



## LABOUR MARKET, INTERNATIONAL TRADE, AND UNEMPLOYMENT IN A LESS DEVELOPED COUNTRY

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**Labour Market, International Trade, and Unemployment in a less  
Developed Country<sup>§</sup>**

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This paper constructs a trade general equilibrium model for a less developed country with three sectors. One is the informal and un-tradable sector characterized by flexible wages, while the other two sectors are tradable, export and import sectors. The model imposes a binding minimum wage over the unskilled labour and efficient wage distortions on the skilled labour. Comparative statics is driven to analyze the effects on the labour market as consequence of opening the economy, raising the minimum wage and the introduction of an augmenting productivity in the export sector.

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# 1 Introduction

Open economic process in less developed countries (LDC) leads the essential discussions about which are its main effects over the labour market. This analysis is relevant for the labour factor due to the impacts on the economic efficiency and on the social welfare. As it is well-known a high national income percentage is produced in the labour market and any effect on this market has a significant economic importance in the economy wide.

International trade and its effect on unemployment rate variations are related to the social welfare. While unemployment people are one of the biggest economic problems in all countries, trade economic models had tended to abstract it. Most trade models are full employment and flexible wages. Outside of economics profession, there are people who think that one of the most important effects of trade is the destruction of jobs, leading to significant unemployment rates. Nevertheless that the previous result will be expected, international trade is also related to the creation of jobs as a result of the new economic dynamic. Recently several labour international trade models are taking into consideration unemployment effects as a result of sticky wages and imperfect labour mobility.

A model of trade and labour market involving two countries is developed by Davis (1998). One country represents the stylized characterization of flexible-wage markets, while the second represents an economy with labour price rigid as consequence of fixing a minimum wage. Davis' paper points out that the first country arises its inequality among high and low wages while in the second country the unemployment climb dramatically. Both types of economies are integrated by two sectors; one of them is skilled labour intensive relative to the other one. Unemployment cannot arise in the flexible wage country. Instate, in an entire integrate equilibrium, the second country must absorb the full integrated equilibrium level of unemployment to sustain the minimum wage level that is determined by both countries.

The main goal of the present paper is to construct a general trade equilibrium model, for a LDC with three-sectors, where the existence of unemployment rate is a general rule. There are two tradable sectors, export and import sectors, and where the mobility of skilled workers is imperfect and the wage paid for unskilled workers is a minimum fixed by the government. The third is an un-tradable sector that demands only unskilled workers, characterized by flexible wages, and this is constituted by a set of small enterprises. The unemployed unskilled workers are represented mainly by households working in informal activities and other people without jobs, such as they are considered by Marjit (2003).

Imperfect mobility of skilled workers between export and import sectors is explained by the existence of turnover costs, when workers need to be hiring and training. In general, new hired workers do not have the same skill than the quitting workers. Those costs reduce the turnover tenure rate and are a decreasing function of their own wage rates. That issue is discussed widely by Stiglitz (1974). The turnover costs are introduced in this paper under the concept of efficiency wage theory, in the sense that higher wages result in some cases in higher productivity levels. When wages are higher than the market-clearing wages due to efficiency reasons, the unemployment rate rises in an equilibrium state (Fields, 2009).

The paper's model also considers some mobility restrictions on the unskilled worker between tradable and un-tradable sectors. It is assumed that unskilled people have some preference to be employed in the tradable sector than in the un-tradable sector as consequence of their higher wage rate and better working conditions. The direct implication of the previous restrictive factor conditions are that unskilled people allocated in the tradable and un-tradable sectors exhibit some imperfect mobility, and this is measured by the elasticity labour mobility, such as it was suggested in a pioneering article by Casas (1984). Casas introduces imperfect labour mobility in a standard two-sectors and two-factors general equilibrium model. His hypothesis is that there are mobility restrictions to equate the low

to the high wages in the economy, even in the long run. Such as Casas's paper, the elasticity of labour mobility is set in the paper's model by a parameter to accomplish this issue.

In this paper unskilled workers employed in the organized tradable sectors receive relatively high contractual wage, a minimum wage, while their counterparts engaged in the un-tradable sector earn a lower competitive wage. So, unskilled people earn two different wages in two different segments of the labour market, and the model integrate unemployment rate that is caused by both imperfect labour mobility and by sector-specific sticky wage. Some authors like Parai and Beladi (1997) integrate unemployment labour rate by manufacturing sticky-wages, according to the Harris-Todaro variety. Wei and Yabuuchi (2006) examine additionally the implications of wage subsidy policy and factor production growth on unemployment rate using as well the Harris-Todaro Model. The previous two models are characterized by the existence of both imperfect labour mobility and urban unemployment.<sup>1</sup>

There is strong theoretical evidence that trade openness in LDC produces unemployment when prices of imported goods fall. However, the expanding export sector might offset that effect and it is more evident if this structural change produces an augmenting productivity in the economy. Several studies have shown that higher productivity is strongly correlated with the export status (Davidson and Matusz, 2005).

