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**Consumption Asymmetry and the Stock Market: Empirical Evidence**

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## **Abstract**

This paper examines whether U.S. stock-market wealth asymmetrically affects consumption. After identifying asymmetric behavior for consumption and stock market wealth, the results confirm that stock-market wealth asymmetrically affects real per capita consumption. Negative 'news' affects consumption more than positive 'news'.

**Journal of Economic Literature Classification:** E21, E44

**Keywords:** Consumption; Stock market; Wealth effect; Asymmetry

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# Consumption Asymmetry and the Stock Market: Empirical Evidence

## I. Introduction

Higher equity prices may increase consumption expenditure and, thus, aggregate demand, where consumption depends on the present value of lifetime income (Mehra, 2001). Since equities represent an important component of overall wealth, increases in stock market wealth can fuel consumption growth. Researchers propose several alternative theoretical channels through which stock price adjustments can affect consumption.<sup>1</sup> The life-cycle model incorporates a direct linkage between wealth and consumption. Romer (1990) argues that investor uncertainty from stock price decreases reduces expenditure on consumer durables. Poterba and Samwick (1995) propose a leading indicator effect, whereby stock price changes forecast future movements in income.<sup>2</sup> Ludwig and Sløk (2002) separate the wealth effect into realized and unrealized components and then offer two additional channels of influence – liquidity-constrained and stock-option-value effects. Shirvani and Wilbratte (2002) concentrate on a negative wealth effect from rising inflation as well as falling personal saving. While the literature proposes various channels of influence, we do not attempt to identify these channels but only consider whether stock price changes affect consumption asymmetrically.

Hall (1978) shows that the stock prices significantly affect private spending. Although Poterba and Samwick (1995) argue that the wealth effect provides a crucial link between the stock market and consumption, they find weak evidence with U.S. data (see also Parker, 1999;

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<sup>1</sup> Groenewold (2003) provides a summary of the various theoretical channels of influence.

<sup>2</sup> Starr-McCluer (2002) also considers this leading-indicator channel linking equity prices to consumption. Starr-McCluer (2002) also considers this leading-indicator channel linking equity prices to consumption. Comparing the wealth and leading indicator effects, Groenewold (2003) concludes "... the wealth effect is alive and robust but that the signaling effect is fragile. These findings are consistent with Starr-McCluer (2002) ... but conflict with ... Poterba and Samwick (1995).

Poterba, 2000; Starr-McCluer, 2002). Boon *et al.* (1998) provide evidence that stock market wealth affects consumption in Canada, Germany, Japan, the Netherlands, and the U.K.

Several researchers consider whether consumption responds asymmetrically to shocks. At the conceptual level, Carroll and Kimball (1996) demonstrate that income uncertainty combined with the hyperbolic absolute risk aversion class of utility functions produces a concave consumption function. In that context, Shea (1995) and Shirvani and Wilbratte (2000) also show that consumption exhibits asymmetric behavior, reflecting loss aversion; individuals suffer more from reduced consumption (i.e., diminishing marginal utility of wealth or risk aversion). Patterson (1993) finds that consumption responds asymmetrically to wealth shocks primarily due to imperfect capital markets (i.e., liquidity constraints). Kuo and Chung (2002) show that business cycles generate asymmetric consumption patterns, concluding that liquidity constrained consumers closely link to business cycle movements. In sum, risk-averse or liquidity-constrained consumers suggest asymmetric responses of consumption to changes in stock-market value. That is, decreases in stock-market value affect consumption more than increases in stock-market value of the same magnitude.

This paper investigates ratchet effects between the U.S. stock market value and consumption. The paper considers whether a stock-market wealth effect exists, using the cointegration, error-correction methodology, and explores whether stock market value exhibits asymmetric effects on consumption.

## **II. Empirical Results**

### *Data*

We use quarterly data from 1957 to 2002 on personal consumption (C), after-tax nominal labor income (Y), domestic prices measured by the consumer price index, and stock market

capitalization (S).<sup>3</sup> We employ capitalization data, since this variable provides a more reliable proxy for stock market wealth due to better measurement of household wealth. We measure consumption, income, and stock market value in real per capita terms. The total (midyear) population data come from the United Nations (2000). Finally, lower case letters indicate the natural logarithm of real per capita variables, insuring that estimates measure elasticities of real per capita consumption with respect to real per capita income and stock market value.

*Preliminary Tests for Consumption Asymmetries*

To test for asymmetry in U.S. consumption, we employ the methodology introduced by Sichel (1993), and described more fully by Speight and McMillan (1998). In particular, we first construct the following skewness measures:

$$D(x) = [(1/T) \sum_t (x_t - \bar{x})^3] / \sigma(x)^3 \text{ and } ST(\Delta x) = [(1/T) \sum_t (\Delta x_t - \overline{\Delta x})^3] / \sigma(\Delta x)^3$$

where  $x$  equals a detrended variable,  $T$  equals the number of observations, a bar indicates the mean, and  $\sigma(x)$  equals the standard deviation of  $x$ . Sichel (1993) calls the former expression “deepness” and the latter “steepness.”<sup>4</sup> We detrended real per capita consumption, using the Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1981).

