Personal income, stock market, and investor psychology

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ABSTRACT

This paper examines how disposable personal income is related to investor psychology as well as stock market values. Since personal income is a main source of investment for market investors, this study explores its time-series characteristics with stock market values and investor sentiment and attempts to explain them based on psychological effects. It is found that personal income is co-integrated with investor sentiment and there exists bidirectional causality between personal income and investor sentiment. The results provide a new insight in terms of behavioral and psychological research in business.

Keywords: personal income, investor psychology, sentiment, co-integration, causality.

INTRODUCTION

A number of studies have investigated various relationships between corporate earnings and stock market values. Since corporate earnings are main sources for the firm's cash flows, the stock valuation based on cash flows is well supported by traditional valuation models and theories. However, if the stock market is considered from the view of investor psychology, personal income would be one of the most influential factors. Theoretically, change in personal income is expected to affect stock returns or market sentiment through change in consumer spending. Baek (2016) investigates fundamental time-series relationships between corporate earnings and investor sentiment and finds that they form co-integrating and causal relationships. In fact, since corporate earnings are closely tied to consumer spending, there must be room to examine how personal income is related to investor sentiment or stock returns. Also, several studies examine psychological effects by focusing on investor sentiment in the stock market. These include Chang et.al. (2015), Baker and Wurgler (2007), and Babu and Kumar (2015).

Ungerer (2003) investigates the relationship between consumer spending and macroeconomic variables and finds that personal income and stock values are positively related to consumer spending though some of the results are not statistically significant. Paiella (2009) confirms that stock prices are significantly related to consumer spending.

Unlike traditional studies that focus on market expectations about corporations' earnings, this study attempts to exploit the role of personal income in the stock market with respect to investor psychology. Based on the fact that behavioral studies on financial markets are gaining ground and there have been few studies about personal income and investor psychology, there must be strong motivation to delve into psychological effects related to personal income that is expected to have more direct effects on investor sentiment than corporate earnings in the stock market. Data and empirical results are described in Section 2 and Section 3 respectively. In Section 4, investor psychology is discussed in more detail with a possible explanation. Then, Section 5 concludes.

DATA

Data consist of U.S. Disposable Personal Income (DPI), Standard & Poor's 500 index (SP500), and CBOE Volatility Index (VIX) downloadable from the Federal Reserve Bank of St. Louis. The VIX is used as an indicator that shows investor psychology because it is often referred to as the measurement of investor sentiment or fear index. An increase in the VIX typically means an increase in investor anxiety. Since the CBOE revised its methodology to calculate VIX values in 2003 and DPI is reported only on a monthly basis, we collect data from January 2004 to June 2018 in order to maintain their consistent nature.

MODELS AND EMPIRICAL RESULTS

To begin with, the unit root test is conducted for all variables. To implement the co-integration test, it should be confirmed that variables are integrated of order one, I(1). The traditional unit root test is as follows:

$$\Delta p_t = \beta_0 + \beta_1 p_{t-1} + \sum_{j=1}^{n} \lambda_j \Delta p_{t-j} + \varepsilon_t \quad (1)$$

where the null hypothesis is that $\beta_1$is equal to zero. While there is no trend in Equation (1), the unit root with a trend is also tested. Because there exists no perfect criterion to select the number of optimal lags, throughout this study, the optimal lags are properly selected and added on the basis of the Akaike Information Criterion (AIC) and the Schwartz Criterion (SC).

Table 1 reports unit root results based on the Augmented Dickey-Fuller (ADF) test. In Panel A, the level of each variable appears to have a unit root because the null hypothesis is not statistically rejected. However, Panel B shows that the null hypothesis is rejected for first differences at the 1% or 5% significance level. This means that all three variables have no unit root for their differences. As a result, they are integrated of order one, I(1).

Basically, the co-integration represents a long run relationship between variables. If two variables are co-integrated, it means that they tend to move together toward a long run equilibrium. Technically speaking, there exists a linear relationship between them so that it can become a stationary process. Thus, their long run causality can be investigated with the vector error correction model (VECM) that adjusts any deviation from their long run equilibrium through an error correction term. On the other hand, if two variables are not co-integrated, they have no long-run relationship and thus, the vector autoregressive (VAR) model can be used to examine their short run causality.

