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Macroeconomic Price Adjustment-control and Price System Equation

A discrete-time dynamic price model in macroeconomy is proposed. The model combines modern control techniques with the input-output analysis of price and with economic principles. It can be used in the macroeconomical price analysis and price adjustment particularly in the concentrated-economy country.

1. INTRODUCTION

China's economic readjustment and reform have focused on the adjustment of price system. The price reforms will help to boost industrial and agriculture production, to improve the circulation of goods and to enliven markets and economy. Without it, a healthy balance between various economic relation could not be founded, the healthy development of national economy would not lost long, and contradiction in the economy would aggravate. But the stable development of economy hings upon the ability to control the price system. Great attention must be paid to re-adjustment of the price structure. This paper discusses the model of price adjustment and control with its application.

The Paper is divided into four sections. Section 2 presents a price system equation. Section 3 gives a price control criterion. Section 4 is the integrated price control model.

2. THE EQUATION OF PRICE SYSTEM

It is all known that macroeconomic price equation is

$$P = A^T P + G + T + H + F \tag{1}$$

where P is the vector of price index,
G is the vector of wage coefficient,

T is the vector of tax coefficient,
F is the vector of profit coefficient,
H is the vector of dipreciation coefficient,
A is the production coefficient matrix.

Equation 1 describes the price relation between economic sectors based on input-output analysis.
Suppose:

$$Y + G + F + T + H \tag{2}$$

we can get from equation (1) that:

$$P = (I - A^T)^{-1} Y \tag{3}$$

where Y is the vector of GNP coefficient by the definition of macroeconomic statistics.

For convenience' sake, we make two conditions. Condition 1 is that technique processing does not happen. A = constant. Condition 2 is that the coefficients of tax, depreciation, and wage do not change.

According to equation 3, on condition 1, the price is determined only by Y. On condition 1 and condition 2, the price is determined solely by the coefficient vector of profit F, and the price adjustment and reform is in fact the adjustment of coefficient of profit among the economic sectors.

The change of Y can be expressed as

$$Y_{K+1} + Y_K + U_K \tag{4}$$

where K is the number of time zone, U_K is the adjustment vector of Y_K, at condition 1 and condition 2, U_K is the adjustment vector of profit F.

From equation (3) and (4), we just right get the price system equation as follows:

$$Y_{K+1} = Y_K + U_K \tag{5}$$

$$P_K = (I - A^T)Y_K \tag{6}$$

$$(K = 0, 1, 2, \ldots M - 1).$$

In the system equation, the vector of price coefficient P is output variable. The vector of GNP coefficient Y is the state variable. The adjustment vector U_K control variable.

The criterion of price control must reflect economic operation law and the government policy. The policy main points of China's price reform is as follows:

1) The price reform is the adjustment of price structures among economic sectors, it aimed to *boost* production.

2) The price adjustment is planned by government.

3) The *process* of price reform is divided into multi-stages. The increment of price level is controlled by government.

4) The price adjustment shall be favourable to the stable development of the national economy and the equilibrium between supply and demand.

According to the above principles, a criterion of price control is proposed as:

$$MinJ = \frac{1}{2}(P_N - P_N^d)^T S(P_N - P_N^d)$$

$$+\frac{1}{2}\sum_{K=0}^{M-1}(P_K - P_K^d)^T G(P_K - P_K^d) \tag{7}$$

where S and G are weight matrices, P_K^d is objective price. It is a price that is expected by government planner and regard as most favourable to bring about an advance in macroeconomy.

Now we discuss the objective price in some detail, it can be obtained by various methods. One can get the objective price based on different way. It may be one of followings:

1) shadow price which come from the macroeconomic programming models,

2) international market price,

3) supply-demand equilibrium price,

4) measuring price which come from the estimating of production cost and normal profit,

5) decision price for reason of government policy,

6) the weight value of the above five prices, and so on.

However from any consideration, government planner must have an objective price before the price reform and make some measures to stablize the price level at about it.

3. THE PRICE ADJUSTMENT AND CONTROL MODEL

From the above discussion, the integrated model of the price adjustment and control model is

$$MinJ = \frac{1}{2}(P_N - P_N^d)^T S(P_N - P_N^d)$$

$$+\frac{1}{2}\sum_{K=0}^{M-1}(P_K - P_K^d)^T G(P_K - P_K^d) \tag{8}$$

subject to: $Y_0 = Y_{(0)}^1$

$$Y_{K+1} = Y_K + U_K \tag{9}$$

$$P_K = (I - A^T)^{-1} Y_K \tag{10}$$

$$(K = 0, 1, 2, \ldots M - 1).$$

This is a discrete-time and output-tracking model, it can be easily solved by dynamic programming or by the maximum principle.

4. CONCLUSION

A discrete-time price model has been developed. The optimal control criterion is incorporated to the price adjustment practice. The model is not very complex, but it has many pragmatic values in price analysis.

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