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Unemployment Reduction in the Presence of a Rural Based Free Trade Zone: Some Policy Implications

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Abstract

Within the framework of an economy characterized by open urban unemployment à la Harris-Todaro, we analyze the effectiveness of a rural based Free Trade Zone (FTZ), established through a subsidy to either domestic or foreign capital, in alleviating unemployment and increasing national income. We establish sufficient conditions under which the establishment of a rural based FTZ leads to a reduction in the absolute level of unemployment in the economy even though it may worsen national income. We also analyze the effect of policy interventions in both the rural and the urban regions of the post-FTZ economy on labor allocations across regions, the absolute level of unemployment and on national income. (JEL Classification: F 21, O18, R30)

I. Introduction

Free trade zones (FTZs)[1] offer an attractive option to the governments of less developed countries (LDCs) unable to completely dismantle existing

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1. Also known as export processing zones (EPZs), duty free zones and enclave sectors.

barriers to free trade and yet seeking avenues to promote exports and diversify their production structure. FTZs are usually set up as enclaves outside the customs territory of the country with the purpose of storing, processing and manufacturing goods without the restrictions and regulations applicable to industries within the customs territory. Some of the incentives offered by the governments to attract foreign firms to locate within an FTZ are: official guarantees that labor employed within an FTZ will not be allowed to unionize, exemption from duties on imported intermediate goods, tax holidays and domestic capital subsidies to the firms located within the FTZ. Foreign firms thus located promote industrialization, expand employment opportunities, introduce advanced technology into the host country and establish linkages with the rest of the economy through purchases of domestically produced intermediate goods to be used as inputs in the FTZs.[2]

LDCs have also been known to establish FTZs in either the rural (*e.g.*, *maquiladoras* in Mexico) or the urban (*e.g.*, the Masan EPZ in South Korea and the Santa Cruz EPZ in India) regions of the economy. The establishment of rural based FTZs is guided primarily by the consideration that rural-urban migration being a common phenomenon in LDCs, an FTZ located in the rural region serves to create employment opportunities thereby preventing rural outmigration. An urban based FTZ, on the other hand, only helps to exacerbate urban unemployment. The existing theoretical literature that analyzes the possible benefits of a rural based FTZ, in the form of unemployment reduction and increasing national income, consists of two recent papers by Miyagiwa [1993] and Datta-Choudhuri and Adhikari [1993]. Under the condition that the urban sector is relatively more capital abundant[3] than the rural sector, both these papers highlight the fact that improvements in national income concur with *increased* unemployment when the tariff imposed on the imported intermediate input employed by the FTZ is either reduced or eliminated.[4]

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2. See Balasubramanyam [1988] and Warr [1987].
3. Capital intensive in the employment adjusted sense.
4. Miyagiwa [1993] and Datta-Choudhuri & Adhikari [1993] both consider an economy characterized by an institutionally fixed urban wage and urban unemployment *à la* Harris-Todaro. However, in Miyagiwa's economy the government establishes an FTZ by *eliminating* the tariff on the imported intermediate good while Datta-Choud-

To the extent that unemployment reduction constitutes a major reason for the establishment of FTZs, particularly rural based ones, it is important to understand why a rural based FTZ exacerbates urban unemployment in the host economy. The answer lies in the theoretical construct of Miyagiwa's and Datta-Choudhuri and Adhikari's papers. In both these papers, the model used to depict the economy is decomposable, *i.e.*, factor prices are determined independently of factor supplies. Under such a situation if domestic capital and labor are perfectly mobile between the urban and the rural sectors of the economy, then a relatively more capital intensive rural sector[5] implies the non-existence of a Harris-Todaro equilibrium. The reasoning is simple. Given the assumption that the economy in question is a price taker in the international commodity markets and that the urban wage is exogenously fixed, the return to domestic capital is determined solely by the urban sector. Once this return is determined, the rural sector being capital intensive is willing to offer a higher wage than the exogenously determined urban wage, thereby leading to a negative rate of unemployment in the economy.[6] Therefore, under the only plausible case, *i.e.*, when the urban sector is relatively more capital intensive in the employment adjusted sense than the rural sector, a rural based FTZ by withdrawing labor out of the domestic sectors leads by virtue of the Rybczynski effect, an expansion of the urban sector output and thus an increase in the probability of finding an urban job. Consequently the absolute level of urban unemployment *increases* in the economy.

On the other hand, the problem of existence associated with the Heckscher-Ohlin-Samuelson type models can be avoided if the economy is depicted instead as a variant of the Ricardo-Viner type.[7] In this scenario, factor prices are no longer independent of factor supplies. However, such a depiction is

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huri & Adhikari consider an economy which establishes an FTZ by *reducing* the tariff on the imported intermediate good used as an input by the FTZ. It should be noted that even though Datta-Choudhuri and Adhikari do not explicitly state that they are considering a rural based FTZ, the fact that labor in the rural sector and the FTZ earn the same wage coupled with their labor market equilibrium condition suggests that the FTZ is rural based.

5. In the employment adjusted sense.
6. The interested reader is referred to Basu [1995].
7. See Miyagiwa [1993], section VII.B.

not without its attendant problems. In particular, the unemployment rate, and therefore the absolute level of unemployment, in this case depends on the endowment of the factor specific to the rural sector (say land). Once the FTZ is established, factor prices and thereby the unemployment rate changes, precluding any comparison between pre and post-FTZ unemployment levels. Therefore, the post-FTZ unemployment rate may turn out to be higher or lower than the pre-FTZ rate depending on whether the economy in question is relatively scarce or abundant in the endowment of land.[8]

Our motivation in this paper is therefore twofold: (i) constructing a simple general equilibrium model that facilitates comparison between the pre and post-FTZ unemployment levels as well as one for which a Harris-Todaro equilibrium exists and (ii) pin down a scenario in which a rural based FTZ *reduces* urban unemployment even in the presence of a capital intensive urban sector. Towards this end, we focus on the situation where a rural based FTZ is established through a subsidy to either domestic or foreign capital used therein. In particular, we show that the establishment of a rural based FTZ reduces the level of unemployment in the economy even though it might worsen national income if the urban sector is relatively more capital intensive than the rural based FTZ. We also show that any subsequent intervention in either the urban or the rural *regions* of the economy helps reduce the level of unemployment further even though their effects on national income may be ambiguous. Labor allocations across the urban and the rural regions of the economy, in response to such policy interventions, however depends crucially on the Allen-Uzawa partial elasticities of substitution between the factors of production used in the FTZ.

