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◆ A Note for Submission



## A Note from the Editor's Board

The YMC Management Review has been published for six volumes so far. And the iFAIRS 2013 conference has been hold at Nanning Guanxi CHINA on 15 June 2013. I would like to thank the University of Guanxi Foreign Language which presented this International conference.

The YMC Management Review publishes two numbers each year. The first number publishes the cooperation of holding the iFAIRS conference. The second number, discussed partly in Mandarin, publishes topics about practical management. The editor's board welcomes all articles that are ready for submission, regarding the practical management discussions or management cases. Furthermore, we hope the YMC Management Review could be included as a member of the Social Science Citation Index (SSCI) in the near future.

I am pleased to announce that this number of the YMC Management Review contains four papers which is the most plentiful number of English issue of YMCMR. *Volatility Index and Trading Volume in the US Stock Market* discusses some investors' behavior in USA shares market. *The Impact of Credit Rating on Corporate Trade Credit Policies* discusses some topics about trade credit in Vietnam. *An Empirical Study on Customer Satisfaction: Banks in Malang City, Indonesia as an Example* discusses some determinants for customer satisfaction in Indonesia. *A Study of Grey VAR on Dynamic Structure between Economic Indicators and Stock Market Indices in the United States* discusses a dynamic framework between economic indicators and stock markets in USA. Each paper is worth reading.

Once again, we invite you to submit your paper to the YMC Management Review any time, and we hope to meet you in the iFAIRS conference every year in the future.

Editor-in-Chief

Alex Kung-Hsiung CHANG



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### Volatility Index and Trading Volume in the US Stock Market

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#### ABSTRACT

This paper investigates the effects of both level and variability of trading volume, a proxy of liquidity, on market return. The change in Volatility Index (VIX) significantly explains the percentage change in trading volume, but such effect only exists in high sentiment period. When the level of VIX during successive trading days is higher, the variability of trading volume during the same period is also higher. The noise traders add liquidity to the market and induce the variability of liquidity. As a result, the realized price impact of noise trader may be a combination of different kinds of impact. This consideration may help in explaining different findings among researches and provide an alternative approach to assess the impact of noise traders.

**Keywords:** *sentiment; trading volume; volatility*

## 1. Introduction

In the area of modern finance, perfect market and rationality are usually assumed. Underlying logic is then carried out to give insight into how the market works. However, the facts in reality may not be consistent with the assumptions. One major assumption which is always challenged by behavioral finance researchers is rationality of investors. Investors are found to be irrational and subject to various biases (e.g. Kahneman and Tversky, 1979). Traditionally, mispricing from irrational investors is considered to be heterogeneous and can be offset. Even though there is mispricing, it disappears quickly due to arbitrage. However, Kumar and Lee (2006) show that some irrational investors' trades are systematically correlated. Besides, investors could motivate trade among each others, which is known as "herd effect". Gleason, Mathur and Peterson (2004) use intraday data and find that herd effect exists in the U.S. stock market. Furthermore, arbitrage can be costly and risky. Irrational investors, or noise traders, play an important role in financial market. De Long, Shleifer, Summers and Waldmann (1990) show that the unpredictability of noise traders' belief can create systematic risk and place limit to arbitrage. The magnitude of price deviation from fundamental value is affected by the proportion of noise traders and the level of mispricing. As the noise traders could have positive return from the trend they "created", they may become stronger and lengthen the mispricing period. Arbitrageurs may not be willing to compete with noise traders due to finite horizon because they could lose their wealth before the price goes back to the fundamental value. Shleifer and Summers (1990) have a detail discussion about the possibility and influence of noise traders. Introducing investor sentiment may help to explain various financial market anomalies.

There are a number of papers to investigate the impact of noise traders or investor sentiment on the stock market. Brown and Cliff (2005) find that sentiment can predict overall market return and the performance of both large and small firms. Neal and Wheatley (1998) compare few sentiment proxies according to their predictive power on return difference between large and small firms. Close-end funds discount and net mutual fund redemptions have such predictive power. Baker and Wurgler (2006) investigate the effect of sentiment on cross-sectional stock returns. They find that small stocks, young stocks and stocks with high volatility are more subject to sentiment than others. During high sentiment period, these stocks are overpriced and thus generate relatively low subsequent return. Glushkov (2006) develops a sentiment beta for individual stocks. It is defined as the change in stock return with respect to the change in sentiment. Consistent with Baker and Wurgler (2006), he finds that stocks with higher sentiment beta are likely to be young, small and comprised of more unique risks than those stocks with low sentiment beta. Cornelli, Goldreich and Ljungqvist (2006) and Dorn (2009) investigate the effect of sentiment on IPO performance. They use grey market price to capture investor sentiment. High grey market price indicates optimism. Stocks that are aggressively bought, or with high price in grey market have high first day return but poor long run performance. Yu and Yuan (2011) find that investors' sentiment affects the risk-return tradeoff. Mean-variance tradeoff is lower during high-sentiment period and becomes higher during low-sentiment period. Lee, Jiang and Indro (2002) find that volatility increases when investors become more bearish and vice versa.

The impact of noise traders leaks out in different way. Black (1986) has a detailed discuss about the noise: "Noise makes financial markets possible, but also makes them imperfect. If there is no noise

trading, there will be very little trading in individual assets.” As noise traders should affect the market by trading, the trading volume is expected to have relationship with the noise. According to the traditional CAPM, systematic risk is the only factor in determining price. As market cannot be perfect, some fashionable variables are found to have explanatory power on return. One of such variables is liquidity (e.g. Pástor and Stambaugh, 2003). Generally, stocks with higher level of liquidity should have lower return. Besides, the second moment of liquidity can also affect return. Chordia, Subrahmanyam and Anshuman (2001) find that there is negative relationship between return and variability of liquidity which is measured by dollar trading volume and share turnover. This surprising finding is explained by Pereira and Zhang (2008). Since higher variation of liquidity provides chance for investors to time their trade, required returns are relatively lower.

Odean (1999) demonstrates that investors with discount brokerage account are overconfident and have excessive trading volume. Brown (1999) shows that small investors would like to trade by using close-end fund data when sentiment is extreme. Furthermore, Baker and Stein (2004) argue that liquidity could serve as a sentiment indicator. Noise traders are likely to be retail investors who are subject to short-sales constraint. If noise traders are bullish about the market, they can simply buy shares and these trades thus facilitate liquidity. However, if noise traders are bearish about the market, short-sales constraint keeps them out of the market. Kurov (2008) finds that trend chasing strategy adopted by noise traders is more active during high sentiment period and this increases market liquidity.

To the best of our understanding, no research investigates the effect of sentiment on the variability of liquidity so far. As mentioned before, noise traders affect stock market by trading. Their trading activities, which affect liquidity, can also affect price. Therefore, it is worth to know the effect of noise traders on both level and variability of trading volume. This paper attempts to investigate this issue and aims to provide a better understanding about the relationship between sentiment and trading volume. Sentiment proxy is developed to capture the noise or irrationality of investors. It can serve as a noise signal which may have some relationships with trading activity. The better understanding on such relationships may help to assess the impact of noise traders. The realized price impact imposed by noise traders may be composed of various parts - price deviation from fundamental value, additional risk they introduce and additional liquidity and variability they provide. The first two parts may increase rational investors' required return whereas the last one could have a contrary impact. Furthermore, this paper uses daily volatility index to proxy sentiment. Sentiment proxies used in previous studies are usually monthly or yearly measures which may take time to be collected. In contrary, daily volatility index can be obtained publicly. It enables practitioners to assess the impact of noise traders more effortlessly and frequently. The following sections are data and methodology and then empirical results. Conclusion follows.

## 2. Data and Methodology

Volatility Index (VIX) is used as the proxy to capture investor sentiment. VIX is firstly introduced by Whaley (1993) and the Chicago Board Options Exchange (CBOE) publishes VIX starting from 1993. The calculation method of VIX was changed in 2003. The original VIX represents the 30-day implied volatility of eight S&P 100 index options. In order to be closer to actual industry practices, since September 2003, VIX has been based on S&P 500 rather than S&P 100 index options because S&P 500 is the most widely used benchmark for the equity market in U.S. VIX used in this paper is downloaded from the CBOE website.<sup>1</sup> It measures the market's expectation of 30-day implied volatility and is often referred to as "investor fear gauge". The higher the VIX, the greater the fear is. Since noise traders are usually overconfident and over optimistic, they can be more aggressive than rational investors. Besides, noise traders are easily affected by various rumors or pseudo-signals. They may increase the volatility and the market expectation on future volatility, thus affect the performance of VIX. Therefore, VIX serves as the measure of noise signal in this paper.

Unlike asset pricing, there is no benchmark model for trading volume. Many factors are found to have influence on trading volume. Chordia, Roll and Subrahmanyam (2001) examine the determinants of daily change in trading activity. The determinants include market return related variables, short term interest rate, quality spread, term spread, weekday dummies, holiday dummy and GDP, unemployment rate and CPI announcement date dummies. These variables are included in our regression analysis to see if VIX has any additional explanatory power on trading volume. Trading volume of New York Stock Exchange (NYSE) is obtained from Datastream. Datastream's market return index is used to proxy the market return which defined as the percentage change of the return index. Interest rate related variables are downloaded from Federal Reserve website.<sup>2</sup> The announcement date of GDP and the announcement date of CPI and unemployment rate are obtained from Bureau of Economic Analysis and Bureau of Labor Statistics respectively.<sup>3</sup> All variables are on daily basis. To be included in the sample, data should be available for all variables in a specific trading day with positive trading volume.

The dependent variable of the first time series regression test is the daily percentage change of trading volume ( $\%\Delta VO$ ) and the explanatory variables are:

**$\Delta VIX$**  : daily change in VIX

**$MKT+$**  : market return at time  $t$  and equals to 0 if return is negative

**$MKT-$**  : market return at time  $t$  and equals to 0 if return is positive

**$MA5MKT+$**  : average return during  $t-1$  to  $t-5$  and equal to 0 if negative

**$MA5MKT-$**  : average return during  $t-1$  to  $t-5$  and equal to 0 if positive

<sup>1</sup> <http://www.cboe.com>

<sup>2</sup> <http://www.federalreserve.gov/econresdata/releases/statisticsdata.htm>

<sup>3</sup> <http://www.bea.gov> and <http://www.bls.gov> respectively



**MA5|MKT|** : average absolute return during t-1 to t-5

**ShortRate** : difference between Federal Fund Rate at t and t-1

**TermSpread** : daily change in the difference between the yield on 10-year Treasury bond and Federal Fund Rate

**QualitySpread** : daily change in the difference between the yield on Moody's Baa corporate bond and yield on 10-year Treasury bond

**Holiday** : 1 if a specific trading satisfies (1) if Independence Day, Christmas, or New Year's Day falls on a Friday, then the previous Thursday, (2) if any holiday falls on a weekend or on a Monday, then the following Tuesday, (3) if any holiday falls on another weekday, then the preceding and following days, and 0 otherwise.

**MON, TUE, WED, THU** : 1 if trading day is a Monday, Tuesday, Wednesday or Thursday respectively, and 0 otherwise.

**GDP(1-2), UNP(1-2), CPI(1-2)** : 1 on the two trading days prior to a GDP, unemployment or CPI announcement respectively, and 0 otherwise.

**GDP(0), UNP(0), CPI(0)** : 1 on the day of a GDP, unemployment, CPI announcement respectively, and 0 otherwise.

Except those dummy variables, all other six variables have been examined for stationarity before running time series regression. Stationarity matters since regression using non-stationary time series could result spurious relationship and misleading result. This paper employs both parametric test, augmented Dickey-Fuller (ADF) test, and non-parametric test, Phillips-Perron (PP) test, to test the null hypothesis of unit root. In both tests, all the six variables are stationary at the 1% significance level.<sup>4</sup>

In addition to the level of trading volume, this paper also examines the effect of sentiment on its second moment - the variability of trading volume. In literature, there is lack of study to investigate the determinants of the variability in trading volume. In our second test, the explanatory variables are modified based on the assumption that variables that can affect the level of trading volume can also affect the variability of trading volume. Thus, the dependent variable of the second test is the coefficient of variation (**CV(VO)**) which is calculated from trading volumes during t to t-4. The explanatory variables are:

**AVG(VIX)** : average VIX during t to t-4

**AVG(MKT+)** : average market return during t to t-4 and equal to 0 if negative

**AVG(MKT-)** : average market return during t to t-4 and equal to 0 if positive

**AVG(ShortRate)** : average ShortRate during t to t-4

**AVG(TermSpread)** : average TermSpread during t to t-4

**AVG(QualitySpread)** : average QualitySpread during t to t-4

**Holiday'** : 1 if there is holiday during t to t-4 and 0 otherwise

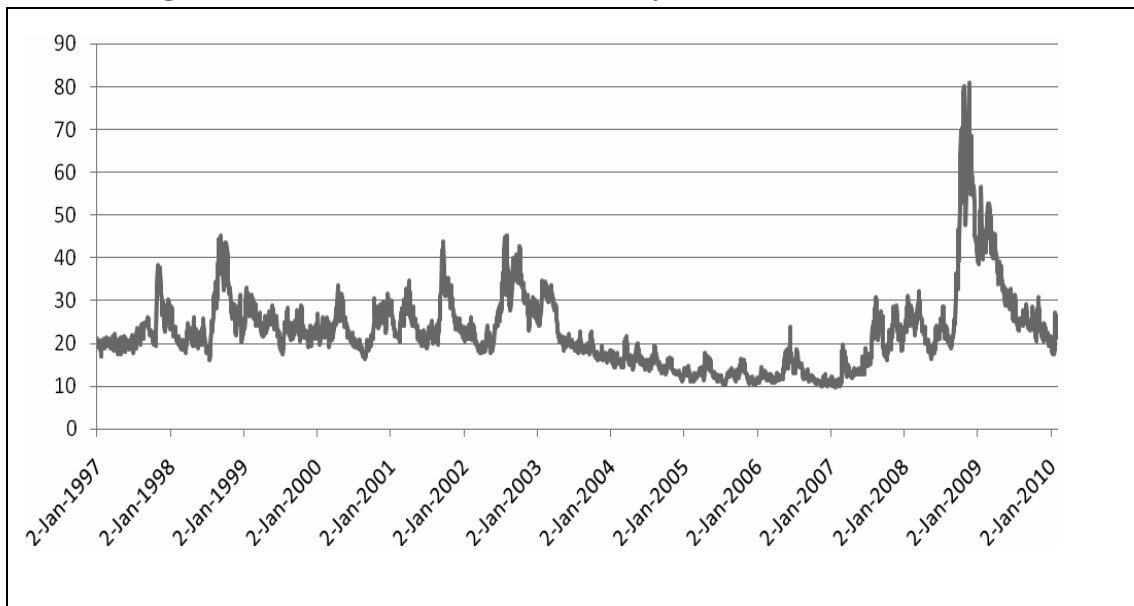
<sup>4, 5</sup> For the sake of brevity, the detailed statistical results are not reported here but available from the authors upon request.

**GDP, UNP, CPI** : 1 if there is GDP, unemployment or CPI announcement during  $t$  to  $t-4$ , respectively

Similar to the first regression test, except those dummy variables, all other five variables have been examined for stationarity by using both ADF test and PP test. The null hypothesis of unit root has been rejected at the 1% significance level for all the variables and thus they are stationary.<sup>5</sup>

Figure 1 below is the time series plot of VIX. VIX is consistently low throughout the period from 1997 to 2007, which includes the Asian crisis, the dot-com bubble and the SARS event. However, VIX around the 2008 financial crisis is extremely high. The result may be due to the development of online trading in the past few years. Most noise traders are likely to be small traders and retail traders. The popularity of online trading helps them to trade easily and frequently. Thus they are easier to assess the stock market and have greater influence (add higher volatility) on the market comparing to the past years.

**Figure 1 Time Series Plot of Volatility Index (VIX), 1997 - 2010**

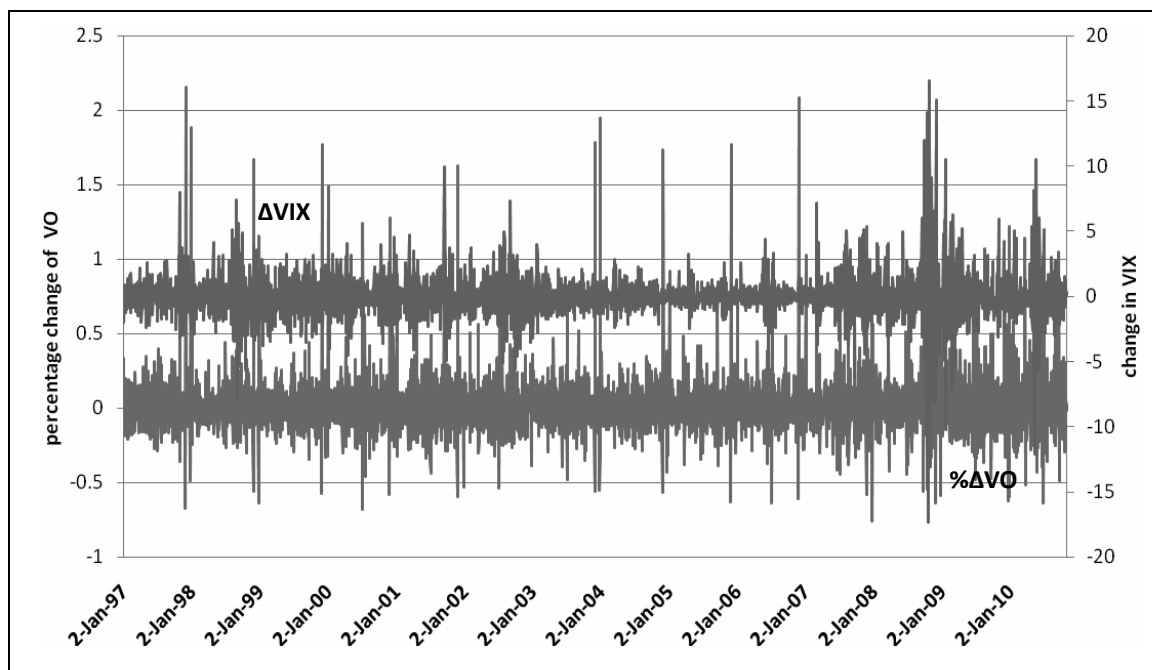


In order to test whether there exists asymmetric effect of sentiment on the trading volume, two sub-samples, namely low and high sentiment period are drawn from the whole sample period from January 1997 to December 2010. January 2005 to December 2005 is defined as low VIX period whereas July 2008 to June 2009 is defined as high VIX period.