Empirical research has documented both the imperfect inter-sector labour mobility and wage differentials in the economies. Imperfect labour market adjustment cannot be explained only by observable differences in worker or job characteristics that might require compensations. These issues have been examined by Fajnzylber and Maloney (2005), and Goldberg and Pavcnick (2003 and 2005).

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<sup>1</sup>The consequences of economic liberalization policies on the skilled-unskilled wage inequality in the LDC are analyzed theoretically by Marjit (2003) and Chaudhuro and Yabuuchi (2007).

The main paper findings are as follows: i) Free trade policies in a small open LDC could explain some unemployment levels if the market frictions and institutional restrictions are considered; ii) The unemployment effects might be offset if the trade liberalization improves both the efficient allocation resources in the economy and the productivity in the export sector; iii) A positive export perform in the economy might increase the un-tradable sector and decrease the unemployment rate; in such way that more productive firms will be bigger, earn higher profits and demand more workers; and iv) The positive effects induced by export sector will be reduced if the minimum wage is raised.

The remainder of the paper is organized as follows. The next section presents the basic model. Section 3 analyses the comparative statics when the economy is liberalized. Section 4 considers the negative impacts when the minimum wage is increased and the positive effects of an augmenting productivity level in the export sector. Last section concludes.

## 2 Model framework

Let define three sectors by analytical convenience: two tradable sectors, export and import sectors, and an un-tradable sector. Outputs are  $x$ ,  $y$ , and  $n$  respectively, such that  $x$  and  $y$  are produced using skilled and unskilled workers ( $L_i$ , and  $L_{ui}$ , where  $i=x,y$ ) under constant returns to scale technology. The un-tradable sector ( $n$ ) demands only unskilled workers ( $L_n$ ).

The model is a static labour market and its equilibrium is the state toward which the market tends and, once there, it stays in. That equilibrium will not be labour market-clearing. The paper purpose is to analyze of equilibrium positions, particularly on their interaction owing to their link via trade, and not the dynamics by which they are reached.

Only the production side of the economic system is described, and then the first order conditions are derived. A reduced form is obtained in order to analyze the comparative statics

(see Appendix 1). The results conduct to explain the skilled - unskilled workers employed, as well the unemployment changes when in a LDC applied a more oriented open economy.

## 2.1 Basic equations

There are six basic equations. Three profit sector equations that set up the behaviours of two tradable sectors and the only one un-tradable sector; two balances of skilled and unskilled workers, and an equation which explains the imperfect unskilled labour mobility between the tradable and the un-tradable sectors.

Firms wish to maximize their profits and to do this they must minimize their labour costs. This means that they hire workers, raise wages, and improve worker quality if these decisions are in their profit-maximizing interest to do so. Firms in the tradable sectors pay a higher wage to the skilled workers if these wages raise the labour productivity (Stiglitz, 1974). This is the efficiency wage theory, where higher wages could result in some cases in higher productivity levels (Fields, 2009).

Sector outputs are obtained according to the Cobb-Douglas functions. In addition, there is the assumption that export sector is intensive in skilled labour with respect to the import sector. The two profit equations in the tradable sectors are written as follows.

The export profit sector ( $x$ )

$$\pi_x = (1 + S)^{-1} (L_x)^\beta L_{ux}^{1-\beta} - \left( rL_x + \bar{W}L_{ux} \right) [1 + \alpha (1 + S_y)] (1 + h)^{-1} - C, \quad (1)$$

and the import profit sector ( $y$ )

$$\pi_y = (1 + S_y) (L_y)^{\beta_y} L_{uy}^{1-\beta_y} - r_y L_y - \bar{W}L_{uy} - C_y. \quad (2)$$

The export price is affected negatively by  $(1 + S)$ , and the import price positively

by  $(1 + S_y)$ .<sup>2</sup>  $S$  is the external restriction parameter for the domestic exports and  $S_y$  is the protected parameter for imports given by domestic tariffs.

The first term at the right hand in (1) and (2) are the output values obtained through the Cobb-Douglas production functions. The following terms in (1) and (2) are the labour costs, being  $r$  the skilled labour wage and  $\bar{W}$  the minimum wage fixed by the government and paid to the unskilled people employed in the tradable sectors ( $L_{ux}$  and  $L_{uy}$ ).

