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A PANEL DATA ANALYSIS OF THE FISHER EFFECT: EVIDENCE FROM THE SELECTED DEVELOPED COUNTRIES

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THESIS SUBMITTED IN FULFILLMENT FOR THE DEGREE OF MASTER OF ECONOMICS

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2012
DECLARATION

I hereby declare that the material in this thesis is my own except for quotations, excerpts, equations, summaries and reference, which have been duly acknowledged.

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ABSTRACT

A PANEL DATA ANALYSIS OF THE FISHER EFFECT: EVIDENCE FROM THE SELECTED DEVELOPED COUNTRIES

The main objective of this study is to evaluate the Fisher effect existing between nominal interest rates and inflation rates in selected developed countries, namely Australia, Canada, Germany, Japan, United Kingdom (UK), and United State (US). The nominal interest rates are combination of inflation rates and real interest rates. This quantitative study analyses a panel of annual data from 1975 to 2008 for six major countries. There are 34 observations for each country and total of 204 observations in this study. The panel co-integration test used is to test the long run relationship. This study finds that there are significant long run relationship between the inflation rate and nominal interest rate. Panel ordinary least square also significantly proves the strong positive relationship for these two variables. The vector error correction model (VECM) designed to be used with series that are known to be co-integrated. The result indicates that there is short run relationship between the inflation rate and nominal interest rate. In order to evaluate the causality, the Granger causality test had been used. It suggests that there is bidirectional Granger causality. This implies that nominal interest rate and inflation rate are affecting each other. Overall conclusions from the results suggest that the policy makers should depending on the level of inflation. Whenever the inflation rate decreases below a level of tolerable inflation, the policy makers will conduct an active policy by changing nominal rates which is consistent with a stance of inflation targeting. However, in a context of increasing inflation, the monetary authorities change nominal interest rates so that inflation rates will return to acceptable values.
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INTRODUCTION

1.1 Overview
Fisher (1930) defined a situation to imply a proportional change in nominal interest rates given that the real interest rates are constant in the long term when there is a change in expected inflation. The hypothesis is fundamental for the economist to differentiate between the nominal interest rates and real interest rates since real interest rates affect the dynamics of asset prices, savings and investments.

The theoretical equation of Fisher (1930) hypothesised state that the nominal rate of interest \( R \) is made up of two components: the expected rate of inflation \( \pi_e \) and the real rate of interest \( r \):

\[
R = r + \pi_e
\]  

This equation is based on the rational assumptions that the agents needs compensation for any purchasing power lost on their nominal money due to price level increases.

In Fisher’s (1930) model, the real interest rate is explained as the difference between nominal interest rate and the expected inflation rate. This linkage of inflation and interest rate has reasonably explained the money flowing from low-yielding currencies into higher-yielding currencies as there is tendency of investors for higher capital returns. The arbitrage can occur as there are advantages in terms of difference in inflation for each country. When the inflation is synchronized, it is considered as a different case for us to expect the dependency of the currency trading values on the differences in the nominal rates of interest. So, it is plausible
for some investors capitalizing on these interest rates which have parity between countries by using a common foreign exchange strategy called the "carry trade".

The interest rate in the Fisher hypothesis is referred as the price a borrower has to pay for temporary usage of capital (Obi, Nurudeen and Wafure, 2009). In other word, it also indicates the return expected by a lender by having their liquidity postponed and from which parted. As common sense, when the interest rate is high, it will bring discouragement to the borrower and encouragement only when the interest rate is low. In a state of equilibrium, interest rates reflect demand and supply in the capital market (Deutsche Bundesbank, 2001). The importance of real interest rates in the growth and development of an economy is evitable since they are the determinant of saving and investment behavior of households and businesses. According to Hakan and Kamuran (1999), the real returns on asset holding is the main concern shared by both households and firms. In contrast to what they learn about their nominal return on which their assets are holding, they have no idea about the direction of inflation in the current period.

Compared to nominal interest rate, the real interest rate remains intact to the inflation. As an information, non-stationary of the real interest rate is a very low probability event and inconsistent with conventional growth theory. The study conducted by Peng (1995) notes that the case of the real interest rate responding to change in economic factor has attributed to the critic of the assumption of a constant real interest rate. Nevertheless, Jorion and Mishkin (1991) have supported the validity of the assumption by using a changes specification in their methodology as the change in real interest rate is constant in their result.