The plan of the paper is as follows: In section II. A we develop the basic model and explain its working. Section II. B introduces the FTZ into the economy and compares pre and post-FTZ levels of unemployment and national income. Section III. A analyzes the effectiveness of an increase in the subsidy rate to either (i) domestic capital or (ii) foreign capital in reducing urban unemployment and increasing national income in the post-FTZ economy. Section III. B does the same for a reduction in the tariff rate on the urban commodity while section IV offers some concluding remarks.

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8. See Khan [1982] for a detailed analysis.

II. The Model

A. The Economy without an FTZ

Consider a small open economy ($\mathcal{E}$) with two sectors: the rural and the urban. In this economy, the urban wage is institutionally fixed at $\bar{w}_u$ and is greater than the rural wage w_r. This distortion in the labor market gives rise to rural-urban migration *à la* Harris-Todaro, resulting in the equalization of the expected urban wage to the rural wage in equilibrium. A fraction of the migrating labor force gets employed in the urban sector while the rest are the urban unemployed, U. We shall confine ourselves to the study of an economy with an institutionally fixed urban wage rather than one in which the urban wage is endogenously determined by either a trade union or set by firms to minimize the cost of labor turnovers. This assumption helps us simplify the analysis while focusing on the effectiveness of different policy instruments in achieving their desired objectives. It can, however, be easily checked that our qualitative results would remain unchanged with an endogenous urban wage.

Consider first the rural sector. The rural sector employs only labor and the output-input coefficient in this sector is fixed and equals β (> 0). This is of course a simplifying assumption, and as we shall see later, is necessitated to pin down the pre and post-FTZ unemployment levels. In effect, one may view our analysis as pertaining to an economy in which land is *not* a scarce factor of production.[9] To sharpen focus and for analytical purposes, let us delineate the equations which formalize this economy.

The production functions of the two sectors with the urban sector exhibiting constant returns to scale and positive but diminishing marginal productivity to each factor are:

$$X_r = \beta L_r \tag{1}$$

$$X_u = F_u(L_u, K_u) \tag{2}$$

where X suitably subscripted, denotes the sectoral outputs, respectively, of

9. Sub-Saharan African economies with low rural population densities and relative abundance of land would serve as practical examples.

the rural (r) and the urban (u) sector. The outputs of both these sectors are internationally traded and their international prices are normalized to unity. Both the commodities are produced at a positive output-price vector and perfect competition prevails in the economy. The price equals unit cost equations are thus,

$$\beta = w_r \tag{3}$$

$$1 + t = C_u(\bar{w}_u, R); \quad 0 < t < 1 \tag{4}$$

where t is the ad-valorem tariff on the urban commodity.

Labor market equilibrium condition is given by:

$$(1 + \lambda) w_r = \bar{w}_u \tag{5}$$

Where, $\lambda(=\frac{U}{L_u})$, is the unemployment rate and is denoted by the ratio of the urban unemployed to those employed in the urban sector. The probability of employment in the domestic urban sector is therefore given by,

$$\frac{1}{1+\lambda} \Leftrightarrow \frac{L_u}{L_u + U}$$

Finally, the material balance equations are:

$$L_u + L_r + U = \mathcal{L} \tag{6}$$

$$K_u = \mathcal{K} \tag{7}$$

The specifications of our model is thus complete. Note that the unemployment rate is known since β (and hence w_r) is given while equation (4) determines R. Once w_r is known, L_r is determined and equation (6) determines L_u and hence U.

(a) Pre-FTZ Unemployment Level

Since $w_r = \beta$, manipulation of equation (5) yields

$$\lambda^o = \frac{\bar{w}_u - \beta}{\beta}$$

where the superscript o denotes pre-FTZ level of the variable in question. The absolute level of unemployment, U^o equals $\lambda^o L_u^o$. However, $L^o_u = a_{L_u} X_u^o$

and $X_u^o = \frac{\mathcal{K}}{a_{Ku}}$, where a_{iu}, $i = L, K$ denotes the input-output coefficient of the urban sector with respect to labor and capital respectively. Substituting for λ^o and L_u^o yields,

$$U^0 = \frac{(\overline{w}_u - \beta)}{\beta} \frac{a_{L_u}}{a_{K_u}} \mathcal{K}$$

(b) Pre-FTZ National Income

Let $\mathcal{V}^o$ denote pre-FTZ national income. Welfare is measured by a concave utility function $\mathcal{U}(.)$ which is defined on domestic consumption (C_r, C_u). Therefore, the minimum expenditure required to reach a level of welfare $\overline{\mathcal{U}}$ is given by $g(P_r, P_u, \overline{\mathcal{U}})$. It is well known that g is (i) positively homogenous of degree one in prices, (ii) concave function of prices and (iii) that $g_n = \frac{\partial g}{\partial P_n} = C_n$, $n = r, u$. In addition, the assumption that both goods being normal implies that $g_n O = \frac{\partial^2 g}{\partial P_n \partial \overline{\mathcal{U}}}$ are positive. National income in the pre-FTZ economy is therefore written as:

$$\mathcal{V}^o = (1+t)X_u^o + X_r^o + t(g_u^o - X_u^o)$$

where $t(g_u^o - X_u^o)$ is the tariff revenue.

Substituting for L_r and L_u in equation (6) we get:

$$(1+\lambda)a_{L_u} X_u + \frac{X_r}{\beta} = \mathcal{L}$$

Now $a_{L_u} X_u^o = \mathcal{K}$. Substituting for λ^o and X_u^o into the above equation and rearranging gives

$$X_r^0 = \beta\mathcal{L} - \frac{a_{L_u}}{a_{K_u}} \overline{w}_u \mathcal{K}$$

Therefore

$$\mathcal{V}^0 = (1+t)\frac{\mathcal{K}}{a_{K_u}} + \beta\mathcal{L} - \frac{a_{L_u}}{a_{K_u}} \overline{w}_u \mathcal{K} + t(g_u^0 - X_u^0)$$

B. The Economy with an FTZ

Consider now the scenario where the government of economy $\mathcal{E}$, by creating an additional distortion in the form of a subsidy to either domestic or foreign capital, disaggregates the rural region into a rural sector and an