" $h$ " is a technology percentage index of progress. For the sake of simplicity, higher productivity drives the export goods to be produced at lower marginal cost. Thus, total labour cost is divided by  $(1 + h)$ , bigger than one, so that at any point of time firms decide how many people employ. The imported component for the export sector is introduced by the parameter  $\alpha$ , whose value is less than one.

The last terms ( $C$  and  $C_y$ ) in (1) and (2) are the training-hiring costs and are functions of the rate of turnover of employees. They are stated as

$$C = \frac{(\bar{W})^2}{r} L_x^b,$$

$$C_y = \frac{(\bar{W})^2}{r_y} L_y^{b_y}.$$

The turnover skilled labour costs, or the tenure average period, are a decreasing function of the wage paid to the skilled workers ( $r$ ) and an increasing function with respect to the minimum wage rate ( $\bar{W}$ ). They play a dominant role in explaining the skilled unemployment rate in the tradable labour market (Stiglitz, 1974).

Parameters  $\beta$  and  $\beta_y$  are the share of skilled workers in the production function, while the parameters  $b$  and  $b_y$  capture part of the turnover cost for skilled workers. The feasible

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<sup>2</sup>By assumption prices of exports and imports are equal to one.



parameter values are defined as follows:

$$0 \leq \beta_y < \beta \leq 1; (b - 1), (b_y - 1) > 1; \text{ and } 0 < \alpha < 1.$$

The un-tradable sector is characterized by a free-entry sector such that prospective workers enter only as a last resort. This is a subsistence sector and the minimum wage paid to people hired by the tradable-formal sector sets its maximum level. The un-tradable sector profit function is written as

$$\pi_n = f(L_n) - W_n L_n; \text{ where } f'(L_n) > 0 \text{ and } f''(L_n) < 0. \quad (3)$$

Unskilled workers ( $L_n$ ), allocated at the un-tradable sector, show a positive but diminishing marginal productivity. Thus people hired in this sector are paid by their marginal productivity ( $W_n$ ).

The skill and unskilled worker balances are given by the following identities. The skilled labour market balance

$$\bar{L} = L_x + L_y + L_d, \quad (4)$$

and the unskilled labour market balance

$$\bar{L}_u = L_{ux} + L_{uy} + L_n + L_{ud}. \quad (5)$$

Let  $\bar{L}$  and  $\bar{L}_u$  be the endowments of skilled and unskilled workers, respectively. The skilled and unskilled people unemployed are standing by  $L_d$  and  $L_{ud}$ , respectively.

## 2.2 Unskilled labour market

Tradable sectors offer relatively attractive wages as other favourable conditions for unskilled workers; while the un-tradable sector, integrated by small firms and some of them in the

informal economic activity, offers relatively unattractive ones.<sup>3</sup> For that reason reallocation of employment from tradable to un-tradable sector could be considered undesirable. The un-tradable sector is defined by the following properties: free entry and competitive markets; unregulated activity; and skills are acquired outside the formal school system.

So that, it is assumed that unskilled workers do not move freely between the tradable and un-tradable sectors. Imperfect mobility is described by the elasticity of inter-sector labour mobility, such as it was introduced by Casas (1984). The assumption is that whatever the initial wage differential between the two sectors, a change in the wage ratio is required to induce movements of workers in either direction. However, this movement will not continue indefinitely, and this will come to an end. Once a new allocation of workers are reached and constitutes the equilibrium, that state will be stable even though it involves different wages between sectors.

The equation of imperfect unskilled labour mobility is written as

$$\frac{\bar{W}}{f'(L_n)} = \left( \frac{L_{ux} + L_{uy}}{L_n} \right)^{\frac{1}{\lambda}} ; \lambda > 0,$$

where  $\lambda$  is the elasticity of labour mobility, and it is assumed to be constant.<sup>4</sup> Labour is completely immobile if  $\lambda = 0$ , and perfect mobility if  $\lambda = \infty$ . The previous equation is rewritten as

$$\frac{L_{ux} + L_{uy}}{L_n} = \left( \frac{\bar{W}}{f'(L_n)} \right)^{\lambda}. \quad (6)$$

A fixed minimum wage  $\bar{W}$  is paid to the unskilled workers employed by the tradable

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<sup>3</sup>An opposite approach is that informal economy is a desirable sector that workers could choose in preference to a formal sector work. In this way there is an internal dualism, that combines two opposite characterizations. Fields (2009) offers a summary of reasons why workers might want to be working in the informal sector, such as: they could earn more, or at least hope to earn more; they value the self-employment and the independence, among others.

