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Fiscal Policy and Entrepreneurship

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Katsuya Takii

Associate Professor, Osaka School of International Public Policy (OSIPP)

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【要約】This paper reexamines the effect of expansionary fiscal policy on real GDP in the presence of entrepreneurship, which is defined as firms' activities to predict and adapt to changes in consumers' tastes. As government expenditure cannot reflect changes in consumers' tastes, it weakens the social role of the firms' ability to process local information for predicting the changes. Hence, government expenditure cannot perfectly substitute for private consumption. It is shown that expansionary fiscal policy can lower real GDP when idiosyncratic risk and the substitutability of goods are large, and when firms have a strong ability to predict changes in consumer tastes. In addition, this paper shows that expansionary fiscal policy discourages firms from investing in activities that aid prediction in the short run. However, expansionary fiscal policy does not influence investment in prediction ability in the long run.

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1 Introduction

Macroeconomics is considered the study of the economy as a whole and attempts to explain the behavior of aggregate statistics. Since the study of macroeconomics began, extensive research has been conducted to find stable relationships among several aggregate statistics on the assumptions that idiosyncratic changes in an economy, and agents' adaptation to the changes, do not influence the behavior of aggregate statistics. It is hoped that once a stable structure of the economy is found, governments may be able to control their economies using fiscal or monetary policy.

Hayek (1945) is known to be an opponent of central planning based on statistical information. He emphasizes the economic importance of "the knowledge of the particular circumstances of time and place":

"If we can agree that the economic problem of society is mainly one of rapid adaptation to changes in the particular circumstances of time and place, it would seem to follow that the ultimate decisions must be left to the people who are familiar with these circumstances, who know directly of the relevant changes and of the resources immediately available to meet them."

Kirzner (1973) calls the agents who adapt to idiosyncratic changes entrepreneurs, and argues that the absence of entrepreneurs in the neoclassical framework means that important aspects of the real economy are missed.

In this paper, I aim to model entrepreneurship, defined as firms' activities to predict and adapt to idiosyncratic changes in consumers' taste, in a general equilibrium model. I examine how the consideration of entrepreneurship changes the consequences of expansionary fiscal policy. I argue that the absence of entrepreneurship in macroeconomics makes researchers overrate the effectiveness of expansionary fiscal policy.

More specifically, I extend Startz's (1989) model and include idiosyncratic taste shocks, to which firms must adapt. In Startz's model, large government expenditure partially crowds out private consumption, but increases real GDP. The existence of partial crowding out generates a trade off between private consumption and government expenditure. In this paper, I show that expansionary fiscal policy can lower real GDP because the existence of entrepreneurship makes it difficult for government expenditure to substitute for private consumption.

The logic is explained as follows. When consumers' tastes alter, private demand shifts to reflect the changes. However, as the government is not aware of the changes due to a lack of local information, a welfare-maximizing government cannot change its demand. Hence, firms that provide goods for consumers must adapt to changes in demand by processing local information, but firms that provide goods to the government do not have to adapt. It is shown that firms' aggressive adaptation makes markets more competitive, causing the aggregate price for private consumption to drop. Hence, when government expenditure partially crowds out private consumption, expansionary fiscal policy forces people to consume relatively expensive goods. Thus, expansionary fiscal policy can lower real GDP when there is entrepreneurship.

It is shown that the multiplier of expansionary fiscal policy is a decreasing function of the level of idiosyncratic risk, the substitutability of goods and the firms' ability to predict the changes in consumer tastes. Hence, the multiplier is likely to be negative if these three factors are large. A rise in idiosyncratic risk increases the importance of prediction, whereas a rise in the substitutability of goods makes demand more sensitive to changes in tastes. Hence, both increase the benefits from adapting to changes by processing local information. On the other hand, an increase in firms' prediction abilities allows firms to correctly adapt to changes. Thus, a rise in all three factors increases the beneficial effects of private consumption on real GDP and makes it more difficult for government expenditure to substitute for it.

In addition, in this paper I investigate how fiscal policy influences firms' investments in prediction ability. It is shown that expansionary fiscal policy lowers investment in the short run, but does not influence it in the long run. In the short run, expansionary fiscal policy crowds out private consumption, which reduces the benefits from investment in prediction ability. However, as firms' profits are kept to zero in the long run due to entries and exits, a reduction in demand does not change the benefits from investment in the long run. Hence, expansionary fiscal policy does not influence investment. It is shown that two demand-side factors—the level of idiosyncratic risk and the substitutability of goods—are the most important determinants of the level of prediction ability in the long run.

Although this paper was stimulated by ideas in Hayek (1945) and Kirzner (1973), I do not attempt to formulate the theories of these economists. As their arguments are based on disequilibrium analysis, it is impossible to integrate them into an equilibrium model. However, as Rosen (1997) argues, I believe that there are gains from trade between Austrian and neoclassical economics. In this paper, therefore, I attempt to focus on the aspects of Hayek's and Kirzner's arguments that can be expressed in an equilibrium model in order to address a neglected issue in the literature of fiscal policy[1] .

This approach deserves more attention as recent micro evidence suggests that the adaptation to idiosyncratic shocks has significant economic impacts. Davis and Haltiwanger (1999) review the literature and insist that unobserved idiosyncratic factors play a dominant role in explaining the redistribution of workers. Hubbard (2003) finds that advanced on-board computers significantly increase capacity utilization in

[1]Interesting recent reviews of literature related to fiscal policy can be found in Chari and Kehoe (1999), Auerbach (2002), and Bénassy (2002).

the trucking industry by improving dispatchers' ability to make resource-allocation decisions. The evidence suggests that the investigation of entrepreneurship is an important neglected area in macroeconomics.

