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MINIMUM WAGE AND INCOME DISTRIBUTION IN THE HARRIS-TODARO MODEL

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The purpose of this paper is to examine the effects of a change in the minimum wage on income distribution and employment in a developing economy. The basic framework of our analysis is the original Harris-Todaro model, in which the only factor that is intersectorally mobile is labor. We analyze the effects of a change in the minimum wage on income distribution, sectoral employment and unemployment, both in the framework of a small open economy, and with endogenous commodity-price changes. Our findings differ from the results of the existing literature and shed light on the complex interaction between the urban and the rural sector of a developing economy.

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1. INTRODUCTION

In their celebrated paper Harris and Todaro (1970) presented a simple general equilibrium model of a dual economy, in which the long-run equilibrium is characterized by unemployment in the urban sector. Since its publication the model has been extended in several ways, primarily in the areas of development economics and international trade.[1]

One aspect of the model, however, to which economists have paid limited attention to is the incidence of the minimum wage, which is set institutionally in the urban sector. The effects of setting or changing this minimum wage may be quite important both with respect to the distribution of income and the sectoral allocation of employment. Two notable exceptions to this literature are the work of Imam and Whalley (1985) and

[1] The literature is really vast. One could mention only very few papers that are related to our work. See, for example, Bhagwati, and Srinivasan (1974, 1975), Calvo (1978), Corden and Findlay (1975), Fields (1975) Neary (1981), Bhatia (2002), etc.

Bhatia (2002). Imam and Whalley examine the incidence of the minimum wage in the Harris-Todaro (H-T) framework and related their analysis to the Harberger's analysis of tax incidence.[2] Bhatia, using a model with sector specific but also intersectorally mobile capital, examines the effects of a change in the minimum wage on the sectoral allocation of factors of production. A similar approach is that of Panagariya and Succar (1986) with the additional assumption that there are economies of scale in the urban sector of the economy. Moreover, they examine the effects of changes in the terms of trade and factor endowments.[3]

The purpose of this paper is to examine the effects of a change in the minimum wage on income distribution and employment in the original Harris-Todaro model. By original model we mean that the only factor that is intersectorally mobile is labor. The importance of factor specificities has been stressed by several authors and particularly by Jones (1971) and Neary (1978). Moreover, we adopt the assumption made by Paragariya and Succar (1986) that there are economies of scale in the manufacturing sector of the economy. In the second part of the paper we present the fundamental features of our model and derive the basic relations that will be used for our analysis. In the third section we analyze the effects of a change in the minimum wage on income distribution, sectoral employment and unemployment, both in the framework of a small open economy, and with endogenous commodity-price changes. Finally, we summarize our main findings and attempt to compare them with those of the existing literature.

2. ECONOMIES OF SCALE AND THE HARRIS-TODARO MODEL

Following the two sector general equilibrium analysis, as proposed by Jones (1971), we shall consider an economy consisting of two sectors, the urban and the rural. The urban sector produces a manufacturing good X_M by utilizing a specific factor, capital (K), and a mobile factor, labor (L_M). Moreover, in the production of this good there are economies of scale, which are external to the firms but internal to the industry, and the production function of a typical firm, k, in manufacturing can be written as follows:

$$X_M^k = g(X_M)F_M(K^k, L_M^k) \tag{1}$$

where X_M^k, K^k, and $L^k{}_M$ denote the quantities of output, capital and labor respectively, associated with firm k in the manufacturing industry. The total industry output is

[2] Neary (1981) also refers to some of the effects of the minimum wage by using mainly a diagrammatic approach.

[3] A more recent paper in the same direction is that of Choi, J-Y (1999)

denoted by X_M. Function F_M is assumed to be linearly homogeneous, with the standard properties of a neoclassical production function. Function g is assumed to be increasing with industry output, and captures the economies of scale. Finally, we define $\varepsilon = (g / X_M)(dX_M / dg)$, and assume that ε is positive, which implies that that there is a positive external effect exercised by the manufacturing sector on the rural sector.[4] We also assume that $0 < \varepsilon < 1$, which ensures that more inputs are required to produce more output.

The output of the manufacturing sector as a whole can be derived by summing over all firms, so that:

$$X_M = g(X_M) F_M(K, L_M), \tag{2}$$

where K and L_M, denote the total quantity of capital and labor respectively, employed in the urban sector (manufacturing).