As the term of inflation has been one of our determinants in our case and linkage to our variables like the real interest rate and nominal interest rate, we need to have a clear picture about the term. In general definition, inflation is the reflection of the increase in the general level of prices of goods and services in an economy over a period of time, which in other sense can be indicator of purchasing power of money. As inflation increases, aggregate demand, production, unemployment, trade deficits and balance of payment decreases. On the other
hand, encouragement of economic activity ensues by low and moderate inflation which results in raising of gross domestic product (GDP), reducing of unemployment and easing of balance of payment problem (Obi, Nurudeen and Wafure, 2009).

By looking at the Consumer Price Index over time, we can examine inflation rate, the annualized percentage change, the effect of inflationary expectation on financial market and market interest rates (Obi, Nurudeen and Wafure, 2009). The traders will demand their wanted compensation for the expected rise of inflation as the decreasing of real price of credit was caused due to the rise in inflationary expectations. Therefore, there happens to add inflationary premium into real price of credit in order to hedge against inflation which is not a delighted scenario to all of us. In small conclusion, the realized rate of return is equal to the nominal interest rate, from which the inflationary expectation is subtracted to get the real interest rate. It is no wonder to have the Fisher theory to conclude that the increase in inflationary premium can dominate the increasing in the nominal interest rate.

1.2 Monetary Policy
The Fisher effect has great implications to debtors and creditors for its effectiveness of monetary policy and efficiency in banking sector. A double-digit inflation has been jarring and the function of interest rate as hedge and predictor of inflation has not been convincing ever since. Efficiency in banking sector is another area relevant to the Fisher effect tested through the random walk and rational expectation theories. Therefore, to make the decision, the central banks mostly take Fisher hypothesis as main consideration. Another supportive source, Payne and Ewing (1997) has suggested that the real interest rate is independent to the changes of monetary policy, but is determined by real economic factors as followed by the establishment of long-run Fisherian link.

As information, inflation is the most concerned issues to all of us, especially to monetary authorities. The monetary authorities have countered inflation in response to the negative supply shocks to raise nominal interest rate (Million, 2004).
These measures are anticipated to drag inflation down to a moderate value in order to sustain the purchasing power. The measure of keeping real interest rate at a high level by the monetary authorities was to persist until the reachable low values for the inflation. The contrary measure would be only to consider when the risk of inflationary pressures was no longer present. As a result, there was no compensation for the loss of purchasing power consecutive to the increasing inflation by increasing the nominal interest rates and real interest rates continued to stay at low levels.

The monetary authorities have been committed to inflation targeting policies and these marked the ends of the disinflation period. As mention by Orphanides and Wilcox (1996), the adjustment of the level of nominal interest rates was not as quick as the changes for the inflation rates to be different from Federal Reserve’s target. The adoption of being watching position was taken to wait for favorable shocks to bring the inflation rates down to the target and a reactive monetary policy is the only alternative when inflation rates just out of the bands by mere tolerance values.

As verified empirically by Bec, Ben Salem and Collard (2002) and Kim, Osborn and Sensier (2002), the reaction of the Central Bank to respond the inflation shocks can be claimed as multiple-regime behavior implying that the monetary authorities run a credible yet opportunistic anti-inflationary policy, reacting more strongly to positive and persistent than to negative or transitory inflation shocks. The mean reversion effects only work for low regime, which corresponds to a situation of higher inflation rates compared to the nominal interest rates. The credibility of the Central bank comes to our light as real interest rates peak at their level for a long period. The situation could be classified as a feedback effect of an opportunistic behavior of the Central Bank for the T-Bill market.

The Fisher equation has been important to analyze the relationship between expected inflation and nominal interest rates (Mitchell-Innes, Aziakpono and Faure, 2008). It has to be taken into account by central banks in making decision during policy making. The study by Van Der Merwe (2004) shows that policy changes have
to depend on the expected development in inflation under the inflation targeting monetary policy regime. The absence of link between the short-term interest rate and the expected inflation subsequently indicates that the short-term interest rates to be largely determined by the decision-making body of the monetary authorities.

