Foreign Firms and Labor Market Implications: An Analysis using Heterogeneous Matching Models

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Abstract

In this paper, the labor market implications of increased foreign firm activity in the local economy is studied by using a heterogeneous matching model framework. There are a number of unskilled and skilled job seekers, and a number of job vacancies posted by local and foreign firms. In this set up, where all workers can engage in on-the-job search, equilibrium conditions and Nash bargaining approach allows derivation of wages for different types of workers and firms. Results suggest that wages are a weighted average of labor productivity and unemployment benefit, where the weight depends on the bargaining power of the workers, labor market tightness and the mass of local and foreign vacancies. Results note that levels of wages paid by foreign firm need not always greater than that paid by local firm, depending on relative costs, skill endowment and technological gap between local and foreign firm. An increase in foreign presence, measured as an increase in foreign firm vacancy creation, can occur because of an exogenous change in cost- public policy, technological improvements and skill upgrading. In this context, depending on the cause of an increase in foreign presence we end up with differential relative wage effects, both on the skill and firm premia.

Keywords: Foreign investment, skill premium, relative wages, matching models, labor markets.

1 Introduction

The rapid growth in international trade, investment and financial flows over the past two decades has been the most remarkable change in the world economy. Entry of multinational firms (MNFs), due to the reductions in trade and investment barriers and the cost of moving goods and information, lead to relocation of capital and jobs and re-determination of factor prices. Actually, MNFs have become one of the key players in extensively integrated economies since they have gained an important ground in transmitting new technologies, managerial techniques, skills and capital across borders (Caves, 1996; Markusen and Venables, 1999, Navaratti and Venables, 2004). In this context, to benefit from new technology, knowledge and market opportunities, domestic policy makers (as well as firms) encourage foreign firms to establish local subsidiaries. Alongside its effect on local firm productivity through technology transfers, investments by foreign firms also have important implications for the local labor market conditions. If one envisages the world production along a continuum of factor intensities the differing labor requirement among the local firm, the foreign affiliate and foreign parent firms would become evident. As such, the increasing extent of foreign firms (affiliates) would have important effects on the skill composition of the local labor market; the relative demand for skilled and unskilled worker, hence their unemployment rates; and, the relative wages of skilled and unskilled workers.

Accordingly, empirical and theoretical debate about the impact of the MNEs' production activities on labor markets, particularly wage differentials and employment, is lively and growing. While the theoretical models that investigate the effect of FDI on employment and the wage structures in both the source and host countries have mostly incorporated the MNEs into the microeconomic – general equilibrium theory of international trade, such as the Heckscher-Ohlin model, a substantial body of empirical work is based on ad hoc observations and surveys, as well as a number of studies using econometric methods. These studies document two fundamental issues:[1] First, as the structure of the domestic production changes upon the entry of foreign firms, the wage gap between skilled and unskilled workers changes (Gopinath and Chen, 2003, Ghosh, 2003, and Markusen and Venables, 1997). Second, foreign firms tend to pay different wages than domestic firms (Aitken et. al., 1996, Feenstra and Hanson, 1996, and Lipsey and Sjöholm, 2004).

The literature is dominated by theoretical studies that explore the first issue regarding the

[1] See Brown et. al., 2002; Ghosh, 2003; Moran, 2002; Hatzius, 1998; and Eckel, 2003 for a detailed discussion.

relative wages between the skilled and unskilled labor, i.e. the skill premium, and by empirical studies exploring the second issue regarding the relative wages paid by foreign and domestic firms. The two issues are rarely discussed simultaneously in both the theoretical and empirical studies on the effects of MNEs, which this paper does. This paper tries to fill the void in the literature, building a model that explains the two observations synchronously and allows for a detailed identification of the absolute and relative wage implications of increased MNE activities in the host country. Furthermore, while the literature has so far been relatively silent on the unemployment effects of foreign investment, a third issue that could be studied in this context is the effect of MNEs on unemployment rates. As such, the below model allows for a discussion of not only the price effects of foreign firms in the local labor markets but also their impact on the unemployment rates.

The theoretical explorations of the skill premia effects of increased MNE activities yields ambigous results, where the common theme is that the effects of foreign direct investment (FDI) on relative wages in the source and the host countries *depends* on the characteristics of the investment and the conditions in the invested environment. Markusen and Venables (1997), Feenstra and Hanson (1996) and Ghosh (2003) find that the relative return to skilled labor increases in both the host and source country upon increased MNE activities. On the other hand, Das (2002), Wu (2001) and Sayek and Sener (2006) find that the relative wage effects depend on the competing domestic entrepreneurs' skill level and the technology gap between the host and the source country; the technology intensity and the type of the foreign investment; and the skill intensity of the foreign production, respectively. Lall (1995) provides an extensive list of conditions which affect the labor market effects of foreign investment. In summary, Lall (1995) suggests these conditions to include the size and the mode of entry (greenfield or acquisition), the nature and flexibility of technology in the foreign firm, level and speed of technology upgrading, the sophistication of the technologies used, trade orientation, the place of the affiliate in the global production, the levels and types of skills needed for the operation of the affiliate, the extent of local design or R&D activity, and the economic and market conditions in the host country and the competitive capability of local firms. The important message to be taken from this strand of the literature is that the *local conditions* as well as the *investment characteristics*, which we will lump in the term "absorptive capacities" matters in the determination of the wage effects of increased foreign presence.[2]

[2] The literature uses the term absorptive capacity to capture both the local market conditions such as the availability of skilled labor (Borenzstein et al, 1998), the availability of financial market services (Alfaro et al, 2004 and Durham and Lensink, 2004), as well as the technology capacity of the local firm, which we labeled as the investment characteristic

Empirical evidence, documenting the two fundamental issues enlisted above, points to the role of absorptive capacities by finding different results among developing countries. Regarding the former observation, Robbins (1994) and Wood (1994) find that Malaysia, Philippines, Singapore and Taiwan have experienced a fall in the skilled-unskilled wage differential, while Beyer et al (1999) and Cragg and Epelbaum (1996) find that Chile and Mexico experienced the opposite after MNEs increased their activities. As noted above, such differential effects could be on account of the different local conditions and investment characteristics discussed in the theoretical models, i.e absorptive capacities.

Studies on the second observation, regarding the differential wages across domestic and foreign firms, tend to echoe a similar *absorptive capacity* story; though the studies mostly document higher wages being paid by foreign firms. For example, Driffield and Girma (2003) and Conyon et al. (2002) demonstrate that even after controlling for industry and firm effects there is a significant wage difference between foreign and domestic frms in the UK. Martins (2004) shows a positive relationship between foreign ownership and wages, though the results suggest a negative effect of foreign acquisition on the *growth rate* of these wages. Aitken, Harrison and Lipsey (1996) also document such wage differences, and find that in Mexico and Venezuela wage differentials between domestic and foreign firms persist, and in fact foreign firms pay higher wages than domestic firms. The authors further show that this wage gap between the local and foreign firms widens as the foreign firms presence increases, mostly on account of the reduction in wages paid by domestic firms.

On the contrary, studying the Indonesian manufacturing industry Lipsey and Sjöholm (2002) conclude that though foreign-owned enterprises pay higher wages than domestic enterprises, a higher foreign presence in an industry is associated with higher level of wages in locally owned enterprises. Furthermore, Almedia (2004) finds only small alterations in the skill composition and wage structure of Portugese domestic firms upon foreign acquisiton. Such evidence can be interpreted as suggesting that the relative wages between domestic and foreign firms might also differ depending on the *absorptive capacities*, either of the local market or of the firm. In fact, Barry et al (2001) find that, since foreign firms use different combinations of skilled and unskilled workers in their production depending on their sector of operation, the wage effects of increased foreign presence may differ across sectors. Providing evidence from Ireland, they find that while increased foreign presence in

above.

a sector has a negative effect on wages paid by domestic firms who are *exporters* it has no effect on wages paid by firms who are *non-exporters*. In similar fashion Girma et al (2001) find no evidence of a positive relationship between foreign presence and wage levels in domestic enterprises, with some weak evidence of a negative effect of foreign presence on domestic enterprises' wage growth.

Ruane and Ugur (2002) suggest several reasons for why MNEs may indeed offer higher wages. Firstly, since MNEs are less familiar with local labor market conditions, they may offer higher wages in order to attract better quality labor. Second, MNEs pay higher wages to minimize technology spillovers to other firms via labor mobility, that is to reduce worker turnover. Thirdly, since MNEs' skill requirements may differ from those of local firms, they have to pay more for those skills. Fourth, they pay higher wages than local firms since MNEs are larger than local enterprises. Actually, due to the productivity advantage, MNEs can afford to do so. To sum up, these conditions can all be included under the absorptive capacity that defines the evolution of several relative wages, i.e. those between firms and those between different types of labor.

As is detailed above, while these explanations support the empirical evidence provided by several studies there is no formal model that explores these relationships. This paper fills this gap in the literature, formalizing the explanations suggested by Ruane and Ugur (2002), among others. Furthermore, the model allows identifying a range of *absorptive capacities* that affect not only the magnitude of the skill and firm premia, and within firms relative wage effects of increased foreign firm presence but also, the direction of these effects.

In summary, although there have been many empirical studies investigating the labor market implications of the entry of foreign firms, evidence on labor mobility in a theoretical set-up is scarce and far from conclusive. The purpose of this paper is to fill this theoretical void, by constructing models allowing for wage differences across skilled and unskilled labor, as well as wage differences across domestic and foreign firms. As such the paper adds value to the literature by combining two well-documented wage effects of foreign firm activity, those on different *types of labor* and those paid by different *types of firms*. Furthermore, models also allow for studying the unemployment effects alongside the wage effects, providing a broad perspective on the labor market.

Specifically, effects of the workers' mobility by means of search models and the matching functions are evaluated. Search and matching models have a crucial role in explaining the labor market transitions, they provide a very suitable framework to study the labor market fluctuations following the entry of foreign firms.

Although the basic structure of Gautier (2002), Albrecht and Vroman (2002) and Dolado et al. (2003) is adopted to study this question, the main contribution to the modeling by allowing for two sided on-the-job-search.[3] The model can be summarized as follows: there are a number of unskilled and skilled job seekers, who are either unemployed or employed. Vacancies are posted by local and foreign firms looking for skilled and unskilled workers. However, job creation through vacancy posting is not a costless procedure. In fact, the structure of job creation costs, which differs between local and foreign firms, plays a major role in the extent of vacancy creation by the foreign firms and has an important effect on the labor market. Job seekers and firms meet according to the matching function.

When a worker and firm meets, the wage is set in accordance with the Nash bargaining approach. In this matching process, skilled and unskilled workers – both in the foreign and local firms– can engage in on-the-job-search. By allowing on-the-job-search, it is possible that skilled and unskilled workers in local (foreign) firms switch into foreign (local) firms. In addition, different productivities across firms and workers are also allowed for. Particularly, the model presented here provides a complete picture to study the effects of foreign job creation on employment and wage differences and it also allows studying the effects of technology and skill upgrading on employment and the wage differentials.