### 3. Empirical Results

Figure 2 below is the time series plot of change in VIX and percentage change in trading volume. Both series exhibit some extreme large changes during the sample period. Change in VIX is relatively small during low sentiment period and large during high sentiment period. On the other hand, the swing of percentage change in trading volume does not vary much across time. The change in VIX has almost zero average, meaning that changes in VIX from time to time offset each other. The investor sentiment cannot persistently increase in the market. It may appear in the market temporarily. The realized VIX may be the sum of general level of VIX which is caused by market fundamental issues and the additional VIX imposed by noise traders. It is hard to observe any relationship between the two variables by simply observing the graph. The coefficient of correlation in Table 1 may highlight some ideas. The three coefficients of correlation are all positive. There is positive relationship between VIX and trading volume. Besides, the coefficient of correlation using high VIX period data (+0.2019) is higher than the other two. The positive relationship between VIX and trading volume is stronger during high VIX period.

**Figure 2 Time Series Plot of Change in VIX and Percentage Change of Trading Volume, 1997 - 2010**



**Table 1 Summary Statistics of  $\% \Delta VO$  and  $\Delta VIX$**

Summary statistics of the percentage change in trading volume and the change in VIX. Coefficient of correlation between them during the whole sample period, high VIX period and low VIX period.

	Mean	Median	Maximum	Minimum	Standard Deviation
$\% \Delta VO$	0.0185	0.0005	2.1552	-0.7604	0.2081
$\Delta VIX$	0.0001	-0.0800	16.5400	-17.3600	1.7080
Coefficient of Correlation ( $\Delta VIX$ & $\% \Delta VO$ )					
	Whole Period (1997/01 - 2010/12)	High VIX Period (2008/07 - 2009/06)	Low VIX Period (2005/01 - 2005/12)		
	0.1107	0.2019	0.1263		

**Table 2 Time Series Regression for Percentage Change in Trading Volume**

The dependent variable is the daily percentage change of trading volume,  $\% \Delta VO$ . The explanatory variables are:  $\Delta VIX$  : daily change in VIX;  $MKT+$  : market return at time  $t$  and equals to 0 if return is negative;  $MKT-$  : market return at time  $t$  and equals to 0 if return is positive;  $MA5MKT+$  : average return during  $t-1$  to  $t-5$  and equal to 0 if negative;  $MA5MKT-$  : average return during  $t-1$  to  $t-5$  and equal to 0 if positive;  $MA5|MKT|$  : average absolute return during  $t-1$  to  $t-5$ ;  $ShortRate$  : difference between Federal Fund Rate at  $t$  and  $t-1$ ;  $TermSpread$  : daily change in the difference between the yield on 10-year Treasury bond and Federal Fund Rate;  $QualitySpread$  : daily change in the difference between the yield on Moody's Baa corporate bond and yield on 10-year Treasury bond;  $Holiday$  : 1 if a specific trading satisfies (1) if Independence Day, Christmas, or New Year's Day falls on a Friday, then the previous Thursday, (2) if any holiday falls on a weekend or on a Monday, then the following Tuesday, (3) if any holiday falls on another weekday, then the preceding and following days, and 0 otherwise;  $MON$ ,  $TUE$ ,  $WED$ ,  $THU$  : 1 if trading day is a Monday, Tuesday, Wednesday or Thursday respectively, and 0 otherwise;  $GDP(1-2)$ ,  $UNP(1-2)$ ,  $CPI(1-2)$  : 1 on the two trading days prior to a GDP, unemployment or CPI announcement respectively, and 0 otherwise;  $GDP(0)$ ,  $UNP(0)$ ,  $CPI(0)$  : 1 on the day of a GDP, unemployment, CPI announcement respectively, and 0 otherwise.

Dependent Variable : % $\Delta$ VO								
Explanatory Variables	Panel A			Panel B			Panel C	
	Whole Period <sup>(a)</sup> (1997/01 - 2010/12) 3443 Observations			High VIX Period <sup>(b)</sup> (2008/07 - 2009/06) 250 Observations			Low VIX Period <sup>(c)</sup> (2005/01 - 2005/12) 250 Observations	
	Coefficients	<i>p</i> -value		Coefficients	<i>p</i> -value		Coefficients	<i>p</i> -value
$\Delta$ VIX	0.0279 ***	0.0000		0.0269 ***	0.0007		-0.0199	0.5123
MKT+	6.9513 ***	0.0000		5.7601 ***	0.0012		11.0057 **	0.0023
MKT-	-1.9560 *	0.0516		-0.0525	0.9799		-20.9593 **	0.0188
MA5MKT+	1.4763	0.3999		8.8393	0.1460		3.4678	0.7138
MA5MKT-	-0.8218	0.4282		-6.5810 ***	0.0015		6.7781	0.2811
MA5 MKT	-4.9120 ***	0.0000		-5.6677 ***	0.0001		-13.9890 **	0.0147
MON	-0.0419 **	0.0124		-0.1141	0.1681		0.0068	0.9208
TUE	0.1056 ***	0.0000		-0.0465	0.4614		0.1040 ***	0.0093
WED	0.0376 ***	0.0004		-0.0707	0.2902		0.0294	0.4065
THU	-0.0021	0.8473		-0.0536	0.3425		-0.0104	0.7814
Holiday	-0.1214 ***	0.0000		-0.1287	0.1433		-0.0664	0.3772
ShortRate	0.0031	0.9721		-0.6226 ***	0.0016		0.2305	0.4662
TermSpread	-0.0968	0.1802		-0.6039 ***	0.0004		-0.0926	0.6763
QualitySpread	0.1780	0.2408		0.0371	0.8812		0.4923	0.3754
GDP(1-2)	0.0163	0.2148		0.0161	0.6830		0.0905	0.2736
GDP(0)	0.0087	0.5289		0.0409	0.5237		-0.0471	0.1965
UNP(1-2)	0.0054	0.5636		-0.0334	0.3543		0.0162	0.4750
UNP(0)	-0.0371 ***	0.0060		-0.1084	0.1055		-0.0680 *	0.0877
CPI(1-2)	-0.0086	0.2423		-0.0410	0.3447		-0.0363	0.2486
CPI(0)	0.0603 ***	0.0000		0.0043	0.9227		0.0074	0.8444
Intercept	-0.0009	0.9401		0.0989	0.1452		-0.0197	0.6675
<i>F</i> -statistic	26.0096 ***	0.0000		3.3657 ***	0.0000		3.1180 ***	0.0000
<i>R</i> -squared	0.1320			0.2272			0.2140	
Adj. <i>R</i> -squared	0.1269			0.1597			0.1454	

\*\*\*, \*\* & \* denote coefficients significantly different from zero at 1%, 5% & 10%, respectively.

(a), (b) & (c) use 8-lag, 4-lag & 4-lag Newey-West standard errors, respectively.

Table 2 shows the first regression results for percentage change in trading volume as the dependent variable. In panel A, the coefficients of  $MKT+$ ,  $MKT-$ ,  $MA5MKT+$ ,  $MA5MKT-$  and  $MA5|MKT|$  are in expected sign.  $MA5|MKT|$  is used to investigate the impact of market volatility on the trading activity. Indeed, it is significant in all the three panels. Volatility is the factor that can significantly affect trading volume regardless the presence of controlled variables. In panel B,  $MKT+$  is positively significant whereas the  $MKT-$  is not significant. Thus it indicates that during high VIX period, the trading volume reacts fast only to the most recent positive market movement. However, the reaction to the negative market movement is relatively slow and reluctant, which is reflected by the significance of  $MA5MKT-$ . When there is a downward trend in the market return, the trading volume starts to decrease. Since noise traders are generally optimistic, they may react fast to the positive market movement and buy shares aggressively. On the other hand, they are reluctant when the market has negative return. They may sell stocks and realize the loss after the market exhibits an obvious decreasing trend. In panel C, both  $MKT+$  and  $MKT-$  are significant while both  $MA5MKT+$  and  $MA5MKT-$  are not significant. As the noise trader becomes the minority during low VIX period, the trading volume reacts fast to the recent market movement.

Comparing panels A and B, the weekday dummies, which are used to capture the systematic seasonal pattern in trading activity (see Chordia, Roll and Subrahmanyam, 2001), become not significant during high VIX period. As the noise traders play a significant role in the high VIX period, VIX is able to capture the trading pattern measured by the week day dummies. Besides, the macroeconomic announcement date dummies also become not significant in panel B. One potential explanation is that the effect of the macroeconomic announcement is grabbed by VIX.

After adding those explanatory variables that used in Chordia, Roll and Subrahmanyam (2001), VIX is still significant in panels A and B. If VIX increases, the percentage change in trading volume also increases. The result implies that more trades are associated with higher VIX. In the two sub-samples, the effect of VIX only exists during high sentiment period. As VIX can be viewed as the signal of noise, the result may imply that noise traders increase trading volume. When VIX is low, the noise traders are out of the market, or their role is not significant, VIX has less power in explaining the changing pattern of trading volume.

**Table 3 Time Series Regression for Coefficient of Variation of Trading Volume**

The dependent variable is the coefficient of variation calculated using trading volume during  $t$  to  $t-4$ , **CV(VO)**. The explanatory variables are : **AVG(VIX)** : average VIX during  $t$  to  $t-4$ ; **AVG(MKT+)** : average market return during  $t$  to  $t-4$  and equal to 0 if negative; **AVG(MKT-)** : average market return during  $t$  to  $t-4$  and equal to 0 if positive; **AVG(ShortRate)** : average ShortRate during  $t$  to  $t-4$ ; **AVG(TermSpread)** : average TermSpread during  $t$  to  $t-4$ ; **AVG(QualitySpread)** : average QualitySpread during  $t$  to  $t-4$ ; **Holiday'** : 1 if there is holiday during  $t$  to  $t-4$  and 0 otherwise; **GDP, UNP, CPI** : 1 if there is GDP, unemployment or CPI announcement during  $t$  to  $t-4$ , respectively.

Dependent variables : CV(VO) <sup>(d)</sup>		
Explanatory variables	Coefficient	<i>p</i> -value
AVG(VIX)	0.0010 ***	0.0048
AVG(MKT+)	1.2671 **	0.0370
AVG(MKT-)	-1.0086 *	0.0753
Holiday'	0.0556 ***	0.0000
AVG(ShortRate)	-0.2264 **	0.0170
AVG(TermSpread)	0.1286	0.1725
AVG(QualitySpred)	0.1469	0.3197
GDP	0.0111 **	0.0317
UNP	-0.0166 ***	0.0000
CPI	-0.0059	0.2108
Intercept	0.0885 ***	0.0000
F-statistic	44.0587 ***	0.0000
<i>R</i> -squared	0.1138	
Adj. <i>R</i> -squared	0.1112	

\*\*\*, \*\* & \* denote coefficients significantly different from zero at 1%, 5% & 10%, respectively.

(d) uses 8-lag Newey-West standard errors.

Table 3 shows the second regression results for coefficient of variation of trading volume as the dependent variable. The level of market return appears to be a determinant of the variability of trading volume. Better market performance is associated with larger variation in trading volume. The coefficient of AVG(VIX) is positive and significant as well. If the level of VIX over the successive trading days is higher, the variability of trading volume over the successive trading days also tends to be larger. Noise traders are usually uninformed. Their trade is based on noise or sentimental belief and is likely to be affected by various news or rumors. During high VIX period, the noise traders share a significant portion of investors. The induced trades are noise trading. The volatility of trading activity is likely to be induced by those noise trading. Their variable trading behavior may also affect the volatility in stock returns. Lee et al. (2002) find that stock market return volatility increases when investors become more bearish.



## 4. Conclusion

Level and variability of liquidity are found to significantly affect market return. Trading volume, as a proxy of liquidity, may be worth to be investigated. Noise traders could impose risks on price by deriving it from the fundamental value. Besides, as noise traders should affect price by trading, their trading behavior, captured by level and variability of trading volume, may also have effect on return. The change in VIX significantly explains the percentage change in trading volume, but such effect only exists in high sentiment period. Their correlation coefficient is positive, meaning that when VIX increases, trading volume also increases. The volatility of trading volume is also found to be positively related to the level of VIX. When the level of VIX during successive trading days is higher, the variability of trading volume during the same period is also higher.

On one hand, noise traders drive price deviation from fundamental value. Arbitrageurs or rational investors may require higher return for compensating the mispricing risk. On the other hand, noise traders also add liquidity and induce the variability of liquidity. Previous researches show that the increase in the level and/or variability in liquidity lower the required return. Therefore, the realized price impact of noise trader may be a combination of different kinds of impact. This consideration may help in explaining different findings among researches and provide an alternative approach to assess the impact of noise traders.

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# The Determinants of Trade Credit: Vietnam Experience

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## Management Implication

After the 2008 – 2009 global financial crises, the risk of overheating in emerging economies is warned and particularly noticed in the period of soaring inflation which threatens to the economic recovery. Especially, due to the fact that interest rate is not enough to offset high inflation, Vietnam is becoming the highest overheating economy in the world. Consequently, high inflation and lending interest rates seriously affected the operating performance of firms. Hence, in this period, firms must rely on and support each other for survival. Trade credit is one of best choice for enterprises, so it is essential to understand how the determinants affect trade credit. Actually, in the financial crises, a range of enterprises went bankrupt which lead to shut down or stop producing, so it led to reduce the demand for capital. Besides, a number of enterprises are ineligible to borrow capital from the banks or the high interest rate exceeds the profitability that firm can earn. As a result, trade credit has played an important rule in Vietnam economy.

## Abstract

Trade credit was born as an indispensable part of economic history. It marks a great step forward in production and circulation of currency as well as supports production process smoothly. The ongoing development of researches on trade credit channel is eloquent evidence for its need.

In the studies of Western countries, trade credit has an especially important role and can substitute for bank credit; yet, in developing countries where the financial system is still based on banking system such as Vietnam, China, trade credit cannot completely substitute for bank credit. However, by virtue of the prominently ongoing financial crisis and the tightening fiscal policies in recent years, the role of trade credit is increasingly emphasized. In particular, because Vietnam is a transition economy, and relies heavily on the banking system, the appearance of trade credit is considered one of the effective measures for business. Therefore, in the period of economic crisis, trade credit received special attention from firms. The thesis will concentrate on studying the determinants of trade credit in listed companies in both the Hanoi Stock Exchange and Hochiminh City Stock Exchange in Vietnam.

This study found that firms rely on cash holding and short-term debt and own financial sources to provide trade credit. However, because of high interest rate, therefore firms can not rely on EBIT to extend trade credit for customers and trade credit and short-term debt can be substituted.

**Keywords:** *Trade Credit, Bank Lending, Vietnam*

## 1. Introduction

In the last two decades, the world economy had to face the severe financial crises such as: the 1994 Mexican economic crisis, the 1997 Asian financial crisis and the 2007-2008 U.S financial crises. They rapidly spread around the world, worsened and hurted the global economy hard, specifically the decline in GDP of every single country. The World Bank reported that the Vietnam's real growth rate fell sharply from 8.5% in 2007 to 6.3% and 5.3% in 2008 and 2009 respectively. As the real GDP has decreased, the unemployment rate has increased. Also, the report said that the inflation rate of Vietnam is about 22.1% in 2008 and 20.9% in 2011, which is relatively high in the region. Since 2005 the State Bank of Vietnam has tightened monetary policy, namely the central bank raised the refinancing and discount interest rates, thereby kept inflation rate under control. The monetary policy was effective in slowing inflation down and encouraging economic growth; however, at the theoretical level, the monetary transmission mechanism studied that the tight credit policy made firms relying heavily on bank's loans difficult to borrow money to finance their business. Over the ten years since Vietnam's first stock market has been launched, Vietnam has successfully developed its capital market and turned them into effective fund to support the economy. However, due to the influence of global economic downturn on domestic economy in recent years and Vietnam's bank-based financial system, the SBV's monetary policy certainly affected enterprises' ability to access capital leading to the impact on performance and investment of businesses.

Nguyen et al. (2012) suggested that Vietnam's high-growth firms have heavily relied on bank financing, mostly short-term loans. The researchers show that large and state-owned enterprises have much easier access to bank loans thanks to the good relationship with banks. Nguyen and Ramachandran (2006) explored the capital structure of both unlisted and listed Vietnam's small and medium-sized enterprises (SMEs) have a high reliance on short-term financing through the banking sector which accounts for 43.9 % of total debt. According to General Statistics Office of Vietnam, Vietnam has 540.000 firms in 2012, including less than 1% of state-owned enterprises and 97% of small and medium-size enterprises (SMEs). Hence, most of them have difficulty in accessing the finance source.

