

THE EFFECTS OF MULTINATIONAL ENTERPRISES INVESTMENT IN THE NONTRADED SECTOR OF DEVELOPING ECONOMIES

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This paper draws attention to the implications of multinational enterprises (MNEs) investment in the nontraded sector of a developing host country when their investment is characterized by the transmission of superior technology, but also draws on the local capital market to secure factors of production. In a simple general equilibrium model, we show that once the MNEs control the nontraded sector, their activities generate disturbing results for the host country's economy. In particular, the host country may experience reduced total employment and real national income as a result of their investment. The cause for such unsettling outcomes is directly related to the MNEs utilization of their sector-specific stock of knowledge-based assets in the production of nontraded goods.

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JEL classification: F10, F23, O10, O19

1. INTRODUCTION

An important factor that establishes the growth-FDI nexus is the creation of accumulation of capital in the host countries [Barro and X. Sala-i-Martin (1995); Balasubramanyam, Salisu and Sapsford (1996)].¹ Under this hypothesis, MNEs are treated as agents for private external financing that reduces or even eliminates the host countries' capital bottleneck. Accordingly, capital-poor countries stand to benefit from the presence of MNEs as they can accumulate the much-needed foreign capital to

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¹ Another factor that explains the growth-FDI nexus is technology. FDI is expected to be growth enhancing as the global firms employ new technology and additional capital input to produce goods or services in the host country. See de Mello (1997) for more explanation.

advance their growth objectives.

This hypothesis *implicitly* assumes that the growth of foreign direct investment and the inflow of capital are one and the same thing. In other words, the growth of FDI flows is regarded as gains of net capital stocks for the developing countries which as a result establishes the growth-FDI nexus in LDCs.² Regrettably, this method of analyzing the effects of foreign investment masks the critical distinction between FDI and international movements of factors of production that have been supported by the well established theoretical explanation and myriad empirical evidence.³ Although the behavior of MNEs is not in conflict with international capital theory, their primary role is different from being capita-arbitragers as explicated by Hymer (1960) more than four decades ago.⁴ Thus, the investment behavior and the financing behavior of MNEs are motivated by their own independent factors. According to Kindleberger (1968), Caves (1971), Dunning (1979) and Casson (1983), the motivation for foreign firms to control and manage production facilities in the host countries, i.e., the cause for FDI, is based on the expected return of their ownership of firm-specific advantages that are not available to national firms. That is why MNEs could compete with national firms that are more familiar with the local environment. Therefore, it is the desire to raise MNEs' total profits that prompts FDI rather than the expected return on capital per se.⁵

The incentive for financial investment, in contrast, has been hypothesized as being determined by a present value maximization motive of MNEs operating in a less than perfect international capital markets. For example, Rugman (1979) highlights the fact that MNEs confront new uncertainties and risks when they undertake financial investment abroad which is completely different from what they face domestically. The decision to transmit foreign capital to host countries is based on whether or not they can avoid these uncertainties and risks and at the same time maximize their wealth. Thus, the MNEs' decision to finance FDI with expenditures from domestic capital markets is based on a more complex set of circumstances than what the capital-arbitrage hypothesis suggests. It is better explained by a modern financial theory of capital asset pricing model (CAPM) that encapsulates the behavior of MNEs financial investment in

² It is conceivable that the relative efficiency of MNEs exerts an independent positive influence on aggregate economic growth. We should note, however, that this assertion has been a point of contention among economists. The other argument emphasizes the negative impact of MNEs technology of industrial countries that fails to adapt sufficiently to the labor-abundant conditions of most LDCs. See, for example, Lall (1978a), Jenkins (1990).

³ See for example, Hymer (1960, 1976), Kindleberger (1969) Caves (1971, 1974), Dunning (1972, 1973), Buckley and Casson (1976), Rugman (1982).

⁴ See Hymer, S.H. (1960) "The International Operations of National Firms: A study of Direct Foreign Investment." Ph.D. Dissertation, M.I.T. (Published by M.I.T. Press (1976)).

⁵ See for example, Dunning (1988).

imperfect capital market.⁶ The CAPM framework is based on the hypothesis that financial markets may be hindered by national barriers to international capital mobility and that MNEs' financial decisions take account of risks arising from these barriers. It supposes that MNEs are global coordinators of their financing activities in an attempt to maximize their profits and minimize their exposure to political and economic risks.

Given that MNEs confront stark country differences in LDCs which sharply contrast with what they encounter in advanced countries, their financial behavior in LDCs is different from developed countries. In advanced countries, these firms come across familiar economic and political systems and market structure. Consequently, they usually take their capital and technology to these countries and a lack of capital inflow has never been a point of debate. In contrast, the difference between the advanced home countries of MNEs and the host developing countries has been cited as the major barrier to an influx of MNEs capital to LDCs.⁷

There are several generic reasons for the difference between the MNEs' home countries and the host LDCs that could explain why they may finance their FDI from the local borrowing rather than exporting their own capital. First, they may seize on the opportunity of existing market credit imperfections, fashioned by host governments' courtship of foreign investment. For instance, Mason, Miller and Weigel (1975) and Batra (1986) indicate that in a capital market like this, MNEs can usually borrow money at interest rates lower than those available for the local firms. Second, they may face political risks as a result of unique political instability or political corruption that characterize the host countries. According to Rugman (1979), these political risks discourage the transmission of foreign capital to LDCs since they affect the level of expected return and the variance of earnings. Third, MNEs may want to avoid the risks associated with 'economic vulnerabilities' such as severe droughts and floods which regularly occur in these countries due to climate change that tends to retard economic growth (for a similar view see Lensink and Morrissey (2001)). Fourth, they may respond to the risk of exposure to exchange-rate fluctuations.

Do MNEs investing in LDCs choose to borrow in the local capital market in order to finance their abroad investments in response to institutional barriers and market imperfections? Numerous surveys and statistical studies suggest that they do. For example, a study by Robbins and Stobaugh (1973) showed that MNEs who invest in LDCs routinely borrow much of what they need locally in order to protect against exchange risks. Lall and Streeten (1977b) have also confirmed, based on the two countries samples studies, the assumption that LDCs do not gain much financial benefit from FDI. In another study dealing with investments in LDCs, Cohen (1975) concluded that the supply of foreign capital by MNEs to the LDCs make an insignificant figure.

⁶ See Solnik (1974) and Lessard (1979) among other authors for theoretical and empirical contributions on CAPM.

