A Theoretical Model of Multinational Expansion in a Small Developing Country

by

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1. Introduction

In this paper we analyze a model of a small, developing economy seeking to transform its economic base via the invitation of foreign direct investment.

We believe this model has implications for the economies of the Caribbean consequent on the Reagan administration's Caribbean Basin Economic Recovery Act (also known as the Caribbean Basin Initiative [CBI]).

2. The Model

We model a host economy comprising three tradable sectors: two domestic and one foreign-controlled. Assume that the host domestic economy is characterized by a dual labor market. This may either be a consequence of the urban-rural dichotomy of Harris and Todaro (1970), or alternatively we might assume that there is unionization in one of the two domestic sectors. With concave, linearly homogeneous, twice differentiable production functions:

$$Y = Y(L_Y, K_Y)$$

$$X = X(L_X, K_X)$$

$$M = M(L_M, K_M, S)$$

and price - unit cost equations:

$$1 = C_Y(w, r)$$

$$1 = C_X(w_X, r)$$

$$p_M = c_M(w_M, r, g)$$

we consider the case where the Y sector pays a wage rate w, and the X sector a competitive wage w_X. The multinational sector may pay either of these two wage rates [i) $w_M = w$, or ii) $w_M = w_X$] depending on a) where it is located or b) the nature of its production. For example, some multinational firms (especially the relatively capital-intensive ones) are willing to pay the higher of the two domestic wages, even though they might not allow unionized activity, while there are others who insist on paying the lowest possible wage rate that workers will accept.

In the first scenario, both Y and M pay the higher wage rate, and the rate of employment associated with these two sectors is given by

$$n_1 = \frac{L_Y + L_M}{L - L_X},$$

The relationship between w_X and w is thus

$$w_X = n_1 w.$$

As long as factor prices in the domestic economy do not change, we are assured of n_1 remaining constant. Rewriting our resource constraints in terms of input -output ratios and differentiating gives

$$\begin{bmatrix} n_1 a_{LX} & a_{LY} & a_{LM} \\ a_{KX} & a_{KY} & a_{KM} \\ 0 & 0 & a_{SM} \end{bmatrix} \begin{bmatrix} dX \\ dY \\ dM \end{bmatrix} = \begin{bmatrix} n_1 dL \\ dK \\ dS \end{bmatrix}$$

whereby $dM/dS = 1/a_{SM} > 0$,

$$\frac{dX}{dS} = \frac{a_{LM}(k_M - k_Y)}{a_{SM}a_{LX}(n_1k_Y - k_X)} = \frac{(k_M - k_Y)}{a_{LX}s_M(n_1k_Y - k_X)},$$

$$\frac{dY}{dS} = \frac{a_{LM}(k_X - k_M n_1)}{a_{LY}a_{SM}(n_1k_Y - k_X)} = \frac{(k_X - n_1k_M)}{a_{LY}s_M(n_1k_Y - k_X)}$$

When $k_M > k_Y > n_1k_Y > k_X$ (i.e. assuming the determinant of the above system to be positive), multinational expansion will lead to a contrac-tion of the Y sector and an expansion of the X sector. A similar result obtains when this ranking is reversed (with appropriate adjust-ment), i.e. $k_M < n_1k_Y < k_Y < k_X$. For the rural sector, and Y and M located in the urban area, the expansion of the multinational sector draws resources from the sector in a ratio which causes displacement of labor. To preserve the rate of employment in the urban area (and thereby the urban expected wage), some labor as well as capital will migrate to the rural sector.

For the case where the multinational sector's capital-labor rat lies between similar ratios for the two domestic sectors, and t determin-ant continues to be positive (i.e. $n_1k_Y > k_X$), it is certain that an increase in the size of the multinational secto will result in contrac-tion of the X sector, while it may or ma not contract the Y sector as well, depending on $k_X \lesseqgtr n_1k_M$. The greater the disparity in the factor intensities of the multinational and domestic X sector, and the smaller the rate o unemploy-ment, the greater the likelihood that the Y sector contracts when the M sector expands.