Trade credit appears if suppliers allow delayed payment, so the payment period of purchase can be extended longer. Since Metlzer (1960) firstly pointed out that, enterprises have had difficulty in accessing bank loans, trade credit would become more important source for enterprises to maintain and develop businesses. Thus, nowadays, trade credit is increasingly being considered and paid much attention by the companies. Obviously, Vietnam's enterprises have recognized the importance and undeniable role of trade credit channel.

There are many investigations about trade credit in developed countries, for example, Love et al. (2007) examined how financial crises affected trade credit in six emerging countries. Historically, bank credit channel has played a very important role in providing capital for companies, yet most enterprises find it is hard to access finance, especially in current period. Thus, trade credit channel is one of the main research studies in recent years.

The paper provides an overview of Vietnam's economy and the development of the financial system. In addition, the main purposes of the thesis are to explore the role of trade credit in the listed Vietnam's firms, and examine how the factors influence on trade credit demand, thereby making trade credit channel the best way to effectively raise financial source of the firms which support the performance and competitiveness of enterprises.

## **2. Literature Review**

Trade credit is a kind of credit among firms, which is expressed in the form of goods purchase and sale and delay for payment. Trade credit is different from bank credit because object of trade credit for lending is goods whereas banking lending channel is currency. Therefore, in comparison with banking lending channel, it has advantage of saving time and dealing cost. Furthermore, due to its abstract, trade credit is preferable to use. It does not have to publicize their activities to the banks. Trade credit is clearly superior to bank credit to raise business capital and is very vital for firms which are lack of funds or have difficulty in accessing bank credit.

On the study of trade credit, Schwartz (1974), he raised a question that “Why do nonfinancial firms commonly participate in the process of financial intermediation by extending credit to their customers?” Also, the same question was asked by Petersen and Rajan (1994) “Why do industrial firms extend trade credit when more specialized financial institutions such as banks could provide finance?” Many authors suggest that trade credit is a critical source of short-term external finance of sellers providing to their customers (see Metlze [1960], Schwartz [1974], Smith [1987], Petersen and Rajan [1994] etc.). Elliehausen and Wolken (1993) indicated that 87% of firms in U.S offered trade credit. Antov and Atanasova (2007) argued that the investment in accounts receivable is over 34 percent of total assets in Spanish enterprises. The issues to clarify are that: Why do not suppliers place the excess funds into banks or make an investment plan? Why do not customers take loans from banks or financial institutions? What are the advantages of sellers to sell trade credit and customers to take trade credit?

Absolutely, suppliers have their own motivations to offer trade credit to their customers. According to Schwartz (1974), there are two reasons for offering trade credit. They are financial motivation and transactions costs motivation, but the author only emphasized on financial motivation. Smith (1987) argued that along with financial motivation there also exists pricing motivation. Accordingly, in this thesis, I focus on three main motivations: financing motivation, transactions cost motivation, operating and strategy motivation to investigate trade credit channel.

There are a substantial number of studies have investigated the determinants of trade credit. However, each economy has distinctive factors which affect trade credit. They may be the differences in financial structure or characteristics of the economy, or even the government policy and legislation etc. This study will present some different points of views on the factors that concern trade credit. Specially, I make use of two main researches: including the determinants of trade credit of SMEs in Europe, and the determinants of trade credit in transaction countries. The former study paid attention on three motivations: operational, commercial and financial perspectives of trade credit while by means of financial and commercial perspectives the latter one not only focused on the determinant of trade credit but also presented the analysis of the role and the effect of trade credit in transaction countries.

Firstly, in Table 1, it indicates determinants of trade credit of 47,197 SMEs in Europe (including Belgium, Finland, France, Greece, Spain, Sweden and UK) during the period of 1996-2002 by Garcia-Teruel and Martinez-Solano (2010) . They demonstrated that accounts receivable over assets are 39.28% in Spain, 35.42% in Belgium, 28.58% in UK, 25.70% in Sweden, 19.18% in Finland, and accounts payable over assets are 28.52% in France and 13.17% in Finland. It exhibited the differences of level about trade credit among these countries as well as proved that trade credit has been played a crucial role in firms.

**Table 1: The determinants of trade credit of SMEs in Europe (1996-2002)**

<i>Nation</i>	<i>Determinants of accounts receivable</i>		<i>Determinants of accounts payable</i>	
	Variables	Define	Variables	Define
Belgium				
Finland				
France	1. LSIZE	The size	1. LSIZE	The size
Greece		The age of the		The age of the
Spain	2. LAGE	company in	2. LAGE	company in
Sweden		years		years
UK	3. CFLOW	The cash flows generated by firm	3. PCFLOW	Positive cash flows generated
	4. STLEV	The short-term financing	4. NCFLOW	Negative cash flows generated
<i>Sector</i>				
Agriculture	5. FCOST	The cost of outside financing	5. STLEV	Short-term finance
Mining				
Manufacturing	6. PGROWTH	The positive sales growth	6. FCOST	Cost external financing
Construction	7. NGROWTH	The negative sales growth	7. PGROWTH	Positive sales growth
Retail trade				
Wholesale trade	8. TURN	The assets turnover	8. NGROWTH	Negative growth
Transport and public			9. TURN	Assets turnover
Services			10. GPROF	Gross profit margin

Source: García-Teruel and Martínez-Solano (2010)

Secondly, referring to the determinant of trade credit in transaction countries, this thesis realized that there are some common characteristics between these countries and Vietnam. Most of the firms have a limited access to bank credit, except for large firms. Furthermore, the financial market has been developed at early stage, and securities market has been recently established, so the financial operation still remains relatively poorly. Accordingly, it finds hard for firms to raise capital effectively. Also, the article suggested that the trade credit would be used to prevent enterprise bankruptcy. Table 2 shows the determinants of trade credit of 9300 companies in nine Central and Eastern European Countries over the period 1999-2000.

**Table 2 : The determinants of trade credit in transition countries (1999-2000)**

<i>Nation</i>	Determinants of accounts receivable		Determinants of accounts payable	
	Variables	Define	Variables	Define
Bulgaria	1. ASSETS	Total assets	1. ASEETS	Total assets
Czech Republic				
Estonia	2. PROFIT	The ratio of profit before tax to turnover	2. PROFIT	The ratio of profit before tax to turnover
Hungary				
Lithuania	3. GROWTH	The growth rate of turnover	3. GROWTH	The growth rate of turnover
Latvia				
Poland	4. LEVERAGE	The ratio of short-term bank loans to total assets	4. EQUITY	The ratio of equity to total assets
Romania				
Slovakia	5. INDUSTRY		5. INDUSTRY	
<i>Sector</i>				
Wholesale trade				
Retail trade				
Manufacturing				
Building				
Agriculture				
Other services				

Source: Delannay and Weill (2004)



### 3. Theory and Hypotheses

Trade credit exists on both sides of the annual balance sheet. In the sellers' balance sheet, it is considered as accounts receivable while in buyers' balance sheet trade credit is accounts payable. Ginanetti and Burkart (2004) said that "What you sell is what you lend"; in other words, both accounts receivable and accounts payable are two main dependent variables for a company. In this article, the Ginanetti and Burkart (2004) suggests some hypotheses based on the theories in chapter two to present the closed relationship between the two dependent variables and other independent variables in financial statement.

This article based on the motivations for the use of trade credit that mentioned in chapter 2 to determine the affecting the trade credit. Based on financial motivation, this study uses three independent variables including firm's size, short-term debt and equity. Based on transactions costs motivation, two independent variables include inventory and cash are determined. Earnings before interest and tax (EBIT) is defined to as operating profit, therefore based on operation motivation, it is referred to as a independent variable. According to strategy motivation, net sales are defined as an independent variable.

Firstly, we estimate the impact of CASH variables on account receivable. The variable cash is measured by cash and cash equivalent. Wu et al. (2011) found that both accounts receivable and accounts payable had intensive influence on firms' cash holdings. In fact, accounts receivable is being used as a cash alternative. Therefore, there will be a negative correlation between cash holdings and accounts receivable. Wu et al. (2011) investigated the links between trade credit and cash holdings in Chinese listed firms. They found that "firms hold an additional \$0.71 of cash for every \$1 of credit payable". In reality, trade credit is intercompany loans, but it is also used to keep some cash to pay for upcoming credit obligations. Wherefore, we should expect a positive relationship between cash and accounts payable.

*H1: There will be a negative correlation between cash holdings and accounts receivable.*

*H2: We should expect a positive relationship between cash holdings and accounts payable.*

The establishment of HOSE and HNX may have changed the credit behavior of the firms. The variable EQUITY is defined as total shareholders' equity which is total assets minus total liabilities; in other word it is the amount of cash a company own. Firms can depend on their own access to finance their customers, so it may be a positive signal to account receivables.

*H3: There will be a positive relationship between equity and accounts receivable.*

Myers (1984) developed the pecking order theory to explain the factors affecting the capital structure of individual firm. This theory is based on the cost of budgetary sources to decide the financial choices. Internal funds are the first option of companies because they do not have to pay any costs and interests. Secondly, it is the debt issuance. Finally, equity issuance is the most expensive cost. Accordingly, firms prefer to utilize trade credit rather than equity issuance. This study examined about listed company in Vietnam, therefore, the increasing of equity will increase of firm's size. As the thesis mentioned above, large firms have advantages to take trade credit from their customers. Positive relationship may be expected.

*H4: Positive link between equity and accounts payable may be observed.*

According to Petersen and Rajan (1997), trade credit is not only regarded as a tool to promote sales but also presents the quality of firms' goods. In the financial statement, NET SALES of a firm is generated after the deduction of returns (net sales revenue is equal gross sales revenue minus sale return or discounts). Therefore, it be should expected the positive relation between net sales and accounts receivable.

*H5: It should be expected the positive relation between net sales and accounts receivable.*

The variable INVENTORY perhaps has a negative influence on accounts receivable. Matueta et al. (2011) has pointed out that holding inventories make firms bear opportunity costs and carrying costs. Suppliers, in addition, face with the uncertainty of demand. Therefore, suppliers extend trade credit to avoid paying more costs.

*H6: There will be a negative correlation between inventory and accounts receivable.*

In financial statement, inventory is an asset, accounts payable is called the current liability. The financial balance sheet shows the equal of assets and liabilities, thus the assets increase so does the liabilities.

*H7: There will be a positive correlation between the accounts payable and inventory.*

SIZE is measured by total assets. Long et al. (1993), Petersen and Rajan (1997) employed total assets to measure the size of firms. It is easy for large firms with their reputation to receive the support from banks. As mentioned in the theory of chapter 2, large firms which act like financial intermediaries have distributed financial resources to customers, so it is generally considered as a positive link between size and accounts receivable. Meltzer (1960) firstly studied about the relationship between trade credit and firms' size. He showed that small firms which do build a reputation and market position often provide trade credit in order to ensure the quality of goods. As a result, large firms also have the opportunity to

receive trade credit. Thus, this study should examine a positive signal between size and accounts payable.

*H8: The correlation can be positive between size and accounts receivable.*

*H9: The correlation can be positive between size and accounts payable.*

In terms of short-term debt (STD), suppliers offering trade credit is actually viewed as the second layer of financial intermediaries. It is proved that firms with short-term bank loans would prefer to provide trade credit for other firms, so a positive relationship may be observed. On other hand, hidden cost of trade credit seems more expensive than the cost of bank credit. Hence, small businesses which have a limited access to bank credit will receive more trade credit from suppliers. We would observe a negative signal between STD with accounts payable.

*H10: There will be a positive correlation between short-term debt and accounts receivable*

*H11: There will be a negative relationship between STD and accounts payable.*

Finally, it is the variable EBIT which is earnings before tax and interests. Earnings before tax and interests is called operating profit, so it measure a firm's profit before pay interest and income tax are expended. The main purpose of every enterprise is to maximize value, so enhancing higher net profit margin is the driving force to offer trade credit. Firms with high profitability are able to be the potential customers of banks, thus high profit is considered as a positive signal for the banks. Consequently, the relationship of profit and accounts payable is regarded as a negative signal.

*H12: There is a significantly positive correlation between EBIT and accounts receivable.*

*H13: There is a negative relationship of EBIT and accounts payable.*

## **4. Data and Methodology**

### **4.1 Data**

This paper uses the data from the annual balance sheets of 300 Vietnamese non-financial listed companies in both Hanoi Stock Exchange (HNX) and Hochiminh City Stock Exchange (HOSE) in the period from 2005 to 2012. The source of the data is extracted from Datastream.

### **4.2 Methodology**

The paper uses two main dependent variables: accounts payable and accounts receivable and some other independent variables above to specify how the determinants affect trade credit demand and supply in firm  $i$  at time  $t$ . Regression models are presented as equation (1) and equation (2).

$$AR_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 EBIT_{i,t} + \beta_3 EQUITY_{i,t} + \beta_4 NETSALES_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 STD_{i,t} + \beta_7 INVENTORY_{i,t} \quad (1)$$

$$AP_{i,t} = \alpha + \beta_1 CASH_{i,t} + \beta_2 EBIT_{i,t} + \beta_3 EQUITY_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 STD_{i,t} + \beta_6 INVENTORY_{i,t} \quad (2)$$

## 5. Empirical Results

### 5.1 Pearson's Correlation Coefficient

In this study, Pearson's correlation coefficient is used to analyze the relationship between the independent variables. The correlation exists between two variables with values ranging from +1 to -1. If value is in the range from 0 to 0.3 or -0.3, it shows a weak positive or negative linear relationship, then values from 0.3 to 0.7 or from -0.3 to -0.7 indicate a moderate positive or negative linear relationship, the other values between 0.7 and 1.0 or -0.7 and -1.0 show a strong positive or negative linear relationship.

Table 3 shows the values range between about 0.4 and 0.9. The correlation coefficient between EBIT and INVENTORY is 0.473. As a result, it indicates a moderate positive link between these two independent variables. The highest correlation coefficient is 0.905 of SIZE and STD which shows the very strong relationship between SIZE and STD. It can be seen that the correlation of the whole variables in this study is very strong positive because there are no negative relationships at all.

Table 3: Correlation Matrix

	ACCOUNTS PAYABLE	ACCOUNTS RECEIVABLE	SIZE	CASH	EBIT	INVENTORY	EQUITY	NET SALES	SHORT-TERM DEBT
ACCOUNTS PAYABLE	1								
ACCOUNTS RECEIVABLE	,882**	1							
SIZE	,875**	,900**	1						
CASH	,783**	,806**	,814**	1					
EBIT	,671**	,600**	,671**	,600**	1				
INVENTORY	,729**	,743**	,875**	,558**	,473**	1			
EQUITY	,801**	,845**	,876**	,789**	,666**	,698**	1		
NET SALES	,878**	,897**	,867**	,843**	,688**	,643**	,862**	1	
SHORT-TERM DEBT	,753**	,840**	,905**	,657**	,507**	,890**	,781**	,773**	1

## 5.2 Empirical Results

In this paper, we use the regression analysis to investigate the determinants of trade credit in Vietnam over the period from 2005 to 2012. Accordingly, there are results of accounts receivable and accounts payable regression models as Table 4 and Table 5.

Table 4 demonstrates the relationship between the dependent variable accounts receivable and independent variables: cash, EBIT, equity, net sales, STD, size, inventory. The results show that all independent variables are significant to accounts receivable; especially variables such as cash, equity, net sales, STD, size are positive significance to accounts receivable.

Firstly, the paper hypothesizes that cash is negative significance to accounts receivable, but the result does not support these hypothesis. The data indicates that one unit increase of cash subject will lead to the amount of accounts receivable increasing by 0.0755. According to the theories mentioned in chapter two, accounts receivable is considered short-term assets to suppliers. Therefore, accounts receivable also is regarded as a substitution for cash holding.

In the usual manner, it is possible for firms depending on financial or debt to expand trade credit for customers. However, there are still some firms extending trade credit because of operating motivation. With relation to the above results, independent variables such as equity, net sales and STD have positive effect on accounts receivable. It can be seen that these results support the hypotheses. As calculated, one unit increase of each independent variable is equivalent to accounts receivable by 0.478, 0.098 and 0.147 unit respectively. Thus, these results are consistent with this study and expectation theories.

However, we can see that there is a huge negative link between EBIT and accounts receivable. This can be explained by high interest rate and high tax which every firm have to pay. Firms have used financial source from banks to provide trade credit, so firms have to employ EBIT to cover high interest rate.

Firm's size has a significantly positive effect on accounts receivable. This finding is also support the theory offered by Meltzer (1960) and the hypothesis expected in the study. It is easier for large firms to get access to financial source from banks than small firms because they have large assets to ensure, so large firms usually act as financial intermediaries to redistribute financial resources through trade credit.

**Table 4: Results of the determinants of accounts receivable**

<i>Independent Accounts Receivable</i>	<i>Expected Relation</i>	<i>Coefficient</i>	<i>P-value</i>
CASH	(-)	0.0755	0.0001
EBIT	(+)	-0.2456	0.0000
EQUITY	(+)	0.0478	0.0006
NETSALES	(+)	0.098	0.0000
STD	(+)	0.147	0.0000
SIZE	(+)	0.0512	0.0000
INVENTORY	(+)	-0.018	0.2121
R-square		0.875	
Adjusted $R^2$		0.875	

**Notes:** CASH is measured by cash and cash equivalent. EBIT is earnings before tax and interests. EQUITY is defined as total shareholders' equity. NET SALES is equal gross sales revenue minus sale return or discounts. SIZE is measured by total assets. STD includes all debt having an original maturity of one year or less. INVENTORY is measured as total amount of goods or materials in store.