⁷ See for example, Batra (1986).

The distinguishing character of MNEs behavior towards FDI and financial investment has been established both by theory and empirical evidence. In practice, MNEs have two choices of financing their FDI in developing host countries. First, they can bring their capital along with their technology to the host countries. Second, they can secure much of the capital they need inside these countries. In the former case, developing countries benefit from the more advanced technology and from the inflow of capital. When the new capital is used to generate the production of additional goods or services, their investment is growth-enhancing and hence the growth-FDI nexus is established [for a survey of growth-FDI nexus in LDCs, see de Mello (1997)]. In the latter case, however, whether their investment supports economic growth or inflicts economic harm depends on many other factors, including on the type of technology that is transmitted and on the type of capital market prevailing in the host countries. Thus, the growth-FDI nexus that seems to motivate the current intense search for determinants of FDI crucially depends on the behavior of MNEs.

In this paper we will examine the growth-FDI nexus using a framework that explicitly incorporates the behavior of MNEs when they undertake FDI in a developing country. Our objective is to discern the character of MNEs behavior that realistically contributes to the host country's overall economic growth. This emphasis on the behavior of MNEs is important in view of the overwhelming attention paid to the investigation of determinants of FDI, which exclusively deals with the locational decision-making of MNEs and in so doing focuses on the behavior of host countries. Our analysis can be interpreted as being a part of the current discussion on the growth-FDI nexus in LDCs which has attracted renewed interest in the recent years.⁸ It is particularly relevant to the ongoing discussion on the existing disconnect between the theoretical literature that posits a positive linkage between FDI and economic growth and the empirical literature that casts considerable doubts on that relationship. As noted by the World Bank (2001) the failure to distinguish the effects of FDI from an inflow of private capital from abroad could bias the inferences on the growth-FDI nexus. In this regard, our focus on the differentiation of FDI flows from international movement of capital should add to the austerity of analysis of FDI's contribution to the host country's economic growth.

⁸ The relationship between economic growth and foreign direct investment is not clear cut. At the firm-level, most studies show that the link between FDI and economic growth is either weak or cannot be shown that it exists. In contrast, most macroeconomic studies indicate that FDI generates positive effects on economic growth depending on the circumstances of host countries. This has stimulated a renewed interest in the recent literature on this subject. See for example, studies at the firm-level by: Aitken and Harrison (1999), Aitken, Hansen and Harrison (1997), De Mello (1997), Kokko, Tansini and Zejan (1996). An example from macroeconomic studies include, [Borensztein, De Gregorio and Lee (1998)], [Balasubramanyam, Salisu and Dapsford (1996)], [Alfaro, Chandra, Kalemli-Ozcan and Syayek (2000)], [Blomstrom, Lipsey and Zejan (1994)] and Carkovic and Levine (2002).

The rest of the paper is organized as follows: In Section II, we introduce our assumptions and a framework that utilizes the ownership element of John Dunning's ownership, location and internalization [OLI] model to study the effect of MNEs investment when they transmit a stock of knowledge-based intangible assets but also secure locally other types of capital that they need to produce in the host country. In Section III, we investigate how the host country responds to the paltry investment of MNEs. In Section IV, we design a policy instrument to ensure the economic interest of the host country is protected. Finally, in Section V, we conclude with an overall assessment of the investment by multinational enterprises in a developing economy.

2. ASSUMPTIONS AND THE MODEL

We assume that MNEs from advanced countries take their technology to the industries that they chose to invest in and purchase existing indigenous assets with the financial capital borrowed from the local market, as opposed to the greenfield investment which requires investing directly in new plants and equipments in a capital-poor and labor surplus host country.⁹ We further infer that as a result of such foreign direct investment, two sectors begin to evolve in the country; the national sector and the foreign sector. In the national sector, the indigenous firms continue to produce. In the foreign sector, however, the MNEs take control of the production process. We also assume that the overriding objective of these firms when they made the decision to invest in the host country is based on their desire to take advantage of their ownership of firm-specific assets. The way they realize this is by transferring a stock of knowledge-based assets within their industries to the host country. Since these assets are exclusively owned and used by the MNEs, they provide cost advantages to their operations over the indigenous firms.¹⁰

The MNEs also need other physical capital to produce in the host country. In most cases, these firms have no problems raising funds locally to finance the procurement of equipments, such as buildings, small machineries, infrastructure and other factors of production that they need to produce their products. Here, we conclude that when the MNEs chose not to externally finance their foreign investment, it is precisely because

⁹ There is a major change in the composition of FDI flows in LDCs. Foreign investment related to the acquisition of existing assets rose from a negligible figure in the late 1980s to more than half the total in the late 1990s. In comparison, greenfield investment experienced a steadily decline in its share in total FDI inflows throughout the 1990s. See for example Calderon, Loayza and Servén (2004).

¹⁰ For persuasive explanation about the stock of knowledge-based assets also referred to as 'proprietary assets', 'intangible assets' or monopoly advantage' see Hymer (1960), Kindleberger (1969), Johnson (1970), Buckley and Casson (1976), Dunning (1977), Caves (1982), Markusen (1995) to name only the few among those whose contributions are well documented in this area.

they can manage to raise the necessary funds for their use in the host country.¹¹

In the national sector, the indigenous firms produce tradable goods in a perfectly competitive system. In the foreign sector, the multinational firms compete with each other to produce goods that are nontraded. Many MNEs are in the service industries, such as hotels, hospitals, telecommunications, utilities, local transportation and constructions that require on-site production in order to access customers. As a matter of fact, a report by the World Bank (1998) shows that FDI from the advanced countries going to the developing countries has shown the most dramatic increase in the service sectors since 1990s. These services are nontraded due to, for example, internationally prohibitive high transportation costs or because they are too localized to be traded internationally.¹² The host country provides two non-specific factors of production, capital and labor. As mentioned above, the MNEs are endowed with one non-specific factor, the stock of knowledge-based assets. This implies that the nontraded good is produced by the local labor (L) and capital (K) and by the knowledge-based assets denoted as S hereafter. Since the host country is characterized by the presence of labor-surplus, we will introduce the unemployment of labor into our model. We use a form of wage-rigidity to introduce this unemployment of labor as shown below.