A similar role for entrepreneurs was previously examined in a general equilibrium framework by Holmes and Schmitz (1990) and Takii (2003c)[2]. Holmes and Schmitz (1990) emphasize the importance of the division of labor between entrepreneurs and managers. Takii (2003c) investigates the effect of entrepreneurship on the total factor productivity in an economy. However, no paper examines a trade-off between entrepreneurship and expansionary fiscal policy.

This paper is organized as follows. In the following section, I set up the model. In Section 3, I analyze the effect of expansionary fiscal policy on real GDP. It is shown that the effect could be negative. In Section 4, I identify the factors that influence the magnitude of the multiplier of expansionary fiscal policy. In Section 5, I investigate the effect of expansionary fiscal policy on firms' investments in prediction ability. Section 6 concludes the paper.

2 The Model

This section sets up the model that enables me to analyze the effect of entrepreneurship on the multiplier of expansionary fiscal policy. The model is based on Startz (1989). I add idiosyncratic taste shocks, to which firms must adapt, to a slightly modified version of Startz's model (1989). This modeling strategy is undertaken to clarify how the consideration of entrepreneurship changes the results in the previous literature.

[2] The different roles of entrepreneurs are incorporated into equilibrium analysis by Kihlstrom and Laffont (1979) with respect to risk bearing, by Schmitz (1989) with respect to imitation, and by Aghion and Howitt (1992) with respect to innovation.

Household: There are identical representative households in an economy, and total population is normalized to be one. It is assumed that the households' utilities depend on a bundle of goods purchased by the household, c_i (C goods), a bundle of goods provided by the government, g_i (G goods), and leisure L:

$$\begin{aligned} U &= \theta \log C + \xi \log G + (1-\theta-\xi) \log L, \\ where\ C &= \left[\frac{\int^{n_c} z_i c_i^{\alpha} di}{n_c^{1-\alpha}} \right]^{\frac{1}{\alpha}}, \\ G &= \left[\frac{\int^{n_g} z_i g_i^{\alpha} di}{n_g^{1-\alpha}} \right]^{\frac{1}{\alpha}}, \\ \alpha &= 1 - \frac{1}{\rho} \in (0,1). \end{aligned}$$

The parameters θ and ξ are assumed to be between zero and one. They measure the relative weights that agents place on C goods and G goods, respectively. The parameter ρ is the measure of the elasticity of substitution. As α is assumed to be between zero and one, ρ is greater than 1. This means that the goods are imperfect substitutes. The variables n_c and n_g measure the varieties of C goods and G goods, respectively. The denominators, $n_c^{1-\alpha}$ or $n_g^{1-\alpha}$, are included in each subutility in order to eliminate the positive taste for variety, as assumed in Startz (1989). The random variables, z_i, represent changes in tastes for each good and are identically and independently distributed (i.i.d). The incorporation of z_i in subutility is the main departure from Startz's (1989) model.

Representative households maximize their utility functions by choosing c_i and L subject to the budget constraint:

$$\int^{n_c} p_{ci} c_i di = \Pi + (N - L) - T,$$

where p_{ci} is the price of the ith C good, Π is capital income, N is the total amount of available labor in this household, and T is lump sum taxes. The wage rate is assumed to be 1. Hence, $N - L$ represents labor income.

Demand functions for C goods and leisure are easily derived, as follows:

$$c_i = \left(\frac{z_i}{p_{ci}}\right)^{\frac{1}{1-\alpha}} P_c^{\frac{\alpha}{1-\alpha}} \left[\frac{\theta}{1-\xi} \frac{\Pi + N - T}{n_c}\right], \forall i, \tag{1}$$

$$L = \frac{1-\theta-\xi}{1-\xi} \left[\Pi + N - T\right], \tag{2}$$

$$\textit{where } P_c = \left[\frac{\int^{n_c} p_{ci}^{\frac{\alpha}{\alpha-1}} z_i^{\frac{1}{1-\alpha}} di}{n_c}\right]^{\frac{\alpha-1}{\alpha}}.$$

$\frac{\theta}{1-\xi}[\Pi + N - T]$ and $\frac{1-\theta-\xi}{1-\xi}[\Pi + N - T]$ are the amounts of expenditure allocated to the purchases of C goods and leisure, respectively. Because of the log linear specification of the utility function, the allocated expenditure is independent of the price index, P_c. This simplifies the analysis below. Note that the demand functions depend on the realization of the random variables, z_i. Hence, a firm must adapt to the changes in tastes when production takes place.

Government: A government purchases G goods and transfers them to households. Following Startz (1989), it is assumed that re-trading G goods is prohibited. The government is assumed to maximize the expected value of $\log G$ subject to its budget constraint:

$$\max_{g_i} \int \left[\log\left(\frac{\int^{n_g} z_i g_i^{\alpha} di}{n_g^{1-\alpha}}\right)^{\frac{1}{\alpha}}\right] q_z(z_i)\, dz_i,$$

$$s.t.\ T = \int^{n_g} p_{gi} g_i di,$$

where p_{gi} is the price of the *ith* G good and $q_z(z_i)$ is a marginal density function of z_i. Without loss of generality, the distribution function of z_i is assumed to be continuous. The main difference between the households' decisions and the government's decisions is that the government cannot observe changes in tastes due to the lack of local information. As the attention of a human being is limited, it is impossible for a decision-maker to observe all information on shifting consumer tastes for individual goods. Hence, the government must maximize the expected value of households' utility. Of course, in reality, politicians would seek to satisfy their own interests. However, my assumption of a benevolent government assists in identifying the problems caused by the lack of local information.