The results of the determinants for accounts payable are presented in Table 5. It estimates the impacts of cash, EBIT, equity, STD, size, inventory on accounts payable. According to the Table 5-3, cash has a positive effect on accounts payable. This provides support to the hypothesis of the relationship between cash and accounts payable. Firms hold cash because of its certainly ongoing obligations.

The results report EBIT present a positive sign and an essential influence on accounts payable while STD is significantly negative with accounts payable. It indicates that STD and trade credit can be substituted. According to trade credit theory, hidden cost in trade credit is considerably more expensive than bank interest rate. However, Vietnam is currently in the economic situation of high inflation and high interest rate, enterprises tend to select trade credit as an alternative choice.

The result of the coefficient of equity and size indicates a positive sign to accounts payable. Raising one unit of equity and size will lead to the increase in account payable by 0.274 and 0.064 respectively.

It can be seen that in relation with accounts payable, there are mainly positive correlations. Hence, the hypotheses in this study are strongly supported.

**Table 5: Results of the determinants of accounts payable**

<i>Independent accounts payable</i>	<i>Expected Relation</i>	<i>Coefficient</i>	<i>P-value</i>
CASH	(+)	0.169	0.0000
EBIT	(-)	0.274	0.0000
EQUITY	(+)	0.0429	0.0009
STD	(-)	-0.071	0.0000
SIZE	(+)	0.064	0.0000
INVENTORY	(+)	0.050	0.0001
R-square		0.792	
Adjusted $R^2$		0.792	

**Notes:** CASH is measured by cash and cash equivalent. EBIT is earnings before tax and interests. EQUITY is defined as total shareholders' equity. SIZE is measured by total assets. STD includes all debt having an original maturity of one year or less. INVENTORY is measured as total amount of goods or materials in store.

## 6. Conclusions

This study investigates the determinants of trade credit in 300 listed companies in Vietnam stock market over the period from 2005 to 2012. As a result, there are both positive correlations and negative correlations between independent variables and accounts receivable as well as accounts payable.

It can be seen that trade credit is not only a financial source which suppliers make use of to support their customers but also a promotional tool boosting total sales growth. Also, it found that firms with laid-up cash, short-term debt tend to extend trade credit. However, EBIT is variable which does not support accounts receivable. It can be explained that high interest rate (eg. The lending interest rate is 17% in 2007 in Vietnam) makes firms under pressure to pay interest. Accordingly, firms prefer to receive trade credit from supplier rather than banks.

Besides, the scale of enterprise is a positive signal to both accounts receivable and accounts payable. In particular, large firms usually redistribute financial resources through trade credit; also they concurrently use their power to receive trade credit from small firms.



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**YMC Management Review****Volume 6, No. 1, 2013 p.p 31-52****An Empirical Study on Customer Satisfaction: Banks in Malang City, Indonesia as an Example**

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**ABSTRACT**

The banking sector requires finding the right strategy in providing Customer Satisfaction and increase Customer Loyalty. Based on previous empirical researches, this study emphasizes the importance of Relationship Management (CRM), Innovation Capability, Corporate Image, Corporate Social Responsibility (CSR), and Ethical Behavior as the antecedents of Customer Satisfaction. Data were collected from 400 customers of Bank in Malang City, East Java, Indonesia and analyzed by using Structural Equation Model (SEM). The major findings include first, Customer Relationship Management (CRM) have significant effect on Customer Satisfaction. Second, Innovation Capability has significant effect on Customer Satisfaction. Third, Corporate Image has significant effect on Customer Satisfaction. Fourth, Corporate Social Responsibility (CSR) has significant effect on Customer Satisfaction. Fifth, Ethical Behavior has significant effect on Customer Satisfaction. And sixth, Customer Satisfaction has significant effect on Customer Loyalty.

**Keywords :** *Customer Relationship Management (CRM), Innovation Capability, Corporate Image, Corporate Social Responsibility (CSR), Ethical Behavior, Customer Satisfaction, Customer Loyalty.*

## 1. Introduction

In line with the development of the world of marketing that makes the level of competition among the companies in Indonesia becomes higher, therefore, that particular company tries to strengthen more on the marketing strategy. In fact, besides the tight competition among the companies, the focus of business changes from the product centric to the customer centric. Getting new customers and loyalties—those two become the most important thing to keep the bank existence. Moreover, a strategy is needed to get customers' loyalty, Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior as a workable business strategy is very appropriate to apply by a company to satisfy its customers and create loyalty (Padmavathy, et al. 2012), Nemati, et al. 2010), Tu, et al. 2012), Walsh & Bartikowski, 2011), and Lee, 2012). The creation of the client's or customer's satisfaction can make the relationship between the service provider and the customer is harmonious. After that, it can create the customer's loyalty and finally it can give more profits to the company.

Sheth, et al. (2008) suggested that CRM refers to a comprehensive strategy and process of acquiring, retaining, and partnering with selective customer to create superior value for the company and the customer. The research conducted by Padmavathy, et al. (2012) show that CRM have positive effect on Customer Satisfaction and Customer Loyalty. Martinez (2008) cited Innovation Capability as the ability to continuously transform knowledge and ideas into new products, processes and system for the benefit of the firm and its stakeholder. Weng, et al. (2012) suggests that higher customer satisfaction arise when the customers perceive higher customer value and higher service innovation. According to Daft, et al. (2010) CSR as management's obligation to make choices and take actions that will contribute to the welfare and interests of society as well as the organization. Luo & Bhattacharya (2006) investigate the relationship of Corporate Social Responsibility, Customer Satisfaction, and Market Value. They found that in firms with low innovativeness capability, CSR actually reduces customer satisfaction levels and, through the lowered satisfaction, harms market value. Zepf (2008) defined Corporate Image as the overall impression an organization has made on people's minds, the sum of beliefs, attitudes, and impressions that a person or group has of an object. The research by Andreassen & Lindestad (1998) state that for complex and infrequently purchased services, corporate image rather than customer satisfaction is the main predictor of customer loyalty. According to Griffin (2008) Ethical behavior is an individual's personal beliefs about whether a behavior, action, or decision is right or wrong. The study conducted by Mulki & Jaramillo (2011) show that ethical perceptions about the organization amplify the impact of customer value on customer satisfaction and eventually loyalty.

The present study emphasizes the importance of antecedents that affect Customer Satisfaction and Customer Loyalty. First, this study examines the impact of CRM on Customer Satisfaction. Second, the impact of Innovation Capability on Customer Satisfaction. Third, the impact of Corporate Image on Customer Satisfaction. Fourth, the impact of Corporate Social Responsibility (CSR) on Customer Satisfaction. Fifth, the impact of Ethical Behavior on Customer Satisfaction. And sixth, the impact of Customer Satisfaction on Customer Loyalty. Limited study conducted to Customer of Bank in Malang City, East Java, Indonesia. The present study contributes to fulfill this research gap.

## 2. Literature Review

Based on previous research, there are 11 construct that affect customer satisfaction, such as Customer Relationship Management (CRM), Innovation Capability, Corporate Image, Corporate Social Responsibility (CSR), Ethical Behavior, Customer Value, Customer homogeneity, Citizenship behavioral, Interactional fairness, Positive affect (PA), and Causes of agency problem (Padmavathy, et al. 2012), Nemati, et al. 2010), Tu, et al. 2012), Walsh & Bartikowski (2011), Spiteri & Dion (2004), Wu (2007), Yi, et al. (2011), Namkung & Jang (2009), Noyan & Simsek (2011), and Lee (2012). Among the five construct such as Relationship Management (CRM), Innovation Capability, Corporate Image, Corporate Social Responsibility (CSR) and Ethical Behavior, no research has been done before that using those five construct together in their research regarding with the relationship of those five construct on customer satisfaction, especially the research in Indonesian banks, they only use one or two among the five construct, it does have an impact on the contribution of research, which only informs the importance of the construct they have been examined, In this research, these have been conceptualized under five main constructs, the researchers conceptualized five constructs together to obtain the more comprehensive information and deeper research contributions concerning with the fifth construct on relationship with Customer Satisfaction and Customer Loyalty.

### 2.1 Theory and Hypothesis

#### 2.1.1 Customer Relationship Management (CRM) and Customer Satisfaction

According to Goldenberg (2008) CRM is integrates people, process, and technology to maximize relationships with all customers. Base on the previous researches, the definition of CRM will be a comprehensive strategy, process, integrates people, and technology of acquiring, retaining, partnering with selective customer to create superior value for the company and the customer and to maximize relationships with all customers.

The researches carry out by Padmavathy, et al. (2012), and Ata & Toker (2012) found Customer Relationship Management has a significant and positive effect on Customer Satisfaction. Ata & Toker (2012) identify CRM as one of the factors accounting for relationship marketing success. Relationship building programs can be supported by technologies such as CRM systems that allow the organization to gain an insight into the behavior of individual customers as well as to generate data concerning those customers. Sivaraks, et al. (2011) this research examines and measures the outcomes of electronic customer relationship management (e-CRM) system implementation in the Thai banking industry from customers' perspectives. The results show that e-CRM implementation has a statistically significant positive relationship with customer-based service attributes and with the quality and outcome of customer-bank relationships as well as an indirect effect on relationship quality and outcome through customer-based service attributes. Base on the previous research this paper proposes hypothesis as following:

**Hypothesis 1:** Customer Relationship Management has a significant and positive effect on Customer Satisfaction.

### 2.1.2 Innovation Capability and Customer Satisfaction

Terziovski (2007) defined innovation as the application of resources to create value for the customer and the enterprise by developing, improving and commercializing new and existing products, processes and services. Base on the previous researches, the definition of Innovation Capability will be a capacity of organization to create new idea, process, product and service successfully.

The researches carry out by Simon & Yaya (2012) and Eng (2011) found that Innovation Capability has a significant and positive effect on Customer Satisfaction. Simon & Yaya (2012) cited that innovative means that organizations are creating something new to increase their customer share and to satisfy their needs. Because innovation means coming up with something unique and different from competitors, it should result in a positive customer experience. Weng, et al. (2012) this study to explore customer satisfaction in relation to service innovation and customer value. The results of this study indicate that both service innovation and customer value have significant positive correlations with customer satisfaction and that service innovation has a significant intervening (or moderating) effect on the relationship between customer value and customer satisfaction. It suggests that higher customer satisfaction arise when hotel customers perceive higher customer value and higher service innovation. Base on the previous research this paper proposes hypothesis as following:

**Hypothesis2:** Innovation Capability has a significant and positive effect on Customer Satisfaction.

### 2.1.3 Corporate Image and Customer Satisfaction.

Zepf (2008) defined Corporate Image as the overall impression an organization has made on people's minds, the sum of beliefs, attitudes, and impressions that a person or group has of an object. Base on the previous researches, the definition of Corporate Image will be all about the experiences, beliefs, feelings, knowledge, impressions and perceptions of the corporate brand among those external to the organization and, in particular, its customers.

The researches carry out by Tu, et al. (2012) and Bloemer, et al. (1998) found that Corporate Image has a significant and positive effect on Customer Satisfaction. Andreassen & Lindestad (1998) cited that Corporate Image is established and developed in the consumers' mind through communication and experience. Corporate image is believed to create a halo effect on customers' satisfaction judgment. When customers are satisfied with the services rendered, their attitude toward the company is improved. This attitude will then affect the consumers' satisfaction with the company. In this article the researcher treat corporate image as an accumulated attitude (experience based or not) towards the company. Gan, et al. (2011) this study identifies and examines the factors influencing

bank customers' satisfaction in the New Zealand banking industry. The relationship between bank customers' overall satisfaction and influential factors such as corporate image and price (fees charged) is also investigated. The results of this study indicate that service quality has the most influence on bank customers' satisfaction compared to value and corporate image. The results also provide support for the moderating effect of value on the relationship between service quality and customer satisfaction, and the moderating effect of corporate image on the relationship between the service quality dimensions identified in this study and service quality. In addition, the results also reveal that demographic variables (age, income, and occupation) are also significant in explaining bank customers' satisfaction in the New Zealand banking sector. Base on the previous research this paper proposes hypothesis as following:

**Hypothesis 3:** Corporate Image has a significant and positive effect on Customer Satisfaction.

#### 2.1.4 Corporate Social Responsibility (CSR) and Customer Satisfaction

Daft, et.al. (2010) CSR is management's obligation to make choices and take actions that will contribute to the welfare and interests of society as well as the organization. Base on the previous researches, the definition of Corporate Social Responsibility (CSR) will be a concept that organizations/managements have an obligation to consider, make choices and take actions that will contribute to the interests of customers, employees, shareholders, communities, and ecological considerations in all aspects of their operations management's obligation to make choices and take actions that will contribute to the welfare and interests of society as well as the organization.

The researches carry out by Walsh & Bartikowski (2012) and McDonald & Thiele (2008) found that CSR has a significant and positive effect on Customer Satisfaction. Walsh & Bartikowski (2012) cited that when customers perceive that "their" firm engages in socially responsible behavior, they form positive images that increase organizational identification and positively affect related outcomes. That is, customers should be more satisfied when they hold positive CSR associations, because they develop a sense of connection with the firm. Greater satisfaction in turn translates into improved word-of-mouth behavior, suggesting that satisfaction mediates CSR-word of mouth relationships. Alafi & sufy (2012) this study has three objectives. First is to investigate the set of relationships among the corporate social responsibility (CSR) services and customer satisfaction (CS); second is to find the relationships between CSR services and financial performance (FP); and third is to examine the mediating effect of customer satisfaction on CSR services and financial performance. The results of this study suggested provision of CSR services is associated with CS. Furthermore, this study found customer satisfaction mediated the relationship between the CSR services and FP. Base on the previous research this paper proposes hypothesis as following:

**Hypothesis 4:** Corporate Social Responsibility (CSR) has a significant and positive effect on Customer Satisfaction.

### 2.1.5 Ethical Behavior and Customer Satisfaction.

Griffin (2008) ethics as an individual's personal beliefs about whether a behavior, action, or decision is right or wrong. Base on the previous researches, the definition of Ethical Behavior will be a set of moral principles prescribing a behavior, rules, or standards governing a person or a profession that can explain what is good and right or bad and wrong that prescribe what humans ought to do, usually in term of duties, principles, specific virtues, or benefit to society.

The researches carry out by Mulki & Jaramillo (2011) and Lee (2012) found that Ethical Behavior has a significant and positive effect on Customer Satisfaction. Thomas, et al. (2002) cited that is a customer will consider the behavior of a retailer as ethical if it meets or exceeds the moral/ethical norms that are expected by that customer relative to the particular retail environment in question. If the customer's ethical expectation is supported and reinforced, then it will positively affect the customer's overall satisfaction with the transaction. If not, the customer's overall satisfaction will likely be negative. Roman & Munuera (2005) the main purpose of this research is to gain a clearer understanding of several key determinants and consequences of the ethical behavior of salespeople. Results suggest that method of compensation and control system (CS) are important determinants of ethical behavior. Age (AGE) also proves to be a significant antecedent of ethical behavior. However, education (EDU) is not significantly related to ethical behavior. Additionally, a salesperson's ethical behavior leads to lower levels of role conflict-interceder and higher levels of job satisfaction, but not higher performance. Lee (2012) this study is to investigate real estate agents' relationships with buyers and sellers. The results indicate that: causes of agency problems can positively affect ethical sales behavior and real estate agent service quality; real estate agents' improved ethical sales behavior can reduce customer complaint behavior and have a positive effect on customer loyalty; real estate agent service quality has a positive effect on customer satisfaction; and customer satisfaction has both a negative effect on customer complaint behavior and a positive effect on Customer Loyalty. Base on the previous research this paper proposes hypothesis as following:

**Hypothesis 5:** Ethical Behavior has a significant and positive effect on Customer Satisfaction.

### 2.1.6 Customer Satisfaction and Customer Loyalty.

Chou, et al. (2009) Customer satisfaction is measure of the organization's total product performance with respect to customer expectations (consisting of both formal and informal requirement). Base on the previous researches, the definition of Customer Satisfaction will be a comparison between products perceived with that predicted before it was purchased or consumed. Egan (2007) loyalty is unspecified number of repeat purchases from the same supplier over a specified period. Type of loyalty includes behavioral, attitudinal. Base on the previous researches, the definition of Customer Loyalty will be a deeply held feeling of commitment on the part of the consumer to a product, brand, marketer, services or organization above and beyond that for the competitors in the



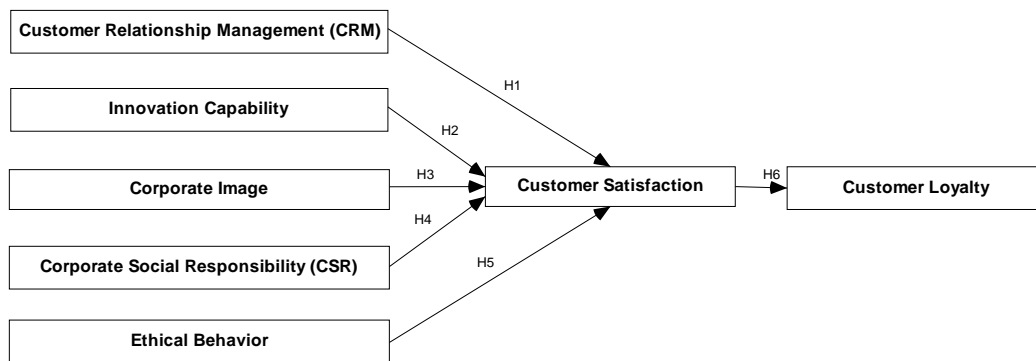
market-place, which results in repeat purchase.