FTZ. The wage prevailing in the FTZ (located in the rural region) and the rural sector is the same, w_r ($< \bar{w}_u$).[10] The internationally traded FTZ commodity is again produced under constant returns to scale with diminishing marginal productivity to domestic and foreign capital. The production function of this sector is given by

$$X_e = F_e(L_e, K_e, K_f) \tag{8}$$

The use of foreign capital (K_f) is restricted only to the FTZ. Foreign capital embodies the necessary foreign technology and know-how and is both specific to and indispensable for the production of the FTZ commodity. Further, all three inputs are substitutes of one another in the production process. The price equals unit cost equation of this sector, with its international price normalized to unity, is given by

$$1 = C_e(w_r, R_e, \tilde{R}_f) \tag{9}$$

where R_e ($< R$) is the return to domestic capital used in the FTZ and $\tilde{R}_f$ is the *effective* return to foreign capital. The amount of foreign capital required by the FTZ is demand determined. We shall follow Miyagiwa (*op. cit*) and assume that foreign investors regard investing in a developing country risky. Therefore, an increasingly higher return is needed to induce an additional unit of foreign investment. As a result, the host economy faces a convex supply schedule for foreign capital given by:

$$K_f = K_f(\tilde{R}_f) \quad K_f' > 0, \quad K_f'' > 0 \tag{10}$$

where R_f is the *true* return to foreign investment in economy $\mathcal{E}$. Note that in the absence of a subsidy to foreign capital, $\tilde{R}_f = R_f$. When foreign investment is subsidized at a rate $\eta > 0$ then, $\tilde{R}_f = R_f(1+\eta)$. Finally the earnings on foreign capital are fully repatriated. Now since $\tilde{R}_f$ is negatively related to both β and R_e, equation (10) can be rewritten as:

$$K_f = K_f(\beta, R_e) \; K_{f_1} < 0, K_{f_2} < 0$$

Consider now the case where domestic capital in the zone is subsidized at

10. The rural sector and the FTZ constitutes the rural region of the economy while the urban sector and the urban unemployed constitute the urban region respectively.

the rate α. The subsidy to domestic capital lowers the return on domestic capital to FTZ producers vis-a-vis their urban counterparts and helps initially to attract foreign capital for the establishment of an FTZ. The equilibrium condition in the domestic capital market is therefore given by:

$$R = (1 + \alpha)R_e; \quad 0 < \alpha < 1. \tag{11}$$

Note that either (i) $\eta > 0$ and $\alpha = 0$ or (ii) $\eta = 0$ and $\alpha > 0$. Again, since domestic capital is mobile between the urban sector and the FTZ while labor is freely mobile between the three sectors, the material balance equations (6) and (7) are rewritten as:

$$L_e + L_u + L_r + U = \mathcal{L} \tag{12}$$

$$K_e + K_u = \mathcal{K} \tag{13}$$

Equations (1) - (5) and (8) - (13) completely characterize the post-FTZ economy. In this economy we need to additionally determine R_e, $\tilde{R}_f$, K_e, L_e, K_f and X_e. Note that equation (11) determines R_e and therefore equation (9) determines $\tilde{R}_f$. Once $\tilde{R}_f$ is known equation (10) determines K_f. With β and R_e given, L_e, K_e and hence X_e is determined.

(a) Post-FTZ Unemployment Level

First note that since $\bar{w}_u$ and β are constants, the unemployment rate in the post-FTZ economy is the same as that of the pre-FTZ economy.[11] The absolute level of unemployment, U^p is however different.[12] The reason being that X_u is different in the post-FTZ economy. Recall that $\bar{\lambda} a_{L_u} X_u^p = U^p$. Now once the FTZ is established, through a subsidy to either domestic or foreign capital, there is an outflow of domestic capital from the urban sector into the FTZ. By virtue of our assumption of constant returns to scale, there is a corresponding outflow labor from the urban sector (note that the input-output coefficients in the urban and the rural sectors remain unchanged in the post-FTZ economy since factor prices in these two sectors are unchanged). Since, $X_u^p = \frac{\mathcal{K}}{a_{K_u}} - \frac{a_{K_e} K_f}{a_{K_f e} a_{K_u}}$ the absolute level of unemployment in the post-FTZ

11. We shall denote $\lambda^o = \lambda^p = \bar{\lambda}$.

12. The superscript p denotes post-FTZ value of the variable in question.

economy is

$$U^{\flat} = (\frac{\overline{w}_u - \beta}{\beta})\frac{a_{L_u}}{a_{K_u}}[\mathcal{K} - \frac{a_{K_e}}{a_{K_f e}}K_f]$$

Comparison between pre and post-FTZ unemployment levels thus yields

$$U^{o} - U^{\flat} = (\frac{\overline{w}_u - \beta}{\beta})\frac{a_{L_u}a_{K_e}}{a_{K_u}a_{K_f e}}K_f > 0$$

We have therefore the following proposition:[13]

Proposition 1: *The absolute level of unemployment falls unambiguously once the rural based FTZ is established in economy $\mathcal{E}$ through a subsidy to either domestic or foreign capital.*

(b) Post-FTZ National Income

Before proceeding to analyze post-FTZ national income let us start with the following definition:

Definition 1: *In economy $\mathcal{E}$, the urban sector is said to be relatively more capital (labor) intensive, in the employment adjusted sense, than the rural based FTZ if and only if*

$$k_u = \frac{K_u}{(1+\lambda)L_u} > (<)\frac{K_e}{L_e} = k_e$$

I. Consider now the post-FTZ economy in which the FTZ is established through a subsidy to domestic capital, *i.e.*, $\alpha > 0$ and $\eta = 0$. The establishment of the FTZ causes domestic capital and labor to move out from the urban sector to the FTZ leading to a fall in the urban sector output and an increase in the FTZ output. The effect of establishing a rural based FTZ on the rural output, however, requires a detailed elucidation. Suppose that the urban sector is relatively more capital intensive, in the employment adjusted sense, than the FTZ. In this case, the urban region releases relatively more capital than labor. The demand for extra labor in the FTZ is met by an exodus of labor from the rural sector leading to a fall in the rural sector output. Conversely, when the urban sector is relatively more labor intensive, in the employment adjusted sense, rural sector output increases.