In reality, the general agreement in economic literature suggests that aggregate demand depends more on long-term rates than short-term ones. Hence, the assessment of monetary policy effectiveness also needs a careful consideration of the link between short-term policy rates and long-term yields (Basci, Ozel and Sarikaya, 2007). The expectations theory of the term structure of interest rates is the most powerful widely accepted theory regarding the relationship between short and long-term interest rates. According to the theory, long-term interest rates are said to be functions of the weighted averages of expected future short-term rates plus a term premium. A rise/fall in the current short-term rates will lead to an/a increase/decrease in long-term rates. However, short-term and long-term rates move in opposite directions if information about the central bank’s policy preferences is revealed.

In common sense, an increase in short-term interest rates reduces inflation and thus reduces long-term interest rates. Romer and Romer (2000) show the unexpected changes of the policy rate will reveal information on the future path of inflation if the Federal Reserve has private information on inflation. The unexpected policy-tightening by the Federal Reserve causes inflation expectation to revise upwards, leading to a stronger response from long rates than symmetric information. The non-existent of co-integrating relationship between the monetary policy rate and the long-term interest rate, the monetary policy will not affect long-term interest rates and hence is reasonable for the monetary policy not known as an efficient tool for inflation targeting. Therefore, co-integration analysis should be conducted to empirically evaluate the relationship.

1.3 Theoretical Background
One of the factors to determine the relationship between expected inflation and nominal interest rate is the liquidity effect (Fahmy and Kandil, 2003). The liquidity
effect poses its impact as the agents prefer to hold cash balances in response to rising inflationary expectation. The other factor which is the Fisher effect, says that there are necessary inflationary premium to compensate investors for incurring the cost of inflation.

According to Tanzi (1984), negative correlation between the ex post real interest rate and the expected inflation exists. The money balances will be shifted out and into real capital as the expected inflation rises, which depresses the marginal product of capital and the equilibrium real rate of interest. Nevertheless, the rise in the expected rate of inflation causes the people to be poorer by reducing the real cash balances of individuals. To overcome this situation, the people will react by increasing their savings and thus pushing down the real rate of interest.

In explaining the liquidity effect on determining the relationship, it can begin with the tendency of the traders in financial markets in demanding a premium corresponding to the real price of credit and inflation anticipation. This only can convince that their return will not be offset by the ex post inflation. The increase in the amount of premium can be expected for assets of longer maturity. As the maturity increases, the interest rate risk increases positively as suggested by Santoni (1984). The risk increases coherently with inflation as a result of great anticipation from the traders about a future rise in the interest rate. One of the constituent for the risk is the possible reduction in the market value of an asset for the case of that anticipation. The increase in the duration of an asset has resulted in the increase in risk since the interest sensitivity of the asset’s price increases as well. Therefore, it is plausible for the case of longer maturity that the reduction for the market price of outstanding assets is greater. Consequently, the inflationary premium is likely to be larger and the delighted is the positive growth for the term structure of the interest rate in accordance with inflationary expectations (Fahmy and Kandil, 2003).

However, the combined effect on the relation between inflation and the term structure of the interest rate has hinged on both factors which are the liquidity effect and the Fisher effect. The relation will be investigated in the subsequent
sections and conclusion, the relation has captured the combined effect of both factors on the response of nominal interest rates and expected inflation.

1.4 Problem Statement
Economists have debated over the issue of Fisher effect about its role on inflation backgrounds for decades. The inconsistencies of results and comments come from researchers no matter they are using time series or panel data analysis. Therefore, the researchers are difficult to reach a consensus for the Fisher effect.

Thus, the main purpose of this study is to evaluate the existence of the Fisher effect in short-run and long-run by using panel data analysis.

1.5 Research Objective
The research objective is the expectation of researchers to achieve in the study. In this study, there will be three clearer objectives:

i) To investigate the existence of Fisher effect in selected developed countries.

ii) To test the causality relationship between nominal interest rates and inflation rates.

iii) To investigate the long-run and short-run relationship of Fisher effect.