The researches carry out by Wu & Wang (2012) and Yap, et al. (2012) found that Customer Satisfaction has a significant and positive effect on Customer Loyalty. Casalo, et al. (2008) cited that a greater degree of customer satisfaction leads to a greater degree of individual loyalty. More specifically, satisfaction has also emerged as a strong predictor of loyalty in the context of the new information and communication technologies. In general, terms, if customers perceive that an organization fulfils the agreed conditions, they will feel satisfied and believe that this behavior will continue in the future. Consequently, their predisposition to develop the relationship with the organization will increase. At the same time, the alternatives in the market will be less attractive. In other words, satisfaction becomes a mechanism by which the customer differentiates between businesses and what they offer. Yap, et al. (2012) the purpose of this paper is to examine the relationship between satisfaction, trust and loyalty by proposing satisfaction as an antecedent of trust. The result shows that service quality has a positive effect on customer satisfaction. This study also provided empirical evidence that satisfaction has a positive effect on trust and this trust will eventually has a positive influence on loyalty to the bank. Complaint handling is found to have a significant effect on satisfaction, trust and loyalty. Therefore, banks should not take complaint handling lightly as poorly handled complaints may be viewed by consumers as banks' incompetence and lack of care towards their customers. Base on the previous research this paper proposes hypothesis as following:

**Hypothesis 6:** Customer Satisfaction has a significant and positive effect on Customer Loyalty.

### 3. Methodology

#### 3.1 Research Framework



**Figure 1**  
**Research framework**

#### 3.2 Measures

The variables in this research are measured by Likert Scale with range from 7 to 1 in which 7 equal to “Strongly Agree” and 1 equal to “Strongly Disagree”. The variables that are studied consist of latent exogenous variables and latent endogenous variables

Latent Exogenous Variable: (1) Customer Relationship Management (CRM), measuring by 2 items for Key customers focus, 2 items for Knowledge Management and 2 items for Technology-based CRM which are adopted by Sin, et al. (2005). (2) Innovation Capability, measuring by 2 items for Process innovation, 2 items for Service innovation and 2 items for Marketing Innovation which are adopted by Lin, et al. (2010). (3) Corporate Image, measuring by 2 items for Financial prospects, 2 items for Market presence and 2 items for Corporate Management which are adopted by Yeo & Youssef (2010). (4) Corporate Social Responsibility (CSR), measuring by 2 items for Contribution to Health sector, 2 items for Contribution to education sector and 2 items for Environmental issues which are adopted by Khan (2010). (5) Ethical Behavior, measuring by 2 items for Honesty & integrity, 2 items for Compliance and 2 items for Transparency which are adopted by Chowdhury (2011). And Latent Endogenous Variable are: (1) Customer Satisfaction, measuring by 2 items for Core service or service product, 2 items for Human element of service delivery and 2 items for Systematization of service delivery: non-human element which are adopted by Sureshchandar, et al. (2002). (2) Customer Loyalty, measuring by 2 items for Intention to stay and 2 items for Peripheral purchase which are adopted by Bloemer & Schroder (2006).

### 3.3 Research Subject and Sampling

The samples in this study were all the customer of Bank in Malang City, East Java, Indonesia. The sampling technique was done by using Convenience Sampling Method. Questionnaire was spread on Bank in Malang City, East Java, Indonesia. According to Bentler & Chou (1987) the normal distribution of sample size to number of free parameter at least 5:1, so the sample size of present research are  $49 \times 5 = 245$  respondents. In order to ensure the reliability, this study collected 400 effective questionnaires.

## 4. Results and Discussion

Data were analyzed using AMOS 17 software package and Structural Equation Model (SEM) program. According to Kaplan (2000) there were two-steps procedures of Structural Equation Model. First step is Measurement Model and the second step is Structural Model.

### 4.1 Measurement Model

#### 4.1.1. Goodness Fit Indices

This Measurement Model was estimated using Confirmatory Factor Analysis (CFA) method. Based on Hooper, et al. (2008) the measurement of fit indices were Chi-square value ( $\chi^2$ ), Goodness of Fit (GFI), Adjusted Goodness of Fit (AGFI), Root Mean Square Error of Approximation (RMSEA), Comparative fit index (CFI), and the other indicators was included in overall Measurement Model fit indices. The analysis results in Table 1 showed  $\chi^2/df$ -ratio of 2.88 were on interval 2. According to Schumacker & Lomax (2004) the acceptable range for normed chi-square was 1 to 3. It means that the model is acceptable. GFI, NFI, NNFI, and CFI are greater than or close to 0.9, so those are acceptable. For the RMSEA value was 0.07, it is still acceptable because according to MacCallum, et al. (1996) the range of RMSEA 0.05 to 0.10 was acceptable. The overall measurement indices showed a good fit to the model.

**Table 1**  
**The Measurement Model Fit Result**

Index	Result
Chi-square ( $\chi^2$ )	429.28
Degree of Freedom (df)	149
$\chi^2/df$	2.88
Goodness of Fit (GFI)	0.91
Adjusted Goodness of Fit (AGFI)	0.87
Root Mean Square Error of Approximation (RMSEA)	0.07
Root Mean Square of Residual (RMR)	0.04
Normed fit index (NFI)	0.95
Non-normed Fit Index (NNFI)	0.96
Comparative fit index (CFI)	0.97

#### 4.1.2. Reliability Analysis of Measurement Model

The measurement model of reliability is to meet the standards for the study variables, including all observed variables using the standardized factor loadings, and to calculate the composite reliability for each variable. Composite reliabilities in Table 2 are larger than 0.7. The recommended value of Fornell & Larcker (1981), are greater than 0.60.

#### 4.1.3. Validity Analysis of Measurement Model

##### 4.1.3.1 Convergent Validity

On the validity of the detection, this study used confirmatory factor analysis to measure the scale of convergent validity. From the Table 2, the standardized loading of all observed variables were greater than 0.7, and their t-values are significant (greater than 1.96), showing the path coefficient is significant, and this was the results of these indicators to meet the convergent validity (Anderson & Gerbing, 1988).

**Table 2**  
**Scale Composite Reliability and Convergent Validity Analysis**

Construct (F) and Indicators (V)		Standardized Loading	t value	Indicator Reliability	Composite Reliability
Customer Relationship Management (CRM) (F1)					
V1	Key customers focus	0.76	17.97	0.58	0.75
V2	Knowledge management	0.99	27.28	0.99	
V3	Technology-based CRM	0.93	24.35	0.87	
Innovation Capability (F2)					
V4	Process innovation	0.88	22.22	0.78	0.95
V5	Marketing innovation	0.95	25.23	0.90	
V6	Service innovation	0.94	24.77	0.88	
Corporate Image (F3)					
V7	Financial prospects	0.79	18.95	0.63	0.94
V8	Market presence	0.97	26.48	0.95	
V9	Corporate management	0.97	26.46	0.95	
Corporate Social Responsibility (CSR) (F4)					
V10	Contribution to health sector	0.97	26.67	0.95	0.96
V11	Contribution to education sector	0.98	26.88	0.96	
V12	Environmental issues	0.86	21.52	0.74	
Ethical Behavior (F5)					
V13	Honesty and integrity	0.82	19.94	0.68	0.94
V14	Compliance	0.98	26.56	0.96	
V15	Transparency	0.94	24.70	0.88	
Customer Satisfaction (F6)					
V16	Core service or service product	0.81	19.23	0.65	0.90
V17	Human element of service delivery	0.89	22.23	0.78	
V18	Systematization of service delivery: non-human element	0.90	22.70	0.80	
Customer Loyalty (F7)					
V19	Intention to stay	0.89	22.14	0.79	0.85
V20	Peripheral purchase	0.82	19.75	0.68	

#### 4.1.3.2 Discriminant Validity

The higher the correlation coefficient between two variables might indicate that the discriminant validity could not be satisfied. Therefore, this study intends to select “Ethical Behavior” and “Customer Satisfaction”, “Ethical Behavior” and “Customer Loyalty” and “Customer Satisfaction” and “Customer Loyalty”, which the correlation coefficient are 0.62, 0.69, 0.94 to verify that the two pairs of variables has discriminant validity.

The results from Table 3 showed that the chi-square difference between measurement and unidimensional measurement model for the one pair is significant. It concludes that those variables were distinct. In general, all measures were shown to have discriminant validity because the biggest of correlation among variables was significantly different.

**Table 3**  
**Discriminant validity analysis**

	Correlation Coefficient		Unidimensional Measurement Model	Measurement Model	The difference	p-value
Innovation		Chi-square	998.97	429.28	569.69	
Capability ↔	0.50***					
Customer		DF	150	149	1	< 0.001
Satisfaction						
Innovation		Chi-square	639.36	429.28	210.08	
Capability ↔	0.60***					
Customer Loyalty		DF	150	149	1	< 0.001
Customer		Chi-square	435.22	429.28	5.94	
Satisfaction ↔	0.97***					
Customer Loyalty		DF	150	149	1	< 0.001

Note: \*p<0.05, \*\*p<0.01, \*\*\*p<0.001.

#### 4.1.3.3 Common Method Variance (CMV)

The effect of common method variance (CMV) is a major potential validity threat in social sciences research (Sharma, et al., 2009). When two or more variables are collected from the same respondents and an attempt is made to interpret their correlation, a problem of CMV could happen. In the line opinion of Podsakoff, et al. (2003) that common method variance refers to a bias which occurs from having a common rater, a common measurement context, a common item context, or from the characteristics of the items themselves. Common method variance can have a substantial impact on the observed relationship between predictor and criterion variables in organizational and behavioral

research.

This study used two ways to test the common method variance. First is Harman's single factor test. It stress if the majority of the variance can be explained by a single factor. The result for this test showed that the value of CMV was 34.82% which below from 50%.. According to Podsakoff, et al. (2003) that CMV is not assumed to exist because a first factor doesn't explains the majority of the variance in the variables.

Second, this study used a common latent factor to capture the common variance among all observed variables in the model. The significant of the differences between common method model and measurement model was tested. The result showed in table 4 that the p value was less than 0.05. Overall of the CMV analysis indicate that there is no bias in the answer, so there was a low potential validity threat to the finding of this research.

**Table 4**  
**Common Latent Factor Result**

	Common Latent Model	Measurement Model	The difference	p-value
<b>Chi-square</b>	6055.42	429.28	<b>5626.14</b>	< 0.05
<b>DF</b>	170	149	<b>21</b>	

## 4.2 Structural Model

**Table 5**  
**Structural Model Goodness Fit Indices**

Combined Model										Structural Model		
Chi-square	DF	$\chi^2/df$	GFI	AGFI	CFI	NFI	NNFI	RMR	RMSEA	RNFI	RPR	RPFI
461.53	154	3.00	0.90	0.87	0.96	0.95	0.96	0.04	0.07	<b>0.97</b>	<b>0.24</b>	<b>0.23</b>

This study provides empirical research about the antecedents of Customer Satisfaction. To examine the research hypothesis, this research used analysis of Structural Equation Model. The result of overall goodness fit of structural model was shown at Table 5. Chi-square ( $\chi^2$ )/df-ratio were 3.00. According to Schumacker & Lomax (2004) the acceptable range for normed chi-square was 1 to 3. GFI and NNFI still acceptable because larger than 0.8 and close to 0.9. RMSEA still was acceptable because it equal or less than 0.1. Overall of the goodness fit indices of structural model is acceptable. The structural model RNFI must be greater than 0.9, the closer to 1 is the better. RPR is in the detection of structural models to parsimony degree, the range from 0.0 to 1.0 the greater the better the goodness of fit. RPFI can be helpful in choosing the model that simultaneously maximizes both fit and

parsimony in the structural portion of the model. With the RPFI, higher values are more desirable. It can be seen from Table 5  $RNFI = 0.97$ , of  $RPR = 0.24$ , and  $RPFI = 0.23$ , this structural model indicated has a good goodness of fit and parsimony.

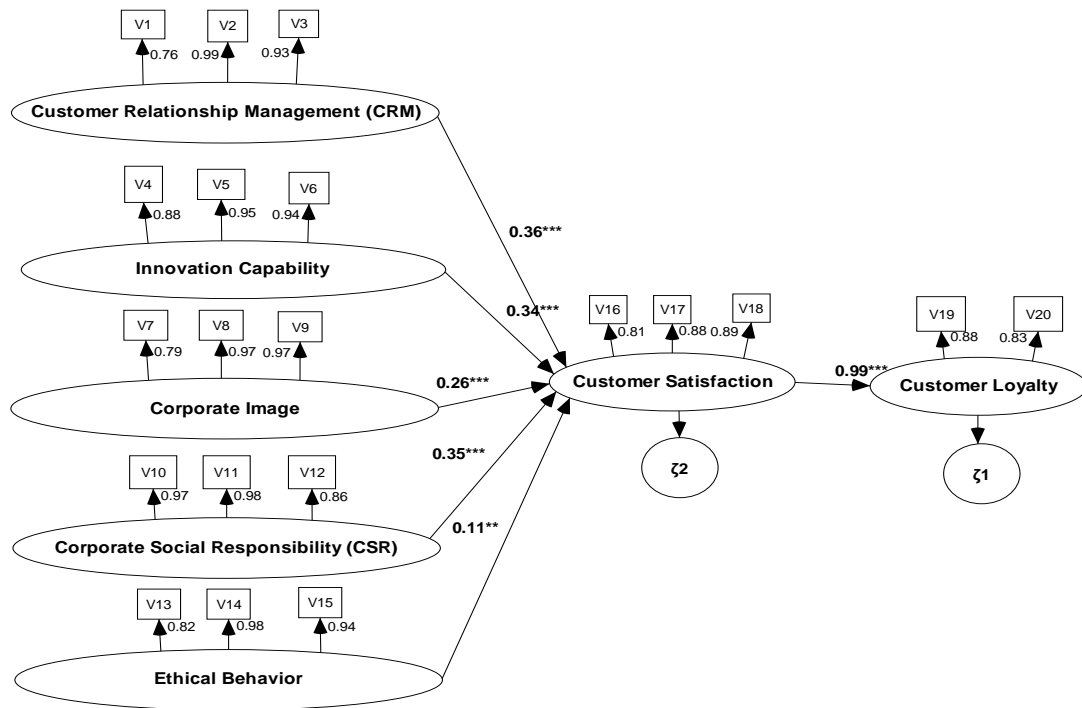
**Table 6**  
**Structural Model Path Coefficient**

Dependent Variable	Independent Variable	Standardized path coefficient	t value	Square Multiple Correlation ( $r^2$ )
Customer Satisfaction	Customer Relationship Management (CRM) (H1)	0.36	10.11***	0.64
	Innovation Capability (H2)	0.34	8.33***	
	Corporate Image (H3)	0.26	6.68***	
	Corporate Social Responsibility (CSR) (H4)	0.35	9.47***	
	Ethical Behavior (H5)	0.11	3.01**	
Customer Loyalty	Customer Satisfaction (H6)	0.99	24.42***	0.97

Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

This part explored validation for the hypothesis. The causal path between the latent variables in the research hypothesis (H1 to H6) and the analysis results are shown in Table 6. The path of structural model result was shown in Figure 1. From the table results, the path coefficients were: Customer Relationship Management (CRM)  $\rightarrow$  Customer Satisfaction were 0.36; Innovation Capability  $\rightarrow$  Customer Satisfaction were 0.34; Corporate Image  $\rightarrow$  Customer Satisfaction were 0.26; Corporate Social Responsibility (CSR)  $\rightarrow$  Customer Satisfaction were 0.35; Ethical Behavior  $\rightarrow$  Customer Satisfaction were 0.11; and Customer Satisfaction  $\rightarrow$  Customer Loyalty were 0.99. Furthermore, “Customer Satisfaction” as the dependent variable, the  $r^2$  value was 0.64; and the “Customer Loyalty”  $r^2$  was 0.97. According to Kleijnen, et al. (2007) categorized  $r^2$  effect sizes as: small: 0.02; medium: 0.13; large: 0.26, so it can be regarded that Customer Satisfaction and Customer Loyalty as having a high degree of support. The result for the path analysis can be seen in Table 6.





Note: \* $p < 0.05$ , \*\* $p < 0.01$ , \*\*\* $p < 0.001$ .

**Figure 2**  
**Structural Model result**

## 5. Conclusion

According to the result and discussion, this section would address conclusion, limitation and suggestion.