Sichel (1993) and Speight and McMillan (1998) define the following variables:

$$z_t = (x_t - \bar{x})^3 / \sigma(x)^3 \text{ and } \Delta z_t = (\Delta x_t - \overline{\Delta x})^3 / \sigma(\Delta x)^3 .$$

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<sup>3</sup> A. Vamvakidis, of the International Monetary Fund, provided all data.

<sup>4</sup> Deepness and steepness refer to the negative skewness of the distribution of  $x$  and  $\Delta x$ , respectively. Deepness means that the movement of  $x$  below its trend exhibits a larger value, on average, than its rise above trend. Steepness means that the decline in  $x$  from its peak occurs more quickly than the recovery of  $x$  from its trough. Speight and McMillan (1998) define positive skewness in  $x$  as “tallness,” meaning that the rise of  $x$  above its trend exceeds, on average, its fall below trend, and positive skewness in  $\Delta x$  as “expansionary steepness.” Thus, the “steepness” definition in Sichel (1993) becomes “contractionary steepness” in Speight and McMillan (1998).

Regressing  $z$  and  $\Delta z$  on a constant allows the computation of the Newey-West (1987) asymptotic standard errors that correspond to the deepness and steepness measures. The empirical results indicate that real per capita consumption exhibits tallness at the 5-percent level and contractionary steepness at the 10-percent level, respectively.<sup>5</sup> In sum, movements in real per capita consumption around its trend exhibit asymmetric patterns. Real per capita consumption rises higher above, than it falls below, its trend (tallness) and decreases more quickly from its peak than it rises from its trough (contractionary steepness).

### *Integration Analysis*

We first test the data for nonstationarity by using the unit-root tests proposed by Dickey and Fuller (1981). Table 1 shows that we cannot reject the hypothesis of a unit root for the natural logarithms of real per capita consumption, real per capita income, and real per capita stock market value at the 1-percent level. Using first differences, we can reject the hypothesis of a unit-root for all variables.

### *Cointegration Analysis: Identifying the Wealth Effect*

Before considering asymmetric wealth effects on consumption, we examine the wealth effect through the cointegration, error-correction methodology of Johansen and Juselius (1990). We identify a 3-lag model, using Perron and Vogelsang (1992), that produces the results in Table 2.

Both the eigenvalue and trace test statistics indicate that a single long-run relationship exists among the natural logarithms of real per capita consumption, real per capita after-tax income, and real per capita stock market value. The following cointegration equation emerges:

$$c = 0.0867 + 0.604 y + 0.0375 s$$

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<sup>5</sup> The deepness and steepness values as well as their asymptotic, heteroskedasticity and autocorrelation consistent standard errors in parentheses, and associated p-values in brackets equal 0.58 (0.23) [0.04] and -0.37 (-0.14) [0.08], respectively.

$$\begin{array}{ccc} (6.48) & (5.82) & (4.39) \\ [0.0] & [0.0] & [0.0] \end{array}$$

$$\bar{R}^2 = 0.91; LM = 3.84[0.11]; NO = 2.44[0.16].$$

where the numbers in parentheses and brackets denote t- and p-statistics.

The cointegrating vector shows that a positive, statistically significant wealth effect exists. The long-run elasticity of real per capita consumption with respect to real per capita stock market value equals 0.0375, while that with respect to real per capita after-tax income equals 0.604. The estimated model satisfies certain diagnostic criteria, including the absence of serial correlation (LM) and the presence of normality (NO).

#### *Is the Wealth Effect Asymmetric?*

To consider an asymmetric response of consumption to changes in stock market value, we adopt a modified error-correction (EC) model:

$$\Delta c = a_0 + \sum_i^{q_1} b_{1i} \Delta c(-i) + \sum_j^{q_2} b_{2j} \Delta y(-j) + \sum_k^{q_3} [b_{3k} \Delta s^+(-k) - b_{4k} \Delta s^-(-k)] + b_5 EC(-1) + v$$

where  $\Delta s(-k)^+$  and  $\Delta s(-k)^-$  equal positive and negative movements in stock market value,  $EC$  equals the error correction term, and  $v$  equals the random error term.<sup>6</sup> A 2-lag error-correction model emerges after implementing the Perron and Vogelsang (1992) methodology.

