The Impact of Stock Prices on Consumption Growth Through the Confidence Channel: A Cointegration Analysis for the United States.

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ABSTRACT

This paper provides an empirical analysis of the effect of stock prices on consumer expenditure through the confidence channel in the United States. Changes in stock prices may affect consumption in two ways: the wealth effect and the confidence effect. The wealth effect implies that an increase in stock prices directly raises aggregate consumption. The confidence effect refers to a boost in consumer confidence caused by increases in stock prices. This is an indirect channel, in which changes in stock prices may increase consumption for both stockholders and non-stockholders. Four categories of real consumption are examined in this paper: total consumption, consumption of durable goods, consumption of non-durable goods, and consumption of services. This paper employs the cointegration and error-correction methods to evaluate both long-run and short-run dynamic adjustments of aggregate consumption and its determinants. The consumer sentiment index is included in the consumption function along with stock prices to quantify the confidence channel. The results indicate that there is a statistically significant effect of stock prices, through the confidence effect, on non-durable goods.

1. INTRODUCTION

Over the past few decades, the impacts of the stock market on household consumption have been well studied in the United States. Changes in stock prices are believed to affect consumption through the wealth effect and the confidence effect. There are, however, few empirical studies focusing on quantifying the confidence effect of stock prices on consumption. Poterba et al. (1995) proposed a leading indicator effect, in which stock price changes could forecast changes in consumption. Romer (1990) identified the confidence effect of stock market collapse that created uncertainty about future income, which in turn reduced expenditure on durable goods. However, the indirect confidence channel to consumer spending has not been explicitly examined in the literature. The purpose of this paper is to quantify the confidence effect generated by the changes in stock prices on total consumption and its subcategories.

The cointegration and error correction models are applied in this analysis to investigate the long-run and short-run dynamic adjustment of consumption. The fluctuations of consumption are evaluated through the wealth effect and the confidence effect. To analyze the wealth effect of stock prices, this paper therefore begins with a simple consumption model relating real consumer expenditure to stock prices and disposable income. The coefficient of stock prices is the estimated marginal propensity to consume out of stock price wealth. Next, the consumption model includes the expected sentiment index and disposable income to estimate the effect of consumer confidence on consumption. The index is believed to contain additional information about consumers' perceptions of economic conditions. The estimated coefficient of the index may explain the effect of changes in consumer confidence on consumption. Lastly, a joint equation includes

both stock prices and the sentiment index in an attempt to isolate the confidence effect of stock prices on consumption. The inclusion of the sentiment index is expected to reduce the coefficient of stock prices. The information contained in the index may amplify the uncertainty of economic conditions and further reduce consumption.

The wealth effect of the stock market on consumer spending for the United States has been empirically studied by many authors (Romer, 1990, Poterba et al., 1995; Ludvigson and Steindel, 1999; Ludwig and Slok, 2002; Groenewold, 2005). The wealth effect implies that an increase in stock prices directly raises aggregate consumption. For instance, Ludwig and Slok (2002) and Groenewold (2005) used the cointegration and error correction models to estimate the wealth effect of stock prices on consumption. Ludvigson and Steindel (1999) used total net worth to evaluate the long-run and short-run wealth effects. This paper uses the S&P500 index to quantify the wealth effect on total consumption and its subcategories, in both long-run and short-run dynamic adjustments.

Several empirical studies tried to explore the question of why consumer sentiment predicts household spending (Carroll et al., 1994; Mehra and Martin, 2003; Kwan and Cotsomitis, 2006). They generally found that the consumer sentiment index could be a useful leading indicator of consumption. Forecasting analysis techniques were applied to estimate the consumer confidence effect on consumption. This paper, however, employs the cointegration and error-correction models to evaluate the effect of consumer confidence on consumption, using the expected consumer sentiment index that captures the perceptions of the economic conditions.

The indirect confidence channel of stock prices is based on the idea that stock prices are the leading indicator of economic activity. Hence, increases in stock market prices may

reflect higher than expected current wealth, boosting consumer sentiment directly. Several authors have explored links between stock prices and consumer confidence in both the United States and Canada (Gulley and Sultan, 1998; Jansen and Nahuis, 2003; Karnizova and Khan, 2010). The purpose of this study is to evaluate how this relation of stock prices and consumer confidence can explain the fluctuations of aggregate consumption and its subcategories in the United States.

The remainder of this paper is divided into five sections: literature review, data, econometric methodology, empirical results/discussion, and conclusion. The literature review focuses on the relationships between stock prices and consumption, consumer confidence and consumption, and stock prices and consumer confidence. The econometric methodology fully details four specifications of the consumption equation. The empirical discussion closely examines both the long-run and short-run dynamic adjustments of the categories of consumption.

2. LITERATURE REVIEW

This section details the empirical studies on the relations of stock prices, consumer confidence, and consumption. The first subsection summarizes the studies focused on the effects of stock market wealth on consumption. The second subsection provides a summary of the empirical studies that explore the predictive content of the confidence index on changes in consumer spending. The third subsection focuses on how stock prices may help explain the changes in consumer confidence. The last subsection highlights the novelty/contribution of the current paper relative to the existing literature. This study attempts to extend the existing literature by evaluating how the simultaneous interaction of

both stock prices and consumer confidence may help explain the confidence channel of stock prices.

2.1 Stock Market and Consumption

The traditional impact of the stock market on consumption through the wealth effect (direct effect) has been a main focus of many studies (Porterba et al., 1995; Starr-McCluer, 2002; Ludwig and Slok, 2002; Black et al, 2002; Groenewold, 2005). The wealth channel gives a possible explanation for the positive empirical correlations between stock prices and consumption. Changes in the value of stock prices can cause changes in consumption by increasing household income. The traditional wealth channel is a simple reflection of the permanent income hypothesis. There are several empirical and theoretical concerns that have been raised in the literature regarding the stock prices effect: (i) a distinction between anticipated and unanticipated changes in stock market wealth and (ii) possible asymmetric effects.

(i) A Distinction Between Anticipated and Unanticipated Changes in Stock Market Wealth

An increase in consumer spending following a rise in stock prices may be explained by two factors. First, changes in stock prices may increase consumers' anticipation of strong economic conditions. This is considered to be the leading indicator role of stock prices. A second factor links stock prices and consumption – the wealth effect of stock prices. The wealth effect implies that an increase in stock prices directly raises aggregate consumption.

The leading indicator property of stock prices suggests that when consumers considered the available information regarding the economic conditions, they might alter

their behaviour before the price changes actually occurred. The subsequent effect of the leading indicator on consumption may provide evidence of the confidence channel of stock prices. The key implication of the confidence effect of stock prices refers to a boost in consumer confidence caused by increases in stock prices. Many authors have identified and proposed the idea of the confidence effect of stock prices (Romer, 1990; Poterba et al., 1995; Ludwig and Slok, 2002; Starr-McCluer, 2002).

The fluctuations in stock prices may signal expectations of future economic activity, which may influence consumer confidence and actual consumption spending – even of households that do not own stock. Romer (1990) identified the consumer confidence channel in her empirical analysis of the stock market collapse in 1929. This extreme movement of stock prices might have generated temporary uncertainty about future income, which in turn led to cut backs in consumption.

Poterba et al. (1995) empirically distinguished between the wealth effect and the leading indicator (expectation channel) of stock prices, using both aggregate and panel data. Their results indicated that there was a strong positive relation between the consumption of durable goods and lagged stock market returns. This effect of lagged stock wealth implied that changes in current consumption depended on the expectation of positive stock returns. Alternatively, they found little evidence to support the wealth effect on consumption.

Following the suggestions of Poterba et al., Starr-McCluer (2002) and Groenewold (2005) also attempted to distinguish between the two effects of stock market wealth. Starr-McCluer used cross-sectional survey data to evaluate how stock market wealth influences decisions about spending or saving. The saving rate was expected to increase when consumers expected uncertainty about the stream of future income. Compared to Poterba et

al., she found some evidence to support the wealth effect of stock prices on consumption of luxury goods but there was no statistical significant effect of the leading indicator (or consumer confidence effect). The results also indicated that increases in wealth might be expected to boost consumer spending and lower the saving rate.

Groenewold applied a new technique to differentiate the two effects of changes in stock prices on consumption. Changes in stock prices are driven by fundamentals and speculation (non-fundamentals). Since these two components of stock prices are not observable, they were estimated by a model. The fundamental component depended on future output and discount rates, implying that this component was relevant for the signalling channel. Groenewold's findings were inconsistent with Poterba et al., in which the signalling effect (leading indicator) was not strong enough to support the changes in consumption.

Ludwig and Slok (2002) differentiated the wealth effect into realized and unrealized. When the values of assets went up but the increase might not be realized, consumers might increase consumption today in the expectation that income and wealth would be higher in the future – the confidence effect. The realized (direct) wealth effect, on the other hand, would have a direct effect on consumption as a consequence of higher asset values. For the bank-based economies, their results suggested that the role of the stock market as a leading indicator was statistically significant but very small. The direct effect of stock market wealth had a greater impact on household spending and dominated the indirect wealth effect.

(ii) Possible Asymmetric Effects

Since changes in asset prices represent an important component of overall wealth, increases in stock market wealth can boost consumption growth. The possible existence of asymmetric effects of stock prices is due to either loss aversion behaviour or an imperfect capital market. Shirvani and Wilbratte (2000) investigated whether consumption responded more strongly to stock price declines than to stock price increases. Their analysis compared the empirical positive and negative effect of stock prices on consumer expenditure for several major countries - Canada, Japan, and United States. Their findings confirmed that the changes of stock prices asymmetrically affected consumption only during the short-run dynamic adjustment for all three countries. Apergis and Miller (2006) also explored the asymmetric effect of stock market capitalization. Their results also confirmed that the asymmetric wealth effects of stock prices were short-run phenomena.

To estimate the marginal propensity to consume (MPC) out of stock wealth, stock returns can be measured by either stock prices or consumer net worth (consumer wealth). Ludvigson and Steindel (1999) used total net worth to evaluate the long-run and short-run dynamic adjustment of stock market wealth on consumption. Although there were distinct roles of stock market wealth and non-stock market wealth, they noted that the fluctuations of total net worth were mainly driven by changes in stock market wealth. Davis and Palumbo (2001) differentiated the effect of stock market wealth from that of non-stock market wealth on the growth of consumption, especially changes in net worth generated by the stock-market boom in the United States in the latter 1990s. Lettau and Ludvigson (2004) examined the influence of total wealth, including tradeable human capital, on the

fluctuation of aggregate consumption. Their results indicated that variation in household net worth only explained a small fraction of variation in aggregate consumer spending.

By contrast, Poterba et al. (1995), Shirvani and Wilbratte (2000), Starr-McCluer (2002), Ludwig and Slok (2002), and Groenewold (2005) used stock prices to measure the wealth channel on consumer expenditures. Choudry (2003), however, used stock market volatility, which was estimated by the mean of the univariate GARCH model, to investigate the long-run relationship between consumer expenditure and its determinants. Stock market volatility was found to have a statistically significant effect on consumer expenditure. It should be noted that the magnitude of the MPC out of stock wealth depended on the chosen sample periods.

To evaluate the long-run and short-run dynamic influences of stock prices on consumption, studies have applied the cointegration and error-correction models (VECM). Ludwig and Slok (2002) employed a VECM to analyze the relationships between stock prices, house prices and consumption for 16 OECD countries. The countries were classified into those with bank-based financial systems and those with market-based financial systems. The market-based financial system is governed by a larger size of stock market. Ludwig and Slok proposed that the structure of the financial system might play an important role of the effect of changes in assets prices to changes in consumption. Groenewold (2005) applied both the VECM and the *impulse response function* (IRFs) to distinguish the effects of changes in stock prices on consumption. Shirvani and Wilbratte (2000) and Apergis and Miller (2006) employed the VECM to investigate the asymmetric effects of stock market fluctuations on consumption.

Alternative econometric methods have also been applied to forecast the fluctuations of the stock market on consumption through both the wealth effect and the confidence effect. Poterba et al. (1995) and Starr-McCluer (2002) used aggregate and cross-sectional data in the first-order autoregression model to evaluate the short-run influence of stock prices on durable goods spending. Romer's (1990) forecasting analysis of consumption included lagged consumption, stock market variability, and changes in real stock prices to evaluate the consumer confidence channel of stock prices.

