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ABSTRACT

This paper investigates the impact of foreign aid on foreign investment when foreign aid is used to finance a public consumption good. By formulating and analyzing a three-good general equilibrium model, we show that such foreign aid could crowd out foreign investment, given a factor intensity condition.

JEL: F21, F35, H4

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1 Introduction

The literature on income transfer goes as far back to Keynes (1929), where he argued that the German reparation payments after WWI had caused a decrease in its terms of trade, known as the orthodox view. Jones (1970) took the literature to a new direction and presented a number of cases where, in absence of trade barriers, an income transfer could result in an increase in donor’s terms of trade and therefore pioneered an unorthodox and somewhat paradoxical view. His paper deals more with presumption and bias about the effects of the terms of trade of the transferring country than the actual effect. That is, the orthodox bias is that the terms of trade of the donor country is deteriorated following a transfer. Jones (1970) sets out to reverse that bias on the premise that "the real income loss represented by the transfer at initial prices may be mitigated by the ‘secondary’ effects of an improvement in the terms of trade."

The literature continues to this day and it has taken a number of different avenues. Jones (1975) reconsidered the effect of income transfer on terms of trade by assuming the existence of non traded goods. Jones (1975) found that the different degrees of demand and supply disparities between countries is a prominent factor in determining the effects on a transferring country’s terms of trade. As well, price sensitivity, both of demanders and producers, as a cause of trade strongly impacts terms of trade in a transfer where a non traded good is present. Brecher and Bhagwati (1981), Bhagwati et al. (1983) and Srinivasan and Bhagwati (1984) indicated the conditions under which an income transfer would be immiserizing for the recipient country, thus establishing the welfare paradox. Brecher and Bhagwati (1981) made a clear distinction between foreign and national income in an economy where foreign ownership is present. When the national and aggregate incomes differ, the recipient country experiences a decrease in national welfare, which is contrary to the standard results. This immiserizing growth is also shown to occur in stable markets. Bhagwati et al. (1983) generalized these results by claiming that this paradox (immiserizing growth to the recipient of the transfer) can only occur with market stability if there are certain "distortions" in that economy. They set up a three-agent model, where two of the agents engage in a bilateral transfer, and the third outside agent is included in order to simulate a multilateral environment. After implementing the conditions of the immiserizing growth, though it appeared as if there were no distortions, in fact, the absence of optimal taxation existed as the said distortion. Hence, the
generalization was established.

Kemp and Kojima (1985) and Schweinberger (1990), among others, investigated welfare paradox of an income transfer when such aid is tied. Kemp and Kojima (1985) verified that perverse outcomes occur in the presence of market stability when dealing with tied aid on the part of the recipient or donor. Unlike previous literature establishing the welfare paradox, their work is not reliant on an additional country or commodity. Schweinberger (1990) offered a slightly alternative model to Kemp and Kojima (1985). He claimed the effects of the tied aid puts constraint on the spending of the private sector's income. A surprising result of his model is that if aid is tied in the donor's export market, the donor paradox (enrichment to the donor) cannot occur. Beladi (1990) reexamines the welfare effects of international transfers in a two country general equilibrium model of trade in the presence of generalized unemployment. In this context he derives the necessary conditions for the occurrence of paradoxical as well as normal results on employment as well as welfare. Lahiri and Raimondos (1995) considered the welfare effects of aid tied to quantitative trade restrictions. They found that these quantitative distortions do not of themselves cause a transfer paradox because unlike price distortions, quotas alone do not bring distortions into other markets. In the case of quantitative trade restrictions, the transfer paradox only occurs with quota reform and only as a result of the welfare changes associated with that reform. Lahiri and Raimondos-Moller (1997) investigated foreign aid tied to tariff reforms. They presented conditions where Pareto-improvement occurs for the recipient and donor countries as well as the third outside country not involved in the transfer. By tying aid to changes in tariffs, they showed that theoretically, a certain level of welfare can be attained in the donor country, while the tariff reduction will not cause the recipient country’s tariff revenue to decrease. Hatzipanayotou and Michael (1995) assumed that the recipient used foreign aid to finance a public consumption good, and they investigated the impact on terms of trade of both the recipient and donor. They also showed that the income transfer could be welfare enriching for the donor and welfare immiserizing for the recipient. In addition to this, they showed that a transfer can increase or decrease world welfare, thus improving or worsening the welfare of both countries. Yano and Nugent (1999) examined the impact of development aid on the welfare of a small open economy in presence of nontraded goods (as a significant amount of aid is spent on nontraded infrastructures) and demonstrated that welfare paradox can take place. They claimed that the expansion of nontraded sectors can outweigh the benefits of aid and therefore
could result in welfare paradox. However, Choi (2003) indicated, in a set up with two factors two tradeable goods and a nontraded good, the terms of trade for a small economy cannot be deteriorated. Thus he claimed that Yano and Nugent (1999) condition on nontraded good sector is not necessary.

