

Time Series

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Student Project

Maroeconomic variables associated with
the study of stock market

Name : Chen Shuan

E-mail : vh955@mail.cki.com.tw

1. Motivation

Factors affecting the stock can be broadly divided into three categories, namely, market factors, industry factors and company factors, including changes in Taiwan's stock market, mostly due to market factors, including interest rates, prices, climate change, exchange rate, money supply, Trade balance and many other macro-economic variables, so whenever the overall economic indicators released, often resulting in stock market volatility.

2. Research purposes

- (1) Selected macroeconomic variables, research on the impact of stock price index, investment decisions and economic forecasts as a reference.
- (2) Explanatory variables were selected for the Stock Price Index, explanatory variables for the Industrial Production Index, Consumer Price Index, the Exchange Rate, Money Supply observed explanatory variables are stock price index and the trend among the explanatory variables, using cointegration test between the existence of long-term equilibrium relationship.
- (3) Using time series models to explore the macroeconomic variables and the dynamic relationship between stock index.
- (4) Granger causality test using the error correction model analysis of dynamic adjustment between the short-term relationship between variables and test the leading countries in the relationship with the backward, so that other variables can increase the period of the early message of the predictive ability of a variable.
- (5) The Impulse Response Function assess the explanatory variables and the explanatory variables are the dynamic between the inter-period effect and by mutual cross-phase dynamic effects, observed changes in the variables that may affect the level, benefit from the timely adjustment decision-making.
- (6) The Variance Decomposition the percentage of forecast error variance decomposition of each explanatory power, to determine the strength of exogenous variables relative.

3. Data

The data period from January 1996 to April 2007 data, was selected explanatory variables for the Stock Price Index, explanatory variables for the Industrial Production Index, Consumer Price Index, the Exchange Rate, Money Supply was observed explanatory variables and the trend among the explanatory variables. Source for the Taiwan Economic Journal database.

The empirical analysis in this study using E-Views software provides analysis, as empirical research measuring software, Figures 1-5 respectively for the SP (stock index),

IND (Industrial Production Price Index), CPI (Consumer Price Index) , RX (exchange rate), MS (money supply) diagram of the variables.