Accordingly, skilled and unskilled workers' wage in the local and foreign firms are found to be a weighted average of labor productivity and the workers' unemployment benefits. Particularly, skilled and unskilled workers' wages depend on job opportunities provided by the firms, which are mainly determined by the cost of job creation and the labor productivity**.** Results show that foreign firms need not always pay more than local firms, which is supportive of the mixed evidence provided in the empirical literature. The relative wage between the local and foreign firms is found to depend on the share of posted vacancies by the local and foreign firms and the technology gap between foreign and local firms; and the share of posted vacancies, which depends on the cost of job-creation for the firms and the labor productivity, i.e. the absorptive capacities. Specifically, if the share of foreign vacancies increase due to the decrease in the foreign job creation cost, then the wages in the local firm tend to decline while wages in the foreign firm are likely to increase. This leads to a decrease in the overall skill premium and an increase in the firm premium, given the costs of the

[3]The literature on matching models with heterogenous agents has developed over the last decade, dating back to the influential contributions by Pissarides (1994), McKenna (1996), Acemoglu (1999), Mortensen and Pissarides (1999), Burdett and Coles (1999) and Shimer and Smith (2000).

local firm and the productivity gap are above a certain threshold.

These results are supported by a wide range of numerical exercises we complete, to both quantify the analytic results found and to identify the effects that are not obtained in explicit form in the analytic solution. The numerical exercise shows that the relative wage effects (both between different skill levels and between firms) depend on the job-creation costs, the productivity levels of labor, and the imperfections in the labor market (which are mainly captured by the bargaining power of the labor in this model). In summary, within this framework, it can be concluded that wage dispersion across foreign and local firms stems from not only productivity differentials but also from the extent of job creation; and the same factors influence the direction and magnitude of the wage effects of increased foreign presence. The model also allows for a detailed discussion of the unemployment effect, across different skill level of MNE activities.

The paper is organized as follows: the following section presents the main characteristics of the model, section three provides an equilibrium analysis and displays wages. This is followed by a numerical example. The final section summarizes and concludes.

1.1 Basic Assumptions

Consider a continuous time model in which workers are infinitely lived and risk neutral. In addition, the measure of workers is normalized to one. We assume that distribution of skills across workers is exogenous: $\mu \in (0,1)$ of the workers are unskilled (l) while the remaining fraction, $1-\mu$, are skilled (s). There are two types of jobs: local (L) and foreign jobs (F). These jobs can be performed by both types of workers. Let y_j^i denote the flow output of a job of type $i\,(=L,F)$ that is filled by a worker of type $j=(l,s)$.

Assumptions on production technology can be summarized as follows[4]:

$$y_s^F > y_s^L \text{ and } y_l^F > y_l^L$$

That is, the flow output that would result from a match between a skilled worker and a foreign firm is higher than the flow output from a match between a skilled worker and a local firm. A similar situation applies to unskilled workers. This is due to the fact that foreign firms are more productive than local firms, which is widely accepted in the literature (Dunning, 1993; Caves, 1996;

[4]**It is important to note that any re-ordering of y_s^F and y_s^L has an important implications.**

Doms and Jensen, 1998 and Conyon et al., 2002). Clearly, as foreign firms act as a source of new technology, production process, managerial technique or a new organizational form (Fosfuri et al., 2001), workers are more productive in foreign firms.

Job destruction is exogenous at rate δ. Whenever a job is destroyed the worker becomes unemployed, while the job becomes vacant. During unemployment workers receive an unemployment benefit b.

On the other hand, restructuring in the labor market by means of job creation is not a costless procedure.[5] Firms must create a vacancy to hire new workers. Particularly, vacancies are a form of investment and firms must incur a cost to reach job seekers and to acquire information on the characteristics of applicants. Due to the informational frictions in the labor market, firms experience difficulties in matching with suitable job seekers. To overcome the informational hurdle and to make vacancies visible, firms spread information about the characteristics of their vacancies by using various recruitment methods such as public employment services, advertisement and private employment agencies (Russo et al., 2005). In this context, to hire a suitable worker, firms need to incur the cost of recruiting including the cost of posting, advertising and screening, and the cost of initial training at all stages of production (Fonseca et al., 2001; Hammermesh,1993; and Russo et al., 2005). Actually, firms use different search strategies and use different recruitment methods, thus, they follow different job creation policies depending on the cost structures. In this regard, when investing in a new market by means of posting job opportunities, foreign firms need to exert effort to locating better matching opportunities and they have to incur a cost which includes all expenses associated with operating in an unfamiliar foreign environment (Fosfuri et al, 2001).[6] In this respect, denoting the costs of job creation in the local and foreign firms as c_L and c_F, respectively, we assume $c_F > c_L$.

Moreover, we also allow for on-the-job-search by skilled and unskilled workers performing local and foreign jobs. Increased heterogeneity of posted vacancies, due to the increased activities of foreign firms, encourages on-the-job-search. Better matching opportunities arise to workers through on-the-job-search. As in Wolinsky (1987), workers can commit to search when they realize that there

[5] **Carlson et al. (2006)**, **Vanhala (2004),** Faggio and Koning (2001) state that assumptions on job creation costs have a crucial role in terms of job reallocation and change the potential policy recommendations of the models.

[6] Evidence shows that MNFs offer more training to workers than do local firms and undertake substantial efforts in the training of local workers (Chen, 1983; Gerschenberg, 1987; ILO, 1981; and Lindsey, 1986). In fact, Fosfuri et al (2001) note that MNFs can use a superior technology in a foreign subsidiary only after training a local worker. Thus, the cost of job generation is higher than that of the local firms, that is, they incur higher costs to generate jobs.

are better partners out there in the market place. Actually, employed workers search either because of a deterioration of the satisfaction with their job or an improvement in outside options (Krause and Lubik, 2004). In fact, this change in satisfaction could induce the workers to voluntarily take a wage-cut while changing jobs, as noted by Postel-Vinay and Robin (2002). Empirical evidence on the mobility of workers in an environment with both local and MNEs states that foreign firms try to overcome their lack of information about the local market by attracting experienced skilled and unskilled workers currently performing local jobs. In turn, local firms may hire the workers doing foreign jobs to benefit from technological spillovers. For instance, Gerschenberg (1987), Bloom (1992) and Pack (1993) find evidence of labor movement from MNEs to local firms in Kenya, South Korea and Taiwan, respectively. This evidence is suggestive of the importance of allowing two-sided on-the-job search option in the theoretical analysis.

1.2 Matching

Suppose that there are vacancies posted by local and foreign firms looking for skilled and unskilled workers. Workers and vacancies meet according to the matching function $q_\imath(.)$ and $q_s(.)$, which is increasing in the relevant amount of job seekers and vacancies. Specifically, the total number of matches between a worker and a firm is determined by the standard Cobb-Douglas matching function,

$$q_\imath\left[v_L+v_F, u_l+e_{\imath L}+e_{\imath F}\right] = \left(u_l+e_{\imath L}+e_{\imath F}\right)^{\alpha}\left(v_L+v_F\right)^{1-\alpha}$$

$$q_s\left[v_L+v_F, u_s+e_{sL}+e_{sF}\right] = \left(u_s+e_{sL}+e_{sF}\right)^{\alpha}\left(v_L+v_F\right)^{1-\alpha}$$

where v_L denotes the mass of local vacancies and v_F is the mass of foreign vacancies; u_l is the mass of unemployed unskilled workers; u_s is the mass of unemployed skilled workers, $e_{\imath L}$ and e_{sL} stand for the number of unskilled and skilled workers performing local jobs, $e_{\imath F}$ and e_{sF} are number of unskilled and skilled workers in the foreign firm; and α corresponds to the elasticity of matching with respect to the mass of job seekers. The number of unemployed workers in the host country is denoted by u which is the sum of u_l and u_s.

The labor market tightness for unskilled and skilled workers is represented by $\theta_\imath = \frac{v_L+v_F}{u_l+e_{\imath L}+e_{\imath F}}$ and $\theta_s = \frac{v_L+v_F}{u_s+e_{sL}+e_{sF}}$, which is the ratio of total job vacancies to total unskilled and skilled job

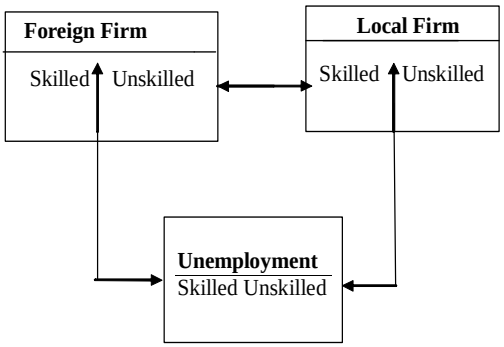

Figure 1: Workers' Mobility

seekers, respectively. In tight (slack) labor markets the pool of job seekers shrinks (enlarges) and the degree of competition among firms intensifies (lessens) (Russo et al., 2005; Burgess, 1993; and Blanchard and Diamond, 1994). In summary, an increase in $\theta_\imath$ or θ_s implies increased job market tightness; which is from the perspective of the employer. Accordingly, the rate at which firms meet an unskilled job seeker is equal to $q_\imath(\theta_\imath) = q_\imath(1, \frac{1}{\theta_\imath}) = \theta_\imath^{-\alpha}$ and the matching rate at which firms meet a skilled worker is equal to $q_s(\theta_s) = q_s(1, \frac{1}{\theta_s}) = \theta_s^{-\alpha}$ while the rate at which unskilled and skilled workers meet a vacant job is equal to $\theta_\imath q_\imath(\theta_\imath) = \theta_\imath^{1-\alpha}$ and $\theta_s q_s(\theta_s) = \theta_s^{1-\alpha}$, respectively. Given the properties of the matching function, the matching rate of firms $q_\imath(\theta_\imath)$ and $q_s(\theta_s)$ is decreasing in $\theta_\imath$ and θ_s, that is, $q_\imath^{'}(\theta_\imath) \leq 0$ and $q_s^{'}(\theta_s) \leq 0$, while the matching rate of workers $\theta_\imath q_\imath(\theta_\imath)$ and $\theta_s q_s(\theta_s)$ is increasing in $\theta_\imath$ and θ_s, respectively. In tight labor markets, the matching rate of firms decreases while the matching rate of workers increases. It is also convenient to define a variable $\eta\left(\eta = \frac{v_L}{v_L + v_F}\right)$, which represents the share of local vacancies in total vacancies.

