The Stolper-Samuelson Theorem when the Labor Market Structure Matters

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Abstract. This paper develops a 2-country, 2-factor, 2-sector trade model with search and matching frictions in the factor market to analyze the effect of a trade induced shock to the relative output price on the relative factor price (skill premium).

Our contribution is to show that the increase in market tightness for skilled workers can dominate the effect of productivity on factor prices when there are factor-specific differences in bargaining power and mobility across sectors. We motivate the theory with the recent evidence in favor of skill-specific bargaining power and sector switching costs. Furthermore, we provide new evidence on the dynamics of the skill premium following trade liberalizations. This motivates us to distinguish between: a *short-run* equilibrium, in which unemployed workers search in the sector offering higher expected value of searching; and a *long-run* equilibrium in which the value of searching in the two sectors has to be the same.

The model predicts that a fall in the relative price of the skill-intensive goods determines an increase of the skill-premium when: (i) in the short-run, skilled workers have higher bargaining power than unskilled workers; (ii) in the long-run, if factors are substitutes, skilled workers are more able to reallocate across sectors than unskilled workers.

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1 Introduction

The Stolper-Samuelson Theorem (SST) is a key result of the classical trade literature, Stolper and Samelson (1941). Nevertheless, this theoretical argument does not provide a satisfactory explanation for neither historical nor modern evidence on the dynamics of relative wages following a trade liberalization; see Davis and Mishra (2007), Lawrence and Lawrence (2010) and Haskel et al. (2012). In particular, the increase in wage inequality for developing countries opening to trade is a robust finding, see Goldberg and Pavcnik (2007), that can hardly be reconciled with the theoretical predictions of the theorem. In this paper we aim to provide a theory that explains why and when the classical (SST) fails, depending on the structure of the factor market.

A major disconnection between theory and evidence is the assumption of perfect factor markets. The strain of literature on search and matching, summarized by Mortensen and Pissarides (1999), sheds light both on the sources of frictions and their consequences on general equilibrium models. The main insight from that literature that is key for our research question is notion that search and matching frictions in the factor market weaken the link between relative output prices, productivities and factor prices, that is at the basis of the (SST). The reason is that, conditionally on output price and factor productivity, the value of a job for the firm is greater the higher is the expected cost of hiring a worker who can fill the vacant job. This intuition is sufficient to outline a consistent argument that shows when the predictions of the SST might be reversed in presence of search and matching frictions in the factor market.

Consider a developing economy, which opening to trade experiences a fall in the relative price of skill-intensive goods. The economy would specialize in the production of no-skill-intensive goods, with a reallocation of the workforce toward that sector. Without frictions in the factor market two channels drive the economy to the new equilibrium. First, because of full employment, the composition of the workforce who reallocates to the no-skill-intensive sector is relatively more skilled than the incumbent employment. As a consequence, under constant economies of scale, the productivity of an unskilled factor in the export sector rises. Second, because of competitive factor market, factor prices are equal to output prices times the factor productivity. Therefore, the reward of an unskilled factor rises more than the price of no-skill-intensive goods.

Frictions in the factor market might lead to a different conclusion by affecting these two channels. First, allowing for unemployment, the reallocation of factors toward the no-skill-intensive sector does not take place necessarily with the same composition at which the skill-intensive sector layoffs factors. Second, the factor price is a function of productivity but not only, it will also increase the tighter is the factor market; namely the higher is the number of vacancies per job applicant, *factor market tightness*. Following the trade liberalization, if the market for skilled factors becomes more tight than the market for unskilled factors then the relative wage of skilled workers will be the outcome of two opposite forces. The relative productivity of the skilled factor falls; this is the *pro*-SST channel. But hiring a skilled worker becomes relatively more difficult; this is the *anti*-SST channel, because it leads to an increase of the relative price of the skilled factor. Therefore, the ultimate task behind our research question is to assess which aspects of factor market imperfections lead to an equilibrium in which the market tightness effect prevails on the productivity effect.

In this paper, we develop a 2-country, 2-factor, 2-sector trade model with search and matching frictions in the labor market. We analyze the response of the within-sector skill premium to a trade liberalization. We distinguish between: a *short-run* equilibrium, in which unemployed workers search in the sector that offers higher expected value; and a *long-run* equilibrium in which the value of searching in the two sectors has to be the same. We show that the theoretical prediction of the SST are reversed when: (*i*) in the short-run, skilled workers have higher bargaining power than unskilled workers; (*ii*) in the long-run, if factors are substitutes, skilled workers are more willing to reallocate across sectors than unskilled workers.

The distinction between short-run and long-run seems appropriate in light of a new evidence we provide on the dynamics of the change in the skill premium after episodes of trade liberalization. Wacziarg and Welch (2008) document events of trade liberalization after 1983. We combine this observation with the information collected in the *Occupational Wages around the World* database, (OWW). We classify employees according to the ILO classification: engineers and supervisors are treated as skilled workers; labor workers are considered as unskilled. From the sample of 29 countries and 15 1-digit industries available after the merge of the two sets of information, we construct a time series that takes the period $t = 0$ as the time of the implementation of a trade liberalization. For each triplet of country c, industry i and time period t we compute the log of the ratio of the average wage of skilled workers w^s_{cit} over the average wage of unskilled workers w^u_{cit}. This variable is our proxy for the skill premium and we regress this dependent variable against the sequence of indicator functions $I_{[t]}$ that are equal to 1 when t is the number of years to (if negative) and from (if positive) the trade liberalization episode, controlling for country δ_c and industry ν_i fixed effects. In Figure 1 we plot the expected value and 90% confidence interval of the coefficient β_t from the regression $log\,(w^s_{cit}/w^u_{cit}) = \sum_{t=-3}^{t=14} \beta_t I_{[t]} + \delta_c + \nu_i + \varepsilon_{cit}$. The net change of the skill premium

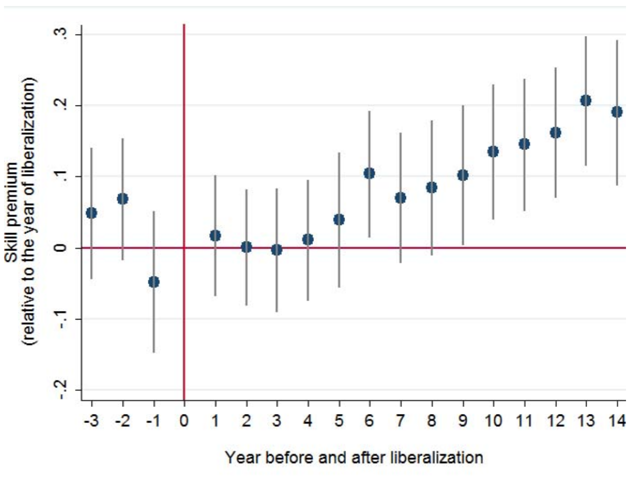

Figure 1: Event study on the skill premium before and after episodes of trade liberalization. Source: ILO, OWW database.

is ambiguous and not significantly different from zero within five years after the trade liberalization. The skill premium starts rising after 5 years following trade reforms. After 10 years, it settles around 0.1 log points higher than its level at the time of the reform.