2.2 Stock Prices and the Consumer Confidence Index

The rational behind the relationship between stock prices and consumer confidence is that an increase in stock prices serves as an indicator of future economic activity and potential income growth. Hence, increases in the stock market prices may reflect an unexpected increase in the current wealth, boosting consumer sentiment directly. Several empirical studies turned the focus on the relationship between stock market and consumer behaviours (Gulley and Sultan, 1998; Jansen and Nahuis, 2003; Bremmer, 2008; Karnizova and Khan, 2010).

Gulley and Sultan evaluated the short-run effects of changes in consumer confidence on stock volatility, bonds and foreign exchange prices. Consumer confidence was found to influence only stock volatility, as reflected by the Dow Jones Industrial Average. Jansen and Nahuis explored the contemporaneous relationship between consumer confidence and the stock market in 11 European countries. This correlation was found to be positive for nine out of eleven countries. Expectations about economy-wide conditions

were the driving forces behind the positive correlation between stock market prices and consumer confidence.

Following the work of Jansen and Nahuis, Bremmer focused on both the short-run and long-run relationships between nine stock indices and consumer sentiment. Their findings indicated that stock indices influenced the change in consumer sentiment, but not the other way around in the short-run. However, there was no long-run relationship between stock indices and consumer sentiment.

In Canada, Karnizova and Khan (2010) distinguished between the two effects of stock prices and explored the existence of the indirect confidence effect of stock prices. They rejected the hypothesis that stock prices influenced consumer expenditure only through the wealth effect. Changes in stock prices had a statistically significant effect on the consumer confidence measures.

2.3. The Consumer Confidence Index and Consumption

There is a growing interest in the impact of the consumer confidence on consumption. A body of literature has been dedicated to exploring the confidence effect by analyzing the correlation between a consumer confidence or sentiment index and consumer expenditure (Carroll et al., 1994; Mehra and Martin, 2003; Ludvigson, 2004; Easaw et al, 2005; Kwan and Cotsomitis, 2006). The literature typically finds that the consumer sentiment index is a useful leading indicator of consumer expenditure. However, there is no commonly accepted explanation of through which economic channel consumer confidence influences consumption. Furthermore, the results on the effects of consumer confidence on consumption often depend on the measure of consumer confidence used.

Carroll et al. (1994) provided two possible interpretations of the ability of the consumer sentiment index to predict consumer expenditure. The first interpretation was that the index was an independent determinant of the consumption equation, in which changes in consumer attitudes caused fluctuations in the economy. The second interpretation was that the index might help to forecast the overall performance of the economy. That is to say, when consumers had a positive outlook for the economy, the confidence effect led to increases in household spending. Their findings suggested that improved consumer confidence could stimulate short-run consumption growth and supported the first interpretation.

Mehra and Martin (2003) argued that consumer sentiment could influence consumption growth through two channels – direct and indirect. The indirect effect of consumer sentiment implied that it could be used to foreshadow current economic conditions. When they controlled for the current income, the real rate, and other lagged variables, the sentiment index appeared to have no direct effect on household spending.

Results on the effects of consumer confidence on consumption often depend on the measure of consumer confidence used. The measures of consumer attitudes vary across survey questions and components of the index. Ludvigson (2004) used both the University of Michigan's Consumer Sentiment Index and the Conference Board's Consumer Confidence index to compare their predictive power on five categories of consumer expenditures. His results confirmed that the lagged values of both indices explained approximately 15% of variation in total consumption expenditure growth. The expectation component of each index provided different time-horizons, implying the consumers' perceptions of the economic conditions in the next twelve months or five years. This

forward-looking nature of the index exhibited even more predictive power on variation of consumption growth.

Several empirical studies (Côté and Johnson, 1998; Kwan and Cotsomitis, 2006) investigated the effectiveness of the Conference Board's Consumer Confidence index and its components as leading indicators of consumer spending in Canada. Côté and Johnson investigated how confidence complements other economic indicators in the consumption equation. The inclusion of the index increased both the magnitude and statistical significance of the effect of disposable income. On the other hand, the change in the unemployment rate became insignificant in the presence of the confidence index. Kwan and Cotsomitis (2006) further evaluated the usefulness of consumer confidence index in forecasting consumer expenditures in Canada at both the national and regional levels. For all five categories[1] of consumption, the regional indices had weaker predictive content when compared to the national index.

2.4 The Place of the Current Study in the Existing Literature

The previous research analyzed the relationships between the stock market wealth effect and consumption, consumer confidence and consumption, and stock prices and consumer confidence, as mentioned above. In contrast, this paper aims to quantify the confidence effect of stock prices on total consumption and its subcategories. This indirect effect is a two-step process. First, changes in stock prices affect the consumer confidence

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[1] Kwan and Cotsomitis examined five categories of consumption, including total consumption, consumption of durable goods, consumption of semi-durable goods, consumption of non-durable goods, and consumption of services.

by changing consumers' perceptions of economic conditions. Acting as an independent channel, the consumer confidence channel may influence attitudes and spending decisions. This paper proposes that the quantified confidence channel of stock prices is the difference between the coefficient of stock prices without and with the sentiment index.

The analysis employs cointegration and error-correction models to test the cointegrating relation of stock prices and consumption in the presence of the sentiment index. The first step is to empirically verify the wealth effect of stock prices and the confidence effect of the sentiment index on consumer expenditures individually. Both the aggregate sentiment index and expected sentiment index are used in the consumption equations. The evaluation of the wealth effect of stock prices is similar to the analysis of Groenewold (2005) and Apergis and Miller (2006) for the United States. It should be noted that Apergis and Miller used stock market capitalization as the measure of stock wealth. The estimation of the confidence effect follows the empirical work of Carroll et al. (1994) and Mehra and Martin (2003). Next, both the sentiment index and stock prices are included in the consumption function to identify and quantify the confidence effect of stock prices. Lastly, the consumption function also includes economic indicators in estimating the cointegrating relation of stock prices on consumer expenditures.

3. DATA

This section describes the data. The empirical analysis was based on the quarterly data for the sample period 1960Q1 to 2011Q2 for the United States. More details and the exact data sources for the variables are listed in Appendix B, Table B.1.

Consumption Series

Data series on nominal total consumer expenditure (PCE), nominal durables goods (DG), nominal non-durable goods (NG), and nominal services (SG) were obtained from the Bureau of Economic Analysis (BEA). The corresponding price indices were used to convert all consumption series into real term.[2]

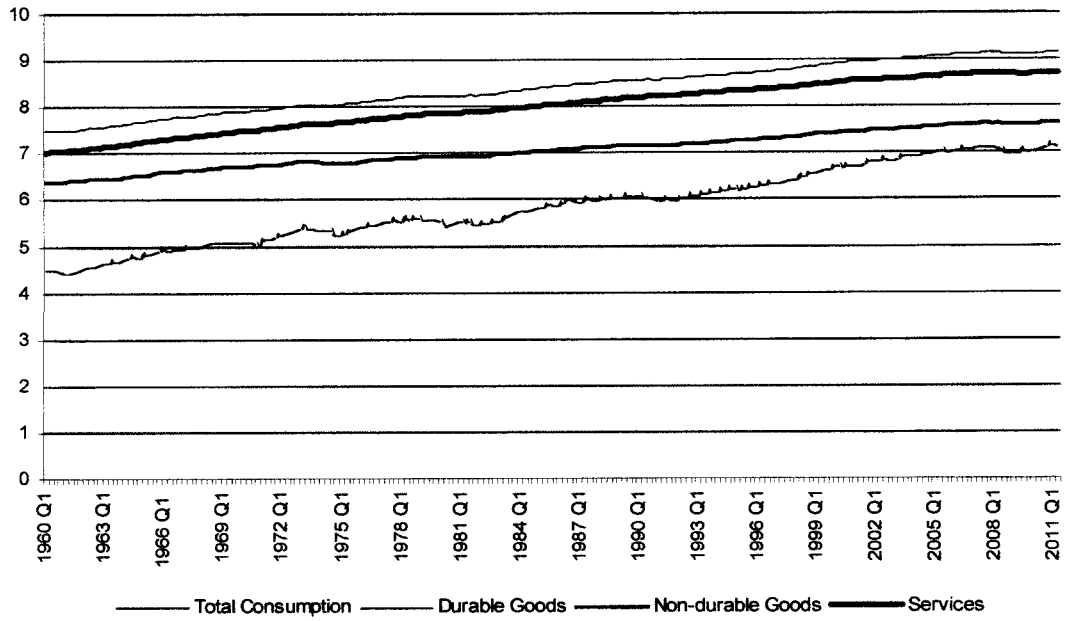

Fig. 1. Natural Logarithms of Quarterly Real Consumer Expenditures
Source: Composition of personal expenditures, Bureau of Economic Analysis.

The total consumer expenditure consisted of 13% durable goods, 29% non-durable goods, and 58% services for this sample period. The percentage share of each category of consumption was calculated for each quarter and then averaged out for the entire sample-period. Figure 1 shows the natural logs of the four consumption series.

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[2] All series were measured in chained-weight 2005 dollars. The formula to convert nominal value to real value is as followed: Real Value = Nominal Value/Price Index (decimal form)

Consumer Sentiment Index

The consumer sentiment index data were obtained from the Surveys of Consumers of the University of Michigan. The aggregate index of consumer sentiment (ICS) is based on the five questions below:

Q1: We are interested in how people are getting along financially these days. Would you say that you (and your family living there) are better off or worse off financially than you were a year ago?

Q2: Now looking ahead--do you think that a year from now you (and your family living there) will be better off financially, or worse off, or just about the same as now?"

Q3: Now turning to business conditions in the country as a whole--do you think that during the next twelve months we'll have good times financially, or bad times, or what?

Q4: Looking ahead, which would you say is more likely--that in the country as a whole we'll have continuous good times during the next five years or so, or that we will have periods of widespread unemployment or depression, or what?"

Q5: About the big things people buy for their homes—such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or bad time for people to buy major household items?

How to compute the ICS?
For each of five questions, one must first compute the relative scores (the % favourable replies minus the % unfavourable replies, plus 100). After each relative score is computed, the ISC is calculated using the formula below.

The ICS is computed by the format below:[3]

$$ICS = \frac{(Q1 + Q2 + Q3 + Q4 + Q5)}{6.7558} + 2.0$$

The denominator is the 1966 base period total, and the addition of 2.0 corrects for survey design changes that occurred in the 1950s.

The survey questions capture both the present situation components and the expectation components. The questionnaire style covers dichotomous questions (yes/no) and semantic

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[3] Following the link below for full explanation of how the consumer sentiment index is computed and set of questionnaire: http://www.sca.isr.umich.edu/documents.php?c=i

differential scale questions with fill-in the blank option. The present situation components of the consumer sentiment index takes a *snapshot* of the current business conditions and labour market condition (see Q1 and Q5). The remaining three questions ask about consumers' expectations. The aggregate of the questions Q2-Q4 is called an expected index, CS^e. Figure 2 illustrates the trend of both the aggregate index and the expectation index.