When the X sector lies intermediary in terms of capital-labor intensity such that $k_M > k_X > k_Y$, it is this sector which contracts while the Y sector expands in response to an increase in the multinational sector's specific factors. The increased demand for labor by the two sectors M and Y results in an increase in the level of unemployment, as more workers seek to find employment in one of these two expanding sectors, since their remaining in the X sector would only result in a decreased wage rate there.

In general, the effect of MNC expansion on domestic labor is given by

$$\frac{dL^d}{dS} = a_{LX}\frac{dX}{dS} + a_{LY}\frac{dY}{dS} + a_{LM}\frac{dM}{dS},$$

$$= \frac{a_{LX}a_{LY}[(k_M - k_Y) + (k_X - k_Mn_1) + (n_1k_Y - k_X)]}{a_{LX}a_{LY}s_M(n_1k_Y - k_X)}$$

$$= \frac{(k_M - k_Y) + (k_X - k_Mn_1) + (n_1k_Y - k_X)}{s_M(n_1k_Y - k_X)}$$

$$= \frac{(k_M - k_Y)(1 - n_1)}{s_M(n_1k_Y - k_X)}$$

and $k_M > k_Y > n_1k_Y > k_X$ leads to an expansion in labor employment, as does $k_X \geq k_Y > k_M$. Clearly we may have $k_Y > k_X$, provided that the denomina-tor remains negative, and still experience a beneficial effect on labor employment consequent on multinational expansion.

If n_1k_Y remains greater than k_X, then as long as the MNC sector's capital-labor ratio is smaller than the same for the Y sector, the demand for labor in the host country contracts with the expansion in S. It is evident that this effect is greater the wider the disparity in the capital-labor intensities in tne urban area, and the higher the rate of urban unemployment. Thus $k_M < k_X$ presents the worst scenario for the employment of domestic labor. In particular, if the multinational sector imports its capital requirements (i.e. $k_M = 0$), the detrimental impact of its expansion on the level of domestic employment is greatest. The effect on domestic income

$$I = w_XL_X + w(L_Y + L_M) + rK$$

of the expansion of the multinational sector is given by

$$\frac{dI}{dS} = w_X\frac{dL_X}{dS} + w\left(\frac{dL_Y + dL_M}{dS}\right)$$

$$= w(n_1dL_X + dL_Y + dL_M)/dS$$

$$= \frac{w[n_1(k_M - k_Y) + (k_X - k_Mn_1) + (n_1k_Y - k_X)]}{s_M(n_1k_Y - k_X)}$$

$$= 0.$$

In the case where the multinational sector pays the competitive wage ($w_M = w_X$), an increase in S will impact on the two domestic sectors as follows:

$$\frac{dX}{dS} = \frac{a_{LM}(k_M - n_2k_Y)}{a_{SM}a_{LX}(n_2k_Y - k_X)} = \frac{(k_M - n_2k_Y)}{a_{LX}s_M(n_2k_Y - k_X)},$$

$$\frac{dY}{dS} = \frac{a_{LM}n_2(k_X - k_Mn_1)}{a_{LY}a_{SM}(n_2k_Y - k_X)} = \frac{n_2(k_X - k_M)}{a_{LY}s_M(n_2k_Y - k_X)},$$

and again assuming that the denominator is positive, the impact of multinational expansion on the unionized (or urban) sector Y depends solely on the relative capital-labor intensities of the X and M sectors [i.e. is contractionary (expansionary) if and only

if $k_M > k_X$ ($k_M < k_X$)], while the impact on the domestic X sector depends on $k_M/k_Y \gtrless n_2$. The effect on total labor employment is

$$\frac{dL^d}{dS} = \frac{(k_M - k_X)(1-n_2)}{s_M(n_2k_Y-k_X)}^1$$

i.e. provided the denominator is positive, the level of labor employed decreases when the X sector is more capital-intensive than the multinational sector.

