# STRUCTURE & SPACE OF INFLATION IN VIETNAM

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## 1. Introduction

Inflation is a hot issue in Vietnam now. Theories of inflation and economic growth can point out several causes: high and continuous increases in money supply, cost push or demand pull (or combination of both forces), inertia of inflation, and dollarization. Besides them, one can mention causes relating to economic structure and model of economic development, such as: (1) development based on big investment, natural resources and cheap labor with a high growth rate as target and poor productivity and added value as results; and (b) poorly-controlled national budget that produces huge and lasting deficit (Trần Đình Thiên, 2010).

Most previous researches on factors of the inflation in Vietnam (a) lack quantification; (b) focus too much on functional factors as mentioned above; and (c) fail to pay proper attention to spatial (or geographical) aspect of inflation. Spatial distribution of inflation (among provinces) is very uneven because of differences in development levels, growth rates, and living standards, and poor distribution of the fruits of economic growth.

This research raises the two following questions:

(1) How do structural factors affect inflation?

(2) How do functional factors, such as exchange rate, affect inflation in the context of current mechanism?

The paper tries to answer the questions with a special econometrical analysis framework instead of usual econometrical methods.

## 2. Model of factors affecting spatially inflation

### a. Framework for inflation analysis:

Goujon, M. (2006) points out that inflation in Vietnam took place against a background of increasing dollarization. Based on this argument, he develops a model of inflation in Vietnam as a dollarized economy. The author adjusts the Goujon's model of inflation to form a special inflation model for provinces in Vietnam. Details of the model are as follows:

- Value of CPI is based on indexes of tradables and non-tradables:

$$p_i = \theta p_i^T + (1 - \theta) P_i^{NT} \qquad (1)$$

where p stands for natural logarithm of CPI; i for province i (1.61); T for tradables; NT for non-tradables; and θ for the fixed weight of tradables included in the CPI with 0< θ <1.

As for a small economy like Vietnam, CPI of tradables can be estimated according to the following formula:

$$p_i^T = \lambda e_i + \mu p_i^W + \delta_T \qquad (2)$$

where e means natural logarithm of nominal exchange rate in the VND; $p^W$ international prices of tradables in foreign currencies; $\delta_T$ intercept that includes such elements as transaction and transport expenses or trade policy.

Prices of non-tradables are offset by various elements on the domestic market. The first group of elements is related to demand and supply of money. Attention must be paid to money difference ($EC_i$), that is, the difference between money actually held and long-term balance of individuals. Regarding the model, we have:

$$EC_i = \beta' X_i \qquad (3)$$

where X is a vector of determinants of demand for money, including interest rate (r), actual GDP (GDP), and depreciation index of the VND against the US dollar.

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In addition, regarding prices of non-tradables, the dollarization is one of factors that escalate inflation via exchange rate policies. Namely, it affects through two channels, according to Goujon, M. (2006):

- Upheavals in exchange rate affect prices of both tradables and non-tradables. In Vietnam, durable and valuable goods, or real estates are usually priced in the US dollar. Some services based on long-term contracts, such as house for rent, are also priced in the dollar. That is why changes in the exchange rate affect more goods in dollarized economies than in non-dollarized ones.

- Upheavals in the exchange rate may affect the domestic money in a broad sense. Depreciation of the domestic currency will lead to increases in the money supply. In other words, upheavals in the exchange rate influence money difference (ECi) and inflation.

The third group of factors that affect the inflation include economic structure and reforms in Vietnam, such as liberation of pricing and trade along with privatization and reforms in the public sector (SOE). In this model, reform in state-owned enterprises is to be examined along with economic structure (STR).

The fourth factor affecting the inflation is budget deficit (BD). Although budget deficit of provinces has not been clarified in the fiscal policy, it certainly has its share in the national budget deficit (Giao, 2008).

Price of non-tradables can be estimated by the following equation:

$$p_i^{NT} = \alpha EC_i + \beta e_i + \gamma_1 SOE_i + \gamma_2 STR_i + \varphi BD_i + \tau_{NT} \quad (4)$$

where β expresses effects of the dollarized price index of non-tradables; $\gamma_1$ measures effects of the reform in state-owned enterprises; $\gamma_2$ measures effects of economic reform on inflation; and φ measures effects of provincial budget deficit.

