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**Fiscal Policy Puzzles and Intratemporal
Substitution among Private Consumption,
Government Spending and Leisure.**

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And

Yuhki Hosoya**

Abstract

This paper investigates how does the response of private consumption to government spending be changed by intratemporal substitution among private consumption, government spending and leisure. We show that the response of private consumption to government spending can be positive even if private consumption and government spending are not complements and private consumption and leisure are not substitutes. In this case, substitution between leisure and government spending plays important role. This view has been overlooked in previous work.

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JEL codes: D11, E21, E62, H31.

Keywords: fiscal policy, non-separable preference, substitutes, complements.

1 Introduction

The aim of this paper is to provide a new solution of fiscal policy puzzles. We consider the relationship between government spending and leisure, and show that the puzzle can be solved when government spending reduces marginal utility of leisure (or, relieves marginal disutility of labor).

The empirical research indicates that private consumption rises in response to an increase in government spending (e.g., Blanchard and Perroti

(2002), Perotti (2005), Gali, López-Salido and Vallés (2007)). As explained by Baxter and King (1993), however, an increase in government spending lowers the present value of after-tax income, thus generating negative wealth effect that induces a fall in private consumption in the standard neoclassical model.¹ This is called “Fiscal policy puzzles”. Hence, several literatures introduce various assumptions to generate a positive effect of government spending on consumption.

For example, Baxter and King (1993) introduces productive government spending to pure Real Business Cycle model, Gali, López-Salido and Vallés (2007) introduces non-Recardian household to New Keynesian model with sticky price, creating the case in which the response of private consumption on government spending is positive, respectively.

In contrast to these approach, this paper applies preference-based approach to solve fiscal policy puzzles. Particularly, we studies how does the response of private consumption to government spending be changed whether they are substitutes or complements.²

Bailey (1971), Barro (1981), Ganelli and Tervara (2009) consider direct substitution between private consumption and government spending, and show that private consumption rises in response to an increase in government spending when their complementarity is strong enough. Aschauer (1985), Karras (1994), Ni (1995), Amano and Wirjant (1998), Okubo (2003), Bouakez and Rebei (2007) examine whether private consumption and government spending are complements or substitutes, but these empirical results are varying and inconclusive.

On the other hand, Linnemann (2006), Monacelli and Perotti (2008) and Bilbiie (2009) argue that fiscal policy puzzles can be solved if private consumption and leisure are substitute (or private consumption and labor are complements). But Bilbiie (2009) shows the condition is equivalent to what consumption goods is inferior.

According to the previous work of preference-based approach, (1) private consumption and government spending are complements and/or (2) private consumption and leisure are substitutes, is the necessary condition to the response of private consumption to government spending be positive.

¹But, as we show later, the reason that private consumption falls in response to government spending comes from the assumption of diminishing marginal productivity of production function and diminishing marginal utility of leisure rather than negative wealth effect.

²In this context, the terms “substitutes” and “complements” are not used in the Hicks’ sense but Edgeworth’s sense. Let the utility function be $U(x_1, x_2)$. Then we say commodity 1 and 2 are substitutes in the sense of Edgeworth if $U_{x_1x_2} < 0$, complements if $U_{x_1x_2} > 0$, and independent if $U_{x_1x_2} = 0$. See, for example, Karras (1994), Ni (1995).

We show that the response of private consumption to government spending can be positive even if private consumption and government spending are not complements “and” private consumption and leisure are not substitutes. It is very important that the relation between the substitution between leisure and government spending in this case. It is possible for consumption to respond positive to the increase of government spending if government spending reduces marginal utility of leisure (or relieves marginal disutility of labor). This view has been overlooked in previous work.

2 The Model

The lifetime utility function of the representative household is

$$\sum_{t=0}^{\infty} \beta^t U(C_t, L_t, G_t), \quad (1)$$

where C_t is private consumption, leisure is $L_t = 1 - N_t$, N_t denotes labor supply and G_t is government spending. Assume that $U_C > 0$, $U_L > 0$, $U_G > 0$, $U_{CC} < 0$, $U_{LL} < 0$ and $U^G : (C, L) \mapsto U(C, L, G)$ satisfies the strict bordered Hessian condition, that is,

$$\begin{vmatrix} U_{CC} & U_{CL} & U_C \\ U_{CL} & U_{LL} & U_L \\ U_C & U_L & 0 \end{vmatrix} > 0.$$

Let Y_t denotes output. the production function of firm is given by

$$Y_t = F(N_t), \quad (2)$$

where F_t is nonincreasing return to scale, that is,

$$F(0) = 0, F_N > 0, F_{NN} \leq 0.$$

It is assumed for simplicity that the firm put only labor into production.