13. Detailed derivations of propositions 1 and 2 are provided in Appendix A

Therefore, national income in the post-FTZ economy in this case is given by:

$$V^p = (1+t)X_u^p + X_r^p + X_e + t(g_u^p - X_u^p) - \alpha R_e K_e$$

The fourth and the last term on the right hand side are respectively the tariff revenue and the subsidy cost of domestic capital used in the FTZ. Comparison of pre and post-FTZ national income is now easy:

$$\mathcal{V}^o - \mathcal{V}^p = (1+t)[X_u^o - X_u^p] + [X_r^o - X_r^p] - X_e + t[X_u^o - X_u^p] + \alpha R_e K_e$$

Noting that $g_u^o = g_u^p$ and simplifying we get:

$$\mathcal{V}^o - \mathcal{V}^p = [X_u^o - X_u^p] + [X_r^o - X_r^p] - X_e + \alpha R_e K_e$$

As noted above, the first term on the right hand side of the above equation is positive as is the second term if the urban sector is relatively more capital intensive, in the employment adjusted sense, than the rural based FTZ. However, we can only say that post-FTZ national income is lower if the decline in the urban sector output overweighs the increase in the FTZ output such that the net effect of $X_u^o - X_u^p - X_e$ is positive. A sufficient condition for this to happen is that the amount of domestic capital used per unit of the FTZ output is greater than or equal to the corresponding amount used per unit of the urban sector output, *i.e.*, $a_{K_e} \geq a_{K_u}$.

II. Under the situation where $\eta > 0$ and $\alpha = 0$ or where the FTZ is established through a subsidy to foreign capital, our analysis above remain unchanged except that the post-FTZ national income in this case is written as:

$$\mathcal{V}^p = (1+t)X_u^p + X_r^p + X_e + t(g_u^p - X_u^p) - \eta R_f K_f$$

where $\eta R_f K_f$ is now the subsidy payment to foreign capital. We end this section with the following proposition:

Proposition 2: *National income falls in economy $\mathcal{E}$ once a rural based FTZ is established through a subsidy to either domestic or foreign capital if (i) the urban sector of the economy is relatively more capital intensive, in the employment adjusted sense, then the FTZ and if (ii) the amount of domestic capital used per unit of the FTZ output is greater than the corresponding amount used per unit of the urban sector output.*

III. Unemployment Reduction in the Presence of a Rural Based FTZ

In this section we shall concern ourselves solely with the post-FTZ economy characterized by equations (1) - (5) and (8) - (13). Our purpose is to analyze the effectiveness of policy interventions by the government of the host economy in the rural and the urban regions of the economy to further reduce unemployment. We shall also identify the conditions under which national income may worsen relative to the *initial* post-FTZ level.

A. Targeting the Rural Region

We shall begin focusing on the effectiveness of an increase in the subsidy rate to either domestic or foreign capital in reducing urban unemployment and improving national income. Before proceeding further, let us define σ_{ij}^{e} as the Allen-Uzawa partial elasticity of substitution between the factors of production in the FTZ.[14]

I. An increase in the subsidy rate to domestic capital.

We begin by stating the following proposition.[15]

Proposition 3: *An increase in the subsidy rate to domestic capital used in the rural based FTZ, decreases employment in the urban sector. Employment in the FTZ increases if* $\sigma_{KK_f}^{e} \geq \sigma_{KL}^{e}$. *Employment in the rural sector increases if (i) the FTZ is relatively more capital intensive, in the employment adjusted sense, than the urban sector and if (ii)* $\sigma_{KK_f}^{e} \geq \sigma_{KL}^{e} \geq \sigma_{LK_f}^{e}$. *The absolute level of unemployment decreases unambiguously in economy* $\mathcal{E}$.

An increase in the subsidy rate leaves unchanged the rural wage, unemployment rate and the return to domestic capital in the urban sector. The return to domestic capital used in the zone decreases proportionately and therefore the return to effective (true)[16] foreign capital increases. The latter two effects lead to an inflow of both domestic and foreign capital into the

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14. For instance, $\sigma_{LK_f}^{e}$ denotes the partial elasticity of substitution between labor and foreign capital in the zone.
15. Detailed derivations of all propositions in this section are presented in Appendix B.
16. In this case the effective return equals the true return.

zone leading to an increase in the FTZ output. The ensuing outflow of domestic capital (and therefore labor) leads to a fall in the urban sector output. Now, employment in the FTZ may or may not increase. The first effect of the subsidy is to lower the return to domestic capital in the zone *vis-a-vis* labor and foreign capital, thereby causing a substitution away from these latter two factors. On the other hand, since there is an inflow of foreign and domestic capital into the zone, expansion of the FTZ output entails an increase in labor usage. The net effect on employment is therefore positive if the Allen-Uzawa partial elasticity of substitution between domestic and foreign capital is greater than the corresponding partial elasticity of substitution between domestic capital and labor. An increase in the subsidy rate in this case leads to foreign capital being substituted to a larger degree than labor by domestic capital in the production of the FTZ commodity. Note that employment also increases in the FTZ if domestic capital is separable from the other two inputs in the production process, *i.e.*, the Allen-Uzawa partial elasticities between domestic capital and labor and between domestic and foreign capital are identical. Suppose now that $\sigma^e_{LK_f} \leq \sigma^e_{KL} \leq \sigma^e_{KK_f}$. Under this situation an increase in the subsidy to domestic capital leads to a relatively greater degree of substitution away from labor in the FTZ leading to a greater amount of labor being absorbed by the rural sector – a phenomenon that is reinforced if the FTZ is relatively more capital intensive in the employment adjusted sense than the urban sector, as discussed in section II. B. a. If however, the urban sector is relatively more capital intensive then there is an outflow of labor from the rural sector, leaving ambiguous the net level of employment in the rural sector. The absolute level of unemployment falls unambiguously since there is an exodus of labor from the urban to the rural region.

Proposition 4: *With full repatriation of the earnings on foreign capital, an increase in the subsidy rate on domestic capital used in the FTZ decreases national income in economy $\mathcal{E}$ if the increase in tariff revenue is "small".*

National income, when domestic capital is subsidized at the rate α can be written as:[17]

17. Henceforth we drop the postscript p.

$$\mathcal{V} = (1+t)X_u^p + X_r^p + X_e + t(g_u^p - X_u^p) - \alpha R_e K_e$$

By the assumption of constant returns to scale and perfect competition and substituting for R from equation (11), the above equation can be rewritten as:

$$\mathcal{V} = w_r \mathcal{L} + (1+\alpha)R_e K_u + (1-\alpha)R_e K_e + t(g_u - X_u)$$

An increase in the subsidy rate leads to a proportionate decline in the return to domestic capital used in the FTZ as well as a decline in the domestic capital usage in the urban sector entailing a fall in the urban sector output. Further, the increase in the subsidy rate leads to a loss of national income due to increased subsidy payments on domestic capital used in the FTZ. Since consumption of the urban commodity remains unchanged, imports of the urban sector commodity increases, leading to an increase in the tariff revenue. National income worsens if the decline in factor income and the increased subsidy payments taken together, is sufficient to overweigh the positive effect of an increased tariff revenue on national income. A sufficient condition for this to happen is that either (i) the tariff rate is "small" or (ii) the elasticity of the urban sector output with respect to the subsidy rate on domestic capital is "small".