Our framework is closely related to the seminal work by Davidson et al. (1999) in which the authors extend the classical trade model to a framework in which unemployment arises in equilibrium as a consequence of search and matching frictions in the factor market. Our setup extends the model by Davidson et al. (1999) to a framework with C.E.S. production technology, (as opposed to a linear production function) and a Cobb-Douglas matching technology (as opposed to a linear matching function). Most importantly, we contribute to the literature because we investigate the role of two novel mechanisms that were not covered in Davidson et al. (1999) and following related works: factors are heterogeneous in bargaining power and mobility. We show that these two channels are necessary and sufficient to generalize the SST and explain the evidence of a rise in the skill premium when the relative price of skill-intensive goods falls. The contribution is two-fold. In the absence of differences in bargaining powers, the theory would not predict any within-sector skill premium; unless ad-hoc differences between sectors in exogenous frictions are assumed. Moreover, frictions in the labor market are not sufficient to overturn the classical SST in the long run (i.e. when the value of searching has to be equal across sectors). Only when factors have different degrees of mobility, the effect of market tightness can be strong enough to more than compensate the productivity effect.

The extension to a frictional factor market is not sufficient to explain the evidence concerning the response of the skill-premium to trade liberalizations. Indeed, the literature based on Davidson et al. (1999) does not predict a substantial departure from the SST predictions. In contrast to the existing models, our theory explains the evidence on the dynamics of the skill-premium following a trade liberalization on the basis of skill-specific bargaining power and mobility across sectors.

Recent evidence on firm and worker matches supports both the idea that skilled workers have higher bargaining power and a different propensity to reallocate across sectors with respect to unskilled workers. Hall and Krueger (2012) survey a representative sample of US manufacturing workers, asking among several question if the worker bargained on the wage or not with the current employer. Table (1) shows that only 6% of blue collar workers bargained on the wage, against a percentage of 87% for knowledge workers. With respect to the representative employee in the sample, knowledge workers have statistically higher probability to bargain

	Bargain?	Difference from base case
Knowledge worker	87%	+54%
	(4)	(7)
Blue collar	6%	-27%
	(2)	(6)
Observations	1,284	

Table 1: Percentage of workers who answered "Yes" to the question if they bargained on the wage. Source: Hall and Krueger (2012), Table 3; bootstrap standard errors in parenthesis.

(+54%); the opposite is true for blue collar workers (−27%). Approximating the

	Bargain?	Difference from base case
Not HS graduate	29%	-3%
	(10)	(9)
Some college	43%	+11%
	(8)	(6)
College graduate	45%	+12%
	(8)	(6)
Profes. training	60%	+27%
	(9)	(7)
Observations	1,284	

Table 2: Percentage of workers who answered "Yes" to the question if they bargained on the wage. Source: Hall and Krueger (2012), Table 3; bootstrap standard errors in parenthesis.

skill-type of an employee with the level of education yields a similar picture. Table (2) documents how the share of bargaining increases from 29% for workers without a high-school degree to 60% for workers with professional training after a college degree; with a probability of bargaining that rises up to +27% higher than the representative employee. Further evidence on skill-based differences in bargaining power is provided by Cahuc et al. (2006) who investigate the determinants of wages in France. They find a negligible contribution of bargaining power for low- and intermediate-skill workers, whereas the contribution is positive for high-skill workers.

The idea that skilled workers and unskilled workers are different not only in terms of bargaining power but also in factor mobility finds support on two very recent and independent contributions. Bagger et al. (2014) decompose the wage both for search and matching characteristics and worker human capital accumulation. They find that controlling for capital accumulation the contribution of bargaining power (among other characteristics of a match) declines over time, while the effect of human capital accumulation dominates. They also find that human capital is higher for highly educated workers and it is a major explanatory factor of the growth in wage over time. Autor et al. (2014) show that after negative import shocks high wage workers are better able to move across employers and sectors than low wage workers. Nevertheless, the reallocation out of import-affected industries leads to a loss of value, in terms of earnings per time of employment. This evidence supports the idea that there are substantial skill-specific switching costs, with a possible explanation in the destruction of industry-specific human capital.

The reminder of the paper is structured as follows. In the next section we outline the model and in section 3 we define and solve the general equilibrium, both in autarky and under a the case of a small open economy. In section 4 we derive the closed form expression for the relationship between skill-premium and relative price; first in the short-run and then in the long-run. Section 5 provides a quantitative assessment of the theory on the basis of a structural estimation of the model. Section 6 concludes.

2 Model

There are two countries, the domestic economy and the rest of the world. Each economy consists of two sectors, producing a *skill-intensive* good S and a *no-skill-intensive* good N. Each country is populated by two types of agents, labor workers and knowledge workers. Workers are endowed each period with one indivisible unit of time that can be rent as labor L or knowledge K, according to the worker type. Both factors are mobile across sectors and internationally immobile.

Each sectors is populated by a large number of identical, small, competitive firms. Every individual firm serves an infinitesimal quantity of total output and it employs infinitesimal shares of total labor employment and knowledge employment. As a consequence, firms are price taker both on the output and on the factor market.[1]

Agents allocate consumption between the two goods according to homothetic preferences. Consumer's preferences are represented by the utility function:

$$C = \left[N_c^{\frac{\sigma-1}{\sigma}} + S_c^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{1}$$

where $\sigma \geq 0$ is the elasticity of substitution between goods, positive and finite. The representative firm in each sector employs both factors to produce output with a C.E.S. technology:

$$N_p = \left[\lambda_N L_N^{\frac{\tau-1}{\tau}} + \kappa_N K_N^{\frac{\tau-1}{\tau}} \right]^{\frac{\tau}{\tau-1}} \quad , \quad S_p = \left[\lambda_S L_S^{\frac{\tau-1}{\tau}} + \kappa_S K_S^{\frac{\tau-1}{\tau}} \right]^{\frac{\tau}{\tau-1}} \tag{2}$$

where $\tau \geq 0$ is the elasticity of technical substitution across factors and there are constant returns to scale $\lambda_y + \kappa_y = 1$ for $y = \{N, S\}$. We assume that, conditionally on the same factor prices across sectors, the production of no-skill-intensive good uses relatively more labor than knowledge: $\frac{\lambda_N}{\kappa_N} > \frac{\lambda_S}{\kappa_S}$.