In the rural sector, the agricultural output (X_A) is produced by using land (T), which is specific to agriculture, and labor (L_A) that is mobile between the urban and the rural sectors.[5] Assuming constant returns to scale we can write the production function of the rural sector as follows.

$$X_A = F_A(T, L_A). \tag{3}$$

With regard to labor markets, we assume that the total amount of labor is in fixed supply, and that the wage in the manufacturing industry (w_M) is set exogenously, while the wage rate in the rural sector is determined by market forces. Labor moves between the urban and the rural sector in such a way as to ensure that the *expected* wage in the former equals the wage in the latter. Following Harris and Todaro, we assume that the expected urban wage is equal to the exogenously set wage rate times the probability of finding employment in the urban sector. More formally, equilibrium in the labor market requires that:

$$w_A = w_M (L_M / (L_M + L_U)), \tag{4}$$

where L_U denotes unemployment in the urban sector, and the term $L_M / (L_M + L_U)$ is the probability of finding employment in the urban sector.

For the other factor markets, we assume that capital and land are specific to each

[4] For a recent review of the importance of variable returns to scale see Choi and Yu (2002)

[5] In this paper we use the terms urban and manufacturing, and rural and agriculture interchangeably.

industry, and their returns, r_M and r_A respectively are set by the markets endogenously. Finally, with the total endowments of factors of production, K, T and L, being in fixed supply, we have:

$$K = \overline{K}\ , \tag{5}$$

$$T = \overline{T}\ , \tag{6}$$

$$L_M + L_A + L_U = \overline{L}\ . \tag{7}$$

Assuming that perfect competition prevails in all markets, except the labor market in the urban sector, we have the following zero profit conditions:

$$a_{LM} w_M + a_{KM} r_M = p_M\ , \tag{8}$$

$$a_{LA} w_A + a_{TA} r_A = p_A\ , \tag{9}$$

where a is the ratio of input i to the output of sector $j, (i = K, T;\ j = M, A)$ and p_j is the price of the output of the j_{th} sector.

Finally, we also have that:

$$a_{ij} = a_{ij}(w_j, r_j)\ . \tag{10}$$

The above equations specify the production structure of our economy. On the demand side, we assume that all individuals have identical and homothetic preferences, and taking p_A, as the numeraire, we have:

$$X_M / X_A = f(p_M / p_A) = f(p_M)\ . \tag{11}$$

Equations (2)-(11) completely specify our model, and we can proceed to its presentation in terms of rates of change, which will facilitate our comparative statics analysis.

2.1. The Model in Terms of Rates of Change

In the following analysis we will employ the approach first introduced by Ronald Jones, and present the model in terms of change, something that makes the analysis easily tractable. Denoting the rate of change by a caret over the relevant variable (i.e., $\hat{x} = dx / x$), we get from total differentiation of Equations (2) and (3) the following:

$$(1-\varepsilon)\hat{X}_M = \theta_{LM}\hat{L}_M + \theta_{KM}\hat{K}\ , \tag{12}$$

$$\hat{X}_M = \theta_{LA}\hat{L}_A + \theta_{TA}\hat{T}\ , \tag{13}$$

where $\theta_{ij}(i = K, T, L;\ j = M, A)$ denotes the share of the i_{th} factor in the value of the j_{th} industry's output, and $\theta_{LM} + \theta_{KM} = \theta_{LA} + \theta_{TA} = 1.$ As we noted earlier $\varepsilon = (g / X_M)(dX_M / dg),$ and $0 < \varepsilon < 1,$ which ensures that more inputs are required to produce more output.

We also differentiate totally Equations (4)-(11), taking into account the fact that there is perfect competition in all markets, with the exception of the minimum wage in the urban sector that is set exogenously, Assuming, also that firms follow average cost pricing in manufactures due to the nature of the returns to scale, we obtain:

$$(1-\lambda_{LA})\hat{w}_A = (1-\lambda_{LA})\hat{w}_M + \lambda_{LU}(\hat{L}_M - \hat{L}_U)\ , \tag{14}$$

$$\lambda_{LM}\hat{L}_M + \lambda_{LA}\hat{L}_A + \lambda_{LU}\hat{L}_U = \hat{\bar{L}} = 0\ , \tag{15}$$