The special case where $k_X = 0$ will always under the above conditions result in the Y sector contracting, while the effect on the X sector continues to depend on $k_M/k_Y \gtrless n_2$. Clearly, the impact of $dS > 0$ is unambiguously expansionary on the level of labor employed.

In the other special case of interest to us, $k_M = 0$, multinational expansion will exacerbate (improve) the level of domestic labor employment if and only if $n_2 > k_X/k_Y$ ($n_2 < k_X/k_Y$). i.e. when the Y sector's capital-labor ratio is sufficiently larger than that of the X sector, domestic employment declines in response to an increase in S. We may therefore conclude that when the multinational sector does not employ domestic capital, and the Y (urban) sector is significantly more capital-intensive than the X (rural) sector, the location of the multina-tional sector within the domestic economy will be inconsequential to the qualitative effect of its expansion on domestic labor employed. When the rate of urban unemployment is the same under both scenarios (i.e. $n_1 = n_2$), as long as $n_1k_Y > k_X$, the effect of multinational expansion on the level of domestic labor demanded will be smaller for M located in the rural area.

If under the conditions $n_1 = n_2$ and $n_1k_Y > k_X$, k_M is intermediary to similar ratios for the other two sectors, the effects of an increase in S are qualitatively dis-similar, in particular the level of unemployment will increase when the M sector is located in the urban area and decrease when M is produced in the rural area. In such an economy, a government concerned about levels of employment should locate the export processing zone in the rural area when the options for taxing the enterprises in the zone are non-existent.

With respect to the level of income, we again show that this remains unaltered:

$$\frac{dI}{dS} = w_X\frac{(dL_X + dL_M)}{dS} + w\frac{dL_Y}{dS}$$

$$= w(\cdot n_2dL_X + dL_Y + n_2dL_M)/dS$$

$$= w\frac{n_2[(k_M-n_2k_Y)+(k_X-k_M)+(n_2k_Y-k_X)]}{s_M(n_2k_Y-k_X)}$$

$$= 0.^2$$

The full employment version of these two variations is readily analyzed by setting $n_1 = 1$ or $n_2 = 1$, whereby an increase in the quantity of multinational factors expands (contracts) the Y sector, and contracts (expands) the X sector when the X (Y) sector is ranked intermediate to the other two sectors by

relative capital-labor intensities.

Thus far, we have not considered any taxes or subsidies in our analysis. It is clear that, cet. par., if the multinational sector's profits are taxed at all, the host economy's national income will improve when S increases.

In neither of these models will it pay to grant a subsidy to the MNC sector, except this subsidy can be countered with a tax in another period. Under such circumstances, if the multi-national sector repatriates all its profits in the first period, the host country's gross domestic income as well as its national income will decline during this period.
We state the following:

Let the host economy comprise three tradable sectors - one foreign and two domestic, with one of the domestic sectors, the urban sector say, paying an above market clearing wage, while the other (rural) pays a competitive wage, such that there is Harris-Todaro type unemployment in the urban area.

PROPOSITION 1. If the multinational sector is located in the urban area and pays the higher of the two wages obtaining in the domestic economy (i.e. the urban wage), necessary and sufficient conditions for expansion of this sector (M) to result in an increase in the level of employment in the domestic economy are that the capital-labor intensities satisfy
i) $k_M > k_Y > n_1k_Y > k_X$ or ii) $k_M < n_1k_Y < k_Y < k_X$, i.e. the domestic urban sector contracts while the rural sector expands. Any other rankings will result in a decline in the level of employment.

PROPOSITION 2. If the multinational sector is located in the rural area and pays the lower of the two wages obtaining in the domestic economy (i.e. the rural wage), necessary and sufficient conditions for expansion of this sector (M) to result in a decrease in the level of employment in the domestic economy are that the capital-labor intensities satisfy i) $k_M > k_X > k_Y$ $(>n_2k_Y)$ or ii) $k_M < k_X$ $(< n_2k_Y) < k_Y$,
i.e. the domestic rural sector contracts and the urban sector expands. Any other rankings result in an improvement in the level of domestic employment.

