

Consumption asymmetry and the stock market: New evidence through a threshold adjustment model

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Abstract

This paper investigates whether stock market wealth affects real consumption asymmetrically through a threshold adjustment model. The empirical findings for the US show that wealth produces an asymmetric effect on real consumption, with negative “news” affecting consumption less than positive “news.” Thus, policy makers may want to focus more attention on preventing asset “bubbles” than on responding to negative asset shocks.

Keywords: Consumption; Stock market; Wealth effect; Asymmetry

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I. Introduction

High equity prices 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). With substitution between wealth and income, unexpected changes in wealth will alter consumption and, thus, aggregate demand. Equities represent an important component of overall wealth. Therefore, sound theoretical reasons suggest that rising stock market wealth could have fuelled high consumption growth in recent years. Such a wealth effect proves consistent with the arguments of the life-cycle consumption model, which argues that a positive association exists between stock market value and current household consumption (Garner, 1990). That association exhibits a small size, since wealth-induced changes in consumption spread over the individual's whole life.

Deaton (1992) and Poterba (2000) argue that a rising stock market could generate higher consumption, while a falling stock market could slow economic activity through lower consumption spending. Equity prices also act as "leading indicators", since they reflect future output growth and, thus, correlate with consumption (Morck *et al.*, 1990; Poterba and Samwick, 1995; Starr-McCluer, 2002). Theory predicts other channels through which an association between equity prices and consumption exist - the expectations effect, the liquidity constraint effect, the stock option value effect, and so on (Romer, 1990). Other research finds a negative wealth effect, since rising inflation as well as personal savings decline (Shirvani and Wilbratte, 2002).

Estimates of the wealth effect prove mixed and sensitive to the choice of the observation

period (Ludvigson and Steindel, 1999). Hall (1978) shows that stock market wealth plays a substantial role in affecting private spending. Temin (1976), after establishing the importance of the wealth effect, demonstrates that it played a crucial role in the Great Depression. Poterba and Samwick (1995) argue theoretically that changes in stock market wealth cause changes in consumption by giving stockholders more flexibility in their consumption choice. They find, however, weak empirical evidence in favour of the wealth effect in the US. Parker (1999), Poterba (2000), and Starr-McCluer (2002) also do not find strong empirical evidence in favour of the wealth effect¹. The primary effect proves short-lived and materializes over 1 to 3 years. Finally, Lettau and Ludvigson (2004) find that only a small fraction of household's wealth relates to aggregate consumption spending, where the absence of such a wealth effect reflects the transitory nature of a significant portion of the wealth effect.

Shulman *et al.* (1995), in contrast, claim that consumption now responds more sensitively to stock market wealth changes than ever before. Campbell (2000), Kiley (2000), Davis and Palumbo (2001), and Dynan and Maki (2001) provide more support for the stock-market-causes-consumption-spending result in the US. Poterba (2000) finds a 5 percent propensity to consume out of stock market wealth in the US. Edison and Sløk (2002) also find a wealth effect, especially in the 1990s when stock ownership increased dramatically (from 40% of the population in 1992 to 52% in 1998) and mainly among the new-economy stocks. Furthermore, Horioka (1996) finds strong evidence, albeit lower than that in the U.S, in favour of the wealth effect in Japan, an economy where asset prices, after experiencing a sharp increase during the 1980s, fell significantly in the 1990s, signalling the protracted downturn in the Japanese

¹ Starr-McCluer (2002) argues that a dollar increase in stock-market wealth raises consumer spending by three to seven cents per year.

economy. Boone *et al.* (1998) also provide support for stock market wealth effect in Canada, Germany, Japan, the Netherlands, and the UK.

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 behaviour, 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 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 behaviour. Finally, Stevens (2004) also produces evidence in favour 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 channelled 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. Stevens (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.

This study investigates whether ratchet effects exist between stock market wealth and real consumption in the US. The paper contributes to the existing literature in the following way: it provides new evidence by using an established novel econometric technique on threshold levels to identify asymmetry in stock market wealth. The rest of the paper is organized as follows: Section 2 presents and discusses the empirical results and Section 3 concludes.

II. 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. Total wealth (S) is measured as the sum of 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) over the period 1957 to 2002. Data for consumption and disposable income come from the US Census Bureau, while those for measuring the stock wealth come from the Board of Governors Flow of Funds series (Table B.100 and items 23, 24, 25, 26, 27, 28, and 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). The ADF tests are reported with and without a trend, while the KPSS tests applied 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 the variables of real consumption per capita, real income per capita, and real wealth per capita at the 1 percent level in both types of tests. Using first differences, we reject unit-root nonstationarity for all variables under study.