1.6 Scope of the Study
The scope of this study is the secondary data from the selected countries to evaluate the Fisher effect. It defines the relationship between the nominal interest rates and expected inflation to influence the monetary policy and banking sector. Federal bank will make any policy depends on the theoretical economic in their country. Therefore, after investigating the evidence of the Fisher effect, Federal bank will take a very suitable policy to overcome the inflation and the level of interest rate. This study will only focus on the developed countries namely Australia, Canada, Germany, Japan, United Kingdom, and United States of America.
1.7 Significant of the Study
For the case of the developed countries, it has less empirical studies of Fisher effect in numbers. Due to the usage of time series and not panel data, some of researches face difficulties to find evidence for the Fisher effect to take place in their study area. Therefore, the focus of this study using panel data analysis is to contribute in such a way of getting consistent result.

The countries that have the strong economic back group have potential to affect the world economy, and can build the issue for the government and policy makers to worry about high rates of interest and inflation. Each time for the advent of an inflation-targeting monetary framework, there will evoke primary motivations behind the monetary policy management. Thus, the significance of the Fisher effect is to be implemented in order to enhance the understandings for the dynamics between nominal interest rates, real interest rates and inflation cannot be ignored.

1.8 Limitation of the Study
The data availability is the main limitation in this study. The data that are available for some developed countries are only for certain periods. Data is difficult to find consistent for the period which is for the most of developed countries. This limitation may cause a selection bias as the countries in the sample may not be representative of the population of interest. As panel co-integration analysis needs a long time span, efficient and consistent data made it necessary to choose the six countries. The researchers are encouraged to consider this limitation and selection effect issue into their studies of the similar topic.

1.9 Organization of the Study
Chapter 2 review to what previous researchers have found for the developed and developing country, what Fisher have found, and the researchers who used the panel data in their study. Chapter 3 explains the methodology that used in this study. All the methods are using to test the relationship between the inflation rate and interest rate. Chapter 4 analyzes the data collected and find out all the result. Chapter 5 shows the conclusion and discussion of the study and some of the suggestions that could be useful to the future researchers.
CHAPTER 2

LITERATURE REVIEW

2.1 Introduction
This chapter will discuss more details on previous studies and how they get the result. It is defined that the different period will reveal the different result of Fisher effect. We will also study the advantage and disadvantage of previous studies and the opinions from researchers. Some of the arguments will come out for the research because of the different methods they used or different periods are used. This chapter will also show the previous research for each countries and their performance of Fisher effect.

As proposed in the Fisher hypothesis, there is a positive correlation between nominal interest rates and expected inflation. One of the supportive studies, Hakan and Kamuran (1999) have investigated the validity of the hypothesis by analyzing the interest behavior within the framework in the country of Turkey. The result suggests when the expected inflation increases, the interest rates increase as well. This discovery has mention that a one-to-one relationship between nominal interest rates and expected inflation to be conclusive.

However, as more as the person agree with, there comes dissidents among whom, Fama (1975) has done his research to question the hypothesis. Using the rational expectation assumptions, he has described the characteristics supposed to be in an efficient market based on relevant information in setting prices. From his work, the author has shown that the observations can be done to a relationship merely between nominal interest rate at a point of time and rate of inflation as long as given in an efficient market.

Regarding on the short-run relationship, the existence of some arguments still prevail. For example, Fahmy and Kandil's (2003) study did not support the
Fisher effect theory based on the ground that the expected inflation has negligible impact on short term interest rates. In addition, research conducted by Mitchell-Innes, Aziakpono and Faure (2008) has investigated the possibility of Fisher effect during the period of inflation by targeting South Africa as their study area from 2000 to 2005. As one of the dissidents, the result has shown that the Fisher hypothesis did not verify during the inflation targeting period. Beyer, Haug and Dewald (2009) also investigated the validity of the hypothesis in short-term by putting short-term interest rates on a quarterly basis and only managed to derive a co-integrating relationship for Germany. This was the only imperfect came out from the same study which has cases in the United Kingdom and Switzerland. Though using a test developed by Carrion-I-Sylvestre and Sans (2006), the only co-integrating in both countries has caused their failure to put rejection on the restriction of one-to-one move for inflation and interest rates.