COROLLARY 1. If the multinational sector imports its capital requirements ($k_M = 0$), its location within the host economy is irrelevant to the qualitative effects of its expansion when the urban (Y) sector is sufficiently more capital-intensive than the rural (X) sector ($n_1k_Y > k_X$), viz. a decline in the level of employment.

The above propositions can be reworded for w and w_X the unionized and non-unionized wage rates respectively.

PROPOSITION 3 A) In neither of the two propositions immediately above will the level of domestic income be affected by the expansion of the multinational sector.
B) When the domestic economy is characterized by full employment of all factors, multinational expansion will not affect the level of domestic income.

Suppose the multinational sector is located in the urban area and brings in some of its non-specific capital requirements, K^*, along with its specific factor, S. The effects of multi-national expansion on both the X and Y sectors are either i) tempered or reversed for $k_M > k_Y > n_1k_Y > k_X$, and ii) intensified when

$k_M < k_X$ $(< n_1k_Y) < k_Y$.

For $dK^*/dS = \beta$, with $K_M < \beta S$,

$dM/dS = 1/a_{SM} > 0$,

$$\frac{dX}{dS} = \frac{(k_M - \beta s_M) - k_Y}{a_{LX}s_M(n_1k_Y - k_X)} \gtrless 0,$$

$$\frac{dY}{dS} = \frac{k_X - n_1(k_M - \beta s_M)}{a_{LY}s_M(n_1k_Y - k_X)} \lessgtr 0,$$

and whereas under i) above we obtained $dX/dS > 0$, $dY/dS < 0$ for $\beta = 0$, $\beta > 0$ allows $dX/dS \leq 0$, $dY/dS \geq 0$ as possible outcomes of multinational expansion, i.e. as the MNC sector's requirement of domestic capital $(k_M - \beta s_M)$ gets smaller, the outcomes in ii) effectively become relevant for our problem. By changing its domestic capital-labor requirement according to the size of its expansion, the multinational can effect a decline in the rural sector and an inflow of migrants to the urban area.

Hence, by creating conditions whereby the MNC sector may import non-specific capital (e.g. as a part of its FDI package), the host economy's level of employment may increase by a smaller proportion then originally, but may eventually decline for sufficiently large β.

The effect on the level of demand for labor is given by

$$\frac{dL^d}{dS} = a_{LX}\frac{dX}{dS} + a_{LY}\frac{dY}{dS} + a_{LM}\frac{dM}{dS}$$

$$= \frac{(k_M - \beta s_M - k_Y) + \beta n_1 s_M + (k_X - k_M n_1) + (n_1 k_Y - k_X)}{s_M(n_1 k_Y - k_X)}$$

$$= \frac{(k_M - \beta s_M - k_Y)(1-n_1)}{s_M(n_1 k_Y - k_X)}$$

and the importation of both types of capital K, S (outside of an EPZ) result in a smaller increase in the level of employment in the host economy when $(k_M - \beta s_M) > k_Y > n_1 k_Y > k_X$, and a larger decrease when $(k_M - \beta s_M) < k_Y$ and the denominator remains positive $(k_X < n_1 k_Y)$. This is reasonable since the expansionary effects of an increase in S have a smaller expansionary impact o the X sector as seen above.

Now the effect on income is given by

$$\frac{dI}{dS} = w_X\frac{dL_X}{dS} + w\left(\frac{dL_Y + dL_M}{dS}\right)$$

$$= w(n_1 dL_X + dL_Y + dL_M)/dS$$

$$= \frac{w[n_1(k_M - \beta s_M - k_Y) + (n_1\beta s_M + k_X - k_M n_1) + (n_1 k_Y - k_X)]}{s_M(n_1 k_Y - k_X)}$$

$$= 0.$$

Again it can be shown that a similar result obtains when the MNC is located in the rural area.[3]

PROPOSITION 4 The creation of a duty free zone for new foreign capital will not alter the level of host country income when there are no subsidies being granted. Under such conditions, domestic capital will not seek employment in the duty-free zone when a lower capital rental rate is obtained there.