Figure 1 illustrates the labor market mobility– from unemployment to employment, from job to job and back to unemployment. That is, unemployed unskilled and skilled workers move into local and foreign firms and workers in local and foreign firms may fall into the unemployment pool and the workers in the local (foreign) firms may switch into the foreign (local) firms. The steady state conditions require that the flows into and out of unemployment for both types of workers be equal. Accordingly, the steady state conditions are given as follows:

$$\theta_\imath^{1-\alpha} u_\imath = \delta(\mu - u_\imath) \tag{1}$$

$$\theta_s^{1-\alpha} u_s = \delta\left(1-\mu-u_s\right) \tag{2}$$

where equation (1) reflects the flow conditions for the unskilled labor. That is, a flow $\theta_\imath^{1-\alpha}$ of unskilled unemployed workers find employment in firms, which equals to the flow of unskilled workers into unemployment due to the job destruction, $\delta\left(\mu-u_\imath\right)$. Similarly, the latter equation, equation (2), is the flow condition for the skilled workers. The same flow conditions for the movement in and out of the local and foreign firms are depicted in equations (3) through (6).

$$\theta_\imath^{1-\alpha}\eta\left(u_\imath+e_{\imath F}\right)=\left(\delta+\theta_\imath^{1-\alpha}\left(1-\eta\right)\right)e_{\imath L} \tag{3}$$

$$\theta_\imath^{1-\alpha}\left(1-\eta\right)\left(u_\imath+e_{\imath L}\right)=\left(\delta+\theta_\imath^{1-\alpha}\eta\right)e_{\imath F} \tag{4}$$

Since we allow for on-the-job-search for both workers in the local and foreign firms, we have equations for local and foreign firms stating that in the steady state the flow of unskilled workers into local firms, $\theta_\imath^{1-\alpha}\eta\left(u_\imath+e_{\imath F}\right)$ is equal to the flow of unskilled workers out of local firm, $\left(\delta+\theta_\imath^{1-\alpha}\left(1-\eta\right)\right)e_{\imath L}$. The flow $\theta_\imath^{1-\alpha}\left(1-\eta\right)\left(u_\imath+e_{\imath L}\right)$ of currently employed unskilled workers into the foreign firm equals the flow out of foreign firms, $\left(\delta+\theta_\imath^{1-\alpha}\eta\right)e_{\imath F}$. The same is valid for the skilled workers, which are captured in equations (5) and (6).

$$\theta_s^{1-\alpha}\eta\left(u_s+e_{sF}\right)=\left(\delta+\theta_s^{1-\alpha}\left(1-\eta\right)\right)e_{sL} \tag{5}$$

$$\theta_s^{1-\alpha}\left(1-\eta\right)\left(u_s+e_{sL}\right)=\left(\delta+\theta_s^{1-\alpha}\eta\right)e_{sF} \tag{6}$$

1.3 Bargaining and Wages

The Nash wage bargaining model is widely used in matching models of the labor market (Albrecht and Vroman, 2002; Dolado et.al., 2003; Gautier 2002; Pissarides, 2000 and Mortensen and Pissarides, 1999). As such, we model the wage determination using the Nash bargaining framework. When a worker and firm meet, the wage is set in accordance with the Nash bargaining solution; that is, workers explicitly negogiate over wages with their employers. Wage offers are treated as endogenous outcomes of job movement decisions made by the workers and firms, who populate the models

(Mortensen and Pissarides, 1999).

In equilibrium, we consider four types of matching: skilled workers in foreign and local jobs and unskilled workers in local and foreign jobs, respectively. The surplus of the match between firms and workers is shared according to the asymmetric Nash bargaining solution. The surplus of a match, $S(i,j)$, between a job of type $i\,(=L,F)$ and a worker of type $j\,(=l,s)$ is given as follows:

$$S(i,j) = W(i,j) + J(i,j) - V(i) - U(j)$$

where $W(i,j)$ denotes the value of employment for a worker of type j on a job of type i, $J(i,j)$ is the value for the firm of filling a job of type i by a worker of type j, $V(i)$ is the value of the vacant job and $U(j)$ denotes the value of unemployment. Matches are consumated whenever the joint surplus $S(i,j)$ is nonnegative, that is,

$$W(i,j) + J(i,j) \geq V(i) + U(j)$$

When a match is formed, the wage w_j^i is given by the Nash bargaining condition

$$W(i,j) - U(j) = \beta\left[W(i,j) + J(i,j) - V(i) - U(j)\right] \tag{7}$$

where $\beta \in (0,1)$ is the exogenous surplus share of workers.

1.4 Asset Values

We next develop expressions for the various value functions. In doing this, let r denote the discount rate, which is assumed to be the same for both individuals and firms.

Workers

The asset value of an unskilled unemployed worker, $U(l)$, satisfies

$$rU(l) = b + \theta_i^{1-\alpha}\eta\left(W(L,l) - U(l)\right) + \theta_i^{1-\alpha}(1-\eta)\left(W(F,l) - U(l)\right) \tag{8}$$

where the first term on the right hand side is the unemployment benefit, b, and the second term refers to the change in the value of unskilled unemployed worker when (s)he becomes employed in

the local firm. The third term is the value gained by being employed in the foreign firm.

Similarly, given the assumption that skilled workers accept both types of jobs, local and foreign, the asset value of unemployed skilled workers, $U(s)$, verifies

$$rU(s) = b + \theta_s^{1-\alpha}\eta\left(W(L,s) - U(s)\right) + \theta_s^{1-\alpha}(1-\eta)\left(W(F,s) - U(s)\right) \tag{9}$$

The second and third terms in equation (9) denote the change in the value of skilled worker if (s)he is employed in local and foreign firms, respectively.

The value of an unskilled worker employed in local and foreign firms satisfies the following equations

$$rW(L,l) = w_l^L + \delta\left(U(l) - W(L,l)\right) + \theta_i^{1-\alpha}(1-\eta)\left(W(F,l) - W(L,l)\right) \tag{10}$$

$$rW(F,l) = w_l^F + \delta\left(U(l) - W(F,l)\right) + \theta_i^{1-\alpha}\eta\left(W(L,l) - W(F,l)\right) \tag{11}$$

where the first terms in equations (10) and (11) are the unskilled workers' wage in the local and foreign firms, respectively, and the second terms are the value loss of becoming unemployed, and the third terms, i.e. $\theta_i^{1-\alpha}(1-\eta)\left(W(F,l) - W(L,l)\right)$ and $\theta_i^{1-\alpha}\eta\left(W(L,l) - W(F,l)\right)$ are the expected return from being successful in on-the-job search for unskilled workers.

The asset values of skilled workers in local and foreign firms, respectively, verify the following conditions:

$$rW(L,s) = w_s^L + \delta\left(U(s) - W(L,s)\right) + \theta_s^{1-\alpha}(1-\eta)\left(W(F,s) - W(L,s)\right) \tag{12}$$

$$rW(F,s) = w_s^F + \delta\left(U(s) - W(F,s)\right) + \theta_s^{1-\alpha}\eta\left(W(L,s) - W(F,s)\right) \tag{13}$$

where w_s^L and w_s^F denote the skilled workers' wage in the local and foreign firms, respectively and the second terms are the value loss of becoming unemployed, and the last terms, i.e. $\theta_s^{1-\alpha}(1-\eta)\left(W(F,s) - W(L,s)\right)$ and $\theta_s^{1-\alpha}\eta\left(W(L,s) - W(F,s)\right)$ correspond to the expected return from being successful in on-the-job search for the skilled workers.

Firms

The values of local and foreign vacancies are given, respectively, by

$$rV(L) = -c_L + \theta_i^{-\alpha} A\left(J(L,l) - V(L)\right) + \theta_s^{-\alpha} B\left(J(L,s) - V(L)\right) \tag{14}$$

$$rV(F) = -c_F + \theta_i^{-\alpha} C\left(J(F,l) - V(F)\right) + \theta_s^{-\alpha} D\left(J(F,s) - V(F)\right) \tag{15}$$

where $A\left(=\frac{u_l+e_{iF}}{u_l+e_{iL}+e_{iF}}\right)$ stands for the share of unskilled workers applying for a local job in the total job seekers, $B\left(=\frac{u_s+e_{sF}}{u_s+e_{sL}+e_{sF}}\right)$ stands for the share of skilled workers applying for local job in the total job seekers, $C\left(=\frac{u_l+e_{iL}}{u_l+e_{iL}+e_{iF}}\right)$ and $D\left(=\frac{u_s+e_{sL}}{u_s+e_{sL}+e_{sF}}\right)$ are the share of unskilled and skilled workers applying for a foreign job in the total job seekers, respectively. Values, given in equations (14) and (15), of local and foreign vacancies reflect the assumption that both worker types are capable of performing the local and foreign jobs. A firm who posts a vacancy must pay a recruitment cost of c_i, where $i = L, F$. Given free entry, all profit opportunities from posting vacancies are exploited, hence, in equilibrium, $V(L) = V(F) = 0$.

The values to the firm of filling these vacancies with unskilled and skilled workers verify

$$rJ(L,l) = y_l^L - w_l^L + \left(\delta + \theta_i^{1-\alpha}(1-\eta)\right)\left(V(L) - J(L,l)\right) \tag{16}$$

$$rJ(F,l) = y_l^F - w_l^F + \left(\delta + \theta_i^{1-\alpha}\eta\right)\left(V(F) - J(F,l)\right) \tag{17}$$

$$rJ(L,s) = y_s^L - w_s^L + \left(\delta + \theta_s^{1-\alpha}(1-\eta)\right)\left(V(L) - J(L,s)\right) \tag{18}$$

$$rJ(F,s) = y_s^F - w_s^F + \left(\delta + \theta_s^{1-\alpha}\eta\right)\left(V(F) - J(F,s)\right) \tag{19}$$

where the terms, $y_l^L - w_l^L$, $y_l^F - w_l^F$, $y_s^L - w_s^L$ and $y_s^F - w_s^F$ represent the output of a worker minus the wage paid to the worker. The last term in each equation captures the value loss in case of exogenous job destruction or transferring into local/foreign firms.

Next, we concentrate on the steady state equilibrium which satisfies the following conditions:

1. Match formation is mutually advantageous relative to the alternative of continuing search. In other words, the workers' and firms' choices constitute a Nash equilibrium in the sense that they are value maximizing, taking as given the actions of the other agents (Albrecht and Vroman, 2002).

2. Firm vacancy creation satisfies zero value conditions. That is, the values of maintaining local and foreign vacancies are zero in the steady state.

3. The appropriate steady state labor market flow conditions are satisfied. That is, flow into and out of unemployment, local and foreign firms will be equal, respectively. In addition, the share of local vacancies in total vacancies, η, should fall within the range $[0, 1]$ and labor market tightness should satisfy $\theta_\imath > 0$, $\theta_s > 0$.

2 Equilibrium

Equilibrium is determined by two job creation conditions, plus, steady state conditions equalizing the flows into and out of unemployment, local and foreign firms, for both types of workers are satisfied.[7] Given exogenous varibles that capture the productivity of labor $\left(y_j^i\right)$, the bargaining and matching environment (α, β), the job destruction rate (δ) and job creation cost (c_L, c_F), the share of unskilled workers in total population (μ) and the interest rate (r). We will solve for the mass of vacancies, v_L and v_F; wages, i.e. w_l^L, w_l^F, w_s^L and w_s^F; the labor market tightness $\theta_\imath$ and θ_s; and unemployment rates; $u_\imath$ and u_s.

Recall equations (1) and (2) captured the flow conditions of workers. We can solve for the unemployment rate of unskilled and skilled workers, $u_\imath$ and u_s, as a function of labor market tightness ($\theta_\imath$) and (θ_s), and the exogenous variables, μ and δ. This yields

$$u_\imath = \frac{\delta\mu}{\left(\delta + \theta_\imath^{1-\alpha}\right)} \tag{20}$$

$$u_s = \frac{\delta\left(1-\mu\right)}{\left(\delta + \theta_s^{1-\alpha}\right)} \tag{21}$$

The unemployment rate of skilled workers $\frac{u_s}{1-\mu} = \frac{\delta}{\left(\delta+\theta_s^{1-\alpha}\right)}$ and unskilled workers $\frac{u_l}{\mu} = \frac{\delta}{\left(\delta+\theta_\imath^{1-\alpha}\right)}$

[7] Derivation of existence and uniqueness of the equilibrium is available upon request from authors.

are derived by re-arranging the terms in equations (20) and (21). Given μ and δ, unemployment rate of skilled workers is decreasing in the labor market tightness of the skilled workers, θ_s, while the unemployment rate of unskilled workers is decreasing in the labor market tightness of the unskilled workers $\theta_\imath$.