Let p_N and p_S be the price of one unit of no-skill-intensive good and one unit of skill-intensive good, respectively. The revenue associated to the marginal unit of labor and knowledge in the production of output $y = \{N, S\}$ are: $MR_{Ly} = p_y \left(\partial y / \partial L_y \right)$ and $MR_{Ky} = p_y \left(\partial y / \partial K_y \right)$. Let w_y and r_y be respectively the factor price for one unit of labor and knowledge. Then, the firm profit associated to the marginal labor worker and knowledge worker are $(MR_{Ly} - w_y)$ and $(MR_{Ky} - r_y)$, respectively.

Time is continuous. Agents are infinitely lived, risk neutral and discount future at a rate $\varrho > 0$. In each period u_{fy} workers endowed with factor $f = \{L, K\}$ are unemployed and searching in sector $y = \{N, S\}$. Firms post vacancies for labor

[1]Notice that the factor average productivity at each single firm coincides with the factor marginal productivity of the representative firm that supplies the aggregate output.

workers v_Ly and for knowledge workers v_Ky. Searching is costly on the firm side: holding a vacancy has a cost $\gamma > 0$ per period. On the worker side, searching effort is subject to a time constraint: in every period an unemployed worker sends one job application to either one of the two sectors; therefore, every unemployed worker receives either zero or one job offer per period from only one of the two sectors.

Job applications and vacancies are matched randomly according to a Cobb-Douglas technology. The matches of factor $f = \{L, K\}$ in sector $y = \{N, S\}$ are $M_{fy} = \epsilon u_{fy}^{\alpha} v_{fy}^{1-\alpha}$, where $\alpha \in (0,1)$ and $\epsilon > 0$ parametrize the response of matches to unemployment and the efficiency of the matching process, respectively. With probability $m_{fy} = \frac{M_{fy}}{u_{fy}}$ an unemployed worker of type $f = \{L, K\}$ becomes employed in sector $y = \{N, S\}$. The probability that a firm of sector $y = \{N, S\}$ fills a vacancy specific to factor $f = \{L, K\}$ is given by: $h_{fy} = \frac{M_{fy}}{v_{fy}}$. The probability that an unemployed worker finds a match and the probability that a firm hires a worker are respectively an increasing and a decreasing function of the factor market tightness $\theta_{fy} = v_{fy}/u_{fy}$:

$$m(\theta_{fy}) = \min\left\{\epsilon \theta_{fy}^{1-\alpha}, 1\right\} \quad , \quad h(\theta_{fy}) = \min\left\{\epsilon \theta_{fy}^{-\alpha}, 1\right\} \tag{3}$$

Existing matches separate because of an exogenous destruction shock that occurs with arrival rate $\delta > 0$. When this shock occurs an employed worker becomes unemployed and a filled job turns into a vacant job.

Let E_{fy} and U_{fy} be respectively the asset value for a worker endowed with factor $f = \{L, K\}$ of being employed in sector $y = \{N, S\}$ or being unemployed and searching in sector y. The flow value of employment is given by the factor price $z_y = \{w_y, r_y\}$, (*current value*), plus the value of a change in the agent's status (*capital gain*), that occurs with probability δ.

Every worker has been employed at least once and employed workers who separate search for a job in either one of the two sectors. When a worker of type $f = \{L, K\}$ who was previously employed in sector $y = \{N, S\}$ decides to search for a job in a different sector $\not{y} = not\,\{y\}$ suffers a loss of value, in terms of a share $\psi_f \in [0, 1)$ of the value of searching in the new sector. It follows that the capital loss for a worker who loses the job in sector N is $[U_{fN} - E_{fN}]$ if she searches in the same sector or $[(1-\psi_f)\,U_{fS}-E_{fN}]$ if she changes the sector; and vice-versa for workers who separate from a firm in sector S.

The current value of unemployment consists of the benefit the worker enjoys from leisure $b \geq 0$. The capital gain of unemployment consists of the expected value of finding a match, in the sector the worker is searching on; either the no-skill intensive sector $m\,(\theta_{fN})\,[E_{fN}-U_{fN}]$ or the skill-intensive one $m\,(\theta_{fS})\,[E_{fS}-U_{fS}]$. The flow values that characterize the supply side of the labor market in steady state are:

$$\begin{aligned} \varrho E_{fy} &= z_y + \delta\,[max\,\{U_{fy},(1-\psi_f)\,U_{f\not y}\} - E_{fy}] \\ \varrho U_{fy} &= b + m\,(\theta_{fy})\,[E_{fy}-U_{fy}] \end{aligned} \tag{4}$$

for every sector $y=\{N,S\}$ and where $z_y=\{w_y,r_y\}$ is the factor price, for labor and knowledge respectively.

Searching workers will switch from sector y to sector $\not y$ as long as $U_{fy} \leq (1-\psi_f)\,U_{f\not y}$; and a flow of workers will move in the opposite direction when $U_{fy} \geq (1-\psi_f)\,U_{f\not y}$. If one of these scenario applies in the long run then production will run out of factor supply in the sector that is associated to the lower value of searching. For a long run allocation in which both factors are supplied to both sectors, workers who separate from a given sector y must be indifferent between sectors:

$$U_{f\not y} = (1-\psi_f)\,U_{fy} \tag{5}$$

for every sector $y=\{N,S\}$.

Let J_{fy} be the value of a filled job in sector $y=\{N,S\}$. The current value of a job consists of the marginal revenue MR_{fy} minus the factor price $z_y=\{w_y,r_y\}$. The capital gain accounts for the effect of a destruction of the match, that occurs with probability δ and replaces a filled job with a vacancy. The current value of a vacant job is the cost of holding a vacancy for the current period $-\gamma$. Whereas, the capital gain consists of the net gain of filling a vacant job $[J_{fy}-V]$ which occurs with probability $h\,(\theta_{fy})$; where V is the value of a vacancy. The flow values that characterize the demand side of the labor market are:

$$\begin{aligned} \varrho J_{fy} &= MR_{fy} - z_y + \delta\,[V - J_{fy}] \\ \varrho V &= -\gamma + h\,(\theta_{fy})\,[J_{fy}-V] \end{aligned} \tag{6}$$

for every factor $f = \{L, K\}$ and every sector $y = \{N, S\}$. The determination of wage and rate of return on knowledge is the equilibrium outcome of Nash bargaining. Firms bargain on the total surplus of the match with old and new employees as if each of them was the marginal worker and without commitment on future matches, as in Stole and Zwiebel (1996).