Following from Corollary 1 we obtain

COROLLARY 2. Assuming that the domestic urban sector is sufficiently more capital-intensive than the rural sector, the establishment of a duty-free zone will begin to have perverse effects on the level of employment of domestic labor as soon as its net domestic capital-labor usage falls i) below that of the urban sector (for the MNC sector urban-located), or ii) below the capital-labor ratio of the rural domestic sector when the M sector is also rural.

We now consider the introduction of distortions in the markets for the domestic goods.

When the production of the relatively capital-intensive Y secto is protected via an import tariff, $p_Y = (1 + t) > p_Y^* = 1$, the level of host country income is given by

$$I = X + (1 + t)Y + p_M M - gS$$

$= w_X L + rK + tY_T$

where Y_T is the level of imports of the Y good. The establishment of the duty-free zone will, by reducing the level of imports (increasing the domestic production of Y), lower the tariff revenues to the host country government, hence lower national income at international prices (cf. Hamada's Proposition 3). For I^* the level of national income at international prices,

$$I^* - I = -tY,$$

and since we have already determined that $dI/dS = 0$, we obtain

$$dI^*/dS = - tdY/dS.$$

Technically, however, we do not need a DFZ for this result to obtain.

For $n_1 = n_2$, i.e. the rate of employment in the urban area depends solely on the relative wage rates, $dY/dS = k_X/a_{LX}s_M(n_1k_Y - k_X)$ for M urban, and

$dY/dS = n_1k_X/a_{LX}s_M(n_1k_Y - k_X)$ for M rural. This is a reasonable consequence of the Harris-Todaro assumption: that the urban domestic sector should be affected less by MNC expansion when the latter (MNC) sector is rural.

Under this scenario, it is necessary for the Y sector to contract in order for the host economy to experience an increase in national income at international prices. For M urban (and our denominator still positive) we need $k_M > k_Y > k_X$, while for M rural both k_M, $k_Y > k_X$ will yield the desired $dI^*/dS > 0$.

PROPOSITION 5 In the three sector model des-cribed above, suppose the domestic urban sector is sufficiently more capital-intensive than the rural sector. As long as the MNC expansion leads to the expansion of the domestic urban sector, Y, national income at international prices will decline. In the presence of a duty-free zone [$(k_M - \beta s_M) = 0$], locating the MNC sector in the urban area will lead to an expansion of the Y sector as well as an increase in the level of urban unemployment.

PROPOSITION 6 For an urban unemployment rate dependent solely on the relative wage rates (independent of the location of the MNC sector), $n_1 = n_2$ yields a smaller expansion of the Y sector when the MNC is located in the rural area. This gives a smaller decline in the level of national income at international prices.

Realistically, we may expect $k_M > \beta s_M$, i.e. the multinational sector has access to domestic as well as international capital. The size of β will then determine the effect of multinational expansion on the host developing economy.

In the event that the distortion cannot be corrected, government might attempt to check the flow of rural to urban migration by creating duty free zones within the rural area. Of course this policy alone cannot reverse all of the urban pull.

It is quite often the case that governments in developing countries find themselves propping up rural wages to keep urban unemployment down. This tendency for rural wages to fluctuate is a consequence of the nature of the demand for this sector's predominantly agricultural outputs. With the granting of a production subsidy here, the host governments may establish duty-free zones within the rural areas to substitute for these

relatively unstable sectors.

By $p_X = (1 + t_2)p_X^* = (1 + t_2) = c_X(w_X, r)$,

$$dI^*/dS = -(1 + t_2)\, dX/dS,$$

and if the increase in S leads to contraction of the X sector, the level of national income at international prices improves (since there is less subsidizing to be done).