The estimation yields:

$$\Delta c = 0.268 \Delta c(-1) + 0.091 \Delta c(-2) + 0.0236 \Delta s^+(-1) + 0.0147 \Delta s^+(-2) - 0.0285 \Delta s^-(-1)$$

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<sup>6</sup> Consumption adjusts differently to increases and decreases in stock market value, but not to increases or decreases in consumption or after-tax income. Consumption also does not respond differently to positive or negative error-correction terms. Future research will explore a threshold cointegration and error-correction modelling strategy, where more channels for asymmetric responses exist. See, for example, Hansen and Seo (2002) for threshold cointegration modelling. The positive and negative changes in stock market value both exhibit I(0) behavior.

$$\begin{array}{ccccc}
(4.57) & (3.71) & (3.64) & (4.11) & (-4.48)^* \\
[0.0] & [0.0] & [0.0] & [0.0] & [0.0] \\
-0.0269 \Delta s(-2) + 0.586 \Delta y(-1) + 0.374 \Delta y(-2) - 0.0782 EC(-1) & & & & \\
(-4.71) & (3.97) & (3.81) & (-4.55) & \\
[0.0] & [0.0] & [0.0] & [0.0] & 
\end{array}$$

$$\bar{R}^2 = 0.76; LM = 1.23[0.22]; RESET = 1.69[0.34]; NO = 2.61[0.14]; HE = 1.93[0.35].$$

Tests (t-tests)

$$\begin{array}{ll}
b_{31}+b_{32}=0.0383, & (3.74); [0.00] \\
b_{41}+b_{42}=0.0554, & (3.93); [0.00]
\end{array}$$

Tests {F-tests}

$$\begin{array}{ll}
b_{31}+b_{32}=0 & \{5.47\}; [0.00] \\
b_{41}+b_{42}=0 & \{18.92\}; [0.00] \\
b_{31}=b_{32}=0 & \{9.22\}; [0.00] \\
b_{41}=b_{42}=0 & \{12.34\}; [0.00] \\
b_{31}+b_{32}=b_{41}+b_{42} & \{11.71\}; [0.00]
\end{array}$$

where numbers in parentheses; braces, and brackets are t-, F-, and p-statistics. The regression satisfies all diagnostics, including the absence of serial correlation (LM), the absence of model misspecification, the presence of normality (NO), and the absence of heteroskedasticity (HE).

The sum of coefficients of positive and negative changes in stock-market value prove positive and statistically significant based on t-tests. The F-tests investigate five hypotheses about the effects of positive and negative returns. The first two F-tests examine whether the sum of the coefficients of the positive or negative stock returns equal zero, which reject the null hypotheses. The next two F-tests examine whether the coefficients of the positive or negative returns jointly equal zero, which reject the null hypotheses. Finally, the last F-test determines whether the coefficients of the positive and negative changes in stock market values affect real per capita consumption symmetrically, which strongly rejects the symmetry hypothesis. Thus, the sum of the coefficients of negative change in stock market value significantly exceeds the sum of the coefficients on the positive change in stock market value, implying that agents do respond more strongly to adverse stock market value news, than to positive news (i.e., loss



aversion).

What quantitative implications emerge from our findings? Consider a 10-percent increase or decrease in stock-market wealth. The cointegration results imply that in the long run, both changes will lead to a 0.375-percent increase or decrease, respectively. The short-run effects differ, however. Assuming only a change in stock-market wealth and the implied adjustments in the error-correction term, but holding income constant, the error-correction equation traces out different paths for the 10-percent increase and decrease in stock-market wealth. Given the stock-market shocks in the 1<sup>st</sup> quarter, the short-run cumulative effects on consumption peak in the 5<sup>th</sup> quarter at 0.59-percent increase and 0.80-percent decrease in consumption, respectively. Then the changes in consumption reverse path and move toward the long-run changes of 0.375-percent increase and decrease. Figures 1 and 2 show impulse response functions for the changes in consumption to 10 percent positive and negative changes in stock market value. The dotted lines depict approximate 95-percent confidence intervals, computed with 500 bootstrap replications.

### **III. Conclusions**

This paper considers whether changes in real per capita U.S. stock market value asymmetrically affects real per capita consumption. After identifying asymmetric consumption behavior as well as a wealth effect due to the stock market, the empirical analysis examines whether this wealth effect exhibits an asymmetric effect on consumption. The empirical results confirm that stock market value asymmetrically affects real per capita consumption during the short-run adjustment process, where bad news exhibits a stronger effect than good news. For equal good- and bad-news shocks, the peak effects show bad news 50-percent higher than good news.

