Journal of International Economic
Integration 6(2) Autumn 1991. 20~33

Is Fiscal Spending Expansionary in a Dual Economy?

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Abstract

A two-region, three-sector, general equilibrium model is utilized to analyze effects of fiscal spending upon a dual economy. We examine the effects of fiscal spending on services prices, the urban unemployment ratio, and national income. The main result of this paper is that fiscal spending may be effective in mitigating unemployment, as Keynesian economists have believe. More importantly, the fiscal policy may even be contractionary under certain plausible conditions.

I. Introduction

In the traditional simple Keynesian models of income determination, it is generally assumed that (1) sectoral outputs are aggregated as a single composite commodity: and (2) wages are uniformly sticky for all sectors, while the level of output and employment adjust in response to changes in aggregate demand. Under these assumptions, a positive multiplier of fiscal spending is generally derived.[1]

Helpman (1976, 1977) relaxed the first assumption by studying the relation between the sectoral structure of an economy and the efficacy of its macroeconomic policy. He showed that assuming uniform sticky wages, the mul-

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1. Recent studies on the effects of fiscal spending focus on situations of developed economy. See, for example, Branson and Rotemberg (1980), Frenkel and Razin (1985), and Devereux(1987).

tiplier effect of government spending in the presence of nontraded goods is smaller than the well-known Keynesian multiplier, though still positive.

The purpose of the present paper is to consider the income effect of fiscal policy when the second assumption of the Keynesian model is also dropped. So, wage rigidity and, hence, unemployment is sector specific. There is a key distinction between Helpman's approach and ours. Helpman utilized a two-sector (traded and nontraded) framework for analyzing the effect of fiscal policy. We will develop a three-sector (exportable, importable, and nontraded) economy for deriving the fiscal multiplier. Nontraded goods such as services contribute a substantial share in the national income of most countries. It is modelled as a major sector along with the two traded goods in our two-region, open economy.

Our model is descriptive of a dual economy, e.g., Harris-Todaro type, in which wage rates in rural regions are perfectly flexible, whereas urban wage rates are set institutionally above the market clearing rates.[2] Consequently, full employment entails in the rural region, while unemployment exists in the urban region. This asymmetry in sectoral employment turns out to be crucial in determining the income effect of fiscal spending. In contrast to traditional wisdom, the multiplier of government spending can become negative.

A fiscal expansion necessarily takes resources away from private consumers. In the present framework, two effects will occur. First, prices of the nontraded goods will be altered, and the effect, known in the literature as a transfer-problem criterion, depends upon the spending propensities of both the fiscal authority and private consumers. Second, the urban unemployment condition will be altered as a result of the change in the nontraded goods prices. Each of these two effects of fiscal policy will be elucidated in the subsequent analysis.

The remainder of the paper is organized as follows. Section II describes the basic two-region, three-sector model with sector-specific unemployment. Section III analyzes the effects of fiscal spending. Section IV offers concluding remarks.

2. The Harris-Todaro (1970) model is a two-sector model with sector-specific unemployment. For recent studies, see Batra and Naqvi (1987), Beladi (1989), and Chao and Yu (1990), among others.

Ⅱ. The Model and Assumptions

The model adopted in this paper is the Harris and Todaro (1970) type extended to include a nontraded, services sector. The economy consists of two regions. The rural region provides agricultural product (X_1), and the urban region produces both manufacturing goods (X_2) and services (X_3).[3] While the production of traded goods X_i (i=1, 2) requires the use of labor and capital, the production of services, X_3, takes place by using labor and a specific factor:

$$X_i = X_i(L_i, K_i),\ i = 1, 2, \tag{1}$$

$$X_3 = X_3(L_3, V), \tag{2}$$

where L_i and K_i denote the labor and capital employed in sector i, and V is the specific fator used in the urban services sector. It is assumed that the country exports agricultural product and imports manufacturing goods. Furthermore, balanced trade is maintained.[4]

The production functions are assumed to be subject to constant returns to scale. Perfect competition prevails in the goods and factor markets. Hence, zero profits prevail for each sector:

$$C^1(w_1, r) = 1, \tag{3}$$

$$C^2(w_2, r) = p, \tag{4}$$

$$C^3(w_3, v) = q, \tag{5}$$

where C^i denotes the unit cost function, w_i, r and v are the returns to labor, capital and the specific factor for services, and p and q represent the goods prices of X_2 and X_3 in terms of X_1. Note that uniform wages exist in the urban region, i.e., $w_2 = w_3$.