The value of a match for the firm is J_{fy}, for the worker is E_{fy}. The outside option for the firm is the value of a vacancy V. The outside option for the worker is the value of being unemployed and searching in the same sector U_{fy}. The equilibrium wage and rate of returns are the unique solutions to the following bargaining rules:

$$\begin{aligned} \mu_L \left[J_{Ly} - V\right] &= (1 - \mu_L) \left[E_{Ly} - U_{Ly}\right] \\ \mu_K \left[J_{Ky} - V\right] &= (1 - \mu_K) \left[E_{Ky} - U_{Ky}\right] \end{aligned} \tag{7}$$

where μ_f is the bargaining power of a worker endowed with factor $f = \{L, K\}$. We assume that knowledge workers have higher bargaining power than labor workers: $0 < \mu_L < \mu_K < 1$.

3 Equilibrium

The equilibrium of the output market consists of quantities of output consumption $\{S_c, N_c\}$, output production $\{S_p, N_p\}$ and prices $\{p_S, p_N\}$. The representative consumer maximizes utility (1) over consumption of goods S_c and N_c subject to the budget constraint $p_S S_c + p_N N_c = I$; where I is the nominal income. Let $P = \left(p_S^{1-\sigma} + p_N^{1-\sigma}\right)^{\frac{1}{1-\sigma}}$ be the consumption based price index then residual demand functions and are:

$$S_c = \frac{I}{P}\left(\frac{p_S}{P}\right)^{-\sigma} \quad , \quad N_c = \frac{I}{P}\left(\frac{p_N}{P}\right)^{-\sigma} \tag{8}$$

In each sector the representative firm minimizes the production cost $w_y L_y + r_y K_y$ for a target level of output $y = \{N_p, S_p\}$. Deriving the cost function yields the average cost, equal to the marginal cost of production as a function of factors' rewards:

$$c_y\left(w_y, r_y\right) = \left[\lambda_y^{\tau} w_y^{1-\tau} + \kappa_y^{\tau} r_y^{1-\tau}\right]^{\frac{1}{1-\tau}} \tag{9}$$

The optimal factor demands are:

$$
\begin{aligned}
L_N &= \left[\lambda_N \frac{c_N}{w_N}\right]^{\tau} N_p \quad , \quad K_N = \left[\kappa_N \frac{c_N}{r_N}\right]^{\tau} N_p \\
L_S &= \left[\lambda_S \frac{c_S}{w_S}\right]^{\tau} S_p \quad , \quad K_S = \left[\kappa_S \frac{c_S}{r_S}\right]^{\tau} S_p
\end{aligned} \tag{10}
$$

The marginal factor productivity of labor and knowledge are equal to the relative factor price with respect to the marginal cost: $\lambda_y \left(y/L_y\right)^{1/\tau} = w_y/c_y$ and $\kappa_y \left(y/K_y\right)^{1/\tau} = r_y/c_y$ for $y = \{N, S\}$.

In both sectors the number of competitors is unbounded, such that the representative firms make zero profit. Therefore, revenue $p_y Y$ minus the cost of production $c_y Y$ has to be equal to the cost of hiring, indeed γ times the number of vacancies posted. Let x_N and x_S be the shares of hiring cost over production cost in the two sectors. The zero profit condition yields the pricing rule:

$$
p_N = (1 + x_N)\, c_N \quad , \quad p_S = (1 + x_S)\, c_S \tag{11}
$$

Multiplying both sides of the zero profit condition (11) by the factor marginal productivities $\frac{w_y}{c_y}$ and $\frac{r_y}{c_y}$ yields the revenue associated to the marginal unit of labor and knowledge in the two sectors:

$$
\begin{aligned}
MR_{LN} &= (1 + x_N)\, w_N \quad , \quad MR_{KN} = (1 + x_N)\, r_N \\
MR_{LS} &= (1 + x_S)\, w_S \quad , \quad MR_{KS} = (1 + x_S)\, r_S
\end{aligned} \tag{12}
$$

Indeed, the price is given as a markup over the marginal cost and the factor marginal revenue is given as a markup over the factor price. The markup consists of the incidence of hiring cost over production cost.

The equilibrium of the factor market consists of factor prices $\{w_y, r_y\}$, factor market tightness θ_{fy} and unemployment rates u_{fy} for every factor $f = \{L, K\}$ in every sector $y = \{N, S\}$. Firms have an incentive to employ factors as long as the value of the marginal job is positive and it is strictly higher than the value of holding a vacancy. If there is an unbounded mass of workers searching for a job then the value of holding the marginal vacancy has to be zero. The free entry condition $V = 0$ in (6) implies two pairs of expressions for the value of a job $J_{Ly} = \frac{MR_{Ly} - w_y}{\varrho + \delta}$,

$J_{Ky} = \frac{MR_{Ky} - r_y}{\varrho + \delta}$ and the value of a vacancy $J_{Ly} = \frac{\gamma}{h(\theta_{Ly})}$, $J_{Ky} = \frac{\gamma}{h(\theta_{Ky})}$ which yield the *job creation* condition:

$$\begin{aligned} w_y &= MR_{Ly} - \frac{\gamma}{\epsilon}(\varrho + \delta)\,\theta_{Ly}^{\alpha} \\ r_y &= MR_{Ky} - \frac{\gamma}{\epsilon}(\varrho + \delta)\,\theta_{Ky}^{\alpha} \end{aligned} \tag{13}$$

for both sectors of employment $y = \{N, S\}$.

From the value of employment in (4), the worker surplus of employment reads $E_{fy} - U_f = \frac{z_y - \varrho U_f}{\varrho + \delta}$. Substituting for the discounted value of unemployment yields the worker surplus in either of the two sectors: $E_{fy} - U_f = \frac{z_y - b}{\varrho + \delta + m_{fy}}$ for $y = \{N, S\}$. Substituting the free entry condition $V = 0$ in the value of a job in (6) yields the surplus of a firm in sector $y = \{N, S\}$ that employs a worker of type $f\{L, K\}$ as $(J_{fy} - V) = J_{fy} = \frac{MR_{fy} - z_y}{\varrho + \delta}$. The bargaining rule (7) yields the *wage equation*:

$$\begin{aligned} w_y &= \mu_L(MR_{Ly} + \gamma\theta_{Ly}) + (1 - \mu_L)\,b \\ r_y &= \mu_L(MR_{Ky} + \gamma\theta_{Ky}) + (1 - \mu_K)\,b \end{aligned} \tag{14}$$

For the sake of simplicity, hereafter let the value of leisure be zero $b = 0$, without loss of generality for our research question.