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**Table 1: Unit-Root Tests**

	Without Trend		With Trend	
	Levels	Differences	Levels	Differences
<b>c</b>	1.37(4)	-6.04(3)*	-1.32(3)	-7.05(2)*
<b>s</b>	-2.18(3)	-7.34(2)*	-2.41(3)	-7.69(2)*
<b>y</b>	-1.97(3)	-5.64(2)*	-2.12(3)	-5.86(2)*
$\Delta s^+$	-4.93(3)*		-5.32(2)*	
$\Delta s^-$	-4.51(3)*		-4.78(2)*	

**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-percent level

**Table 2: Cointegration Tests**

<b>r</b>	<b>(n - r)</b>	<b>m.λ.</b>	<b>95%</b>	<b>Tr</b>	<b>95%</b>
<b>r = 0</b>	<b>r = 1</b>	40.44	15.87	42.35	20.18
<b>r ≤ 1</b>	<b>r = 2</b>	8.61	10.57	8.94	9.16
<b>r ≤ 2</b>	<b>r = 3</b>	1.76	6.36	1.76	6.36

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

Figure 1. Consumption responses to positive wealth shocks and confidence bands

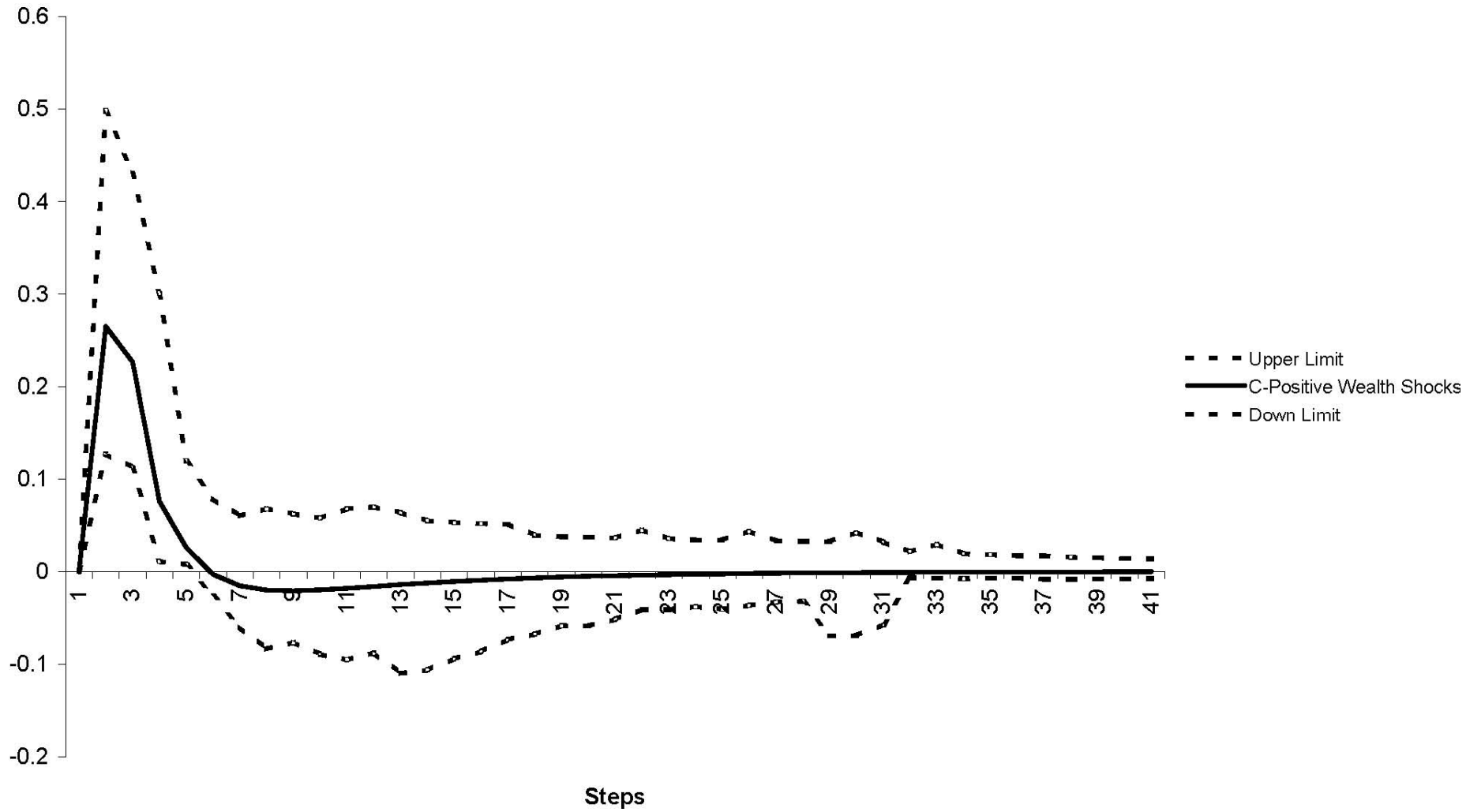


Figure 2. Consumption responses to negative wealth shocks and confidence bands