### 5.1 Research Conclusion

#### 5.1.1 The effect of Customer Relationship Management (CRM) on Customer Satisfaction (H1 is supported).

Base on Table 6, the finding of data analysis found that Customer Relationship Management (CRM) has a significant and positive effect on Customer Satisfaction (coefficient=0.36,  $t=10.11$ ,  $p<.001$ ). This result is consistent with the Padmavathy, et al. (2012) and Ata & Toker (2012) empirical research that Customer Relationship Management has a significant and positive effect on Customer Satisfaction. It indicates Customer Relationship Management (CRM) plays a critical role in influencing on Customer Satisfaction. Bank can increase Customer Satisfaction by improving three alternatives such as: (1) Key customers focus. Example, a) the bank should be able to provides customized services and products to its key customers. And b) the bank should try to makes an effort to find out what is a key customer need. (2) Knowledge management. Example, a) the employees should have willingness to help customers in a responsive manner. And b) the employees should fully understand the needs of the key customers via knowledge learning. And (3) Technology-based CRM. Example, a) the bank should has the right technical personnel to provide technical support for the utilization of computer technology in building customer relationships. And b) the bank should maintains a comprehensive database of its customers

#### 5.1.2 The effect of Innovation Capability on Customer Satisfaction (H2 is supported).

According to previous analysis and discussion, it indicates Innovation Capability has a significant and positive effect on Customer Satisfaction (coefficient=0.34,  $t=8.33$ ,  $p<..001$ ). This result is consistent with the previous empirical research by Simon & Yaya (2012) and Eng (2011) Innovation Capability has a significant and positive effect on Customer Satisfaction. It indicates innovation capability plays a critical role in influencing on Customer Satisfaction. Bank can increase the Customer Satisfaction by improving three alternatives such as: (1) Process innovation. Example, a) the bank should be able to adopt new process technology better than the competitor. And b) the bank should be able to obtain process technology patents better than the competitor. (2) Marketing innovation. Example, a) the bank should be able to continually enlarges potential demand markets better than the competitor. And b) the bank should be able to utilize advanced CRM systems in markets better than the competitor. And (3) Service innovation. Example, a) the bank should be able to develop innovative before-sale or after-sale service methods better than the competitor. And b) the bank should be able to adopt innovative order management and follow-up systems better than the competitor.

### 5.1.3 The effect of Corporate Image on Customer Satisfaction (H3 is supported).

Based on analysis and discussion, Corporate Image has a significant and positive effect on Customer Satisfaction (coefficient=0.26,  $t=6.68$ ,  $p<.001$ ). This result is consistent with Tu, et al. (2012) and Bloemer, et al. (1998) research that Corporate Image has a significant and positive effect on Customer Satisfaction. It indicates Corporate Image plays a critical role in influencing on Customer Satisfaction. Bank can increase the Customer Satisfaction by improving three alternatives such as: (1) Financial prospects. Example, a) the bank should have high profitability. And b) the bank should have good financial growth. (2) Market presence. Example, a) the bank should be a leader in its field. And b) the bank should have powerful presence in the marketplace. And (3) Corporate management. Example, a) the bank should be high moral company. And b) the bank should have a good management system.

### 5.1.4 The effect of Corporate Social Responsibility (CSR) on Customer Satisfaction (H4 is supported).

The findings of analysis is that CSR has a significant and positive effect on Customer Satisfaction (coefficient=0.35,  $t=9.47$ ,  $p<.001$ ). It is consistent with result provided by Walsh & Bartikowski (2012) and McDonald & Thiele (2008) that CSR has a significant and positive effect on Customer Satisfaction. It indicates Corporate Social Responsibility (CSR) plays a critical role in influencing on Customer Satisfaction. Bank can increase the Customer Satisfaction by improving three alternatives such as: (1) Contribution to health sector. Example, a) the bank should provides medical support for serious illnesses patients such as HIV / AIDS, cancer, stroke etc. And b) the bank should provides health assistance to underprivileged and disabled children. (2) Contribution to education sector. Example, a) the bank should provides Scholarship to meritorious, poor students and for physical disable students. And b) the top management of the bank should support education sector such as provides Part time job facilities for the students or gives lectures / speeches in several universities. And (3) Environmental issues. Example, a) the bank should supports for public/private actions designed to protect the environment (e.g. compressed natural gas (CNG) station establishment). And b) the bank should promoting environmental awareness to the community through promotional tools

### 5.1.5 The effect of Ethical Behavior on Customer Satisfaction (H5 is supported).

The result from previous analysis found that Ethical Behavior has a significant and positive effect on Customer Satisfaction (coefficient=0.11,  $t=3.01$ ,  $p<.001$ ). Following to Mulki & Jaramillo (2011) and Lee (2012) research, this study supports that Ethical Behavior has a significant and positive effect on Customer Satisfaction. It indicates Ethical Behavior plays a critical role in influencing on Customer Satisfaction. Bank can increase the Customer Satisfaction by improving three alternatives such as: (1) Honesty and integrity. Example, a) the bank executives should do not take bribe. And b) the bank should do not encourage customers to conduct illegal transaction. (2) Compliance. Example, a) the bank should maintains conformity in charges as they promise. And b) the bank should maintains conformity as it promotes its products and services. And (3) Transparency. Example, a) the bank executives should do not approve false financial statement. And b) the bank should do not collect cross cheque other than the actual payee.

### 5.1.6 The effect of Customer Satisfaction on Customer Loyalty (H6 is supported).

The result from previous analysis found that Customer Satisfaction has a significant and positive effect on Customer Loyalty (coefficient=0.99,  $t=24.42$ ,  $p<.001$ ). Following to Wu & Wang (2012) and Yap, et al. (2012) research, this study supports that Customer Satisfaction has a significant and positive effect on Customer Loyalty. It indicates Customer Satisfaction plays a critical role in influencing on Customer Loyalty. Bank can increase the Customer Loyalty by improving three alternatives such as: (1) Core service or service product. Example, a) the bank should have a wider range of financial services, e.g. deposits, retirement accounts, loans for purchases of cars, houses, foreign exchange, traveler's cheques, safe deposit lockers, etc.) And b) the bank should provide information/details on a regular basis through post; telephonic banking; ATM; room service facility; cards to defense personnel, etc.). (2) Human element of service delivery. Example, a) the employee of the bank should have willingness to help customers and the readiness to respond to customers' requests. And b) the bank should make customers feel safe and secure in their transactions. And (3) Systematization of service delivery: non-human element. Example, a) the banks' employee should have adequate and necessary personal for good customer service. And b) the banks' employee should have adequate and necessary facilities for good customer service.

## 5.2 Limitation, Suggestion and Managerial implications

Although the analyze antecedents of Customer Satisfaction was based on extant research findings with the changing of environment business, the analyze antecedents of Customer Satisfaction may change over time. Based on previous analyzing in this research, it has the limitation and suggestion for further research.

### 5.2.1 Limitation

This study has some limitations. First, the sample features (i.e. convenience sample) warrant caution before generalizing the results beyond the population studied and require replication of the scale to other industries and nations for generalizability. Second, this study focused on Bank because it was based on the data from customer of Bank in Malang City, East Java, Indonesia, so it generalizes at Bank field. Third, this research considered customer perceptions towards Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior and future research should examine employee perceptions towards relationship practices and its outcomes on business performance.

### 5.2.2 Suggestion

This study can be extended in several directions for further research. There are suggestions based on this study. First, this study focused on Bank field and in the specific area in Indonesia. The suggestion for future research can extend the result by analyzing different country. Second, the analysis method of this study is a cross-sectional analysis. The aim is to explore the antecedents of Customer Satisfaction within a certain period of time, and the effect to Customer Loyalty. However, some variables may be changes over time so it makes the results change. Therefore, this study suggests that future researchers can develop theoretical model to be more exhaustive construct. Third, the theoretical

framework in this study consists of 7 variables as research variables such as Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image, Ethical Behavior, Customer Satisfaction and Customer Loyalty. Therefore, this study suggests that future research can develop the study by analyzing other antecedents such as Customer Value (Spiteri & Dion, 2004) and Customer Relationship Proneness (CRP) (Noyan & Simsek, 2011)

### 5.2.3 Managerial implications

The study findings have significant implications for bank managers. We identified the key dimensions of Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior that should be implemented to enhance the business performance. The twenty dimensions to measure the effectiveness of Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior efforts in Indonesian banks namely, Key customers focus, Knowledge management and Technology-based CRM for Customer Relationship Management (CRM), Process innovation, Marketing innovation and Service innovation for Innovation Capability, Financial prospects, Market presence and Corporate management for Corporate Image, Contribution to health sector, Contribution to education sector and Environmental issues for Corporate Social Responsibility (CSR), and Honesty & integrity, Compliance and Transparency for Ethical Behavior, those all dimensions are important in enhancing Customer Satisfaction. Those scales can also be used as a tool by the banks to identify the aspects of Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image, and Ethical Behavior where improvements are needed to increase the levels of Customer Satisfaction and Customer Loyalty. Periodic assessment of the effectiveness of Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior, using those scales could help bank managers track changes in Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior dimensions that impact Customer Satisfaction and Customer Loyalty over time. The identification of those dimensions enables bank managers to design an effective Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image, and Ethical Behavior that fosters enduring relationships with customers. Further, those dimensions emphasize that Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image and Ethical Behavior efforts should focus on those twenty dimensions above (Sin, et al., 2005), Lin, et al. (2010), Yeo & Youssef (2010), Khan (2010) and Chowdhury (2011). Thus, bank managers should focus on orchestration (harmonization and combination) of all the twenty dimensions to maximize Customer Relationship Management (CRM), Innovation Capability, Corporate Social Responsibility (CSR), Corporate Image, Ethical Behavior effectiveness. The finding, that Ethical Behavior has smaller path coefficient that influence Customer Satisfaction. The bank managers should emphasize more proactive and aggressive in competitive to meet with the opportunity by improving three alternatives namely, Honesty & integrity, Compliance and Transparency (Chowdhury, 2011). Another implication from this study is that the Customer Satisfaction and Customer Loyalty from relational perspective provide opportunities for banks to cross-sell other banking products/services. Thus, managers should focus on relational practices that enhance satisfaction and loyalty as the customers are likely to spread their purchases across different categories offered by the bank. Moreover, this implies that the bank managers should pay attention to customers who are at a specific point of relationship with the bank for cross-selling of other banking products.

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**YMC Management Review****Volume 6, No. 1, 2013 p.p 53-74****A Study of Grey VAR on Dynamic Structure between Economic Indicators and Stock Market Indices in the United States**

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**ABSTRACT**

This study takes four Indies and the four belonging indices from United States stock market and United States macro-economic indicators as examples. The monthly closing stock indices and macro-economic from January 2000 to December 2010 were sampled. We applied GM(1,1) on VAR into a GVAR to realize the dynamic structure between economic indicators and United States stock market indices which consist of the Dow Jones index, NASDAQ index, S & P 500 index, and PHLX Semiconductor index.

According to the empirical results, we found that interest rates, CPI's, foreign reserves, M1's, M2's and M3's have a Granger causality relationship with stock market indices respectively. Based on the AIC rule, stock market indices are a leading index to economic indicators for eight months. By using Granger causality, decomposition variance and the impact response analysis, we realized the existence of the dynamic structure between economic indicators and stock market indices in United States. And we discovered this dynamic structure is interacted and matched frequently at the state in United States economic.

**Keywords :** *United States, Macro-Economic indicators, The Dow Jones Index, NASDAQ index, S & P 500 Index, PHLX Semiconductor Index, GM(1,1), Grey Vector Autoregression Model (GVAR)*

## 1. Introduction

Stock market is a mirror to economy. We could understand a nation's economy from the variations and trend of stock markets indices. There are a lot of economic factors which affect each other's and the stock market as well. Based on past research, it must be a close relationship between economic variables and stock market indices. (Likes Ratanapakorn & Sharma, 2007; Flannery & Protopadakis., 2002) The economy in United States grew since 1940s, and now is still the strongest developed economy in the world even was seriously hurt from financial crisis in 2008.

Chang and Wu(1996), and Chang, Wu, and Lin(1998, 2000) studied the interaction between stock market, monetary market, and foreign exchange market using a grey vector autoregression model (GVAR). The conclusion denoted that the noise in financial markets could be erased and forecasting accuracy could be increased.

This paper takes United States as an example and studies the dynamic structure between economic indicators and four stock market indices consist of the Dow Jones index, NASDAQ index, S & P 500 index, and PHLX Semiconductor index using a GVAR model. We try to understand the dynamic relationship between economic variables and stock market indices in the United States.

## 2. Reference review

### 2.1 Relationship between economic variables and stock market indices

There are numerous economic variables which affect the stock markets. A lot of scholars have studied the relationship between them. The economic variables selected in the past studies consist of US dollar index, interest rate, consumer price index (CPI), production price index (PPI), monetary supply, export and import, and foreign exchange reserves. Some references were reviewed as below.

- 1) US dollar index (USDIX): Chiou, Lee & Chiou (1998), Ajayi, Friedman & Mehdian (1998), Mok (1993), Vygodina (2006) study the relationship between currency exchange rate and stock market using Granger Causality in United States. Flood & Rose (2001) and Chen (2002) used a VAR model on the relationship between currency exchange rate and stock market as well. They found that the relationship between them was obvious.
- 2) Interest rate: Mok (1993) and Ratanapakorn & Sharma (2007) study the relationship between interest rate and stock market using the Granger Causality in United States. They denoted that the relationship between them was obvious.

- 3) Consumer price index (CPI) and production price index (PPI): Flannery & Protopadakis (2002) and Chang (2004) study the relationship between consumer price index and stock market. The results showed that there is a positive relationship between them, and inflation rate had causality on stock market.
- 4) Monetary supply, export and import, and foreign exchange reserves: few references about affection of monetary supply, export and import, and foreign exchange reserves on stock market in United States. Some studies denote that monetary supply, export and import, and foreign exchange reserves had causality on stock market. Like research from Pearce & Raley (1985), Lee (1994), Mukherjee & Naka (1995), Lin (1997), Deng (1998), Flannery & Protopadakis (2002), Liu (2005), Patra & Poshakwale (2006), Chen, Lin & Lin (2006), Ratanapakorn & Sharma (2007) are on monetary supply. Researches from Hsu & Tsai (1993), Hseng (1996), Wang (2000), Graham, Nikkinen & Sahlstrom (2003), and Chang (2009) are on export and import. And search from Mookerjee & Yu (1997) is on foreign exchange reserves.

Ratanapakorn & Sharma (2007) showed that there is a negative relationship between long-term interest and stock market indices, and inflation rate, short-term interest, monetary supply, and exchange rate had positive causality on stock market. In this study, we consider monetary supply M1 and M2, export and import, US dollar index (USDIX), interest rate, and foreign exchange reserves and four main stock markets indices as variables.

## 2.2 Applications of grey forecasting model on economic and finance issues

In the finance studies, a grey forecasting model was first used in the VAR model intending to eliminate noise and increase the accuracy of forecasting stocks' prices. (Chang, 1997; Chang and Wu, 1998; Chang, Wu, and Lin, 2000) The results showed that the Grey forecasting model could capture the securities' price impulse and make the process of price discovery stable. The out-of-the-period forecasting accurate also had been increased.

Chang and Wu (1998) have discussed the seasonality about Chinese Festival in Taiwan's Security Market using Grey Forecasting Model. The results showed that the forecasting accurate was better than a Moving Average Model.

Cheng and Chan (2002) built a Grey foreign exchange model. The forecasting ability of that was better than a random walk model and a GARCH model, especially in a 3-month-period. But a random walk model' forecasting accurate was best within them. The results showed that a Grey forecasting model is better in a short time horizon.

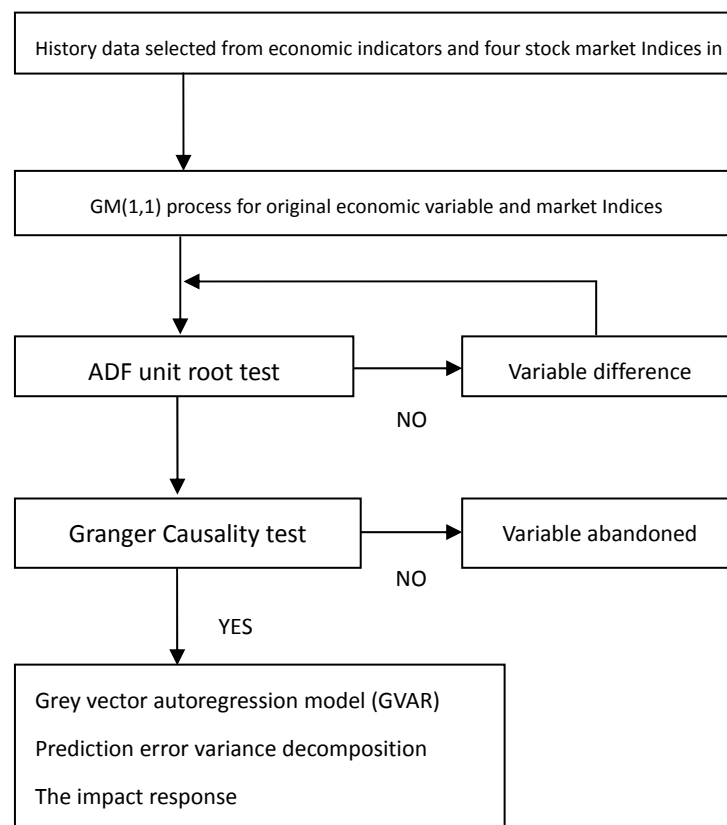
Chang (2004, 2005) used a GM (1,1) to forecast the out-of-period beta, using Dow Jones 30 Industrial Index' component stocks and component securities markets indexes of the MSCI World Index from 1998 to 2003 as samples separately. The results show that a grey  $\beta$  is a good indicator of a systematic risk in the stocks market. A GM (1,1) decreases 39.86% and 57.63% on estimation error rather than the classical Moving Average separately.