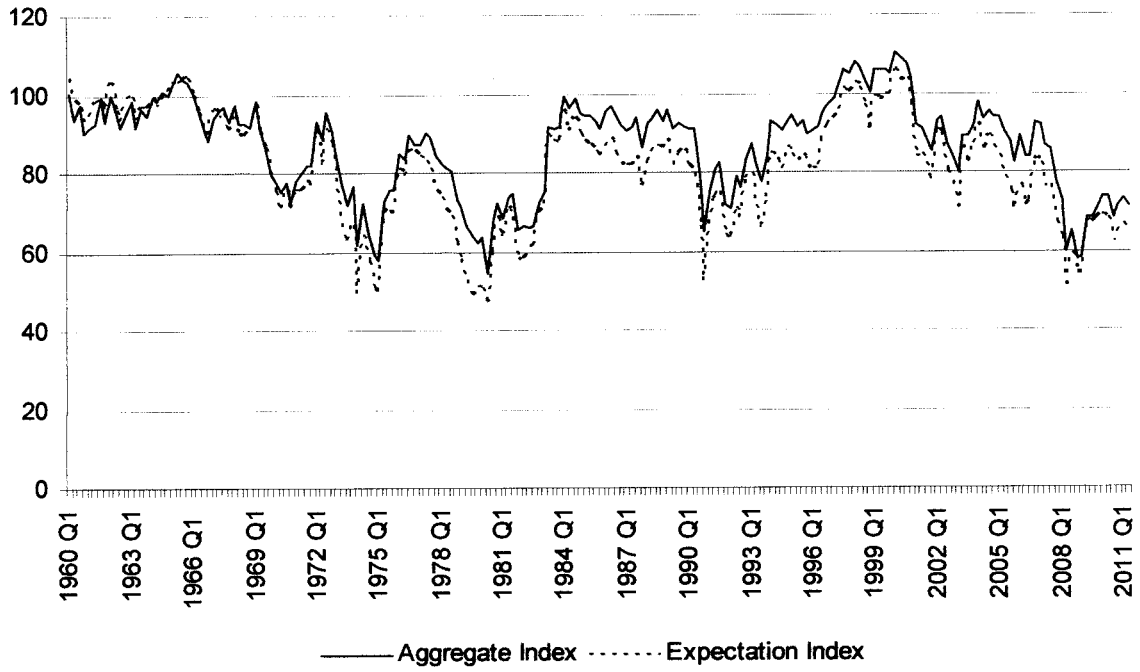

Figure 2: Aggregate Index vs. Expectation Index for 1960Q1-2011Q2.
Michigan Index, 1996Q1=100
Source: University of Michigan Survey Research Center.

Expected (ex-ante) Real Interest Rate

This study used the expected real interest rate to explain the changes in consumption. Figure 3 illustrates the trend of the expected real interest rate. The estimation of the expected real rate was computed as suggested by Dotsey et al.(2003). In their analysis of the real interest rate, they found that the realized (ex-post) and expected (ex-ante) real

interest rates behaved rather differently. For example, the expected real rate was found to be positively correlated with current and lagged GDP. By contrast, the correlation of the ex-ante interest rate with current and lagged GDP was negative.

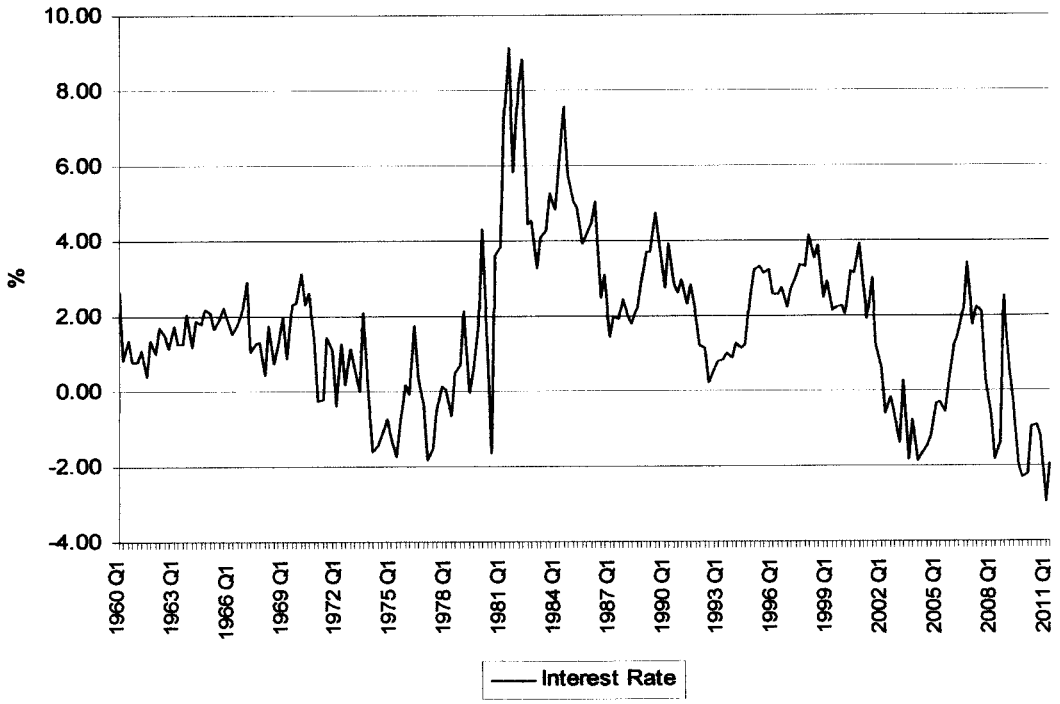

Fig. 3 Expected Real Interest Rate.

The expected real interest rate (r^e) is defined as the nominal three-month Treasure Bill rate less the expected inflation rate for the next period, $r^e_t = R3_t - E_t[\pi_{t+1}]$. The expected inflation rate for next period, $E_t[\pi_{t+1}]$, was estimated using the in-sample VAR forecasting approach. Dotsey et al. found that the computation of the expected inflation rate was more sensitive to the price index, especially when the Consumer Price Index was used, than to the methodology.

This study therefore used the total consumer price index to calculate the inflation rate. Given the price index, P, the inflation rate was computed as $\pi_t = 400\ln(P_{t+1}/P_t)$. The in-sample VAR forecasting regression is expressed as follows:

$$\pi_{t+1} = \nu_0 + \sum_{i=0}^{3}\beta_i\pi_{t-i} + \sum_{i=0}^{3}\xi_i U_{t-i} + \sum_{i=0}^{3}\delta_i R3_{t-i} + \varepsilon_t$$

where the expected inflation rate depends on its lags (π_{t-1}), the unemployment rate (U), and the three-month Treasury Bills rate (R3).

Stock Prices Series, Disposable Income, Unemployment, 3-Month Treasury Bill Rate

The closing prices of the S&P 500, the NASDAQ Composite, and the Russell 2000 and 3000 were extracted from Yahoo Finance. Figure 4 illustrates the natural logarithms of these stock indices.

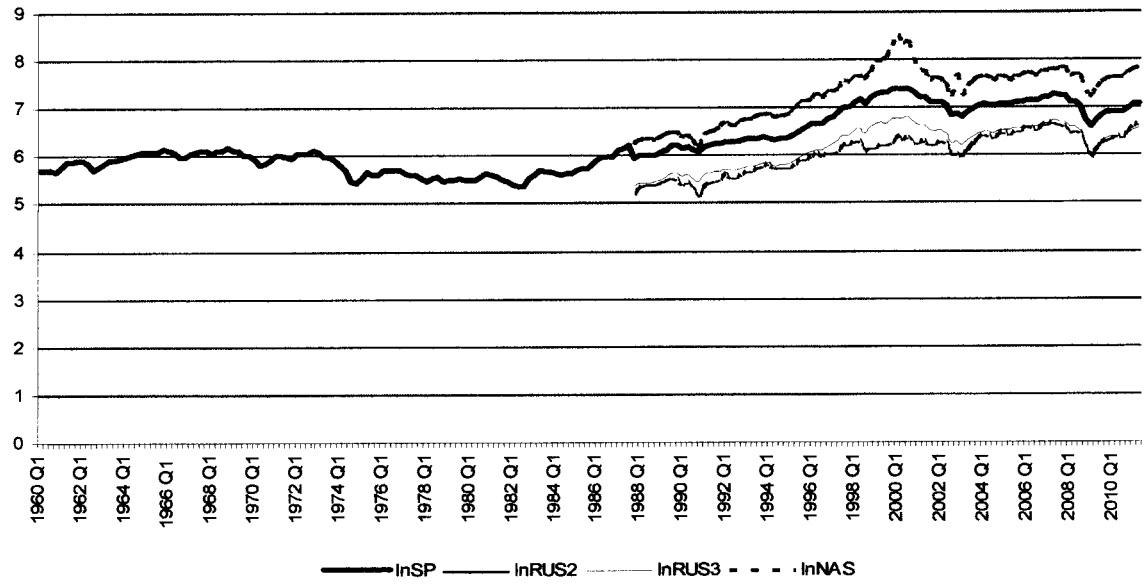

Fig. 4 Natural Logarithms of the S&P 500, the Russel 2000, Russell300, and the NASDAQ Composite indices
Source: Yahoo Finance

The nominal disposable income series was provided by the BEA. The total consumer expenditure (PCE) price index was used to convert the closing stock prices and disposable income into real values, using the same method as for the consumption series. Data on the civilian unemployment rate (U) and 3-month Treasury-Bill Rate (R3) were obtained from the Federal Reserve of St. Louis.

4. ECONOMETRIC METHODOLOGY

The changes in stock prices are believed to influence consumption growth through the wealth effect and the confidence channel. Within the intertemporal consumption framework, increases in the value of stock prices would be perceived as an increase in permanent income. The confidence effect implies that a sharp decrease in stock prices causes uncertainty about future economic condition and alters consumption behaviour of stock holder and non-stock holders (Romer, 1990).

The study employs a cointegration and vector error-correction model (VECM) to examine the influence of stock prices, the sentiment index or both on each category of consumption. The VECM captures both long-run and short-run dynamic adjustments of each variable. The regressions are performed with the one-stage Johansen procedure. A constant term, which captures the trending characteristics of the time series involved, is included in the error correction regression and the first-differenced VAR regression. To examine the influence of stock prices, the sentiment index or both on each categories of consumption, this study estimates four specifications. The specifications are described below.

In all econometric specifications, the following notation is used. The θ_i, ω_i, τ_i, ψ_i, and ϕ_i coefficients capture the short-run dynamic interaction between real consumer expenditure and its explanatory variables. The term $\alpha\beta'C_{t-1}$ contains the cointegrating relations, where α and β are the loading matrix and the cointegration matrix, respectively. The $\beta'C_{t-1}$ term can be replaced by ec_{t-1}.

The disequilibrium adjustment of each variable towards its long-run equilibrium values is captured by the error correction term, ec_{t-1}. The hypothesis of lack of causality from the determinants to real consumption is rejected not only if the coefficients are significant but also the speed-of-adjustment (α) is significant. If α is zero, the change in changes in consumption does not at all respond to the deviation from the long-run equilibrium in. The estimated cointegration relation (ec_t) can be expressed in the following form:

$$\ln C_t = -\lambda_1 \ln SP_t - \lambda_2 \ln Y_t - con$$

where con denotes the constant term and λ coefficients indicate the long-run effect of determinants on consumption.

All variables are expressed in natural logarithms, except for the sentiment index, the real interest rate, and the unemployment rate. The inflation rate variable is not included in the consumption equation because the determinants are expressed in real terms, after having been deflated by the consumer expenditure price index (Côté and Johnson, 1998).

4.1 Consumption Equation: Specification (1)

The baseline specification includes measures of consumption, stock prices, and disposable income in the VECM.

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-1} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \varepsilon_t \quad (1)$$

where: con = a constant term
ε_t = a white-noise disturbance term, iid.
lnC = the natural logarithm of real consumer expenditure, including PCE, DG, NG, and SG
lnSP = the natural logarithm of real S&P500 stock prices
lnY = the natural logarithm of real disposable income
Δ = the first-differenced variables capturing the short-run dynamic adjustment

Equation (1) reflects the traditional stock market wealth effect on consumption, which is a function of permanent labour income and wealth income (Ludvigson and Steindel, 1999; Shirvani and Wilbratte, 2000; Groenewold, 2005; Apergis and Miller, 2006). Changes in consumption should be directly related to changes in stock prices and personal income. Consequently, both θ_i and ω_i are expected to be positive. These coefficients are the marginal propensity to consume (MPC) out of stock wealth and out of permanent income, respectively.

For equation (1), the Akaike Information Criterion (AIC) suggests five lags for lnPCE, three lags for lnDG, one lag for lnNG, and three lags for lnSG. Three lags, therefore, are included in the VECM analysis for the equation (1). To track the changes in both magnitudes and statistical significance of each determinant in the consumption equation when other variable(s) are added into the regression, three lags are included in specifications 1-4.