II. An increase in the subsidy rate to foreign capital.

In this case $\eta > 0$ and $\alpha = 0$. We start with the following proposition.

Proposition 5: *An increase in the subsidy rate to foreign capital used in the rural based FTZ decreases employment in the urban sector and increases employment in the FTZ. Employment in the rural sector increases if (i) the FTZ is relatively more capital intensive, in the employment adjusted sense, than the urban sector and if (ii)* $\sigma_{KK_f}^e \geq \sigma_{LK_f}^e$. *The absolute level of unemployment decreases unambiguously in economy* $\mathcal{E}$.

An increase in the subsidy to foreign capital used in the zone leads to an increase in the inflow of foreign capital which in turn engenders a proportionate increase in the demand for labor and domestic capital. FTZ output increases while urban sector output falls. Employment (and thus output) rises in the rural sector if the FTZ is relatively more capital intensive, in the

employment adjusted sense, than the urban sector and if foreign and domestic capital are better substitutes of one another than foreign capital and labor in the production of the FTZ commodity. The latter effect reinforces the former because the increased inflow of foreign capital displaces domestic capital relatively more from the rural region than labor. The absolute level of unemployment falls in response to the exodus of labor from the urban to the rural region.

Proposition 6: *With full repatriation of the earnings on foreign capital, an increase in the subsidy rate on foreign capital used in the FTZ decreases national income in economy $\mathcal{E}$ if the increase in tariff revenue is "small".*

National income, when foreign capital is subsidized at the rate η is written as:

$$\mathcal{V} = w_r \mathcal{L} + R\mathcal{K} - \eta R_f K_f + t(g_u - X_u)$$

Note that R_f, the true return to foreign capital, remains unchanged when the subsidy to foreign capital is increased. The effective return, however, increases proportionately. An increase in the subsidy payment to foreign capital has two effects: (i) A negative effect on national income due to the increased subsidy payments engendered by an increased inflow of foreign capital and (ii) a positive effect due to the increase in tariff revenue engendered by a fall in the urban sector output with unchanged consumption. It is possible for the first effect to overweigh the second if the tariff rate is small and/or the elasticity of the urban sector output with respect to the subsidy rate on foreign capital is small.

B. Targeting the Urban Region

In section III. A, we have seen that once an FTZ is established in the rural region by providing a subsidy to either domestic or to foreign capital used therein, then targeting the rural region (*i.e.*, by increasing the subsidy rates) reduces urban unemployment. Can the government achieve the same outcome by targeting instead the urban region (*i.e.*, by decreasing the tariff rate on the urban sector)? Before proceeding further, it bears emphasis that reduction in the tariff rate is seldom a feasible option, and as noted in the

Introduction the inability of governments to completely eliminate tariff barriers makes the establishment of FTZs a lucrative alternative to free trade. Therefore, our analysis in this subsection should be construed as one that pertains to "minor adjustments" in the tariff rate. Further, we consider such adjustments only in the presence of an FTZ established through a subsidy to domestic capital. Consider then the following proposition:

Proposition 7: *A decrease in the tariff rate on the urban sector commodity decreases employment in the urban sector. Employment increases in the FTZ if* $\sigma^e_{KK_f} \geq \sigma^e_{KL}$ *and employment increases in the rural sector if (i) the FTZ is relatively more capital intensive, in the employment adjusted sense, then the urban sector and if (ii)* $\sigma^e_{KK_f} \geq \sigma^e_{KL} \geq \sigma^e_{LK_f}$. *The absolute level of unemployment falls unambiguously in economy* $\mathcal{E}$.

A decrease in the tariff rate on the urban commodity decreases the return to domestic capital in the urban sector. This leads to a substitution away from labor towards domestic capital in the urban sector. However, the ensuing proportionate fall in the return to domestic capital in the FTZ increases the return to foreign capital engendering an increase in the inflow of foreign capital. Since domestic capital is now relatively cheaper as compared to the other two factors, there is a substitution away from labor and foreign capital towards domestic capital in the FTZ. This leads to an outflow of domestic capital from the urban sector leading to a fall in its output. If however, the elasticity of substitution between domestic capital and labor is less than the corresponding elasticity of substitution between domestic and foreign capital in the FTZ, then employment increases in the FTZ. The chain of events that leads to an increase in employment in the rural sector is similar to the one explained for proposition 3. Unemployment falls unambiguously due to the exodus of labor from the urban to the rural region.

Proposition 8: *With full repatriation of the earnings on foreign capital, the effect of a decrease in the tariff rate on the urban commodity on national income in economy* $\mathcal{E}$ *is ambiguous if the FTZ is established through a subsidy to domestic capital. If, however, the FTZ is established through a subsidy to foreign capital then national income (i) worsens if the increase in tariff revenue is "small" and (ii) unambiguously worsens if tariff revenue decreases.*

Consider first the case where the FTZ is established through a subsidy to domestic capital. A decrease in the tariff rate reduces the return to domestic capital in both the urban sector and the FTZ. Consequently the effect on subsidy payments is ambiguous since the decrease in the return to domestic capital tends to reduce subsidy payments while the increased inflow of domestic capital into the FTZ tends to increase it. The same is true for tariff revenue. Tariff revenue (i) increases due to increased demand for the urban sector output and a corresponding fall in the urban sector output and (ii) decreases due a lower rate of tariff. However, in the event where the FTZ is established through a subsidy to foreign capital, a decrease in the tariff rate increases subsidy payments by increasing both the return to and the amount of foreign capital. Consequently national income decreases if the increase in tariff revenue is small. On the other hand, national income unambiguously decreases if tariff revenue falls.