<sup>4</sup>Casas (1984) derives this type of labour supply from a CES utility function.

sectors, and that wage is higher than the wage earn in the un-tradable sector. That is

$$\bar{W} > f'(L_n).$$

That inter-sector wage differential explains why some unskilled workers are unemployed ( $L_{ud}$ ). That outcome would not result in the economy if all jobless workers could migrate again into the un-tradable sector and to be engaged in the economy activity.

When the wage gap between people hired by the tradable and by un-tradable sectors is higher, more unskilled workers will stay in the first sector. In fact, more unskilled workers migrate than the vacancies available in the tradable-formal sector and this feature explains why some unskilled workers could be unemployed. The unemployment level acts to discourage further labour movements. As long as the wage gap is increased, the unemployment equilibrium rate will be greater.

### 3 Comparative statics

Six first order conditions with respect to skilled and unskilled labour demands are derived, and the skilled wages determined from (1) and (2). These conditions (see Appendix 1) let conduct the comparative static analysis when trade policy, minimum wage, and export productivity parameters change.

#### 3.1 Reduced model

The six first order conditions (Appendix 1), the two labour balances, (4) and (5), and the mobility restrictions over unskilled labour (6) set up the ten equilibrium conditions of the model. They allow to derive the following results: three factor production prices ( $r$ ,  $r_y$ ,  $W_n$ ), five demands for workers ( $L_x$ ,  $L_y$ ,  $L_n$ ,  $L_{ux}$ ,  $L_{uy}$ ) and as well the unemployment rates of unskilled and skilled workers ( $L_d$ ,  $L_{ud}$ ).

Skilled labour wages are derived from (36) and (39), and they are

$$r = \left( \frac{1+h}{1+\alpha(1+S_y)} \right)^2 \bar{W} L_x^{\frac{b-1}{2}}, \quad (7)$$

$$r_y = \bar{W} L_y^{\frac{b_y-1}{2}}, \quad (8)$$

such that skilled worker wages are positively related to both minimum wage rate ( $\bar{W}$ ) and the training hiring costs per worker. For the export sector case (7), the skilled worker wage is negatively related to the protected parameter for imports,  $S_y$ , and positively to the productivity level,  $(1+h)$ .

Equations (4), (5), (6), (7), and (8) are replaced in the first order conditions. Then, those conditions are differentiated with respect to labour demands, trade policy parameters, minimum wage, and technology changes. Finally a system of the second derivatives is obtained and written in matrix form as

$$\mathbf{H} \cdot d\mathbf{L} = \mathbf{A} \cdot d\mathbf{D}, \quad (9)$$

where  $\mathbf{H}$  is the Hessian matrix (see Appendix 2);  $d\mathbf{L}$  is a vector of labour variations and written in transpose form is  $(dL_x \ dL_{ux} \ dL_d \ dL_n)$ .  $\mathbf{A}$  is a vector of parameters that pre-multiply the vector  $d\mathbf{D}$ . The last vector in transpose form is defined as  $(dS \ dS_y \ dW \ dh)$ . The determinant of matrix  $\mathbf{J}$  is

$$\Delta = \frac{\Theta \cdot (b-1)(b_y-1)}{4(1-\beta_y) L_x L_y L_{ux} L_{uy}} < 0, \quad (10)$$

and its negative sign shows that the model solution is a maximum. The parameter  $\Theta$  is defined as

$$\Theta = \left( \frac{\bar{W}}{f'(L_n)} \right)^\lambda \left[ \lambda \frac{f''(L_n)}{f'(L_n)} L_n - 1 \right] < -1. \quad (11)$$

and it is a decreasing function of the elasticity labour mobility ( $\lambda$ ).

### 3.2 Trade policy liberalization

Trade policy effects on the labour market are considered in this paper through two channels. The first effect is analyzed when the trade policy is fixed by foreign countries and has a negative impact over the domestic exports,  $(1+S)$ . The second is when trade policy is fixed by the domestic country in order to restrict its own imports,  $(1+S_y)$ . Thereby both policies are oriented to reduce the international trade flows.

In the last decades restriction over trade flows in most countries have been substantially reduced and the protection dispersion across products and sectors has been practically minimized. These process of reforms have hit the import sector as the precedent protection barriers had led many inefficient firms continue producing and as they had undertaken only few productivity upgrades.

Nowadays countries design their trade policies to liberalize the international markets. The more relevant trade policies are currently related to bilateral, regional, and multilateral trade agreements that restrict the capacity of countries to change their trade policies. As a matter of fact, they have taken the commitment to be involved in the process of globalization and to move their economies toward an integrated world.