More recently, Abe and Takarada (2005) attempted to resolve some of the issues surrounding the dispute between Kemp and Kojima (1985) and Schweinberger (1990). Their model of tied aid showed that when the households of the recipient country have knowledge of the transfers and have the ability to trade the purchased goods, no transfer paradoxes occur in the context of normal commodities. Kemp (2005) extended the theory of tied aid by creating a model that is compatible with non-tradable public consumption goods. He argued that with private consumption goods households can resell the aid on world markets, essentially "untying" the aid. The transfer paradox, in this context, still exists. Torsvik (2005) examined the implications of donor cooperation and mutual aid policy. He showed that donor cooperation is always beneficial when aid contracts are used. When contracts are not used, however, cooperation can harm the donor countries involved in the transfer. Alesina and Dollar (2000) studied the trends of foreign aid allocation. They find that political strategy plays a role as significant as the economic needs of the recipient countries in determining who gets what aid. The study reveals that all other things constant, democratic countries are granted more aid. And although politics strongly influence foreign aid allocation, the economics of recipient countries significantly stimulate foreign direct investments.

The purpose of this paper is to raise an entirely different question: Does foreign aid crowd out foreign investment, given that the foreign aid is used by the recipient to finance a public consumption good? On the one hand, the recipient countries are often poor developing countries. On the other hand, the impact of foreign investment on economic development of such poor economies is undisputable. Therefore, it is imperative to investigate this question.

To answer our question, we consider a three-sector general equilibrium model with two tradable sectors (exportable and import competing) and a non traded public consumption good sector. In this, our framework is closely related to Kemp (2005), Jones (1975) and Hatzipanayotou and Michael (1995). As in Hatzipanayotou and Michael (1995), we assume that the recipient country uses foreign aid to finance the production of the public consumption good. We further assume that

\footnote{\textsuperscript{1}See also Brecher and Diaz Alejandro (1977).}
foreign investment takes place in the exportable sector. This last assumption (which is relaxed later in the paper) is compatible with the behavior of multinational corporations in less developed countries. As our result, we show that such foreign aid impedes foreign investment if importable sector is more capital intensive than the public good sector. The reason is quite intuitive. An increase in foreign aid draws resources from the importable sector. As the capital intensity of importable sector is higher, some labor will also have to be moved from the exportable sector to the public good sector. This would reduce the marginal product of foreign capital, which in turn reduces foreign investment. Moreover, We investigate whether our result holds for an economy where foreign capital is used across the economy, implying that the domestic capital and the foreign capital are perfect substitute. We demonstrate that in fact a similar result holds and again factor intensity plays a crucial role.

In addition to being an appealing theoretical exercise, our paper has a vital policy implication. Accordingly, there might be a trade-off between foreign aid and foreign investment that policy makers should be aware of.

The rest of the paper is organized as follows. We present a model with foreign capital specificity in section 2. Section 3 is allocated to the case where foreign capital is used across the economy, while section 4 draws the concluding remarks.