Besides, a lot of studies find that grey technical analysis indices can increase investment performance than original ones in China, Hong Kong, Singapore, Taiwan, USA, UK, Japanese, German, and Canada. ( Likes Chang & Lu (2007), Chou (2008), Chang & Lin (2009), Chang & Hsu (2009), Cheng (2009), Lee (2009), Chang & Lin (2010), Chang & Hung (2010), and Chang & Chen (2010) separately)

### 3. Methodology

This study builds a Grey vector autoregression model (GVAR) to understand the dynamic relationship between economic variables and stock market indices in United States. Some studies using autoregression model (VAR) had have been applied successfully in stock markets. (Likes Lin, Pan, & Fung (1996), Yu (1997), Chang (2009), Chang (2004), Chang & Chen (2011), and Chang & Chen (2011).)

First of all, we select the history data of economic variables and Dow Jones index, NASDAQ index, S & P 500 index, and PHLX Semiconductor index in the United States. Then, we get a whitened data base through a Grey forecasting model GM (1, 1). In order to ensure that the data is identical to the stationary process, an ADF unit root test is used before Granger Causality test. After Granger Causality test, related economic variables and four stock market indices are selected into the vector autoregression model (VAR). Through the VAR model, we could understand the dynamic relationship between economic variables and stock market indices in the United States. Prediction error variance decomposition and impact response module are showed.



**Figure 1 The Study Frame**

## 4. 4. Results

### 4.1 Granger Causality test

Granger (1980), Ng and Perron(1995) denoted that a lag period selection is important within a time series model. This paper uses Akaike information criterion (AIC) to decide auto regression lag. All of the economic variables suited to stock market indices are identical to stationary process after difference, we find seven period lagged is suited to Granger Causality test. The results are showed as table 1.

**Table 1 An AIC suited lag period test**

Lag	Dow Jones index	NASDAQ	PHLX	S & P 500
0	107.81	105.44	103.18	103.47
1	105.96	103.62	101.51	101.55
2	105.10	102.68	100.63	100.64
3	105.55	103.10	101.04	101.05
4	105.99	103.40	101.42	101.44
5	105.46	103.04	101.14	101.08
6	105.42	102.94	100.99	101.02
7	104.95*	102.39*	100.34*	100.52*

\*denotes significant at a 95% lever.

We found that almost all of the economic variables and stock market indices have one-way causality relationship after Granger Causality test. But some of them have a two-way causality relationship. The results are showed on tables 2 to 3. The first panel in table 2 denotes the causality relationship between economic indicators; the second panel denotes the causality relationship between economic indicators and stock market indices; the third panel denotes the causality relationship between four stock market indices. From the result, we could recognize that CPI, export, import, and M2 are the active economic indicators in United States.

**Table 2 The Granger Causality relationship between economic variables and stock market indices**

One-way Granger Causality	Duo- way Granger Causality
CPI, Import, Export→Interest	CPI↔ M1, M2, Import, Export
PPI→CPI, Export	PPI↔Import
Import→Interest, Export	
M1→M2, Import, Export	
M2→ Import, Export	
Interest→M2	
FOREX reserves→ CPI, M1, M2, Import, Export	
M2→ Dow Jones, NASDAQ, S & P 500, PHLX	Import↔ Dow Jones, S & P 500
CPI→ S & P 500	Export↔ Dow Jones, S & P 500
Import→ NASDAQ	USD <sub>X</sub> ↔NASDAQ, PHLX
FOREX reserves→ Dow Jones	
Dow Jones, S & P 500→USD <sub>X</sub>	
PHLX→ NASDAQ	
NASDAQ → S & P 500	

Table 3 Granger Causality test between economic variables and stock market indices

Granger Causality from / to	CPI	PPI	Import	Export	M1	M2	RATE	FORE X	USD X	Dow Jones	S & P 500	NASDAQ	PHLX	sum
CPI			***	***	*	***	***				*			6
PPI	***		**	**										3
Import	***	*		**			***			*	***	*		7
Export	***						***			**	**			4
M1	***		***	*		***								4
M2	***		***	***						**	**	*	**	7
RATE						*								1
FOREX res.	***		***	***	*	**				*				6
USD X												*	*	2
Dow Jones			*	**					*					3
S & P 500			*	**					*					3
NASDAQ									*		**			2
PHLX									**			*		2
Sum	6	1	7	8	2	4	3	0	4	4	5	4	2	50

Note : \*\*\*, \*\*, and \* denote 1%, 5%, and 10% significant respectively.

#### 4.2 Prediction error variance decomposition

We could get a prediction error from the variance decomposition of variables in a vector autoregression model (VAR). According to relative percentage of the variance decomposition of variables, we can understand that the variance source from itself or others. After a Granger Causality test, some interactive variables likes CPI, M2, Dow Jones index, NASDAQ index, S & P 500 index, and PHLX Semiconductor index as examples, we know that their prediction error variance is from decomposition by the first, second, third, seven, and twelfth interval separately. Due to the seven-month period lag, which was identical to stationary process, the seven-month period's prediction error variance decomposition will be steady. The results are shown on tables 4 to 9.

**Table 4 Prediction error variance decomposition of CPI**

Period	CPI	PPI	IMP	EXP	M1	M2	RATE	FOREX	USDX	DJ	NASDAQ	PHLX	S&P500
1	100	0	0	0	0	0	0	0	0	0	0	0	0
2	83.3088	0.6313	0.0210	2.0800	1.5436	0.0306	7.4682	0.0059	2.0540	1.2667	0.1197	0.0376	1.4326
3	65.8171	1.0899	1.1784	8.9030	2.8584	0.0431	11.1823	0.1402	4.3908	1.8804	0.9161	0.0340	1.5664
7	57.6452	1.0773	2.6808	13.1413	2.7485	0.3668	12.0427	1.3549	4.2242	1.7735	1.3020	0.2928	1.3499
12	57.0121	1.0847	2.6619	13.0332	2.7189	0.4986	12.2782	1.4791	4.4478	1.7767	1.3250	0.3571	1.3267

From the empirical result of table 4, we can understand that the CPI could explain itself by 100 percentages in the initial period. Within the three-month period, the CPI explains itself decreasingly to 65.8%, and 34.2% have been regulated by other variables, like the export, interest, US dollar index, and M1. The percentage of CPI explains itself by the 57.6% within the eighth-month period.



**Table 5 Prediction error variance decomposition of M2**

Period	CPI	PPI	IMP	EXP	M1	M2	RATE	FOREX	USDX	DJ	NASDAQ	PHLX	S&P500
1	5.2237	0.5376	0.1095	0.0153	16.0514	78.0625	0	0	0	0	0	0	0
2	4.6625	1.4664	6.5169	1.5389	12.4624	69.1631	0.8337	0.0947	0.2245	2.6545	0.1471	0.0096	0.2257
3	3.5943	1.5328	10.8125	1.2169	15.2635	56.3120	2.7110	0.1169	1.0223	6.9900	0.1294	0.1007	0.1977
7	6.0747	1.4402	10.1316	10.1301	12.4251	45.0048	4.4590	1.4590	1.0604	5.9548	0.3063	0.5269	1.0272
12	6.8000	1.4080	10.1870	10.0389	12.3485	44.1516	4.5517	1.5024	1.1104	5.9996	0.3226	0.5464	1.0328

From empirical result of table 5, we understand that the M2 could explain itself for 78.1 percentages in the initial period. Within the second-month period, M2 explains itself decreasingly by 69.2%, and 30.8% is regulated by other variables, like M1, CPI, and import. The percentage of M2 explains itself decreasingly by 45% within the seven-month period.

**Table 6 Prediction error variance decomposition of Dow Jones 30 Index**

Period	CPI	PPI	IMP	EXP	M1	M2	RATE	FOREX	USDX	DJ	NASDAQ	PHLX	S&P500
1	2.7214	0.6181	1.1587	0.8862	0.0136	0.0560	0.0539	0.0082	5.1357	89.3482	0	0	0
2	2.2294	0.5073	6.4187	3.5579	0.0577	0.0459	0.2322	0.1279	4.1535	80.4224	0.1783	1.1791	0.8897
3	3.6976	0.5855	5.5919	7.8904	0.8590	0.3711	0.2016	0.3560	4.9558	71.7525	0.2618	1.0515	2.4252
7	4.8346	1.1469	5.2661	8.0362	1.7360	1.7179	2.4169	0.5004	5.3610	64.9767	0.6582	1.1171	2.2320
12	4.8471	1.1398	5.3012	8.2096	1.9964	1.8463	2.4409	0.5866	5.5094	64.1007	0.6867	1.1279	2.2074

From the empirical result of table 6, we understand that Dow Jones 30 Index could explain itself by 89.3 percentages in the initial period. Within the second-month period, Dow Jones 30 index explains itself decreasingly to 80.4%, and 19.6% be regulated by other variables, like CPI, PPI, and US dollar index. The percentage Dow Jones 30 Index explains itself decreasingly by 65% within the seven-month period.

**Table 7 Prediction error variance decomposition of NASDAQ Index**

Period	CPI	PPI	IMP	EXP	M1	M2	RATE	FOREX	USDX	DJ	NASDAQ	PHLX	S&P500
1	1.4952	0.0130	2.0491	4.5777	0.0115	0.1025	0.0381	0.0747	0.6951	47.3766	43.5665	0	0
2	1.2636	1.0347	5.8950	5.5390	0.1509	0.2664	0.0426	0.4226	1.6320	42.4272	38.0794	2.8988	0.3476
3	1.8148	1.7367	5.4299	8.0218	0.1620	0.2596	0.0643	0.5607	1.7102	40.0558	34.6605	2.8474	2.6762
7	2.1361	1.8843	5.4485	8.1828	0.3028	0.8382	2.2784	0.6721	1.8110	39.0334	31.0969	3.7361	2.5793
12	2.1401	1.8867	5.4123	8.2928	0.4184	1.0572	2.4236	0.7248	1.8780	38.6982	30.7820	3.7250	2.5611

From the empirical result of table 7, we understand that NASDAQ index could explain itself by 43.6 percentages in the initial period only, and be regulated by Dow Jones 30 index mainly by 47.4%. The percentage NASDAQ index explains itself decreasingly by 31.1% within the seven-month period.

**Table 8 Prediction error variance decomposition of PHLX index**

Period	CPI	PPI	IMP	EXP	M1	M2	RATE	FOREX	USDX	DJ	NASDAQ	PHLX	S&P500
1	0.8142	0.0121	1.6610	4.1313	0.4428	0.0764	0.0338	0.6454	0.0264	34.8958	36.5472	20.7135	0
2	1.3302	1.2169	2.5690	4.4362	0.3928	0.3916	0.8886	0.6657	0.1619	35.3545	34.0065	18.5797	0.0066
3	1.7378	1.7705	2.4330	6.5129	0.4576	0.3515	1.2516	0.6006	1.3156	33.6370	30.4522	16.5580	2.9216
7	1.8176	1.8234	2.7473	7.2532	0.4872	0.8548	1.5141	0.6227	1.9195	32.9860	28.9135	15.8889	3.1718
12	1.8209	1.8244	2.7458	7.3477	0.5119	0.8939	1.5607	0.6314	1.9278	32.8885	28.8123	15.8460	3.1886

From the empirical result of table 8, we understand that PHLX index could explain itself by 20.7 percentages in the initial period, and be regulated by Dow Jones 30 index, NASDAQ index and export by 34.9%, 36.5%, and 4.1% separately. Within the second-month period, PHLX index explains itself decreasingly to 18.6%, and decreasingly by 15.9% within the seven-month period.

Table 9 Prediction error variance decomposition of S & P 500 index

Period	CPI	PPI	IMP	EXP	M1	M2	RATE	FOREX	USD	DJ	NASDAQ	PHLX	S&P500
1	1.1519	0.0537	3.0116	2.1061	0.2728	0.1946	0.7031	0.0002	4.1502	80.0583	4.9599	0.3076	3.0300
2	1.0542	0.2394	8.7930	5.1695	0.2968	0.1495	0.5292	0.5303	3.8664	69.6479	3.6090	2.1133	4.0014
3	1.9976	0.5648	7.7780	9.6341	0.9155	0.1926	0.6146	0.7541	4.2111	62.6966	3.3170	1.8572	5.4666
7	3.2520	0.9723	7.0996	9.5863	1.5338	1.3141	3.1322	0.7687	4.5230	57.8925	3.1565	1.9126	4.8566
12	3.2583	0.9680	7.0876	9.7680	1.8098	1.5010	3.1790	0.8363	4.6865	57.0622	3.1589	1.9018	4.7825

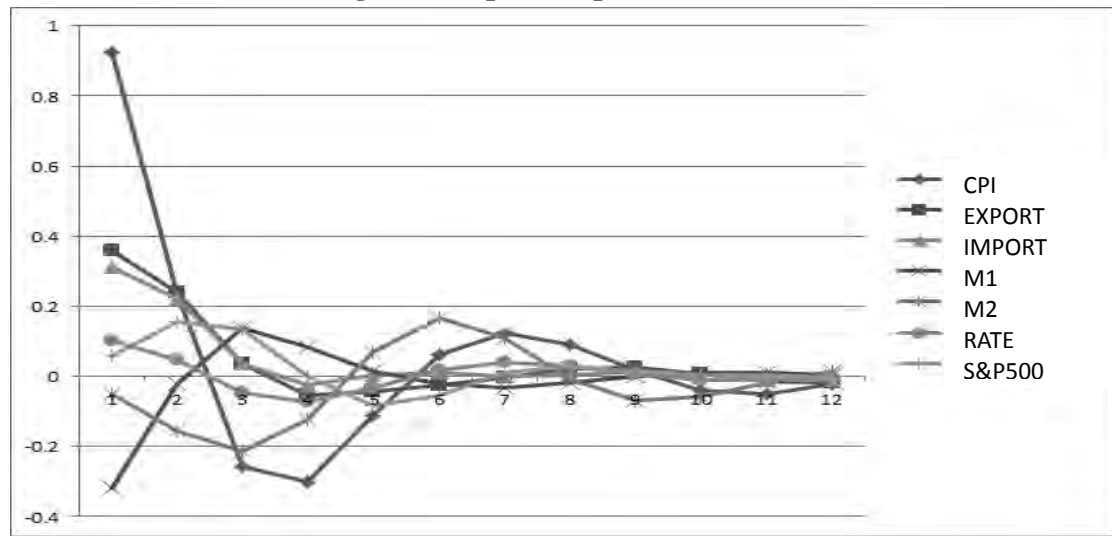
From the empirical result of table 9, we understand that S&P 500 index could explain itself by 3 percentages only in the initial period, and be regulated by Dow Jones 30 index and NASDAQ index by 80% and 5% separately. Within the second-month period, PHLX index explains itself increasingly to 4%, and increasingly by 4.9% within the seven-month period, and be regulated by other variables, like Dow Jones 30 index, NASDAQ index, export, import, and US dollar index.

According to the open economy, stock market indices in United States are affected by macro economic variables easily, especially the PHLX index and S&P 500 index are affected by Dow Jones 30 index, NASDAQ index, export, import, and US dollar index significantly. M1 and M2 interact with each other closely.

### 4.3 Impact responses analysis

An empirical result for impact responses analysis based on the Word principal is obtained. (Sim, 1980) From the results showed by the impact responses analysis, we could ascertain that the impact responses are shortly or not, positively or negatively. The following are some empirical results:

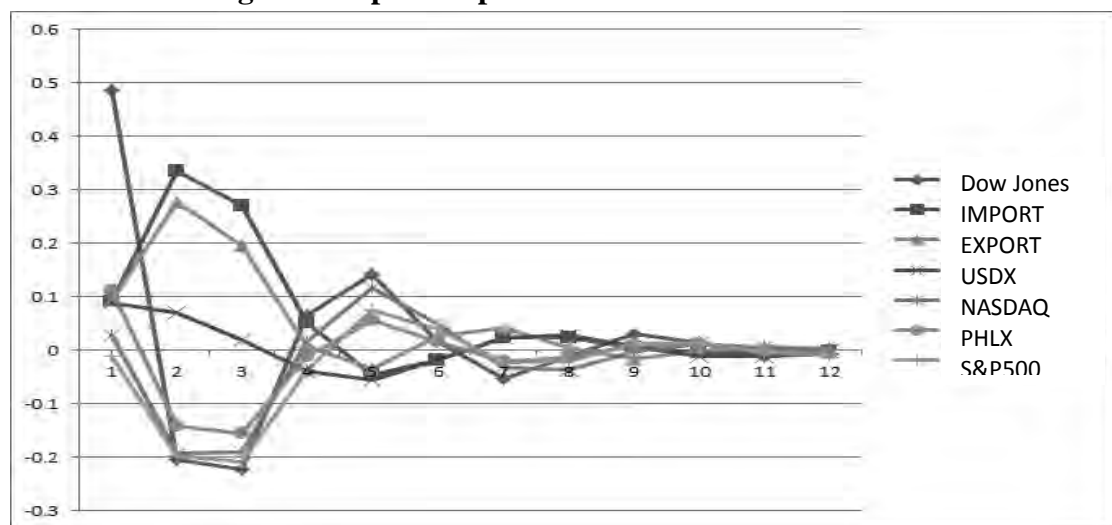
**Figure 2 Impact responses from CPI**



From the empirical result of figure 2, we can understand that whenever a unit CPI's spontaneous interference happens, the impact responses exist until the seven-month interval.