Since equilibrium requires that $V(L) = 0$ and $V(F) = 0$, equations (14) and (15) could be written as follows

$$\frac{c_L}{\theta_\imath^{-\alpha}} = A\left(\frac{y_l^L - w_\imath^L}{r+\delta+\theta_\imath^{1-\alpha}(1-\eta)}\right) + \left(\frac{\mu}{1-\mu}\right)^{-\alpha} B\left(\frac{y_s^L - w_s^L}{r+\delta+\theta_s^{1-\alpha}(1-\eta)}\right) \tag{22}$$

$$\frac{c_F}{\theta_\imath^{-\alpha}} = C\left(\frac{y_l^F - w_\imath^F}{r+\delta+\theta_\imath^{1-\alpha}\eta}\right) + \left(\frac{\mu}{1-\mu}\right)^{-\alpha} D\left(\frac{y_s^F - w_s^F}{r+\delta+\theta_s^{1-\alpha}\eta}\right) \tag{23}$$

The total amount of vacancies and their allocation across markets are determined by these conditions given above. Actually equations (22) and (23) are defined as job creation conditions. These conditions equate the benefit to the firm of filling vacant positions with the suitable candidate and the cost of opening vacancies. In other words, both equations relate the expected cost of a posted vacancy to the expected benefit of a filled job. For instance, if the left hand side of either equation is smaller than the right hand side, then entry to labor market by opening a vacant position is profitable, so that the number of vacancies posted increases. This leads to a rise in the labor market tightness of unskilled and skilled workers until the benefits of job creation are consumed.

2.1 Wages

A Nash bargaining approach to wage setting is used to derive equilibrium wages. Substituting (8), (10), (14), (16) into (7) and imposing the free-entry condition for local vacancies, $V(L) = 0$, we obtain the wage rate from matching of an unskilled worker with a local firm:

$$w_\imath^L = \varpi_{\imath b}^L b + \varpi_{\imath y}^L y_\imath^L \tag{24}$$

where $\varpi_{\imath b}^L = \frac{(1-\beta)\left(r+\delta+\theta_\imath^{1-\alpha}(1-\eta)\right)}{r+\delta+\theta_\imath^{1-\alpha}(1-\eta+\beta\eta)}$ and $\varpi_{\imath y}^L = \frac{\beta\left(r+\delta+\theta_\imath^{1-\alpha}\right)}{r+\delta+\theta_\imath^{1-\alpha}(1-\eta+\beta\eta)}$, are the weights attached to the unemployment benefit and labor productivity, respectively. The wage of unskilled workers' employed in the local firm is determined by the weighted average of the unemployment benefit, b and the output of unskilled worker in the local firm, y_l^L. Particularly, $w_\imath^L$ depends on the bargaining

power of workers, β, share of local vacancies, η and the labor market tightness of the unskilled workers, $\theta_\imath$. Figure 2 presents $w_\imath^L$ as a function of $\theta_\imath$ and η. It is clear that unskilled wages in the local firm increase as the share of local vacancies rises in total, but falls as the share of foreign firms in total vacancies increases. Although we plot wages against η, we are aware that η is endogenous, so in the numerical exercises we will look into a change in the exogenous parameters, i.e. the cost of opening local and foreign vacancies, c_L and c_F on η. Here, for simplicity, we ignore the reason behind the change in η, and indirectly on the wages.

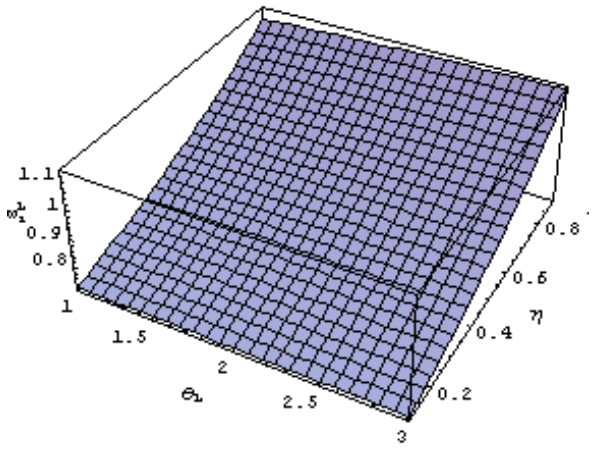

Figure 2: Unskilled workers' wage in the local firm

Substituting (8), (11), (15), (17) into (7) and imposing the free-entry condition for foreign vacancies, $V(F) = 0$, we obtain the wage from a matching of an unskilled worker with foreign firm:

$$w_\imath^F = \varpi_{\imath b}^F b + \varpi_{\imath y}^F y_\imath^F \tag{25}$$

where $\varpi_{\imath b}^F = \frac{(1-\beta)\left(r+\delta+\theta_\imath^{1-\alpha}\eta\right)}{r+\delta+\theta_\imath^{1-\alpha}(\eta+\beta-\beta\eta)}$ and $\varpi_{\imath y}^F = \frac{\beta\left(r+\delta+\theta_\imath^{1-\alpha}\right)}{r+\delta+\theta_\imath^{1-\alpha}(\eta+\beta-\beta\eta)}$ are the weights attached to unemployment benefit and labor productivity, respectively. Similarly, the wage of unskilled workers' working in the foreign firm is determined by the weighted average of unemployment benefit, b and the output of unskilled worker in the foreign firm, y_l^F. Specifically, bargaining power of workers, β, the share of local vacancies, η and the labor market tightness of the unskilled workers, $\theta_\imath$, play a vital role in the determination of unskilled workers' wage in foreign firm. As pointed out in Figure 3, $w_\imath^F$, as a function of $\theta_\imath$ and η, increases as the share of foreign vacancies rises.

Substituting (9), (12), (14), (18) into (7) and imposing the free-entry condition for local vacan-

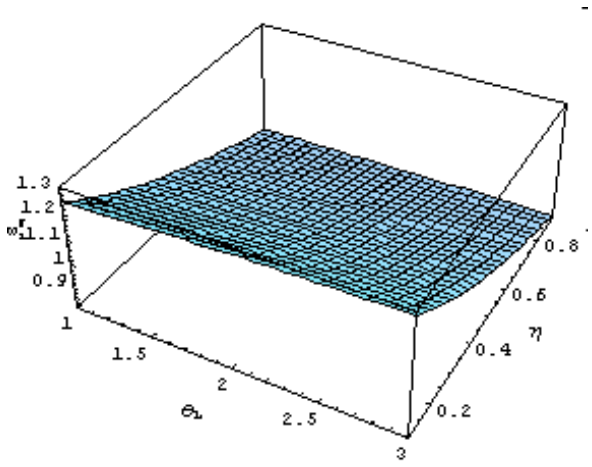

Figure 3: Unskilled workers' wage in the foreign firm

cies, $V(L) = 0$, we obtain the wage of a skilled worker in the local firm given as:

$$w_s^L = \varpi_{sb}^L b + \varpi_{sy}^L y_s^L \tag{26}$$

where $\varpi_{sb}^L = \frac{(1-\beta)\left(r+\delta+\theta_s^{1-\alpha}(1-\eta)\right)}{r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)}$ and $\varpi_{sy}^L = \frac{\beta\left(r+\delta+\theta_s^{1-\alpha}\right)}{r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)}$ are the weights attached to unemployment benefit and labor productivity, respectively. Skilled workers' wage in the local firm mainly depends on the share of local and foreign vacancies, bargaining power of workers and the labor market tightness of the skilled worker. Figure 4 presents w_s^L as a function of θ_s and η. It is clear that wages of the skilled workers in the local firm increase as the share of local vacancies rises, but falls as the share of foreign firms in total vacancies increase.

Substituting (9), (13), (15), (19) into (7) and imposing the free-entry condition for foreign vacancies, $V(F) = 0$, yields a wage of a skilled worker in the foreign firm, which is expressed as follows:

$$w_s^F = \varpi_{sb}^F b + \varpi_{sy}^F y_s^F \tag{27}$$

where $\varpi_{sb}^F = \frac{(1-\beta)\left(r+\delta+\theta_s^{1-\alpha}\eta\right)}{r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta)}$ and $\varpi_{sy}^F = \frac{\beta\left(r+\delta+\theta_s^{1-\alpha}\right)}{r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta)}$ are the weights attached to unemployment benefit and labor productivity, respectively. Skilled workers' wage in foreign firm depends on the share of local vacancies, η, bargaining power of workers, β, unemployment benefit, b and the flow output of skilled worker in foreign firm, y_s^F. Figure 5 shows that w_s^F increases as foreign firms

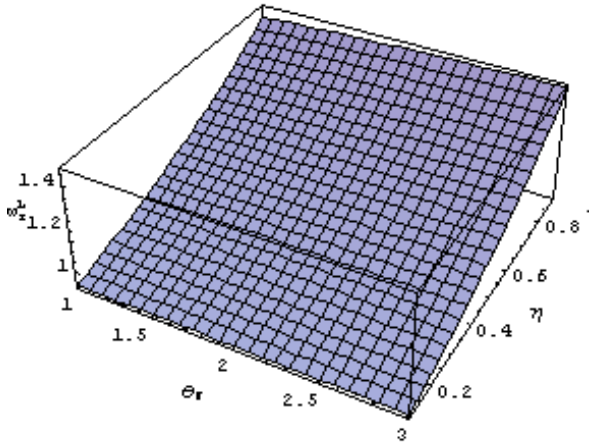

Figure 4: Skilled workers' wage in the local firm

provide more job opportunities.

In the essence of equations (24)-(27), the mass of local and foreign vacancies and the productivity of workers play a vital role in the wage determination. Actually, wages of both unskilled and skilled workers in the local and foreign firms depend on labor market tightness, share of local (foreign) vacancies and the bargaining power of the workers, but to a different extent. This is due to the fact that the values to the firms of filling those vacancies with the suitable worker depends on the mass of vacancies created by the firms and the productivity of workers, which differs across workers and firms.

Given its central role in wage-determination it is important to identify factors that affect the mass of vacancies created by both types of firms. The mass of vacancies created by local and foreign firms are determined by the job creation conditions, which are obtained by substituting wage equations given in (24)-(27) into the equilibrium conditions given in (22)-(23):

$$c_L = \begin{array}{c} \left(\frac{1-\beta}{\theta_i^{\alpha}}\right)\left(\frac{u_i+e_{iF}}{\mu}\right)\left(\frac{y_i^L-b}{r+\delta+\theta_i^{1-\alpha}(1-\eta+\beta\eta)}\right)+ \\ (\theta_s/\theta_i)^{-\alpha}\left(\frac{u_s+e_{sF}}{1-\mu}\right)\frac{y_s^L-b}{r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)} \end{array} \tag{28}$$

$$c_F = \begin{array}{c} \left(\frac{1-\beta}{\theta_i^{\alpha}}\right)\left(\frac{u_i+e_{iL}}{\mu}\right)\left(\frac{y_i^F-b}{r+\delta+\theta_i^{1-\alpha}(\eta+\beta-\eta\beta)}\right)+ \\ \left(\frac{1-\beta}{\theta_i^{\alpha}}\right)(\theta_s/\theta_i)^{-\alpha}\left(\frac{u_s+e_{sL}}{1-\mu}\right)\left(\frac{y_s^F-b}{r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\eta\beta)}\right) \end{array} \tag{29}$$

Job creation conditions for foreign and local firms differ according to the costs of creating new

jobs and productivities of the workers and this gives rise to equilibrium wage differentials in the presence of labor market frictions. Equations (28) and (29) can infact be rewritten as two equations with two unknowns, v_F and v_L, since both θ_j's and η are function of v_F and v_L, as are u_j and e_{ij}.

