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MONOPOLISTIC PRICE ADJUSTMENT AND THE EFFECTIVENESS OF ANTICIPATED MONEY*

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This paper examines the effectiveness of anticipated monetary policy under a monopolistic price adjustment rgule based on profit maximizing behavior. Sargent and Wallace (1975) demonstrated that anticipated monetary policy does not have an effect on real output if markets are perfectly competitive and expectations are formed rationally. This paper shows how, under a monopolistic price adjustment rule, an expected change of the money stock can affect real output through its effects on real money balances and the relative prices of foreign goods.

An aggregate price adjustment rule is derived from the monopolistically competitive firm's profit maximizing behavior when nominal wages are determined competitively. The monopolistic price adjustment rule shows how prices do not adjust equiproportionately to a change of the money stock. This nonequiproportionate adjustment of prices in response to a change of the money stock accounts for the real balance effect. Moreover, this paper shows that an expected change of the money stock affects relative prices of foreign goods through the effect on the foreign demand for domestic output and affects domestic real output.

I. INTRODUCTION

Whether monetary policy can have an effect on the real economy is an important issue in monetary theory. Lucas (1973), Sargent (1973), Sargent and Wallace (1975) have proposed, given a certain subset of conditions, that an anticipated change of the nominal money supply cannot affect real output. This conclusion is a well known "policy ineffectiveness proposition" of the new classical macroeconomists.

The policy ineffectiveness proposition developed by Lucas (1973), Sargent (1973), and Sargent and Wallace (1975) is based on the following three theoretical assumptions. The first assumption is that economic agents form their ex-

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pectations rationally. This implies that individual agents are assumed to be rational in the sense that they do not ignore information in forming their expectations about the future price level and money supply.[1] The second assumption is that the aggregate supply function depends on the gap between the current price level and the expectation of the price level (it is referred to Lucas-type aggregate supply function).[2] The third assumption is that prices are fully flexible and equate the quantities of aggregate output supplied and demanded in each period.

However, many economists have criticized the monetary policy ineffectiveness proposition [for example, Phelps and Taylor (1977), Fischer (1977, 1979), Fair (1978), Blinder and Fischer (1981), Taylor (1982), Frydman (1981), and Jansen (1985)]. One of the major criticisms of the monetary policy ineffectiveness proposition is that it relies on extremely simple specification for the aggregate supply function (see Attfield et al., 1984, ch.4). In other words, Lucas-type supply function excludes some important variables such as the interest rate, asset variables and the tax rate. Therefore, if we change the specification of the Lucas-type supply function, then the implications of the rational expectations model may change significantly.

Another important criticism is related to price stickiness. Fischer (1977) and Phelps and Taylor (1977) argue the fully flexible price assumption is unrealistic. Long-term wage contracts in labor markets and the costs of price adjustment in goods markets can explain why the fully flexible price assumption needs modification. Phelps and Taylor demonstrate that if a price stickiness assumption is incorporated into a rational expectations model, then anticipated monetary policy can affect the real output although one assumes rational expectations.

There are more recent attempts to explain price stickiness from the monopolistic firms' profit maximizing behavior [Gordon (1981), Rotemberg (1982), Mankiw (1985), Akerlof and Yellen (1985), Rowe (1986), and Blanchard and Kiyotaki (1987)]. Gordon (1981) states that price stickiness has to be explained from the firms' profit maximizing behavior rather than from extraneous assumptions. Rowe (1986) argues that the monopolistic market approach can explain why prices are imperfectly flexible.

Rotemberg (1982) and Blanchard and Kiyotaki (1987) have derived a price adjustment rule from the microfoundation of the monopolistic firm's profit maximizing behavior. They explain that because there is some cost of price

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[1] Under the rational expectation assumption, economic agents form their expectations on the basis of all information available (Muth, 1961).

[2] This supply function was developed by Lucas and Rapping (1969) and Lucas (1972). The Lucas-type supply function is also referred to as a "surprise supply function" (Buiter, 1980).

adjustment,[3] a profit maximizing monopolist adjusts his price slowly to a change of aggregate demand or money stock.