In this study, Engle and Granger test is implemented to identify if there exists a co-integrating relationship between DPI and two market variables. The following linear equation is employed between two variables.

$$x_t = \mu_0 + \mu_1 y_t + \varepsilon_t \tag{2}$$

Then, the unit root test is applied to residuals. The null hypothesis is that residuals are not stationary. If the null hypothesis is rejected, two variables are co-integrated. Again, this means that they are linearly related over the long run and any deviation from their long run equilibrium can be adjusted through an error correction term.

In Table 2, the optimal lag length tends to be small based on the AIC and the SC values. While the SC shows one lag as an optimal lag length, the AIC shows some mixed results. However, the number of optimal lags appear to be a maximum of three lags and thus, residuals are tested with one to three lags. For SP500 and DPI, they seem to be contemporaneously positively correlated because $\mu_1$is positive. However, the null hypothesis is not rejected for residuals with all three lags. This means that SP500 and DPI are not co-integrated. In other words, disposable personal income doesn't form any long-run relationship with stock market prices. On the other hand, while the null hypothesis is not rejected with two and three lags for VIX and DPI, the null hypothesis is rejected with one lag for them. However, based on the issue about the number of lags mentioned above and the optimal lag length with the SC, in fact, VIX and DPI appear to be co-integrated. Moreover, they have contemporaneously negatively correlated because $\mu_1$is negative. As a result, it is concluded that disposable personal income is closely related to investor sentiment rather than stock prices over the long run.

Next, their causal relationships are examined. Since the Granger causality test requires all variables to be stationary, returns (first differences) of each variable are used for DPI, SP500, and VIX because all of them are stationary as shown in Table 1. Since VIX and DPI are co-integrated, their long run causality is investigated with the vector error correction model

(VECM). However, the vector autoregressive (VAR) model is used for SP500 and DPI because they are not co-integrated.

$$\Delta p_t = \alpha + \alpha_1 \hat{e}_{t-1} + \sum_{j=1}^{n} \beta_j \Delta p_{t-j} + \sum_{j=1}^{n} \lambda_j \Delta q_{t-j} + \varepsilon_t \quad (3)$$

$$\Delta p_t = \alpha + \sum_{j=1}^{n} \beta_j \Delta p_{t-j} + \sum_{j=1}^{n} \lambda_j \Delta q_{t-j} + \varepsilon_t \quad (4)$$

where $\alpha_1$is the coefficient of the error correction term and $\hat{e}_{t-1}$ is obtained from the co-integrating regression. If the coefficient of the error correction term is statistically significant, then there exists a causal relationship from the explanatory variable to the dependent variable. Also, the coefficient of the error correction term is expected to be negative because any deviation above or below the long run equilibrium should be inversely adjusted through the error correction term.

Table 3 shows causality results for ΔSP500 and ΔDPI with the null hypothesis that $\lambda_j$is equal to zero. From the F-test, the null hypothesis that ΔSP500 does not cause ΔDPI is rejected. Thus, there exists a unidirectional causality from stock returns to disposable personal income. Moreover, coefficients of three lag terms are positive. This means that an increase (decrease) in stock returns causes an increase (decrease) in disposable personal income. Actually, this finding is not consistent with the traditional view that disposable income leads the value of the stock market. On the other hand, in Table 4, both of the null hypotheses for ΔVIX and ΔDPI are rejected because the coefficient of the error correction term is statistically significantly. Thus, there exists a bidirectional causality between investor sentiment and disposable personal income. Since the coefficient of the error correction term is negative, this means that any deviation from the long run equilibrium is correctly adjusted. Furthermore, coefficients of three lag terms are all negative except only for λ_2(0.0018) in the second null hypothesis. This means that an increase (decrease) in disposable personal income causes a decrease (increase) in investor sentiment (or anxiety) and vice-versa.

PERSONAL INCOME AND INVESTOR PSYCHOLOGY

As already mentioned, VIX is often used to measure investor's emotional states, especially anxiety and fear. Anxiety and fear are associated with uncertainty about the situation, so they are usually elevated when individuals are uncertain about what will happen and whether they will be able to control the situation (Smith & Ellsworth, 1985). A change in personal income can be a factor that determines the level of uncertainty. An increase in personal income indicates that people have more resources and higher controllability of environment while its decrease means the deprivation of resources and controllability, which can be a stressful condition.

Table 2 and Table 4 show that DPI and VIX are co-integrated and they have bidirectional causal relationship, which means that they dynamically interact toward their long-run equilibrium. VIX is the indicator of state anxiety based on a pattern of variables that vary over occasions and fluctuation of the condition of individuals (Spielberger, 1966). In this study, investors' state anxiety is negatively affected by change in their personal income. A decrease in personal income leads to stressful situations and causes investors' state anxiety to increase. The

opposite direction is also supported by the results. Figure 1 shows all causal directions graphically.