$$\hat{K} = \hat{\bar{K}} = 0\ , \tag{16}$$

$$\hat{T} = \hat{\bar{T}} = 0\ , \tag{17}$$

$$\theta_{LM}\hat{w}_M + \theta_{KM}\hat{r}_M = \hat{p}_M + \varepsilon\hat{X}_M\ , \tag{18}$$

$$\theta_{LA}\hat{w}_A + \theta_{TA}\hat{r}_A = \hat{p}_A = 0\ , \tag{19}$$

$$\hat{L}_M - \hat{K} = -\sigma_M(\hat{w}_M - \hat{r}_M)\ , \tag{20}$$

$$\hat{L}_A - \hat{T} = -\sigma_A(\hat{w}_A - \hat{r}_A)\ , \tag{21}$$

$$\hat{X}_M - \hat{X}_A = -\sigma_D(\hat{p}_M - \hat{p}_A) = -\sigma_D\hat{p}_M\ , \tag{22}$$

where λ_{ij} denotes the allocative share of factor i in sector j, e.g., $\lambda_{LA} = L_A / L,$ σ_j is the elasticity of substitution between labor and the specific factor in industry j and σ_D is the elasticity of substitution between commodities in consumption. It is obvious that $\lambda_{LA} + \lambda_{LM} + \lambda_{LU} = 1,$ where λ_{LU} is the unemployment rate.

For our future analysis, it will be useful to obtain the supply function of manufactures. Making use of Equations (12) and (16)-(19), and with some appropriate substitutions and manipulations, we obtain:[6]

$$\hat{X}_M = s_M(\hat{p}_M - \hat{w}_M), \tag{23}$$

where $s_M = \theta_{LM}\sigma_M / [(1-\varepsilon)\theta_{KM} - \varepsilon\theta_{LM}\sigma_M]$. It is clear that s_M is the price elasticity of the supply of output of the manufacturing sector. It is plausible to assume that it is positive, which means that $(1-\varepsilon)\theta_{KM} - \varepsilon\theta_{LM}\sigma_M > 0$.[7] It can be also assumed that the urban sector is relatively capital intensive, although in the case of perfect factor mobility Neary (1981) has shown that stability requires that the urban sector should be capital abundant.

From the above relations it is clear that, with fixed factor supplies and using p_A as numeraire, we have that $\hat{L} = \hat{K} = \hat{T} = \hat{p}_A = 0$. Thus, there are nine Equations [(12-15), and (18-22)] with nine unknown variables, ($\hat{X}_M, \hat{X}_A, \hat{L}_M, \hat{L}_A, \hat{w}_A, \hat{r}_A, \hat{r}_M, \hat{p}_A$), and five exogenous variables $(K, T, L, p_A,$ and $w_M)$. We can now proceed to the analysis of the effects of a change in the minimum wage on income distribution, sectoral employment, output, and urban unemployment.

3. THE INCIDENCE OF A CHANGE IN THE MINIMUM WAGE

One of the most common assumptions in the theory of international trade is to assume that we deal with a small open economy, where commodity prices are exogenous. In the following analysis we shall consider first the case of a small open economy and secondly the case of variable commodity prices.

3.1. Incidence in a Small Open Economy

The assumption of the small open economy implies that commodity prices change exogenously, and therefore $\hat{p}_M = 0$. From Equation (12), (16), (18), and (20), we obtain that:

[6] Making use of (16) and (20) we get $\hat{r}_M = [(1-\varepsilon)\hat{X}_M / \theta_{LM}\sigma_M] + \hat{w}_M$. Substituting this into (18) we get Equation (23) of the text.

[7] This is a condition also required for long-run stability in the case of intersectoral mobility of all factors of production, as Panagariya and Succar (1986) have shown. We also assume that this holds in our model, which can be considered as the short-run version of the Panagariya -Succar model.

$$\hat{r}_M = -A\hat{w}_M \, , \tag{24}$$

where $A = [(1-\varepsilon)\theta_{LM} + \varepsilon\theta_{LM}\sigma_M]/[(1-\varepsilon)\theta_{KM} - \varepsilon\theta_{LM}\sigma_M]$, which is positive since we have assumed that manufacturing is relatively capital intensive and $0 < \varepsilon < 1$. It is clear from (24) that the return to capital in the manufacturing sector will fall as a result of the increase in the minimum wage. As regards the effect of the increase in the minimum wage on labor demand in the manufacturing sector, we obtain from Equations (20) and (24) that:

$$\hat{L}_M = -e_M \hat{w}_M \, , \tag{25}$$

where $e_M = (1-\varepsilon)\sigma_M / [(1-\varepsilon)\theta_{KM} - \varepsilon\theta_{LM}\sigma_M]$ is the elasticity of demand for labor, and which, according to our assumptions, is positive. As is clear from Equation (25) the demand for labor in the urban sector will fall, as expected.[8] The fall in demand for labor, however, releases workers who would normally move into the rural sector. But the increase in the minimum wage raises, ceteris paribus, the expected urban wage, and therefore, it is not clear whether there will be out-migration to the rural sector.Making use of Equations (14), (15), (18)-(21), (24) and (25) we can find that the change of the employment in the rural sector is given by the relationship:[9]

$$\hat{L}_A = (-1/B)(1-\lambda_{LA})e_A(1-e_M)\hat{w}_M \, , \tag{26}$$

where $e_A = \sigma_A / \theta_{KA}$, is the elasticity of demand for labor in the rural sector, and $B = (1-\lambda_{LA}) + \lambda_{LA}e_A$. It is clear that the demand for labor in the rural sector may rise or fall, depending on whether the elasticity of demand for labor in the urban sector is greater or less than one. But even if the demand for labor in the rural sector rises, i.e., $e_M > 1$, it does not imply that urban unemployment will fall, since the increase of the demand for labor in the agricultural sector may be less than the labor that is released from the urban sector. It is straightforward to show that:

$$\lambda_{LU}\hat{L}_U = (1-B)[(1-\lambda_{LA})(\lambda_{LM}e_M + \lambda_{LA}e_A) - (\lambda_{LU}\lambda_{LA}e_Ae_M)]\hat{w}_M \, . \tag{27}$$

As Equation (27) reveals, the change in the urban unemployment does not depend only on the elasticities of demand for labor in the urban and the rural sectors, but also on the initial level of urban unemployment. An intuitive explanation for these results may

[8] For a similar result see Bhatia (2002), particularly his result 1.

[9] For more details see appendix.

be the following: If e_M is greater than one, the increase in the minimum wage will reduce employment in the urban sector by a larger proportion than the wage rate change. This released labor could move to the rural sector, where employment would rise. At the same time, however, the expected urban wage may rise as a result of the increase in the minimum wage, and despite the decrease in the probability to find employment in the urban sector. Consequently there will be an extra incentive for rural workers to move to the urban sector and those fired by manufacturing to stay in the urban sector to look for a job there. Thus, urban unemployment rises. If, however, the level of urban unemployment is already high, the increase in the minimum wage may not by sufficient to compensate for the reduced probability to find employment in the urban sector, and the expected urban wage will fall. As a result there will be out-migration from the urban to the rural sector, and if this out-migration exceeds the reduced employment in manufactures, urban unemployment will fall.

With respect to the effects of the minimum wage on other factor prices we have that:

$$\hat{w}_A = (1-B)(1-\lambda_{LA})(1-e_M)\hat{w}_M \ , \tag{28}$$

$$\hat{r}_A = (-1/B)(\theta_{LA}/\theta_{KA})(1-\lambda_{LA})(1-e_M)\hat{w}_M \ . \tag{29}$$

As expected, the wage rate in the rural sector will rise if e_M is less than one, which means that the employment in that sector falls, and given the fixed supply of land the marginal productivity of labor there will rise. At the same time, however, the marginal productivity of land, and its return, will fall. If, on the other hand, e_M is greater than one the above results will be reversed. In other words, the increase in the minimum wage may lead to an increase in the wage rate in the rural sector as well, and it is possible that the latter rises by more than the urban wage rate. More formally, comparing the wage changes in the two sectors we have that:

$$\hat{w}_M - \hat{w}_A = (1/B)\{-(1-\lambda_{LA})(1-e_M) + \lambda_{LU}[1-\lambda_{LA}(1-e_A)]\}\hat{w}_M \ . \tag{30}$$

It is obvious that if we assume that $e_M < 1$, e_A is very small, and λ_{LU} is also small, then the rural wage may rise by more than the urban wage. In other words, the exogenous increase in the urban wage might finally benefit by more those who remain working in agriculture. A similar relationship can be derived for $\hat{r}_M - \hat{r}_A$ and $\hat{X}_M - \hat{X}_A$.