As z_i has an i.i.d. distribution and g_i must be independently chosen due to the lack of information, $\int^{n_g} z_i g_i^\alpha di = \int^{n_g} z^e g_i^\alpha di$, where $z^e = \int z_i q_z(z_i) dz_i$. Hence, there is no random component for this maximization problem. The following demand function is easily derived:

$$g_i = \left(\frac{z^e}{p_{gi}}\right)^{\frac{1}{1-\alpha}} P_g^{\frac{\alpha}{1-\alpha}} \left(\frac{T}{n_g}\right), \ \forall i, \tag{3}$$

$$where\ P_g = \left[\frac{\int^{n_g} (p_{gi})^{\frac{\alpha}{\alpha-1}} (z^e)^{\frac{1}{1-\alpha}} di}{n_g}\right]^{\frac{\alpha-1}{\alpha}}.$$

Note that the demand for G goods does not have any random components. As the government guarantees the amount of demand, firms do not need to adapt to changes in demand.

C-goods firm: Each variety of C goods and G goods is produced by a single firm. A C-goods firm must make two decisions: it must choose how much it produces, and what the price of its product is. The timing of decisions is as follows. (1) A taste shock, z_i, occurs. (2) A firm, i, observes a noisy signal, s_i, and infers the realized z_i. (3) The firm produces non-storable goods, c_i. (4) The firm discovers what the true z_i is. (5) The firm sets its price, p_{ci}.

Let us first consider how the firms set their prices. As it is assumed that goods cannot be stored, the optimal strategy is for the firms to set the highest possible price

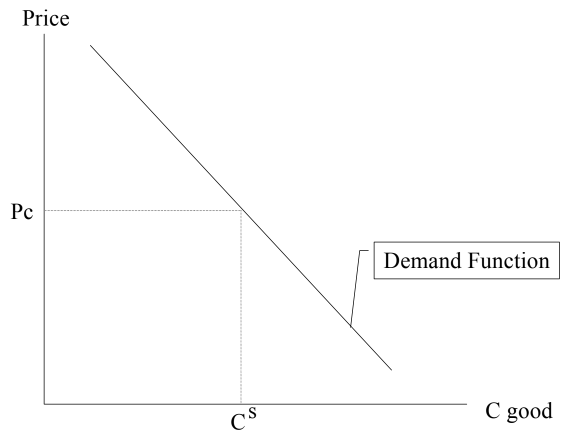

Figure 1: *The Pricing Decision* (the picture shows that the highest possible price the firm can set when the firm has already produced c^s is determined by the inverse demand curve.)

at which they can sell all the products they have already produced[3]. Assume that firms know the households' demand function and that they have already produced c_i^s units of the goods. The optimal price for the firm i is derived from the inverse demand function, which is depicted by Figure 1:

$$p_{ci} = z_i \left(c_i^s\right)^{\alpha-1} P_c^{\alpha} \left[\frac{\theta}{1-\xi} \frac{\Pi + N - T}{n_c} \right]^{1-\alpha}.$$

Note that given this price, p_{ci}, the demand for the good always equals the supply of the good: $c_i = c_i^s$. Hence, I use c_i to denote the amount of supplied goods as well.

When the firm makes its production decision, it must predict the changes in tastes. It knows that the price will be set on the inverse demand function no matter what

[3] When $\alpha \in (0,1)$ in the utility function of consumers, it is not optimal for the firm to throw the product away in order to keep the price high.

the realization is. Hence, the firm's problem is specified by the following equation.

$$\begin{aligned}
\pi(s_i) &= \max_{c_i}\left\{E^h[p_{ci}|s_i]\,c_i - \frac{c_i}{A}\right\} \\
s.t.\ p_{ci} &= z_i c_i^{\alpha-1} P_c^{\alpha}\left[\frac{\theta}{1-\xi}\frac{\Pi+N-T}{n_c}\right]^{1-\alpha} \\
where\ E^h[p_{ci}|s_i] &= \int p_{ci} q^h_{z/s}(z_i|s_i)\,dz_i, \\
q^h_{z/s}(z_i|s_i) &= \frac{q^h_{s/z}(s_i|z_i)\,q_z(z_i)}{\int q^h_{s/z}(s_i|z_i)\,q_z(z_i)\,dz_i}
\end{aligned} \tag{4}$$

and A measures the productivity of the firm and $q^h_{s/z}(s_i|z_i)$ is a conditional density function of s_i given the realization of z_i. The last equation shows that $q^h_{z/s}(z_i|s_i)$ is a posterior density of z_i having observed s_i.

Note that $q^h_{s/z}(s_i|z_i)$ depends on h, which measures the firms' ability to predict the changes in households' tastes. If the firm can accurately predict the realization of z_i, the firm has a likelihood function endowed with high h and is considered to have precise knowledge about the nature of shifting tastes for a particular good. As the knowledge makes it possible for the firms to adequately adapt to the changes, the parameter, h, can be interpreted as the index of firms' entrepreneurial ability. The ordering of h is mathematically defined later.