- When a unit positive CPI interference happens, it has a 92% delayed effect in the first period. A 26% and 30% revivification can happen in the third-month period and the fourth-month period respectively, and vanish in the seven-month period.
- CPI has a positive impact on import, and export by 36%, and 31% respectively in the first-month period, and have a negative impact on M1, and M2 by 32% and 5% respectively in the first-month period.

**Figure 3 Impact responses from Dow Jones 30 index**

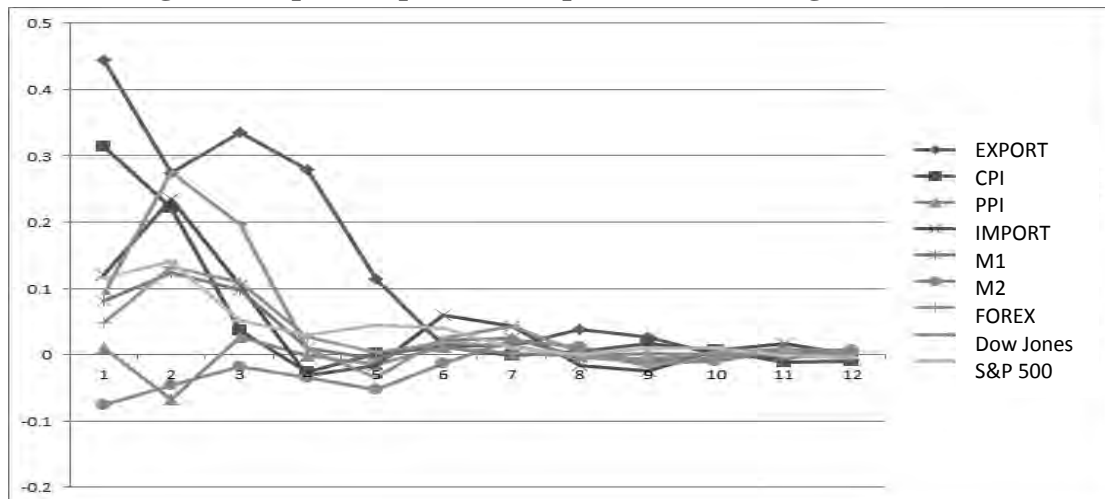


From the empirical result of figure 3, we can understand that whenever a unit Dow Jones index's

spontaneous interference happens, the impact responses exist until the seven-month interval.

- When a unit positive Dow Jones index interference happens, it has a 49% delayed effect in the first period. A 20% and 22% revivification happen in the second-month period and the third-month period respectively, and vanish in the seven-month period.
- Dow Jones index has a positive impact on import, and export by 33%, and 28% respectively in the second-month period, and have a negative impact on NASDAQ, PHLX and S&P 500 by 19%, 14% and 20% respectively in the second to third-month period.

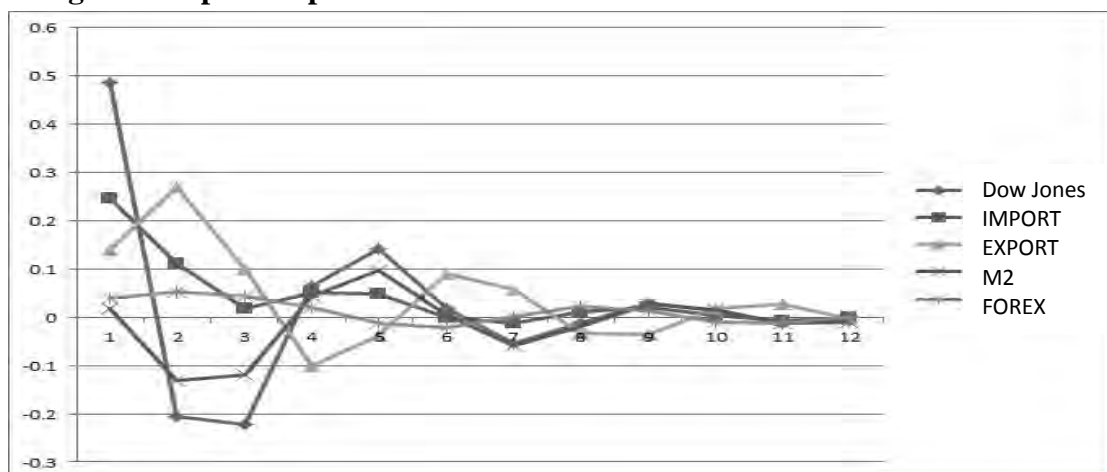
**Figure 4 Impact responses of export from other eight variables**



From the empirical result of figure 4, we can understand that whenever a unit spontaneous interference from other variables happen, how the export responses. The impact response exists until the six-month interval.

- When a unit export interference happens, it has a 44% and 27% impact in the first and second-month period respectively.
- CPI has an impact on export by 31% in the first-month period.
- Dow Jones index and import index have the greatest impact on export by 28% and 24% respectively in the second-month period.
- M2 has the greatest negative impact on export by -7.5% in the first-month period.

**Figure 5 Impact responses of Dow Jones 30 index from other four variables**

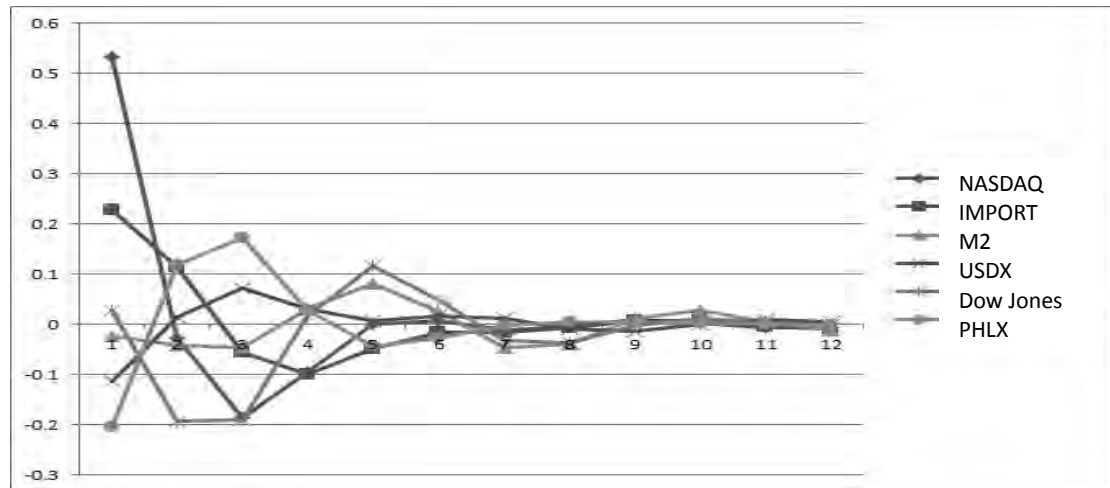


From the empirical result of figure 5, we can understand that whenever a unit spontaneous interference from other variables happen, how the Dow Jones 30 index responses. The impact response

exists until the seven-month interval.

- When a unit import interference happens, it has a 25% impact on Dow Jones index in the first-month period. And when a unit export interference happens, it has a 27% impact on Dow Jones index in the second-month period.
- M2 has the greatest negative impact on Dow Jones index by -13% and -12% respectively in the second and third-month period.

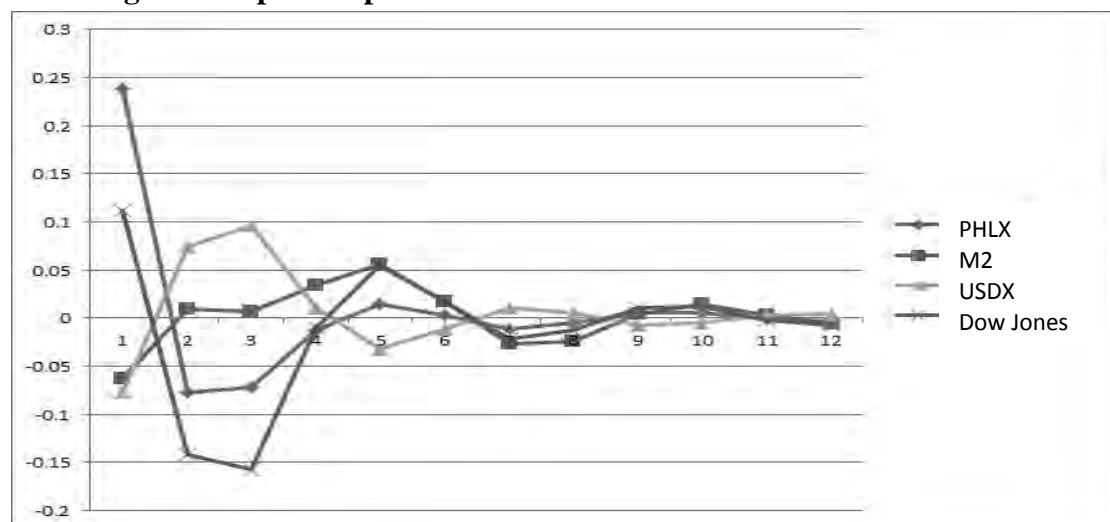
**Figure 6 Impact responses of NASDAQ index from other five variables**



From the empirical result of figure 6, we can understand that whenever a unit spontaneous interference from other variables happen, how the NASDAQ index responses. The impact response exists until the five-month interval.

- When a unit import interference happens, it has a 23% impact on NASDAQ index in the first-month period. And US dollar index have a negative impact on the NASDAQ index by 11.5% in the first-month period.
- When a unit PHLX interference happens, it has a -21%, 12%, and 17% impact on NASDAQ index in the first, second, and third-month period respectively.

**Figure 7 Impact responses of PHLX index from other three variables**

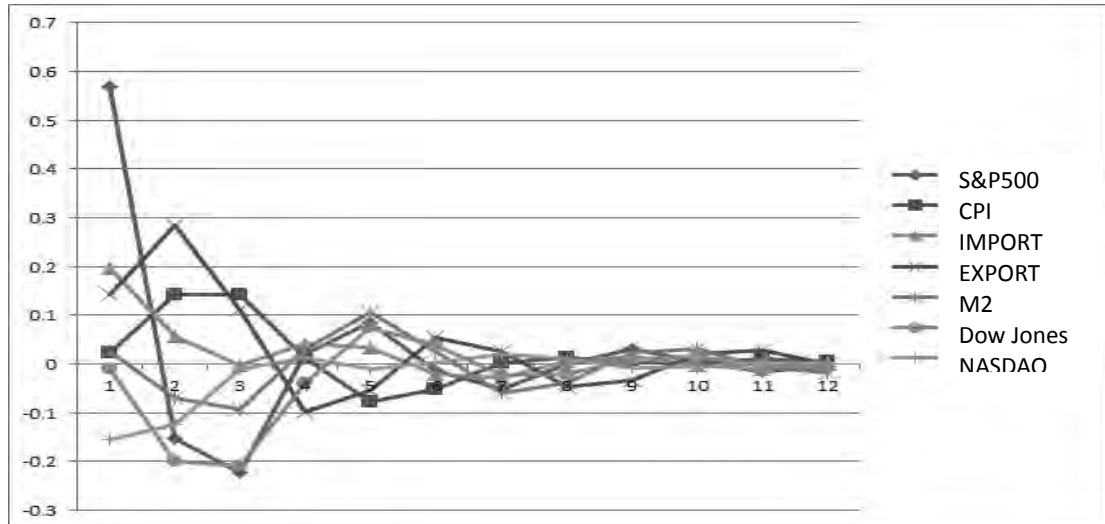


From the empirical result of figure 7, we can understand that whenever a unit spontaneous interference from other variables happen, how the PHLX index responses. The impact response exists

until the five-month interval.

- When a unit M2 interference happens, it has a 6% impact on PHLX index in the first-month period. And US dollar index have a negative and positive impact on the PHLX index by -8%, 7%, and 10% in the first, second, and third-month period respectively.
- When a unit Dow Jones index's interference happens, it has a 11%, 14%, and -16% impact on PHLX index in the first, second, and third-month period respectively.

**Figure 8 Impact responses of S&P 500 index from other six variables**



From the empirical result of figure 8, we can understand that whenever a unit spontaneous interference from other variables happens, how the S & P 500 index responses. The impact response exists until the six-month interval.

- When a unit import interference happens, it has a 20% impact on S & P 500 index in the first-month period. And when a unit export interference happens, it has a 28% impact on S & P 500 index in the second-month period.
- When a unit CPI interference happens, it has a 14% impact in the second and third-month period respectively.
- When a unit Dow Jones index's interference happens, it has a -20%, and -21% impact on S & P 500 index in the second and third-month period respectively.

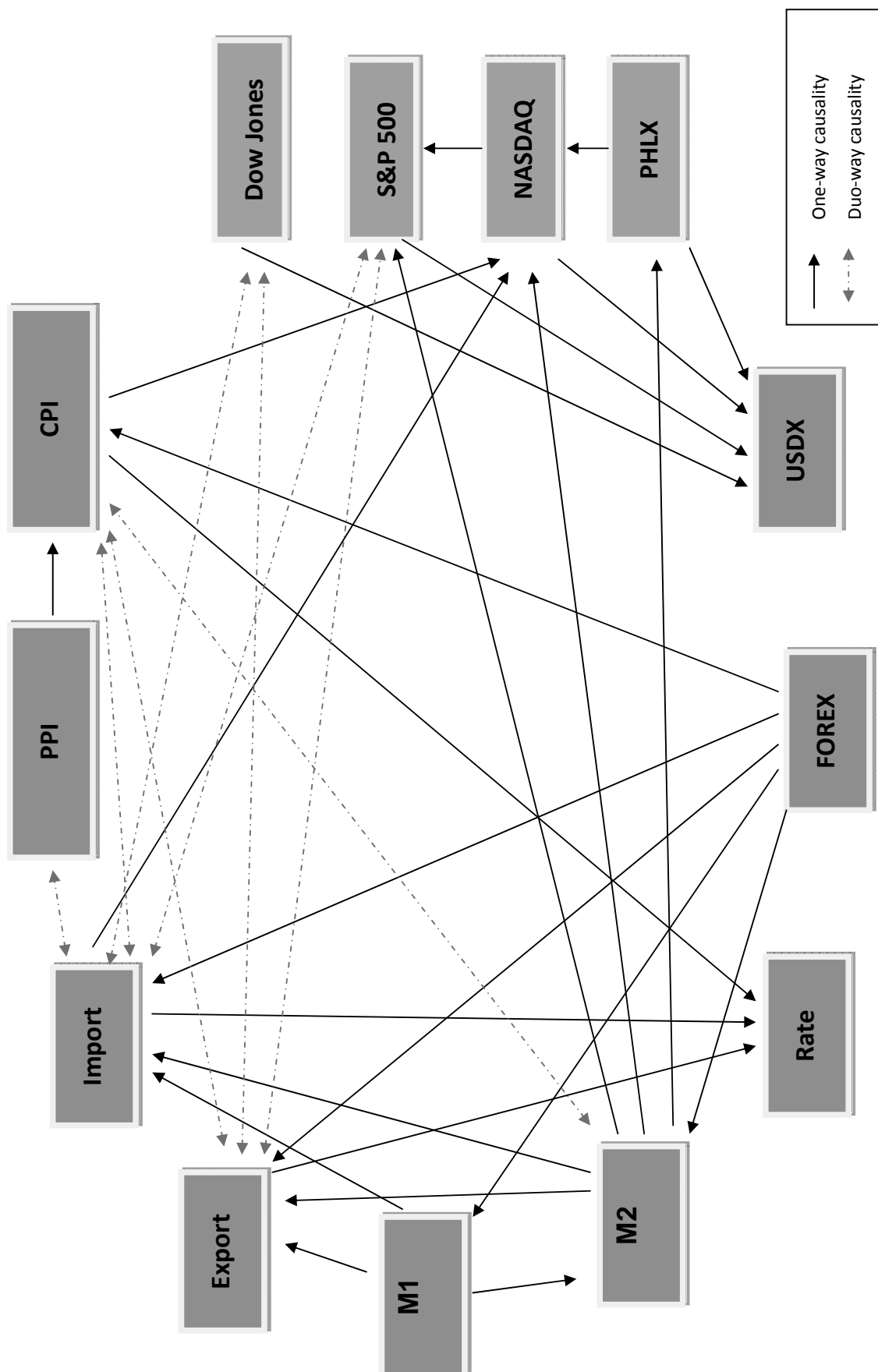
## 5. Concluding Remarks

This paper studies the dynamic structure between macro-economic indicators and United States stock market indices, using the Dow Jones 30 index, NASDAQ index, PHLX index and S&P 500 index from United States stock market and United States macro-economic indicators as examples. The monthly closing stock indices and macro-economic variables from January 2000 to January 2010 are sampled.

1. Based on AIC rule, stock market indices iterate with macro-economic indicators for seven months.
2. According to the empirical results from GVAR, We found that the CPI, export, import, M2 have a Granger causality relationship with stock market indices respectively. (Please see Fig. 9.)
3. By using the Granger causality, decomposition variance and the impact response analysis, we can understand the existence of the dynamic structure between economic indicators and stock market indices in United States. Stock market indices in United States are affected by macro economic variables easily; especially the variation of the PHLX Index and S&P 500 Index can be explained by Dow Jones 30 Index, NASDAQ, export, import, and US dollar index significantly. M1 and M2 interact with each other closely, and M2 is an important macro-economic indicator in the United States.



Figure 9 Causality relationships between economic variables and stock market indices in USA



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