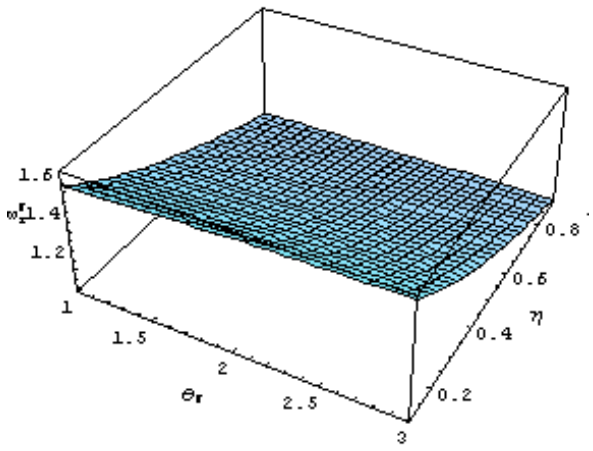

Figure 5: Skilled workers' wage in the foreign firm

2.2 Explaining the Relative Weights and Absolute Wages

In summary, wages of the skilled and unskilled workers in the local and foreign firms, equations (24)-(27), are a weighted average of the worker's reservation value (or unemployment benefit), b, which is treated as a constant and the output in the current match. To understand the overall story behind the wage determination and to realize the effect of the entry of foreign firm (by creating vacancies) on wages, the corresponding weights for unemployment benefit $\left(\varpi_{ib}^{L}, \varpi_{ib}^{F}, \varpi_{sb}^{L}, \varpi_{sb}^{F}\right)$ and the output produced by the match between a worker and a firm $\left(\varpi_{iy}^{L}, \varpi_{iy}^{F}, \varpi_{sy}^{L}, \varpi_{sy}^{F}\right)$ need to be examined. Weights determining local and foreign wages depend on the bargaining power of the workers and the mass of local and foreign vacancies, which are captured in the labor market tightness measures (θ_L, θ_F) and the share of local vacancies (η). Most importantly, the mass of vacant positions offered by local and foreign firms play a key role in explaining wage differentials. Also, wage differentials arise since we assumed an asymmetric technology– the output from a match between a worker and a local job is not the same as the output that would result from a match between a worker and a foreign job. Furthermore, the share of unskilled and skilled workers in the population and the job creation costs also play an important role in the wage gap between unskilled and skilled workers

both in the local and foreign firms through their effect on vacancy creation.

The bargaining power of the workers raises the weight of the respective labor productivity, while decreasing the weight assigned to the unemployment benefit. As workers become more powerful in the negotiation process, the effect of the return to unemployment on wages will be marginal since workers are willing to end up with higher wages. Particularly, they are likely to widen the gap between unemployment benefit and the wage by demanding higher wages in the bargaining process. On the other hand, due to an increase in the bargaining power of the workers, the link between output and the wages will be stronger. That is, the weight of the output produced by a worker tends to increase as workers become more powerful in the bargaining process. Within this set up, it is clear that better bargaining position of the workers puts an upward pressure on wages, i.e.

$\frac{d\varpi_{sb}^{L}}{d\beta} < 0$, $\frac{d\varpi_{sy}^{L}}{d\beta} > 0$, $\frac{d\varpi_{sb}^{F}}{d\beta} < 0$, $\frac{d\varpi_{sy}^{F}}{d\beta} > 0$ and therefore

$\frac{dw_{i}^{L}}{d\beta} > 0$, $\frac{dw_{s}^{L}}{d\beta} > 0$, $\frac{dw_{i}^{F}}{d\beta} > 0$, $\frac{dw_{s}^{F}}{d\beta} > 0$.

The mass of vacancies created by local and foreign firms play a major role in wage determination. Actually, job creation acts a source of competition between local and foreign firms. Once firms offer job opportunities, they try to pay more to fill that position. Also, a rise in job opportunities increases labor market tightness, that is, it makes it difficult for the firms to fill the job while job seekers are better off due to the new vacant positions in the firms. In our model, since we allow for on-the-job-search in both local and foreign firms, vacant positions created by foreign (local) firms also have an important impact on the local (foreign) wages. In this context, it becomes clear that wage differentials between local and foreign firms are extensively dependent upon the job creation by these firms, where job creation is strictly linked to available technologies to the firms and the cost of creating vacant positions. Below, we analyze the effect of increased foreign (local) firm activity through provision of new job opportunities on absolute wages.

An increase in the mass of local vacancies raises the wages in the local firm. This could be explained by the fact that as the value of filling the vacant positions increases, local firms are willing to pay more to fill the position. The relative weights assigned to the unemployment benefit and the output of the match are extensively influenced from new job opportunities offered by local and foreign firms. Particularly, since the probability of being matched with a local firm increases for the unemployed workers, the weight assigned to the return to unemployment decreases, thus the effect of unemployment benefit on local wages is likely to become weaker in this case. An increase in the mass of local vacancies strengthens the weight assigned to output produced by the worker

in the local firm and this puts an upward pressures on local wages. Moreover, the new positions offered by local firms decrease the wages in the foreign firm since they improve the outside option value of workers, that is, the probability of being successful in the on-the-job-search increases for the workers employed in the foreign firm. In other words, foreign firms anticipate that workers will quit job whenever local firms start to post new vacancies, so they tend to pay less[8]. Contrary to the case of wages paid by local firms, in this case, the weight of the unemployment benefit increased due to a rise in the local job opportunities. In this context, the effect of unemployment benefit on wages, which is positive, will be more powerful. On the other hand, the weight of the output produced in the foreign firm is likely to decline in response to a rise in the local job opportunities. The extent of the effect of output on foreign wages will become negligible as the number of vacancies offered by local firms increase. Thus, we end up with two opposite effects on the wage of the workers, that is, a rise in local job opportunities tends to raise the wage of local workers, while reducing the wage of the workers in the foreign firm.

$\frac{d\varpi_{sb}^{L}}{dvl} < 0$, $\frac{d\varpi_{sy}^{L}}{dvl} > 0$, $\frac{d\varpi_{sb}^{F}}{dvl} > 0$, $\frac{d\varpi_{sy}^{F}}{dvl} < 0$ and therefore

$\frac{dw_{i}^{L}}{dvl} > 0$, $\frac{dw_{s}^{L}}{dvl} > 0$, $\frac{dw_{i}^{F}}{dvl} < 0$, $\frac{dw_{s}^{F}}{dvl} < 0$

Earnings of the workers in the foreign firm increase due to the job opportunities created by the foreign firm since they have to pay enough to fill those vacant positions. Also, as more foreign vacancies are posted, the matching rates of workers increases and the increased availability of foreign jobs decrease the weight assigned to unemployment benefit. In addition, the weight of the output produced by the worker in the foreign firm increases due to an increase in foreign job creation, and therefore the impact of productivity of workers in a foreign firm on wages will be more powerful. On the other hand, new job opportunities created by the foreign firm increases the outside option of unemployed and employed workers**.** Thus, since local firms anticipate that workers' probability of being successful in on-the-job search increases, which reduces the match surplus, they tend to pay less for the workers. In this context, the effect of unemployment benefits on local wages, which is positive, will be more powerful, due to a rise in the foreign job opportunities. Unemployed workers can accept the local job since they know that they are allowed to change their employee if the foreign

[8]**In the search literature, wage is a function of the outside option of the workers, where the outside option of the workers depends on the mass of vacancies posted by an other firm. Thus, increased likelihood of leaving the firm requires workers to accept lower wage and since firms anticipate that their higher quit rate- reducing the match surplus, they tend to pay less (See Gautier, 2002 and Krause and Lubik, 2004).**

firm offers new positions. Also, the weight assigned to output produced from a match between a local firm and a worker decreases, this makes the effect of productivity on wages negligible since local firms anticipate that the worker may benefit from the foreign job opportunities. In short, wages of the local workers decrease while the earnings of the workers of the foreign firm increase due to the increased foreign firm activity which is captured by foreign job creation.

$\frac{d\varpi_{sb}^{L}}{dvf} > 0$, $\frac{d\varpi_{sy}^{L}}{dvf} < 0$, $\frac{d\varpi_{sb}^{F}}{dvf} < 0$, $\frac{d\varpi_{sy}^{F}}{dvf} > 0$ and therefore

$\frac{dw_{i}^{L}}{dvf} < 0$, $\frac{dw_{s}^{L}}{dvf} < 0$, $\frac{dw_{i}^{F}}{dvf} > 0$, $\frac{dw_{s}^{F}}{dvf} > 0$

Within this framework, wage differentials arise mainly due to the job distribution. If the mass of local (foreign) vacancies increase, the wages of both unskilled and skilled workers are likely to rise in local (foreign) firms, but new jobs available in foreign (local) firms reduce the wages of both workers in the local (foreign) firm. Briefly, as in Krause and Lubik (2004), fluctuations in vacancies offered by local and foreign firms become a key component in explaining labor market dynamics, particularly, wage differentials. In addition, however**,** productivity differentials across firms play a basic role in explaining wage dispersion and the extent of creation of vacant positions. In this regard, we are in the line with the literature in which a vast amount of studies note that higher wages paid by MNEs is largely attributable to productivity differences. On the other hand, we are able to show that wage differentials arise in part due to the on-the-job-search. That is, as the likelihood of finding a foreign job increases (the number of vacancies posted by foreign firms increase), wages paid to the workers in the local firm decreases since the increased likelihood of leaving the firm requires workers to accept a lower wage as a compensating differential for workers.

Determination of the absolute wages paid to both the skilled and unskilled labor by both the local and foreign firms allows a discussion regarding the skill as well as firm premia. The first insight in this framework allows to regarding the extent of firm premia in wages. We are able to discuss whether the foreign firm premia is greater than one; i.e. whether foreign firm always pay more than local firms for a skilled or unskilled labor. This leads to proposition 1.

Proposition 1 *Skilled (unskilled) workers in the foreign firm are not always paid more than skilled (unskilled) workers in local firm. The firm premium depends on the mass of vacancies created by the firms and the labor productivity.*[9]

Proof. Skilled and unskilled workers in foreign firms may earn more than that of the local firms,

[9] Here, we provide the proof for skilled workers, the one for unskilled workers could be easily replicated.

that is, $\frac{w_s^F}{w_s^L} > 1$ and $\frac{w_i^F}{w_i^L} > 1$ depending on the labor market frictions, in terms of posted vacancies, and the productivity of the workers in different firms.

$$\frac{(1-\beta)\left(r+\delta+\theta_s^{1-\alpha}\eta\right)b+\beta\left(r+\delta+\theta_s^{1-\alpha}\right)y_s^F}{\left(r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta)\right)} \gtreqless \frac{(1-\beta)\left(r+\delta+\theta_s^{1-\alpha}(1-\eta)\right)b+\beta\left(r+\delta+\theta_s^{1-\alpha}\right)y_s^L}{\left(r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)\right)}$$

$$(1-\beta)\,\theta_s^{1-\alpha}\,(2\eta-1)\,b+\left(r+\delta+\theta_s^{1-\alpha}\,(1-\eta+\beta\eta)\right)y_s^F-\left(r+\delta+\theta_s^{1-\alpha}\,(\eta+\beta-\beta\eta)\right)y_s^L \gtreqless 0$$

Since $y_s^F > y_s^L$, it is clear that the second term in the above inequality is positive and the sign of the first term is determined by the share of vacancies created by the firms. Clearly, if the productivity gap between foreign and local firms is sufficiently large, foreign firms end up with higher wages even when labor market imperfections are taken into account. ■

In the empirical literature, it is argued that foreign firms pay more since the they are more productive than local firms (Aitken et al., 1996; Feenstra and Hanson 1996; Lipsey and Sjöholm, 2002; and Ruane and Uğur, 2002). Furthermore, these studies also point out the fact that MNEs pay more to minimize labor mobility and to attract better workers. While these stylized facts are supported by our model, we are able to show the range of conditions that could alter the foreign firm premium. Specifically, we show that if the productivity gap is negligible, foreign firms do not pay more than local firms. In this framework, the wage gap between local and foreign firms also depends on the allocation of vacancies created by the firms, which are implicitly determined by the job creation conditions. This is in line with Matsuoka (2001), who argues that wage differentials between foreign and local firms should be explained by labor market imperfections, with foreign firms dominating the segmented labor market for particular skills.

