# ARBITARAGE PRICING THEORY MODEL TESTING ON SHARES IN BANKING SECTOR

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## ABSTRACT

*Many studies empirically shown that both short-term and long term stock return can be predicted by using market variables and interest rate, but no satisfactory theory would argue that the relation between financial markets and the macro economy is entirely in one direction. However, stock prices are usually considered as responding to external forces. In 1976, Ross designed APT as a response to the weakness of CAPM (Capital Asset Pricing Model), in where CAPM predicts only one systematic risk that will affect return which is market risk. While APT assumed there are more systematic risks that affect return of stocks. Making a decision in an investment needs an overall analysis to factors affecting expected return which are the conditions of macro economy in the country. Chen, Roll and Ross (1980) found out that indicators of macro economy affecting return of the stocks are inflation, GNP, investor confidence (estimated with corporate bond premium) and the change of yield curve. Empirical studies reveal that once financial deregulation takes place, the stock markets of a country become more sensitive to both domestic and external factors. Many studies have documented the relationship between macroeconomic variables and stock returns, and they provide different results. This study aims to see and analyze which macroeconomics factors that can affect the stock return in banking sector period of 2005-2010. Sample used in this study are shares on banking sector that listed in Indonesia Stock Exchange. The macroeconomics variables used in this study are Consumer Price Index, Industrial Production Index, Gold price and Money Supply. The results shows that simultaneously, Consumer Price Index, Industrial Production Index, Gold price and Money Supply do not affect banking sector in Indonesia Stock Exchange. This finding is consistent with theory and a number of empirical studies. And out of 8 companies tested, the APT model only significant in explaining Bank Central Asia, simultaneously but partially only CPI and Money Supply are significant.*

**Keywords: APT, Consumer Price Index, Industrial Production Index, Gold price, Money Supply..**

## INTRODUCTION

Many studies empirically shown that both short-term and long term stock return can be predicted by using market variables and interest rate, but no satisfactory theory would argue that the relation between financial markets and the macro economy is entirely in one direction. However, stock prices are usually considered as responding to external forces.

In 1976, Ross designed APT as a response to the weakness of CAPM (Capital Asset Pricing Model), in where CAPM predicts only one systematic risk that will affect return which is market risk. While APT assumed there are more systematic risks that affect return of stocks. Making a decision in an investment needs an overall analysis to factors affecting expected return which are the conditions of macro economy in the country. Chen, Roll and Ross (1980) found out that indicators of macro economy affecting return of the stocks are inflation, GNP, investor confidence (estimated with corporate bond premium) and the change of yield curve.

Empirical studies reveal that once financial deregulation takes place, the stock markets of a country become more sensitive to both domestic and external factors. Many studies have documented the relationship between macroeconomic variables and stock returns, and they provide different results.

In 2002 Flannery and Protopapadakis wrote "Macroeconomic Factors do Influence Aggregate Stock Returns" and they reevaluate the effect of some macro announcement series on US stock returns, and they found out that the real GNP and industrial production do not appear to be related with stock returns. While in 2003, in "Macroeconomic Variables and the Malaysian Equity Market A View Through Rolling Subsamples", Ibrahim and Aziz investigate the relationship between stock prices and industrial production, money supply, consumer price index, exchange rate in Malaysia and the result shows that industrial production has positive effect to the stock price.

In 2010, Mishra and Das examined the gold price volatility and the causality between domestic gold prices and stock market returns in India for the period 1991 to 2009 and the results shows that there's a relation between the vitality of gold and stock returns. The fluctuation of gold price caused investors to choose gold as one of the alternatives investment. If the gold price rises, investors tend to sell their shares at the time before the decline of the market index, and then they will transfer its investment in gold whose price has a tendency to rise. Bilson, Brailsford and Hooper (2001) use value weighted world market index and some macroeconomic variables for explaining stock returns in selected emerging markets, the result shows that money supply has positive effect on stock returns. While in 2003, the study taken place in Malaysian stock exchange shows that stock returns stock prices have a negative association with money supply and Ringgit exchange rate.

The different results of these studies have changed according to the macroeconomic factors used, the research methodology employed and the countries examined. This research investigates the role of macroeconomic factors in explaining Indonesian banking sector stock returns. Researcher chose the banking sector since it has a bright future prospects. For couple of years, beside mining and property sector, banking sector has become the center of attention of investors. It is believed that those stocks in banking sector have prospects and great potential for long-term benefits. The step of banking regulator in lowering BI rate has a positive impact on the movement of stocks related to interest rate, especially stocks in banking sector. Bank stocks are hunted because investors are optimistic that the outlook for the banking performance will be improved (Infobanknews, 2010).