It is posited that the urban wage is subject to a minimum rate, w_2, which is institutionally set, and also is functionally related to the goods prices. Thus, we

3. For example, hospital and financial services are usually provided in urban areas in developing countries.

4. Imbalances in trade are allowed in Helpman's analysis.

have

$$w_2 = w_2(p, q). \tag{6}$$

Let $\omega_k = (k/w_2)(\partial w_2/\partial k)$ be the partial elasticity of w_2 with respect to k, $k = p, q$. It is assumed that ω_k lies between 0 and 1.

Since w_2 is assumed to be set above the market-clearing wage, urban unemployment (L_u) emerges. Defining the urban unemployment ratio by $\lambda = L_u/(L_2 + L_3)$, the Harris-Todaro equilibrium condition for the labor market is as follows:

$$w_1 = w_2/(1+\lambda), \tag{7}$$

That is, in equilibrium, rural wages is equal to expected urban wages, which is the actual wages (w_2) times the probability to find a job in the urban region, $1/(1+\lambda)$.

While labor unemployment exists, capital and the specific factor are fully employed. Equations (8)-(10) provide the employment conditions for labor, capital, and the specific factor for services:

$$C_w^1(w_1, r)X_1 + (1+\lambda)[C_w^2(w_2, r)X_2 + C_w^3(w_3, v)X_3] = L \tag{8}$$

$$C_r^1(w_1, r)X_1 + C_r^2(w_2, r)X_2 = K, \tag{9}$$

$$C_v^3(w_3, v)X_3 = V, \tag{10}$$

where C_j^i is the unit-factor demand for j in sector i, and L and K denote the endowment of labor and capital, respectively.

Now let us turn to the demand side of the model. The demand conditions can be presented as follows:

$$E(p, q, u) = X_1 + pX_2 + qX_3 - T, \tag{11}$$

$$G_1 + pG_2 + qG_3 = T, \tag{12}$$

$$G_3 + E_q(p, q, u) = X_3. \tag{13}$$

Equation (11) equates the private expenditure (E) to the after-tax income for consumers, where u denotes the utility for private consumers and T is the lump-sum taxes. The government budget constraint is expressed by equation (12), where G_i represents the government purchase of good i, and it states that government expenditure has to be financed by tax revenue, issuance of bonds, or by money creation. For simplicity, we focus on tax-financed government spending. The market equilibrium condition for services is given in equation (13), where $E_q(.) = \partial E/\partial q$ represents the private demand for services. Note that assuming trade is balanced, the market equilibrium conditions for the two traded goods are satisfied.

Let the fiscal spending be denoted by G, which is allocated between the traded and nontraded goods:

$$G = (G_1 + pG_2) + qG_3 \tag{14}$$

Following Frenkel and Razin (1985) and Devereux (1987), we adopt the fiscal spending rule:

$$G_1 + pG_2 = \gamma G, \tag{15}$$

$$qG_3 = (1-\gamma)G, \tag{16}$$

where γ and $(1-\gamma)$ are the weights of fiscal spending on the traded and nontraded goods, respectively; $0 \leq \gamma \leq 1$.