The production is perfectly distributed to household as labor wage income and dividend of profit, and government spending is financed by lump-sum taxes on households. Hence the temporary budget constraint of the representative household is given by

$$C_t = F(N_t) - G_t. \quad (3)$$

3 Results

Under given G_t , the household maximizes the utility function (1) subject to the budget constraint (3). We assume the solution is not the corner solution. Then the first order condition for household's problem can be written as

$$U_L(C_t, L_t, G_t) = U_C(C_t, L_t, G_t)F_N(1 - L_t), \quad (4)$$

$$F(1 - L_t) = C_t + G_t. \quad (5)$$

We redefine (4) and (5) as follows,

$$H^1(C_t, L_t, G_t) = U_L(C_t, L_t, G_t) - U_C(C_t, L_t, G_t)F_N(1 - L_t),$$

$$H^2(C_t, L_t, G_t) = F(1 - L_t) - C_t - G_t,$$

and check whether the implicit function theorem is applicable. Then,

$$\begin{aligned} H_t \equiv \begin{vmatrix} H_C^1 & H_L^1 \\ H_C^2 & H_L^2 \end{vmatrix} &= U_{LL} - 2U_{CL}F_N + U_{CC}(F_N)^2 + U_C F_{NN} \\ &= U_C F_{NN} - \begin{vmatrix} U_{CC} & U_{CL} & 1 \\ U_{LC} & U_{LL} & F_N \\ 1 & F_N & 0 \end{vmatrix} \\ &= U_C F_{NN} - (U_C)^{-2} \begin{vmatrix} U_{CC} & U_{CL} & U_C \\ U_{LC} & U_{LL} & U_L \\ U_C & U_L & 0 \end{vmatrix} < 0, \end{aligned}$$

where the last inequality comes from the strict bordered Hessian condition of U^G . Therefore, the implicit function theorem is applicable and both C_t and L_t can be represented as continuously differentiable functions of G_t . We denote those functions as $C_t(G_t), L_t(G_t)$, respectively.

Calculating $C'_t(G_t), L'_t(G_t)$ from the implicit function theorem, the following equation is obtained.

$$C'_t(G_t) = \frac{-U_{LL} + U_{CL}F_N + U_{LG}F_N - U_{CG}(F_N)^2 - U_C F_{NN}}{H_t}, \quad (6)$$

$$L'_t(G_t) = \frac{F'(U_{CG} - U_{CC}) + U_{LC} - U_{LG}}{H_t}. \quad (7)$$

Since H_t is negative, we get the following proposition.

proposition 1 $C'_t > 0$ if and only if

$$-U_{LL} + U_{CL}F_N + U_{LG}F_N - U_{CG}(F_N)^2 < U_C F_{NN},$$

or equivalently,

$$(U_C)^{-3} \begin{vmatrix} U_{CG} & U_{CL} & U_C \\ U_{LG} & U_{LL} & U_L \\ U_C & U_L & 0 \end{vmatrix} < F_{NN}.$$

Since $F_{NN} \leq 0$, the necessary condition of $C'_t > 0$ (i.e. C_t increase in response to G_t) is (a): $U_{CG} > 0$ (private consumption and government spending are complements), (b): $U_{CL} = U_{LC} < 0$ (private consumption and leisure are substitutes) and/or (c): $U_{LG} < 0$ (leisure and government spending are substitutes). Condition (a) and (b) have already shown in previous work.

We show that the response of C_t on G_t can be positive when condition (c) holds even if condition (a) and (b) are not satisfied. That is, government spending reduces marginal utility of leisure (or relieves marginal disutility of labor), private consumption can rise in response on government spending. It is the main finding of this paper.

4 Discussion

In this section, we consider the reason why private consumption can rise in response of government spending when U_{LG} is negative.

Suppose that government spending increases. The increase in G_t causes negative wealth effect, then leisure falls and labor rises. Y_t will increase as a result. The response of Y_t on G_t is

$$Y'_t(G_t) = \frac{F_N(U_{LG} - U_{LC}) + (F_N)^2(U_{CC} - U_{CG})}{H_t}. \quad (8)$$

To focus on U_{LG} , we set $U_{CG} = U_{LC} = 0$. Then,

$$Y'_t(G_t) = \frac{F'U_{LG} + (F')^2U_{CC}}{U_{LL} + (F')^2U_{CC} + U_C F''}. \quad (9)$$

If $U_{LG} = 0$,

$$Y'_t(G_t) = \frac{(F')^2U_{CC}}{U_{LL} + (F')^2U_{CC} + U_C F''}. \quad (10)$$

Thus we get $0 < Y_t(G_t) < 1$. Hence, the increase in Y_t is less than that in G_t . This means that private consumption must fall.³ A intuitive explanation

³Christiano, Eichenbaum and Rebero (2009) and Woodford (2010) also show that government spending multiplier is less than 1 if the utility function is additive separable in consumption and leisure and doesn't depend on government spending (i.e., $U_{CG} = U_{CL} = U_{LG} = 0$).

of the result is following. If government spending increases 1 dollar, output must increase 1 dollar for maintaining level of private consumption. But marginal disutility of labor is higher and marginal productivity of production is lower than before. Thus, production increases less than 1 dollar, private consumption must fall because of resource constraint. It is essentially necessary for rise in private consumption that government spending multiplier should be larger than 1.

But if $U_{LG} < 0$, government spending relieves marginal disutility of labor, it is possible that output increase larger than 1 dollar, allowing for private consumption to rise. This result suggests that it will stimulate the economy if government spending improves work environment and enhances incentive to work.

5 Conclusion

In this paper, we studied how does the response of private consumption to government spending be changed by intratemporal substitution among private consumption, government spending and leisure. As a result, considering substitution between government spending and leisure, government spending can increase private consumption even if private consumption and government spending are not complements and private consumption and leisure are not substitutes. This result proposes a new perspective to the role of government spending.

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