Steady State. In steady state, the outflow of workers from employment to unemployment, δL_y and δK_y, has to be equal to the inflow of workers from unemployment to employment, $m(\theta_{Ly})\,u_{Ly}$ and $m(\theta_{KN})\,u_{Ky}$. This argument establishes the *Beveridge curve*:

$$\begin{aligned} m(\theta_{LN})\,u_{LN} &= \delta L_N \quad , \quad m(\theta_{KN})\,u_{KN} = \delta K_N \\ m(\theta_{LS})\,u_{LS} &= \delta L_S \quad , \quad m(\theta_{KS})\,u_{KS} = \delta K_S \end{aligned} \tag{15}$$

Long run. We assume that in the long run the economy reaches a steady state in which there is a strictly positive supply of factors to both sectors. A necessary condition for the existence of such allocation is that the ex-ante value of searching in the two sectors is equal in steady state. From (5), employed workers in sector S endowed with factor $f = \{L, K\}$ in case of separation will continue searching in the same sector if: $m(\theta_{fS})\,[E_{fS} - U_{fS}] \geq (1 - \psi_f)\,m(\theta_{fN})\,[E_{fN} - U_{fN}]$. This constraint holds with equality when workers have the time to reallocate and it yields the *arbitrage condition* for the factor price across sectors:

$$\begin{aligned} \frac{w_N}{w_S} &= a_L \, \frac{\varrho+\delta+\epsilon\theta_{LN}^{1-\alpha}}{\varrho+\delta+\epsilon\theta_{LS}^{1-\alpha}} \left(\frac{\theta_{LS}}{\theta_{LN}}\right)^{1-\alpha} \\ \frac{r_N}{r_S} &= a_K \, \frac{\varrho+\delta+\epsilon\theta_{KN}^{1-\alpha}}{\varrho+\delta+\epsilon\theta_{KS}^{1-\alpha}} \left(\frac{\theta_{KS}}{\theta_{KN}}\right)^{1-\alpha} \end{aligned} \tag{16}$$

where $a_f = \frac{1}{1-\psi_f} \geq 1$ is the distortion in factor prices across sectors induced by the attachment of unemployed workers of type $f = \{L, K\}$ to the sector of their previous employment.

Equilibrium of the factor market. Let the marginal revenue MR_{fy} in (12) be understood, then the system of job creation (13) and wage equation (14) yields the pair of factor prices $\{w_y, r_y\}$ and factor market tightness $\{\theta_{Ly}, \theta_{Ky}\}$ for every sector $y = \{N, S\}$ as a function of the share of hiring cost over production cost in the two sectors $\{x_N, x_S\}$.

The system of (13)-(14) yields the factor market tightness:

$$\begin{aligned} \theta_{Ly} &= \left(\frac{\varrho+\delta}{\epsilon}\frac{1-\mu_L(1+x_y)}{\mu_L x_y}\right)^{\frac{1}{1-\alpha}} \\ \theta_{Ky} &= \left(\frac{\varrho+\delta}{\epsilon}\frac{1-\mu_K(1+x_y)}{\mu_K x_y}\right)^{\frac{1}{1-\alpha}} \end{aligned} \tag{17}$$

for $x_N, x_L < \frac{1-\mu_K}{\mu_K} < \frac{1-\mu_L}{\mu_L}$. The levels of factor market tightness, for both factors θ_{fy}, are a decreasing function of the employment cost share in the sector x_y. Factor prices are a decreasing function of the employment cost share in the sector x_y:

$$\begin{aligned} w_y &= \frac{\gamma(\varrho+\delta)}{\epsilon x_y}\left(\frac{\varrho+\delta}{\epsilon}\frac{1-\mu_L(1+x_y)}{\mu_L x_y}\right)^{\frac{\alpha}{1-\alpha}} = \frac{\gamma(\varrho+\delta)}{\epsilon x_y}\theta_{Ly}^{\alpha} \\ r_y &= \frac{\gamma(\varrho+\delta)}{\epsilon x_y}\left(\frac{\varrho+\delta}{\epsilon}\frac{1-\mu_K(1+x_y)}{\mu_K x_y}\right)^{\frac{\alpha}{1-\alpha}} = \frac{\gamma(\varrho+\delta)}{\epsilon x_y}\theta_{Ky}^{\alpha} \end{aligned} \tag{18}$$

both directly, and indirectly as an increasing function of the corresponding factor market tightness. Notice that the total effect of factor bargaining power on market tightness and factor prices cannot be understood from (17) and (18) since the factor shares x_N and x_S are endogenous variables, function of the bargaining powers as well.

Substituting for the equilibrium factor prices (18) in (9) yields the marginal costs c_N and c_S as a function of hiring cost shares x_y and market tightness θ_{fy} levels. The pricing rule (11) implies $c_N = \frac{p_N}{1+x_N}$ and $c_S = \frac{p_S}{1+x_S}$ and it can be used to explicit for the hiring cost, indeed the output prices weighted by cost shares:

$$\begin{aligned} \frac{x_N}{1+x_N} p_N &= \frac{\gamma(\delta+\varrho)}{\epsilon} \left[\lambda_N^\tau \theta_{LN}^{\alpha(1-\tau)} + \kappa_N^\tau \theta_{KN}^{\alpha(1-\tau)} \right]^{\frac{1}{1-\tau}} \\ \frac{x_S}{1+x_S} p_S &= \frac{\gamma(\delta+\varrho)}{\epsilon} \left[\lambda_S^\tau \theta_{LS}^{\alpha(1-\tau)} + \kappa_S^\tau \theta_{KS}^{\alpha(1-\tau)} \right]^{\frac{1}{1-\tau}} \end{aligned} \tag{19}$$

Define the relative price of skill-intensive goods $p = \frac{p_S}{p_N}$. From the definition of the consumption based price index P, it follows that $p_N = \left(\frac{1}{1+p^{1-\sigma}}\right)^{\frac{1}{1-\sigma}} P$ and $p_S = \left(\frac{p^{1-\sigma}}{1+p^{1-\sigma}}\right)^{\frac{1}{1-\sigma}} P$. Let the composite good C be the numeraire, indeed the consumption based price index is $P = 1$. Indeed, the price of the no-skill-intensive good p_N is a monotonic decreasing function of the relative price p; the opposite is true for the price of the skill-intensive goods p_S.

For a given relative price p, the pair of values $\{x_N, x_S\}$ that solves the system of (17) and (19) does exist and it is unique.[2] The system of the four equations in (17) and the two equations in (19) yields the four factor market tightness $\{\theta_{LN}, \theta_{LS}, \theta_{KN}, \theta_{KS}\}$ and the two employment cost shares $\{x_N, x_S\}$ as a function of the relative price of skill-intensive goods p.