The solution to the profit-maximization problem reveals that the price has to be equal to a constant markup, $\frac{1}{\alpha}$, times marginal cost, $\frac{1}{A}$, on average:

$$p(z_i, s_i) \equiv p_{ci} = \frac{z_i}{\alpha A E^h(z_i|s_i)}, \tag{5}$$

where $E^h(z_i|s_i) = \int z_i q^h_{z/s}(z_i|s_i)\,dz_i$. Note that the actual price deviates from the constant mark-up rule due to firms' misunderstanding the changes in tastes, $\frac{z_i}{E^h(z_i|s_i)}$. When the firm discovers the true z_i, it realizes that z_i differs from the predicted value. If the realized z_i is greater than the predicted one, $E^h(z_i|s_i)$, then the firms can set a higher price than the mark-up rule. If z_i is lower than $E^h(z_i|s_i)$, then the firm must set a lower price. Hence, $\frac{z_i}{E^h(z_i|s_i)}$ can be interpreted as the measure of "a wonderful surprise"[4].

G-goods firm: G-goods firms have the same technology as C-goods firms, but the demand for goods is guaranteed by the government. Hence, when the firms decide how much they produce, the prices of the goods are automatically determined from the government's inverse demand function. The G-goods firms' problem is written as:

$$\begin{aligned} \pi_{gi} &= \max_{g_i} \left\{ p_{gi} g_i - \frac{g_i}{A} \right\}, \qquad (6) \\ s.t.\ p_{gi} &= z^e g_i^{\alpha-1} P_g^{\alpha} \left(\frac{T}{n_g} \right)^{1-\alpha}. \end{aligned}$$

As there is no random variable on the inverse demand function, there is nothing to predict. Hence, the price is set at exactly the markup, $\frac{1}{\alpha}$, times marginal cost $\frac{1}{A}$:

$$p_{gi} = \frac{1}{\alpha A}. \qquad (7)$$

Capital-Market Clearing Condition: It is assumed that a capital market is perfectly competitive and that entrepreneurs can hedge their own risk. Hence, the following capital-market clearing condition must be satisfied:

$$\Pi = n_c \left[\int \pi(s_i)\, q_s^h(s_i)\, ds_i - F(h) \right] + n_g \left[\pi_g - F_g \right], \qquad (8)$$

[4]Kirzner (1997) points out that entrepreneurs correct their decisions during the equilibrative market process because the decision-makers discover their earlier errors. Thus, discovery is always accompanied by a sense of "surprise". Of course, his emphasis is on " unthought-of knowledge", which differs from the "known ignorance" in this paper. However, I believe that a careful examination of entrepreneurial discovery based on "known ignorance" clarifies the benefits and the limits of the neoclassical framework, which is part of the purpose of this paper.

where $q_s^h(s_i) = \int q_{s/z}^h(s_i|z_i)\, q_z(z_i)\, dz_i$, and $F(h)$ and F_g are fixed costs for the production of C goods and G goods, respectively.

Fixed cost can be interpreted as the cost of employing management groups and analysts, the importance of which is emphasized by Chandler (1990). The fixed costs, $F(h)$ and F_g, may differ as C-goods firms must employ professional analysts in order to predict the changes in tastes. Hence, the natural assumption would be $F(h) \geq F_g$.

Equilibrium: The market equilibrium in the short run is formally defined as follows.

Definition 1 *The market equilibrium in the short run is* $\{c(\cdot), L, g_i, p(\cdot,\cdot), p_g, \pi(\cdot), \pi_g, \Pi\}$, *which satisfies the following conditions:*

1. *Households maximize their utility: equations (1) and (2).*
2. *A government maximizes households' expected utility: equation (3).*
3. *C-goods firms and G-goods firms maximize their own profits: equations (4), (5), (6) and (7).*
4. *The capital market is cleared: equation (8).*

The labor market clearing condition is omitted from the definition of the market equilibrium because of Walras's law. The market equilibrium in the short run is defined with a given n_c and n_g. The zero profit conditions that determine n_c and n_g will be introduced later to define the market equilibrium in the long run.

The Expected Revenue in the Equilibrium: Substituting the profit-maximizing prices of the C-goods firm and the G-goods firm into the demand functions, the expected revenues of the firms are derived as follows:

$$
\begin{aligned}
E^h\left[p\left(z_i, s_i\right) c\left(s_i\right)\right] &= \left[z\left(h\right)\right]^{\frac{1}{1-\alpha}} \left(\alpha A\right)^{\frac{\alpha}{1-\alpha}} P_c^{\frac{\alpha}{1-\alpha}} \frac{\theta}{1-\xi} \frac{\Pi + N - T}{n_c}, & (9) \\
p_g g &= \left[z^e\right]^{\frac{1}{1-\alpha}} \left(\alpha A\right)^{\frac{\alpha}{1-\alpha}} P_g^{\frac{\alpha}{1-\alpha}} \frac{T}{n_g}, & (10) \\
where\ z\left(h\right) &= E^h\left[E^h\left[z_i | s_i\right]^{\frac{1}{1-\alpha}}\right]^{1-\alpha},
\end{aligned}
$$

and $E^h\left[p\left(z_i, s_i\right) c\left(s_i\right)\right] = \int p\left(z_i, s_i\right) c\left(s_i\right) q_{s/z}^h\left(s_i | z_i\right) q_z\left(z_i\right) dz_i ds_i$ and $E^h\left[E^h\left[z_i | s_i\right]^{\frac{1}{1-\alpha}}\right] = \int \left[\int z_i q_{z/s}^h\left(z_i | s_i\right) dz_i\right]^{\frac{1}{1-\alpha}} q_s^h\left(s_i\right) ds_i$.