There may be a possible psychological explanation. People who are anxious, uncertain about their situations tend to have low levels of self-efficacy. Also, they are less likely to be motivated. Self-efficacy refers to one's judgement and belief about his/her ability to succeed and attain goals (Ormrod, Anderman & Anderman, 2016). If people are less motivated and believe that they have a low chance to succeed and achieve their goals, they will not invest full amount of effort and time and this will affect their lower performances. In turn, their lower performances may be related to lower their income.

CONCLUSION

This study investigates co-integrating and causal relationships between disposable personal income and the stock market and attempts to explain a psychological connection behind empirical findings. It is discovered that personal income and investor sentiment measure have bidirectional causal relationship and they tend to move together toward their long-run equilibrium. Moreover, they show a negative direction for their relationships. In other words, an increase in personal income is related to a decrease in investor sentiment and vice versa. As mentioned in Section 4, this may be explained based on investor psychology such as motivation and self-efficacy.

Since there has been little research about personal income and investor sentiment, this study provides a new insight and makes a significant contribution to the literature.

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APPENDIX

Table 1 Unit root test results

Panel A – Augmented Dickey-Fuller Test for Level (t-statistics)			
	DPI	SP500	VIX
Constant with no trend	-1.03	-2.24	-2.44
Constant with trend	-3.14	-2.00	-2.40
Panel B – Augmented Dickey-Fuller Test for Log Difference (t-statistics)			
	ΔDPI	ΔSP500	ΔVIX
Constant with no trend	-4.31**	-3.57**	-5.45**
Constant with trend	-4.35**	-3.67*	-5.49**

Note: * and ** indicate statistical significance at the 5% and 1% levels, respectively.

Table 2 Engel and Granger Co-integration Results

	μ_1	Residuals	Augmented Dickey-Fuller for Residuals
SP500 and DPI		Constant with no trend with 1 lag	-1.63
		Constant with trend with 1 lag	-2.49
SP500 and DPI	0.2313**	Constant with no trend with 2 lags	-1.35
		Constant with trend with 2 lags	-2.08
SP500 and DPI		Constant with no trend with 3 lags	-1.34
		Constant with trend with 3 lags	-1.68
VIX and DPI		Constant with no trend with 1 lag	-3.72*
		Constant with trend with 1 lag	-3.81*
VIX and DPI	-0.0007*	Constant with no trend with 2 lags	-3.05
		Constant with trend with 2 lags	-3.12
VIX and DPI		Constant with no trend with 3 lags	-2.85
		Constant with trend with 3 lags	-2.83

Note: * and ** indicate statistical significance at the 5%, and 1% levels, respectively.

Table 3 Causality Results for ΔSP500 and ΔDPI

Null Hypothesis	F-statistic	λ_j
ΔDPI does not cause ΔSP500	2.17	λ_1= -0.5418 λ_2= 0.4464 λ_3= 0.5258
ΔSP500 does not cause ΔDPI	2.80*	λ_1= 0.0418 λ_2= 0.0142 λ_3= 0.0097

* and ** indicate statistical significance at the 5%, and 1% levels, respectively.

Table 4 Causality Results for ΔSP500 and ΔDPI

Null Hypothesis	α_1 (Error Correction Coefficient)	λ_j
ΔDPI does not cause ΔVIX	-0.0052*	λ_1= -0.1005 λ_2= -2.5507 λ_3= -4.1761
ΔVIX does not cause ΔDPI	-0.0002*	λ_1= -0.0024 λ_2= 0.0018 λ_3= -0.0033

* and ** indicate statistical significance at the 5%, and 1% levels, respectively.

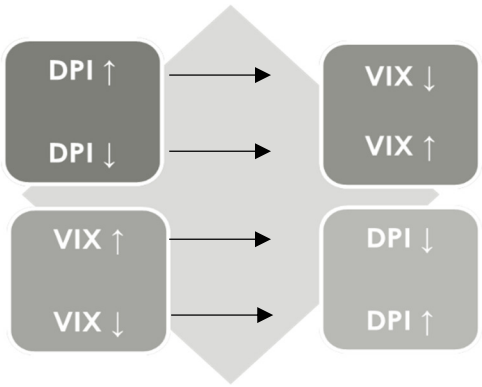

Figure 1. Causal relationship between DPI and VIX