From (2) to (4) and combining them with (1) we get the following shortened form of the equation of inflation:

$$p_i = \delta_1 e_i + \delta_2 p_i^W + \delta_3 GDP_i + \delta_4 SOE_i + \delta_5 STR_i + \delta_6 BD_i + \tau \quad (5)$$

Process of estimating (5) is presented in the next section.

***b. Model of factors affecting spatially the inflation:***

First of all, the model (5) is estimated with OLS method. Spatial autocorrelation may make the OLS become unfit. The special autocorrelation takes place when a variable in one province is affected by the same variable found in some surrounding province. Because inflation in one province may be affected by inflation in a nearby province, it is necessary to test for special autocorrelation in data. Another possibility relating to the autocorrelation is correlation between residues. This means that residues may have some special correlation; or, observations in neighboring provinces may have approximate residues. In both cases, hypotheses based on the OLS are violated and estimates become incorrect if the special autocorrelation is not adjusted properly.

Relation in the first case is called special lag model that is expressed as follows:

$$p_i = \delta_1 e_i + \delta_2 p_i^W + \delta_3 GDP_i + \delta_4 SOE_i + \delta_5 STR_i + \delta_6 BD_i + \tau + \beta \Sigma_{j \neq 1} w_{ij} y_j + \varepsilon_i \quad (6)$$

where β is spatial autocorrelation coefficient, $w_{ij}$ is spatial weight that reflects closeness of provinces i and j, and $e_i$ is residue. Spatial weighted matrix w expresses the spatial closeness of pairs of observations. Entries in the matrix are worth 1 if two provinces are adjacent and 0 otherwise.

Relation in the second case is called model of spatial error and is expressed as follows:

$$p_i = \delta_1 e_i + \delta_2 p_i^W + \delta_3 GDP_i + \delta_4 SOE_i + \delta_5 STR_i + \delta_6 BD_i + \tau + \beta \Sigma_{j \neq 1} w_{ij} \varepsilon_j + \varepsilon_i \quad (7)$$

Spatial autocorrelation may be identified by using such instruments as Moran's index and Geary coefficient, and G statistics. Lagrange multiplier method is used for determining which model is chosen, and the chosen one should have a bigger Lagrange value (Anselin and Rey, 1991).

After identifying econometrical model of spatial inflation, we can assess spillover effects of inflation on different provinces expressed in pre-residue components in equations (6) and (7).

***c. Results of estimation of model of factors affecting spatially inflation:***

First of all, variables and representative variables in models (6) and (7) are explained. Firstly, inflation (p) is expressed by annual CPI with the

previous year used as the base year. Secondly, exchange rate (e) is expressed by increase in the exchange rate in the year. Thirdly, increase in price of gold is used as a representative variable for international price of tradables (pw) because information about export and import values of provinces is not available and reliable, if any (1). Fourthly, because of unreliable statistics of provincial gross products, average spending of households is used as a variable representing the size of provincial economy that affects the demand for money. Fifthly, variable representing the reform in state-owned enterprises is the share held by the State in total investment by the enterprise gathered from the 2006 general investigation of enterprises. Sixthly, economic structure is represented by increases in industrial and agricultural output. Seventhly, provincial budget deficit is expressed by ratio of deficit in provincial budget. Sources of data, representative variables and units are presented in Appendix 1.

Test results show that there exists a spatial lag autocorrelation in inflation at provincial level. This means that the model (6) is the suitable one.

Estimation results presented in Table 1 (column 2) show that explanatory coefficients of the model are rather high (0.65) and all regression coefficients bear the expected signs.

External causes of inflation are reflected clearly in the model through effects of highly statistical significance of increases in gold price and exchange rate. This affirms the cost-push inflation in Vietnam when prices of materials (steel and fuel for example) affected directly market prices and made the CPI higher.

When other factors do not change and gold price index rises by 1%, inflation index increases by 0.16%. When other factors do not change and exchange rate index rises by 1%, inflation index increases by 0.21%. Thus, the exchange rate index produces a greater effect on the inflation than the gold price index does. This is appropriate to argue that the exchange rate affects the inflation via dollarized prices of non-trdables. And as a result, the higher the dollarization, the greater the inflationary pressure caused by increases in the exchange rate index.

More calculations based on the first regression coefficient in Table 1 show that if the weight of prices of tradables is 0.77 (IMF, 2006), the coefficient of effect of international price of tradables on CPI of tradables in the province is 0.21. This means that when other factors do not change and the international price of foreign tradables increases by 1%, the CPI of tradables in the province rises by 0.21 percentage point.