Let X and Y respectively be a composite of the nontraded goods and the traded goods and P_x and P_y denote the respective prices of X and Y. The host country's unemployment is introduced as follows:

$$W = P_x^\alpha P_y^{1-\alpha}, 0 < \alpha < 1,^{13} \quad (1)$$

Where W denote the nominal money wage rate, which is homogeneous of degree one in P_x and P_y . Logarithmic differentiation of (1) gives:

$$\hat{W} = \alpha \hat{P}_x + (1 - \alpha) \hat{P}_y. \quad (2)$$

¹¹ Even if the MNEs incur higher net interest payments (due to the scarcity of capital) in the host country, the prospect of lose in income arising from the riskier economic or political environment, as explained in section I, would be considered more significant in this case. That is, MNEs' operations do not primarily depend on moving capital from where it is cheap to where it is costly. MNEs response to the economic and political risks of the host country may explain why they finance their investment from the local borrowing even if capital rentals are higher than their home countries. See for example Aliber (1993) and Caves (1996).

¹² The current surge in FDI flows going to the service sectors of developing countries parallels the reorientation in government economic policy and the liberalization and privatization of service enterprises by the governments of these countries in part to attract foreign investment. See World Bank (1998).

¹³ Brecher (1974a, 1074b 1978), Helpman (1976) and Das (1981) have made use of such a wage function. For an analysis of the impact of a minimum wage restriction on some standard theorems in international trade theory, see Brecher (1974a, 1974b, 1978).

The circumflex ($\hat{}$) is used to reflect the percentage change of the variable, and where α and $(1-\alpha)$ stand for partial elasticities of the nominal wage with respect to the two prices. We take the traded good as the numeraire. Thus, the real wage in terms of traded good is given by:

$$w = \frac{W}{P_Y} = \left(\frac{P_X}{P_Y} \right)^\alpha = P^\alpha, \quad w \geq \bar{w}, \quad (3)$$

Where \bar{w} is the (exogenously given) minimum value of w and P represents the relative price of nontraded good in terms of the traded good. Next, we will present the employment and the price equations of the two sectors. We will do this starting with the employment equation in the multinational sector.

Let C_{ij} be the quantity of the i^{th} factor used in the production of one unit of the j^{th} commodity, $i = S, K_x, L_x$ and $j = X$. Noting the homogeneity of degree one of the production function $X = F(L_x, K_x, S)$, the employment demand equations corresponding to the MNEs sector is written as:¹⁴

$$C_{S_x}(\bar{w}, r_x)X = \bar{S}, \quad (4)$$

$$C_{L_x}(\bar{w}, r_x)X = L_x, \quad (5)$$

$$C_{K_x}(\bar{w}, r_x)X = K_x. \quad (6)$$

Equation (4) reveals the fact that the MNEs transmit only the stock of knowledge-based assets to the host country that are exclusively used to produce the nontraded good. A bar over the variable S shows that it is fully employed in the host country. The MNEs also share with the indigenous firms the local labor and the local capital to produce the nontraded good X as Equations (5) and (6) indicate.

The apparent advantage of factor S to the MNEs is that its utilization in the host country becomes the source of a pure profit because of its property that connotes the nature of public goods and because of a negligible cost involved in its transmission to the host country.¹⁵ In view of this, the MNEs' profit in the host country can be expressed as in (7) below:

¹⁴ Where $C_{ij}(\cdot)$ are solutions to the cost minimization problem and $C_{S_j}(\cdot)$, $C_{L_j}(\cdot)$, $C_{K_j}(\cdot)$ are homogeneous of degree zero in w (real wage) and r_x (real rental in sector X). This property results from the linearity of the object function in the minimization problem.

¹⁵ See, for example, Harry Johnson (1970).

$$\pi = PF_s S - U, \quad (7)$$

Where F_s is the marginal product of factor S and where U reflects a one-time cost that the MNEs incur in transmitting factor S to the host country. In light of (7), the price of nontraded good in terms of the traded good is given by (8):

$$C_{Kx}(\bar{w}, r_x)r_x + C_{Lx}(\bar{w}, r_x)\bar{w} + \pi = P. \quad (8)$$

In the national sector, the indigenous firms employ the two non-specific factors to produce the traded good. Once again let C_{ij} be the quantity of the i^{th} ($i = L_y, K_y$) factor used in the production of one unit of the j^{th} commodity, $j = Y$. The employment equations may then be written as:

$$C_{Ky}(\bar{w}, r_y)Y = \bar{K} - K_x, \quad (9)$$

$$C_{Ly}(\bar{w}, r_y)Y = L_y, \quad (10)$$

where r_y denotes the real rental of capital in Y sector.

The price equation corresponding to the traded good is written as:

$$C_{Ky}(\bar{w}, r_y)r_y + C_{Ly}(\bar{w}, r_y)\bar{w} = 1. \quad (11)$$

We complete the two-sector model by equilibrating the domestic consumption and the production of nontraded good and by specifying the real national income in terms of traded good as shown in (12) and (13) respectively:

$$D_x(P, I) - X = 0, \quad (12)$$

$$I = \bar{w}L + r\bar{K} + U. \quad (13)$$

3. THE EFFECTS OF MNEs' INVESTMENT TO THE HOST COUNTRY

As we noted in Section 2, the MNEs although acting as conduits to the transmission of superior technology are tapping the local capital markets in order to secure factors of production and to carry on the production of nontraded good. Are these features of the

¹⁶ I made use of Euler's theorem to get (13).

MNEs behavior compatible with the macroeconomic interest of the host country? In this section we will examine how the host country responds to the MNEs' investment by including their distinguishing features as outlined in Section 2.

For the MNEs, the advantage of ownership and exclusive use of the stock of knowledge-based assets goes beyond just adding to their profits. They also serve to attract labor and capital from the national sector to their own sector. They do this first by raising the marginal product of capital in the nontraded sector which initiates its shift to that sector. At the same time, due to the capital-labor ratio, as capital diminishes in the national sector, labor may also move away from the traded sector to the nontraded sector. So, the MNEs sector tends to expand just as the national sector tends to shrink. Given well-known stylized facts that the MNEs sector is the relatively more capital-intensive and the national sector is the relatively more labor-intensive, the expansion of the MNEs sector together with the contraction of the national sector imply a deterioration in the employment opportunities for the capita-poor and labor-surplus host country turning the problem of unemployment into a more serious situation.¹⁷ This problem will more likely inflict a drop in the real income since the number of working people is now reduced in the country. The exact effects of MNEs emergence on the host country's economy at the initial relative price are derived in the appendix [see Appendix A].