IV. Conclusion

We have shown in this paper that the establishment of a rural based FTZ through a subsidy to either domestic or foreign capital reduces the level of unemployment in the economy and worsens national income if (i) the urban sector is relatively more capital intensive in the employment sense than the FTZ and if (ii) the amount of domestic capital used per unit of the FTZ output is greater than or equal to the corresponding amount used per unit of the urban sector output. In effect, our paper provides a result counter to that posited by Miyagiwa (*op. cit*) where establishment of a rural based FTZ leads to increased unemployment in the economy, even though national income may increase. It should, however, be noted that for reasons explained in the *Introduction*, our model is restrictive in the sense that it pertains to a land abundant economy.

Subsequently, we have shown that further interventions in the urban or the rural regions of the economy helps reduce urban unemployment in the post-FTZ economy even though the effect on national income is in general ambiguous. Note however that we have not considered the effect of a technological improvement in the rural sector (an increase in β) on the unemployment level in the post-FTZ economy. The reason being that the effect of

such an improvement is ambiguous. A technological improvement, on one hand, reduces the unemployment rate by increasing proportionately the rural wage. On the other hand, the ensuing fall in the employment levels in both the rural sector and the FTZ causes an exodus of labor to the urban region. The net effect on the urban unemployment level is therefore ambiguous.

Finally, throughout this paper we have not considered explicitly the sources of financing the subsidies and have assumed that non-distortionary or lump-sum taxation is available to any desired extent. It would be an interesting exercise to check how our results are modified when the sources of financing the subsidy are explicitly considered. Also, even though we have shown that an increase in the subsidy rate to either domestic or foreign capital as well as a decrease in the tariff rate on the urban commodity help reduce unemployment in the economy, we have not provided a ranking between the three policies, possible extensions we leave for future research.

Appendix A

Denoting a_{i_n} $i = K_f, K, L$ and $n = e, u, r$ as the amount of the ith input used in the production of the nth sector output, we can solve equations (10), (12) and (13) for the output levels of the three sectors in the post-FTZ economy. Noting that the input-output coefficients are unchanged in the post-FTZ economy since factor prices have remained unchanged we have:

$$\begin{bmatrix} (1+\lambda)a_{L_u} & a_{L_e} & a_{L_r} \\ a_{K_u} & a_{K_e} & 0 \\ 0 & a_{K_{fe}} & 0 \end{bmatrix} \begin{bmatrix} \hat{X}_u \\ \hat{X}_e \\ \hat{X}_r \end{bmatrix} = \begin{bmatrix} \mathcal{L} \\ \mathcal{K} \\ K_f(\beta, R_e) \end{bmatrix}$$

The determinant of the above matrix is

$$|\Omega| = a_{L_r} a_{K_u} a_{K_{fe}} > 0$$

Therefore we have:

$$X_u = \frac{\mathcal{K}}{a_{K_u}} - \frac{a_{K_e}}{a_{K_u} a_{K_{fe}}} K_f$$

$$X_e = \frac{K_f}{a_{K_{fe}}}$$

$$X_r = \frac{(1+\lambda)a_{L_u}a_{L_e}}{a_{L_r}a_{K_u}a_{K_{fe}}}(k_e - k_u)K_f + \frac{1}{a_{L_r}a_{K_u}}(a_{K_u}\mathcal{L} - (1+\lambda)a_{L_u}\mathcal{K})$$

Proof of Proposition 1:

Since $U = \lambda L_u$ and $\lambda^o = \lambda^p = \bar{\lambda}$, we have

$$U^o - U^p = \bar{\lambda}(L_u^o - L_u^p) = \bar{\lambda}a_{L_u}(X_u^o - X_u^p)$$

$$= \frac{(\bar{w}_u - \beta)}{\beta}\frac{a_{L_u}a_{K_e}}{a_{K_u}a_{K_{fe}}}K_f > 0$$

Proof of Proposition 2:

Change in national income due to the establishment of an FTZ, through a subsidy to domestic capital can be analyzed as follows:

$$\mathcal{V}^o - \mathcal{V}^p = (X_u^o - X_u^p) - X_e + (X_r^o - X_r^p) + \alpha R_e K_e$$

Now

$$(X_u^o - X_u^p) = \frac{a_{K_e}}{a_{K_u}a_{K_{fe}}}K_f$$

$$X_e = \frac{K_f}{a_{K_{fe}}}$$

$$(X_r^o - X_r^p) = \frac{\beta a_{K_e}}{a_{K_{fe}}}(\frac{1}{k_e} - \frac{1}{k_u})K_f$$

Substituting and rearranging we get:

$$\mathcal{V}^o - \mathcal{V}^p = \frac{K_f}{a_{K_{fe}}}(\frac{a_{K_e}}{a_{K_u}} - 1) + \frac{\beta a_{K_e}}{a_{K_{fe}}}(\frac{1}{k_e} - \frac{1}{k_u})K_f + aR_eK_e$$

The above expression is positive if (i) $k_u > k_e$ and if (ii) $a_{Ke} \geq a_{K_u}$.

Similarly, when the FTZ is established through a subsidy to foreign capital we have:

$$\mathcal{V}^o - \mathcal{V}^p = \frac{K_f}{a_{K_{fe}}}\left(\frac{a_{K_e}}{a_{K_u}} - 1\right) + \frac{\beta a_{K_e}}{a_{K_{fe}}}\left(\frac{1}{k_e} - \frac{1}{k_u}\right)K_f + \eta R_f K_f$$

again the above expression is positive if (i) $k_u > k_e$ and if (ii) $a_{K_e} \geq a_{K_u}$.

Appendix B

In this appendix since all variables refer to post-FTZ values, we drop the superscript p from all the variables.

Using equations (4), (5) and (9) along with the Wong-Viner Theorem, we get;

$$\begin{bmatrix} 0 & \theta_{K_u} & 0 \\ 0 & \theta_{K_e} & \theta_{K_{fe}} \\ -1 & 0 & 0 \end{bmatrix} \begin{bmatrix} \hat{\lambda} \\ \hat{R} \\ \hat{\tilde{R}}_f \end{bmatrix} = \begin{bmatrix} \hat{t} \\ \theta_{K_e}\hat{\alpha} - \theta_{K_{fe}}\hat{\eta} \\ \hat{\beta} \end{bmatrix}$$

$\mathcal{D}$, the determinant of the above matrix is denoted by,

$$|\mathcal{D}| = -\theta_{K_u}\theta_{K_{fe}} < 0$$

Where a circumflex over a variable denotes proportional change ($\frac{dq}{q} = \hat{q}$). However, $\hat{t} = \frac{dt}{(1+t)}$, $\lambda = \frac{d\lambda}{(1+\lambda)}$, $\eta = \frac{d\eta}{(1+\eta)}$ and $\hat{\alpha} = \frac{d\alpha}{(1+\alpha)}$. Finally, the θ's suitably subscripted denotes the share of the factor in the unit cost of the commodity in question.