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 labour 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 use current income as a proxy for the human wealth. In addition, the share of equities in the composition of household total wealth is relatively small, while the presence of equity investment accounts, such as IRAs and 401(k) plans, renders limited accessibility to consumption. Nevertheless, Garner (1990) and Ghoshdary (2003) argue that although household wealth includes money, government bonds, real estate and tangible assets, in addition to equities, stock market fluctuations prove the primary cause of variation in total household's wealth due to the excessive volatility of stock prices².

² Using a broader measure of wealth, Lettau and Ludvigson (2001) find that the majority of movements in wealth

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 consumption, current income, and stock market wealth as this arises through a conventional budget constraint (Cambell and Mankiw, 1989; Lettau and Ludvigson, 2001; Ludvigson and Steindel, 2002):

$$c_t = a_0 + a_1 y_t + a_2 s_t + v_t, \quad (1)$$

where c equals real consumption spending per capita, y equals real income per capita, s equals wealth per capita, and v is a random term. Since the regression is linear in logarithms, the coefficient of stock market wealth (a_2) measures the elasticity of consumption with respect to stock market wealth as follows (Boone *et al.* 1998):

$$a_2 = (\Delta C_t / \Delta S_t) \times (S_{t-1} / C_{t-1}) = mpc \times (S_{t-1} / C_{t-1}) \text{ or}$$

$$mpc = a_2 / (S_{t-1} / C_{t-1}), \quad (2)$$

where the mpc equals the marginal propensity to consume out of stock market wealth and (S/C) equals the ratio of stock market capitalization to private consumption spending. For the US, this ratio equals 2.25.

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. The tests for cointegration results are reported in Table 2.

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 stock market wealth

represent transitory (cyclical) movements, which do not correlate with consumption. Most movements in consumption reflect trend (permanent) changes.

(capitalization) per capita. The methodology of dynamic least-squares (DOLS), proposed by Stock and Watson (1993), yields the following cointegration equation. The methodology estimates the long-run parameters using a linear model with leads and lags. Maddala and Kim (1998) argue that this provides the best estimate of a long-run regression, since the Johansen estimator exhibits 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:

$$c = 0.74 y + 0.12 s$$

χ^2 -statistics: 6.72[0.0] 8.41[0.0] R-BAR² = 0.57

From the cointegrating vectors, stock prices clearly exert a positive and statistically significant effect on consumption. In particular, the elasticity of total consumption with respect to stock wealth and income equals 0.12 and 0.74, respectively. From equation (2), the marginal propensity to consume (with respect to total consumption) out of wealth equals 0.053 (0.12/2.25). In other words, a one-dollar increase in the value of the stock portfolio will increase consumption by 5.3 cents in the long run. The stock market wealth elasticity falls within the estimates conventionally reported in the literature.

A Vector Error Correction Model (VECM)

We next estimate a VECM and use the results to back out permanent and transitory components of the variables under investigation. The results for consumption, income, and wealth yield:

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

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

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

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

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

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

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

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

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

The coefficient of the error-correction (EC) term in the consumption equation exhibits a statistically significant negative value. The coefficients of the error-correction terms in the wealth and income equations exhibit statistically significant positive values. Moreover, the signs of the coefficients of the error-correction terms suggest dynamic stability, where the variables move to correct any error. In the consumption equation, the EC term significantly correlates with next period's wealth, which implies that consumption growth shows predictability over long horizons. Finally, diagnostics 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.

Our VECM findings differ in several significant ways from those reported in Lettau and Ludvigson (2004). To wit, the coefficients of all variables in our VECM prove significant at the 1-percent level whereas only 5 of 16 coefficients prove significant in their analysis.³ The difference in findings exhibits the starkest contrast for the wealth (stock market value) equation. Lettau and Ludvigson only find the coefficient of the error-correction term significant; we find significant effects for all variables. Thus, the choice of the wealth measure probably affects the findings. We employ a narrow measure of wealth – the value of stock held by the household sector. They employ a broad measure – the net worth of the household sector. We suggest that several components of net wealth, such as real estate and durable consumer goods, do not affect consumption, since they indirectly generate their own flow of consumption services. Remember

³ All signs match, except for the coefficient of lagged income in the income equation. We report a significantly positive coefficient; they report an insignificant negative coefficient.

that the measure of consumption excludes consumption of consumer durables or the service flowing from the existing stock of consumer durables.

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

In this section, we measure the correlation between consumption and wealth after we decompose them into permanent and transitory components. Following the methodology of Lettau and Ludvigson (2004), we obtain the permanent-transitory decomposition of the three variables under study. With three variables and a single cointegrating vector, we assume two permanent shocks and one transitory shock exist. We also use the previously estimated VECM to obtain variance decompositions that determine the fraction of total variance in the forecast error of Δc , Δs , 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 are statistically different from zero. Table 3 reports the decomposition results. They show that the variation of growth for all three variables mainly reflects permanent shocks. These findings imply that the variability of consumption, driven by permanent shocks, closely associates with the variability in wealth, driven also by permanent shocks. In other words, our results support the hypothesis that consumption adapts to permanent innovations in stock market wealth.