The relative price adjustment, which takes place due to the reduced demand for the nontraded good that is caused by the falling national income, becomes an important variable in determining the effects of MNEs investment on the economy of the host country. The new market clearing relative price of the nontraded good will indicate whether or not the shift of local capital and labor from the traded-sector to the nontraded-sector is reversible. Since the real wage is exclusively determined by the relative price in this model, so must be the real rental, r_j in sector j as well as the capital-labor ratio, k_j in the two sectors. Thus, the effect of relative price change on the allocation of labor and capital between the traded sector and the nontraded sector can be determined by studying the real wage-price ratio and the capital-labor ratio in the two-sector without violating the real wage assumption.

At the same time as the new reduced relative price serves to indicate the impact of MNEs investment on the allocation of labor and capital between the national and the foreign sectors, a change in the stock of knowledge-based assets could also affect the movement of the two factors of production between the two sectors. This is likely because as demonstrated by Jones (1971) the movements of labor and capital between the two sectors adjust their own returns and the return of specific factor within the two sectors independent of the relative price.

We are now all set to present the precise effects of MNEs investment on different economic issues of the host country. We will begin with an analysis of how changes in

¹⁷ See for example, Caves (1996), Jenkins (1990), Batra (1986) and Lall (1977b) among many others who present a more thorough analysis of MNEs' use of technology in LDCs.

the relative price and in the stock of knowledge-based assets influence the employment of labor and capital in the MNEs sector. In order to do that, we will make use of the employment Equations (4)-(6) to obtain the rate of changes of these factors as shown by the following two equations:

$$\hat{L}_x = \left\{ \frac{[\beta_{Ls}\sigma_x^{ls} + \beta_{Ks}(\sigma_x^{lk} + \sigma_x^{sk})][(\theta_{Lx} + \theta_{Kx})(1-\alpha)]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \hat{P} - \left\{ \frac{[\beta_{Ls}\sigma_x^{ls} + \beta_{Ks}(\sigma_x^{sk} + \sigma_x^{lk})]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s + \hat{S}, \quad (14)$$

$$\hat{K}_x = \left\{ \frac{[\beta_{Ls}(\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks}\sigma_x^{sk}][(\theta_{Lx} + \theta_{Kx})(1-\alpha)]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \hat{P} - \left\{ \frac{[\beta_{Ls}(\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks}\sigma_x^{sk}]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s + \hat{S}, \quad (15)$$

Where \hat{F}_s denotes a percentage change in F_s .¹⁸

Equations (14) and (15) indicate that the changes in the relative price of nontraded good and stock of knowledge-based assets do influence the employment of labor and capital in the MNEs sector. This can be observed by examining the effects of \hat{P} and \hat{S} on \hat{L}_x and \hat{K}_x . A closer look at the two equations reveals that \hat{P} tend to reduce \hat{L}_x and \hat{K}_x reversing the previous trend that showed a rise in the employment of labor and capital in that sector when the global firms first began the production of the nontraded good. Conversely, \hat{S} tends to increase \hat{L}_x and \hat{K}_x a condition that further improves the employment of labor and capital in the foreign sector countering the effect of \hat{P} .

As we indicated earlier, the reduced income level that the host country faces after the emergence of MNEs initiates a change in the relative price. This readily follows from the equilibrium conditions in the nontraded good (12). The new market clearing relative price will raise the real wage-price ratio in terms of the nontraded good compelling the

¹⁸ The stock of knowledge-based assets, factor S have no external market and their values are assumed to depend on the efforts at developing them by the MNEs in their source countries. See for example, Johnson (1970) and Batra and Ramachandran (1980). θ_{ix} = The share of the i^{th} factor in the total earnings in the commodity X . ($i = S, L_x, K_x, L_y, K_y$). $\beta_{Ks} = \frac{\theta_{Kx}}{\theta_{Sx}}$, $\beta_{Ls} = \frac{\theta_{Lx}}{\theta_{Sx}}$. The symbol σ_j stands for the elasticity of substitution in the j^{th} ($j = X, Y$) sector.

MNEs to reduce the number of workers in that sector. Because of changes in the capital-labor ratio, the MNEs will be forced to release some capital as well. The influence of relative price on the employment of labor and capital in the nontraded sector is shown by its impact on the bracketed expressions that are on the left-hand side of Equations (14) and (15) or,

$$\left\{ \frac{[\beta_{Ls}\sigma_x^{ls} + \beta_{Ks}(\sigma_x^{lk} + \sigma_x^{sk})][(\theta_{Lx} + \theta_{Kx})(1-\alpha)]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \hat{P}$$

and $\left\{ \frac{[\beta_{Ks}\sigma_x^{sk} + \beta_{Ls}(\sigma_x^{ls} - \sigma_x^{lk})][(\theta_{Lx} + \theta_{Kx})(1-\alpha)]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \hat{P}$. Both expressions are negative

because \hat{P} is negative. Thus, the reduced relative price unambiguously undercuts the employment of labor and capital in the foreign sector.

In contrast, the MNEs stock of knowledge-based assets exerts the opposite effect on the employment of labor and capital through its impact on their marginal products in the foreign sector. An increase in the knowledge-based specific factor and or a decrease in the two mobile factors tend to lower the marginal product of S and raise the marginal products of L_x and K_x with the nontraded good's price held constant. As a result, the workers who have been employed in this sector and the owners of capital have no incentive to shift back to the national sector. Clearly \hat{F}_s is negative in Equations (14) and (15) because \hat{S} is positive.¹⁹ That means, expressions

$$-\left\{ \frac{[\beta_{Ls}\sigma_x^{ls} + \beta_{Ks}(\sigma_x^{sk} + \sigma_x^{lk})]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s + \hat{S}$$

and $-\left\{ \frac{[\beta_{Ks}\sigma_x^{sk} + \beta_{Ls}(\sigma_x^{ls} - \sigma_x^{lk})]}{\theta_{Lx}(\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx}(\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s + \hat{S}$ have positive signs.

Given the opposing influences of \hat{P} and \hat{S} on \hat{L}_x and \hat{K}_x , Equations (14) and (15) are ambiguous. This is clearly confirmed by the conflicting signs of \hat{P} , \hat{F}_s and \hat{S} in the two equations which cause the indeterminacy of \hat{L}_x and \hat{K}_x . Hence, the impact of MNEs investment on the employment of labor and capital in the nontraded-sector is not a clear-cut.