#### i) **International trade restrictions induced by foreign countries, $(1+S)$ :**

If these restrictions are removed by foreign countries, domestic firms might set their own exporting prices higher in the international market. The positive effects that produce on labour market are presented in (12), for skilled workers, and (13), for unskilled workers.

$$\frac{dL_x}{dS} = -\frac{2L_x}{(1+S)(b-1)\beta} < 0; \frac{dL_y}{dS} = 0; \text{ and } \frac{dL_d}{dS} = -\frac{dL_x}{dS} > 0; \quad (12)$$

$$\frac{dL_{ux}}{dS} = -\frac{(b+1)L_{ux}}{(1+S)(b-1)\beta} < 0; \frac{dL_{uy}}{dS} = 0; \frac{dL_n}{dS} = \frac{1}{\Theta} \cdot \frac{(b+1)L_{ux}}{(1+S)(b-1)\beta} < 0. \quad (13)$$

Reducing external trade restrictions on exports let the domestic firms become more competitive in the external markets. Policy liberalization in favour of exports brings the attention on three meaningful results. First, there is a general reduction on the unemployment rate in the economy wide. Second, export sector raises its demands for skilled and unskilled workers, but labour demands from imported sector are not affected. And third, as long as the export sector gets larger, wages paid for skilled workers go up and the unemployment rate for both types of people go down.

Equation (14) is obtained using the results in 13, and shows a reduction of unskilled worker unemployment when the external restrictions are removed.

$$\frac{dL_{ud}}{dS} = \frac{(\Theta - 1)}{\Theta} \cdot \frac{(b + 1) L_{ux}}{(1 + S)(b - 1)\beta} > 0. \quad (14)$$

ii) **Cutting the domestic tariff,  $(1+S_y)$ :**

As the economy is opened to the external competition, many firms are restructured and stay in the market, but others has to close. When the domestic government cuts its tariffs, the expected intuitive results on the skilled labour are gotten in the model. Skilled workers employed in the export sector increase since this sector is expanded, and this is shown in (15). By contrast, the import sector is depleted and therefore its demand for skilled workers becomes lower (16).

$$\frac{dL_x}{dS_y} = -\frac{(\beta(h - 1) + 2)\alpha L_x}{\beta\phi} < 0, \quad (15)$$

$$\frac{dL_y}{dS_y} = \left[ \frac{2L_y}{\beta_y(b_y - 1)(1 + S_y)} \right] > 0, \quad (16)$$

Where

$$\phi = (1 + \alpha(1 + S_y))(1 + h)(b - 1) > 0.$$

There are two opposite forces that affect the unemployment rate on the skilled workers, such as it is pointed out in (17), results that are derived from equations (15) and (16). On the one hand, there is a favourable relation between the trade policy liberalization and the skilled labour demanded by export sector, and thus unemployment rate of this kind of workers tend to go down. On the other hand, there is an unfavourable effect on the import sector and therefore the unemployment rate of this type of workers tends to increase. The net effect depends on which sector is bigger. If that sector is the tradable import sector, the unemployment rate goes up (17).

$$\frac{dL_d}{dS_y} = \left\{ \frac{(\beta(h-1) + 2)\alpha L_x}{\beta\phi} - \frac{2L_y}{\beta_y(b_y - 1)(1 + S_y)} \right\}. \quad (17)$$

However both effects are reduced by the training hiring costs, such as it is given by  $(b-1)$  for the export sector, and  $(b_y-1)$  for the import sector. It is well known that job creation takes time, while job destruction can take place immediately. Hence, there would be a higher unemployment rate if the import sector, where the price falls, is the dominant economy activity.

The results on unskilled workers are the following. Since there is an imported component in the production of the export sector, cutting-tariffs conduct to reduce the unskilled labour demand in this sector if the augmenting productivity ( $h$ ) is not big enough (18). This makes sense when firms located in this sector have the possibility to import intermediate goods at lower prices and substitute local by imported components.

$$\frac{dL_{ux}}{dS_y} = \frac{(b+1 - \beta(h+3))\alpha L_{ux}}{\beta\phi} > 0, \quad (18)$$

lower demand of unskilled people in the export sector let the tradable import sector and the un-tradable sector to increase their demands for this kind of people (19 and 20). But at the same time the last two sectors are affected negatively as consequence of lower protective custom barriers. The net effect on the unskilled people demand with respect to the two

previous sectors will depend on which is the dominant sector in the economy. If this sector is tradable-import sector, then a reduction of custom barriers affects negatively the demand for this type of workers. In turn, a large migration of unskilled workers from tradable sector to the un-tradable sector could explain a lower productivity in the overall economy.