The system of equations (3)−(16) contains 14 unknowns: w_1, w_2, r, v, λ, q X_1, X_2, X_3, u, T, G_1, G_2, and G_3, and a fiscal policy variable G. A fiscal expansion is represented by $dG>0$. The equilibrating mechanism to finance the fiscal expansion in this paper involves increases in the lump-sum taxes, T. The other equilibrating mechanisms, such as income taxes or commodity taxes, can be similarly analyzed.[5] Note that the prices of the imported goods, p, are exogenously given under the small-country assumption

III. Effects of Fiscal Spending

Before examining the effects of fiscal spending for this model, it is useful to

5. See Dinwiddy and Teal (1990) for a related discussion.

derive some production-side relations. We first elucidate the relation between the urban unemployment ratio and the services prices. Equations (3)－(6) can be solved for w_i, r and v as functions of q. Then, substituting the results into the differential of equation (7) yields

$$\hat{\lambda} = \omega_q[(1+\lambda)/\lambda](\theta_{L2}/\theta_{K2})(\theta_{K2}/\theta_{L2}-\theta_{K1}/\theta_{L1})\,\hat{q}, \tag{17}$$

where "∧" denotes the percentage change of a variable, ω_q is the partial elasticity of w_2 with respect to q, and $\theta_{Li}=w_iC_2^i/C^i$ and $\theta_{Ki}=rC_r^i/C^i$ are the labor and capital share in sector i.

As shown in the Appendix, a sufficient condition for stability of the model is that the manufacturing sector is capital-intensive relative to the agricultural sector , i.e., $\theta_{K2}/\theta_{L2}>\theta_{K1}/\theta_{L1}$. Thus, from equation (17), a rise in the prices of services increases the urban unemployment ratio. The reason for this result is as follows. A rise in q puts upward pressure on urban wages, leading to a fall in capital returns for manufacturing, since p remains fixed. Hence, capital moves out of urban manufacturing to rural agriculture. This reduces the demand for labor in the urban region, causing a higher urban unemployment ratio.[6]

Secondly, the response in the production fo X_3 to changes in q can be obtained from the differentials of equations (5), (6) and (10) as

$$\hat{X}_3 = \sigma_3(1-\omega_q)\hat{q} > 0, \tag{18}$$

where $\sigma_3=C^3C_{wr}^3/C_w^3C_r^3$ represents the factor substitution in the service sector. For convenience, we let $s=\hat{X}_3/\hat{q}$. Since $s>0$, the price-output response in the services sector remains normal in the presence of urban unemployment.

To examine the effects of fiscal spending on national income, we begin by differentiating the private and the fiscal authority's budget conditions in equations (11) and (12), and combining the results as

6. This relationship between q and λ is attributed to mobility of capital between urban manufacturing and rural agriculture. See Batra and Naqvi (1987) and Chao and Yu (1990) for related discussions.

$$E_u du = -dG + G_3 dq - w_1(L_2 + L_3)d\lambda \tag{19}$$

where $E_u = \partial E/\partial u > 0$ and $E_u du$ captures the change of income in the private sector.[7] The first term on the right-hand side of equation (19) represents the direct effect of fiscal spending on private income; a fiscal expansion takes resources away dollar-for-dollar from private consumers. The second term denotes a service price-induced effect of fiscal policy. A rise in q, for instance, increases income for the private sector when it sells services, G_3, to the fiscal authority. And the last term indicates an unemployment effect of fiscal spending, which can be approximately measured by $-w_1 dL_u$ by recalling $\lambda = L_u/(L_2 + L_3)$.

Note that, from (17), λ is a function of q and hence $d\lambda = (\partial\lambda/\partial q)dq$. Therefore, to find the effects of fiscal spending on national income, we need to determine the price effect of fiscal spending, dq/dG. Differentiating the market clearing condition for services in equation (13), then utilizing the relation of $qG_3 = (1-\gamma)G$ yields

$$qE_{qu}du - [G_3 + (e+s)X_3]\, dq = -(1-\gamma)dG \tag{20}$$

where $E_{qu} = \partial E_q/\partial u > 0$ and $e = -(q/X_3)(\partial E_q/\partial q)$ is the own-price elasticity of the private demand for services, which is asumed to be positive. The supply response is captured by s, which is positive by equation (18).