The structure of the expected revenue between the C-goods firm and that of the G-goods firm is similar. The main difference is that the expected revenue of the C-goods firm is affected by h through $z\left(h\right)$, whereas that of the G-goods firm is not. It is shown below that $z\left(h\right)$ is an increasing function of h. This means that if entrepreneurs have greater ability to predict changes in tastes, they can expect to obtain more revenue. Talented entrepreneurs produce more when they can set high prices, and produce less when they must set low prices. Hence, the correlation between the price and output is high. That is why they expect to receive a high revenue. To formally prove this intuition, we need the following assumption.

Assumption: Assume that h is ordered by the informativeness, in the sense of Blackwell (1953). That is, $h^1 \geq h^2$ if and only if there exists a nonnegative function $\phi\left(s_i^2 | s_i^1\right)$, which satisfies the following three relations:

$$
\begin{aligned}
\int \phi\left(s_i^2 | s_i^1\right) ds_i^2 &= 1,\ a.e.\ \forall s_i^1, \\
\int \phi\left(s_i^2 | s_i^1\right) q_{s/z}^{h^1}\left(s_i^1 | z_i\right) ds_i^1 &= q_{s/z}^{h^2}\left(s_i^2 | z_i\right),\ a.e.\ \forall z_i, \forall s_i^2 \\
\int \phi\left(s_i^2 | s_i^1\right) ds_i^1 &\in \left(0, \infty\right),\ a.e.\ \forall s_i^2.
\end{aligned}
$$

Blackwell (1953) proves that if h is ordered by this criterion, information structure h^1 brings higher ex-ante utility than information structure h^2 for any utility function. Using Blackwell's (1953) definition of informativeness, it is shown that $z(h)$ is increasing in h.

Lemma 2 *If h is ordered by the informativeness in the sense of Blackwell (1953), then $z(h)$ is increasing in h and $z(h) \geq z^e$ for any h.*

Proof. *As $E^h[z_i|s_i]^{\frac{1}{1-\alpha}}$ is convex in $E^h[z_i|s_i]$ and $E^h[z_i|s_i]$ is convex in $q^h_{z/s}(z_i|s_i)$, $E^h[z_i|s_i]^{\frac{1}{1-\alpha}}$ is convex in $q^h_{z/s}(z_i|s_i)$. From Theorem 2 in DeGroot (1970, p.436), the result is immediate.* ■

Using the above lemma, the expected revenue of the C-goods firm is increasing in h. However, consumers allocate a constant amount of expenditure to C goods, $\frac{\theta}{1-\xi}[\Pi + N - T]$. Hence, the expenditure on C goods is independent of h. As the expenditure must be equal to the total expected revenue of the C-goods sector in equilibrium, the price must be adjusted. That is, the firms' aggressive adaptation to the changes in tastes would raise competition in the market, and, therefore, the price index of C goods would drop. It is shown that P_c and P_g are decreasing in $z(h)$ and z^e, respectively:

$$P_c = \frac{1}{\alpha A z(h)^{\frac{1}{\alpha}}},$$
$$P_g = \frac{1}{\alpha A (z^e)^{\frac{1}{\alpha}}}.$$

The equations show that the price index for C goods is lower than the price index for G goods. Because of high competition in the C-goods market, the price index of C goods is lower than that for G goods.

Substituting the price indexes into equations (9) and (10), the expected revenue in the equilibrium is independent of h:

$$E^h\left[p\left(z_i, s_i\right) c\left(s_i\right)\right] = \frac{\frac{\theta}{(1-\xi)}\left(\Pi + N - T\right)}{n_c},$$
$$p_g g = \frac{T}{n_g}.$$

The equation shows that the expected revenues of C-goods and G-goods firms in the equilibrium are equivalent to the expenditure allocated to those goods per firm. As the total expenditure on C goods is independent of h, the expected revenue is also independent of h in the equilibrium. The benefits of strong prediction ability are always cancelled out by a rise in competition.

Of course, if the utility function is not log linear in C, G, and L, the total expenditure on C goods is affected by the relative price of C goods and G goods. A reduction in P_c raises the total expenditure on C goods and the expected revenue in the equilibrium. The log linear specification eliminates this additional effect and makes my analysis simpler.

3 The Multiplier and Prediction Ability

In this section, the effect of expansionary fiscal policy on real GDP is examined. In particular, I am interested in how firms' ability to predict the changes in tastes affects the multiplier of government expenditure. It is shown that the multiplier can be negative.

Real GDP: Real GDP consists of real private consumption and real government expenditure:

$$Y \equiv \frac{n_c E^h\left[p\left(z_i, s_i\right) c\left(s_i\right)\right]}{P_c} + \frac{n_g p_g g}{P_g},$$

$$
\begin{aligned}
&= \frac{\frac{\theta}{(1-\xi)}(\Pi + N - T)}{P_c} + \frac{T}{P_g}, \\
&= C + G.
\end{aligned}
$$

The above equation shows that the definition of real GDP equals the sum of subutility from C goods and G goods. Note that as $\frac{n_g p_g g}{P_g} = G$, G is equivalent to real government expenditure. Although G is treated as endogenous in this paper, as $G = \frac{T}{P_g}$, and P_g and T are exogenous, G can be also considered as a policy instrument[5]. Hence, there are two possible policy instruments: real government expenditure, G, or nominal government expenditure, T. Following Startz (1989), G is chosen to be a suitable policy instrument. The choice of policy instrument does not affect the main arguments below.

