ASSESS THE EFFECTS OF NOMINAL INFLATION, MONEY SUPPLY AND EXCHANGE RATE TO NOMINAL INTEREST RATE IN VIETNAM, PERIOD 2008 - 2013

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ABSTRACT
Nominal inflation, money supply, exchange rate and interest rate are the basic economic indexes in each national economy. This paper focuses on assessing the relationship between nominal inflation, money supply, exchange rate and interest rate, basing on the economic theoretical basics and the fact data in Vietnam, period 2008 - 2013. These theories and data have been used to analyze the current problem of Vietnam’s economy. Moreover, the Ordinary Least Square model has been constructed and tested to demonstrate this relationships more clearly. Depending on the result of econometric model, the research has already pointed out that nominal inflation, money supply and exchange rate can explain about 75% the change of nominal interest rate in Vietnam. Specifically, exchange rate and nominal inflation have positively correlated with interest rate, on the other hand, money supply has negatively correlated with interest rate. This findings have implications in interest rate’s managements in the future and some consistent suggestions are given for the interest’s operating in Vietnam.

Key words: inflation, money supply, interest, exchange rate, econometric model.

1. INTRODUCTION
The interest rate, which is one of the most important variables, is closely managed in each national economy. This is one of the most important tools of the Central Bank to operate monetary policy. Therefore, understanding this variable will help the Central Bank to make accurately decisions to achieve the objectives in the short- term and long- term.

The subprime lending crisis erupted in 2008, starting in the United States, has led to serious consequences, not only for the U.S economy but also for almost countries in the world, which has indicated the broken string with a wide range of financial institutions, as well as destroying the global economy. Naturally, Vietnam is not exception. The effect of the U.S. financial crisis has made the customer’s repayment ability decline, which makes most of commercial banks focus on ensuring operation safely rather than promote lending. Since 2008, the State Bank of Vietnam has constantly adjusted the operating policy of interest rate, from the agreement interest rate to the basic rate and the interest rate cap. However, the results of these adjustments have not come up to expectations yet. It can be said that the operating interest rate has carried heavily subjective of the policy makers, not towards the motivation of the market, so their results are not really satisfactory, leading the interest rate race condition, liquidity shortage in the banking system and the state of dollarization. Therefore, it is very important to have a research about the interest rate movements in Vietnam.

Among the factors that influence the interest rate, inflation, exchange rate and money supply have been identified as factors playing an important role in. It can be said that the relationship between
these factors is very close and influenced by many other factors, so that, clarifying the relationships between the above factors are extremely important.
Consequently, the study of the relationship between the variables: interest rate, inflation, exchange rate and money supply are extremely essential. The study will be the basis for the Central Bank in operating monetary policy of government towards the goal of macroeconomic stability and economic growth in the near future.

1.2. Research objectives.
- Evaluating the relationship between inflation, money supply, exchange rate and nominal interest rate systematically, basing on the economic theoretical basics and practical data in Vietnam. Then, constructed and tested the suitable econometric model to demonstrate this relationships.
  - Depending on the result of econometric model, we pointed out that the correlation between dependent variable and independent variables, so the research team will give some consistent suggestions for the interest’s operating in Vietnam.

1.3. Scope of the study subjects.
- Audience research: the study of the fluctuations in economic variables: inflation, exchange rate, money supply and interest rate in Vietnam.
- Scope of study: analyze and point out the relationship between inflation, exchange rate and the money supply and variable interest rate. This research not goes deeply analysis of other factors affecting the economic variables.
- Project duration: from 1/2008 to 12/2013.

1.4. Research methods.
To ensure the reliability and science of this working paper, the research team have used both qualitative and quantitative methods. Qualitative research has been done through finding reading material, articles, magazines, scientific researches and foreign economic variables on interest rates, nominal inflation, exchange rates and the money supply. On that basis, gradually building suitable econometric models. Quantitative methods has been used to quantify the relationships between the variables, and tested the soundness of the economic indexes.