4.2 Consumption Equation: Specification (2)

The second specification evaluates the explanatory power of consumer sentiment for consumer expenditure.

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t \quad (2)$$

where CS^e = the expected consumer sentiment index

Equation (2) is a restricted version similar to Carroll et al. (1994) and Mehra and Martin (2003). This version includes the consumer sentiment index as an independent determinant of consumer spending. The aggregate index contains information on consumers' assessment of their past and future financial status, expectation of the labour market, and whether it is a good time to make a purchase. Increases in the consumer confidence index reflect the positive outlooks on the economy. The coefficients τ_i are expected to be positive, at least jointly.

4.3 Consumption Equation: Specification (3)

As illustrated in the equations (1) and (2), stock prices and the sentiment index as determinants of consumption can help to investigate the wealth channel and confidence channel individually. The objective of this study, however, is to isolate the wealth effect of stock prices on consumption in equation (1) from the confidence effect. The estimated coefficient of stock prices is expected to capture both the wealth effect and the confidence effect. One possible approach to quantifying the confidence channel of stock prices is to have both stock prices and the sentiment index enter simultaneously. Thus, the equation (3) includes both stock prices and the consumer confidence index:

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i)} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS_{t-i} + \varepsilon_t \quad (3)$$

Given that the sentiment index contains information about the state of the economy, the inclusion of the sentiment index is expected to reduce the coefficient of stock prices. The quantified confidence effect of stock prices is the difference between the coefficient of stock prices in the equations (1) and (3).

4.4 Consumption Equation: Specification (4)

The changes in consumption growth are also influenced by the fluctuations of economic indicators, such as the interest rate and the unemployment rate (Black et al, 2002; Groenewold, 2005; Nastansky and Strohre, 2010). The specification (4) allows for the possibility that consumption is correlated with the lagged values of economic indicators other than consumer sentiment and stock prices:

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \sum_{i=1}^{3} \psi_i \Delta r^e_{t-i} + \sum_{i=1}^{3} \phi_i \Delta U_{t-i} + \varepsilon_t \quad (4)$$

where r^e = the expected real interest rate and U = the civilian unemployment rate

The effect of the real interest rate on consumption is unclear. One possibility is that the real interest rate reflects substitution effects, so that when the interest rate is high households choose to invest rather than to consume. The coefficient of the interest rate on consumption is expected to be negative. An alternative scenario is that an increase in the interest rate can increase consumer expenditure. Consumers want to smooth out their life-time consumption by saving for tomorrow. An increase in the interest rate can lead to higher returns on savings or investments. With the high investment returns, consumers realize that they can save less now and are still able to smooth out their consumption.

Hence, they may choose to increase their current consumption. Previous studies use either the yield spread of interest rates (Côté and Johnson, 1998) or the deflated (realized) real interest rate (Nastansky and Strohre, 2010). This paper, however, uses the expected real interest rate, which serves as a forward looking indicator. The fluctuations in the unemployment rate (U) imply uncertainty in the future stream of income. The effect of the unemployment rate on consumption is expected to be negative.

5. EMPIRICAL RESULTS/DISCUSSION

5.1. *Integration Analysis*

The data series are tested for stationarity.[4] Table 1 reports the results of the integration analysis for the level and first-differenced variables. The augmented Dickey-Fuller (ADF) tests are based on models of the form:

$$\Delta \ln Y_t = \alpha + \sigma Y_{t-1} + \sum_{i=1}^{p-1} \delta_i \Delta \ln Y_{t-i} + \varepsilon_t \qquad (5)$$

An intercept term (α) is included in the individual regression for all series. The number of the lagged dependent variables is chosen to minimize the Akaike Information Criteria (AIC).

In this model the pair of hypotheses is H_0: $\sigma = 0$ versus H_1: $\sigma < 0$. The hypothesis is tested based on the t-statistics of the coefficient σ. Under the null hypothesis all time series exhibit a unit root. One can reject the null hypothesis if the test statistic is more negative than the 5% critical value (-2.86). The results in table 1 imply that the augmented

[4] The spurious regression has a high R^2, t-statistics that appear to be significant, but the results are without any economic meaning. In the presence of unit root, the mean and/or variance of a non-stationary series are time dependent. This means the variance goes to infinity as time approaches infinity.

Dickey-Fuller test rejects a unit root in the aggregate sentiment index (CS) and consumption of services (lnSG), implying that theses series are integrated of order zero, I(0). Hence, the CS and lnSG are not considered in the cointegration analysis. Integration of order of one, I (1), cannot be rejected for lnPCE, lnDG, lnNG, lnSP, lnRUS2, lnRUS3, lnNAS, lnY, CS^e, r^e, and U.

5.2 Cointegration Analysis

Given that the series selected for the study are I(1), Johansen's trace test for cointegration is used to test the null hypothesis of no cointegration or long-run relationship. Two or more non-stationary time series are cointegrated if a linear combination of these is stationary or I(0). The number of lagged differences selected is based on the Akaike Information Criterion.

Table 3 reports the results of the cointegration analysis for specification (1) – consumption, stock prices, and disposable income. The p-values of the trace statistic are in parenthesis. The trace statistic rejects the null hypothesis of no cointegration for all categories of consumption – the trace statistics are greater than the 95% critical values. Therefore, there exists one cointegrating vector for each category of consumption. The same cointegration test is applied to consumption in specifications (2) and (3). The cointegration test results show that there is only one cointegrating vector for each category of consumption in both specifications.

Based on specification (4), the cointegration test results indicate that there are at least three cointegrating vectors (see Table 5). When there are multiple cointegrating vectors, it is not straightforward to interpret the cointegration relations. Also, the estimated

error-correction regressions are expected have multiple speeds of adjustment. Hence, the analysis of both the long-run and short-run of specification (4) will not be pursued in this study.

To verify the cointegration relations for stock prices and consumption, Johansen's trace test is also applied to the bivariate system. As shown in Table 2, the pairwise cointegration tests indicate that there exists a unique long-run relationship for all categories of consumption and stock prices for the studied period of 1960Q1-2011Q2. At the beginning of this study, the analysis came across the disposable income data only for the sample period of 1982Q2-2011Q1. The cointegration test performed at the time confirmed that there was no cointegration relation between total consumption and stock prices (lnPCE, and lnSP).

5.3 Cointegration Relation Results and Estimated Error Correction Results

5.3.1 Diagnostic Tests: Causality and Non-normality

Two types of causality tests - Granger causality and instantaneous causality - are executed in *JMulti* statistical software in a VEC model. The standard tests for zero restrictions on coefficients of the short-run dynamic terms in VEC model may be used in testing the causality (F or χ^2 tests based on the Wald principle).

The joint significant analysis in this study is based only on the *short-run Granger-causality* in the vector error-correction model. Note that the absence of the short-run Granger causality does not rule out a possibility that a variable could still have long run effects through the error correction term. The null hypothesis is the absence of Granger causality. That is, the coefficients on all the variables in equations 1-3, except for lagged

consumption, must be zero to accept the null. By contrast, if some of the coefficients are found to be significant, the null is rejected. Typically, Granger causality is tested for a specific variable. For example, one can test the null hypothesis of Granger causality from the stock prices to consumption. In this case, the null is that all coefficients on the lagged stock prices are equal to zero.

5.3.2 Stock Prices: Wealth Channel

Based on specification (1), the wealth effect of stock prices is analyzed in both the long-run and the short-run. For convenience, the specification is reproduced here:

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \varepsilon_t \qquad (1)$$

Three categories of consumption are evaluated, namely total consumption, consumption of durable goods, and consumption of non-durable goods. The equations L1-L3 below present the cointergration relation results for each category of consumption and its determinants (stock prices and disposable income). Tables 6-8 report the transitory components of the series, capturing the short-run dynamic adjustment of the cointegration variables. The diagnostic tests of causality and non-normality are also reported in tables 6-8.

Long-run dynamic adjustment for specification (1)

To verify the traditional wealth effect of stock market on consumption, the analysis starts with the regression based on the specification (1) for each category of consumption. The S&P 500 index is considered in the consumption regressions. The estimated cointegration

relations for one cointegration vector, $r = 1$, provide the following estimated cointegration relations:

$$\ln PCE_t = \underset{(-3.729)^*}{2.487} + \underset{(-2.092)^*}{0.176}\ln SP_t + \underset{(-5.475)^*}{0.603}\ln Y_t \quad \text{(L1)}$$

$$\ln DG_t = \underset{(6.391)^*}{31.022} - \underset{(1.246)}{0.764}\ln SP_t + \underset{(-5.605)^*}{4.482}\ln Y_t \quad \text{(L2)}$$

$$\ln NG_t = \underset{(-4.975)^*}{6.312} + \underset{(-2.041)^*}{0.331}\ln SP_t - \underset{(0.320)}{0.067}\ln Y_t \quad \text{(L3)}$$

where t-values are in parenthesis and * indicates statistical significance at the 5% level.

As the long-run equations indicate, the coefficient on stock price is significant in two tests; in the case of the durable goods it does not have a significant effect. In the cases of total expenditure and non-durable goods, stock prices have positive and statistically significant effects at the 5% significance level, implying a direct relationship between stock prices and consumption. For the total consumption regression, the estimated coefficient of 0.176 for $\ln SP_t$ in (L1) therefore means a 1% increase in SP_t will increase PCE_t by 0.176%. The estimated coefficient of stock prices is the measure of the marginal propensity to consume out of stock market wealth. The wealth effect of stock prices is relatively one-third of the effect of personal income on total consumption. Stock prices may play a significant role in explaining changes in consumer expenditure. Several other empirical studies also found that stock prices had statistically significant effect on aggregate consumption (Shirvani and Wilbratte, 2000; Ludwig and Slok, 2004; Groenewold, 2005).

From equation (L3), the coefficient of stock prices is approximately 0.331, implying an increase of 0.331% consumption of non-durable goods when stock prices increase by 1%. For this sample period, it is possible that households who have investment assets hold a relatively large portion in stocks. Therefore, changes in stock prices have strong wealth

effects for most households. Stock prices, on the other hand, are statistically insignificant in explaining the growth of consumption of durable goods in the long-run.

To test the robustness of stock prices in explaining changes in consumption, other stock indices have been considered in this study as well. These stock prices include the NASDAQ Composite index, as well as the Russell 2000 and the Russell 3000 indices. The relation between stock prices and different measures of consumption is examined. Table 9 reports the cointegration analysis results for consumptions and the new stock price indices. The coefficients of stock prices in table 9 are statistically significant but the effects on consumption are negative. Only the Russell 2000 stock prices have an expected positive effect as expected on consumption. However, the magnitude of the regression coefficient for this stock index does not make economic sense.

The evaluation of the effects of stock prices on consumption also considers other measures of the inflation rate. The S&P 500 index, for example, is deflated by both consumer price index (CPI) and PCE price index. When the CPI is used to deflate the S&P500 index, the estimated coefficient of stock prices is similar to the estimates with the PCE index. As suggested by some empirical work, the Consumer Price Index tends to over-estimate inflation (Bryan and Cecchette, 1993). The core CPI excludes prices of foods and energy which are essential to households. This study therefore uses the PCE price index as the deflator for stock prices as well as for disposable income.

The coefficient of disposable income is statistically significant and has the expected positive sign only for total consumption and consumption of durable goods. The estimated coefficient of 0.631 for $\ln Y_t$ in (L1) means a 1% increase in Y_t will increase PCE_t by 0.603%. Previous studies have found the coefficient of disposable income to be

approximately between 0.604 and 0.720 (Lugvigson and Steindel, 1990; Shirvani and Wilbratte, 2000; Groenewold, 2005). Although the coefficient of disposable income is statistically significant for durable goods, its positive effect implies that consumers spend approximately four times more than they can earn. The effect of disposable income on the consumption of durables does not make economic sense. Although consumption of non-durable goods accounts for about 29% of total consumption, a change in disposable income is unexpected and has statistically insignificant effect on the consumption of non-durables goods. For this studied period, the changes in the consumption of non-durable goods respond to stock prices rather than to disposable income.