Substituting equation (20) into equation (19) yields the price response to fiscal spending:

$$dq/dG = [(1-\gamma) - m_3]/\triangle, \tag{21}$$

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7. The private expenditure function is defined by

$$E(p, q, u) = \min\{D_1 + pD_2 + qD_3 : u(D_1, D_2, D_3) \geq u\},$$

where D_i is the private demand for good i, $i = 1, 2, 3$. From the first-order conditions, we obtain

$$E_u du = du/u_1 = dD_1 + pdD_2 + qdD_3,$$

where $u_1 = \partial u/\partial D_1$. Following Jones (1969), the change in private income in terms of X_1 is measured by $E_u du$.

where $m_3 = qE_{qu}/E$ and $\triangle = (e+s)X_3 + (1-m_3)G_3 + m_3 w_1 (L_2 + L_3)(d\lambda/dq) > 0$. Since the expenditure function is homogeneous of degree one in goods prices, the marginal propensity to demand for services by private consumers is denoted by m_3,which lies in 0 and 1.

The interpretation for equation (21) is quite simple. A fiscal expansion takes resources away from private consumers, thereby raising the public demand for services by $(1-\gamma)$ while reducing the private demand by m_3. The effects of the fiscal spending on the service prices clearly depend on the fiscal and the private spending propensities for services. If the spending propensity by the fiscal authority is larger (smaller) than that by the private consumers, the service prices will rise (fall). This service price effect is usually referred to as the transfer-problem criterion.[8]

Let us consider several interesting cases. When fiscal expansion is conducted in the form of purchasing only traded goods, i.e., $\gamma=1$, it is clear from equation (21) that $dq/dG<0$. The fiscal policy results in a lower services price. On the other hand, when fiscal spending occurs only on the nontraded services, i.e., $\gamma=0$, $dq/dG>0$. The fiscal policy leads to a higher services price. Note also that when $1-\gamma=m_3$, it is immediate that $dq/dG=0$. Fiscal spending has no effect on the services price.

We can deduce the impact of fiscal spending on the unemployment ratio as

$$d\lambda/dG = (d\lambda/dq)(dq/dG). \tag{22}$$

Recalling from equation (17) that $d\lambda/dq>0$, the sign of $d\lambda/dG$ is solely determined by the sign of dq/dG, which as noted earlier in equation (21), depends upon the relative spending propensities between the fiscal authority and the private consumers. If $m_3>(1-\gamma)$, then $d\lambda/dG<0$. Fiscal spending reduces the urban unemployment ratio, a result consistent with conventional wisdom. In contrast, if $m_3<(1-\gamma)$, then $d\lambda/dG<0$. Fiscal expansion results in a higher unemployment ratio.

The effect of fiscal spending on private income in equation (19) can be rewritten as

8. See Frenkel and Razin (1985) and Devereux (1987).

$$E_u du/dG = -1 + [\ G_3 - w_l(L_2+L_3)(d\lambda/dq)]\ (\mathrm{dg}/\mathrm{dG}), \tag{23}$$

which can be simplified by substituting equation (21) into equation (23):

$$E_u du/dG = -\ [(e+s)X_3 + \gamma G_3 + (1-\lambda)w_l(L_2+L_3)(d\lambda/dq)]/\triangle \tag{24}$$

It is clear that $E_u du/dG$ is unambiguously negative. Tax-financed fiscal policy always reduces private income.

Finally, we analyze the effects of fiscal spending on national income. Let $dY = E_u du + dG$ denote the change of national income in terms of X_l, where Y represents national income. Then, from equation (23), we have

$$dY/dG = [G_3 - w_l(L_2+L_3)(d\lambda/dq)](dq/dG). \tag{25}$$

In view of equation (25), we can consider several interesting cases. First, suppose the spending propensities are equal, $(1-\gamma)=m_3$. Then, from equation (21), $dq/dG=0$, and equation (25) becomes

$$dY/dG=0 \tag{26}$$

The fiscal expansion completely crowds out the private income, and thus the multiplier of fiscal spending is equal to zero.