Clearing conditions. The steady state relationships (15), labor market clearing, $L = L_N + L_S + u_{LN} + u_{LS}$ and $K = K_N + K_S + u_{KN} + u_{KS}$ and the optimal factor demand (10) determine one feasibility constraint for each factor. For every factor $f = \{L, K\}$ and every sector $y = \{N, S\}$, define the loading factors ℓ_{fy} as the inverse of factor average productivity: $\ell_{fy} = \left(\frac{\lambda_y c_y}{z_y}\right)^\tau$ and define the employment factors $e_{fy} = \frac{m(\theta_{fy})+\delta}{m(\theta_{fy})}$, from the steady state relationship (15). The *frontier of production possibilities* is given by:

$$e_{LN}\ell_{LN}\ N_p + e_{LS}\ell_{LS}\ S_p \quad = \quad L \tag{20}$$

[2]The factor market tightnesses levels are convex decreasing function of the share x_y, by (17). Indeed the r.h.s. of (19) goes to infinity for $x_y \to 0$ and it goes to zero for $x_y \to \frac{1-\mu_K}{\mu_K}$. The l.h.s. of (19) is an increasing and concave function that spreads out from the origin and it tilts up the higher is the output price.

$$e_{KN}\ell_{KN}\ N_p + e_{KS}\ell_{KS}\ S_p \quad = \quad K$$

For a given relative price p, the mix of production $\{N_p, S_p\}$ is uniquely identified by the intersection of the two feasibility constraints in (20). The production mix satisfies:

$$\frac{N_p}{S_p} = \frac{L\left[e_{KS}\ell_{KS}\right] - K\left[e_{LS}\ell_{LS}\right]}{K\left[e_{LN}\ell_{LN}\right] - L\left[e_{KN}\ell_{KN}\right]} \tag{21}$$

Notice that although the frontier of production possibilities looks like the one of a model with fixed technological coefficients, the terms e_{fy} and ℓ_{fy} change endogenously. As a consequence of the equilibrium in the factor market, they are function of the relative price of skill-intensive goods p. Consider the production mix (21). The numerator is decreasing in θ_{KS} and increasing in θ_{LS}; while the denominator is increasing in θ_{KN} and decreasing in θ_{LN}.

Equation (21) represents the relative supply curve in our model. Davidson et al. (1999) discuss the possibility that the relative supply curve fails to be monotonic and increasing in the corresponding relative price when unemployment and search frictions are taken into account. In our framework this feature depends on the (endogenous) coefficients $\{e_{fy}, \ell_{fy}\}$. The dependence of these variables on the respective factor market tightness θ_{fy} is not ambiguous and it is independent on factor endowments. Therefore, it would always be possible to find a relative endowment of labor L/K such that the relative supply of no-skill-intensive goods $\frac{N_p}{S_p}$ is a decreasing function of the relative price of skill-intensive goods p.[3]

The consumption expansion path satisfies the optimality of the consumption allocation, from (8):

$$N_c = p^{\sigma} S_c \tag{22}$$

When the economy trades with the rest of the world at a given relative price $\frac{p_S}{p_N} = \varphi$ then the output market clearing holds:

$$\left(S_c - S_p\right)\varphi = \left(N_p - N_c\right) \tag{23}$$

under the assumption of balanced trade.

[3]This condition is satisfied if he contribution due to the change in θ_{KS} dominates the change in the numerator of (21) and the contribution due to the change in θ_{KN} dominates the change in the denominator of (21).

Autarky. In the case of autarky, the consumption bundle and the production bundle must be the same, $N_c = N_p$ and $S_c = S_p$, indeed the balanced trade condition (23) is satisfied as an identity. The relative supply (21) and the relative demand (22) identify a unique relative price p at which both the labor market and the output market are in equilibrium.

Trade. When the domestic economy trades with the rest of the world at a given relative price φ, the linear system of (22) and (23) yields each consumption allocation N_c and S_c as a function of the production allocation $\{N_p, S_p\}$. The new relative price φ fixes the equilibrium of the factor market and indeed the production allocation $\{N_p, S_p\}$ through the frontier of production possibilities (20).

4 Skill premium and relative price

Notice that at this point we did not impose yet the indifference condition (16) and the steady state condition (15). Therefore, the equilibrium allocation does not guarantee that unemployed workers are willing to search for a job in both sectors. We derive the skill premium under this *short-run* equilibrium (before the indifference condition applies) and then we restrict the discussion to the *long-run* equilibrium in which searching workers must be indifferent between sectors.

4.1 Short run

Consider a partial equilibrium allocation in which the levels of factor market tightness satisfy (17), factor prices $\{w_N, w_S, r_N, r_S\}$ and output prices $\{p_N, p_S\}$ are given by (18) and (19) respectively, and the clearing conditions (20)-(22) hold. This analysis is a partial equilibrium in the sense that the indifference condition (16) does not apply.

The ratio in factor prices (18) yields the skill premium within sector as an increasing and concave function of the relative market tightness of the skilled factor:

$$\begin{aligned} \frac{r_N}{w_N} &= \left(\frac{\theta_{KN}}{\theta_{LN}}\right)^{\alpha} = \left(\frac{\mu_L}{\mu_K}\frac{1-\mu_K\left(1+x_N\right)}{1-\mu_L\left(1+x_N\right)}\right)^{\frac{\alpha}{1-\alpha}} \\ \frac{r_S}{w_S} &= \left(\frac{\theta_{KS}}{\theta_{LS}}\right)^{\alpha} = \left(\frac{\mu_L}{\mu_K}\frac{1-\mu_K\left(1+x_S\right)}{1-\mu_L\left(1+x_S\right)}\right)^{\frac{\alpha}{1-\alpha}} \end{aligned} \tag{24}$$

Equation (24) implies the first two results of the model:

Proposition 1. The difference in factor's bargaining power is a necessary condition for the existence of within-sector skill premium.

Proof. Consider (24). If $\mu_L = \mu_K$ then the skill premium is $\frac{r}{w} = 1$, regardless the sector.

Proposition 2. If the bargaining power of knowledge workers is higher $\mu_K > \mu_L$, then the within-sector skill premium is a decreasing function of the share of hiring cost over production cost in the sector x_y.

Proof. Consider (24). If $\mu_K > \mu_L$ then $sign\left\{\frac{\partial(r_y/w_y)}{\partial x_y}\right\} = sign\left\{\mu_L - \mu_K\right\} < 0$ for every sector $y = \{N, S\}$.

Notice that the difference in bargaining powers is not necessary for a skill premium across sectors tough: $\frac{r_N}{w_S} = \frac{x_S}{x_N}\left(\frac{\theta_{KN}}{\theta_{LS}}\right)^{\alpha}$ and $\frac{r_S}{w_N} = \frac{x_N}{x_S}\left(\frac{\theta_{KS}}{\theta_{LN}}\right)^{\alpha}$; by the equilibrium factor prices (18). The equilibrium of the labor market (17) implies that factor market tightness θ_{fy} is a decreasing function of the hiring cost share. Therefore, the across-sector skill premium is higher the lower is the share of hiring cost in the sector knowledge workers belong to.