Figure 1

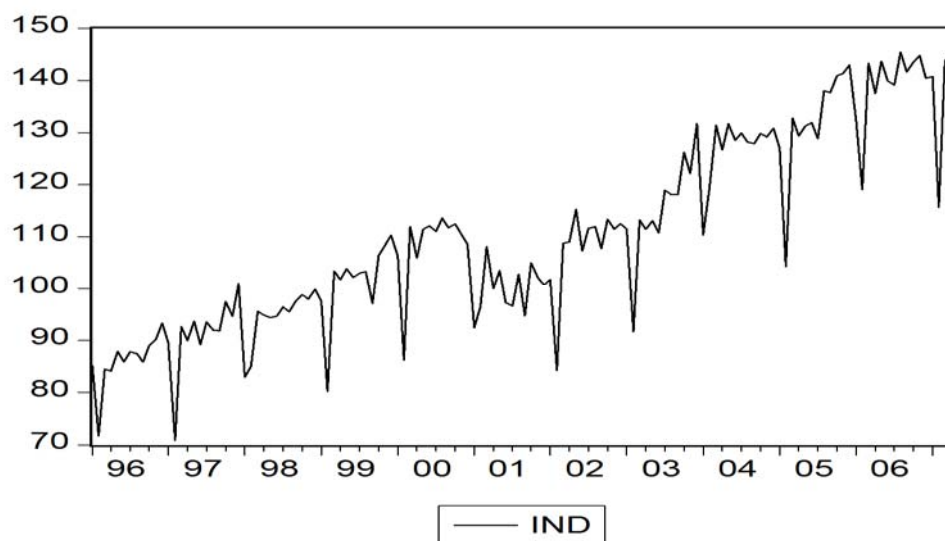


Figure 2

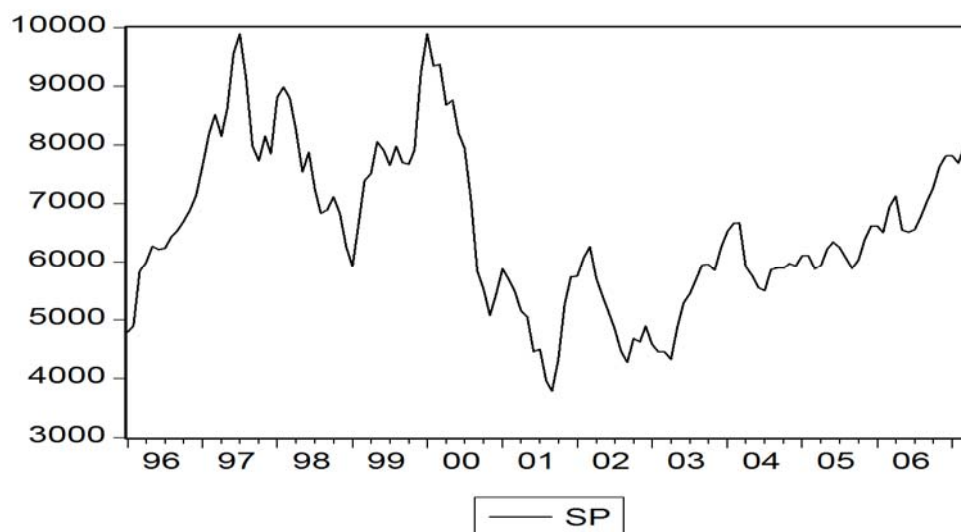


Figure 3

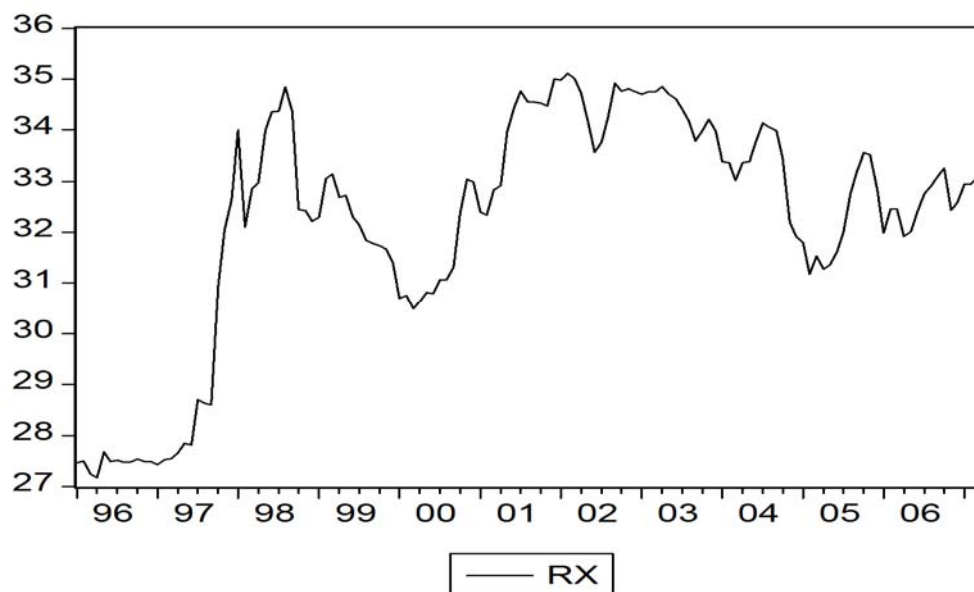


Figure 4

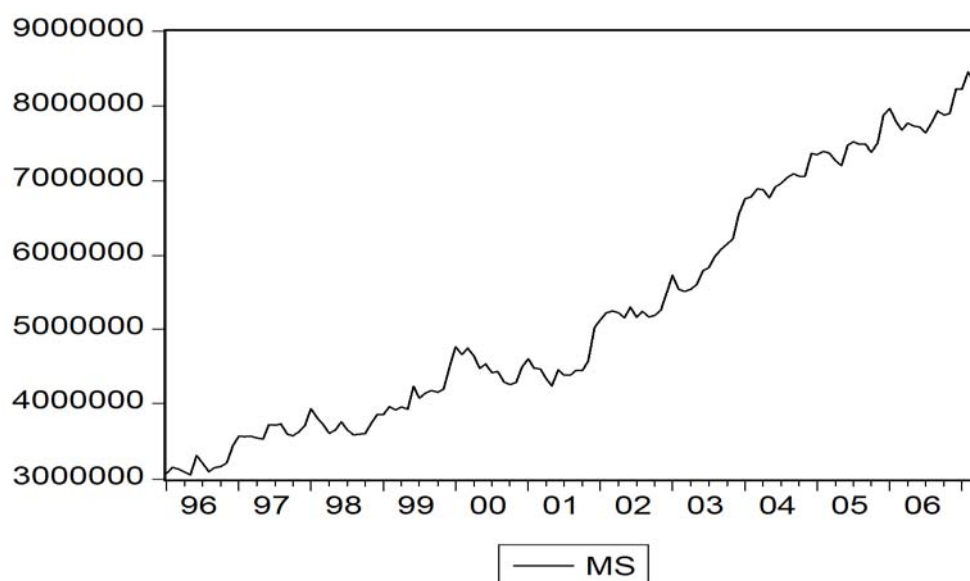
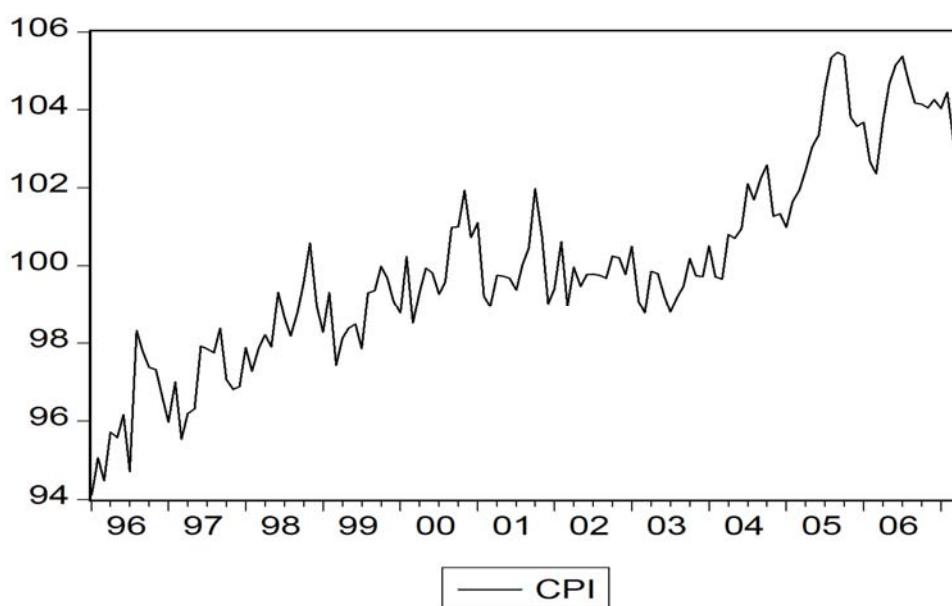


Figure 5



4. Data verification and empirical analysis

4.1 unit root test

In this study, the variables are interpreted as the stock price index, explanatory variables are industrial production price index, consumer price index, exchange rate and money supply, the existence of mutual long-term equilibrium relationship between variables in the analysis of cointegration test before, must first test variables, the integration of the existence of the same series, so, were the first to be done on a unit root test of the variables, this study used a ADF test of the optimal choice of off-order term is used AIC method.

ADF test result:

- (1) The variables listed in a ADF test result, the standard item in the sequence of raw data by the ADF test results were significant and there is no significant denial of a unit root type, in order to obtain the same integrated series, so, for all sequence data and then do a differential for a ADF test to determine whether the time series data have the same integration between the series.
- (2) By a difference after all variables were significantly rejected at the 5% significance level there is a single null hypothesis that the integration of its sequence is the same series I (1) pattern.