The effects of changes in the relative price and stock of knowledge-based assets on the employment of labor and capital in the traded-sector is determined by totally differentiating the national industries' employment Equations (9) and (10) to get:

¹⁹ The other possibility is a decrease in S that reduces the marginal product of L_x and K_x . Since the MNEs could transfer without incurring significant cost to the host country for their production purpose, we rule out this possibility.

$$\begin{aligned} \hat{L}_y = & - \left\{ \left[\frac{\sigma_y \alpha}{\theta_{Ky}} + \frac{\lambda \left\{ \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right] \left[(\theta_{Lx} + \theta_{Ks}) (1 - \alpha) \right] \right\}}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right] \right\} \hat{P} \\ & + \left\{ \frac{\lambda \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s - \lambda \hat{S},^{20} \end{aligned} \quad (16)$$

$$\begin{aligned} \hat{K}_y = & - \left\{ \frac{\lambda \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right] \left[(\theta_{Lx} + \theta_{Kx}) (1 - \alpha) \right]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \hat{P} \\ & + \left\{ \frac{\lambda \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s - \lambda \hat{S}. \end{aligned} \quad (17)$$

In the traded-sector, the relative price has the effect of reducing the real-wage ratio in terms of traded good that tends to boost the employment of labor and capital. On the other hand, the knowledge-based assets tend to deter the local labor and capital from seeking further employment in the traded-sector by raising their marginal products in the nontraded sector. Once again, the effects of the relative price and stock of knowledge-based assets on the employment of the two factors are at odds in the traded sector as well. Hence, the impact of MNEs investment on the employment of labor and capital in the traded sector is ambiguous. This is clearly marked by the positive signs of the bracketed expressions on the left-hand side in (16) and (17) equations,

$$\begin{aligned} & - \left\{ \left[\frac{\sigma_y \alpha}{\theta_{Ky}} + \frac{\lambda \left\{ \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right] \left[(\theta_{Lx} + \theta_{Ks}) (1 - \alpha) \right] \right\}}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right] \right\} \hat{P} \\ & \text{and} \quad - \left\{ \frac{\lambda \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right] \left[(\theta_{Lx} + \theta_{Kx}) (1 - \alpha) \right]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \hat{P} \quad \text{which contradict the negative} \\ & \text{signs of the middle and the right-hand side terms of} \quad \left\{ \frac{\lambda \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s - \lambda \hat{S} \\ & \text{and} \quad \left\{ \frac{\lambda \left[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{sk} \right]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s - \lambda \hat{S}. \end{aligned}$$

When taken as a whole, the four results that we obtained in Equations (14)-(17) have an uncertain effect on the total employment. In other words, the MNEs which transfer technology but invest no capital of their own may cause a worsening of unemployment conditions in a labor-surplus developing country. This must raise a grave concern for the host country. After all, given the existence of unemployment, the one detrimental thing

²⁰ θ_{iY} = The share of the i^{th} factor in the total earnings in the commodity Y, and where $\lambda = \frac{K_x}{K_y}$.

that it may not need from the MNEs is an additional unemployment.

It is worth to emphasize the crucial role of the MNEs knowledge-based assets in driving the above results. To all intents and purposes, the MNEs' stock of knowledge-based assets function as a magnet to attract the local labor and capital to the MNEs' sector and to discourage them from seeking employment in the national sector. This has the chilling effect on the total employment of labor considering the relatively capital-intensive MNEs sector and the relatively labor-intensive national sector. That is, even if the MNEs employ massive number of workers, they also contribute to a shrinking in employment in the national sector by attracting capital away from the indigenous industries. In tandem, the expansion of the MNEs sector and the contraction of the national sector cause the employment to plummet. Barring the counteractive role of the MNEs knowledge-based assets, the relative price would have eliminated concerns of reduced employment by expanding the traded sector and contracting the nontraded sector. As a result, the injuries economic impact of MNEs would have been reversed.

As stated at the beginning of this section, the possible detrimental effect of the MNEs on the employment of the host country is caused by their meager investment that did not include the inflow of capital to the country. It was the absence of foreign capital to finance their investment that caused an increase in the employment of labor in the MNEs sector, L_x and a reduction in the employment of labor in the national sector, L_y , as shown in appendix A. The effect of the MNEs financial behavior on total employment is shown to be the sum of their impact on L_x and L_y , which turned out to be ambiguous. An interested reader can easily formulated a condition in which the total capital stock in the host country goes up with the emergence of MNEs that would imply a definite directions for \hat{L}_x and \hat{L}_y and hence for the total employment.

On the whole, the impact on employment of labor and capital in the two sectors is dependent on several parameters such as the share of the i^{th} factor in the total earnings in j^{th} commodity (θ_{ij}), the relative share of local capital and labor in the two sectors (β_{ij}), the elasticity of substitution among i^{th} factor in the j^{th} sector (σ_j) and weights in the wage function ($\alpha, 1 - \alpha$). It shows that none of these parameters have the influence to alter the direction of any one of these variables.

The key question to ask is, does the investment by the MNEs accelerate economic growth or retard it in a capital-poor and labor-surplus host country? To answer this question, we compute a total logarithmic differentiation of the income Equation (13) to obtain,

$$\hat{I} = \left\{ \delta_x \left[(\theta_{Lx} + \theta_{Kx}) \left(1 + \frac{\phi}{\varphi} \right) \right] - \delta_y \left(\beta_{Ls} \sigma_y \alpha + \frac{\psi}{\varphi} \right) \right\} \hat{P} + [\delta_x (\theta_{Lx} + \theta_{Kx}) \delta_y \lambda] \hat{S},$$

$$- \left\{ \frac{\delta_x [(\beta_{Ls} \sigma_x^{ls} + \beta_{Ks} \sigma_x^{sk})(\theta_{Lx} + \theta_{Kx})] - \delta_y \lambda [\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{lk}]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}^{21} \quad (18)$$

where δ_j represents the share of the j^{th} sector.