Wealth Effect:[6] Because monopoly prices exceed marginal costs, an increase in government expenditure raises aggregate profits:

$$
\Pi = \frac{(1-\alpha)\theta N - (1-\xi)(n_c F(h) + n_g F_g) + \frac{(1-\xi-\theta)(1-\alpha)}{\alpha A(z^e)^{\frac{1}{\alpha}}} G}{1 - \xi - (1-\alpha)\theta}.
$$

Using this equation, after-tax wealth, $\Pi + N - T$, is solved as a function of G:

$$
\Pi + N - T = \frac{(1-\xi)\left[N - \frac{G}{A(z^e)^{\frac{1}{\alpha}}} - (n_c F(h) + n_g F_g)\right]}{1 - \xi - (1-\alpha)\theta}.
$$

[5] If G is chosen to be a policy instrument, T must be considered as an endogenous variable. This means that the government is assumed to minimize T, provided that it guarantees the subutility G to representative consumers. The solution is the same.

[6] The wealth effect that operates through an increase in profits is considered the reason for the Keynesian multiplier effect [ex. Silvestre (1989)]. Unayama, Otaki, and Saito (2000) and Bénassy (2002) point out that, in fact, the real reason for output expansion in response to expansionary fiscal policy is the negative wealth effect: as a rise in tax reduces agents' wealth, agents consume leisure less and work more. The argument in this paper does not depend on the reason for GDP expansion.

The equation shows that an increase in government expenditure lowers after-tax wealth. Hence, it lowers private consumption. This brings about a trade off between government expenditure, G, and private consumption, C.

Fiscal Policy: Substituting the derived after-tax wealth into the definition of real GDP, real GDP in the short run is shown to be a function of government expenditure.

Proposition 3 *Real GDP in the short run, Y^S, can be expressed as a function of real government expenditure, G:*

$$\begin{aligned} Y^S &= i_s + m_s G, \\ \textit{where } m_s &= \frac{(1-\xi-\theta) + \alpha\theta\left(1-\left(\frac{z(h)}{z^e}\right)^{\frac{1}{\alpha}}\right)}{1-\xi-(1-\alpha)\theta}, \\ i_s &= \frac{\alpha A\theta\left[N-(n_c F(h) + n_g F_g)\right]}{\left[1-\xi-(1-\alpha)\theta\right]} z(h)^{\frac{1}{\alpha}}. \end{aligned}$$

If $z(h) = z^e$, which can be interpreted as the case of no entrepreneurial activity, then the result is the same as Startz (1989) and m_s is always positive. However, if $z(h) > z^e$, m_s can be negative. That is, if there are entrepreneurial activities, large government expenditure can lower real GDP. Note that if $z(h) > z^e$, then $P_c < P_g$. As large government expenditure partially crowds out private consumption, households must spend more on relatively expensive goods. Hence, large government expenditure can lower real GDP.

Note that because $z'(h) > 0$, an improvement in the firms' ability to predict the changes in tastes lowers the multiplier. That is, active entrepreneurial activities can weaken the effect of expansionary fiscal policy.

Now, let us consider the effectiveness of expansionary fiscal policy in the long run. In the long run, firms enter the market as long as expected profits are positive. Expected profits are zero in the long-run equilibrium:

$$E^h\left[\pi(s_i)\right] = F(h),$$

$$\pi_g = F_g,$$

where $E^h [\pi(s_i)] = \int \pi(s_i) q_s^h(s_i) ds_i$. Substituting the zero profit conditions into equation (8), $\Pi = 0$. Using this result, real GDP in the long run is derived from the definition of real GDP.

Proposition 4 *Real GDP in the long run, Y^L, can be expressed as a function of real government expenditure, G:*

$$\begin{aligned} Y^L &= i_l + m_l G, \\ \text{where } m_l &= \frac{1-\xi-\theta\left(\frac{z(h)}{z^e}\right)^{\frac{1}{\alpha}}}{1-\xi}, \\ i_l &= \frac{\theta N \alpha A z(h)^{\frac{1}{\alpha}}}{(1-\xi)}. \end{aligned}$$

The results are qualitatively the same as those for the short run: if there is no entrepreneurial activity ($z(h) = z^e$), then m_l is positive, as in Startz (1989), whereas if entrepreneurial activities are present ($z(h) > z^e$), then m_l can be negative. However, the magnitude of the multiplier is different between the long run and the short run:

$$m_l - m_s = -\frac{\theta(1-\alpha)(1-\xi-\theta)}{[1-\xi-(1-\alpha)\theta](1-\xi)}\left(\frac{z(h)}{z^e}\right)^{\frac{1}{\alpha}} < 0.$$

This result also appeared in Startz (1989). However, there are two new observations. First, the difference is larger when $z(h)$ is larger. That is, when firms have a strong ability to predict changes in tastes, the multiplier in the long run is substantially lower than that in the short run. Second, as m_l can be negative, it is possible that even when expansionary fiscal policy raises real GDP in the short run, it can be the source of long-run stagnation.

4 Idiosyncratic Risk and Substitutability

In this section, I make a further assumption on the information structure in order to identify the conditions that influence the multiplier of expansionary fiscal policy. It is shown that the level of idiosyncratic risk, the substitutability of goods, and the prediction ability are the key parameters influencing the multiplier.

I assume that $\log z_i$ comprises a predictable component μ and an unpredictable component u_i:

$$\log z = \mu + u_i$$

where u_i is normally distributed with a mean of 0 and a variance of σ_u^2. It is assumed that the unpredictable component u_i summarizes unexpected changes in tastes. The firms cannot observe u_i before making production decisions, but they can observe the signal s_i:

$$s_i = u_i + \varepsilon_i$$

where ε_i is normally distributed with a mean of 0 and a variance of $\sigma_\varepsilon^2(h)$. Note that the variance of the noise term differs when the firms' prediction ability differs.