ADF table

	raw data		First-order differential	
	t-Statistic	Prob.*	t-Statistic	Prob.*
SP	-2.562410	0.1034	-8.134521	0.0000
IND	0.186573	0.9707	-3.209030	0.0218
CPI	-1.775882	0.3911	-15.38505	0.0000
RX	-2.134939	0.2315	-9.734416	0.0000
MS	0.536525	0.9874	-11.13440	0.0000

Note: SP (stock index), IND (Industrial Production Price Index), CPI (Consumer Price Index) , RX (exchange rate), MS (money supply)

4.2 Cointegration test

Test results by a single integration of the variables are all the same series I (1) time series variables, cointegration test, because of the different phases of off-order will have different results, so choose the smallest SBC value of installments for the best off-order phases, the table for the SP, IND, CPI, RX, MS of the variables selected by the AIC criterion five Johansen cointegration model AIC values

Model 1: Vector autoregressive model without trend term, total integration of the equation without the intercept.

Model 2: Vector autoregressive model without trend term, cointegration equation in intercept.

Model 3: Vector autoregressive models with linear trend term, cointegration equations have intercepts.

Model 4: Vector autoregressive model and common integration formula in the linear trend term and intercept term.

Model 5: vector autoregressive model with quadratic trend term, cointegration equation with a linear trend term and intercept term.