Determination of the absolute wages also allows discussion of both the economy-wide skill and the firm premiums. It furthermore allows a discussion of within firm and within skilled/unskilled labor-groups relative wages. While the model suggests that the two factors mainly contributing to the evolution of wages upon the entry of foreign firm or domestic firm are the imperfections in the local labor market and the relative labor productivity of the foreign and local firms, we can not analytically show the effect of foreign (local) vacancies on alternative relative wages.

The literature denotes relative wages as the gap between skilled and unskilled wages. Here, the model allows us to examine the wages both within firm and between firm. Skill premium in local and foreign firms is captured by (w_s^L/w_i^L) and (w_s^F/w_i^F) which could be also defined as the within firm skill premium. In addition, W^{sp} represents the overall skill premium which is calculated as the ratio of the weighted average of skilled workers' wage in the foreign and local firms to unskilled workers'

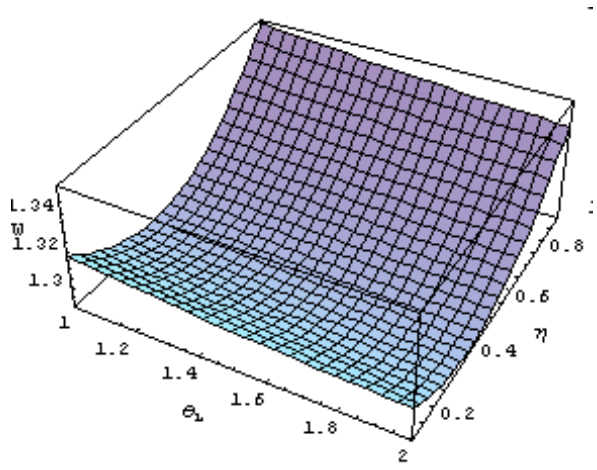

Figure 6: Skill Premium

wage in the local and foreign firms. Firm premium for the skilled and unskilled labor, which stands for the wage gap between foreign and local firms are denoted by (w_s^F/w_s^L) and (w_i^F/w_i^L), respectively. W^{fp} is the overall firm premium which is calculated as the ratio of weighted average of wages paid by the foreign firm to wages paid by the local firm. **Figures 5 and 6 present the skill premium and firm premium as a function of θ_i and η. While the firm premium increases as the share of foreign vacancies rise, the response of skill premium on the share of foreign vacancies is not clear depending on the reasons behind job creation.**Since the signs of the derivatives of skill premium and firm premium with respect to local and foreign vacancies is ambiguous, numerical solution is needed to see the effects of increased foreign firm activities on these relative wages. Accordingly, we study the absolute and relative wage effects of increased foreign firm activities in detail by providing a numerical example. In the next section, that is the numerical example, it will also be possible to see the effects of change in the productivity levels and job creation cost and on both absolute and relative wages.

3 Numerical Example

In this section, we provide a numerical example to illustrate the properties of the model. Numerical example allows us to capture effects of an exogenous increase in the cost of job creation on the extent of foreign firm activity in the local economy, and in turn its effects on absolute and relative wages,

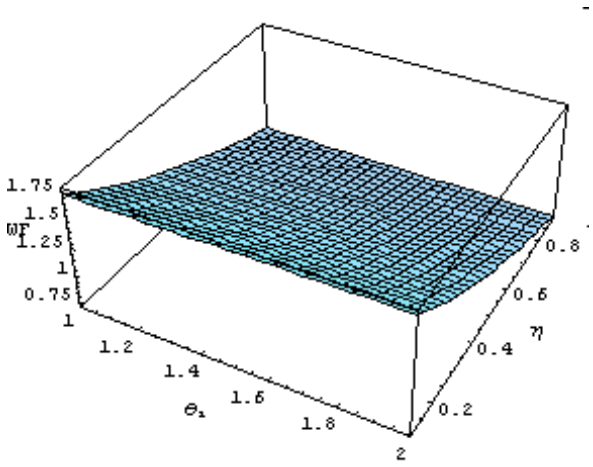

Figure 7: Firm Premium

and unemployment. It furthermore allows a discussion of the relationship between skill upgrading and technological progress and absolute and relative wages, and unemployment. The example uses the matching function, $q(\theta_i) = \theta_i^{-\alpha}$ and $q(\theta_s) = \theta_s^{-\alpha}$ together with the baseline parameter values, $r = 0.05$, $\beta = 0.5$, $\delta = 0.1$, $b = 0.1$, $c_L = 0.5$, $c_F = 0.7$, $\mu = 0.8$, $\alpha = 0.5$, $y_s^F = 1.9$, $y_s^L = 1.7$, $y_i^F = 1.5$, $y_l^L = 1.3$. All these parameter values are reasonable and in line with the other studies including Albrecht and Vroman (2002), Gautier (2002) and Dolado et al. (2003). In the baseline example, the share of unskilled workers in the population, μ, is assumed to compose the 80 percent of the total population and the productivity gap between foreign and local firms, $\frac{y_j^F}{y_j^L}$ is assumed to be 10% [10]. Also, skilled and unskilled workers in the foreign firm are more productive than the ones in local firm and skilled workers are more productive than the unskilled workers (Caves, 1996; Conyon et al., 2002; Dunning, 1993; Doms and Jensen, 1998; and Fosfuri et al., 2001). The interest rate is 5 percent and job destruction rate is 0.1. It seems reasonable to assume that foreign jobs are more costly to create than local jobs, where $c_L = 0.5$ and $c_F = 0.7$ (Carlson et al, 2006; Faggio and Koning, 2001; Fonseca, 2001; Hammermesh, 1993; Russo et al., 2005; and Vanhala, 2004). The unemployment benefit level is set at 0.1. Under this choice of parameters, Table 1 presents the baseline solutions.

[10] The productivity gap between foreign firm and local firm fluctuates between 10% to 100%. (Aitken and Harrison, 1998; Karpaty 2005, Doms and Jensen, 1998; Kimura and Kiyota, 2004; Conyon et al, 2002 and Davies and Lyons, 1991.

3.1 Benchmark Case

< Insert Table 1 >

The examination of the baseline solution shows that the share of foreign vacancies is 73% of the total vacancies. The unemployment rate of unskilled workers and skilled workers are 10.7% and 5.7%, respectively and the overall unemployment rate is 16%. The wage of skilled (unskilled) workers in the foreign firm is lower than the skilled (unskilled) workers wage in the local firm. Unskilled workers get paid less than skilled workers both in the local and foreign firms. Table 1 shows that the wage gap between skilled and unskilled workers in the local firm is higher than the wage gap between skilled and unskilled workers in the foreign firm. In other words, the skill premium in the local firm is higher than the skill premium in the foreign firm. Results also show that firm premium of unskilled workers is higher than that of the skilled workers. While these within-group relative values allow for identification of important differences between labor-types and firms, it is important to talk about an overall skill and firm premium. The benchmark findings suggest that economy-wide skill premium is more than the overall firm premium. One should also note that, at these parameter values, we find that the firm premium is less than one.

< Insert Table 2 >

3.2 Changes in the Cost Structure

Job creation costs play a vital role in explaining wage dynamics and unemployment. Actually, governments lower job creation costs to encourage foreign firm entry and to benefit from increased foreign firm activity. However, while in some cases, government could lower the costs for both local and foreign firms, in other cases, the reduction in costs only applies to foreign firms. We undertake exercises regarding both possibilities. Results presented in Table 2 study the latter public policy environment where only the costs incurred by the foreign firm are altered, while results in Table 3 show the former case where a symmetric cost change occurs for both the local and foreign firms.

Panel A and panel B in Table 2 shows the effects of an exogenous decrease in the job creation cost of foreign firms on vacancy creation and relative wages, keeping the cost incurred by the local firm constant. As the job creation cost of foreign firms' falls, the cost gap between local and foreign firms melt down and this stimulates foreign job creation leading to changes in wages paid by the foreign firm and the local firm.

The skill premium in the local firm decreases from 1.33 to 1.31 and the skill premium in the foreign firm increases from 1.26 to 1.28, when the foreign job creation costs fall from 0.9 to 0.5. While the skill premium within firms move in opposite directions, the increase in foreign presence by 160% (from 0.18 to 0.47) leads to a fall in the economy-wide skill premium.

The premium of working for a foreign firm increases for both skilled and unskilled workers and the economy-wide firm premium rises from 0.94 to 1.21 in response to increased foreign firm presence. This phenomenon could be explained by the fact that as foreign firms offer more vacant positions, the outside options of the workers performing local jobs increases, decreasing the value of filling local jobs with a suitable worker, thereby reducing all wages paid by the local firm. In this context, foreign firms pay more to attract skilled and unskilled workers from both the unemployment pool and the local firms since filling new vacant positions will increase the value of filling a foreign job with suitable workers. Briefly, as the cost differential for creating foreign and local jobs becomes lower, the wage gap between skilled and unskilled workers in the local firm falls and the premium of working in a foreign firm increases. The overall skill premium tends to decrease in response to the fall in the cost of job creation in the foreign firm.The results also show supporting evidence for proposition 1. At levels of foreign vacancy job creation cost exceeds 0.7, the foreign firm pays less than the local firm, i.e. the firm premium is less than 1 for both skilled and unskilled labor, as well as economy-wide. This is reversed when the foreign job creation cost falls to and below 0.7. One should keep in mind that the threshold level we find foreign job creation cost, 0.7, depends on the parameter values. However, regardless of the parameter values the results show support for proposition 1

Panel C in Table 2 shows the effects of an exogenous increase in the share of foreign firm vacancies on unemployment. Increased availability of foreign vacancies decreases the unemployment rate of unskilled workers from 10% to 8% and the skilled workers from 5% to 4%. Overall unemployment rate decreases from 15.8% to 13.4% following the new job opportunities. This result is suggestive that the increased presence of foreign firms could indeed contribute to reducing unemployment rates for both unskilled and skilled workers, under certain conditions.

< Insert Table 3A >

We next study a change in job creation cost with no change in the playing field, i.e. no special treatment to foreign firms. Table 3 shows the effects of an exogenous decrease in the job creation

cost of both foreign and local vacancies. When the job creation costs of foreign and local firms fall by the same absolute amount and the cost gap between local and foreign firms stays same, the share of foreign vacancies in total vacancies does not increase, it even decreases. In this case, the share of local vacancies tends to increase leading to a rise in local and a fall in the foreign firm wages paid. If the cost of job creation in local and foreign firms becomes 0.3 and 0.5, respectively, then the share of local vacancies form 65 % of the total and thereby, local firms start to pay more than foreign firms. Once again, this is in line with propositon 1 noting that foreign firms do not always pay more as the wage difference between local and foreign firms depends on the job opportunities provided by local and foreign firms, which are extensively determined by the cost of job creation and productivity of workers.

As opposed to the findings where the playing field was changed, such that the costs of foreign firms were reduced keeping those of local firm constant, the skill premium in the local firm increases from 1.32 to 1.33 and the skill premium in the foreign firm decreases from 1.27 to 1.25 in response to the fall in the cost of job creation in both firms. Overall, this leads to a rise in the economy-wide skill premium.