$$\frac{dL_{uy}}{dS_y} = - \left\{ \frac{2(b+1-2\beta)\alpha L_{ux}}{\beta\phi} - \frac{(b_y+1)L_{uy}}{\beta_y(b_y-1)(1+S_y)} \right\}, \quad (19)$$

$$\frac{dL_n}{dS_y} = \frac{1}{\Theta} \cdot \left\{ \frac{(b+1+\beta(h-1))\alpha L_{ux}}{\beta\phi} - \frac{(b_y+1)L_{uy}}{\beta_y(b_y-1)(1+S_y)} \right\}. \quad (20)$$

Since there are unskilled labour mobility restrictions between the tradable and un-tradable sectors, given by the expression  $\Theta$  in (20), any effects of removing tariffs in the economy are de-escalated by the market frictions. The before comment is also applied to the tradable sector frictions through the terms  $(b-1)$  and  $(b_y-1)$ .<sup>5</sup>

Equation (21) is derived from equations (18) - (20). The main implication from (21) is that trade liberalization conducts to increase the unemployment rate on unskilled workers as long as the import sector is the largest in the economy. If there are not acceptable economic opportunities in the un-tradable sector, where the market entry costs for firms are relatively low, some workers are forced to be unemployed. As far as the export sector is expanding, that negative effect could be reduced. It is worth to say in this case that mobility restrictions in (21) are negligible.

$$\frac{dL_{ud}}{dS_y} = \frac{\Theta-1}{\Theta} \cdot \left\{ \frac{(b+1+\beta(h+1))\alpha L_{ux}}{\beta\phi} - \frac{(b_y+1)L_{uy}}{\beta_y(b_y-1)(1+S_y)} \right\}. \quad (21)$$

An additional implication in this section is the inter-sector wage differential arising from imperfect labour mobility. Once new allocation of the labour force is established, and constitutes a new stable equilibrium, this involves different wages rates among workers

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<sup>5</sup>Those parameters are the skilled labour frictions but they affects indirectly the unskilled labour market through the production functions.



allocated in different sectors. International trade liberalization leads to increase the wage gap between the skilled workers employed in the export and import sectors (7 and 8). As long as the share of the export sector goes up, the unskilled labour wage gap between the minimum wage and the wage paid in the un-tradable sector raises. The last outcome is due to the decreasing marginal productivity in the un-tradable sector.

*The main theoretical results obtained in this section could be summarized in the following propositions:*

*A process of international market liberalization in a LDC produces the following effects on the unemployment rate in the economy, and on the unskilled workers employed by the un-tradable sector:*

*i) Open trade in both sides (e.g. free trade agreements) produces two positive effects on export sector that conducts to reduce the unemployment rate for both skilled and unskilled workers. That result is affected negatively by a reduction in the labour demands for both types of workers in the import sector. Additionally, those effects are cut down by the turnover cost, for the case of skilled workers, and labour mobility restrictions, for the case of unskilled workers.*

*ii) International trade policy liberalization produces a mixed effect on the un-tradable sector and on unemployment of the unskilled workers. More competition on import sector leads the un-tradable sector to reduce its labour demand and therefore this effect raises the unemployment of the unskilled worker. The previous effect is in some degree offset by the labour adjustment in the export sector.*

## 4 Changing the minimum wage policy and the augmenting export sector productivity

This section is divided in two folds. First, there is a short discussion on the effects of a minimum wage change on the unemployment level for different types of workers; and second, the model is examined when a boon of productivity is produced by the free trade, especially on workers employed by the export sector.<sup>6</sup>

### 4.1 Changing the minimum wage rate policy

A critical issue related to the free trade agreements is the effects that a minimum wage policy produces on the labour market. Since higher minimum wage rises the skilled workers payment (7 and 8), there is an unambiguously negative effect over the skilled labour demand. Higher wages drive up production cost, that erodes the country's comparative advantage and destroy jobs. Hence the unemployment exists because the entire labour market is subject to an exogenously specific floor, or minimum, which exceeds the level required for full employment. However, the negative effect over skilled workers may be reduced by the turnover cost,  $(b - 1)$  and  $(b_y - 1)$ .

The results over export and import sectors are

$$\frac{dL_x}{d\bar{W}} = -\frac{2L_x}{(b-1)\beta\bar{W}} < 0, \quad (22)$$

$$\frac{dL_y}{d\bar{W}} = -\frac{2(2-\beta_y)(1-\beta_y)L_y}{\beta_y(b_y-1)\bar{W}} < 0, \quad (23)$$

and thereby the unemployment rate for skilled workers go up, as it is shown in (24).

$$\frac{dL_d}{d\bar{W}} = \frac{2}{\bar{W}} \left\{ \frac{L_x}{(b-1)\beta} + \frac{(2-\beta_y)(1-\beta_y)L_y}{(b_y-1)\beta_y} \right\} > 0. \quad (24)$$

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<sup>6</sup>Currently, there are positive spillover effects on the rest of the economy.