Short-run Dynamic Adjustment for specification (1)

The results for error correction are reported in tables 6-8. The lagged differences of the variables capture the short-run dynamics in the consumption model. The coefficient of ec_{t-1} denotes the speed of adjustment. It is negatively signed and is statistically significant for all consumption, except for the consumption of durable goods.

The results for total consumer expenditures are reported in Table 6. The speed of adjustment (coefficient of the error-term) towards the long-run equilibrium in the regression for the total consumption is approximately 1.2% per quarter. A 1% increase in stock prices in the first lag may result in a 0.023% increase in total consumption. The null hypothesis of disposable income and stock prices do not Granger-cause total consumption is rejected at the 5% level (see column 2).

As for the subcategories of consumption in tables 7 and 8, a 1% increase in stock prices in period (t-1) result in an approximately 0.093% increase in consumption of durable

goods, a higher response relative to non-durable goods (0.027%). A relatively large effect of stock prices on durable goods may due to the positive outlook of the stock market regarding future income.

5.3.3 Consumer Sentiment Index: Confidence Channel

The consumption equation based on specification (2) relates the consumer expenditure to the expected consumer sentiment index and disposable income. For convenience, the specification is reproduced here:

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t \qquad (2)$$

Changes in the expected index may capture the consumer confidence on consumption in the forward looking nature. The analysis examines both the long-run and the short-run dynamic adjustments for three categories of consumption, namely total consumption, consumption of durable goods, and consumption non-durable goods. The long-run dynamic adjustments for all three categories of consumption are presented in equations L4-L6. Tables 10-12 report the transitory components of the series, capturing the short-run dynamic adjustment of the cointegration variables. The test results of causality and non-normality are also reported in tables 10-12.

Long-run dynamic adjustment for specification (2)

The coefficient of the sentiment index may capture information about future changes in consumer spending beyond that already contained in other indicators - real disposable income, the interest rate, and the unemployment rate. Given the cointegration vector of one

for all categories of consumption, the estimated cointegration regressions of the confidence effect are listed as followed:

$$\underset{}{\ln PCE_t} = \underset{(-0.350)}{0.188} + \underset{(-4.692)^*}{0.012CS^e_t} + \underset{(-15.723)^*}{0.889\ln Y_t} \quad \text{(L4)}$$

$$\underset{}{\ln DG_t} = \underset{(-1.353)}{26.151} + \underset{(-3.775)^*}{0.320CS^e_t} + \underset{(1.945)}{3.883\ln Y_t} \quad \text{(L5)}$$

$$\underset{}{\ln NG_t} = \underset{(1.430)}{11.416} + \underset{(3.921)^*}{0.142CS^e_t} - \underset{(-1.456)}{1.207\ln Y_t} \quad \text{(L6)}$$

where t-values are in parenthesis and * indicates statistical significance at the 5% level.

The coefficient of the expected index is statistically significant in all three categories of consumption and has the expected sign. As indicated in equation (L4), a one point increase in the sentiment index will lead to a 1.2% increase in total consumption. The consumption of durable goods responds more to an increase in the sentiment index relative to non-durable goods for this sample period of 1960Q1-2011Q2. This may imply that an increase in consumer confidence in the future of the economy increases consumer expenditure on durable goods. Choudry (2003) also found a relatively large effect of consumer sentiment on the consumption of durable goods, implying that when consumer sentiment induces an increase in the consumption of durable goods, consumers may have less income for other expenditures.

In only one out of three cases of consumption the coefficient of real income is positive as expected and significant at the 5% level. The magnitude of the coefficient is close to unity, implying a relatively larger effect of disposable income on total real expenditure. From equation (L4), the coefficient of disposable income is approximately 0.889, implying an increase of 0.889% in total consumption when disposable income increases by 1%. This relatively large effect of disposable income on consumer expenditure may possibly be explained by the *expected* consumer confidence. The forward-looking

nature of the index may capture the consumers' positive outlooks of the economy in the next 12 months or 5 years. Hence the consumers may decide to increase theirs consumptions out of disposable income. For the same restricted consumption version, Carroll et al (1994) and Mehra and Martin (2003) estimated the coefficient of disposable income to be 0.543 and 0.530, respectively. Changes in real disposable income do not have a statistically significant effect on the consumption of durable goods or non-durable goods in the long run.

The positive response of total consumption to the changes in both disposable income and sentiment index is as expected. Similar results are also found in the work of Mehra and Martin (2003). In their empirical analysis of consumer sentiment and consumption, they found that aggregate consumer expenditure depended upon lagged consumer spending, the sentiment index, and disposable income.

Short-run dynamic adjustment for specification (2)

Tables 10-12 report the error-correction results for total consumption, consumption of durable goods, and consumption of non-durable goods. The coefficient on the lagged error term is negative and statistically significant for total consumption, durable goods, and non-durable goods. From table 11, the speed-of-adjustment for the consumption of durable goods towards the long-run equilibrium is 0.1% per quarter. The low coefficient implies that the variables slowly return to their long-run steady state after a shock in previous quarter.

The lagged variables in the specification for the consumption of durable goods are statistically significant. For instance, a one point increase in the sentiment index increases

consumption by 0.1% in the first lag. However, an increase in the sentiment index does not seem to affect total consumption and consumption of non-durable goods in all three lagged periods. For the same argument as in the long-run dynamics, the positive change in consumer attitudes induces a slight increase in the consumption of durable goods. As shown in column 2 of table 11, the p-values equal to 0.0001 indicate a rejection of the null hypothesis that sentiment index and disposable income do not Granger-cause total real expenditure.

5.3.4 Stock Prices and Sentiment Index: Confidence Channel

The evaluation of the confident effect of stock prices in both long-run and short-run dynamic adjustments is specified in specification (3). For convenience, the specification is reproduced here:

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i)} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS_{t-i} + \varepsilon_t \qquad (3)$$

The analysis aims to explicitly quantify the confidence channel of stock prices. The consumption function includes both stock prices and sentiment index. The inclusion of the sentiment index provided information regarding economic conditions, which in turn can affect the spending behaviours of households. Three categories of consumption are evaluated, namely total consumption, consumption of durable goods, and consumption of non-durable goods. The cointegration relation results for each category of consumption and its determinants (stock prices, sentiment index, and disposable income) are indicated in equations L7-L9. The short run dynamic adjustment of cointegration variables are reported

in tables 13-15. The diagnostic test results of short-run Granger causality and non-normality are also reported in tables 13-15.

Long-run dynamic adjustment for specification (3)

The number of cointegration vectors is one, $r = 1$, for all consumer expenditures with the consumer sentiment index. The estimated cointegration relations are expressed as follows:

$$\underset{}{\ln PCE_t} = \underset{}{1.815} + \underset{(-0.881)}{0.191}\ln SP_t + \underset{(0.707)}{0.730}\ln Y_t + \underset{(-2.215)^*}{0.035}CS^e_t \quad \underset{(-3.452)^*}{} \qquad \text{(L7)}$$

$$\underset{}{\ln DG_t} = \underset{(4.739)^*}{-12.333} + \underset{(-0.963)}{0.316}\ln SP_t + \underset{(-4.930)^*}{2.015}\ln Y_t - \underset{(2.769)^*}{0.033}CS^e_t \qquad \text{(L8)}$$

$$\underset{}{\ln NG_t} = \underset{(-0.213)}{0.177} + \underset{(-1.985)^*}{0.116}\ln SP_t + \underset{(-8.615)^*}{0.768}\ln Y_t + \underset{(3.517)^*}{0.009}CS^e_t \qquad \text{(L9)}$$

where t-values are in parenthesis and * indicates statistical significance at the 5% level.

The inclusion of the consumer sentiment index changes the statistical significance and increases the magnitude of the coefficient of disposable income. That is, the consumer sentiment index supplements other economic variables in the consumption equation explaining household expenditure. The index may provide positive outlook about expected income, implying that consumers may spend more out of disposable income wealth. Côté and Johnson (1998) also found that when the index was included in the consumption equation the statistical significance and absolute value of the coefficient of disposable income increased.

The coefficient of stock prices is positive as expected, but the coefficient of stock prices remains statistically significant only in the equation for the consumption of non-durable goods (see equation (L9)). A 1% increase in stock prices increases the consumption of non-durable goods by 0.116%. In comparison to the previous scenario without consumer sentiment (equation L3), the coefficient drops to 0.116 from 0.331. There may be an

important link between stock prices and the expected sentiment index. The index contains information regarding business conditions and financial conditions in the next 12 months or 5 years, implying consumers' perceptions of future economic condition. The existence of an independent confidence channel of stock prices may explain the decrease of consumption out of stock price wealth.

In comparison to the previous cases without the sentiment index, the coefficient of disposable income is positive as expected and significant in all three cases. In the case of durable goods, the magnitude of the coefficient is larger than one, indicating a relatively larger effect of disposable income on these categories of consumption. The sentiment index may induce an increase in the consumption of durable goods; hence, consumers may have less income for non-durable goods. Even though, consumption of durable goods only accounts for 13% of total real consumption.

Short-run dynamic adjustment for specification (3)

As shown in tables 13-14, the coefficients of the lagged error correction term are statistically significant for all three types of consumption. In comparison to the previous case without the sentiment index, the speed of adjustment decreases to 0.7% from 1.5% for total consumption, increases to 0.8% and 1.2% from 0.1% and 0.1% for consumption of durable goods and non-durable goods, respectively.

Table 12 reports the short-run dynamic adjustment of consumption and its determinants. Lagged stock prices have statistically significant effects on all three categories of consumption. The same results are obtained as in the long-run dynamic adjustment. For instance, a 1% increase in stock prices leads to an increase of 0.018% in

total consumption in the first lag. Compared to the previous case, the estimated coefficients of stock prices on total consumption, consumption of durable-goods and consumption of non-durable goods decline when the expected sentiment index is included in the consumption equation.

6. CONSLUSION and FUTURE DIRECTIONS

Remarks of this Study

This paper empirically investigated the influences of stock prices on consumption through the wealth and the confidence channels. The study adopted the Johansen multivariate cointegration method and the error correction model to explain the behaviour of consumer expenditure in the United States, using quarterly data for the period 1960Q1-2011Q2. Four categories of consumptions were studied, namely total consumption, consumption of durables and non-durable goods, and services. The consumption function examined the effect of the sentiment index and stock prices individually to identify the confidence channel and the wealth channel, respectively. To quantify the confidence channel of stock prices, the consumption function employed both stock prices and the sentiment index. The inclusion of the sentiment index provided information regarding economic conditions, which in turn can affect the spending behaviour of households.

When the sentiment index was included in the consumption regression, the magnitudes and significance of stock prices declined while the coefficient of real income increased. The cointegration results indicated a long-run relationship between consumption expenditure and its determinants. In the presence of the sentiment index, stock prices were

found to have a positive effect on all categories of consumption. Only the positive effect on the consumption of non-durable goods, however, was statistically significant.

For all three series of consumption, the short-run Granger causality test results from the error correction regressions confirmed that there was causality from the determinants to the consumption expenditures. The results of stock prices without sentiment index had positive and significant effect on all series of consumption.

Possible Directions for Future Research

Some important issues have been identified in this study and required further investigation. First of all, this study examined how the simultaneous interactions of multi-variables might influence the changes in consumer expenditures. To better understand how the relationships between these variables, one may consider the impulse response analysis[5], which measures the time profile of the effect of a shock, or an impulse on the future values of a variable.

As indicated in specification (4), the inclusion of the real interest rate and the unemployment results in multiple cointegrating vectors. Due to multi-cointegration vectors, the error-correction regressions also generated multiple coefficients of the speed of adjustment. It is possible that consumption is correlated with the lagged real interest rate and unemployment other than consumer sentiment and stock prices. Hence, further econometric techniques are required to investigate and solve the issue of multi-cointegration vectors.

Lastly, it should be noted that the variables in the short-run VECM are I(1), thus the Wald test for Granger causality may result in non-standard limiting distribution. It is

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[5] See Groenewold (2005) for discussion on the application of an impulse response analysis in the VECM.

because each variable enters the model both in the error correction term and as lagged differences in the short-run part of each equation. To carry out a proper test of Granger causality, both the long-run and the short-run components of the model need to be taken into account. As for the cointegrated variables, one may consider the modified Wald (MWALD) procedure.[6]

[6] See Ran and Zapata (2008) for further discussion on the application of the modified Wald test in the VECM.