The following measure to capture the firms' ability to predict the change in consumer tastes, u_i, is suggested by Takii (2003a).

Definition 5 *The measure of the firms' ability to predict changes in tastes, u, (the firms' prediction ability), is defined by:*

$$h = 1 - \frac{\int Var(u|s)\, q_s^h(s)\, ds}{\sigma_u^2},$$

where $Var(u|s) = \int \left(u - \int u q_z^h(z|s)\, dz\right)^2 q_z^h(z|s)\, dz$ *and* $u = \log z - \mu$.

This measure implies that the firms accurately predict u when on average they reduce the conditional variance, having observed s_i. To compare ability in different environments, $\int Var(u|s)\, q_s^h(s)\, ds$ is divided by σ_u^2, which is the unconditional variance of u_i. The measure h ranges from 0 to 1. If the firms perfectly predict the changes, $h = 1$, whereas if the firms do not predict the changes at all, $h = 0$.

Using the definition of h, the variance of the noise term is endogenously determined as follows:

$$\sigma_\varepsilon^2(h) = \frac{(1-h)\,\sigma_u^2}{h}. \tag{11}$$

As expected, when the firms more accurately predict unexpected changes, the variance of the noise term is smaller. When $h = 1$, the variance is 0, whereas when $h = 0$, the variance is infinite.

Given this definition, it is shown that:

$$z(h) = z^e \exp \frac{(\rho - 1)\,\sigma_u^2 h}{2}, \tag{12}$$

where $\rho = \frac{1}{1-\alpha}$. The equation shows that the marginal value of prediction ability is larger if risk is large and goods are more substitutable. If goods are more substitutable, demand is more sensitive to the changes in tastes, from equation (1). Hence, it is more important for the firms to predict the changes.

Substituting equation (12) into the definitions of m_s and m_l , the following proposition is derived.

Proposition 6 *Both the multipliers in the short run and long run are decreasing in the level of idiosyncratic risk, σ_u^2, the substitutability of goods, ρ and the firms' prediction ability h:*

$$m_s = \frac{1 - \xi - \theta - \left(1 - \frac{1}{\rho}\right)\theta\left(\exp\frac{\rho\sigma_u^2 h}{2} - 1\right)}{1 - \xi - \frac{\theta}{\rho}}, \tag{13}$$

$$m_l = \frac{1 - \xi - \theta \exp\frac{\rho\sigma_u^2 h}{2}}{1 - \xi}. \tag{14}$$

Note that because the multipliers are decreasing in risk, the substitutability of goods and the firms' prediction ability, the multipliers are likely to be negative if the three factors are large. A rise in idiosyncratic risk increases the importance of prediction, and a rise in the substitutability of goods makes demand more sensitive to changes in tastes. Hence, both increase the benefits from adapting to changes by processing local information. On the other hand, an increase in firms' prediction abilities allows firms to correctly adapt to changes. Thus, a rise in all three factors increases the beneficial effects of private consumption on real GDP and makes it more difficult for government expenditure to substitute for it.

5 Investment in Prediction Ability

An increase in government expenditure may have a further detrimental effect on the economy: it may discourage investment in prediction ability. This section asks a different question than the previous section did, focusing on how expansionary fiscal policy affects firms' investment in prediction ability.

Suppose that C-goods firms can invest in their management staff and choose the level of prediction ability before starting their businesses.

$$\max_h E^h \left[\pi\left(s_i\right)\right] - F\left(h\right),$$

$$E^h \left[\pi\left(s_i\right)\right] = \frac{\left[\left(1-\frac{1}{\rho}\right)A\right]^{\rho-1} P_c^{\rho-1} \frac{\theta}{1-\xi} \frac{\Pi+N-T}{n_c}}{\rho} \left(z^e\right)^\rho \exp \frac{\rho\left(\rho-1\right)\sigma_u^2 h}{2}.$$

Assume that the convexity of the F function is strong enough to satisfy the second order condition. That is, $F''\left(h\right) > \left[\frac{\rho(\rho-1)\sigma_u^2}{2}\right]^2 E^h\left(\pi\left(s_i\right)\right)$ for any $E^h\left(\pi\left(s_i\right)\right)$ in the equilibrium. Moreover, it is assumed that $F'\left(0\right) < \frac{\rho(\rho-1)\sigma_u^2}{2} E^0\left(\pi\left(s_i\right)\right)$ and $F'\left(1\right) > \frac{\rho(\rho-1)\sigma_u^2}{2} E^1\left(\pi\left(s_i\right)\right)$. These two conditions guarantee that the solution is interior in

[0, 1]. Hence, the optimal h satisfies:

$$F'(h) = \frac{\rho(\rho-1)\sigma_u^2}{2} E^h(\pi(s_i)).$$

The firms' investment in prediction ability can be analyzed by examining $E^h(\pi(s_i))$ in the short run and in the long run.