The first square-bracketed expression on the left-hand side and the last square-bracketed expression on the right-hand side are negative, all other terms are positive. Consequently, \hat{I} is undetermined. It also shows that the higher the relative magnitude of the share of the real income in the national sector, $\delta_y \left(\beta_{Ls} \sigma_y \alpha + \frac{\psi}{\varphi} \right)$,

compared to the share of the real income in the MNEs sector, $\delta_x \left[(\theta_{Lx} + \theta_{Kx}) \left(1 + \frac{\phi}{\varphi} \right) \right]$,

the more is the chance that the total real income increases, *ceteris paribus*. This is, however, may not come about when the MNEs attract the local capital to their sector from the national industries, but hire less than the number of workers released by the national industries because of the kind of technology they bring with them to the host country. As a result, the opportunity for employment diminishes with the emergence of MNEs that may reduce the total real income in the host country. In the presence of the nontraded good, however, the fall in the real income has the distributional impact that affects factor rewards in the two sectors due to the new market clearing relative price. But, as we have shown in Equations (14)-(17), the effect of the new relative price on the allocation of local labor and capital between the two sectors is obscured by the more efficient technology used in the MNEs sector. That is why we cannot say how the foreign direct investment affects the total real income of the host country. This is clearly indicated by the indeterminacy of Equation (18) which is caused by the conflicting role of the relative price and the stock of the knowledge-based assets on the real income.

This raises another interesting question about the determinants of FDI as the strategy to attract the MNEs to developing countries on the assumption that their investment is growth-enhancing. The determinants of FDI constitute distinctive behavioral qualities that a developing country should possess in order to maximize the probability of being selected by global firms as their host country.²² Thus, it solely focuses on the behavior of host countries but takes for granted the behavior of MNEs in the developing countries. On the other hand, as we have shown in this paper, when the investment of MNEs characterizes the transmission of efficient technology only, the growth-FDI nexus that

²¹ $\phi \equiv [(\beta_{Ls} \sigma_x^{ls} + \beta_{Ks} \sigma_x^{sk})(\theta_{Lx} + \theta_{Kx})(1 - \alpha)]$, $\varphi \equiv [\theta_{Lx} (\beta_{Ls} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})]$, $\psi \equiv \{[\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{lk}](\theta_{Lx} + \theta_{Kx})(1 - \alpha)\}$

²² For a comprehensive review of FDI determinants, see, for example Morrissey and Rai (1995).

the notion of FDI determinants assumes cannot be ascertained.²³

4. POLICY IMPLICATIONS FOR THE HOST COUNTRY

Clearly the interest of the host country in the presence of MNEs reflects the desire for a healthy relationship between their activities and its economic objectives. On the contrary, our study indicates that it is likely to suffer from such relationship: that it may sustain economic injuries as a direct result of the MNEs activities. As a matter of fact, if this incongruous relationship between the MNEs and the host country is let to continue, it could grow to be detrimental to the country's economic hope. Henceforth, the government of the host country ought to devise appropriate policy measures, if it desires to correct the ill-advised relationship it has established with the global firms. In the rest of this section, we will formulate a suitable income tax on global firms that the government can impose to make certain their harmful economic impact is minimized or eliminated.

The potency of such policy instrument is measured based by its potential to redirect the directions of key economic factors without exasperating the activities of MNEs in the country. For example, in order to undo the negative economic effects of the MNEs, a suitable income tax must change the movement of local labor and capital from the national sector to the foreign sector. This then will lead to a rise in the employment of labor and capital in the national sector and a fall in the foreign sector. Concomitantly, the total employment of labor and the real national income will also rise in the host country. A tax imposed on earned income by the MNEs, either on the non-wage income or on the non-rental income will exactly do that.

A tax on non-wage income, to be precise on $(PX - wL_x)$ is much more effective in the sense that it serves to ensure the economic interest of the host country is protected without driving out the MNEs. Making a note of our assumption of perfect competition in all markets, the profit level of MNEs, when the government imposes an income tax on the non-wage income is given by,

$$\Pi = (PX - wL_x)(1 - t) - r_x K_x. \quad (19)$$

The global firms now maximize their profits when

$$w = PX_L(L_x, K_x) + XP'_x X_L(L_x, K_x), \quad (20)$$

²³ MNEs that transfer both knowledge-based assets and tangible capital from their home countries to invest in the capital-poor and labor-surplus developing country can be shown to increase the total employment of labor as well as raise the real national income in the host country. See, for instance, Batra (1986).

$$r_x = (1-t)\{[PX_K(L_x, K_x) + XP'_x X_L(L_x, K_x)]\}. \quad (21)$$

As indicated in section II, the local firms maximize their profits when

$$w = Y_L(L_y, \bar{K} - K_x), \quad (22)$$

$$r_y = Y_K(L_y, \bar{K} - K_x). \quad (23)$$

Also, since this is a long-run model, we require the rentals in the local and foreign sector to be equal, or

$$(1-t)\{[PX_K(L_x, K_x) + XP'_x X_L(L_x, K_x)]\} = Y_K(L_y, \bar{K} - K_x). \quad (24)$$

We now totally differentiate (20), (22) and (24) with respect to t , to get:

$$\frac{dL_x}{dt} = \frac{[P^2 + 2PXP'_x + (XP'_x)^2]Y_{LL}X_{KL}X_x}{D} < 0, \quad (25)$$

$$\frac{dK_x}{dt} = \frac{-[P^2 + 2PXP'_x + (XP'_x)^2]Y_{LL}X_{LL}X_K}{D} < 0, \quad (26)$$

$$\frac{dL_y}{dt} = \frac{-[P^2 + 2PXP'_x + (XP'_x)^2]Y_{KL}X_{LL}X_K}{D} > 0, \quad (27)$$

$$\frac{dK_y}{dt} = \frac{[P^2 + 2PXP'_x + (XP'_x)^2]Y_{LL}X_{LL}X_K}{D} > 0, \quad (28)$$

Where $D = -(1-t)Y_{LL}[P^2 + 2PXP'_x + (XP'_x)^2](X_{LL}X_{KK} - X_{KL}^2) > 0$.²⁴

Equations (25) and (27) show that the employment of labor declines in the capital-intensive sector and rises in the labor-intensive sector when capital shifts back to the local sector from the MNEs sector as indicated by Equations (26) and (28). If we accept that cross partials are positive and own partials are negative, $\frac{dL_x}{dt} < 0$ and

²⁴ This follows from the properties of production function that satisfies the following assumptions: (1) First partial derivatives are positive, but the second derivatives are negative. (2) $H_X = X_{LL}X_{KK} - X_{KL}^2 > 0$ and $X_{KL} > 0$, while $H_Y = Y_{LL}Y_{KK} - Y_{KL}^2 > 0$ and $Y_{KL} > 0$.