A shock to the relative price of a good has an effect on the skill premium, through the channel established by the difference in bargaining powers; Propositions 1 and 2. Opening to trade, the domestic economy is small in the international market and it takes the terms of trade of the rest of the world as given: $\frac{p_S^{\star}}{p_N^{\star}} = \varphi$. Proposition 3 discusses the effect of trade openness, in the short run (before that the labor market reaches a stable allocation).

Proposition 3. If the relative price of skill-intensive goods in the international market is lower than in autarky, $\varphi < p$ then:
(3.1) The share of hiring cost over production cost increases in the skill-intensive sector and decreases in the no-skill-intensive sector.
(3.2) The skill premium decreases in the skill-intensive sector and increases in the no-skill-intensive sector.

(3.3) Factor prices and factor market tightness decrease in the skill-intensive sector and increase in the no-skill-intensive sector.

Proof. Output prices are: $p_N = \left(\frac{1}{1+p^{1-\sigma}}\right)^{\frac{1}{1-\sigma}}$ and $p_S = \left(\frac{p^{1-\sigma}}{1+p^{1-\sigma}}\right)^{\frac{1}{1-\sigma}}$. At the new terms of trade $\varphi < p$, the price of no-skill-intensive goods rises $p_N \uparrow$ and the price of skill-intensive goods falls $p_S \downarrow$. Consider the equilibrium condition (19). In the space of hiring cost share x_y (on the horizontal axis) and level $x_y c_y$ (on the vertical axis), the l.h.s. of (19) tilts up in the sector no-skill-intensive goods $y = N$ and down in the sector of skill-intensive goods $y = S$. The r.h.s. of (19) does not change. The new intersection identifies a higher $x_S \uparrow$ and a lower $x_N \downarrow$; which proofs the claim (3.1).
Given the result (3.1), then (3.2) follows from Proposition 2. The results of the claim (3.3) follow from the fact that both factor prices and factor market tightness are a decreasing function of the share of hiring cost over total cost in the sector.

Propositions (1)-(3) clarify the key role of the differences in bargaining power between factors in the determination of the within-sector skill premium in the short run. Several remarks should be noticed. First, gains and losses from trade depend on the sector of employment; they are not factor specific. Second, workers in the no-skill-intensive sector gain from trade, both in real and in nominal terms; the opposite is true for workers who are employed in the skill-intensive sector. Third, the ex-ante expected reward in the skill-intensive sector falls, whereas it rises in the no-skill-intensive sector. As a consequence, opening to trade determines a reallocation of workers from the skill-intensive sector to the no-skill-intensive sector (as predicted by the classical theory). After the trade liberalization, more workers are allocated to the sector in which the skill premium rises. Therefore, in the short run there is a tendency to a rise of the average skill premium across employed workforce (the opposite of what the classical theory predicts). Nevertheless, the total effect depends on the composition of the workforce between sector at the time of the trade liberalization. The higher is the share of employment in the skill-intensive sector the greater is the weight of the fall of the skill-premium in that sector relative to the rise of the skill premium in the no-skill-intensive sector. The evidence of an ambiguous and then positive but not significant change of the skill premium can be explained in the light of these two channels.

In the next section we discuss the effect of a trade liberalization on the within-sector skill premium when the reallocation of workers lasts for enough time such that the value of searching is equalized across sectors.

4.2 Long run

We are now in the position to discuss the equilibrium allocation when unemployed workers are indifferent between searching in either one of the two sectors. Computing the ratio of equilibrium factor prices (18) then substituting in the arbitrage condition (16) together with the equilibrium factor market tightness (17) yields the equilibrium relationship between factor market tightness across sectors:

$$\theta_{LN} = a_L \theta_{LS} \quad , \quad \theta_{KN} = a_K \theta_{KS} \tag{25}$$

There are three cases in which the relationship between skill premium and relative price can be discussed.

Perfect mobility. Assume that workers are perfectly mobile across sectors: $a_L = a_K = 1$. The indifference condition (25) implies $\theta_{LS} = \theta_{LN}$ and $\theta_{KS} = \theta_{KN}$. Therefore, the equilibrium factor market tightness (17) yields $x_N = x_S$ and the factor prices have to be identical across sectors: $w_N = w_S$ and $r_N = r_S$; as implied by (18). The ratio in output price (19) yields the one level of skill premium in the economy as a function of the relative price of skill intensive goods p:

$$\phi^{per} = \left(\frac{\left(\frac{1}{p}\right)^{1-\tau} \lambda_S^{\tau} - \lambda_N^{\tau}}{\kappa_N^{\tau} - \left(\frac{1}{p}\right)^{1-\tau} \kappa_S^{\tau}} \right)^{\frac{1}{1-\tau}} \tag{26}$$

Symmetric imperfect mobility. Assume that workers are mobile across sectors but with the same degree of attachment: $a_L = a_K = a > 1$. The indifference condition (25) implies $\theta_{LN} = a\theta_{LS}$ and $\theta_{KN} = a\theta_{KS}$. Therefore, $\theta_{LN} > \theta_{LS}$ and $\theta_{KN} > \theta_{KS}$ together with the equilibrium factor market tightness (17) yields to the conclusion that the share of hiring cost in the no-skill-intensive sector is lower: $x_N < x_S$. The equilibrium factor prices in the no-skill-intensive sector are relatively higher: $w_N > w_S$ and $r_N > r_S$; as it is implied by (18). Nevertheless notice that the ratio in output price (19) yields one level of skill premium in the economy:

$$\phi^{sym} = \left(\frac{\left(\frac{x}{p}\right)^{1-\tau} \lambda_S^{\tau} - \lambda_N^{\tau} a^{\alpha(1-\tau)}}{\kappa_N^{\tau} a^{\alpha(1-\tau)} - \left(\frac{x}{p}\right)^{1-\tau} \kappa_S^{\tau}} \right)^{\frac{1}{1-\tau}} \tag{27}$$

where for notational convenience, we defined $x = \frac{1+x_S}{1+x_N} \frac{x_N}{x_S} \in (0, 1)$.