The effect on the unskilled worker demands is equally negative. Three important features should be highlighted. First, lower demand for unskilled workers hired by the export sector is in part reduced as long as the turnover-cost is bigger. Second, negative effect on the unskilled workers allocated in the import and in the un-tradable sectors goes up, such as the elasticity of labour mobility increases. And third, the previous results are increasing as the sharing of the export sector and the un-tradable sectors are higher. These results are shown in (25)-(27).

$$\frac{dL_{ux}}{d\bar{W}} = -\frac{(2\beta - 1) L_{ux}}{\bar{W}\beta(b - 1)} < 0, \quad (25)$$

$$\frac{dL_{uy}}{d\bar{W}} = -\frac{1}{\bar{W}} \cdot \left\{ \frac{(b - 2\beta + 2)}{\beta(b - 1)} L_{ux} + \left[ \lambda \left( \frac{\bar{W}}{f'(L_n)} \right)^\lambda + \frac{(b_y + 2b - 2\beta_y - 1)}{(b_y - 1)} \right] L_n \right\} < 0, \quad (26)$$

$$\frac{dL_n}{d\bar{W}} = \frac{1}{\Theta} \cdot \frac{\frac{(b+1)}{\beta(b-1)} L_{ux} + \left[ \lambda \left( \frac{\bar{W}}{f'(L_n)} \right)^\lambda + \frac{(b_y+2b-2\beta_y-1)}{(b_y-1)} \right] L_n}{\bar{W}} < 0. \quad (27)$$

Consequently, a minimum wage exacerbates the unemployment rate on the unskilled workers in the economy (28). That result is positively related by the number of workers allocated in the export and un-tradable sectors.

$$\frac{dL_{ud}}{d\bar{W}} = \frac{(\Theta - 1)}{\Theta} \cdot \frac{(1 - \beta_y) \left\{ \frac{(b+1)}{\beta(b-1)} L_{ux} + \left[ \lambda \left( \frac{\bar{W}}{f'(L_n)} \right)^\lambda \cdot \frac{\Theta}{(\Theta-1)} + \frac{(b_y+2b-2\beta_y-1)}{(b_y-1)} \right] L_n \right\}}{\bar{W}(1 - \beta)} > 0. \quad (28)$$

## 4.2 Augmenting the export sector productivity

Negative effects that are produced by increasing the foreign competition on the import sector, could be overwhelming if the international trade could boost export sector productivity, especially for skilled workers. This positive aspect is reached simply by finding better ways to use more efficiently the existing skilled workers and other resources no considered in this

model. As it is stated analytically further, output level is associated with efficiency rather than accumulation factor.

$$\frac{dL_x}{dh} = \frac{(h\beta - \beta + 2) L_x}{(b - 1) (1 + h)^2 \beta} > 0, \quad (29)$$

$$\frac{dL_y}{dh} = -\frac{(2h\beta + 2\beta + 2) L_x}{(1 + h)^2 (b - 1) \beta} < 0. \quad (30)$$

Opening the economy activity to international trade exposes producers to great competition, forcing them to cut cost and increasing their efficiency while providing greater access to more and better inputs. International trade helps to reallocate resources in favour of more productive uses, as it is the export sector. In the extreme case, where the higher productivity ( $\alpha$ ) is located only in the export sector, the demands for all types of workers in this sector go up (29) while the workers employed in the import activities go down (30). Thus, the net effect is that the job creation exceeds the job destruction.<sup>7</sup> In this sense the unemployment rate in the overall economy falls, such as in shown in (31).and (32).

$$\frac{dL_d}{dh} = -\frac{(3\beta + h\beta) L_x}{(b - 1) (1 + h)^2 \beta} < 0, \quad (31)$$

$$\frac{dL_{ud}}{dh} = -\frac{(\Theta - 1)}{\Theta} \cdot \frac{(\beta(h - 1) + b + 1) L_{ux}}{(b - 1) (1 + h)^2 \beta} < 0. \quad (32)$$

At the same time, higher productivity would probably benefit both formal and informal firms, and in addition could provide incentives for formalization some of them.<sup>8</sup> The result in (33) shows that un-tradable sector raises, in despite of the import sector is not affected by spill over positive effects, in terms of productivity. In general, firms that operate in the un-tradable sector could try to reduce their labour costs, replacing permanent workers with part-time labour.

$$\frac{dL_n}{dh} = -\frac{1}{\Theta} \frac{(\beta(h - 1) + b + 1) L_{ux}}{(b - 1) (1 + h)^2 \beta} > 0. \quad (33)$$

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<sup>7</sup>Davidson and Matusz (2005) find a strong negative correlation between net exports and job destruction using data for both Canada and USA economies.