$\frac{dK_x}{dt} < 0$, but $\frac{dL_y}{dt} > 0$ as well as $\frac{dK_y}{dt} > 0$ which indicate the movements of local capital and labor between the two sectors could be reversed. Thus the theorem by Batra (1986) that a tax on non-wage income earned by MNEs gives rise to an increase in the employment of capital and labor in the local sector and a decrease in their employment in the MNEs is reinforced in the presence of nontraded sector. The shift of two local resources from the nontraded sector to the traded sector translates into a positive employment of labor for the host country as the equation below shows:

$$\frac{dL}{dt} = \frac{\left[P^2 + PXP'_x + (XP'_x)^2 \right] \left[Y_{KL} X_{KL} (k_x - k_y) + Y_{KL} X_{LS} \frac{S}{L_x} \right] X_K}{D} > 0. \quad (29)$$

Thus, the expansion of the labor-intensive national sector together with the contraction of capital-intensive foreign sector eliminates the injuries economic impact of MNEs by boosting the total employment and the real national income.

5. CONCLUSIONS

In this paper, an attempted was made to study the contributions of MNEs when they control the production of goods and services that are internationally nontraded by explicitly incorporating some features of their behavior in less developing countries. We have shown that if the MNEs investment is characterized by the transmission of their more advanced technology that is not reciprocated by the inflow of tangible capital, then a developing host country may suffer from a reduced total employment and real national income. Our analysis indicate that when MNEs opt to tap the host country's resources rather than to bring with them their own resources, it is precisely because they can use their sector-specific stock of knowledge-based assets not only to attract local capital and labor to produce the nontraded good but also to hold on to them as long as their operation lasts. With the shift of more local resources to the MNEs sector from the national sector, the employment of labor may dwindle in the capital-poor and labor-surplus host country if the MNEs sector is relatively capital-intensive and the national sector is relatively labor-intensive. Hence, the overall contribution of MNEs to the country's economy may result in a worsening of its real national income.

Our conclusions invoke some interesting observations about current priorities of interaction between the MNEs and developing countries. First, it may be a self-defeating proposition for developing economies to favor an FDI that characterize technology over the inflow of tangible-capital as such investment may cause harmful effects on their economies. The constructive measure should be to exhort that the mix of FDI be capital-investment. Needless to say this may be a precarious requirement to satisfy on the part of global firms, given the current scramble for FDI by the host governments of

developing countries. Second, the overwhelming focus paid to the determinants of FDI as the strategy to attract MNEs to developing countries on assumption that their investment is growing-enhancing is based on an ill-conceived notion that MNEs are sources for external private capital for the host countries that contradicts their behavior in LDCs.

APPENDIX A

In this section we will show how the host country responds to the emergence of MNEs at the initial output prices considering the global firms while acting as a conduit to the transmission of superior technology, but also tap the local capital market in order to secure factors of production and carry on the production of nontraded good.

To examine the impact of the MNEs investment on the allocation of resource between the two-sectors, we totally differentiate the employment equations in the multinational sector, (4)-(6) and the employment equations in the national sector, (9)-(10) with respect to \bar{S} to get:

$$\frac{dK_x}{d\bar{S}} = \frac{C_{K_x}}{C_{S_x}} > 0 = -\frac{dK_y}{d\bar{S}}, \quad (1A)$$

$$\frac{dL_x}{d\bar{S}} = \frac{C_{L_x}}{C_{S_x}} > 0, \quad (2A)$$

$$\frac{dL_y}{d\bar{S}} = -\frac{C_{L_y} C_{K_x}}{C_{K_y} C_{S_x}} < 0. \quad (3A)$$

According to Equations (1A)-(3A) the national firms lose the local capital and labor to the global firms. As a result, the MNEs industries (nontraded-sector) flourish at the expense of the national industries (traded-sector).

The results we obtain in (1A)-(3A) imply that the overall impact of the emergence of MNEs on the total employment is determined based on the capital/labor ration in the two-sector. This can be seen by adding together Equations (2A) and (3A) as follows:

$$\begin{aligned} \frac{dL_x}{d\bar{S}} + \frac{dL_y}{d\bar{S}} &= \frac{dL}{d\bar{S}} \\ &= C_{L_x} C_{L_y} \left[\frac{k_y - k_x}{C_{K_y} C_{S_x}} \right] < 0. \end{aligned} \quad (4A)$$

Given our assumption of the higher capital-intensity of the MNEs sector compared to the local sector that could be justified when we consider factor-intensity differences, which exist between advanced countries and LDCs, it is safe to assume that $k_x > k_y$ (where $k_x = \frac{K_x}{L_x}$, $k_y = \frac{K_y}{L_y}$). For that reason, Equation (4A) becomes negative.

Also, as stated in the text, since the employment level has reduced with the emergence of MNEs, so must the total real income. This is shown by totally differentiating the income equation $I = \bar{w}L + r\bar{K} + U$ with respect to \bar{S} :

$$\begin{aligned} \frac{dI}{d\bar{S}} &= \bar{w} \frac{dL}{d\bar{S}} \\ &= \bar{w} C_{L_x} C_{L_y} \left[\frac{k_y - k_x}{C_{K_y} C_{S_x}} \right] < 0. \end{aligned} \quad (5A)$$

APPENDIX B

The effects of MNEs' investment to the host country

In the presence of internationally nontraded good, a decrease in the national income will clearly reduce its demand in the host country. The reduce demand of the nontraded good in turn will affect its relative price. This new price determines the distributional effects of MNEs on the local factors that cause movements of labor and capital between the two sectors. Hereafter, we will show the impact of MNEs on different economic variable of the host country through its impact on the new relative price of nontraded good.

We note that in the nontraded sector, cost minimization applies only to labor (L_x) and to capital (K_x) since the stock of knowledge-based assets (S) have no external markets and their value is assumed to depend on the efforts at developing them by MNEs. Keeping this in mind and owing to the facts that $w dC_{L_j} + r dC_{K_j} = 0$ and $\hat{C}_{L_j} - \hat{C}_{K_j} = \sigma_j (\hat{r}_j - \hat{w})$, total differentiation of the employment equations and the price equations of the two-sector model as specified in Section 2 obtains,

$$\hat{w} = \alpha \hat{P}, \quad (1B)$$

$$\hat{r}_y = -\beta_{L_y} \alpha \sigma_y \hat{P}, \quad (2B)$$

$$\hat{r}_x = \frac{\{(\beta_{L_s} + \beta_{K_s})[(\theta_{L_x} + \theta_{K_x})(1-\alpha) + [\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})]\alpha]\} \hat{P} - (\theta_{L_x} + \theta_{K_x}) \hat{F}_s}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \quad (3B)$$