The purpose of this paper is to examine the effectiveness of expected monetary policy under a price adjustment rule based on the monopolistic firm's profit maximizing behavior. We attempt to show how, under a monopolistic price adjustment rule, an expected change of money stock can affect real output through its effects on real money balances and the relative price of foreign goods.

An aggregate price adjustment rule is derived from the monopolistically competitive firm's profit maximizing behavior when nominal wages are determined competitively. The monopolistic price adjustment rule shows that prices do not adjust equiproportionately to a change of the money stock. This non-equiproportionate adjustment of prices in response to a change of the money stock accounts for the real balance effect. Moreover, an expected change of the money stock affects relative prices of foreign goods through the effect on the foreign demand for domestic output and affects domestic real output.

This paper is organized as follows. In section II, the basic model and aggregate price adjustment rule based on the profit maximizing monopolistic firms' behavior will be presented, and, the effectiveness of anticipated money under a monopolistic price adjustment rule is analyzed when nominal wages are determined competitively. Concluding remarks will be offered in section III.

II. THE MODEL AND ANALYSIS

The economy is composed of n monopolistic firms.[4] Each firm produces a product which is an imperfect substitute for goods produced by other firms. Each firm has a monopoly power when it sets its price; and each firm maximizes its profit taking the prices set by the other agents as given. Following Neuman and Von Hagen (1986), we assume that monopolistic firm i produces a tradeable good i with a domestic labor input and a foreign input. The pro-

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[3] Rotemberg (1982) points out that price adjustment is costly for two reasons: "first, there is the administrative cost of changing the price lists, informing dealers, etc. Secondly, there is implicit cost that results from the unfavorable reaction of customers to large price change" (p.522). Rotemberg (1982) and Blanchard and Kiyotaki (1987) show that, in a sticky price system, an expansionary change of money stock has a positive effect on real output.

[4] The model of this paper is based on the models of Rotemberg (1982) and Blanchard and Kiyotaki (1987). However, unlike their model, we incoperate foreign input in the production function and foreign demand in the demand equation. Therefore, the model of this paper can catch the foreign sector reason of price stickiness. Moreover, we explain the price stickiness not with the cost of price adjustment but with the determinant of marginal revenue and marginal cost. These are the main differences between my model and the models of Rotemberg (1982) and Blanchard and Kiyotaki (1987).

duction function for firm i is

$$(1)\quad Y_i = AL_i^{\alpha} F_i^{\beta}$$

where Y_i = the output of firm i;
L_i = the quantity of labor used in the production of output i;
F_i = the quantity of foreign input used in the production of output i, called the imported raw material;
A = the scale parameter;
α = the elasticity of output with respect to labor;
β = the elasticity of output with respect to the foreign input;

In the production function (1), we assume that the labor input and the foreign input are close substitutes. Thus if wages are high relatively to foreign input costs, then utilization of the foreign input increases. If foreign input costs are high relatively to wages, then the producer uses more labor input.

We assume that firm i faces a following downward sloping demand schedule for its product i[5]

$$(2)\quad Y_i^d = B[(\frac{P_i}{P})^{-\gamma}(\frac{M}{P})^{\delta}(\frac{eP^f}{P})^{\lambda}]$$

where Y_i^d = the quantity of good i demanded;
P_i = the price of good i;
P = the aggregate price level;
M = the nominal level of the money stock;
P^f = the foreign general price level in terms of foreign currency;
e = the nominal exchange rate;
B = the demand scale parameter;
γ = the elasticity of demand with respect to the relative price;
δ = the elasticity of demand with respect to real money balances;
λ = the elasticity of demand with respect to the relative price of foreign goods;

and the aggregate price level P is a weighted geometric average of the n prices charged by n monopolists:[6]

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[5] On this point, see Neuman and Von Hagen (1987, pp.4-6).