Before ending this section it is worth noting that some of these results have been derived by Neary (1981) in a framework with constant returns to scale in manufacturing. Neary's approach, however, has been mostly diagrammatic and his main interest was the long-run stability properties of the H-T model. Our analysis has allowed for a more general and rigorous analysis of the incidence aspects of the minimum wage, and moreover our results differ quantitatively from those derived by Neary. Similarly, Bhatia (2002) examines a number of cases with respect to the value of the elasticity of substitution between labor and the specific factor, and as already noted some of his results are similar to ours. However, in our model, the presence of returns to scale changes significantly the value of the elasticity of demand for labor in the urban sector. Under constant returns to scale this elasticity is equal to σ_M / θ_{KM}, while in our model $e_M = (1-\varepsilon)\sigma_M / [(1-\varepsilon)\theta_{KM} - \varepsilon\theta_{LM}\sigma_M]$, which is greater than σ_M / θ_{KM}. In order to see this more clearly, consider the following example. Suppose that $\theta_{KM} = .6$, *and* $\varepsilon = .4$. Under constant returns to scale the elasticity of demand for labor in the urban sector will be equal to $.83 < 1$, while under increasing returns to scale this elasticity becomes 1.07>1.

3.2. Variable Prices and the Incidence of the Minimum Wage

In the following analysis we shall relax the assumption of the small open economy and assume instead that commodity prices change endogenously, under the influence of demand and supply conditions. Taking the price of the agricultural good as numeraire, the only commodity price that changes is that of the manufacturing output, namely p_M Solving simultaneously Equations (12)-(22), we can obtain the relationships for commodity and factor price changes, urban and rural employment, and urban unemployment.

Let us consider first the effect of the change in the minimum wage on sectoral employment and urban unemployment, on the basis of following equations:

$$\begin{aligned} \hat{L}_M &= (\sigma_M / \Delta)\{(1-\lambda_{LA} + \lambda_{LA}\sigma_A)E\sigma_D \\ &\quad + (1-\lambda_{LA})\theta_{LA}\sigma_A[\sigma_M + E(1-\sigma_M)]\}\hat{w}_M, \end{aligned} \tag{31}$$

$$\hat{L}_A = (1/\Delta)(1-\lambda_{LA})\sigma_A[\sigma_D(1-e_M) + s_M]\hat{w}_M, \tag{32}$$

$$\begin{aligned} \lambda_{LU}\hat{L}_U &= (-1/\Delta)\{\lambda_{LM}\sigma_M(1-\lambda_{LA} + \lambda_{LA}\sigma_A)E\sigma_D \\ &\quad + (1-\lambda_{LA})\sigma_A[\lambda_{LM}\sigma_M\theta_{LA}(E - A\sigma_M) + \lambda_{LA}\sigma_D(1-e_M) + \lambda_{LA}s_M]\}\hat{w}_M, \end{aligned} \tag{33}$$

where $\Delta = -[(1-\lambda_{LA} + \lambda_{LA}\sigma_A)(\sigma_D + s_M) + (1-\lambda_{LA})\theta_{LA}\sigma_A\sigma_M] < 0$, and $E = (1-\varepsilon)/[\theta_{KM}(1-\varepsilon) - \varepsilon\theta_{LM}\sigma_M] > 1$.

If $e_M < 1$, which implies that $\sigma_M < 1$, then we have from Equations (31)-(33) that employment in the urban and rural sectors will fall and urban unemployment will rise. An intuitive explanation for this change may be the following: As the minimum wage rises the demand for labor, and therefore employment, in the urban sector will fall. The released labor will either move to the rural sector or stay in the urban sector as unemployed, looking for employment there. The increase in the minimum wage, however, affects the expected urban wage in two ways: First it raises the urban wage, and secondly it reduces the probability of finding employment in the urban sector. With $e_M < 1$ the increase in the minimum wage outweighs the decrease in the probability of employment in the urban sector, and, therefore, the expected urban wage rises.[10] As a result there is also migration from the rural to the urban sector, and rural employment falls (see also Equation 32). The reduced employment in the urban and the rural sector leads to an increase in the urban unemployment, as Equation (33) also reveals. With the same reasoning we can analyze the case where $e_M > 1$, and the above results may be reversed. It is interesting to note that in this case, and under certain conditions concerning the value of s_M and σ_D, it is possible that even urban employment may rise and urban unemployment may fall although this does not seem very likely.