More calculations based on the second regression coefficient in Table 1 show that coefficient of effect of dollarized price of non-tradables on CPI of non-tradables in the province is 0.08. This means that when other factors do not change and index of dollarized price of non-tradables increases by 1%, the CPI of non-tradables in the province rises by 0.08 percentage point.

Economic growth rate certainly contributes to increases in inflation rate. Calculations show that when the per capita real spending rises by 1%, the price index will rise by 0.034 on condition that other factors do not change.

Participation of the State in operations of state-owned enterprises helps them gain certain advantages and reduces pressure of market competition against them. But support for state-owned enterprise with poor performance may produce inflationary pressure. My model shows that the government support for state-owned enterprises makes the inflation higher through its share in total investment of the enterprise. When other factors do not change and the share of the State increases by 1%, the inflation rate in the province rises by 3.9%.

Economic structure produces a remarkable effect on inflation. According to structuralists, difference in productivity between manufacturing and agricultural sectors and temporary fixity of output from one or both sectors will cause the price to rise (Streeten, 1962; Baumol, 1967). In the model, effects of industrial and agricultural growth on inflation bear positive signs, and effect of the agricultural sector is greater than that from the manufacturing one. This means that the agricultural output is relatively more fixed than the in-

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**Table 1: Results of estimation of spatial inflation**

| Variable | Model 1<br>Inflation rate (CPI) | Model 2<br>Inflation rate (CPI) |
|---|---|---|
| Gold price index | 0.158(5.54)*** | 0.159(5.6)*** |
| Index of exchange rate to the dollar | 0.208(2.23)** | 0.033(3.27)*** |
| Per capita real spending | 0.034(3.24)** * | |
| Share of the State in total investment of enterprise | 0.039(2.42)** | |
| 2005 Index of industrial growth | 0.042(1.68)* | 0.040(1.66)* |
| 2006 Index of industrial growth | 0.115(4.49)*** | 0.113(4.73)*** |
| 2005 Index of agricultural growth | 0.072(2.23)** | 0.072(2.24)** |
| 2005 Index of agricultural growth | 0.149(2.55)** | |
| Provincial budget deficit | 0.0002(2.05)** | 0.0002(2.15)** |
| *Interaction between index of exchange rate and Share of the State in total investment of enterprise* | | 0.008(2.43)** |
| *Interaction between index of exchange rate and 2006 index of agricultural growth* | | 0.033(2.66)*** |
| Constant | -0.723(0.53) | 0.225(0.20) |
| Observations | 61 | 61 |
| rho | .339  (.206) | 0.341(1.64) |
| Variance ratio | 0.647 | 0.646 |
| Correlation coefficient- square | 0.65 | 0.65 |
| Wald test with rho = 0 | $\chi^2(1) =$ 2.688 (0.101) | $\chi^2(1) =$ 2.678 (0.102) |
| Lagrange multiplier test with rho = 0 | $\chi^2(1) =$ 3.696 (0.055)* | $\chi^2(1) =$ 3.725 (0.054)* |

z statistical value is in bracket

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

dustrial output.

Provincial budget deficit is thought to causes inflation to increase to a certain extent, because such deficit demands increases in the money supply (Sargent and Wallace, 1981). According to the modern version of the quantity theory of money by Milton Friedman, the inflation takes place when increase in the money supply is higher than that in real output of the economy. This has happened in Vietnam in recent years. This research shows that when other factors do not change and provincial budget deficit rises by 1%, the provincial inflation rate will increase by some 0.2%.

A noteworthy point in the model of spatial inflation is existence of spillover effect of ordinary significance (coefficient of some 0.34). The spillover coefficient consists of various elements, including inertia of spatial inflation, spread of mentality over spaces, and spread of inflation through spatially economic connections between localities, etc. Changes in an element affecting the inflation will impinge on the inflation rate not only in one province but also other ones and the whole economy as well. Let's consider some examples of spillover effect of the inflation in the Table 2.