Then the growth of banking assets in Indonesia is also much higher compared to other ASEAN countries. From 2004 to 2008, for example, Indonesia's banking assets grew about 82%. Special in 2008, the growth of Indonesia's banking assets by 17%, higher than Malaysia 11%, Singapore 9% and Thailand 4.1%. (Vibiznews, 2010). Based on the description and interest of the writer, so this paper is prepard with title: **"Arbitrage Pricing Theory model testing on shares in banking sector"**

## LITERATURE REVIEW

### 2.1 Study about money supply and stock return

Conover, Jensen and Johnson (1999) have examined the impact of international monetary policy on stock returns in Sweden. They found a significant relationship between monetary policies taken by the government with stock returns. A recent study by Flannery and Protopapadakis (2002) reevaluate the effect of some macro announcement series on US stock returns. Among these series, six macro variables, namely, balance of trade, housing starts, employment, consumer price index, M1, and producer price index seem to affect stock returns.

Tursoy (2008) tested the Arbitrage Pricing Theory model in Istanbul Stock Exchange for period of 2001-2005 with monthly based using 13 macroeconomic variables. various macroeconomic variables representing the basic indicator of an economy employed which are; money supply, industrial production, crude oil price, consumer price index (CPI), import, export, gold price, exchange rate, interest rate, gross domestic product (GDP), foreign reserve, unemployment rate and market pressure index (MPI) which is built by the authors. The regression results indicate that there is no significant pricing relation between the stock return and the tested macroeconomic variables. Money supply only has 1% of significance in this study which shows that it doesn't have any relation with stock return.

### 2.2 Study about gold price and stock return

In 2010, Mishra and Das examined the gold price volatility and the causality between domestic gold prices and stock market returns in India for the period 1991 to 2009. The study uses monthly data on the defined time series. The required data have been collected from the database of Reserve Bank of India. The Augmented Dickey-Fuller test says that the time series of the study are stationary and all integrated of order one. The Johansen's cointegration test reveals that there exists long run equilibrium relation between gold prices and stock market returns in India. Then application of Granger causality test in the vector error correction model suggests the evidence of feedback causality running between the gold prices and BSE 100 Index based stock returns in India.

### 2.3 Study about consumer price index and stock return

In 2009, Ozbay did a study on macroeconomics factor on stock return in Turkish Stock Exchange using 5 macroeconomics variables; interest rate, industrial production, consumer price index, Money supply (M1, M2, and M2Y), and foreign transaction. He found out that, industrial production and consumer price index don't have significant effect on stock return. Contrary, another study conducted by Ibrahim and Aziz (2003) found out that industrial production and CPI share positive long-run relationships. The study investigates the relationship between stock prices and industrial production, money supply, consumer price index, exchange rate in Malaysia and stock prices in Malaysian Stock Exchange.

### 2.4 Study about industrial production index and stock return

Cooper and Priestley (2008) investigate the output gap as a direct link between future stock returns and economic fundamentals. They define output gap as the deviation of the log of industrial production from a trend constructed from both linear and quadratic components. Using unrevised industrial production data, aggregate U.S. stock market returns and Treasury bill yields (to calculate excess returns) for the period 1948-2005, they conclude that the industrial production (output) gap may have some meaningful predictive power for broad U.S. stock returns over relatively long periods.

Kandir (2008) also did the similar study on Turkish stock return with various macroeconomic variables such as growth rate of industrial production index, change in consumer price index, growth rate of narrowly defined money supply, change in exchange rate, interest rate, growth rate of international crude oil price and return on the MSCI World Equity Index. The result shows that industrial production, money supply and oil prices do not appear to have any significant affect on stock returns.

## DATA AND METHODOLOGY

The population in this study is the entire stock of a variety of issues that have been grouped into banking sector and are already traded and listed on the Indonesia Stock Exchange.

### 3.1 Samples

The sample in this study was selected using non-probability a method of sampling which is a type of purposive sampling is based on certain criteria or considerations. The criteria used to select the sample in this study are those shares in banking sector and are included as most active shares from period of 2006-2010. There are 31 shares that categorized in banking sector, and after some selections according to criteria, 8 shares are selected as most active shares in banking sector and used in this research.