As the share of local vacancies in total vacancies rises, the premium of working for a foreign firm decreases for both skilled and unskilled workers, and the economy wide firm premium falls due the reduction of job creation costs for both local and foreign firms. One should therefore note that labor market effect of foreign firms, particularly those on wages, are influenced by the cost decision of the policy makers. If the cost gap between foreign and local firms are kept constant, than the skill premium increases and firm premium decreases. On the contrary, when the cost gap between foreign firm and local firm narrows, the skill premium falls and firm premium rises.

Panel C in Table 3 shows the effects of an exogenous increase in the share of local firm vacancies due to the decrease in the job creation cost of both firms on unemployment. The unemployment rate of unskilled workers decreases from 11% to 5% and the unemployment rate of skilled workers decreases from 5% to 3%. Overall unemployment rate decreases from 16.8% to 8% following the new foreign and local job opportunities, given both c_L and c_F decreases.

To sum up, it is clear that the numerical example results supports our theoretical predictions that the response of the overall skill and firm premium as well as the response of the absolute wages to changes in the extent of labor market imperfections and foreign presence depends on several conditions in the market. Briefly, this experiment reveals that, the labor market imperfections and

foreigners' share in the labor market have important non-linear effects on the wages of unskilled and skilled workers.

In the above case, we examine the labor market implications of the change in the cost structure of firms. An alternative way of interpreting those results would be through imputations of elasticities of relative wages and unemployment rates.

In this respect, Table 4 presents these elasticities -calculated by the help of the Table 2- with respect to the cost of foreign job creation[11]. While the signs of the elasticities suggest that increased foreign presence in the economy decreases the skill premium and increases the firm premium, there are differences in the direction of impact on the within firm skill premiia. Increased foreign presence decreases the skill premium paid by local firms, while increasing the skill premium paid by foreign firms. The foreign firm premium however changes in the same direction for both skilled and unskilled labor. However, this table not only reiterates the results rearding the direction of changes but also allows for a discussion regarding the magnitude of changes. Wages of the unskilled and skilled workers performing local and foreign jobs are more sensitive to increased foreign firm presesence. The elasticity of skill premium is lower than the elasticity of foreign firm premium with respect to the increased foreign firm activity. Particularly, 60% increase in the foreign vacant positions lead to 1% decrease in the economy-wide skill premium, while 11% increase in the economy-wide firm premium. Furhermore, the mass of foreign vacancies is highly elastic to the cost of foreign job creation. In other words, foreign job generation is highly sensitive to the cost.

< Insert Table 4 >

3.3 Sensitivity Analysis

Absolute wages, skill premium and firm premium extensively depend on the rate of vacany creation of the firms, which are influenced directly by the job creation cost and the labor productivity of the firms and indirectly by the skill endowment of the population. If their respective cost of job creation decreases, foreign firms increase their activity by offering various job opportunities for skilled and unskilled workers and they pay more for skilled and unskilled workers than the domestic firm pays. Yet, note that the productivity gap between local and foreign firms also play a crucial role in explaining wage differentials as mentioned in proposition 1. Therefore, we next analyze the

[11] **Elasticity is measured by the percentage change in vacancies (wages, unemployment) divided by the percentage change in the cost.**

impact of a rise in the output gap between foreign and local firms (which in part could be due to technological progress) and evaluate the effect of the consecutive decrease in job creation cost on absolute and relative wages when the output of foreign job is sufficiently higher than that of the local job. Along the same lines, we also test the sensitivity of the results to the skill endowment parameter.

< Insert Table 5 >

Technological Upgrading

Due to the technological upgrading, foreign firms become more productive, increasing the gap between y_j^F and y_j^L. As the output gap between foreign and local firms increases, foreign firms start to offer more positions for workers, hence, the share of vacancies posted by foreign firms increase. While foreign jobs are relatively scarce to start with, in particular, because the cost of opening foreign vacancies is higher than the cost of opening local vacancies, the supply of foreign jobs exceeds the local jobs due to the technological upgrading. In this context, in response to a rise in the foreign job opportunities, wages of the local firm decrease and wages of the foreign firm increase (The results are compared to our benchmark case, where the technology gap[12] is given as 10%).

Here, we should also note that an increase in the share of foreign vacancies due to the improvement in foreign firm technology puts an upward pressure on the overall skill premium and firm premium. While an increase in the share of foreign job offerings due to the technological progress (i.e., productivity advantage of the foreign firm rises) lowers the skill premium in the local firm, it raises the skill premium in the foreign firm. Actually, Panel B in the Table 5 reveals that technological progress in the foreign firm increases the premium of working for a foreign firm for both unskilled and skilled workers. This is due to the fact that an increase in the productivity advantage of the foreign firms directly generates an increase in the foreign wages, in particular for the skilled wages, but also its effect on wages become more powerful since it increases the jobs created by foreign firms.

According to Panel C in Table 5, overall unemployment decreases in response to technological progress (technology gap increases from 10% to 25%). This could be explained by the fact that

[12] y_j^F/y_j^L is technology gap, which is defined as the productivity advantage of the foreign firm.

the technological progress facilitates job creation and to this end foreign firms provide new job opportunities.

< Insert Table 6 >

We re-examine the effects of a fall in the job creation cost of foreign firms on wages and unemployment by assuming the productivity gap between foreign and local firms is sufficiently large ($y_j^F/y_j^L = 2.00$). As is shown in Panel A and Panel B in the Table 6, a decrease in the cost gap between local and foreign firms and increase in the productivity gap between foreign and local firms makes it profitable to create foreign jobs and search for the appropriate candidates. Due to the decrease in the cost gap and the improvement in technology not only are more jobs created, but the job composition shifts towards more productive foreign jobs. As such both the skill and firm premium tend to increase. In other words, an increase in the share of foreign jobs due to the widened production differentials and narrowed cost gap puts an upward pressure on foreign wages and overall relative wages while lowering the wages of the workers in the local firm. However, results presented in Table 2 where the $\frac{y_j^F}{y_j^L}$ is assumed to be 10% say that decrease in the job creation cost of the foreign firm leads to a fall in the economy-wide skill premium and a rise in the economy-wide firm premium. Further, when the Panel C of the Tables 2 and 6 are compared, increased foreign presence, in response to a decline in the job creation cost, leads to a decrease in the unemployment rates, both for the skilled and unskilled workers. But if technological upgrading accompanied declining costs, the decrease in unemployment rates will be higher than the case presented in Panel C of the Table 2.

Skill Upgrading

Given the baseline parameter values, we focus on the skill upgrading and the share of skilled workers increase from 20% to 40%, that is, $\mu = 0.6$. Table 7 presents the effect of skill upgrading on vacancy creation, wages and unemployment.

< Insert Table 7 >

When skilled work force constitutes 40% of the total population, the mass of local and foreign vacancies record a significant rise. According to the Panel B in Table 7, skill premium in the local firm fall from 1.32 to 1.30 and skill premium in the foreign firm decrease slightly from 1.30 to 1.28

due to the skill upgrading when the results are compared to the Table 1. Earnings of the skilled workers fall slightly in the foreign and local firms. Also, both the skill and firm premium decreases due to the skill upgrading. Panel C in Table 7 notes that while unemployment rate for skilled workers increase and unemployment rate for unskilled workers decrease.

< Insert Table 8 >

Table 8 examines the effect of a decrease in the cost of foreign job creation when one considers the skill upgrading. Given the share of skilled workers as 40 % of the population, foreign firms create new job opportunities in response to a fall in the foreign job creation cost. This leads to a decline in the economy-wide skill premium and a rise in the economy-wide firm premium. Particularly, an increase in the share of skilled workers does not change results presented in Table 2 as in the case of technological upgrading, specifically for the economy-wide skill premium and firm premium. Particularly, Panel C in Table 8 shows that overall unemployment rate decreases due to a fall in the cost gap between foreign and local firms. Further, when the Panel C of the Tables 2 and 6 are compared, increased foreign presence, in response to a decline in the job creation cost, leads to a decrease in the unemployment rates, both for the skilled and unskilled workers. But if skill upgrading accompanied declining costs, the decrease in unemployment rate for the skilled workers will be higher than the case presented in Panel C of the Table 2. Table 6 and Table 8 reveal that impact of a decrease in the cost of foreign job creation on overall relative wages depends on the technology available in the foreign firm and the share of skilled workers in the local labor market

4 Conclusion

In this paper, we examine the role of foreign firms in job creation as well as its role in changing the structure of employment and explaining wage inequalities in the local market by using a heterogenous matching model. There are a number of skilled and unskilled workers both in the unemployment pool and in the local and foreign firm looking for jobs posted by firms. Given this framework, wages are determined by the Nash bargaining approach and equilibrium conditions. In particular, the model not only presents absolute wages but also it allows us to study within firm (local and foreign) and within group (skilled and unskilled) relative wages.

Our results suggest that wages are a weighted average of labor productivity and unemployment

benefit, where the weight depends on the bargaining power of the workers, labor market tightness and the mass of local and foreign vacancies. In fact, the mass of vacant positions in the foreign firm depends on the job-creation costs and relative labor productivities. This model allows us to find:

1. Levels of wages paid by foreign firm need not always greater than that paid by local firm. We call this as the firm premium, so results suggest that it could be greater or smaller than one depending on relative costs, skill endowment and technological gap between local and foreign firm.

2. An increase in foreign presence, defined as the share of foreign vacancies in total vacancy, can occur because of:

(a) exogenous change in cost- public policy.

(i)level field making it worse for both local and foreign firms, leading to a rise in economy-wide skill and a fall in the firm premium.

(ii)special treatment to foreign firm, leading to a decline in economy-wide skill premium and increase in firm premium.

(b) technological improvements- foreign firm biased- increases both economy-wide skill and firm premium.

(c) skill upgrading - decreases economy-wide skill premium and firm premium.

Therefore, depending on the cause of an increase in foreign presence we end up with differential relative wage effects, both on the skill and firm premia.