When the gold price index rises by 10% on average in a province, the CPI in that province rises by some 1.65 percentage point while CPI in other provinces put together makes a rise of 0.8 percentage point. Thus, considering the whole economy, if the gold price index rises by 10% in all provinces, the average CPI of the economy may increase by up to 2.5 percentage points. When the index of exchange rate to the dollar increases 1% in a province, provincial CPI rises by some 0.22

**Table 2: Illustration of spillover effect of the inflation**

| | Gold price index increasing by 10% | | | | |
|---|---|---|---|---|---|
| | **Hà Nội** | **HCMC** | **Đà Nẵng** | **Hải Phòng** | **Cần Thơ** |
| Direct increase in local CPI (percentage point) | 1.68 | 1.63 | 1.64 | 1.63 | 1.64 |
| Indirect increase in CPI caused by spillover effects (percentage point) in remaining localities put together | 0.8 | 0.88 | 0.92 | 0.83 | 0.75 |
| | Index of exchange rate to the dollar increasing by 1% | | | | |
| | **Hà Nội** | **HCMC** | **Đà Nẵng** | **Hải Phòng** | **Cần Thơ** |
| Direct increase in local CPI (percentage point) | 0.23 | 0.22 | 0.22 | 0.22 | 0.22 |
| Indirect increase in CPI caused by spillover effects (percentage point) in remaining localities put together | 0.11 | 0.12 | 0.13 | 0.11 | 0.1 |

*Source:* Author's calculations

percentage point, and CPI in other provinces increases by some 0.11 percentage point. Suppose that the index of exchange rate to the dollar rises by 1% in all provinces, the national CPI may rise by some 0.33 percentage point.

Column 3 (model 2) in Table 1 presents results of analysis of effects of traditional factors, such as exchange rate, on the inflation with proper attention to shortcomings of the economic structure. Results in the column 3 show that inflation becomes more serious when financial subsidies for state-owned enterprises are widespread, and imbalance between manufacturing and agricultural sector makes its appearance. If the index of agricultural growth is at a medium level (about 104.34 in 2006, see Appendix 2), the exchange rate index rise by 1% and inflation index by 3.73%, in which a rise of 0.33 percentage point comes from the sole effect of the exchange rate, and 3.4 percentage point is from a double effect of economic structure and exchange rate. Similarly, when the share held by the State in total investment of enterprise is at a medium level (about 0.668 in 2006, Appendix 2), exchange rate index rises by 1% and the double effect of subsidies for state-owned enterprise and exchange rate makes inflation index rise by 0.5% on condition that other factors do not change.

## 3. Conclusion and suggestion

This research tries to point out determinants of spatial inflation in Vietnam with a view to answering two questions of (1) how structural factors affect inflation, and (2) how traditional and common factors (such as exchange rate) affect inflation.

Results of the research affirm that besides pass-through effects from foreign inflation (imported inflation) caused by the gold price, and effect of the exchange rate (consistent with previous researches on Vietnamese inflation, such as the one by Goujon, M., 2006), economic growth rate and inflation in Vietnam also depends on its economic structure. In addition, new findings show that subsidies for state-owned enterprises and provincial budget deficit partly cause inflation to rise. Moreover, the spillover effect of inflation on provinces is not small: its index is about 0.34. Finally, the inflation will be more serious because of widespread subsidies for state-owned enterprises and imbalance between agricultural and manufacturing sectors.

Policy implications for Vietnam and other dollarized economies suffered from spatial inflation are:

- Curbing the inflation at provincial or municipal level is very important because it helps reduce

both direct effects of provincial inflation on the national economy and spillover effect of inflation. Allocation of essential goods over provinces, and timely intervention of the government are important to success in inflation control.

- To limit the spread of inflation over provinces, it is necessary to cut both official and unofficial costs when transporting goods from province to province; reform procedures that cause waste of time and money; supply free information about local markets; and take measures to stabilize mentality of consumers and producers.

- Exchange control policy must be implemented carefully and flexibly because changes in the exchange rate have the greatest impact on inflation.

- Economic structure is a long-term problem that increases inflation rate. The Government should adjust relation between manufacturing and agricultural growth rates. As for the public sector, the Government had better only invest in enterprises with good performance, or enterprises with good promise and in need of capital for their reform programs; and sell or privatize state-owned enterprises with a lot of debt and no future.

- New mechanisms for controlling provincial budget income and expenditure are very necessary in order to help provincial authorities understand that local budget deficit is one of causes of inflation.

- Finally, inflation must be dealt with based on a strategy that combines all short- and long-term factors to ensure sustainable development■

(1) To the best of my knowledge, the use of such representative variable has neven been found in similar researches

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