$$\hat{X} = \frac{\{[(\beta_{L_s} \sigma_x^{ls} + \beta_{K_s} \sigma_x^{sk})(\theta_{L_x} + \theta_{K_x})](1-\alpha)\} \hat{P} - (\beta_{L_s} \sigma_x^{ls} + \beta_{K_s} \sigma_x^{sk}) \theta_{Sx} \hat{F}_s}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} + \hat{S}, \quad (4B)$$

$$\hat{Y} = - \left\{ \left\{ \beta_{L_y} \sigma_y \alpha + \frac{\lambda \{[\beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{K_s} \sigma_x^{sk}](\theta_{L_x} + \theta_{K_x})(1-\alpha)\}}{\theta_{L_x}(\beta_{L_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \right\} \hat{P} \\ + \frac{\lambda [\beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{K_s} \sigma_x^{sk}] \theta_{Sx} \hat{F}_s}{\theta_{L_x}(\beta_{L_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} + \lambda S \quad (5B)$$

$$\hat{L}_x = \left\{ \frac{[\beta_{L_s} \sigma_x^{ls} + \beta_{K_s}(\sigma_x^{lk} + \sigma_x^{sk})](\theta_{L_x} + \theta_{K_x})(1-\alpha)}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \hat{P} \\ - \left\{ \frac{[\beta_{L_s} \sigma_x^{ls} + \beta_{K_s}(\sigma_x^{sk} + \sigma_x^{lk})]}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s + \hat{S}, \quad (6B)$$

$$\hat{K}_x = \left\{ \frac{[\beta_{K_s} \sigma_x^{sk} + \beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk})](\theta_{L_x} + \theta_{K_x})(1-\alpha)}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \hat{P} \\ - \left\{ \frac{[\beta_{K_s} \sigma_x^{sk} + \beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk})]}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s + \hat{S}, \quad (7B)$$

$$\hat{K}_y = - \left\{ \frac{\lambda [\beta_{K_s} \sigma_x^{sk} + \beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk})](\theta_{L_x} + \theta_{K_x})(1-\alpha)}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \hat{P} \\ + \left\{ \frac{\lambda [\beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{K_s} \sigma_x^{sk}]}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s - \lambda \hat{S} \quad (8B)$$

$$\hat{L}_y = - \left\{ \left\{ \frac{\sigma_y \alpha}{\theta_{K_y}} + \frac{\lambda \{[\beta_{K_s} \sigma_x^{sk} + \beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk})](\theta_{L_x} + \theta_{K_x})(1-\alpha)\}}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \right\} \hat{P} \\ + \left\{ \frac{\lambda [\beta_{K_s} \sigma_x^{sk} + \beta_{L_s}(\sigma_x^{ls} - \sigma_x^{lk})]}{\theta_{L_x}(\beta_{K_s} - \sigma_x^{ls}) + \theta_{K_x}(\beta_{K_s} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s \quad (9B)$$

The effect on national income is obtained by totally differentiating the income equation $I = Y + PX - \pi$ where $\pi = PF_s - U$.

$$dI = PX(\theta_{Lx} + \theta_{Kx})\hat{X} + PX(\theta_{Lx} + \theta_{Kx})\hat{P} + Y\hat{Y}. \quad (10B)$$

Substituting the \hat{X} and \hat{Y} values from Equations (4B) and (5B) into expression (10B) and dividing through by I furnishes,

$$\hat{I} = \left\{ \delta_x \left[(\theta_{Lx} + \theta_{Kx}) \left(1 + \frac{\phi}{\varphi} \right) \right] - \delta_y \left(\beta_{Ls} \sigma_y \alpha + \frac{\psi}{\varphi} \right) \right\} \hat{P} + [\delta_x (\theta_{Lx} + \theta_{Kx}) \delta_y \lambda] \hat{S} \\ - \left\{ \frac{\delta_x [(\beta_{Ls} \sigma_x^{ls} + \beta_{Ks} \sigma_x^{sk}) (\theta_{Lx} + \theta_{Kx})] - \delta_y \lambda [\beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk}) + \beta_{Ks} \sigma_x^{lk}]}{\theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})} \right\} \theta_{Sx} \hat{F}_s, \quad (11B)$$

Where, $\varphi = \theta_{Lx} (\beta_{Ks} - \sigma_x^{ls}) + \theta_{Kx} (\beta_{Ks} - \sigma_x^{sk})$, $\phi = (\beta_{Ls} \sigma_x^{ls} + \beta_{Ks} \sigma_x^{sk}) [(\theta_{Lx} + \theta_{Kx}) (1 - \alpha)]$, and $\psi = [\beta_{Ks} \sigma_x^{ls} + \beta_{Ls} (\sigma_x^{is} - \sigma_x^{lk})] [(\theta_{Lx} + \theta_{Kx}) (1 - \alpha)]$

The effect of MNEs on the relative price is determined, first by totally differentiating the equilibrium equation $D_x(P, I) = X$ to get,

$$-PX\xi\hat{P} - PX(m_y + m_x\theta_{Sx})\hat{X} - PXm_x\theta_{Sx}\hat{P} + Ym_x\hat{Y}, \quad (12B)$$

Where ξ represents the pure substitution elasticity of demand for the nontraded good, m_x and stand for the marginal propensity to spend on the nontraded good and traded good respectively. Lastly, inserting (4B) and (5B) and dividing by I give,

$$\hat{P} = - \frac{\left\{ \delta_x [(m_y + m_x\theta_{Sx}) (\beta_{Ls} \sigma_x^{ls} + \beta_{Ks} \sigma_x^{sk})] + \delta_y m_x \lambda [\beta_{Ks} \sigma_x^{sk} + \beta_{Ls} (\sigma_x^{ls} - \sigma_x^{lk})] \right\} \theta_{Sx} \hat{F}_s}{\left\{ \delta_x [(\xi + m_x\theta_{Sx}) \varphi + (m_y + m_x\theta_{Sx}) \phi] + \delta_y m_x [(\beta_{Ly} \sigma_y \alpha) \varphi + \lambda \psi] \right\}} \\ + \frac{[\delta_y (m_y + m_x\theta_{Sx}) + \delta_y m_x \lambda \varphi] \hat{S}}{\left\{ \delta_x [(\xi + m_x\theta_{Sx}) \varphi + (m_y + m_x\theta_{Sx}) \phi] + \delta_y m_x [(\beta_{Ly} \sigma_y \alpha) \varphi + \lambda \psi] \right\}}. \quad (13B)$$

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