<sup>8</sup>Golberg and Pavnik (2003) find weak evidence about the relation between trade liberalization and the informal employment for Colombia and Brazil. Their model implies that trade liberalization leads to an increase of informal employment.

## 5 Conclusion

The model analyzed in this paper is consistent with the stories on how a LDC exposure to international trade creates opportunities for some firms, especially in the export sector, while simultaneously contributing to the downfall of other firms in the import sector. In essence, protection for trade is in relation to shelter inefficient firms. There is evidence that exposure the economy to trade forces leads the less productive firms to exit from the market.

International trade works as a catalyst to dynamize the productivity in the economy, especially in the export sector. When empirical analysis considers permanent trade liberalization episodes, like P. Dutt et al. (2009), there is an immediate rising in unemployment, but in the long term that result tends to be reversed. But a policy oriented to raising the minimum wage minimizes those favourable effects. An increase in the minimum wage conducts the economy to reduce its capacity to compete in the international markets and therefore the overall unemployment rate jumps up and the labour demand realized by the un-tradable sector falls.

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## Appendix 1

### First order equations

$$\frac{\partial \pi}{\partial L_x} = \beta (1 + S)^{-1} \left( \frac{L_{ux}}{L_x} \right)^{1-\beta} - r \frac{1 + \alpha (1 + S_y)}{1 + h} - \frac{\bar{W}^2 b}{r} L_x^{b-1} = 0. \quad (34)$$

$$\frac{\partial \pi}{\partial L_{ux}} = (1 - \beta) (1 + S)^{-1} \left( \frac{L_x}{L_{ux}} \right)^{\beta} - \frac{\bar{W} (1 + \alpha (1 + S_y))}{1 + h} = 0. \quad (35)$$

$$\frac{\partial \pi}{\partial r} = -\frac{1 + \alpha (1 + S_y)}{1 + h} L_x + \left( \frac{\bar{W}}{r} \right)^2 L_x^b = 0. \quad (36)$$

$$\frac{\partial \pi_y}{\partial L_y} = (1 + S_y) \beta_y \left( \frac{L_{uy}}{L_y} \right)^{1-\beta_y} - r_y - \frac{(\bar{W})^2 b_y}{r_y} L_y^{b_y-1} = 0. \quad (37)$$

$$\frac{\partial \pi_y}{\partial L_{uy}} = (1 + S_y) (1 - \beta_y) \left( \frac{L_y}{L_{uy}} \right)^{\beta_y} - \bar{W} = 0. \quad (38)$$

$$\frac{\partial \pi_y}{\partial r_y} = -L_y + \left( \frac{\bar{W}}{r_y} \right)^2 L_y^{b_y} = 0. \quad (39)$$

$$\frac{\partial \pi_n}{\partial L_n} = f'(L_n) - W_n = 0 \text{ and ; } f''(L_n) < 0. \quad (40)$$

## Appendix 2

### Total differentiating the first order conditions

$$-\frac{b - 2\beta + 1}{2} \frac{dL_x}{L_x} + \frac{(1 - \beta) dL_{ux}}{L_{ux}} = \frac{dS}{1 + S} + \frac{\alpha dS_y}{2(1 + \alpha(1 + S_y))} + \frac{d\bar{W}}{W} + \frac{dh}{2(1 + h)}.$$

$$-\frac{dL_x}{L_x} + \frac{dL_{ux}}{L_{ux}} = \frac{ds}{\beta(1 + S)} + \frac{\alpha dS_y}{\beta(1 + \alpha(1 + S_y))(1 + h)} + \frac{d\bar{W}}{\beta W(1 + h)} - \frac{dh}{(1 + h)^2 \beta}.$$

$$\begin{aligned} \frac{1 - 2\beta_y + by}{2(1 - \beta_y)} \cdot \frac{dL_x + dL_d}{L_y} - \frac{(\Theta dL_n + dL_{ux})}{L_{uy}} &= -\frac{dS_y}{(1 + S_y)(1 - \beta_y)} \\ &\quad - \left( \lambda \left( \frac{\bar{W}}{f'(L_n)} \right)^\lambda L_n - \frac{L_{uy}}{(1 - \beta_y)} \right) \frac{d\bar{W}}{\bar{W} L_{uy}}. \end{aligned}$$

$$-\frac{dL_x + dL_n}{L_y} + \frac{1}{L_{uy}} (\Theta dL_n + dL_{ux}) = -\frac{dS_y}{\beta_y(1 + S_y)} + \left( \lambda \left( \frac{\bar{W}}{f'(L_n)} \right)^\lambda L_n - L_{uy} \right) \frac{d\bar{W}}{\bar{W} L_{uy}}.$$