1.5. Expected to contribute new threads
The study is the synthesis and system the classic economic theories of the relationships between the variables of inflation, money supply and exchange rates and interest rates to build economic models to quantify that relationships. The study results are further complement about the theoretical interest rates, exchange rates, inflation and money supply in Vietnam, and research results also have implications in the management of interest rates in Vietnam in the coming time.

1.6. Outline of topic.
The working paper is divided into three chapters:
Chapter 1: Theoretical flame work and Literature review.
Chapter 2: Assess the actual relationship between nominal rate, money supply, exchange rate and interest in Vietnam, from 2008 to 2013.

Chapter 3: Analyses the findings, forecast the interest in next year and have some essential suggestions for administrators.

2. LITERATURE REVIEW.

“The relationship between interest rates and inflation in South Africa: revisiting fisher’s hypothesis” is the Master’s thesis of Henry Alexander Mitchell-Innes was published in 5/2006 focusing on the relationship between interest rates and inflation in South Africa, basing on the Fisher effect. This work presents a general econometric model used to estimate the relationship between inflation and interest rates, as well as the accompanying inspection and apply it in the study, inflation and interest rates in South Africa.

Mitchell-Innes has established accreditation model between interest rates and inflation are as follows:

\[ i_t = \alpha + \beta \pi_t + \mu_t \]

Among them:
- \( \alpha \): the real long-term interest rates.
- \( \pi_t \): the actual inflation.
- \( \mu_t \): other factors affecting.

When that is sound and Fisher hypothesis makes sense when:
- \( \alpha \) lies between inflation (\( \pi_t \)) and the nominal interest rate (\( i_t \)).
- \( \beta = 1 \), if \( \beta < 1 \), the relationship between these two variables is increasingly weakening.

This model proved that the real interest rate is constant and extent of relationship between interest rates and inflation through \( \beta \), if \( \beta \) as close to 1, the effect Fisher exact higher level. If \( \beta \) to 0, the relationship of two variables maybe loosed, Fisher effect does not exist, or exist weakly. But in Vietnam, the State Bank still has the administrative regulations on interest rates as the interest rate ceiling and interest rate floor, which can lead the relationship between inflation and interest rates has not been made clearly. Moreover, in addition to research on the impact of inflation on interest rates, the team was more variable inflation, exchange rate and money supply in order to assess the influence of interest in this context is like in Vietnam.

Research of Ben Obi and colleagues (2009) “An Empirical Investigation of The Fisher Effect in Niger: An Co-integration and Error Correction Approach” also used the model and verification methods such as works of Henry Alexander Mitchell-Innes was used, which was the same model and the associated error correction. Specific model used by the author are:

\[ \text{INTR} = f(\text{IFN}_t, \text{LnMOS}_t, \text{FISBA}_t, U_t) \]

