Government Spending and Pattern of Trade in the Presence of Economies of Scale

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Abstract

In the context of a two-country model, this paper shows that the country that spends more on public goods imports the output of the industry which is subject to economies of scale. This result is consistent with the fact that a number of LDCs export the output of primary industries (which are subject to constant cost) and import the output of manufacturing industries (which are subject to economies of scale). In addition, size of the government in the LDCs is large as compared to the Developed Countries. It is also shown that there is a negative relationship between size of the government and real wage rate.

I. Introduction

Government spending constitutes a significant proportion of GDP in all real economies. This spending can be divided into two broad categories: (i) spending on public goods and (ii) spending on public inputs. Spending on public inputs can directly affect production of industries and hence the pat-

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tern of trade.[1] On the other hand, spending on public goods cannot directly affect production however, it can affect the pattern of trade. Some existing studies ⟨e.g., Svensson [1987], Durlauf and Staiger [1990] and Frenkel and Razin [1992], among others⟩, have examined the international transmission of government spending on public goods. However, the relationship between government spending on public goods and the pattern of trade has not received much attention in the existing literature.[2] Furthermore, most relevant studies assume that all industries are subject to constant returns to scale. (i.e., there are no economies or diseconomies of scale). The presence of constant returns to scale is a convenient assumption as far as economic modeling is concerned, however economies of scale do exist in at least some industries in all real economies.

This paper considers the relationship between government spending on a public good and the pattern of trade in the context of a two-country model where each country produces an identical intermediate good and a final good. There are economies of scale in the intermediate good industry whereas the final good industry is subject to constant cost. It is shown that, although the supply of the public good does not affect production directly, differences in its supply can determine the pattern of trade. Specifically, the country that produces more public good imports the output of the industry which is subject to economies of scale.

It is well known that most Less Developed Countries export primary goods and import manufactured goods. Furthermore, the literature on economic development and international trade suggests that the production of primary goods is subject to constant returns to scale, whereas the production of manufactured goods is subject to economies of scale. Summers and Heston [1984] have developed improved international comparisons of real GDP and its composition for the period 1950-1980. According to their study, during 1980 the percentage of GDP devoted to government in some Less

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1. McMillan [1978], Manning and McMillan [1979], Abe [1990] and Anwar [1992, 1994] among others have examined the relationship between government spending on a public input and the pattern of trade.
2. Anwar [1993] has considered the relationship between the supply of a public good and pattern of trade in the context of a Heckscher-Ohlin model where all goods are produced under constant returns to scale.

Developed Countries was as follows: Jordan 29%, Morocco, Papua New Guinea, Turkey and Zaire 30%. The corresponding figures for some Developed Countries were as follows: Japan 7%, Canada and France 11%, Australia 12% and the US 14%. The results presented in this paper are consistent with the fact that a number of Less Developed Countries export primary goods (produced under constant returns to scale) and the size of government sector in these economies is large relative to the Developed Countries.

In order to examine the relationship between government spending on a public good and pattern of trade in the presence of economies of scale, a simplest general equilibrium model that is sufficient for the purposes of the present paper is developed. This model is used to examine the relationship between autarky relative prices and the supply of a public good in section two. Section three contains concluding remarks.

II. A Simple General Equilibrium Model

Consider a closed economy that produces one final good and an intermediate good. "The intermediate good (X) is produced by means of labor. The final good (Y) is produced by means of labor and the intermediate good. There are constant returns to scale in the production of Y. On the other hand, there are economies of scale in the production of X.[3] Economies of scale in the production of X are due to Marshallian external economies. The government provides a public good (G) which is produced by means of labor. Labor is fully mobile within the economy. The production functions for X_i, Y and G are as follows:

$$X_i = \phi(X)L_{xi}; \quad X = nX_i$$

$$Y = f(X_y, L_y)$$

$$G = \alpha L_g$$

X_i is the output of firm i in industry X; n is the number of firms in industry X; L_{xi}, L_y and L_g are respectively the labor used in the production of X_i, Y and G; X_y is the output of industry X used in the production of Y; and α is a

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3. In general terms, results of this paper will be unaffected if X is produced under constant returns to scale and there are economies of scale in Y industry.

positive constant. The elasticity of $\phi(X)$ with respect to X, which lies in the range $[0, 1]$, measures the degree of economies of scale in industry X. Y is the numéraire and all markets are competitive. For a given G, the equilibrium of the private sector can be characterized by the following equations:

$$1 = c(w, p) \tag{1}$$

$$p = w/\phi(X) \tag{2}$$

$$Yc_p(w, p) = X \tag{3}$$

$$[X/\phi(X)] + Yc_w(w, p) + G/\alpha = L \tag{4}$$

w is the wage rate, p is the price of the intermediate good, $c(w, p)$ and $w/\phi(\cdot)$ are unit cost functions for Y and X respectively. $c_p(\cdot) = X_y/Y$; $X/\phi(\cdot)$, $Yc_w(\cdot)$ and G/α are labor used in the production of X, Y and G respectively. L is the supply of labor which is fixed. (1) and (2) are zero profit conditions for industry Y and X respectively. (3) is the market clearing condition for the intermediate good which shows that the intermediate good is not available for direct consumption. (4) is the labor market clearing condition. The cost of public good is financed by means of a proportional income tax (t). $w(G/\alpha)$ and $t(wL)$ are respectively the cost of the public good and government tax revenue. Accordingly, $w(G/\alpha) = t(wL)$ is the government budget constraint. The representative consumer maximizes utility as follows:

$$\text{Max } U = u(C_y, G) \text{ subject to } C_y = (1 - t)wL$$

where $u(\cdot)$ is the utility function and C_y is the consumption of Y. By using the government budget constraint, the indirect utility function can be derived as follows:

$$U = u[w\{L - (G/\alpha)\}, G] \tag{5}$$

The private sector takes the supply of the public good as given, however for the economy as a whole G is endogenous. Optimal supply of the public good can be determined by maximizing (5) with respect to G. The optimality condition is as follows:

$$[\partial u(\cdot)/\partial G]/[\partial u(\cdot)/\partial C_y] = [w/\alpha] - [L - (G/\alpha)][\partial w/\partial G] \tag{6}$$

(6) shows that the first best rule for the provision of public goods does not hold as long as $\partial w/\partial G$ is non-zero. The first best rule, also known as Samuelson's rule, requires that the marginal willingness to pay must equal the marginal cost of the public good. In the context of the present model the first best rule requires that $[\partial u(\cdot)/\partial G]/[\partial u(\cdot)/\partial C_y]$ be equal to $[w/\alpha]$.[4]

The relationship between government spending on a public good and autarky price of the intermediate good can be examined by differentiating (1) to (4) with respect to G as follows:

$$(\partial p/\partial G)(G/p) = \lambda_{\phi x}[L_g\{wc_w(\cdot)/c(\cdot)\}]/\Delta > 0 \qquad (7)$$

$$(\partial w/\partial G)(G/w) = -\lambda_{\phi x}[L_g\{pc_p(\cdot)/c(\cdot)\}]/\Delta < 0 \qquad (8)$$

$$(\partial X/\partial G)(G/X) = -L_g/\Delta < 0 \qquad (9)$$

$$(\partial Y/\partial G)(G/Y) = -L_g[1 + \{pc_{pp}(\cdot)/c(\cdot)\}(\lambda_{\phi x})]/\Delta? \qquad (10)$$

$$(\partial X/\partial G)(G/X)-(\partial Y/\partial G)(Y/G) = L_g[\{pc_{pp}(\cdot)/c(\cdot)\}(\lambda_{\phi x})]/\Delta < 0 \quad (11)$$

where $\lambda_{\phi x} = [X/\phi(X)][\partial\phi(X)/\partial X] > 0$

$$\Delta = L_x + L_y + \lambda_{\phi x}[L_y\{wc_{ww}(\cdot)/c(\cdot) + pc_{pp}(\cdot)/c(\cdot)\} - L_x] > 0$$

Δ is positive provided that the equilibrium is stable.[5] (7) shows that the autarky relative price of the intermediate good is positively related to the supply of the public good. An increase in G reduces the supply of labor to the private sector. Consequently, the average cost of industry X increases because this industry is subject to economies of scale. On the other hand the average cost of industry Y is fixed. An increase in G therefore increases the price of X relative to Y. In the context of a two-country world, this implies that if two countries have (i) identical technology, (ii) labor supply and labor is internationally immobile then the country that produces more

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4. $[\partial u(\cdot)/\partial G]/[\partial u(\cdot)/\partial C_y]$ and $[w/\alpha]$ are respectively the marginal willingness to pay and marginal cost of the public good.

5. Stability of the equilibrium requires Δ to be positive. Derivation of the stability condition is available from the author upon request. Chang [1981] and Okamoto [1985] have derived a similar condition.

public good produces the final good relatively cheaply. The country which produces more public good therefore exports Y and imports X.

(8) shows that when (i) two countries have identical technology and labor supply, (ii) there are economies of scale in the intermediate good industry, then there is a negative relationship between the size of the government and real wage rate. In the context of a two-country world, where labor is internationally mobile, the final good is traded and the intermediate good is non-traded, (8) implies that the country that produces more public good will import the final good and export labor services.

In the present study Y is the numéraire. When the intermediate good X is the numéraire, it can easily be shown that if (i) labor is internationally mobile, (ii) the final good is non-traded and (iii) the intermediate good is traded then, the country that produces more public good will import the intermediate good and export labor services.

An increase in the supply of the public good decreases the output of X whereas its impact on the production of the final good is not clear. (11) shows that the relationship between G and (X/Y) is negative and therefore $(\partial p/\partial G)(G/p)$ is negative.

In the present study, the presence of external economies plays an important role. Notice that if $\lambda_{\phi x}$ is zero then $(\partial X/\partial G)(G/X)=(\partial Y/\partial G)(Y/G)$ and therefore both $(\partial p/\partial G)$ and $(\partial w/\partial G)$ are zero. In other words, in the absence of economies of scale, differences in the production of public good alone cannot determine the pattern of trade and factor mobility.

III. Concluding Remarks

This paper considers the relationship between size of the government and pattern of trade in the context of a two-country general equilibrium model. Each country produces one final good and an intermediate good. There are economies of scale in the production of the intermediate good whereas the production of the final good is subject to constant returns to scale. It is shown that the country that produces more public good imports the intermediate good and exports the final good. Furthermore, there is a negative relationship between size of the government and real wage rate. This result is also conistent with the real world situation: the

real wage rate in LCDs is lower than the DCs but the size of the government in most LDCs is relatively large.

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