[6] The definition of aggregate price level P can be obtained as follows:
Let nominal aggregate demand be

$$PY = \sum_{i=1}^{N} P_i Y_i$$

$$P=[\frac{1}{n}\sum_{i=1}^{n}P_i^{1-\gamma}]^{-\frac{1}{1-\gamma}}$$

Equation (2) implies that demand for good i consists of home demand and foreign demand. Home demand for good i is assumed to depend negatively on its relative price to aggregate prices and positively on real money balances. Foreign demand is assumed to depend negatively on the relative price of foreign goods in terms of the foreign currency.[7] Consequently, equation (2) indicates that the demand for product i depends negatively on its relative price and positively on real money balances and the relative price of foreign goods.

If we invert equation (2) to obtain the price equation, we have the following inverse demand function (i.e., the price equation) :

$$(3)\ P_i=PY_i^{-\frac{1}{\gamma}}B^{\frac{1}{\gamma}}(\frac{M}{P})^{\frac{\delta}{\gamma}}(\frac{eP^f}{P})^{\frac{\delta}{\gamma}}$$

Each period, the monopolist i maximizes profits subject to the production function and demand function. The profit function for firm i is

$$(4)\ V_i=P_iY_i-W_iL_i-P^rF_i$$

where V_i: the profits for firm i ;
W_i: the nominal wages for labor L_i ;
P^r: the foreign input prices in terms of domestic currency.

Following Neuman and Von Hagen (1987), we assume that the foreign input price P^f is an exogenous variable.[8] If we rewrite the profit function by substituting equation (1) and (3) into (4), we obtain

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Using individual demand equation (2) in text, we rewrite the above equation as

$$PY=\sum_{i=1}^{N}P_iB(\frac{P_i}{P})^{-\gamma}(\frac{M}{P})^{\delta}(\frac{eP^f}{P})^{\lambda}$$

Using that all relative prices must be equal to unity in equilibrium, if we rewrite the above equation for P, we obtain the aggregate price level P in text.

[7] On this point, see Neuman and Von Hagen (1987, pp.4-6).

[8] Following Neuman and Von Hagen (1987), we assume that $p_t^r=ep_t^{fr}$ where e is the exchange rate and p_t^{fr} is the foreign input prices in terms of foreign currency. As Neuman and Hagen(1986) describe, the economy in a small country is small, hence the foreign input price p_t^{fr} is assumed to be an exogenous variable. Therefore, in a fixed exchange rate system, the foreign input price in terms of domestic currency p_t^r is also assumed to be exogenous.

$$(5)\ V_i = A^{\frac{\gamma-1}{\gamma}} B^{\frac{1}{\gamma}} P\left(\frac{M}{P}\right)^{\frac{\delta}{\gamma}} \left(\frac{eP^f}{P}\right)^{\frac{\lambda}{\gamma}} L_i^{\frac{\alpha\gamma-\alpha}{\gamma}} F_i^{\frac{\beta\gamma-\beta}{\gamma}} - W_i L_i - P^f F_i$$

From the maximization conditions of equation (5), solving for L_i and F_i respectively, we obtain equations (6) and (7)

$$(6)\ L_i = C\left(\frac{W_i}{P}\right)^{\eta 1}\left(\frac{M}{P}\right)^{\eta 2}\left(\frac{eP^f}{P}\right)^{\eta 3} F_i^{\eta 4}$$

and

$$(7)\ F_i = D\left(\frac{P^r}{P}\right)^{\phi 1}\left(\frac{M}{P}\right)^{\phi 2}\left(\frac{eP^f}{P}\right)^{\phi 3} L_i^{\phi 4}$$

where C, D, η_i, and ϕ_i are definitionally related to the parameters of equations (1) and (2). Equations (6) and (7) are not yet the final solutions for L_i and F_i respectively. From (6) and (7), the final solutions for L_i and F_i are (in log-linear form with time subscript and deleting the constant term)

$$(8)\ l_{it} = c_1(w_{it} - p_t) + c_2(p_t^r - p_t) + c_3(m_t - p_t) + c_4(e_t + p_t^f - p_t)$$
$$c_1 < 0,\ c_2 > 0,\ c_3 > 0,\ c_4 > 0$$