2 Sector specific foreign investment

Assume a small open recipient economy producing three goods: an exportable, an import competing, and a nontraded public consumption good. The production technology for the exportable good is represented by the production function \( x_e = F_e(L_e, K_f) \), where \( x_e, L_e, \) and \( K_f \) are the quantities of production of exportable, labor usage, and the foreign capital used by the exportable sector, respectively. We assume that foreign capital is only used by the exportable sector. This assumption is consistent with the observation that the multinational corporations are responsible for most of the foreign investments, which are targeted towards exports (we will relax this assumption in the next section). The production technology for the import competing sector is \( x_i = F_i(L_i, K_i) \), where \( x_i \) is the production of import competing good, \( L_i \) and \( K_i \) are the labor and capital usage by this sector. The public good is produced privately and supplied to the public free of charge by the gov-
ernment. However, the government finances the production of this good through foreign aid. The production technology of the public good is represented by the production function \( g = F(L_g, K_g) \), where \( g, L_g, K_g \) are the production of public good, labor used in the production of public good, and the domestic capital used by the public good sector, respectively. Finally, we assume all the neoclassical assumption regarding the above production functions, which exhibit constant returns to scale as well as diminishing marginal productivity.

We further assume that the markets for the tradable sectors are perfect competitive. Therefore, we have the following zero profit equilibrium conditions.

\[
\begin{align*}
& a_{L_i} w + a_{K_i} r = p_i \\
& a_{L_j} w + a_{K_j} r = p_j
\end{align*}
\]

where \( a_{L_j}, a_{K_j}, \) and \( p_j, j = e, i, \) are the unit labor cost, unit capital cost, and the price in sector \( j, \) respectively. Moreover, \( w, r_f, \) and \( r \) denote the wage rate, the return to foreign capital, and the return to domestic capital, respectively. Note also that the return to foreign capital and the prices of import competing and exportable goods are determined in the international markets and therefore they are fixed for our recipient economy.

As production of public consumption good is financed by the foreign aid, we have the following equilibrium condition for the public sector.

\[
(a_{L_g} w + a_{K_g} r) g = T
\]

where \( a_{L_g} \) and \( a_{K_g} \) are the optimal unit labor and capital costs, respectively. \( T \) denotes foreign aid. The left hand side of equation (3) is the cost of public good.

The resource constraints are given by the following equations.

\[
\begin{align*}
& a_{L_e} x_e + a_{L_i} x_i + a_{L_g} g = L \\
& a_{K_e} x_e = K_f \\
& a_{K_i} x_i + a_{K_g} g = K
\end{align*}
\]

5
where $L$ and $K$ are the fixed endowments of labor and domestic capital, respectively. Equation (4) implies that labor is mobile across all three sectors. Equation (5) states that foreign capital is specific to the exportable sector, while equation (6) indicates that domestic capital is mobile between the importable sector and the public sector. Equations (1)-(6) constitute our complete general equilibrium system with endogenous variables $x_e, x_i, g, w, r$, and $K_f$.

Now we answer our research question, assuming that foreign investment is specific to the exportable sector: What is the impact of foreign aid on foreign investment? By differentiating equations (1)-(3), we obtain:

$$a_{Le}w = 0$$ \hspace{1cm} (7)

$$a_{Li}w + a_{Ki}r = 0$$ \hspace{1cm} (8)

$$a_{Lg}w + a_{Kg}r + (a_{Lg}w + a_{Kg}r)\hat{g} = T\hat{T}$$ \hspace{1cm} (9)

where circumflex denotes proportional changes. Equations (7)-(8) imply that $w = r = 0$. Using this and equations (3) and (9), we conclude that:

$$\hat{g} = \hat{T}. \hspace{1cm} (10)$$

Now, by substituting equation (5) into equation (4) and then totally differentiating the resulting equation as well as equation (6), we obtain:

$$\lambda_{Le}\hat{K}_f + \lambda_{Li}\hat{x}_i + \lambda_{Lg}\hat{g} = 0$$ \hspace{1cm} (11)

$$\lambda_{Ki}\hat{x}_i + \lambda_{Kg}\hat{g} = 0$$ \hspace{1cm} (12)

where $\lambda_{Lj}, j \in e, i, g$, is the fraction of labor used in sector $j$ and $\lambda_{Kj}, j \in i, g$, is the fraction of domestic capital used by sector $j$. Note also that, in deriving equations (11) and (12), we used the fact that unit factor costs do not change.