PROPOSITION 7 If the economy grants a production subsidy to check the flow of migrants from the rural to the urban area, the establishing of a rural duty-free zone will, by contracting the X sector, reduce the size of the subsidy, hence increase the level of national income at international prices. Unemployment will however increase, though not by as much as if the DFZ were urban-located. Again, there will be no change in national income at domestic prices.

3. Conclusions

The model which we have presented above describes a small, developing economy which plays host to a multinational sector. In this three sector model, we showed how the decision on where to locate the multinational sector - e.g. in rural or urban area - within the host economy has consequences for the level of unemployment when there is Harris-Todaro type unemployment, although this result does not alter the level of national income in the absence of tariffs or subsidies.

In the case where the multinational sector is most capital-intensive and is located in the high-wage area while the rural sector is least capital-intensive, domestic employment is enhanced by the expansion of the MNC sector. If the latter sector is established in a duty-free zone, and the urban domestic sector is sufficiently more capital-intensive than the rural sector, MNC expansion leads to a decline in domestic employment. The creation of a duty-free zone for new foreign capital does not alter the level of host country income, ceteris paribus. However, in the presence of import tariff distortions, the level of national income at international prices declines under the conditions stated immediately above. If, alternatively, in this case, the host economy is subsidizing its domestic exports from the rural area, MNC expansion will lead to a reduction in the size of the subsidy, although the level of unemployment in the urban area increases. In our model, increases in the price of the MNC sector's output do not alter the level of domestic income in the absence of taxes/subsidies.

We have analyzed a scenario in which the host country allows multinational expansion without taxing the firms in this sector. Clearly, taxes on the MNC output can increase the host country's income provided that this sector does not respond negatively to such. Likewise, we can easily determine what are the consequences when the host country grants subsidies to the firms in this sector.

We believe the results of this analysis has implications for the consequences of multinational expansion in the Caribbean.

REFERENCES

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NOTES

1. $\frac{dL^d}{dS} = a_{LX}\frac{dX}{dS} + a_{LY}\frac{dY}{dS} + a_{LM}\frac{dM}{dS} =$

$$\frac{a_{LX}a_{LY}[(k_M-n_2k_Y)+n_2(k_X-k_M)+(n_2k_Y-k_X)}{a_{LX}a_{LY}s_M(n_2k_Y-k_X)}$$

$$= \frac{(k_M-n_2k_Y) + n_2(k_X-k_M) + (n_2k_Y-k_X)}{s_M(n_2k_Y-k_X)}$$

$$= \frac{(k_M - k_X)(1-n_2)}{s_M(n_2k_Y-k_X)}$$

2. From $n_2 = L_Y/(L - L_X - L_M) = w_X/w$, it is clear that $wL_Y = w_X(L - L_X - L_M)$, i.e. $I = w_XL + rK$. The fact that none of these variables change in our model explains why there is no change in the level of income in response to an increase in S.

3. Here we show the effects on domestic labor demand when the MNC is rural.

$$\frac{dL^d}{dS} = a_{LX}\frac{dX}{dS} + a_{LY}\frac{dY}{dS} + a_{LM}\frac{dM}{dS},$$

$$= \frac{a_{LX}a_{LY}[(k_M-n_2k_Y)-\beta s_M+n_2(k_X-k_M+\beta s_M)+(n_2k_Y-k_X)}{a_{LX}a_{LY}s_M(n_2k_Y-k_X)}$$

$$= \frac{(k_M - \beta s_M - k_X)(1-n_2)}{s_M(n_2k_Y-k_X)}$$

and for i) $k_M > k_Y > n_2k_Y > k_X$, or ii) $k_M < k_X (< n_2k_Y) < k_Y$, the increase in labor demanded is tempered by smaller contraction in the Y sector and smaller expansion in the X sector.