Of general interest are the cases of unequal spending propensities. If $(1-\gamma)>m_3$ and thus $dq/dG>0$, then

$$dY/dG \gtrless 0 \quad \text{if} \quad G_3 dq \gtrless w_l(L_2+L_3)d\lambda \tag{27}$$

A fiscal spending is expansionary (contractionary) when the gain realized by private consumers through the increased services prices outweighs (is outweighed by) the loss of higher urban unemployment (which can be approximated by $w_l dL_u$).

The above result can be illustrated graphically. Figure 1 depicts a national income profile in response to fiscal spending when $(1-\gamma)>m_3$. Note that the national income function is approximately convex.[9] And the income profile displays the following features:

1. Consider initially $G=G_3=0$. National income in the absence of fiscal policy is given by Y_0. An introduction of tax-financed fiscal spending, $dG>0$, reduces national income due to a sufficiently strong priced-induced urban unemployment ratio.
2. As fiscal spending rises, income loss becomes more pronounced because of the increased urban unemployment effect.
3. The income loss reaches its maximum when $G=G^*$, where $G^*=(w_l/\gamma)(L_2+L_3)(d\lambda/dq)$
4. Any further increase in fiscal spending, i.e., $G>G^*$, results in a production gain from a higher services price (net of unemployment loss). Hence, national income starts to rise.

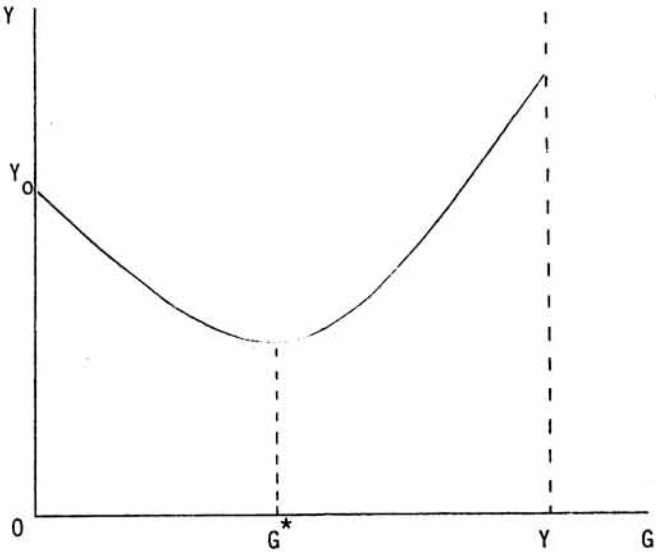

Figure 1

Income Effects of Fiscal Spending $(1-\gamma)>m_3$

9. Differentiating equation (25) at the equilibrium values of G_3, w_l, L_2 and L_3, and then imposing the first order condition, $G_3 = w_l(L_2+L_3)(d\lambda/dq)$, yields

$$d^2Y/dG^2 = -w_l(L_2+L_3)(d^2\lambda/dq^2)(dq/dG),$$

where $d^2\lambda/dq^2=A(1+\lambda)(\omega_a/q^2)(A\omega_q-1)<0$, because $A = (\theta_{L2}/\theta_{K2})(\theta_{K2}/\theta_{L2}-\theta_{K1}/\theta_{L1})<1$. Hence, sign $(d^2Y/dG^2)=$sign (dq/dG).

5. The upper bound on the level of G is given by Y, because fiscal spending is financed by taxes and the maximum amount of tax is 100% of Y.
6. The optimal level of G, denoted by G^o, can be found by comparing the national income sustained under the two cases in whcich $G=0$ and $G=G_s<Y$, where $G_s(>G^*)$ would yield the income level consistent with the highest possible tax, which is conceptually smaller than 100%. That is, $G^o=\{G\colon \max(Y|_{G=0}, Y|_{G=Gs})\}$.