Finally, by solving equations (11) and (12) and using equation (10), we obtain:

$$\lambda_{Le}\hat{K}_f + (\lambda_{Lg} - \frac{\lambda_{Li}\lambda_{Kg}}{\lambda_{Ki}})\hat{T} = 0 \hspace{1cm} (13)$$
Note that the terms in brackets will be positive if and only if $k_i > k_g$, where $k_j = \frac{K_j}{L_j}, j \in [i, g]$, is capital intensity in sector $j$. Thus, equation (13) concludes the following proposition, which formally addresses the question we raised.

**Proposition 1.** Assume that foreign aid is used to finance a public consumption good and that foreign capital is specific to the exportable sector. Then, foreign aid impedes (encourages) foreign investment if the public sector is more labor intensive than the import competing sector.

This interesting result states that foreign aid could crowd out foreign investment depending on factor intensities in the import competing and the public sectors. The economic explanation behind this result is somewhat intuitive. An increase in foreign aid used to finance the production of a public consumption good would increase the production of public consumption good. This in turn results in movements of both capital and labor from the import competing sector to the public sector. Assuming that the import competing sector is more capital intensive than the public good sector, less labor for each unit of capital moves out of the import competing sector than required by the public sector. Thus, some labor must also move from the exportable sector to the public sector, resulting in a decrease in marginal productivity of capital in the exportable sector. As the return to foreign investment is fixed and determined internationally, due to the small country assumption, the level of foreign investment would fall. Now assume that the public sector is more capital intensive than the import competing sector. Then, as resources move out of the import competing sector, more units of labor for each unit of capital leave this sector than required by the public sector. As a result, some of these units of labor must move to the exportable sector, causing an increase in marginal productivity of foreign capital. This would result in an increase in the usage of foreign capital, leading to an increase in foreign investment.

### 3 Mobile capital

We next investigate whether the result of the preceding section will remain valid if we assume no distinction between domestic capital and foreign capital, i.e. we assume foreign investment takes place economy wide. To do so, we rewrite our model by assuming that the foreign capital is used
in all three sectors. Equations (1)-(3) would then change to:

\[ a_{Le} w + a_{K^e}r_f = p_e \]  \hspace{1cm} (14)

\[ a_{Li} w + a_{K^i}r_f = p_i \]  \hspace{1cm} (15)

\[ (a_{Lg} w + a_{K^g}r_f)g = T \]  \hspace{1cm} (16)

According to the above equilibrium conditions, as there is no distinction between domestic capital and foreign capital, the economy-wide rate of return to capital is the internationally determined rate of return. Therefore, such a rate of return is fixed for our recipient economy.

Similarly, the resource constraints would change to:

\[ a_{Le} x_e + a_{Li} x_i + a_{Lg} g = \bar{L} \]  \hspace{1cm} (17)

\[ a_{Ke} x_e + a_{K_i} x_i + a_{Kg} g = \bar{K} + K_f \]  \hspace{1cm} (18)

Equation (18) indicates mobility of foreign capital, as well as domestic capital, across all three sectors of the economy. Our new complete economic system consists of equations (14)-(18) with five endogenous variables \( x_e, x_i, g, w, \) and \( K_f \). Recall that returns to capital is fixed in this system.

We now return to our question of whether foreign aid crowds out foreign investment within the context of this section. By differentiating equation (14), we obtain equation (7). Furthermore, we differentiate equations (15) and (18) to obtain:

\[ a_{Li} w = 0 \]  \hspace{1cm} (19)

\[ a_{Lg} w + (a_{Lg} w + a_{Kg} r_f)g \dot{g} = TT \dot{T} \]  \hspace{1cm} (20)

Similar to the preceding section, we use equations (7), (19), and (20) to derive equation (10).