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Tables

Table 1. Baseline Solution

Benchmark Parameters									
$r = 0.05$, $\beta = 0.5$, $\delta = 0.1$, $b = 0.1$, $c_L = 0.5$, $c_F = 1$									
$\mu = 0.8$, $\alpha = 0.5$, $y_s^F = 1.9$, $y_s^L = 1.7$, $y_i^F = 1.5$, $y_l^L = 1.3$									
Labor Market: Job Opportunities and Unemployment									
v_L		v_F		η		u	u_l	u_s	
0.3995		0.1473		0.7305		0.1648	0.1078	0.0570	
Wages									
w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
0.9685	0.8900	1.3028	1.1268	1.3451	1.2660	0.9189	0.8649	1.3251	0.9048

Table 2. Decrease in the Job Creation Cost of Foreign Firm and its Labor Market Implications

Panel A: Vacancies										
	vl			vf			η			
c_L= 0.5										
c_F= 0.9	0.408			0.18			0.68			
c_F= 0.8	0.413			0.23			0.64			
c_F= 0.7	0.410			0.29			0.58			
c_F= 0.6	0.397			0.37			0.51			
c_F= 0.5	0.367			0.47			0.43			
Panel B: Wages										
	w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
c_F= 0.9	0.94	0.90	1.27	1.14	1.339	1.2683	0.9549	0.90	1.318	0.9416
c_F= 0.8	0.92	0.92	1.23	1.17	1.333	1.2711	0.9997	0.95	1.310	0.9876
c_F= 0.7	0.90	0.95	1.19	1.21	1.326	1.2746	1.0564	1.01	1.304	1.0456
c_F= 0.6	0.87	0.98	1.15	1.26	1.320	1.2789	1.1288	1.09	1.298	1.1198
c_F= 0.5	0.84	1.02	1.10	1.32	1.312	1.2842	1.2219	1.19	1.295	1.2151
Panel C: Unemployment										
	u			u_i			u_s			
c_F= 0.9	0.1585			0.1040			0.0545			
c_F= 0.8	0.1527			0.1002			0.0525			
c_F= 0.7	0.1469			0.0963			0.0506			
c_F= 0.6	0.1410			0.0925			0.0485			
c_F= 0.5	0.1347			0.0887			0.0460			

Table 3A. Decrease in the Job Creation Cost of Foreign and Local Firms and its Labor Market Implications

Panel A: Vacancies										
	vl			vf			η			
$c_L = 0.7; c_F = 0.9$	0.28			0.23			0.54			
$c_L = 0.5; c_F = 0.7$	0.41			0.29			0.58			
$c_L = 0.3; c_F = 0.5$	0.69			0.37			0.65			
$c_L = 0.1; c_F = 0.3$	1.71			0.36			0.82			
Panel B: Wages										
	w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
$c_L = 0.7; c_F = 0.9$	0.88	0.96	1.16	1.23	1.3264	1.2796	1.0956	1.05	1.3042	1.0856
$c_L = 0.5; c_F = 0.7$	0.90	0.95	1.19	1.21	1. 3266	1.2746	1.0564	1. 01	1.3043	1.0456
$c_L = 0.3; c_F = 0.5$	0.94	0.92	1.25	1.17	1. 3282	1.2677	0.9827	0.93	1.3074	0.9712
$c_L = 0.1; c_F = 0.3$	1.06	0.86	1.42	1.08	1. 3355	1.2569	0.8085	0.76	1.3241	0.7963
Panel C: Unemployment										
	u			u_i			u_s			
$c_L = 0.7; c_F = 0.9$	0.1682			0.1102			0.0580			
$c_L = 0.5; c_F = 0.7$	0.1469			0.0963			0.0506			
$c_L = 0.3; c_F = 0.5$	0.1211			0.0796			0.0415			
$c_L = 0.1; c_F = 0.3$	0.0885			0.0585			0.0300			

Table 3B. Gap Between Job Creation Cost of Foreign and Local Firms and its Labor Market Implications

Panel A: Vacancies										
	vl			vf			η			
c_L/c_F= 1	0.367			0.47			0.43			
c_L/c_F= 2	0.399			0.14			0.73			
c_L/c_F= 3	0.336			0.05			0.86			
Panel B: Wages										
	$w_\imath^L$	$w_\imath^F$	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_\imath^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_\imath^F}$	$\frac{\mathbf{w}_\imath^F}{\mathbf{w}_\imath^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
c_L/c_F= 1	0.84	1.02	1.10	1.32	1.312	1.284	1.221	1.19	1.295	1.215
c_L/c_F= 2	0.96	0.89	1.30	1.12	1.345	1.265	0.918	0.86	1.325	0.904
c_L/c_F= 3	1.03	0.84	1.41	1.05	1.369	1.258	0.814	0.74	1.357	0.796
Panel C: Unemployment										
	u			$u_\imath$			u_s			
c_L/c_F= 1	0.1347			0.0887			0.0460			
c_L/c_F= 2	0.1648			0.1078			0.0570			
c_L/c_F= 3	0.1924			0.1255			0.0669			

Table 4. Cost Elasticity of Vacancies, Wages and Unemployment

Panel A: Vacancies										
	vl			vf			η			
Baseline $c_F = 0.9$										
%11 decrease in c_F	-0.10			-2.30			0.63			
%22 decrease in c_F	-0.02			-2.65			0.69			
%33 decrease in c_F	0.08			-3.06			0.75			
%44 decrease in c_F	0.23			-3.54			0.82			
Panel B: Wages										
	$w_\imath^L$	$w_\imath^F$	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_\imath^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_\imath^F}$	$\frac{\mathbf{w}_\imath^F}{\mathbf{w}_\imath^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
Baseline $c_F = 0.9$										
%11 decrease in c_F	0.21	-0.20	0.25	-0.22	0.04	-0.08	-0.47	-0.49	0.05	-0.46
%22 decrease in c_F	0.23	-0.23	0.27	-0.25	0.04	-0.05	-0.50	-0.55	0.05	-0.51
%33 decrease in c_F	0.24	-0.26	0.28	-0.29	0.04	-0.04	-0.56	-0.63	0.04	-0.57
%44 decrease in c_F	0.26	-0.30	0.30	-0.33	0.04	-0.04	-0.64	-0.72	0.04	-0.66
Panel C: Unemployment										
	u			$u_\imath$			u_s			
Baseline $c_F = 0.9$										
%11 decrease in c_F	0.33			0.33			0.33			
%22 decrease in c_F	0.33			0.33			0.33			
%33 decrease in c_F	0.33			0.33			0.33			
%44 decrease in c_F	0.34			0.33			0.35			

Table 5. Technological Upgrading and its impact on the Labor Market

Panel A: Vacancies										
	vl			vf			η			
Baseline technology gap (%10)	0.41			0.29			0.58			
Changes from baseline										
technology gap %25	0.40			0.33			0.54			
technology gap %50	0.38			0.43			0.46			
technology gap %75	0.35			0.51			0.40			
technology gap %100	0.31			0.61			0.33			
Panel B: Wages										
	$w_\imath^L$	$w_\imath^F$	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_\imath^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_\imath^F}$	$\frac{\mathbf{w}_\imath^F}{\mathbf{w}_\imath^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
Baseline technology gap (%10)	0.90	0.95	1.19	1.21	1.326	1.2746	1.0564	1. 01	1.304	1.0456
Changes from Baseline										
technology gap %25	0.88	1.03	1.17	1.36	1. 323	1.3348	1.1636	1.17	1.322	1.1663
technology gap %50	0.85	1.27	1.12	1.69	1. 315	1.3331	1.4868	1.50	1.326	1.4918
technology gap %75	0.82	1.52	1.08	2.03	1.310	1.3415	1.8345	1.87	1.333	1.8457
technology gap %100	0.80	1.86	1.04	2.49	1.305	1.3373	2.3216	2.37	1.331	2.33
Panel C: Unemployment										
	u			$u_\imath$			u_s			
Baseline technology gap (%10)	0.1469			0.0963			0.0506			
Changes from Baseline										
technology gap %25	0.1438			0.0943			0.0495			
technology gap %50	0.1374			0.0902			0.0472			
technology gap %75	0.1332			0.0875			0.0457			
technology gap %100	0.1294			0.0850			0.0444			

Table 6. Decrease in the Job Creation Cost of Foreign Firm and its Impact on Vacancies and Wages (Technological Upgrading)

Panel A: Vacancies										
	vl			vf			η			
$c_L = 0.5$										
$c_F = 0.9$	0.3677			0.4729			0.4374			
$c_F = 0.8$	0.3425			0.5404			0.3879			
$c_F = 0.7$	0.3102			0.6159			0.3349			
$c_F = 0.6$	0.2704			0.6990			0.2789			
$c_F = 0.5$	0.2233			0.7887			0.2207			
Panel B: Wages										
	w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
$c_L = 0.5$										
$c_F = 0.9$	0.8414	1.7564	1.1047	2.3360	1.3129	1.33	2.0873	2.1145	1.3253	2.0943
$c_F = 0.8$	0.8226	1.8071	1.0768	2.4097	1.3089	1.3334	2.1967	2.2378	1.3279	2.2072
$c_F = 0.7$	0.8033	1.8651	1.0484	2.4943	1.3051	1.3373	2.3216	2.3791	1.3315	2.33
$c_F = 0.6$	0.7839	1.9309	1.0201	2.5907	1.3012	1.3416	2.4631	2.5395	1.3361	2.4824
$c_F = 0.5$	0.7647	2.0049	0.9923	2.6996	1.2976	1.3465	2.6217	2.7205	1.3417	2.6467
Panel C: Unemployment										
$c_L = 0.5$										
	u			u_l			u_s			
$c_F = 0.9$	0.1353			0.0888			0.0465			
$c_F = 0.8$	0.1323			0.0869			0.0454			
$c_F = 0.7$	0.1294			0.0850			0.0444			
$c_F = 0.6$	0.1266			0.0832			0.0434			
$c_F = 0.5$	0.1241			0.0816			0.0425			

Table 7. Skill Upgrading and its Impact on Labor Market

Panel A: Vacancies										
	vl			vf			η			
$\mu = 0.6$	0.4402			0.3109			0.5860			
Panel B: Wages										
	w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
$\mu = 0.6$	0.9090	0.9562	1.1871	1.2064	1.3059	1.2615	1.0519	1.0162	1.287	1.0352
Panel C: Unemployment										
	u			$u_ı$			u_s			
$\mu = 0.6$	0.15			0.0820			0.068			
Panel D: Baseline Solution										
Job Opportunities and Unemployment										
	v_L	v_F	η		u		u_l		u_s	
$\mu = 0.8$	0.4107	0.2922	0.5842		0.1469		0.0963		0.0506	
Wages										
	w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
$\mu = 0.8$	0.9019	0.9528	1.1966	1.2145	1.3266	1.2746	1.0564	1.0149	1.3043	1.0456

Table 8. Decrease in the Job Creation Cost of Foreign Firm and its Impact on Vacancies and Wages (Skill Upgrading)

Panel A: Vacancies										
	vl			vf			η			
$c_L = 0.5$										
$c_F = 0.9$	0.4362			0.1968			0.6890			
$c_F = 0.8$	0.4419			0.2465			0.6419			
$c_F = 0.7$	0.4402			0.3109			0.5860			
$c_F = 0.6$	0.42702			0.394797			0.5196			
$c_F = 0.5$	0.3968			0.5025			0.4412			
Panel B: Wages										
	w_i^L	w_i^F	w_s^L	w_s^F	$\frac{\mathbf{w}_s^L}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_i^F}$	$\frac{\mathbf{w}_i^F}{\mathbf{w}_i^L}$	$\frac{\mathbf{w}_s^F}{\mathbf{w}_s^L}$	W^{sp}	W^{fp}
$c_L = 0.5$										
$c_F = 0.9$	0.9578	0.9098	1.2557	1.1452	1.3109	1.2586	0.9498	0.9119	1.2952	0.9320
$c_F = 0.8$	0.9351	0.9304	1.2236	1.1722	1.3085	1.2599	0.9949	0.9580	1.2912	0.9775
$c_F = 0.7$	0.9090	0.9562	1.1871	1.2064	1.3059	1.2615	1.0519	1.0162	1.287	1.0352
$c_F = 0.6$	0.8795	0.9893	1.1460	1.2500	1.3030	1.2635	1.1248	1.0908	1.2828	1.1089
$c_F = 0.5$	0.8467	1.0319	1.1006	1.3064	1.2998	1.2659	1.2187	1.1868	1.2792	1.2038
Panel C: Unemployment										
$c_L = 0.5$										
	u			u_l			u_s			
$c_F = 0.9$	0.1623			0.0887			0.0736			
$c_F = 0.8$	0.1561			0.0853			0.0708			
$c_F = 0.7$	0.15			0.0820			0.068			
$c_F = 0.6$	0.1439			0.0787			0.0652			
$c_F = 0.5$	0.138			0.0755			0.0625			