Among them:
- \( \text{INTR} \): the interest rate.
IFN: inflation.  
LnMOS: money supply.  
FISBA: budget deficit.  
The author did before running regression testing done two: the static tests of the chain (stationary) or the original value (unit root) to ensure that research results were significant and expertise Dicker-Fuller (ADF) to test the homogeneity of the variables. The regression results indicated the author's R = 72.3 or variables in the model explained about 72.3% of interest rate fluctuations. Testing also said the explanatory variables were significant with interest rate fluctuations. The study results, which also indicated that the relationship between interest rates and inflation in the past was clear, but not though 0.13. The model also said that the money supply have a major influence on interest rates, with correlation’s coefficients of 1.35%, while the budget deficit did not significantly affect, the correlation coefficient was 0.000025%. This meant that the Fisher effect only existed in a part of Niger's economy. Therefore, the authors proposed that Niger Central Bank should use fiscal policy to curb inflation is key, there is increased production investment, investing in grassroots term as telecommunications, roads, power plants. 
This result helped the research team in identifying econometric models, as well as the influence of the indicators as inflation, money supply and budget deficit to variable interest rates, thereby building the right model with reality in Vietnam.  
"The relationship the between nominal interest rates and inflation: International Evidence"  
Booth. G and Ciner. C (2001) was published in the Journal of Financial Management of Multinational, No. 11. Authors studied the long-term relationship between short-term variable interest rate of the Euro to U.S. inflation and 10 countries Europe in the period from 1/1978 to 2/1997. The study used the same methodology linked to inspection data concluded short-term interest rate linked to inflation, so it told us about the change in long-term and short-term inflation were also true. With the majority of the countries in the study, a rise in inflation expectations will lead to a rise in the nominal interest rate of the European common currency, but larger than a point in relations with the United States. Hence, there are two variables together fluctuations in Europe however have great relationships than in America.  
In the research paper, "The Return of the Liquidity Effect: A study of the short-run relation the between money growth and interest rates” written by John H. Cochrane, published on the International Journal of Statistics and Business Economics gave the empirical relationship between money supply and interest rates in the U.S. with a total observation period 166 to perform this study, Cochrane ran OLS regression model with variable speed increased supply M₁ money, treasury bills rate three- month maturities and interest rates of government bonds 20 year maturities. The study results showed a negative correlation between money supply and interest rates. Money supply rose as interest rates fell with latency up to 1 year. This was explained by the effect Cochrane liquidity premium than the expected inflation effect. Inversely correlated in this article indicated liquidity
effect, but not provide the level of correlation: how much and how long they would fall if interest rates increased the money supply. Based on the results of this study, the research team proposes a suitable model for the study, and also identify the variables affecting interest rates in Vietnam.

3. DATA AND METHODOLOGY

3.1. Theoretical framework: overview the relationships between inflation, money supply, exchange rates and nominal interest rates.

The relationship between inflation and interest rates.

- Fisher effect.

In this book "The theory of interest" (1930), Fisher hypothesized that nominal interest rates by expected inflation plus the real interest rate. This assumption is represented by the formula: :

\[ i = r + \pi^c \]  

(1.1)

In particular:

- \( i \): nominal interest rate;
- \( r \): real interest rate;
- \( \pi^c \): inflation expectations.

In the above formula, according to Fisher, the real interest rate is expected to be relatively stable and not considered in the long-term change. If expected inflation increases, nominal interest rates rise and vice versa.

- The development Fisher effect according to Frederic Mishkin.

Thus, based on the theory of asset demand, Mishkin has proved the correctness of the Fisher effect on the stock market. Similar formulas (1.1), if inflation increases, if the real interest rate does not change, then the nominal interest rate also increases to balance the formula still. So it is understandable that many economists suggest that government should keep inflation at a low level if they want to keep interest rates low.

The relationship between money supply and interest rates.

- Preferred model of Keynes liquidity.

The analysis of preferred method seems to liquidity leads to the conclusion that the increase in money supply will reduce interest rates. The Kuan has many important implications for policy, because it often leads to policies that increase the money supply to lower interest rates.

- Milton Friedman's theory.

Milton Friedman, recipient of the Nobel Prize in economics, acknowledged that the preferred method of analysis of Keynes's liquidity and called the correct conclusion that the liquidity effect. Friedman also pointed out that the increase in the money supply will cause other effects on the economy and in turn, these impacts can increase the interest rate. If the impact is large, it is fully capable of increasing
the money supply and interest rates. That's the effect: the income effect, price effect and the expected effect of inflation.

*The relationship between exchange rates and interest rates.*

- Asset demand theory.

Theory of asset demand for the most important factors that influences on the demand for deposits and deposits in foreign countries are projected income, asserted and compared with each other. Parity equation of interest is stated that:

$$i^D = i^S - (E^{t+1} - E^t)/E^t$$

Among them:

- $i^D$: the interest rate on domestic currency deposit.
- $i^S$: the interest rate on foreign currency deposit.
- $E^t$: the exchange rate at time $t$.
- $E^{t+1}$: the expected exchange rate at time $t+1$.