Next, we differentiate resource constraints, i.e. equations (17) and (18), to get:

\[ \lambda_{Le} \dot{x}_e + \lambda_{Li} \dot{x}_i + \lambda_{Lg} \dot{g} = 0 \]  \hspace{1cm} (21)
\[ \lambda_{K}\dot{x}_e + \lambda_{K_i}\dot{x}_i + \lambda_{K_g}\dot{g} = \dot{K} \]  

where \( K = K + K_f \). Note that, as the stock of domestic capital is fixed, \( dK = dK_f \) implying that \( \dot{K} = \frac{dK}{K} = \frac{dK_f}{K} \).

Finally, we use equations (10), (21), and (22) to obtain:

\[ d\dot{K}_f = L_i(k_i - k_e)\dot{x}_i + L_g(k_g - k_e)\dot{T}. \]  

We use equation (23) to conclude the equivalence of Proposition 1. It states that the answer to our question depends on capital intensity ranking.

**Proposition 2.** Assume that foreign aid is used to finance a public consumption good and that foreign capital is used in all three sectors. Then, an increase in foreign aid decreases (increases) foreign investment if \( k_i > k_e > k_g \) (\( k_g > k_e > k_i \)).

Again, according to this proposition, foreign aid may crowd out foreign investment given the stated factor intensity ranking. Economic intuition is interesting. First, assume that the import competing sector is more capital intensive than the exportable sector and that the capital intensity of exportable sector is greater than that of public good sector. Then, the expansion of the public good sector due to an increase in foreign aid will require movement of all factors from the tradable sectors to the public sector. On the one hand, as the import competing sector (and the exportable sector) is more capital intensive than the public good sector, the public sector needs less capital per unit of labor than released by the tradable sectors. On the other hand, the domestic capital is fixed while the foreign capital is variable. In conclusion, the economy as a whole will substitute domestic capital for foreign capital, resulting in a decrease in the use of foreign capital. Thus, foreign aid crowds out foreign investment. Now, let the public good sector be the most capital intensive sector, followed by the exportable sector. An increase in foreign aid expands the public sector at the expense of tradable sectors. However, as the public sector is the most capital intensive sector in the economy, this sector requires more capital for each unit of labor than moved out of the tradable sectors. To make up the difference, foreign capital moves in. Thus, under the stated factor intensity ranking, foreign aid encourages foreign investment.
4 Conclusion

Some of the foreign aid to developing economies is used to finance public consumption goods. On the other hand, foreign investment has played an increasingly important role in economic development of such economies. These stylized facts motivated us to question the impact foreign aid may have on foreign investment in recipient developing economies.

We used a three-good general equilibrium model to represent a recipient economy, assuming two traded goods and a non-traded public consumption good. First, we considered a case where foreign capital is used only in the exportable sector. We demonstrated that an increase in foreign aid, used to finance a public consumption good, would discourage foreign investment if the import competing sector is more capital intensive than the public good sector. Then, we examined whether our result is robust with regard to the assumption of sector specificity of foreign capital. To do this, we allowed perfect substitutability of foreign capital and domestic capital. We showed that foreign aid would cause a substitution of domestic capital for foreign capital, and thus a reduction of foreign capital usage, if the import competing sector is more capital intensive than the exportable sector and the exportable sector is more capital intensive than the public sector.

The possibility of crowding-out effect of foreign aid on foreign investment has a clear and imperative policy implication. Policy makers, specially in recipient developing economies, should be aware of such a possible trade-off.

This article opens an entirely new direction to the literature on foreign aid. In addition to its theoretical contribution and useful policy implication, our paper provides a foundation for empirical investigation of the impacts of foreign aid on foreign investment.
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The rest of the paper is organized as follows. We present a model with foreign capital specificity in section 2. Section 3 is allocated to the case where foreign capital is used across the economy, while section 4 draws the concluding remarks.