With regard to the changes in factor and commodity prices we have the following relationships:

$$\begin{aligned}\hat{r}_M &= (1/\Delta)\{[1-\lambda_{LA}+\lambda_{LA}\sigma_A][\theta_{LM}E + s_M(\varepsilon\sigma_D - 1)] \\ &\quad + E(1-\lambda_{LA})\theta_{LA}\sigma_A(1-\sigma_M))\}\hat{w}_M \,, \end{aligned} \tag{34}$$

$$\hat{r}_A = (1/\Delta)(1-\lambda_{LA})\theta_{LA}[\sigma_D(1-e_M)+s_M]\hat{w}_M \,, \tag{35}$$

$$\hat{w}_A = -(1/\Delta)\theta_{KA}(1-\lambda_{LA})[\sigma_D(1-e_M)+s_M]\hat{w}_M \,, \tag{36}$$

$$\hat{p}_M = -(1/\Delta)[(1-\lambda_{LA}+\lambda_{LA}\sigma_A)s_M + (1-\lambda_{LA})\theta_{LA}\sigma_A(1-e_M)]\hat{w}_M \,. \tag{37}$$

It is clear that if $e_M < 1$, the wage rate in the rural sector will rise, since, as we explained earlier, employment in that sector will fall. Similarly the marginal productivity of land will fall, and consequently its return. Also, the return to capital will fall, and the price of the manufactured good will rise. If on the other hand, $e_M > 1$, the preceding results may be reversed, depending also on the elasticity of substitution between commodities in consumption, the price-elasticity of supply of the manufactures, and the elasticity of substitution between labor and land.

Finally, it may be worth examining whether the increase in the minimum wage may benefit the rural workers by more than the urban workers as in the case of a small open economy. From (36) we can obtain that:

[10] More formally, this can be seen by combining Equations (14), (31)-(33), and the equations for change in the rural sector below.

$$\begin{aligned}\hat{w}_A - \hat{w}_M &= (1/\Delta)\{(1-\lambda_{LA})[(\theta_{LA} + \theta_{KA}e_M)\sigma_D + \theta_{LA}\sigma_A\sigma_M] \\ &\quad + \lambda_{LA}\sigma_A(\sigma_D + s_M)\}\hat{w}_M \ .\end{aligned} \tag{38}$$

We can see from the above relationship that the wage rate in the urban sector will unambiguously rise in relation to the rural wage, while in the case of the small open economy the opposite result could not be excluded.

Comparing our results with those of Panagariya and Succar (1986), whose model can be considered as the long-run version of ours, we observe that they are quite different as expected. While in the Panagariya and Succar approach the relative factor intensities play a very important role in determining the effects of a change in the minimum wage, in our analysis the elasticities of factor substitution play a much more important role. Moreover, we have allowed for endogenous price variability, while Panagariya and Succar take commodity prices as exogenous. Our result could also be compared with those derived by Iman and Whalley (1985), if we were to relax the assumption of increasing returns to scale. In that case, we also observe that our result differ significantly from theirs, something that is quite natural since the Imam-Whalley model assumes perfect mobility of all factors of production, like the Panagariya and Succar model, while our model is much closer to the original Harris-Todaro model. Finally, our results cannot be directly compared to those of Bhatia, since he employs a model for a small open economy, i.e., commodity prices are exogenously determined.

4. SOME CONCLUDING REMARKS

The Harris-Todaro model has been a valuable instrument in the hands of economists in order to analyze the effects of various trade and development policies on national welfare, income distribution and factor allocation. One aspect of the model that has been little exploited, with very few notable exceptions, is that associated with the effects of the change in the minimum wage in the urban sector.

In the preceding analysis we have attempted to examine the incidence and the factor allocation effects of a change in the minimum urban wage in the original Harris-Todaro model. By original we mean that the only factor that is freely mobile between activities is labor, while all other factors of production, capital in manufacturing, and land in agriculture, are not shiftable. Our model can be considered, therefore, as a short-run version of the Panagariya and Succar (1986) model, if we assume that in the longer run all factors of production could move from one activity to the other. Our analysis has shown that this approach can be very fruitful since the derived results are quite different, not only from those of Panagariya and Succar, but also from the analyses of Neary (1981), Imam and Whalley (1985), and Bhatia (2002).