Then follow the Johansen maximum likelihood method for cointegration test, test the existence of the variables between the long-term equilibrium relationship. Empirical results in Table IND, CPI, RX, MS cointegration test of the variables table.

Cointegration test results:

Industrial production price index and consumer price index are the most suitable model for model 5, the optimal model of money supply as a model 1

.Relative to other global variable, the exchange rate on the stock price index, perhaps because of information during the selection, resulting in long-term relationship without a fixed line, so I can not show the difference between the cointegration relationship.

	Model 1 H0(R)	Model 2 H1*(R)	Model 3 H1(R)	Model 4 H2*(R)	Model 5 H2(R)
IND	0.5895	0.7956	0.6519	0.0114	0.0006*
CPI	0.2852	0.5125	0.3765	0.0692	0.0064*
RX	0.4250	0.1949	0.0675	0.5943	0.2078
MS	0.0006*	0.0024	0.4789	0.2864	0.1020

Note:SP (stock index), IND (Industrial Production Price Index), CPI (Consumer Price Index) , RX (exchange rate), MS (money supply)

4.3 Granger Test

Empirical results obtained following table, the causal relationship between different variables, different from the results, we can clearly see that there were three kinds of relationships: 1. Is not a causal relationship. 2 variables with one-way between the leader - behind the relationship. 3 has a two-way relationship between variables

Granger test results:

Stock price index and consumer price index and industrial production index is not a causal relationship between stock index and money supply variables, with one-way between the leader - behind the relationship between stock index and currency are leading the way showing mutual relations.

Granger Table

	IND	CPI	RX	MS
SP	×	×	⊙	○

Note:SP (stock index), IND (Industrial Production Price Index), CPI (Consumer Price Index) , RX (exchange rate), MS (money supply) ; x:Is not a causal relationship ; ○: variables with one-way between the leader - behind the relationship ; ⊙: has a two-way relationship.