APPENDIX A

Table 1. Augmented Dickey-Fuller Tests for Unit Roots

	Level		**First Difference**			
	Constant Term		Constant Term		Constant & Time Trend	
Variable	Trace statistic	Lags	Trace statistic	Lags		Lags
lnPCE	-2.1529	3	-4.9500*	2	-3.5238*	2
lnDG	-0.8558	3	-6.9796*	2	-6.9596*	2
lnNG	-1.4670	3	-6.1619*	2	-3.7336*	2
lnSG	**-3.3462***	**6**	**-3.0679***	**5**	**-2.8805**	**5**
lnSP	-0.8346	1	-10.9991*	0	-10.9815*	0
lnNAS	-1.7495	0	-10.4547*	0	-10.4534*	0
lnRUS2	-1.6698	0	-8.8134*	0	-8.7690*	0
lnRUS3	-1.8577	1	-7.0560*	0	-7.0829*	0
lnY	-2.8521	5	-5.4788*	4	-6.4478*	4
CS	**-3.0122***	**0**	**-15.9072***	**0**	**-15.8696***	**0**
CS^e	-2.8541	0	-15.6478*	0	-15.6086*	0
r^e	-2.5353	5	-9.3636*	3	-9.3818*	3
U	-2.4469	9	-4.5859*	8	-4.6275*	8
5% C.V.	**-2.86**		**-2.86**		**-3.41**	

Notes: lnPCE, lnDG, lnNG, lnSG, lnSP, lnRUS2, lnRUS3, lnNAS, and lnY represent the natural logarithm of total real consumption, real consumption on durable goods, real consumption on non-durable goods, real consumption on services, real stock prices (S&P500), real RUSSELL2000 index, real RUSSELL3000 index, real NASDAQ Composite index, and real disposable income. CS, CS^e, r^e, and U denotes the consumer sentiment index, expected real interest rate, and unemployment rate. The data series on the stock prices – RUSSELL2000, RUSSELL3000, and NASDAQ Composite- are available for the sample period of 1987Q4-2011Q2. While the S&P500 index is for 1960Q1-2011Q2. * indicates that the null hypothesis (H0) of unit root can be rejected at least at the 5% significant level. To be able to reject the H0, the test-statistics needs to be more negative than the 5% critical value (C.V). The required number of lags is based on the Akaike information criterion (AIC) for each variable. The unit root test includes a non-zero intercept term.

Table 2. Johansen Trace Test Results: Pair-wise Cointegration Test for All Variables

Variables	No. of lagged differences	H_0: $r \leq r_0$	Test statistics	5% Critical Value	10% Critical Value
lnPCE, lnSP	4	$r_0 = 0$ $r_0 = 1$	34.01 2.63	20.16 9.14	24.69 12.53
lnPCE, lnY	6	$r_0 = 0$ $r_0 = 1$	32.50 8.32	20.16 20.16	24.69 12.53
lnPCE, r^e	5	$r_0 = 0$ $r_0 = 1$	30.28 6.27	20.16 9.14	24.69 12.53
lnPCE, U	5	$r_0 = 0$ $r_0 = 1$	52.60 7.22	20.16 9.14	24.69 12.53
lnPCE, CS^e	1	$r_0 = 0$ $r_0 = 1$	254.91 8.39	20.16 9.14	24.69 12.53
lnDG, lnSP	3	$r_0 = 0$ $r_0 = 1$	32.57 2.44	20.16 9.14	24.69 12.53
lnDG, lnY	6	$r_0 = 0$ $r_0 = 1$	40.96 3.00	20.16 9.14	24.69 12.53
lnDG, r^e	3	$r_0 = 0$ $r_0 = 1$	32.07 8.04	20.16 9.14	24.69 12.53
lnDG, U	10	$r_0 = 0$ $r_0 = 1$	25.14 4.57	20.16 9.14	24.69 12.53
lnDG, CS^e	2	$r_0 = 0$ $r_0 = 1$	71.91 5.43	20.16 9.14	24.69 12.53
lnNG, lnSP	2	$r_0 = 0$ $r_0 = 1$	69.71 2.92	20.16 9.14	24.69 12.53
lnNG, lnY	6	$r_0 = 0$ $r_0 = 1$	40.18 6.09	20.16 9.14	24.69 12.53
lnNG, r^e	***2***	***$r_0 = 0$*** ***$r_0 = 1$***	***64.73*** ***10.30***	***20.16*** ***9.14***	***24.69*** ***12.53***
lnNG, U	***2***	***$r_0 = 0$*** ***$r_0 = 1$***	***96.24*** ***10.15***	***20.16*** ***9.14***	***24.69*** ***12.53***
lnNG, CS^e	2	$r_0 = 0$ $r_0 = 1$	93.85 7.06	20.16 9.14	24.69 12.53
lnSP, lnY	6	$r_0 = 0$ $r_0 = 1$	45.71 2.95	20.16 9.14	24.69 12.53
lnSP, r^e	***2***	***$r_0 = 0$*** ***$r_0 = 1$***	***14.96*** ***2.19***	***20.16*** ***9.14***	***24.69*** ***12.53***
lnSP, U	***3***	***$r_0 = 0$*** ***$r_0 = 1$***	***10.36*** ***2.29***	***20.16*** ***9.14***	***24.69*** ***12.53***
lnSP, CS^e	2	$r_0 = 0$ $r_0 = 1$	20.05 1.82	20.16 9.14	24.69 12.53
lnY, r^e	6	$r_0 = 0$	35.03	20.16	24.69

		$r_0 = 1$	6.52	9.14	12.53
lnY, U	6	$r_0 = 0$ $r_0 = 1$	52.49 6.92	20.16 9.14	24.69 12.53
lnY, CS^e	6	$r_0 = 0$ $r_0 = 1$	53.45 5.25	20.16 9.14	24.69 12.53
r^e, U	***5***	***$r_0 = 0$*** ***$r_0 = 1$***	***10.89*** ***4.49***	***20.16*** ***9.14***	***24.69*** ***12.53***
r^e, CS^e	***2***	***$r_0 = 0$*** ***$r_0 = 1$***	***18.68*** ***6.95***	***20.16*** ***9.14***	***24.69*** ***12.53***
U, CS^e	***2***	***$r_0 = 0$*** ***$r_0 = 1$***	***37.31*** ***9.45***	***20.16*** ***9.14***	***24.69*** ***12.53***

Independent pair-wise cointegration tests are performed for real total consumption (lnPCE) and its subcategories – durables (lnDG), and non-durable (lnNG)-and economic indicators. The considered economic indicators are real stock prices (lnSP), real disposable income (lnY), expected real interest rate (re), unemployment rate (U), and expected consumer sentiment index (CS^e).
If the trace statistic is greater than the critical value, then reject the H_0. H_0: r=0 implies there is no cointegration relationship or no long-run relationship between the interested variables. The cointegration test includes the non-zero mean. The number of lags is chosen to minimize the Akaike Information Criterion (AIC).

Table 3. Johansen Cointegration Test Results: Long-run Relationship Between Consumer Expenditure, Stock Prices, and Real Disposable Income

		Trace Statistics				
H_0	**H_1**	**Total Consumption**	**Durable Goods**	**Non-durable Goods**	**95% Critical Value**	**99% Critical Value**
$r = 0$	$r > 0$	51.70 (0.0003)	54.94 (0.0001)	70.82 (0.0000)	35.07	40.78
$r \leq 1$	**$r > 1$**	**16.14 (0.1705)**	**8.90 (0.7466)**	**9.15 (0.7246)**	**20.16**	**24.69**
$r \leq 2$	$r > 2$	2.92 (0.6043)	3.36 (0.5257)	3.61 (0.4850)	9.14	12.53
Cointegrating rank		1	1	1		
Lags		4	4	2		

Three independent cointegration tests for consumption categories – total consumption, durables and non-durable- and other variables. The number of lags is chosen to minimize the Akaike Informatin Criterion (AIC).
The null hypothesis of $r = 0$ implies there is no cointegration relation between the variables. If the trace statistic is greater than the critical value, then reject the null hypothesis, H_0. The null hypothesis implies there is no cointegration relationship or no long-run relationship.
P-values are in parenthesis.

Table 4. Johansen Cointegration Test Results: Long-run Relationship Between Consumer Expenditure, Stock PriceS, Real Disposable Income, and Expected Consumer Sentiment Index

		Trace Statistics				
H_0	**H_1**	**Total Consumption**	**Durable Goods**	**Non-Durable Goods**	**95% Critical Value**	**99% Critical Value**
$r = 0$	$r > 0$	125.85 (0.0000)	117.30 (0.0000)	112.20 (0.0000)	53.94	60.81
$r \leq 1$	**$r > 1$**	**33.58 (0.0727)**	**33.90 (0.0673)**	**32.42 (0.0962)**	**35.07**	**40.78**
$r \leq 2$	$r > 2$	14.72 (0.2484)	11.36 (0.5163)	9.49 (0.6934)	20.16	24.69
$r \leq 3$	$r > 3$	4.96 (0.2984)	4.12 (0.4066)	43.92 (0.4455)	9.14	12.53
Cointegrating rank		1	1	1		
Lags		2	2	2		

Three independent cointegration tests for consumption categories – total consumption, durables and non-durable- and other variables. The number of lags is chosen to minimize the Akaike Informatin Criterion (AIC).
The null hypothesis of $r = 0$ implies there is no cointegration relation between the variables. If the trace statistic is greater than the critical value, then reject the null hypothesis, H_0. The null hypothesis implies there is no cointegration relationship or no long-run relationship.
P-values are in parenthesis.

Table 5. Johansen Cointegration Test Results: Long-run Relationship Between Consumer Expenditure, Stock Prices, Real Disposable Income, Expected Consumer Sentiment Index, Real Interest Rate, and Unemployment Rate

H_0	H_1	Total Consumption	Durable Goods	Non-Durable Goods	95% Critical Value	99% Critical Value
$r = 0$	$r > 0$	243.64 (0.0000)	231.06 (0.0000)	212.25 (0.0000)	103.68	112.88
$r \leq 1$	$r > 1$	106.25 (0.0000)	104.36 (0.0001)	95.04 (0.0009)	76.81	84.84
$r \leq 2$	$r > 2$	58.93 (0.0160)	57.17 (0.0243)	52.91 (0.0621)	53.94	60.81
$r \leq 3$	**$r > 3$**	**30.82 (0.1381)**	**31.59 (0.1162)**	**27.31 (0.2772)**	**35.07**	**40.78**
$r \leq 4$	$r > 4$	15.48 (0.2041)	10.87 (0.5620)	10.98 (0.5523)	20.16	24.69
$r \leq 5$	$r > 5$	5.29 (0.2620)	4.09 (0.4112)	4.33 (0.3771)	9.14	12.53
Cointegrating Rank, r		3	3	3		
No. of lagged differences		2	2	2		

Three independent cointegration tests for consumption categories – total consumption, durables and non-durable- and other variables. The number of lags is chosen to minimize the Akaike Informatin Criterion (AIC).
The null hypothesis of $r = 0$ implies there is no cointegration relation between the variables. If the trace statistic is greater than the critical value, then reject the null hypothesis, H_0. The null hypothesis implies there is no cointegration relationship or no long-run relationship.
P-values are in parenthesis.