The other interesting case involves $(1-\gamma)<m_3$, and, hence, $dq/dG<0$. It is clear again from equation (25) that fiscal spending is expansionary (contractionary) if the gain from decreased unemployment, $w_1(L_2+L_3)d\lambda$, outweighs (falls short of) the production loss due to the lowered services price, G_3dq.

This result is illustrated in Figure 2. Given $dq/dG<0$, the income function is approximately concave with respect to G. The income effects of fiscal spending here are just the opposite of those found in the earlier case of $(1-\gamma)>m_3$. National income rises and then falls when G increases. The optimal level of fiscal spending, G^o, is therefore at G^*, where the gain from lower unemployment is just

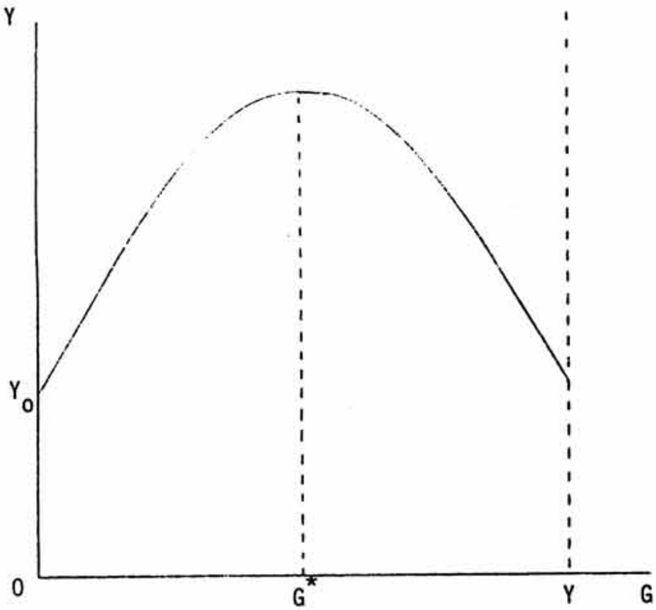

Figure 2

Income Effects of Fiscal Spending $(1-\gamma)<m_3$

offset at the margin by the production loss due to the lowered services price.

Since national income may fall as fiscal spending increases, the tax-financed fiscal multiplier can be negative. This result stands in sharp contrast to the traditional Keynesian multiplier or the multiplier derived by Helpman, which, albeit equal or less than unity, is positive. The implication of our analysis is apparent. When wage rigidity is sector specific in a typical dual economy, fiscal policy can be contractionary.

Ⅳ. Concluding Remarks

We have deployed a two-region, three-sctor, general equilibrium model to analyze the effects of fiscal spending upon a dual economy. We have examined the effects of fiscal spending on the services prices, the urban unemployment ratio, and national income. The main result of this paper is that fiscal spending may not be effective in mitigating unemployment, as Keynesian economists have believed. More importantly, the fiscal policy may even be contractionary under certain plausible conditions.

Several extensions of this paper are possible. It may be interesting to study the effects of terms-of-trade shocks under the present model. In addition, constructing a two-country world economy, one can examine the international transmission of fiscal spending between developed and developing countries.

Appendix

Following Dei (1985), the adjustment process for demand for services is

$$\dot{q} = aZ(q),$$

where the dot represents the time derivative, a is a positive constant and $Z = G_3 + E_q(p, q, u) - X_3$ denotes the excess demand for services. From equation (20), we can obtain that u is a function of q. By keeping G or G_3 constant, we can take a linear approximation of the above adjustment process around the equilibrium point q^e as

$$\dot{q} = a(dZ/dq)(q-q^{f}).$$

Hence, the necessary and sufficient condition for stability of the system is

$$dZ/dq < 0.$$

From equations (19) and (20), we obtain

$$dq/dZ = -q/\triangle,$$

where $\triangle = (e+s)X_3 + (1-m_3)G_3 + m_3 w_1 (L_2 + L_3)(d\lambda/dq)$. Since $e>0$ and $s>0$, a sufficient condition for $\triangle>0$ is $d\lambda/dq>0$. That is, the urban manufacturing is capital-intensive relative to the rural agriculture.

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