Prediction ability in the short run: In the short run, the number of firms does not change and profits are positive. Hence, the expected profits depend on the demand for C goods:

$$\begin{aligned} F'(h) &= \frac{(\rho-1)\sigma_u^2}{2} \frac{\theta(\Pi + N - T)}{n_c(1-\xi)}, \\ \frac{\theta(\Pi + N - T)}{(1-\xi)} &= \frac{\theta\left[N - \frac{G}{A(z^e)^{\frac{\rho}{\rho-1}}} - (F(h)n_c + F_g n_g)\right]}{1 - \xi - \frac{\theta}{\rho}}. \end{aligned}$$

Applying the implicit function theorem to the first order condition, h is derived as a function of G, σ_u^2 and ρ in the short run:

Proposition 7 *Prediction ability in the short run, h^s, is decreasing in G and increasing in σ_u^2:*

$$h^s \equiv H^s\left(G, \sigma_u^2, \rho\right), H_G^s\left(G, \sigma_u^2, \rho\right) < 0, H_\sigma^s\left(G, \sigma_u^2, \rho\right) > 0.$$

The proposition shows that large government expenditure discourages investment in prediction ability whereas large idiosyncratic risk requires prediction ability. Because of the crowding- out effect, private demand is lower when the government spends more. This lowers the firms' incentives to invest in prediction ability. Strong uncertainty about taste shocks requires that firms have more ability to predict taste changes. This increases the firms' incentives to invest in h.

The effect of substitutability of goods is ambiguous. On the one hand, the more substitutable goods are, the more sensitive demand is to changes in tastes. Hence, the substitutability of goods increases the importance of prediction ability. On the other hand, however, strong substitutability of goods reduces the monopoly rents of firms and, therefore, reduces the expected profits of the firms in the equilibrium. This effect discourages firms from investing in prediction ability. However, the following corollary shows that the first effect dominates the second effect in my model, if the expected taste shocks are normalized to be 1.

Corollary 8 *Prediction ability in the short run, h^s, is increasing in ρ if $z^e = 1$:*

$$If\ z^e = 1,\ H^s_\rho\left(G, \sigma^2_u, \rho\right) > 0.$$

Note that proposition 6 shows that the multiplier is decreasing in firms' prediction ability. Hence, the results in proposition 7 and corollary 8 reinforce the results in proposition 6: an increase in risk and substitutability of goods reduces the economic effectiveness of expansionary fiscal policy.

Prediction ability in the long run: Eventually, entries and exits occur and $E^h\left(\pi\left(s_i\right)\right) = F\left(h\right)$ is satisfied in the long run:

$$F'\left(h\right) = \frac{\rho\left(\rho-1\right)\sigma^2_u}{2} F\left(h\right).$$

This means that changes in demand cannot affect the investment decisions in the long run. The implicit function theorem proves that h is increasing in σ^2_u and ρ in the long run.

Proposition 9 *Firms' prediction ability in the long run, h^l, is increasing in σ^2_u and ρ:*

$$h^l \equiv H^l\left(\sigma^2_u, \rho\right), H^l_\sigma\left(\sigma^2_u, \rho\right) > 0, H^l_\rho\left(\sigma^2_u, \rho\right) > 0.$$

Note that government expenditure does not influence firms' prediction ability in the long run. The only important variables that influence prediction ability from the demand side are the level of idiosyncratic risk and the substitutability of goods.

Evidence that risk requires prediction ability is found by Takii (2003a, 2003b) in different contexts. Although there is no evidence about the substitutability of goods and prediction ability, casual observations indicate that prediction ability is highly demanded in financial markets, in which, I believe, goods are greatly substitutable.

6 Conclusion

This paper reexamines the effectiveness of expansionary fiscal policy in the presence of entrepreneurship. It is shown that the budget-balancing multiplier can be negative when idiosyncratic risk, substitutability of goods, and prediction ability are large. In addition, it is shown that expansionary fiscal policy discourages investment in prediction ability in the short run, but does not affect it in the long run.

Two remarks on this paper are required. First, my analysis is not valid either when crowding out does not occur or when aggregate shocks are more important than idiosyncratic shocks. If there is no crowding out, there is no trade off between private consumption and government expenditure. Therefore, there is no trade off between entrepreneurship and central planning.

If aggregate shocks are more important than idiosyncratic shocks, then it would not be difficult for government to access information[7]. The comparison between aggregate shocks and idiosyncratic shocks reminds us that Hayek (1945) compares the relative importance of different kinds of knowledge - scientific knowledge and the knowledge of the particular circumstances of time and place. This paper implies

[7] Bénassy (2001) shows that the optimal fiscal policy is activist even if government is less informed about aggregate shocks.

that the effectiveness of expansionary fiscal policy may depend on the answers to the questions raised by Hayek (1945). Note that, as mentioned in the Introduction, recent micro evidence emphasizes the importance of unobserved idiosyncratic factors explaining the redistribution of workers. It suggests that a quantitative examination of the model would be fruitful[8]. Although I have chosen to work with a static model to clarify the main intuition in this paper, for the quantitative exercise, the model should be extended to a standard dynamic model in order to incorporate the effects of intertemporal substitution, capital accumulation, and government-debt accumulation. This extension is the next interesting challenge.

Second, the model in this paper aimed to examine the effect of expansionary fiscal policy on real GDP, but did not attempt to examine the optimal size of government expenditure. In this sense, the result of this paper cannot be judged from a normative point of view. The log linear specification of my utility function allows us to ignore how the relative price between C and G goods influences the demand for C goods. This assumption assists in clarifying the intuition of my analysis by eliminating auxiliary effects. However, the same assumption requires that I ignore how the relative price affects the optimal size of government expenditure. As the effect of entrepreneurship is summarized by the price index, the assumptions are fairly restrictive for examining the optimal size of government expenditure. This is an issue that needs to be analyzed separately. That task is also left for future research.

[8] Of course, these exercises might underestimate the role of entrepreneurship that is emphasized by Kirzner (1997), as a statistical distribution can only measure Knightian risk faced by entrepreneurs. Nonetheless, I believe that the quantitative exercise can at least provide a lower bound about the effect of entrepreneurship.

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