and

$$(9)\ f_{it} = d_1(p_t^r - p_t) + d_2(w_{it} - p_t) + d_3(m_t - p_t) + d_4(e_t + p_t^f - p_t)$$
$$d_1 < 0,\ d_2 > 0,\ d_3 > 0,\ d_4 > 0$$

where the coefficients c_i and d_i are definitionally related to the parameters of equations (6) and (7). The lower case letters denote the log of their respective upper case letters (hereafter e_t is the log of the exchange rate). Equation (8) is a derived demand function for labor, which indicates that demand for labor depends negatively on real wages, positively on relative price of foreign input, positively on real money balances, and positively on relative price of foreign goods. The reason for the positive effect of the relative price of foreign input on labor demand is that labor and foreign inputs are close substitutes in this model. The increase in the relative price of foreign input leads firms to employ more labor input to minimize the input costs. The reasons for the positive effects of real money balances and the relative price of foreign goods on labor demand are (1) real money balances have a positive effect on home demand, (2) the relative price of foreign goods has a positive effect on foreign demand for domestic products, (3) hence, increases in home demand and foreign demand

for domestic goods have positive effects on labor demand.

Equation (9) is a derived demand function for the foreign input which indicates that the quantity of the foreign input demanded by monopoly firm i depends negatively on the relative price of foreign input to domestic average price level, positively on the real wage, positively on real money balances, and positively on the relative price of foreign goods. Because labor and foreign inputs are close substitutes, real wages have a positive effect on the demand for foreign input.

By substituting equation (1) into equation (3) and taking logarithms, we obtain the log-linear form of the relative price equation for product i (we delete the constant term for simplicity and add time subscripts) :

$$(10)\quad p_{it}-p_t=g_1 l_{it}+g_2 f_{it}+g_3(m_t-p_t)+g_4(e_t+p_t^f-p_t)$$
$$g_1<0,\ g_2<0,\ g_3>0,\ g_4>0$$

where g_1-g_4 are definitionally related to the parameters of equations (1) and (2). Using equations (8) and (9) in equation (10), we can rewrite equation (10) as follows

$$(11)\quad p_{it}-p_t=(g_1c_1+g_2d_2)(w_{it}-p_t)+(g_1c_3+g_2d_3)(m_t-p_t)$$
$$+(g_1c_4+g_2d_4+g_4)(e_4+p_t^f-p_t)$$

Aggregating equation (11) over all firms, we obtain the following aggregate price adjustment equation

$$(12)\quad p_t=k_1w_t+k_2p_t^r+k_3m_t+k_4(e_t+p_t^f)$$

where the coefficients k_1-k_4 are definitionally related to the coefficients of equations (8), (9), and (10). Equation (12) implies that aggregate price adjustment is related to the change of input costs (here wages and foreign input cost) and the change of aggregate demand (here home demand and foreign demand).[9] We have already assumed that home demand depends on real money balances and foreign demand depends on the relative price of foreign goods to domestic goods. Thus, price adjustment to demand change depends on the the money stock and the foreign average price level. Finally, equation (12) indicates that aggregate price level responds systematically to wages, the foreign

[9] Bruno (1979) derives a price equation similar to the one derived here. His price equation states that price adjustment is a "linear function of the change of unit variable costs and the shift in demand" (p.191).

input price, the amount of the money stock, and the foreign average price level. In this model we will assume that the foreign input price and the foreign average price level are determined exogenously. We will also assume that the supply of money is determined by the monetary authority according to a linear -feedback rule to minimize the fluctuation of the output level. The money supply rule will be discussed later. We next address the issue of how the nominal wage level is determined in the labor market.