Parity equation of interest is stated that interest rates in the country by foreign interest rate minus expected appreciation of the domestic currency, or said another way, the domestic interest rate equal to the interest rate plus foreign projected growth rates of foreign currencies.

### 3.2. Data

The model uses data from 2008 to 2014 of World Bank and Asia Development Bank, in which, interest is explained variable and three independent variables: inflation, money supply, exchange rates.

- **Interest rate (IR):** data of average one month Vietnam Inter Bank Interest rate (%).
- **Exchange rate (EX):** data of VND/USD Inter-Bank average exchange rate.
- **Inflation (IF):** For the analysis of inflation we have used the general CPI index (the year 2000 = 100%)
- **Money supply (MS):** MS also called $M_2$, includes coins, notes in circulation and other money equivalents that are easily convertible into cash and short-term time deposits in banks and 24-hour money market funds.

### 3.3. Data reconstruction.

Economics’ data is subject to cyclical movements. In fact, seasonality can seriously distort the analysis of the long-term inflation behavior.

To removing seasonality, we use “Single Moving Averages” (SMA) method. It is defined as:

$$X'_t = \frac{X_{t-1} + X_t + X_{t+1}}{3}$$

- $X'_t$: The value of variable $X$ at $t$ time after reconstruction.
- $X_{t-1}$: The value of variable $X$ at $t-1$ time before reconstruction.
- $X_t$: The value of variable $X$ at $t$ time before reconstruction.
• $X_{t+1}$: The value of variable $X$ at $t+1$ time before the reconstruction.

3.4. Econometric model.

To assess the effect of inflation, exchange rate and money supply to interest rate. We have used four variables linear regression model and Ordinary Least Square method (OLS).

- Population regression function:
  
  $\text{IR}_i = \beta_1 + \beta_2 \text{EX}_i + \beta_3 \text{IF}_i + \beta_4 \text{MS}_i + u_i$

- Sample regression function:
  
  $\hat{\text{IR}}_i = \hat{\beta}_1 + \hat{\beta}_2 \text{EX}_i + \hat{\beta}_3 \text{IF}_i + \hat{\beta}_4 \text{MS}_i$

3.5. Lag selection.

Eviews software provides optimal lag. In which, exchange rate lagged 3 months, inflation and money supply lagged 2 months.

3.6. The experimental result.

With Eviews software’s result, the result of sample regression function is expressed as:

$\text{IR} = -11.0549834 + 1.6700267 \text{EX} - 3 + 2.39728262 \text{IF} - 2 - 0.548211915 \text{MS} - 2$

3.7. Model test.

To check the correctness of model, we use the following test: coincidence test, parametric statistical test – Wald test, autocorrelation test - Breusch – Godfrey test, normal distribution test - Jacque –Bera test and multicollinearity test.

Testing results show that the model is a perfect fit and the independent variables are significant in explaining the change in the dependent variable. However, modeling phenomena encountered autocorrelation and multicollinearity phenomenon. With autocorrelation phenomena, we are overcome by the standard error sustainable methods. Particularly with multicollinearity phenomenon, we accepted phenomenon without removing variables.

The reason given is that the elimination of the exchange rate or the money supply to overcome multicollinearity is not feasible, because these are two variables playing a significant role in influencing variable interest rates. Furthermore, the regression results also show that the $\text{se}(\hat{\beta}_j)$ is not large and not too large to compare with $\hat{\beta}_j$. The problem of multicollinearity does not cause significant effects in the model.

4. RESULT AND DISCUSSION

4.1. Analysis of research results

Firstly, the estimation results for regression model indicates that all three variables inflation, money supply and exchange rate influence on interest rates. This implies the importance and consonance with the hypothesis: Interest rates is positively related with inflation and exchange rates but is negatively related with money supply. Inflation has the highest level of significance, which demonstrates interest
rates is mainly influenced by inflation. Modeling significance levels is 75% denote three elements inflation, money supply and exchange rate to show the fairly good changes in interest rate. Thus, interest rates depends on many quantitative and non-quantitative factors but we still can understand and quantify fairly accurate the relationship of the variables economy.