Also note that $\tilde{R}_f$ is the *effective* return to foreign capital. Applying Cramer's rule to the above matrix we get:

$$\frac{\hat{\lambda}}{\hat{t}} = \frac{\hat{\lambda}}{\hat{\eta}} = \frac{\hat{\lambda}}{\hat{\alpha}} = 0$$

$$\frac{\hat{R}}{\hat{t}} = \frac{1}{\theta_{K_u}} > 0, \quad \frac{\hat{R}}{\hat{\alpha}} = \frac{\hat{R}}{\hat{\eta}} = 0$$

Since $\hat{R} = \hat{R}_e + \hat{\alpha}$, we have therefore:

$$\frac{\hat{R}_e}{\hat{t}} = \frac{1}{\theta_{K_u}} > 0, \quad \frac{\hat{R}_e}{\hat{\alpha}} = -1, \quad \frac{\hat{R}_e}{\hat{\eta}} = 0$$

$$\frac{\hat{\bar{R}}_f}{\hat{t}} = -\frac{\theta_{K_e}}{\theta_{K_u}\theta_{K_{fe}}} < 0, \quad \frac{\hat{\bar{R}}_f}{\hat{\alpha}} = \frac{\theta_{K_e}}{\theta_{K_{fe}}} > 0, \quad \frac{\hat{\bar{R}}_f}{\hat{\eta}} = 1 > 0$$

Using equations (10), (12) and (13) and substituting for U in equation (10), we get

$$\begin{bmatrix} (1+\lambda)L_u & L_e & L_r \\ K_u & K_e & 0 \\ 0 & K_f & 0 \end{bmatrix} \begin{bmatrix} \hat{L}_u \\ \hat{L}_e \\ \hat{L}_r \end{bmatrix} = \begin{bmatrix} 0 \\ -K_u(\hat{a}_{K_u} - \hat{a}_{L_u}) - K_e(\hat{a}_{K_e} - \hat{a}_{L_e}) \\ K_f\{\epsilon_{R_e}\hat{R}_f - (\hat{a}_{K_{fe}} - \hat{a}_{L_e})\} \end{bmatrix}$$

The determinant of the above matrix is

$$|Q| = L_r K_u K_f > 0$$

and where

$$\hat{\alpha}_{K_u} - \hat{\alpha}_{L_u} = \sigma^u_{LK}(\hat{\bar{w}}_u - \hat{R})$$

$$\hat{\alpha}_{K_e} - \hat{\alpha}_{L_e} = \theta_{L_e}(\sigma^e_{LK} - \sigma^e_{LL})\hat{w}_r + \theta_{K_e}(\sigma^e_{KK} - \sigma^e_{LK})\hat{R}_e + \theta_{K_{fe}}(\sigma^e_{KK_f} - \sigma^e_{LK_f})\hat{\bar{R}}_f$$

$$\hat{\alpha}_{K_{fe}} - \hat{\alpha}_{L_e} = \theta_{L_e}(\sigma^e_{LK_f} - \sigma^e_{LL})\hat{w}_r + \theta_{K_e}(\sigma^e_{KK_f} - \sigma^e_{LK})\hat{R}_e + \theta_{K_{fe}}(\sigma^e_{K_fK_f} - \sigma^e_{LK_f})\hat{\bar{R}}_f$$

Substituting the above into the right hand side of the employment matrix and noting that (i) $\sigma^e_{ii} < 0$, $i = L, K, K_f$ and (ii) $\epsilon_{R_e} < 0$ is the elasticity of foreign capital inflow with respect to the return to domestic capital used in the FTZ, we get:

Proof of Proposition 3:

$$\frac{\hat{L}_u}{\hat{\alpha}} = \frac{K_e\theta_{K_e}}{K_u}\{\sigma^e_{KK} + \sigma^e_{K_fK_f} - 2\sigma^e_{KK_f}\} + \frac{K_e}{K_u}\epsilon_{R_e} < 0$$

$$\frac{\hat{L}_e}{\hat{\alpha}} = -\epsilon_{R_e} + \theta_{K_e}\{(\sigma^e_{KK_f} - \sigma^e_{KL}) - \sigma^e_{K_fK_f} + \sigma^e_{LK_f}\}$$

$$\frac{\hat{L}_r}{\hat{\alpha}} = \frac{(1+\lambda)L_u}{L_rK_u}\{L_e(k_e - k_u)[-\epsilon_{R_e} + \theta_{K_e}((\sigma^e_{KK_f} - \sigma^e_{KL}) - \sigma^e_{K_fK_f} + \sigma^e_{LK_f})]$$
$$+ K_e\theta_{K_e}(\sigma^e_{KK_f} + (\sigma^e_{KL} - \sigma^e_{LK_f}) - \sigma^e_{KK})\}$$

Now $\frac{\hat{L}_e}{\hat{\alpha}}$ is positive if $\sigma^e_{KK_f} \geq \sigma^e_{KL}$ and $\frac{\hat{L}_r}{\hat{\alpha}}$ is positive if (i) $k_e > k_u$ and if (ii) $\sigma^e_{KK_f} \geq \sigma^e_{KL} \geq \sigma^e_{LK_f}$. If instead, $k_e < k_u$ then the effect of an increase in the subsidy rate to domestic capital used in the FTZ on rural sector employment is ambiguous. Now totally differentiating $\lambda L_u = U$, we get:

$$\hat{L}_u - \frac{(1+\lambda)}{\lambda}\hat{\beta} = \hat{U}$$

Substituting for $\hat{L}_u$ we get

$$\frac{\hat{U}}{\hat{\alpha}} = \frac{\hat{L}_u}{\hat{\alpha}} < 0.$$

Proof of Proposition 5:

$$\frac{\hat{L}_u}{\hat{\eta}} = \frac{K_e\theta_{K_{fe}}}{K_u}\{\sigma^e_{K_fK_f} - \sigma^e_{KK_f}\}$$

$$< 0$$

$$\frac{\hat{L}_e}{\hat{\eta}} = -\theta_{K_{fe}}\{\sigma^e_{K_fK_f} - \sigma^e_{LK_f}\}$$

$$> 0$$

$$\frac{\hat{L}_r}{\hat{\eta}} = \frac{(1+\lambda)L_uL_e\theta_{K_{fe}}}{L_rK_u}\{\sigma^e_{K_fK_f}(k_u - k_e) - (k_u\sigma^e_{LK_f} - k_e\sigma^e_{KK_f})\}$$

$\frac{\hat{L}_r}{\hat{\eta}}$ is positive if (i) $k_e > k_u$ and if (ii) $\sigma^e_{KK_f} \geq \sigma^e_{LK_f}$. If instead, $k_e < k_u$, then the effect of an increase in the subsidy rate to foreign capital on rural sector employment is ambiguous.