The main conclusions of our analysis could be summarized as follows. Under the assumption that the elasticity of demand for labor in the urban sector is less than one, we have that: First, the increase in the urban minimum wage will most likely increase urban unemployment. Secondly, employment in the urban sector (manufacturing) will most likely fall, and with capital been specific to that activity, manufacturing output will also fall. This is also accompanied by a fall in the employment in the agricultural sector. Third, in the case of a small open economy, the return to capital will fall, the return to land will fall, and the rural wage will rise. In other words, the increase in the minimum wage benefits labor and harms landowners and capitalists. Fourth, with variable commodity prices, the above factor-price changes may be reversed depending also on the price-elasticity of supply of the manufactures, and the elasticity of substitution between commodities in consumption. Finally, it is worth noting that if the elasticity of demand for labor in the manufacturing sector is greater than one, all the above results may be reversed.

In our view the preceding analysis has confirmed the view expressed by Neary (1981 b), namely that "…the sector-specific model exhibits properties which are at least as interesting as those of the much better explored Heckscher-Ohlin model with intersectoral capital mobility". Our approach is certainly an attempt in that direction.

APPENDIX

In this appendix, we shall attempt to show how some of the basic relationships of our model are derived.

Differentiating totally Equations (8) and (9) we obtain:

$$\theta_{LM}\hat{w}_M + \theta_{KM}\hat{r}_M = \hat{p}_M - (\theta_{LM}\hat{a}_{LM} + \theta_{KM}\hat{a}_{KM}) , \tag{A1}$$

$$\theta_{LA}\hat{w}_A + \theta_{TA}\hat{r}_A = \hat{p}_A - (\theta_{LA}\hat{a}_{LA} + \theta_{TA}\hat{a}_{TA}) . \tag{A2}$$

From Equations (12) and (13), but also the assumption of cost minimization, we have:

$$\varepsilon \hat{X}_M = -(\theta_{LM}\hat{a}_{LM} + \theta_{KM}\hat{a}_{KM}) , \tag{A3}$$

$$0 = -(\theta_{LA}\hat{a}_{LA} + \theta_{TA}\hat{a}_{TA}) . \tag{A4}$$

since, $\hat{a}_{LM} = \hat{L}_M - \hat{X}_M$, etc. From (A1)-(A4), we obtain Equations (18) and (19) of the text.

By substituting into (15) Equations (21) and (25), we get:

$$-\lambda_{LM} e_M \hat{w}_M - \lambda_{LA}\sigma_A(\hat{w}_A - \hat{r}_A) + \lambda_U \hat{L}_U . \tag{A5}$$

From (19) we have that

$$\hat{r}_A = -(\theta_{LA} / \theta_{KA})\hat{w}_A . \tag{A6}$$

Combining (A5) and (A6) yields

$$\lambda_{LU}\hat{L}_U - \lambda_{LA}e_{A_A}\hat{w}_A = \lambda_{LM}e_M\hat{w}_M , \tag{A7}$$

where $e_A = \sigma_A / \theta_{KM}$. Similarly form Equation (14) and (15) we obtain:

$$\lambda_{LU}\hat{L}_U + (1-\lambda_{LA})\hat{w}_A = (1-\lambda_{LA} - \lambda_{LU}e_M)\hat{w}_M . \tag{A8}$$

Solving simultaneously (A7) and (A8), and making use of (A6), we obtain Equations (27)-(29) of the text.

Subtracting (13) from (12), and making use of (22) and (A6) we obtain:

$$\Gamma\hat{r}_M + \sigma_D\hat{p}_M - \sigma_A\hat{r}_A = \Gamma\hat{w}_M , \tag{A9}$$

where $\Gamma = \theta_{LM}\sigma_M /(1-\varepsilon)$

From (14), (15) and (A6), we can get:

$$-(1-\lambda_{LA} + \lambda_{LA}\sigma_A)\hat{r}_A - (1-\lambda_{LA})\theta_{LA}\sigma_M\hat{r}_M = (1-\lambda_{LA})\theta_{LA}(1-\sigma_M)\hat{w}_M . \tag{A10}$$

Finally, substituting (16), (17), (20) and (12) into (18), we obtain after some manipulations:

$$\hat{r}_M - E\hat{p}_M = -A\hat{w}_M . \tag{A11}$$

Solving simultaneously Equations (A9)-(A10), and taking into account (A6), we get Equations (34)-(37) of the text. By substituting these values into Equations (20), (21) and (15), we can obtain the relationships (31)-(33), which give the change in the allocation of labor between the rural and urban sectors, and the change in urban unemployment.

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