Our results run counter to those reached by Lettau and Ludvigson (2004), where most movement in (broader) wealth reflected transitory shocks. The starkest difference occurs when they restrict the coefficients of the error-correction terms in the consumption and income equations to equal zero. Including all error-correction term coefficients in the analysis increases the percentage of the movement in wealth attributable to its permanent component, but it still fell below 50 percent. We find that the permanent component explains a little over 60 percent of the movements in wealth, which proves significantly higher than 50 percent. As noted above, this

probably reflects the different definitions of wealth used. More specifically, we employ only stock market wealth in our measure of wealth whereas Lettau and Ludvigson (2001) also include tangibles (real estate, consumer durables, and so on), deposits, and credit market instruments netted against liabilities.

Having calculated the permanent series for consumption, income, and stock market wealth, we also calculate the simple cointegration regression using these permanent values. We report those DOLS results as follows:

$$c = 0.93 y + 0.16 s$$

$$x^2\text{-statistics: } 6.49[0.0] \quad 8.39[0.0] \quad R\text{-BAR}^2 = 0.63$$

The coefficient estimates nearly match those in the regression using the observed values.

Tests for an Asymmetric Wealth Effect

Given the association between consumption, income, and wealth, we next proceed to investigate whether this association 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.

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

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

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

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

where τ is the threshold value. We test the null hypothesis of symmetric adjustment ($\rho_1 = \rho_2$)

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. Consistent estimates of the M-TAR model yield the following results:

Total Consumption ($\gamma=2$)

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

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

$F_{\rho_1=\rho_2} = 10.61$ [p-value=0.00] and t-statistics are in parentheses. An asterisk indicates significance at the 1-percent level. The empirical findings indicate that both ρ s are negative, indicating convergence. In addition, we reject the null hypothesis of symmetric adjustment at the 1-percent level. Moreover, the value of the F statistic validates the cointegration results (i.e., we strongly reject the null hypothesis of no cointegration at the 1-percent level). In other words, consumption cointegrates with stock wealth with an asymmetric adjustment mechanism. The estimates indicate that the speed of adjustment exhibits a more rapid response for positive than for negative discrepancies. In other words, consumers respond more strongly to favourable news than to unfavourable news. The results differ from those reached by Kahneman *et al.* (1991) and Shea (1995), who conclude that strong loss aversion exists.

III. Conclusions, Policy Implications, and Suggestions for Future Research

This paper considers the effects of stock market wealth on the macroeconomy. Economic theory (i.e., the life-cycle model of consumption) argues that wealth effects consumption, albeit with a much smaller marginal propensity than for income. Empirical evidence also supports a significant, but small, wealth effect in the consumption function. The existence of this wealth effect on the consumption function raises two policy issues. First, negative stock-market shocks (e.g., October 1987 and the collapse of Long-Term Capital) by lowering consumption demand

may trigger a recession. Expansionary monetary and fiscal policy may provide an offset to such negative shocks. Second, the experience of other countries with “asset bubbles” (e.g., Japan) implies that policy makers may want to focus on inflation in asset values in addition to inflation in goods and services. That is, “pricking the bubble” early in its development by policy makers may forestall future macroeconomic problems that could develop if a much larger “bubble” collapsed from its own weight. Of course, policy makers face the difficult issue of identifying bubble activity from fundamental activity in the stock or other asset markets, no easy task.

Our findings suggest a ratchet effect of stock market wealth on consumption. That is, increases in stock market wealth generates a larger increase in consumption than the decline in consumption from a similar reduction in stock market wealth. These results may imply that policy makers should more quickly respond to rising stock market wealth to head off inflationary pressures. Less policy attention needs to focus on declines in stock market wealth.

Finally, future research will investigate the difference between our and Lettau and Ludvigson’s (2004) findings on the trend (permanent) component of wealth. That is, we will see if expanding our measure of wealth from only stock market wealth to include tangibles, deposits, and credit market instruments alters our original findings and reproduces Lettau and Ludvigson’s results.

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Table 1. Unit root tests

ADF tests									
Variable	without trend				with trend				
	Levels	First differences			Levels	First differences			
c	-1.37(4)	-6.04(3)*			-1.32(3)	-7.05(2)*			
s	-2.18(3)	-7.34(2)*			-2.41(3)	-7.69(2)*			
y	-1.97(3)	-5.64(2)*			-2.12(3)	-5.86(2)*			

KPSS tests									
Variables	Lags:	Levels-with trend				First differences-without trend			
		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#

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%
(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

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

Forecasting horizon	Consumption		Income		Wealth	
	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)	

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.