Substituting for $\hat{L}_u$ we get

$$\frac{\hat{U}}{\hat{\eta}} = \frac{\hat{L}_u}{\hat{\eta}} < 0.$$

Proof of Proposition 7:

$$\frac{\hat{L}_u}{\hat{t}} = -\frac{K_e\theta_{K_e}}{K_u\theta_{K_u}}\{\sigma^e_{KK} + \sigma^e_{K_fK_f} - 2\sigma^e_{KK_f}\} - \frac{1}{\theta_{K_u}}\{\frac{K_e}{K_u}\epsilon_{R_e} - \sigma^u_{LK}\} > 0$$

$$\frac{\hat{L}_e}{\hat{t}} = \frac{\epsilon_{R_e}}{\theta_{K_u}} - \frac{\theta_{K_e}}{\theta_{K_u}}\{(\sigma^e_{KK_f} - \sigma^e_{KL}) - \sigma^e_{K_fK_f} + \sigma^e_{LK_f}\}$$

$$\frac{\hat{L}_r}{\hat{t}} = \frac{(1+\lambda)L_u}{\theta_{K_u}L_rK_u}\{L_e(k_e - k_u)[\epsilon_{R_e} - \theta_{K_e}((\sigma^e_{KK_f} - \sigma^e_{KL}) - \sigma^e_{K_fK_f} + \sigma^e_{LK_f})]$$
$$- K_e\theta_{K_e}(\sigma^e_{KK_f} + (\sigma^e_{KL} - \sigma^e_{LK_f}) - \sigma^e_{KK}) - K_u\sigma^u_{LK}\}$$

Now $\frac{\hat{L}_e}{\hat{t}}$ is positive if $\sigma^e_{KK_f} \geq \sigma^e_{KL}$ and $\frac{\hat{L}_r}{\hat{t}}$ is positive if (i) $k_e > k_u$ and if (ii) $\sigma^e_{KK_f} \geq \sigma^e_{KL} \geq \sigma^e_{LK_f}$. If instead, $k_e < k_u$ then the effect of a decrease in the tariff rate on rural sector employment is ambiguous.

Substituting again for $\hat{L}_u$ we get

$$\frac{\hat{U}}{\hat{t}} = \frac{\hat{L}_u}{\hat{t}} < 0.$$

Proof of Proposition 4:

National Income ($\mathcal{V}$) for the economy ($\mathcal{E}$) can also be written (when domestic capital to the FTZ is subsidized at the rate t) and when the earnings on foreign capital is fully repatriated, as follows,

$$\mathcal{V}|_{\eta=0} = w_rL + (1-\alpha)R_e\mathcal{K} + 2\alpha R_eK_u + t(g_u - X_u)$$

Totally differentiating the above equation with respect to α and noting that $\hat{K}_u = \hat{X}_u$ we get:

$$\left.\frac{d\mathcal{V}}{d\alpha}\right|_{\eta=0} = -\frac{1}{\alpha}R_e\mathcal{K} + 2R_eK_u\frac{\hat{X}_u}{\hat{\alpha}} - t\frac{X_u}{\alpha}\frac{\hat{X}_u}{\hat{\alpha}}$$

The first two terms are negative while the last term is positive. National income may decrease if either (i) t is small or (ii) the elasticity of the urban sector output with respect to the subsidy rate on domestic capital, ($\frac{\hat{X}_u}{\hat{\alpha}}$), is small, such that the combined effect of the first two terms outweigh the last term above.

Proof of Proposition 6:

When the FTZ is established through a subsidy to foreign capital (and the earnings on foreign capital is repatriated fully), we have:

$$\mathcal{V}|_{\alpha=0} = w_rL + R\mathcal{K} - \eta R_fK_f + t(g_u - X_u)$$

Totally differentiating the above equation with respect to η and noting that (i) $\hat{K}_u = \hat{X}_u$ and (ii) $\frac{dR_f}{d\eta} = 0$, *i.e.*, the true return remains unchanged when the subsidy to foreign capital is increased, we get:

$$\left.\frac{d\mathcal{V}}{d\alpha}\right|_{\alpha=0} = -(1+\epsilon_\eta)R_f K_f - t\frac{X_u}{\eta}\frac{\hat{X}_u}{\hat{\eta}}$$

The first term is negative while the last term is positive. Note that $\epsilon_\eta > 0$ is the supply elasticity of foreign capital with respect to the subsidy rate on foreign capital. National income may therefore decrease if either (i) t is small or (ii) the elasticity of the urban sector output with respect to the subsidy rate on foreign capital, ( ), $\frac{\hat{X}_u}{\hat{\eta}}$ small, such that the first term outweighs the last term above.

Proof of Proposition 8:

We shall only consider the case where $\alpha > 0$ and $\eta = 0$. Noting that in this case $\hat{K}_u = \hat{X}_u - \theta_{L_u}\sigma^u_{LK}\hat{R}$ and that m is the marginal propensity to consume the urban sector commodity, we have:

$$g_o(1-\frac{mt}{(1+t)})\frac{d\mathcal{V}}{dt} = [(1-\alpha)\mathcal{K} + 2\alpha K_u]\frac{R_e}{t}\frac{\hat{R}_e}{\hat{t}} + 2\alpha R_e\frac{K_u}{t}\frac{\hat{X}_u}{\hat{t}}$$

$$-\frac{\theta_{L_u}}{\theta_{K_u}}\sigma^u_{LK} - (1+\epsilon_t^{X_u})X_u$$

First note that $\varepsilon_t^{Xu} > 0$ is the elasticity of the urban sector output with respect to the tariff rate and that $g_O(1 - \frac{mt}{(1+t)}) > 0$. Therefore the first two terms on the right hand side of the above equation are positive while the last two are negative, rendering ambiguous the effect of a decrease in the tariff rate on national income in the presence of a rural based FTZ established through a subsidy to domestic capital.

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