2 Sector specific foreign investment

Assume a small open recipient economy producing three goods: an exportable, an import competing, and a nontraded public consumption good. The production technology for the exportable good is represented by the production function \( x_e = F_e(L_e, K_f) \), where \( x_e, L_e, \) and \( K_f \) are the quantities of production of exportable, labor usage, and the foreign capital used by the exportable sector, respectively. We assume that foreign capital is only used by the exportable sector. This assumption is consistent with the observation that the multinational corporations are responsible for most of the foreign investments, which are targeted towards exports (we will relax this assumption in the next section). The production technology for the import competing sector is \( x_i = F_i(L_i, K_i) \), where \( x_i \) is the production of import competing good, \( L_i \) and \( K_i \) are the labor and capital usage by this sector. The public good is produced privately and supplied to the public free of charge by the gov-
ernment. However, the government finances the production of this good through foreign aid. The production technology of the public good is represented by the production function \( g = F(L_g, K_g) \), where \( g, L_g, K_g \) are the production of public good, labor used in the production of public good, and the domestic capital used by the public good sector, respectively. Finally, we assume all the neoclassical assumption regarding the above production functions, which exhibit constant returns to scale as well as diminishing marginal productivity.

We further assume that the markets for the tradable sectors are perfect competitive. Therefore, we have the following zero profit equilibrium conditions.

\[
\begin{align*}
   a_{Le}w + a_{Ke}r_f &= p_e \\
   a_{Li}w + a_{Ki}r &= p_i
\end{align*}
\]

where \( a_{Lj}, a_{kj}, \) and \( p_j, j = e, i, \) are the unit labor cost, unit capital cost, and the price in sector \( j, \) respectively. Moreover, \( w, r_f, \) and \( r \) denote the wage rate, the return to foreign capital, and the return to domestic capital, respectively. Note also that the return to foreign capital and the prices of import competing and exportable goods are determined in the international markets and therefore they are fixed for our recipient economy.

As production of public consumption good is financed by the foreign aid, we have the following equilibrium condition for the public sector.

\[
(a_{Lg}w + a_{Kg}r)g = T
\]

where \( a_{Lg} \) and \( a_{Kg} \) are the optimal unit labor and capital costs, respectively. \( T \) denotes foreign aid. The left hand side of equation (3) is the cost of public good.

The resource constraints are given by the following equations.

\[
\begin{align*}
   a_{Le}x_e + a_{Li}x_i + a_{Lg}g &= L \\
   a_{Ke}x_e &= K_f \\
   a_{Ki}x_i + a_{Kg}g &= K
\end{align*}
\]
where $L$ and $K$ are the fixed endowments of labor and domestic capital, respectively. Equation (4) implies that labor is mobile across all three sectors. Equation (5) states that foreign capital is specific to the exportable sector, while equation (6) indicates that domestic capital is mobile between the importable sector and the public sector. Equations (1)-(6) constitute our complete general equilibrium system with endogenous variables $x_e, x_i, g, w, r,$ and $K_f$.

Now we answer our research question, assuming that foreign investment is specific to the exportable sector: What is the impact of foreign aid on foreign investment? By differentiating equations (1)-(3), we obtain:

$$a_{Le}w = 0$$  
$$a_{Li}w + a_{Ki}r = 0$$  
$$a_{Lg}w + a_{Kg}r + (a_{Lg}w + a_{Kg}r)\hat{g} = T\hat{T}$$  

where circumflex denotes proportional changes. Equations (7)-(8) imply that $w = r = 0$. Using this and equations (3) and (9), we conclude that:

$$\hat{g} = \hat{T}.$$  

Now, by substituting equation (5) into equation (4) and then totally differentiating the resulting equation as well as equation (6), we obtain:

$$\lambda_{Le}\hat{K}_f + \lambda_{Li}\hat{x}_i + \lambda_{Lg}\hat{g} = 0$$  
$$\lambda_{Ki}\hat{x}_i + \lambda_{Kg}\hat{g} = 0$$

where $\lambda_{Lj}, j \in e, i, g$, is the fraction of labor used in sector $j$ and $\lambda_{Kj}, j \in i, g$, is the fraction of domestic capital used by sector $j$. Note also that, in deriving equations (11) and (12), we used the fact that unit factor costs do not change.