From equation (8), by aggregating over all firms, we obtain the aggregate demand function for labor

$$(13)\ l_t^d = c_1(w_t - p_t) + c_2(p_t^r - p_t) + c_3(m_t - p_t) + c_4(e_t + p_t^f - p_t)$$
$$c_1 < 0,\ c_2 > 0,\ c_3 > 0,\ c_4 > 0$$

For simplicity, let the aggregate labor supply function be given by

$$(14)\ l_t^s = c_5(w_t - p_t),\ c_5 > 0.$$

In equation (14), we implicitly assume that domestic labor suppliers do not consume foreign goods. If domestic labor suppliers consume foreign goods, the labor supply function must be respecified to allow real wages to be affected by foreign aggregate price level.

If the labor market is competitive, from equation (13) and (14), the equilibrium nominal wage is

$$(15)\ w_t^* = q_1 p_t + q_2 p_t^r + q_3 m_t + q_4(e_t + p_t^f),$$
$$q_1 > 0,\ q_2 > 0,\ q_3 > 0,\ q_4 > 0,$$

where the coefficients $q_1 - q_4$ are definitionally related to the parameters of equations (13) and (14). Combining the price equation (12) and the wage equation (15), the aggregate price equation can be reduced as follows

$$(16)\ p_t = \theta_1 m_t + \theta_2 p_t^r + \theta_3(e_t + p_t^f),$$

where $\theta_1 = \dfrac{k_1 q_3 + k_3}{1 - k_1 q_1}$;

$\theta_2 = \dfrac{k_1 q_2 + k_2}{1 - k_1 q_1}$;

$\theta_3 = \dfrac{k_1 q_4 + k_4}{1 - k_1 q_1}$.

Equation (16) indicates that aggregate price level depends positively on the stock of money, foreign input prices, and foreign average price level. In equation (16), if $\theta_1 = 1$, it implies that prices adjust equiproportionately to the change of money stock, while if $0 < \theta_1 < 1$, it implies that prices adjust partially to the change of money stock. However, in this model, we rarely have a reason to expect that the value of θ_1 is unity. The value of θ_1 depends on the values of α, β, γ, δ, and λ which are parameters in the production and demand functions. From the values of α, β, γ, δ, λ, and the relation of θ_1 with them, we can infer that the value of θ_1 is not unity in general. Thus, equation (16) implies that prices do not adjust equiproportionately to the change of money stock.

We have two reasons why there is no equiproportionate relationship between price level and the money stock. The first reason can be found from the inclusion of the foreign sector in this model. To capture the effects of the foreign sector on price adjustment, we incorporate the foreign input on the production side and foreign demand on the demand side. In our model we find that the foreign sector discourages domestic monopoly firms from changing prices quickly in response to a change of domestic money supply. The increase in the domestic price level in response to an increase in domestic money supply decreases the relative prices of foreign input and foreign goods. On the production side, the decrease in the relative price of the foreign input increases the domestic producers' demand for foreign inputs. When labor and foreign inputs are close substitutes in a production technology, the increase in the domestic producer's demand for the foreign input causes nominal wages not to increase in response to the increase in the domestic money supply. On the demand side, the decrease in the relative price of foreign goods decreases the foreigners' demand for domestic goods. The decrease in the foreigners' demand for domestic goods discourages firms from increasing prices in response to an increase in domestic money supply in order to avoid a decrease in the foreigner's demand for domestic goods. Therefore, the foreign sector causes domestic prices not to respond equiproportionately to the changes of the domestic money supply.

The second reason for the nonequiproportionate relationship between the price level and the money stock in this model can be found from the characteristics of a monopolistic price adjustment rule. From standard microeconomic theory, the change in the optimal price set by a monopolist depends on marginal revenue and marginal cost. However, as Gordon (1981) points out, the determinants of marginal cost and marginal revenue are not the same. He illustrates, (using diagram, p.521, figure 1), that marginal revenue for the monopolist will change in response to the demand change. Gordon maintains that if marginal cost for the monopolist changes by exactly the same amount as the demand change, then price will change by the same amount as the demand shift itself. In other words, as Gordon states, "price adjustment will be complete

if perceived marginal cost responds fully to the aggregate shock, but not otherwise"(p.521). However, Gordon argues that "firms rarely have a reason to expect such a close correspondence between movements in demand and cost, and thus conventionally respond to a demand shift partially by a change in price and partially by a change in the real quantity sold"(p. 522). In this model, for reasons similar to Gordon's, marginal revenue of a monopolist will change by the same proportion as demand changes. But marginal cost of production will not change by the same proportion as demand changes, because marginal cost does not have a close relationship with a demand change. Therefore, although we do not explicitly incorporate the cost of price adjustment, this model shows how prices may fail to adjust equiproportionately to the change of money stock.[10]