Secondly, the research results shows inflation had strong influence and is positively related with interest rates. With a two-month lag, when inflation increases, nominal interest rates will increase or vice versa. Thus, the Fisher effect exists in Vietnam, a good basis for the planner who use interest rate instruments to regulate inflation. The regulation bases on correlation coefficient of two variables. This results has important implications in the operation of the government, which needs to keep inflation lower if they wants to keep interest rates lower.

Thirdly, the research indicates that the liquidity effect dominates the income effect, the price – level effect and the expected - inflation effect in Vietnam. With a two-month lag, the liquidity effect operates quickly to lower the interest rate, but as time goes by, the other effect start to reverse some of the decline. Because the interest rate does not rise back to its initial level, the liquidity effect is larger than other effects.

The last, the exchange rate is positively related with interest rates. It can be seen from the period 2008 to 2013, the State Bank of Vietnam devaluated continuously in VND, the resulting is the VND/USD continuously increased, and the raised exchange rate affects interest rates after 2 months later (the lag is 2 months). However, the impact of the exchange rate is no more in interest rates, because the State Bank of Vietnam has implemented conventional fixed peg arrangement and has intervention in the operation and maintenance of the exchange rate.

4.2. Forecast of interest rates
The researchers calculate the error of interest based on the regression model and the actual data and detect that most of the calculated value have error less 20% than the actual data. Thus, the model has relatively high reliability and significance in forecasting policy. In 2014, the state bank of Vietnam propounds the objectives: The growth of money supply is 16-18%, the exchange rate is stable and increases less 2% per year, the inflation is controlled at 7%. Therefore, the researchers determined the average one-month interbank rate in 2014 will range from 3.04% to 4.13%. This result is consistent with the interest rate policy of Vietnam in 2014.

5. CONCLUSION AND IMPLICATIONS
5.1. Policy Recommendations
Firstly, according to the results of the model, interest rates is positively related with inflation and exchange rates. Therefore, the state bank wants to reduce the lasting interest rates, inflation must be reduced and exchange rate needs to be stabilized. Because the coefficient of inflation is larger than exchange rate, the role of inflation will be greater in the operating interest rates.
In Vietnam, inflation has been kept low in the last two years, but inflation is very sensitive to the current conditions, specially the conditions can impact on the expectations of the public, inflation still have a risk outbreak back. Therefore, the state bank of Vietnam needs to concentrate to control inflation even at low levels to avoid risks for the coming year and stabilize exchange rate with the amplitude of the permitted level.

Secondly, money supply from the model is negatively related with interest rates. The amount of money is put into the economy affecting production and business but do not show much of the price. Thus, the state bank can control inflation at once increase the reasonable money supply to promote growth, still keep interest rates low.

5.2. Conclusion

In this research, we have presented evidence of the relationship between nominal inflation, money supply, exchange rate and interest rates, basing on the economic theoretical basics and the fact data in Vietnam, period 2008 - 2013. The study has developed the model and has been tested to ensure the correctness. Thus, we can conformly explain the theory and reality occurred in Vietnam. At the same time, it is also a reliable reference materials and has a high generality for further research. Depending on the result of econometric model, the researchers show forecast of interest rates to make the consistent policy recommendations with the fact in Vietnam.

Despite of the effort, the research is still inevitable mistakes. There are many quantitative and non-quantitative factors influent interest rates, but not collect the data of all factors, the meaningful model is not high. Moreover, because of limiting in the time and the resources, the data can be only collected to 2013 year-end but can not be updated to the current time.

The research is capable of further development from the contributions of the thesis by extending observation period has updated data to improve reliability for the study and adding variable affecting interest rates as the government budget deficits, monetary policy, aggregate demand ... or non-quantitative factors such as psychology and external shocks of Vietnam economy.

REFERENCES LIST