Finally, by solving equations (11) and (12) and using equation (10), we obtain:

$$\lambda_{Le}\hat{K}_f + (\lambda_{Lg} - \frac{\lambda_{Li}\lambda_{Kg}}{\lambda_{Ki}})\hat{T} = 0$$  

where $\hat{T}$ is the change in the total capital stock.
Note that the terms in brackets will be positive if and only if $k_i > k_g$, where $k_j = \frac{K_j}{L_j}, j \in [i, g]$, is capital intensity in sector $j$. Thus, equation (13) concludes the following proposition, which formally addresses the question we raised.

**Proposition 1.** Assume that foreign aid is used to finance a public consumption good and that foreign capital is specific to the exportable sector. Then, foreign aid impedes (encourages) foreign investment if the public sector is more labor intensive than the import competing sector.

This interesting result states that foreign aid could crowd out foreign investment depending on factor intensities in the import competing and the public sectors. The economic explanation behind this result is somewhat intuitive. An increase in foreign aid used to finance the production of a public consumption good would increase the production of public consumption good. This in turn results in movements of both capital and labor from the import competing sector to the public sector. Assuming that the import competing sector is more capital intensive than the public good sector, less labor for each unit of capital moves out of the import competing sector than required by the public sector. Thus, some labor must also move from the exportable sector to the public sector, resulting in a decrease in marginal productivity of capital in the exportable sector. As the return to foreign investment is fixed and determined internationally, due to the small country assumption, the level of foreign investment would fall. Now assume that the public sector is more capital intensive than the import competing sector. Then, as resources move out of the import competing sector, more units of labor for each unit of capital leave this sector than required by the public sector. As a result, some of these units of labor must move to the exportable sector, causing an increase in marginal productivity of foreign capital. This would result in an increase in the usage of foreign capital, leading to an increase in foreign investment.

3 Mobile capital

We next investigate whether the result of the preceding section will remain valid if we assume no distinction between domestic capital and foreign capital, i.e. we assume foreign investment takes place economy wide. To do so, we rewrite our model by assuming that the foreign capital is used
in all three sectors. Equations (1)-(3) would then change to:

\[ a_{Le}w + a_{Ke}r_f = p_e \tag{14} \]
\[ a_{Li}w + a_{Ki}r_f = p_i \tag{15} \]
\[ (a_{Lg}w + a_{Kg}r_f)g = T \tag{16} \]

According to the above equilibrium conditions, as there is no distinction between domestic capital and foreign capital, the economy-wide rate of return to capital is the internationally determined rate of return. Therefore, such a rate of return is fixed for our recipient economy.

Similarly, the resource constraints would change to:

\[ a_{Le}x_e + a_{Li}x_i + a_{Lg}g = \bar{L} \tag{17} \]
\[ a_{Ke}x_e + a_{Ki}x_i + a_{Kg}g = \bar{K} + K_f \tag{18} \]

Equation (18) indicates mobility of foreign capital, as well as domestic capital, across all three sectors of the economy. Our new complete economic system consists of equations (14)-(18) with five endogenous variables \( x_e, x_i, g, w, \) and \( K_f \). Recall that returns to capital is fixed in this system.

We now return to our question of whether foreign aid crowds out foreign investment within the context of this section. By differentiating equation (14), we obtain equation (7). Furthermore, we differentiate equations (15) and (18) to obtain:

\[ a_{Li}w = 0 \tag{19} \]
\[ a_{Lg}w + (a_{Lg}w + a_{Kg}r)g\dot{g} = T\ddot{g} \tag{20} \]

Similar to the preceding section, we use equations (7), (19), and (20) to derive equation (10).

