RESET = 1.37[0.62] ARCH(8) = 1.28[0.91]

$$\Delta nw1_t = 0.356\ EC_{t-1} + 0.066\ \Delta c_{t-1} + 0.048\ \Delta c_{t-2} + 0.112\ \Delta nw1_{t-1} + 0.057\ \Delta nw1_{t-2}$$
t-statistics: (7.55)* (3.72)* (3.15)* (5.93)* (3.56)*
$$-\ 0.036\ \Delta y_{t-1} - 0.019\ \Delta y_{t-2}$$
(-4.71)* (-3.88)*
$\text{R-BAR}^2 = 0.037$ LM = 4.74[0.32] RESET = 0.06[0.80] ARCH(8) = 2.03[0.97]

$$\Delta y_t = 0.011\ EC_{t-1} + 0.531\ \Delta c_{t-1} + 0.127\ \Delta c_{t-2} + 0.082\ \Delta nw1_{t-1} + 0.053\ \Delta nw1_{t-2}$$
t-statistics: (7.44)* (3.61)* (3.51)* (3.38)* (5.46)*
$$+\ 0.129\ \Delta y_{t-1} + 0.052\ \Delta y_{t-2}$$
(5.51)* (4.98)*
$\text{R-BAR}^2 = 0.073$ LM = 1.48[0.54] RESET = 1.38[0.49] ARCH(8) = 1.92[0.94]