Given these two reasons for the nonequiproportionate adjustment of the price level to the change of money stock, we can infer that if the elasticity of demand with respect to foreign relative price, λ, is zero or the elasticity of output with respect to foreign input, β, is zero, the foreign sector explanation for partial adjustment of prices in response to the change of money stock will disappear. If we assume that in a fully flexible exchange rate system the relative price of foreign goods to domestic price is unity: i.e., the elasticity of demand with respect to the relative price of foreign goods is zero, this implies that in a fully flexible exchange rate system the foreign price level does not affect the domestic price level. For the same reason, in a fully flexible exchange rate system, if the relative price of foreign input to the domestic price level is unity: i.e., the elasticity of production with respect to foreign input is zero, then the foreign input price level does not affect the domestic price level. Therefore, in our model, if $\beta \neq \lambda \neq 0$', this implies that the exchange rate is not flexible and we have foreign sector effects, while if $\beta = \lambda = 0$, this implies that the exchange rate is fully flexible and we do not have foreign sector effects. Thus, if $\beta \neq \lambda \neq 0$, the price adjustment to the change of money stock will be larger than the case of $\beta = \lambda = 0$. In other words, if we do not consider the foreign sector effects on the price level, the price adjustment to the change of domestic money stock will be larger.[11]

From the individual demand equation (2), by aggregating over the economy, we can obtain the following form of aggregate demand function (log-linear form with time subscript)

$$(17)\quad y_t = a_0 + a_1(m_t - p_t) + a_2(e_t + p_t^f - p_t), \quad a_1 > 0,\ a_2 > 0,$$

[10] Gordon (1981) also explains the sticky price (or the partial adjustment of price to the change of aggregate demand) with the relation between marginal revenue and marginal cost for the profit maximizing monopolist. Although he does not consider explicitly the cost of price adjustment, prices are sticky in his model.

[11] This implies that If $\beta \neq \lambda \neq 0$, the price will be "stickier" than the case of $\beta = \lambda = 0$.

where $a_0=lnB$, $a_1=\delta$, $a_2=\lambda$. Equation (17) indicates that aggregate demand depends positively on real money balances and relative price of foreign goods in terms of foreign currency.

To complete the model, we need to specify the money supply rule of the monetary authority. Following Sargent (1973) and Sargent and Wallace (1975), we assume that to minimize the fluctuation of real output the monetary authority adjusts the stock of money according to a linear-feedback rule. The linear-feedback rule for money stock determination implies that the supply of money is determined by the monetary authority in response to the past values of macroeconomic variables, for example, output level, industrial production, price level, unemployment rate, interest rate, and the current account in balance of payment. However, to simplify the model, we assume that the money stock equation is

$$(18)\quad m_t=HX_{t-1}+\varepsilon_t^m,$$

where X_{t-1} represents the set of past values of all of the endogenous and exogenous variables in the model, H is a vector of parameters conformable to X_{t-1} and ε_t^m is a random part of money supply with a zero mean and a constant variance. The monetary authority chooses the vector H to minimize the fluctuation of real output, price level, or the employment level. Under the rational expectations assumption, the economic agents are assumed to know the value of feedback money supply rule. However, the random part of the money supply ε_t^m is not known. Thus, equation (18) shows that the money stock consists of anticipated and unanticipated components.