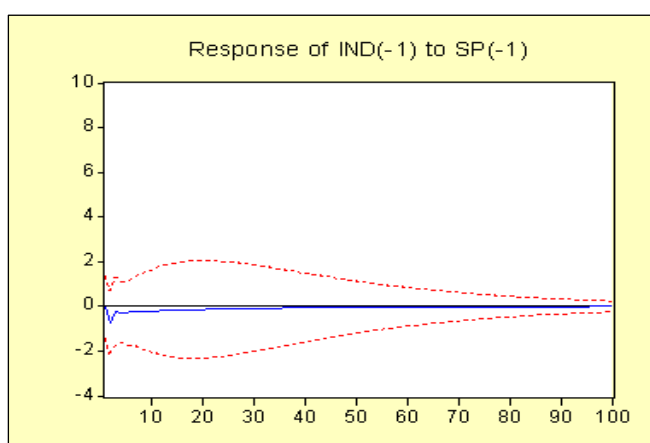
4.4 Impulse response analysis

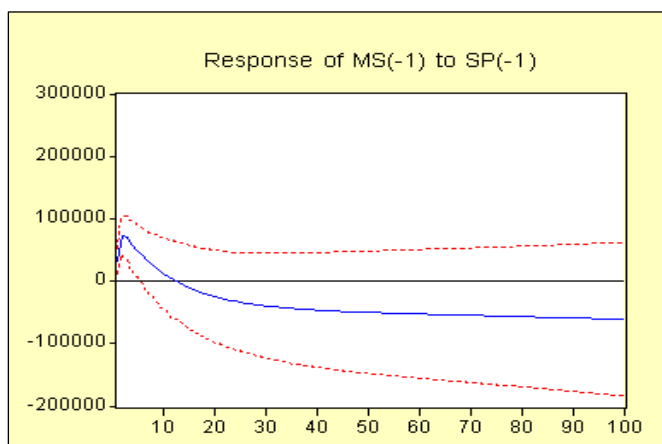
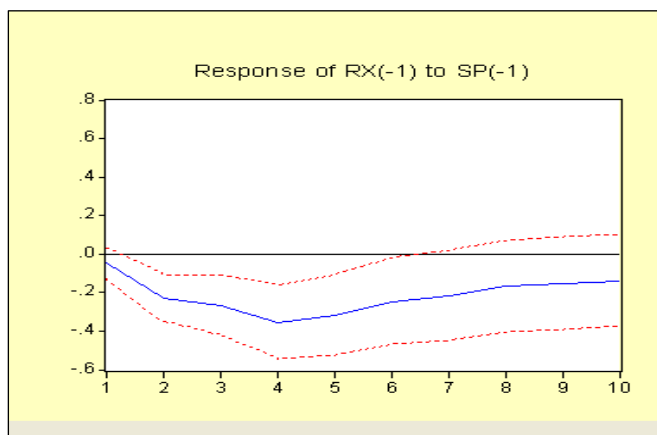
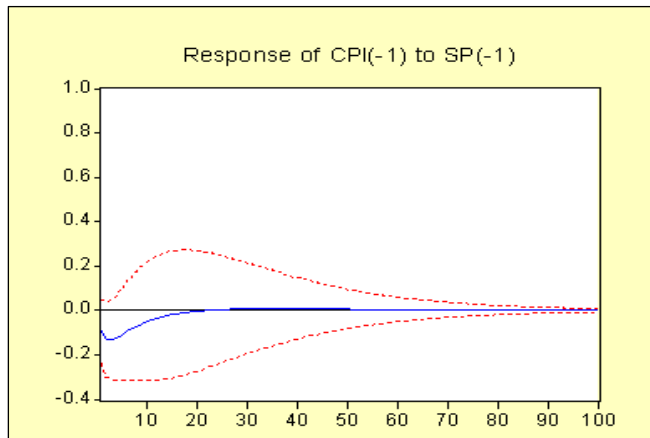
Focuses on the SP, IND, CPI, RX, MS if a variable is the variable produced spontaneous interference, the interference of the spontaneous reaction of the variable speed, the impact will be variables in the relationship between the use of the indirect effects of other variables, and learn about the when other variables change in the resulting intertemporal dynamic effects, and impulse response duration of this length in the direction of each other as positive or negative response, impulse response results in persistent or beating on the nature of the effect, so , impulse response analysis focuses on the impact, rather than serving size.

Impulse response analysis result:

Money supply on share price index, because in the short term, increase the money supply will have a positive impact on the policy of the stock, but in the long run, shocks gradually reduced. Consumer price index for stock index price index may be due to the hike. Exchange rate on stock index in the short term, the first showing a positive impact, while the long term, with no influence. Stock price index of industrial production index for the whole show very little influence.

Impulse response analysis chart





4.5 Variance decomposition

The main evidence of how the variance in decomposition to determine the strength of exogenous variables and the relative forecast error variance decomposition of the percentage of each explanatory power of each variable's variance. The variance is expressed as a weighted sum of all variables.

Variance decomposition result:

When a mutation occurs when the stock index, the explanatory power of its own up to 100%, showing a strong exogenous stock index, the explanatory power of their high variability, the overall index by other impact is quite low.

Variance decomposition table

	Period	SP
MS	1	0.000000
	25	0.357872
	50	0.465227
	75	0.653732
	100	0.884230
SP	1	100.0000
	25	99.64213
	50	99.53477
	75	99.34627
	100	99.11577
CPI	1	0.000000
	25	1.842982
	50	2.973604
	75	3.103642
	100	3.115228
IND	1	0.000000
	25	0.465315
	50	0.893335
	75	1.007667
	100	1.031007
RX	1	0.000000
	25	7.920980
	50	9.597021
	75	9.621246
	100	9.621342

4.6 Autoregression analysis

According to Engle and Granger (1987) proposed "Granger Representation Theory" of the theory, when the cointegration relationship exists between variables, the relationship between the observed variables can not only test their value with other variables and backward variables for the current effects need to consider long-term imbalance adjustment, a total of the entire relationship with the previous disequilibrium term error correction model exist.. However, cointegration test results show that some variables do not exist cointegrating vectors, so will use the vector autoregressive model (VAR) to test the overall stock and short-term interactions between variables.

Optimum gap phases of the consumer price index for the first two, industrial production price index and money supply are the optimal gap for the first three installments, the exchange rate gap between the optimal number of installments for the first five

	IND	CPI	RX	MS
1	22.17811	17.41542	16.35419	41.14320
2	21.80102	17.27570*	16.09766	40.99446
3	21.76594*	17.28473	16.11923	40.99388*
4	21.80129	17.34168	16.11272	40.99979
5	21.77304	17.40365	16.08487*	41.01787

Note:SP (stock index), IND (Industrial Production Price Index), CPI (Consumer Price Index) , RX (exchange rate), MS (money supply)

5. Conclusion

1996-2007 based study period, the overall economic impact on the stock market index, this analysis found that only the exchange rate and money supply have a more significant response, and especially from 1996 to 2000, a turning point in the larger.