The criteria of the sample are as follows:

1.  Go public banks and listed in Indonesia stock exchange.

2.  Bank with complete data of closing price during observation period 2006-2010

3.  Bank that has annual average selling volume above 1.000.000 shares

In this study, the type of data used by researchers is secondary data. Such data include:

-   The closing price of the shares, including the banking sector monthly periods during 2006 to 2010.
-   Composite stock price index monthly periods during 2006 to 2010
-   Industrial production index during 2006 to 2010
-   Consumer price index monthly periods during 2006 to 2010
-   Gold price monthly period during 2006 to 2010
-   Money supply monthly periods during 2006 to 2010

### 3.2 Hypothesis

The hypothesis for this study are as follows:

- Hypothesis 1: Industrial production index has positive and significant impact on stock returns
- Hypothesis 2: Consumer price index has positive and significant impact on stock returns
- Hypothesis 3: Money supply affects on stock returns positively
- Hypothesis 4: The change in gold price has positive impact on stock returns

## 3.3 **The use of APT Model**

For the APT model, the author combines all the macroeconomic variables that's been used in the previous studies. The model is as follows:

$$Ri - Rf = \beta_1 IPI + \beta_2 CPI + \beta_3 GP + \beta_4 M1 + e$$

Where,

Ri      : Stock return to i
Rf      : Yields on risk-free asset
         : Slope (sensitivity of stock I to factor k)
IPI     : Industrial production index
GP      : The change in gold price
CPI     : Consumer price index
M1      : Money supply
e       : Error

This model was chosen on the basis of compliance with the study by Chen, Roll and Ross (1986) in their study entitled Economic Forces and Stock Return. The model is consistent with research conducted by Ibrahim and Aziz (2003) in which the factors that significantly affect stock returns are industrial production, money supply, consumer price index.

## ANALYSIS OF TEST RESULT

**Table 4.1**
**APT Testing**

|  |  | C | CPI | Gold | IPI | M1 | F-statistic | R squared |
|---|---|---|---|---|---|---|---|---|
| **BBCA** | Coefficient | 5.307 | -9.623 | -0.218 | -0.634 | 1.514 | 4.063 | 0.238 |
|  | Probability | 0.053 | 0.013 | 0.510 | 0.294 | 0.003 | 0.006 | |
| **BBNI** | Coefficient | 1.645 | -4.936 | 0.449 | 0.555 | 0.507 | 1.599 | 0.110 |
|  | Probability | 0.537 | 0.189 | 0.173 | 0.360 | 0.299 | 0.189 | |
| **BBRI** | Coefficient | 7.119 | -8.915 | -0.013 | 0.238 | -0.236 | 1.905 | 0.128 |
|  | Probability | 0.006 | 0.013 | 0.967 | 0.676 | 0.566 | 0.124 | |
| **BDMN** | Coefficient | 9.037 | -11.669 | -0.432 | 0.389 | 0.093 | 1.287 | 0.090 |
|  | Probability | 0.032 | 0.054 | 0.418 | 0.686 | 0.904 | 0.287 | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **BMRI** | Coefficient | 4.774 | -4.953 | -0.060 | -0.552 | 0.789 | 0.805 | 0.058 |
| | Probability | 0.133 | 0.263 | 0.876 | 0.440 | 0.174 | 0.528 | |
| **BNGA** | Coefficient | 4.047 | -3.906 | 0.083 | 0.697 | 0.587 | 1.033 | 0.074 |
| | Probability | 0.180 | 0.354 | 0.821 | 0.308 | 0.286 | 0.399 | |
| **BNII** | Coefficient | -0.043 | 3.147 | 0.483 | 0.088 | 0.420 | 0.230 | 0.017 |
| | Probability | 0.993 | 0.657 | 0.438 | 0.939 | 0.650 | 0.920 | |
| **PNBN** | Coefficient | 3.216 | -3.817 | -0.059 | -0.182 | 0.201 | 0.340 | 0.0250 |
| | Probability | 0.207 | 0.284 | 0.848 | 0.751 | 0.664 | 0.850 | |

From the Table 5.4, it can be seen that only BBCA that can be explained using APT model with R square or 23.8%.

**Table 4.2**
**Multiple Regression Analysis**

| Model | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | t | Sig. |
| 1 (Constant) | 3.216 | 1.480 | | 2.172 | .034 |
| CPI | -4.065 | 2.074 | -.262 | -1.960 | .055 |
| IPI | .053 | .336 | .022 | .159 | .874 |
| gold | .022 | .182 | .016 | .121 | .904 |
| m1 | .350 | .271 | .174 | 1.292 | .202 |

a. Dependent Variable: return

From the results of data processing that the regression equation can be written as:

$$Return = 3.216 - 4.065\,CPI + 0.053\,IPI + 0.022\,GOLD + 0.350\,M1$$

The interpretation from the equation above is as follow:

- Constant value of 3.216 stated that if there is no CPI, IPI, Gold and Money Supply (M1), the stock return of banking sector will be at the level of 3.216
- Coefficient of regression of CPI – 4.065 shows that each additional 1 point from CPI will impact the stock return to decrease by 4.065 points.
- Coefficient of regression of IPI + 0.0053 shows that each additional 1 point from IPI will impact the stock return to increase by 0.053 point.
- Coefficient of regression of gold price + 0.022 shows that each additional 1 point from IPI will impact the stock return to increase by 0.022 point.
- Coefficient of regression of money supply + 0.350 shows that each additional 1 point from IPI will impact the stock return to increase by 0.350 point.