Table 6. Error Correction Results: Total Real Consumer Expendiures with Stock Prices

$$\Delta \ln PCE_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln PCE_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \varepsilon_t$$

	$\Delta \ln PCE_t$	$\Delta \ln SP_t$	$\Delta \ln Y_t$
con	0.029	-0.003	0.028
	[0.000]	[0.000]	[0.000]
ec_{t-1}	-0.012*	0.010	-0.011*
	[-5.393]	[0.044]	[-4.677]
$\Delta \ln PCE_{t-1}$	0.055	0.053	0.247*
	[0.700]	[0.060]	[2.819]
$\Delta \ln SP_{t-1}$	0.023*	0.255*	0.013
	[3.497]	[3.510]	[1.778]
$\Delta \ln Y_{t-1}$	0.063	0.062	-0.060
	[0.921]	[0.080]	[-0.786]
$\Delta \ln PCE_{t-2}$	0.192*	0.314	0.038
	[2.408]	[0.352]	[0.428]
$\Delta \ln SP_{t-2}$	0.010	-0.025	0.016*
	[1.531]	[-0.329]	[2.201]
$\Delta \ln Y_{t-2}$	-0.096	-0.569	0.000
	[-1.408]	[-0.747]	[-0.006]
$\Delta \ln PCE_{t-3}$	0.221*	1.758*	0.227*
	[2.789]	[1.985]	[2.598]
$\Delta \ln SP_{t-3}$	-0.001	-0.065	0.016*
	[-0.215]	[-0.854]	[2.164]
$\Delta \ln Y_{t-3}$	-0.034	-1.042	-0.026
	[-0.514]	[-1.407]	[-0.359]
F-statistic	3.0854* (0.0021)	1.1421 (0.3330)	7.9163* (0.0000)
JB statistic	51.6756*	74.5612*	19.6006*
Skewness	-0.5720*	-0.7645*	-0.1152*
Kurtosis	5.2049*	5.5622*	4.5124*

Notes: lnPCE, lnSP, and lnY represent the natural log of total consumption, S&P500 stock prices, and real disposable income.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value is in the parenthesis, and * indicates statistical significance at the 5% level.

Table 7. Error Correction Results: Real Consumer Expendiures on Durable Goods with Stock Prices

$$\Delta \ln DG_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln DG_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \varepsilon_t$$

	$\Delta \ln DG_t$	$\Delta \ln SP_t$	$\Delta \ln Y_t$
con	0.089	0.076	0.065
	[0.000]	[0.000]	[0.000]
ec_{t-1}	0.003*	0.002	0.002*
	[2.324]	[0.848]	[7.238]
$\Delta \ln DG_{t-1}$	-0.197*	-0.001	0.027
	[-2.613]	[-0.004]	[1.549]
$\Delta \ln SP_{t-1}$	0.093*	0.262*	0.017*
	[3.044]	[3.681]	[2.414]
$\Delta \ln Y_{t-1}$	0.373	0.153	0.003
	[1.212]	[0.213]	[0.042]
$\Delta \ln DG_{t-2}$	0.072	-0.030	0.015
	[0.936]	[-0.166]	[0.839]
$\Delta \ln SP_{t-2}$	0.089*	-0.021	0.017*
	[2.799]	[-0.288]	[2.347]
$\Delta \ln Y_{t-2}$	-0.027	-0.266	0.048
	[-0.089]	[-0.381]	[0.679]
$\Delta \ln DG_{t-3}$	0.077	0.329	0.039
	[1.021]	[1.890]	[2.242]
$\Delta \ln SP_{t-3}$	-0.005	-0.043	0.018*
	[-0.154]	[-0.574]	[2.411]
$\Delta \ln Y_{t-3}$	0.088	-0.733	0.027
	[0.304]	[-1.089]	[0.406]
F-statistic	3.6903* (0.0003)	0.8053 (0.5981)	6.5245* (0.0000)
JB statistic	52.5638*	61.1755*	18.5130*
Skewness	-0.6721*	-0.6996*	-0.1147*
Kurtosis	5.1142*	5.3123*	4.4690*

Notes: lnDG, lnSP, and lnY represent the natural log of consumption of durable goods, S&P500 stock prices, and real disposable income.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value in the parenthesis, and * indicates statistical significance at the 5% level.

Table 8. Error Correction Results: Real Consumer Expendiures on Non-durable with Stock Prices

$$\Delta \ln NG_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln NG_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \varepsilon_t$$

	$\Delta \ln NG_t$	$\Delta \ln SP_t$	$\Delta \ln Y_t$
con	0.029	0.030	0.047
	[0.000]	[0.000]	[0.000]
ec_{t-1}	-0.005*	-0.005	-0.007*
	[-3.796]	[-0.401]	[-6.335]
$\Delta \ln NG_{t-1}$	0.009	0.335	0.256*
	[0.123]	[0.439]	[3.392]
$\Delta \ln SP_{t-1}$	0.027*	0.244*	0.011
	[3.627]	[3.344]	[1.517]
$\Delta \ln Y_{t-1}$	0.200*	-0.118	-0.048
	[2.722]	[-0.162]	[-0.660]
$\Delta \ln NG_{t-2}$	0.045	0.677	0.085
	[0.574]	[0.872]	[1.107]
$\Delta \ln SP_{t-2}$	-0.004	-0.041	0.013
	[-0.507]	[-0.533]	[1.746]
$\Delta \ln Y_{t-2}$	-0.019	-0.565	0.003
	[-0.258]	[-0.778]	[0.041]
$\Delta \ln NG_{t-3}$	0.081	1.064	0.059
	[1.067]	[1.409]	[0.784]
$\Delta \ln SP_{t-3}$	0.000	-0.056	0.022
	[-0.014]	[-0.728]	[2.921]
$\Delta \ln Y_{t-3}$	0.022	-0.737	0.042
	[0.311]	[-1.060]	[0.612]
F-statistic	3.7245* (0.0003)	0.8533 (0.5561)	7.1406* (0.0000)
JB statistic	5.9597	80.1296*	20.8758*
Skewness	0.0564	-0.7757*	-0.1691*
Kurtosis	3.8360	5.6759	4.5422

Notes: lnNG, lnSP, and lnY represent the natural log of consumption of non-durable goods, S&P500 stock prices, and real disposable income.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value in the parenthesis, and * indicates statistical significance at the 5% level.

Table 9. Cointegration Relation Results: Robustness of Stock Prices

	Total Consumption	Durable Goods	Non-durable Goods
$\ln NAS_t$	-0.077*	-0.246*	-0.055*
	(4.897)	(3.438)	(7.025)
$\ln RUS2_t$	7.803*	-1.520*	-0.802*
	(-4.623)	(5.448)	(5.290)
$\ln RUS3_t$	-0.144*	-0.663*	-0.096*
	(5.296)	(3.791)	(6.692)

The cointegration analysis follows specification (1):

$$\Delta \ln C_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln C_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \varepsilon_t$$

where lnC represents lnPCE, lnDG, and lnNG, and lnSP represents the new stock price indices (lnNAS, lnRUS2, and lnRUS3)

Note: lnNAS, lnRUS2, and lnRUS3 represent the natural logarithm of the NASDAQ Composite index, the Russell 2000 index, and the Russell 3000 index.

t-values are in the parenthesis and * indicates statistical significance at the 5% level.

Table 10. Error Correction Results: Total Real Consumer Expendiures with the Consumer Sentiment Index

$$\Delta \ln PCE_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln PCE_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t$$

	$\Delta \ln PCE_t$	ΔCS_t	$\Delta \ln Y_t$
con	0.003	0.028	0.007
	[0.0000]	[0.0000]	[0.0000]
ec_{t-1}	-0.015*	-0.147	-0.011*
	[-6.332]	[-0.063]	[-4.003]
$\Delta \ln PCE_{t-1}$	0.028	155.497*	0.270*
	[0.348]	[2.006]	[2.981]
ΔCS^e_{t-1}	0.000	-0.102	0.000
	[1.557]	[-1.326]	[0.609]
$\Delta \ln Y_{t-1}$	0.025	-171.575*	-0.045
	[0.358]	[-2.582]	[-0.578]
$\Delta \ln PCE_{t-2}$	0.101	-61.473	0.038
	[1.237]	[-0.776]	[0.415]
ΔCS^e_{t-2}	0.000	-0.022	0.000
	[0.560]	[-0.298]	[-0.534]
$\Delta \ln Y_{t-2}$	-0.076	-37.643	0.019
	[-1.095]	[-0.556]	[0.240]
$\Delta \ln PCE_{t-3}$	0.163*	96.065	0.204*
	[2.036]	[1.234]	[2.242]
ΔCS^e_{t-3}	0.000	0.042	0.000*
	[1.473]	[0.602]	[2.167]
$\Delta \ln Y_{t-3}$	-0.049	-45.573	-0.067
	[-0.715]	[-0.683]	[-0.866]
F-statistic	4.1335* (0.0001)	2.1409 (0.0457)	7.2141* (0.0000)
JB statistic	5.9597	80.1296	20.8758
Skewness	0.0564	-0.7757*	-0.1691*
Kurtosis	3.8360*	5.6759*	4.5422*

Notes: lnPCE and lnY represent the natural log of total consumption and real disposable income. CS^e denotes the expected consumer sentiment index.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value in the parenthesis, and * indicates statistical significance at the 5% level.

Table 11. Error Correction Results: Real Consumer Expendiures on Durable Goods with the Consumer Sentiment Index

$$\Delta \ln DG_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln DG_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t$$

	$\Delta \ln DG_t$	ΔCS_t	$\Delta \ln Y_t$
con	0.031	2.149	14.000
	[0.0000]	[0.0000]	[0.0000]
ec_{t-1}	-0.001*	-0.082	0.001*
	[-3.712]	[-1.241]	[-6.974]
$\Delta \ln DG_{t-1}$	-0.225*	16.067	0.031
	[-3.014]	[1.052]	[1.731]
ΔCS^e_{t-1}	0.001*	-0.099	0.000
	[2.488]	[-1.300]	[0.584]
$\Delta \ln Y_{t-1}$	0.134	-145.891*	0.009
	[0.429]	[-2.287]	[0.126]
$\Delta \ln DG_{t-2}$	0.033	-11.696	0.009
	[0.428]	[-0.745]	[0.509]
ΔCS^e_{t-2}	0.001	-0.025	0.000
	[1.944]	[-0.326]	[-0.543]
$\Delta \ln Y_{t-2}$	-0.077	-26.843	0.062
	[-0.246]	[-0.419]	[0.816]
$\Delta \ln DG_{t-3}$	0.057	14.334	0.030
	[0.767]	[0.948]	[1.691]
ΔCS^e_{t-3}	0.000	0.045	0.000*
	[1.396]	[0.628]	[2.107]
$\Delta \ln Y_{t-3}$	0.011	-39.040	-0.030
	[0.034]	[-0.622]	[-0.404]
F-statistic	4.2796* (0.0001)	1.7026 (0.0949)	5.3850* (0.0000)
JB statistic	87.2275*	4.4302	16.0013*
Skewness	-0.7670*	0.2037	-0.1043*
Kurtosis	5.8394*	3.6025	4.3664*

Notes: lnDG and lnY represent the natural log of consumption on durable goods and real income. CS^e denotes the expected consumer sentiment index

The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.

The t-values are in the square-brackets [ ], p-value in the parenthesis, and * indicates statistical significance at the 5% level.

Table 12. Error Correction Results: Real Consumer Expendiures on Non-durable Goods with the Consumer Sentiment Index

$$\Delta \ln NG_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln NG_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t$$

	$\Delta \ln NG_t$	ΔCS_t	$\Delta \ln Y_t$
con	0.010	1.559	0.013
	[0.0000]	[0.0000]	[0.0000]
ec_{t-1}	-0.001*	-0.137	-0.001*
	[-4.882]	[-0.843]	[-5.819]
$\Delta \ln NG_{t-1}$	0.028	137.914*	0.263*
	[0.373]	[2.136]	[3.501]
ΔCS^e_{t-1}	0.000	-0.111	0.000
	[1.696]	[-1.469]	[0.328]
$\Delta \ln Y_{t-1}$	0.151*	-143.916*	-0.028
	[2.076]	[-2.269]	[-0.381]
$\Delta \ln NG_{t-2}$	-0.028	-93.326	0.081
	[-0.362]	[-1.403]	[1.046]
ΔCS^e_{t-2}	0.000	-0.022	0.000
	[-0.891]	[-0.295]	[-0.757]
$\Delta \ln Y_{t-2}$	-0.016	-31.996	0.011
	[-0.212]	[-0.495]	[0.141]
$\Delta \ln NG_{t-3}$	0.059	-0.998	0.069
	[0.787]	[-0.015]	[0.918]
ΔCS^e_{t-3}	0.000*	0.080	0.000*
	[2.559]	[1.142]	[2.679]
$\Delta \ln Y_{t-3}$	-0.037	-2.812	-0.021
	[-0.514]	[-0.045]	[-0.282]
F-statistic	5.4071 (0.0000)	1.8663 (0.0629)	6.7389* (0.0000)
JB statistic	5.5622	7.6178*	18.1535*
Skewness	0.0481	0.2387*	-0.1575*
Kurtosis	3.8093	3.8257*	4.4382*

Notes: lnNG and lnY represent the natural log of consumption on non-durable goods and real income. CS^e denotes the expected consumer sentiment index.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value in the parenthesis, and * indicates statistical significance at the 5% level.