While the studies about short-run relationship have been done extensively, there is also no exception for the long-run relationship. Study conducted in Australia, by Mishkin and Simon (1995) examined the effect and their result showed the positive Fisher effect in the long run though it did not speak the same for the short-run. A similar study conducted by Chen and Shrestha (1998), who examined the long-run relationship in the US, UK, Canada and Japan by using monthly data on Euro-currency interest rates and inflation rates. Their finding showed that the existence of long-run relationship for the Fisher effect which is applicable for all those countries. Using quarterly data of long-run interest rates, Engsted (1995) has analyzed it by applying the Johansen techniques. The analysis of the integration properties has convinced the author to find that the nominal interest rate in countries of Switzerland and Germany were nominal, which fairly supported the hypothesis. By using quarterly short-term and long-term rate from 1973 to 1993, Yuhn (1995) found that the long-term nominal interest rate of the United Kingdom was stationary.
2.2 The Fisher Hypothesis

The Fisher effect has shown that there is a positive correlation between nominal interest rate and expected inflation. This indicates that as followed by the increasing in inflation rate, there comes directly increasing in the nominal interest rate. The hypothesis done by Fisher (1930) has said that the nominal rate is made up of expected rate of inflation and real rate of interest. Apart from that, the hypothesis also implied that real interest rate is independent of money measures and therefore it is constant. This statement has brought up the inference that Fisher effect can also be defined as a one-to-one relationship between nominal interest rate and expected inflation.

As discovered in earlier chapters, the research of Fisherian has been thoroughly done across global and indeed draws attention in world economies. Nevertheless, the blotch remains to be inadequate evidence for the validity of the hypothesis in developing countries. Not as great as the number of studies to examine those countries, the hypothesis still cannot be said applicable in those developing economies. The fact that no previous researches were using data from inflation-targeting monetary policy has hampered the effort as well.

By using consumer price index (CPI) data between the years 1890 to 1927 in US market and 1820 to 1924 in UK market, Fisher (1930) has obtained a distributed lag structure. The 20 years of lags for price changes in US and 28 years of lags in UK has enabled Fisher to find no relationship between price changes and interest rate in those countries for the short-run case. Despite that depressing finding, when a distributed lag of pass inflation was used as a proxy of expected inflation, the improvement of result has convinced Fisher to draw another conclusion.

Fisher (1930) stated that if there has the effects of price change upon interest rate to take place over several years, we can find remarkably high coefficients of correlation, which means that interest rates follow price changes closely in degree though rather distantly. Derived from these observation, Fisher concluded that nominal interest rate does follow inflation and only as valid as for
long run. From the painstaking efforts of Fisher put into the researches, we still can say that Fisher has succeeded to show the one-to-one positive relationship between nominal interest rates and expected inflation for constant the real interest rate.

2.3 Empirical Evidence

2.3.1 Developing Countries

Developing country also called underdeveloped country where the average income is much lower than industrial country. Mexico is one of the developing countries. Thornton (1996) finds strong evidence of Fisher hypothesis between nominal interest rate and inflation between 1978 and 1974 in Mexico. This will give strong confidence for researchers to do the same study. Beside, Jorgensen and Terra (2003) also use VAR model to test the Fisherian between interest rates and inflation in major Latin American economies. From the research, they also find strong relationship in Mexico.

Based on the previous literature, there are lacks of researches about Fisher hypothesis using South African data. Wesso (2000) uses co-integration and modeling techniques to evaluate the relationship between expected inflation and nominal bond yield in South African and he finds that bond yields are co-integrated with expected inflation. In additional, Wesso also examine whether interest rates are good predictors of future inflation or others words whether real interest rates have been affected by monetary policy since inflation-targeting. However, the researcher's study has some weakness inference of limited information and methodology.

For Sri Lanka, the country has experienced a high inflation during 1970 to 1980. This will lead the researchers to get the inaccurate result. Cooray (2002-2003) investigate by using the 3 month Treasury bill rates and forecasting model to test the Sri Lankan data. He found that interest rates react slowly to inflation expectation and concludes that real interest rates are impacted by monetary policy in short-run.
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