**Table 4.3**

**Coefficient of determination**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Durbin-Watson |
|---|---|---|---|---|---|
| 1 | .322[a] | .104 | .035 | 6.7859016 | 1.797 |

a. Predictors: (Constant), m1, CPI, gold, IPI

b. Dependent Variable: return

- The results of the regression shows the R squared is 0.104. It means that the correlation or the relationship between return of stock with the other independent variables is not very strong. This means that 10.4% stock return variable can be explained by the independent variables whereas the rest 89.6% is explained by other factors.

**Table 4.4**

**Result of t test**

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | 3.216 | 1.480 | | 2.172 | .034 |
| CPI | -4.065 | 2.074 | -.262 | -1.960 | .055 |
| IPI | .053 | .336 | .022 | .159 | .874 |
| Gold | .022 | .182 | .016 | .121 | .904 |
| m1 | .350 | .271 | .174 | 1.292 | .202 |

a. Dependent Variable: return

According to (Santoso, 2010) basis for decision making based on probability:

- If the probability> 0.05, Ho is accepted
- If a probability < 0.05, Ho is rejected

From the regression result above it can be seen clearly that none of the independent variables above; CPI, IPI, gold price and MI, partially affect the stock return because the results of the regression indicates significance value above 0.05 level (5%). If the value t count bigger than value t tables with a significance level of 0.05 (5%) it means that H0 is rejected. From the output above we can conclude that:

- For variable of CPI, the value of t test is smaller that t-table which is – 1.960 < 1.673 which means that CPI doesn't affect stock return partially.
- For variable of IPI, the value of t test is smaller that t-table which is 0.159 < 1.673 which means that IPI doesn't affect stock return partially.
- For variable of gold price, the value of t test is smaller that t-table which is 0.121< 1.673 which means that gold price doesn't affect stock return partially.
- For variable of money supply (M1), the value of t test is smaller that t-table which is 1.292 < 1.673 which means that M1 doesn't affect stock return partially.

**Table 4.5**

**Result from F test**

| Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| 1 Regression | 277.879 | 4 | 69.470 | 1.509 | .213[a] |
| Residual | 2394.520 | 52 | 46.048 | | |
| Total | 2672.399 | 56 | | | |

a. Predictors: (Constant), m1, CPI, gold, IPI

b. Dependent Variable: return

According to the result of F test, we can see that the F count is 1.509 with significance level of 0.213. This shows that independent variables simultaneously do not affect the stock return.

**4.1 Discussion**

Arbitrage Pricing Theory is well known for its law of one price, where financial securities with similar characteristics are believed to be sold in the same price. But realistically, those securities with similar characteristics are sold in different price in financial market even though they belong to the same macroeconomics conditions. This study is trying to see which macroeconomics factors that can affect the price differentiation in those securities.

From 8 companies used, only one company that can be explained using APT which is BBCA. And the R square from this company is only 23.8% which means that the independent variables used can explain the stock return in banking sector for only 23.8%. From the statistical calculation, independent variables used do not affect the return of stock in banking sector partially and simultaneously. According to Hasiholan (2008), there are many other factors beyond the variables which are tested in this study that affect stock returns. These factors include political risk, market sentiment, taxes, government regulations, supply and demand of such shares and the internal condition of the company.

**CONLCUSION**

Based on the results of statistical data processing and analysis it can be concluded that:

1. The testing of APT model on banking sector stocks using four macroeconomics variables; Consumer Price Index (CPI), Industrial Production Index (IPI), gold price and money supply, cannot explain the price variability.

2. The change in Consumer Price Index does not affect the stock return in banking sector. Chen, Roll and Ross (1986) stated stock returns would only be affected by the unexpected change in inflation while with CPI we can predict the change in inflation that's why we cannot conclude that CPI has the effect on stock return.

3. The change in Industrial production does not affect the stock return in banking sector. IPI doesn't have direct relationship with financial sector because IPI only measures the output of manufacturing, mining and utilities sector.

4. The change in gold price does not affect the stock return in banking sector because investors choose to stay in stocks investment rather than gold. A massive growth in Indonesia's banking sector and banking assets among ASEAN countries would be the reason behind this phenomenon. Even though the price of gold is also stable and promising as an investment tool it doesn't affect the investor to switch their funds from stocks investment to gold.

5. Money supply does not affect the stock return in banking sector. It can be deduced that people prefer to invest in banking sector, savings deposits, time deposits or government bonds with smaller risk.

6. When each companies is tested using APT model, out of 8 companies, the APT model only significant in explaining Bank Central Asia simultaneously but partially only CPI and Money supply are significant.