Asymmetric imperfect mobility. Imposing the arbitrage condition (25) in the equilibrium factor market tightness (17) yields a system of two independent linear equations in $\frac{1}{x_N}$ and $\frac{1}{x_S}$. Therefore, for the case in which $a_L \neq a_K$, the hiring cost shares are determined:

$$\begin{aligned} x_N &= \frac{\tilde{a}_K - \tilde{a}_L}{\tilde{\mu}_K (\tilde{a}_K - 1) \tilde{a}_L - \tilde{\mu}_L (\tilde{a}_L - 1) \tilde{a}_K} \\ x_S &= \frac{\tilde{a}_K - \tilde{a}_L}{\tilde{\mu}_K (\tilde{a}_K - 1) - \tilde{\mu}_L (\tilde{a}_L - 1)} \end{aligned} \tag{28}$$

where $\tilde{a}_f = a_f^{1-\alpha}$ and $\tilde{\mu}_f = \frac{\mu_f}{1-\mu_f}$ are increasing monotonic transformations of a_f and μ_f for both factors $f = \{L, K\}$. The parameter restrictions $\tilde{a}_K \neq \tilde{a}_L$ and $\frac{\tilde{a}_K}{\tilde{a}_L} > \frac{1+\tilde{\mu}_L}{1+\tilde{\mu}_K}$ hold in order to guarantee that there are vacancies posted in both sectors $x_N, x_S > 0$ when knowledge workers have higher bargaining power $\mu_K > \mu_L$.

Once the arbitrage allocation (25) is imposed in (19), then the relative price of skill-intensive good $p = \frac{p_S}{p_N}$ can be written as a function of the within-sector skill premium; either the one for the skill-intensive sector $\phi_S = \left(\frac{\theta_{KS}}{\theta_{LS}}\right)^{\alpha}$ or the one for the no-skill-intensive sector $\phi_N = \left(\frac{a_K}{a_L}\right)^{\alpha} \phi_S$. The skill premium in the skill-intensive sector reads:

$$\phi_S = \left(\frac{\left(\frac{x}{p}\right)^{1-\tau} \lambda_S^{\tau} - \lambda_N^{\tau} a_L^{\alpha(1-\tau)}}{\kappa_N^{\tau} a_K^{\alpha(1-\tau)} - \left(\frac{x}{p}\right)^{1-\tau} \kappa_S^{\tau}} \right)^{\frac{1}{1-\tau}} \tag{29}$$

where, as in the previous case $x = \frac{1+x_S}{1+x_N} \frac{x_N}{x_S} \in (0, 1)$.[4]

The following proposition summarizes the prediction of the model on the relationship between within sector skill-premium and the relative price of skill intensive goods.

[4]The share x is computed by the means of (28), $x = \frac{\tilde{a}_K(1+\tilde{\mu}_K) - \tilde{a}_L(1+\tilde{\mu}_L)}{\tilde{a}_K(1+\tilde{\mu}_K) - \tilde{a}_L(1+\tilde{\mu}_L) + \tilde{a}_L \tilde{a}_K (\tilde{\mu}_K - \tilde{\mu}_L)}$.

Proposition 4. A fall in the relative price of the skill intensive good determines an increase of the skill premium in both sectors if: (i) factors are complements $\tau \in (0,1)$ and knowledge workers are less willing to switch sector than labor workers; or (ii) factors are substitutes $\tau > 1$ and knowledge workers are more willing to switch sector than labor workers; such that:

$$\left(\frac{a_K}{a_L}\right)^{\frac{\alpha(1-\tau)}{\tau}} > \frac{\lambda_N/\kappa_N}{\lambda_S/\kappa_S} > 1 \tag{30}$$

Proof. The sign of the derivative $\frac{\partial \phi_S}{\partial p}$ from (29) is negative when (30) holds. Notice that, when the expression (30) is satisfied with equality then $\frac{\partial \phi_S}{\partial p} = 0$.

Proposition 4 leads to the conclusion that under perfect mobility or in the absence of asymmetric degrees of attachment, the within-sector skill premium is necessarily positively related to the relative price of skill-intensive goods (as predicted by the classical theory). When factors are different in the degree to which they are willing to switch sector tough, the classical Stolper-Samuelson result can be overturned. Equation (30) clearly shows how the long run effect depends on three contributions: technological differences between sectors $\frac{\lambda_N/\kappa_N}{\lambda_S/\kappa_S}$, the degree at which knowledge workers reallocate with respect to labor workers $\frac{a_K}{a_L}$ and the substitutability between factors τ. For a given labor technological bias of the no-skill-intensive sector, there are two scenarios in which the within-sector skill premium increases after a fall in the relative price of skill-intensive goods: (*i*) in case of substitutability, if knowledge workers reallocate easier than labor workers at a rate that dominates the technological bias of the no-skill-intensive sector; (*ii*) in case of complementarity, if the difficulty to reallocate knowledge workers with respect to labor workers dominates over the technological bias of the no-skill-intensive sector.

The evidence of a rise in the within-sector skill premium following a trade liberalization can be explained in the light of the predictions of the model. A specific knowledge investment will be consistent both with factor complementarity and a relatively higher degree of attachment for knowledge workers. On the other side, in the absence of specific knowledge investment, both the degree of substitutability between factors an the mobility of knowledge workers are expected to be higher.

5 Quantitative assessment of the theory

[To be added]

6 Conclusion

In this paper we investigate the effect of a trade induced change in relative output prices on relative factor prices. This is a research question to which the classical trade theory answers by means of the Stolper and Samuelson Theorem (SST). When factor markets are competitive, the change in relative marginal productivities is the only driver of the change in relative factor prices. Nevertheless, there is substantial evidence that contradicts the predictions of the classical SST, documenting the increase of skill premium after trade liberalizations, both for skill and no-skill abundant countries.

With frictional factor markets, the within-sector skill premium is not only a function of relative productivity (*pro*-SST), but it also increases the tighter is the market for skilled workers (*anti*-SST). Nevertheless, introducing frictional labor market is not sufficient to reconcile theory and evidence. The increase in market tightness for skilled workers can explain the rise in the skill-premium when skilled and unskilled workers are different in two dimensions: (*i*) bargaining power and (*ii*) sector switching costs.

The focus on these two dimensions of skill-specific heterogeneity is the novel contribution of the model. We find support to our theory on the recent evidence on firm-worker matches and trade induced worker reallocation, that documents the presence of these two channels. Moreover, we provide evidence of a short-run ambiguous response of the skill premium to trade liberalization episodes and a long-run positive and significant increase.

In a two country, two good, two factor model with search and matching frictions our theory predicts that a fall in the relative price of the skill-intensive goods determines: (*i*) in the short-run, an increase of the skill-premium in the no-skill intensive sector and a decrease in the skill-intensive sector, when skilled workers have higher bargaining power than unskilled workers; (*ii*) in the long-run, if factors are substitutes, the skill-premium increases in both sectors, if the skilled workers are better able to reallocate across sectors than unskilled workers. These results explain both the short-run and the long-run evidence on the dynamics of the skill premium following trade liberalization episodes.

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