Next, we differentiate resource constraints, i.e. equations (17) and (18), to get:

\[ \lambda_{Le}\dot{x}_e + \lambda_{Li}\dot{x}_i + \lambda_{Lg}\dot{g} = 0 \tag{21} \]
\[ \lambda_{Ke} \dot{x}_e + \lambda_{Ki} \dot{x}_i + \lambda_{Kg} \dot{y} = \dot{K} \]  
(22)

where \( K = K + K_f \). Note that, as the stock of domestic capital is fixed, \( dK = dK_f \) implying that \( \dot{K} = \frac{d\dot{K}}{K} = \frac{dK_f}{K} \).

Finally, we use equations (10), (21), and (22) to obtain:

\[ d\dot{K}_f = L_i(k_i - k_e)\dot{x}_i + L_g(k_g - k_e)\dot{T}. \]  
(23)

We use equation (23) to conclude the equivalence of Proposition 1. It states that the answer to our question depends on capital intensity ranking.

**Proposition 2.** Assume that foreign aid is used to finance a public consumption good and that foreign capital is used in all three sectors. Then, an increase in foreign aid decreases (increases) foreign investment if \( k_i > k_e > k_g \) (\( k_g > k_e > k_i \)).

Again, according to this proposition, foreign aid may crowd out foreign investment given the stated factor intensity ranking. Economic intuition is interesting. First, assume that the import competing sector is more capital intensive than the exportable sector and that the capital intensity of exportable sector is greater than that of public good sector. Then, the expansion of the public good sector due to an increase in foreign aid will require movement of all factors from the tradable sectors to the public sector. On the one hand, as the import competing sector (and the exportable sector) is more capital intensive than the public good sector, the public sector needs less capital per unit of labor than released by the tradable sectors. On the other hand, the domestic capital is fixed while the foreign capital is variable. In conclusion, the economy as a whole will substitute domestic capital for foreign capital, resulting in a decrease in the use of foreign capital. Thus, foreign aid crowds out foreign investment. Now, let the public good sector be the most capital intensive sector, followed by the exportable sector. An increase in foreign aid expands the public sector at the expense of tradable sectors. However, as the public sector is the most capital intensive sector in the economy, this sector requires more capital for each unit of labor than moved out of the tradable sectors. To make up the difference, foreign capital moves in. Thus, under the stated factor intensity ranking, foreign aid encourages foreign investment.
4 Conclusion

Some of the foreign aid to developing economies is used to finance public consumption goods. On the other hand, foreign investment has played an increasingly important role in economic development of such economies. These stylized facts motivated us to question the impact foreign aid may have on foreign investment in recipient developing economies.

We used a three-good general equilibrium model to represent a recipient economy, assuming two traded goods and a non-traded public consumption good. First, we considered a case where foreign capital is used only in the exportable sector. We demonstrated that an increase in foreign aid, used to finance a public consumption good, would discourage foreign investment if the import competing sector is more capital intensive than the public good sector. Then, we examined whether our result is robust with regard to the assumption of sector specificity of foreign capital. To do this, we allowed perfect substitutability of foreign capital and domestic capital. We showed that foreign aid would cause a substitution of domestic capital for foreign capital, and thus a reduction of foreign capital usage, if the import competing sector is more capital intensive than the exportable sector and the exportable sector is more capital intensive than the public sector.

The possibility of crowding-out effect of foreign aid on foreign investment has a clear and imperative policy implication. Policy makers, specially in recipient developing economies, should be aware of such a possible trade-off.

This article opens an entirely new direction to the literature on foreign aid. In addition to its theoretical contribution and useful policy implication, our paper provides a foundation for empirical investigation of the impacts of foreign aid on foreign investment.
References


Does Foreign Aid Impede Foreign Investment?

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Abstract

This paper investigates the impact of foreign aid on foreign investment when foreign aid is used to finance a public consumption good. By formulating and analyzing a three-good general equilibrium model, we show that such foreign aid could crowd out foreign investment, given a factor intensity condition.

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