Table 13. Error Correction Results: Total Real Consumer Expendiures with Stock Price and the Consumer Sentiment Index

$$\Delta \ln PCE_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln PCE_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t$$

	$\Delta \ln PCE_t$	$\Delta \ln SP_t$	$\Delta \ln Y_t$	ΔCS_t
con	0.012	0.009	0.01	0.743
	[0.000]	[0.000]	[0.000]	[0.000]
ec_{t-1}	-0.007*	-0.006	-0.006*	-0.450
	[-6.562]	[-0.470]	[-4.930]	[-0.430]
$\Delta \ln PCE_{t-1}$	-0.033	-0.004	0.205*	107.058
	[-0.412]	[-0.004]	[2.283]	[1.371]
$\Delta \ln SP_{t-1}$	0.018*	0.296*	0.008	19.171*
	[2.700]	[3.889]	[1.046]	[2.907]
$\Delta \ln Y_{t-1}$	0.048	0.450	-0.062	-166.573*
	[0.709]	[0.589]	[-0.807]	[-2.515]
ΔCS^e_{t-1}	0.000	-0.001	0.000	-0.180
	[0.366]	[-1.593]	[-0.144]	[-2.227]
$\Delta \ln PCE_{t-2}$	0.084	0.040	-0.023	-58.546
	[1.039]	[0.044]	[-0.254]	[-0.742]
$\Delta \ln SP_{t-2}$	0.010	-0.024	0.021*	-6.367
	[1.395]	[-0.301]	[2.654]	[-0.923]
$\Delta \ln Y_{t-2}$	-0.078	-0.822	0.025	-51.814
	[-1.146]	[-1.074]	[0.330]	[-0.781]
ΔCS^e_{t-2}	0.000	0.001	0.000	0.007
	[0.187]	[0.832]	[-1.691]	[0.082]
$\Delta \ln PCE_{t-3}$	0.180*	1.254	0.184*	92.054
	[2.278]	[1.409]	[2.068]	[1.192]
$\Delta \ln SP_{t-3}$	-0.006	-0.152	0.011	0.773
	[-0.815]	[-1.887]	[1.356]	[0.111]
$\Delta \ln Y_{t-3}$	-0.046	-1.000	-0.069	-39.421
	[-0.692]	[-1.326]	[-0.914]	[-0.603]
ΔCS^e_{t-3}	0.000	0.002*	0.000	0.033
	[1.655]	[2.560]	[1.449]	[0.436]
F-statistic	3.6688* (0.0000)	1.6950 (0.0635)	6.2901* (0.0000)	2.3169 (0.066)
JB statistic	25.1837*	57.5542*	14.7571*	5.4451
Skewness	-0.3418*	-0.7013*	-0.0400*	0.2767
Kurtosis	4.5937*	5.2147*	4.3250*	3.5864*

Notes: lnPCE, lnSP, and lnY represent the natural log of total consumption, stock prices, and real income. CS^e denotes the expected consumer sentiment index.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value is in the parenthesis, and * indicates statistical significance at the 5% level.

Table 14. Error Correction Results: Real Consumer Expendiures on Durable goods with Stock Price and the Consumer Sentiment Index

$$\Delta \ln DG_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln DG_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t$$

	$\Delta \ln DG_t$	$\Delta \ln SP_t$	$\Delta \ln Y_t$	ΔCS_t
con	0.109	0.070	0.056	8.042
	[0.000]	[0.000]	[0.000]	[0.000]
ec_{t-1}	0.008*	0.005	0.004*	0.610
	[3.514]	[0.964]	[7.638]	[1.266]
$\Delta \ln DG_{t-1}$	-0.261*	-0.015	0.017	11.286
	[-3.522]	[-0.087]	[0.974]	[0.743]
$\Delta \ln SP_{t-1}$	0.072*	0.300*	0.012	20.901*
	[2.245]	[4.012]	[1.561]	[3.204]
$\Delta \ln Y_{t-1}$	0.165	0.556	-0.023	-148.517*
	[0.535]	[0.766]	[-0.314]	[-2.349]
ΔCS^e_{t-1}	0.000	-0.002	0.000	-0.181*
	[1.242]	[-1.644]	[-0.167]	[-2.262]
$\Delta \ln DG_{t-2}$	0.013	-0.105	0.000	-10.964
	[0.176]	[-0.590]	[0.001]	[-0.708]
$\Delta \ln SP_{t-2}$	0.078*	-0.022	0.022*	-6.635
	[2.336]	[-0.283]	[2.719]	[-0.970]
$\Delta \ln Y_{t-2}$	-0.083	-0.558	0.050	-42.729
	[-0.273]	[-0.779]	[0.693]	[-0.684]
ΔCS^e_{t-2}	0.000	0.001	0.000	0.004
	[1.019]	[0.830]	[-1.657]	[0.052]
$\Delta \ln DG_{t-3}$	0.061	0.239	0.028	16.005
	[0.843]	[1.408]	[1.609]	[1.081]
$\Delta \ln SP_{t-3}$	-0.013	-0.138	0.014	1.691
	[-0.380]	[-1.728]	[1.683]	[0.242]
$\Delta \ln Y_{t-3}$	0.041	-0.775	-0.035	-29.449
	[0.137]	[-1.105]	[-0.491]	[-0.482]
ΔCS^e_{t-3}	0.001	0.002*	0.000	0.030
	[1.390]	[2.559]	[1.353]	[0.387]
F-statistic	3.7855* (0.0000)	1.5224 (0.1108)	5.4813* (0.0000)	2.1809 (0.0112)
JB statistic	60.2742*	46.9774*	12.1872*	6.1690*
Skewness	-0.6597*	-0.6360*	0.0123	0.3118
Kurtosis	5.3359*	4.9978*	4.2061*	3.5866*

Notes: lnDG, lnSP, and lnY represent the natural log of consumption on durable goods, stock prices, and real income. CS^e denotes the expected consumer sentiment index.
The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.
The t-values are in the square-brackets [ ], p-value is in the parenthesis, and * indicates statistical significance at the 5% level.

Table 15. Error Correction Results: Real Consumer Expendiures on Non-durable Goods with Stock Price and the Consumer Sentiment Index

$$\Delta \ln DG_t = con + \alpha ec_{t-1} + \sum_{i=1}^{3} \gamma_i \Delta \ln DG_{t-i} + \sum_{i=1}^{3} \theta_i \Delta \ln SP_{t-i} + \sum_{i=1}^{3} \omega_i \Delta \ln Y_{t-i} + \sum_{i=1}^{3} \tau_i \Delta CS^e_{t-i} + \varepsilon_t$$

	$\Delta \ln NG_t$	$\Delta \ln SP_t$	$\Delta \ln Y_t$	ΔCS_t
con	0.003	0.004	0.004	0.523
	[0.000]	[0.000]	[0.000]	[0.000]
ec_{t-1}	0.0120*	0.020	0.017*	2.397
	[4.648]	[0.799]	[6.701]	[1.086]
$\Delta \ln NG_{t-1}$	-0.029	0.300	0.215*	96.054
	[-0.383]	[0.394]	[2.823]	[1.452]
$\Delta \ln SP_{t-1}$	0.021*	0.286*	0.006	18.881*
	[2.708]	[3.711]	[0.818]	[2.826]
$\Delta \ln Y_{t-1}$	0.184*	0.256	-0.055	-145.215*
	[2.527]	[0.350]	[-0.754]	[-2.294]
ΔCS^e_{t-1}	0.000	-0.002	0.000	-0.188*
	[0.622]	[-1.689]	[-0.309]	[-2.330]
$\Delta \ln NG_{t-2}$	-0.027	0.480	0.013	-92.979
	[-0.347]	[0.619]	[0.166]	[-1.383]
$\Delta \ln SP_{t-2}$	-0.001	-0.038	0.019*	-5.969
	[-0.088]	[-0.471]	[2.361]	[-0.856]
$\Delta \ln Y_{t-2}$	-0.007	-0.910	0.020	-36.823
	[-0.102]	[-1.252]	[0.278]	[-0.584]
ΔCS^e_{t-2}	0.000	0.001	0.000	0.002
	[-0.575]	[0.727]	[-1.895]	[0.022]
$\Delta \ln NG_{t-3}$	0.061	0.704	0.024	-21.741
	[0.811]	[0.938]	[0.316]	[-0.334]
$\Delta \ln SP_{t-3}$	-0.008	-0.146	0.016*	4.078
	[-1.016]	[-1.804]	[1.974]	[0.579]
$\Delta \ln Y_{t-3}$	-0.018	-0.819	-0.011	10.950
	[-0.256]	[-1.149]	[-0.151]	[0.177]
ΔCS^e_{t-3}	0.000*	0.002*	0.000	0.050
	[2.635]	[2.558]	[1.624]	[0.659]
F-statistic	4.2773* (0.0000)	1.6142 (0.0828)	6.1309* (0.0000)	2.1767 (0.0113)
JB statistic	2.9626	63.0906*	14.3780*	9.6922*
Skewness	0.0832	-0.7302*	-0.0218*	0.3390*
Kurtosis	3.5710	5.3238*	4.3095*	3.8352*

Notes: lnNG, lnSP, and lnY represent the natural log of consumption on non-durable goods, stock prices, and real income. CS^e denotes the expected consumer sentiment index.

The F-statistic is the test statistic of the short-run Granger-causality. The null hypothesis of no Granger causality is rejected if p-value is smaller than 0.05. Tests for non-normality can be based on the skewness and kurtosis of the standardized residuals. **JB=Jarque Bera statistic** for non-normality.

The t-values are in the square-brackets [ ], p-value is in the parenthesis, and * indicates statistical significance at the 5% level.

APPENDIX B

Table B.1: Variables and Data Sources

Variable	Description	Sources
lnPCE	Natural logarithm of total personal consumer expenditures	Table 2.3.5. Personal Consumer expenditures by Major Type of Product (Billionsof dollars). Seasonally adjusted at annual rate. Bureau of Economic Analysis
lnDG	Natural logarithm of durable consumption	
lnNG	Natural logarithm of non-durable consumption	
lnSG	Natural logarithm of service consumption	
lnSP, lnNAS, lnRUS2, and lnRUS3	Natural logarithm of S&P 500, NASDAQ Composite, Russell 2000, and Russell 3000	Yahoo Finance: http://finance.yahoo.com/q/hp?s=^GSPC&a=00&b=1&c=1957&d=11&e=31&f=2011&g=m
Price Index		Table 2.3.4. Price Indexes of Personal Consumer expenditure s by Major Type of Product. Bureau of Economic Analysis
R3	Three-Month Treasure Bill Rate	Series ID: TB3MS, Federal Reserve of St. Louis
lnY	Natural logarithm of real personal disposable income	Table 1.7.5. Relation of Gross Domestic Product, Gross National Product, Net National Product, National Income, and Personal Income
CS, CS^e	Aggregate and expected consumer sentiment index	Table 1, Surveys of Consumers, University of Michigan. http://www.sca.isr.umich.edu/data-archive/mine.php?table=1
U	Civilian Unemployment Rate	The unemployment rate represents the number of unemployed as a percentage of the labour force. Labour force data are restricted to people 16 years of age and older, who currently reside in 1 of the 50 states or the District of Columbia, who do not reside in institutions (e.g., penal and mental facilities, homes for the aged), and who are not on active duty in the Armed Forces. Federal Reserve of St. Louis
r^e	Expected (ex-ante) real interest rate	Used three sources of data on price index of PCE, unemployment rate, and 3-month T-bill rate. The methodology is discussed in the DATA section.

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