To solve the reduced form of the price level, combine the price equation (16) and the money supply equation (18), which yields

$$\begin{aligned}(19)\quad p_t&=\theta_1(HX_{t-1}+\varepsilon_t^m)+\theta_2 p_t^r+\theta_3(e_t+p_t^f)\\&=\theta_1 HX_{t-1}+\theta_2 p_t^r+\theta_3(\bar{e}+p_t^f)+\theta_1\varepsilon_t^m\end{aligned}$$

In equation (19), we consider the case of fixed exchange rate in the short-run (i.e., the exchange rate e_t is fixed at $\bar{e}$). We have already assumed that the foreign input prices and the foreign average prices are exogenous variables. Thus, equation (19) is a reduced form of the price equation because it includes only the predetermined or exogenous variables of the model.

In a monopolistically competitive economy, output is always equal to the quantity demanded. Therefore, using equations (18) and (19) in equation (17), we obtain the reduced form equation for real output under a market-clearing

wage rate w^*.[12]

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\begin{aligned}
(20)\ y_t &= a_0 + a_1[H(1-\theta_1)X_{t-1} - \theta_2 p_t^r - \theta_3(\bar{e}+p_t^f) + (1-\theta_1)\varepsilon_t^m] \\
&\quad - a_2[\theta_1 H X_{t-1} + \theta_2 p_t^r - (1-\theta_3)(\bar{e}+p_t^f) + \theta_1 \varepsilon_t^m] \\
&= a_0 + H[a_1 - (a_1+a_2)\theta_1]X_{t-1} - (a_1+a_2)\theta_2 p_t^r \\
&\quad - [(a_1+a_2)\theta_3 - a_2](\bar{e}+p_t^f) + [a_1 - (a_1+a_2)\theta_1]\varepsilon_t^m
\end{aligned}
$$

Equation (20) shows that the anticipated monetary policy parameter H does not disappear in the real money balance term (in the first line) and the relative price of foreign goods term (in the second line). This implies that an expected change in the money stock can affect real output through the effect on real money balances and the relative price of foreign goods. In the real money balance term (the bracketed term in the first line), the effectiveness of the anticipated monetary policy is related to the nonequiproportionate price adjustment to the change of money stock. In the relative price of foreign goods term (the bracketed term in the second line), the increase in domestic prices in response to an increase in the domestic money supply has a negative effect on the relative price of foreign goods, and, hence, a negative effect on domestic output. Consequently, we can conclude that an expected change of money stock can affect real output. As the bracketed term in the third line, equation (20) shows us, the sign and the magnitude of the effect of the expected money on real output depend on the relative strength among the parameters of the production and demand functions.

III. CONCLUSION

This paper demonstrates that in a monopolistically competitive economy an anticipated change in the money stock can affect real output through effects on real money balances and the relative price of foreign goods. The effect of real money balance on real output results in a non-equiproportionate adjustment of prices to the change of money stock. Our model shows that the prices set by a profit maximizing monopolist do not adjust equiproportionately to the change of money stock. There are two reasons for the non-equiproportionate adjustment of prices to the change of the money stock : first, to discourage the decrease in the foreigners' demand for domestic products, monopolistic firms do not fully adjust their prices in response to the increase in the domestic money

[12] We have also found that an anticipated change of money stock in the case of nominal wage contracting can affect real output. However, we do not present here the analysis in the case of nominal wage contracting.

supply ; second, because the determinant of marginal revenue and marginal cost for the monopolist are not the same, prices which satisfy the monopolist profit maximization condition (marginal revenue = marginal cost) do not respond equiproportionately to the change of demand or the money stock. This non-equiproportionate adjustment of prices to the change of the money stock leads to the effect of the anticipated money on real output. In addition to this real money balance effect, our model shows that anticipated money affects the foreign demand for domestic output through the effect of the relative price of foreign goods, and, hence, affects real output.

One lesson from our study is that disinflation policy with corresponding reduction of the money stock may be costly because a reduction of the money stock, even though it is perfectly known or anticipated to the public, will decrease real output due to slow adjustment of the price level. The cost of disinflation will be higher in the case of rapid reduction of the money stock because the price adjustment to the change of money stock will be slower.

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