The welfare implications of immigration in a search and matching model with heterogeneous workers

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Abstract

We develop a search and matching model characterized by the presence of firing costs where two goods are produced using skilled and unskilled workers. We analyze the effect of shock to the supply of unskilled labour on the wage level and unemployment of both skilled and unskilled workers. We find that while the wage level of unskilled workers decrease as a consequence of the increased supply of unskilled workers, the wages of skilled workers are higher due to the lower average price level. On the other hand, unemployment is higher among unskilled workers due to the excess labour supply. We study how the magnitude of these effects differs in economy with rigid versus flexible labour markets. Countries with greater wage rigidity and protective institutions, such as some of the southern European economies, are expected to respond with less flexibility to immigration, resulting in small wage effects and negative employment effects for native workers. Finally, we focus on policy measures that could be implemented to redistribute wealth across workers.
1 Introduction

The recent rise in immigration has been a hotly debated and politically charged topic. At the heart of this debate is the widespread belief by the general public and policy-makers that immigration has large effects on the labour market.

Studies of the effect of immigration on native labor market outcomes are abundant. Recent surveys of the literature are Blau and Kahn (2012); Longhi et al. (2010). One of the key questions that have been addressed in the literature regarding immigration concerns the issue of whether benefits are higher than costs for the receiving economies. This issue is rather important as fears that immigration may, at least in the short run, have adverse effects on the labour market opportunities of the native population are a main reason for opposing more liberal migration policies. Many people hold the belief that immigrants ‘take jobs’ from the native labor force in industrial countries; that they crowd out job opportunities; and that they depress wages. However, the evidence provided by the empirical studies on the topic that immigration in fact has a negative effect on wages or leads to large negative employment effects is rather mixed (Dustmann et al., 2001, 2012; Manacorda et al., 2012). Overall, a review of the literature finds little evidence of a wage-depressing effect of immigration because immigrants are absorbed into the receiving economy through a series of adjustments by firms and workers. Once these adjustments are accounted for, the wages of native workers, even workers with skills similar to those of immigrants, do not change much in response to immigration (Ottaviano and Peri, 2012). Nevertheless, economists tend to agree on the fact that whenever wage responses to immigration occur, they are not distributed evenly across native workers, but will affect specifically those parts of the distribution where immigrants compete with native workers (Foged and Peri, 2015).

Many studies in recent decades have analyzed the effect of immigration on the wages of native workers, assessing the magnitude and direction of the impact. These studies are based both on cross-sectional and panel data from countries that have received large inflows of immigrants, such as Canada, Germany, Spain, the UK, and the US. Peri (2014) summarizes that abundant literature, based on a review of 27 original studies published between 1982 and 2013, which together produced more than 270 baseline estimates of the effects of an increase in the share of immigrants on the wages of natives in the same labor market. He finds that on average the estimated effect is close to zero.

From a theoretical point of view, a number of papers have chosen a production technology that distinguishes between skilled and unskilled labour, and assume that immigrants are perfect substitutes with their corresponding native skill category. The definition of skills varies by study, but typical dimensions are educational attainment (Altonji and Card, 1991; Dustmann et al., 2001), occupation (Card, 2001), or experience and education (Borjas, 2003). In these papers, the economy consists of skilled and unskilled workers and whenever immigrants with a specific skill level arrive in the economy, they induce a change in the overall skill composition. This leads to a disequilibrium between supply of and cost minimising demand for different labour
types at existing wages and output levels. Due to the excess supply of a specific type of workers at the going wage rate, the absorption of the immigrants into the economy involves short-run changes in wages and employment levels of different skill types.

In particular, those workers that are most similar to immigrants in their skill composition may lose, but workers that possess different skills may gain. In the case in which immigrants and natives are only imperfect substitutes within the same (observable) skill group (Manacorda et al., 2012; Ottaviano and Peri, 2012), an increase in labour supply due to immigration will primarily affect other immigrants already living in the host country. Due to the overall complementarity of immigrants with natives, most groups of natives actually experience significant wage gains from immigration. However, due to their higher substitutability, the detrimental effect from newly arriving immigrants on the wages of existing immigrants that are estimated in these studies are substantial.

There are however alternative adjustment mechanisms besides wages that may play an important role in the way an economy responds to immigrant inflows. For instance, Sa’ (2015) studies the effect of immigration on house prices in the UK as an alternative channel through which immigration may affect the economy. Alternatively, if we allow for multiple goods and competitive prices, then migration, even if changing the skill structure of the economy, may affect not only wages, but also the price level and the output mix. This type of mechanism has not been deeply explored in the literature, as far as we are aware of, and that is the scope of this paper. The objective of our analysis is to provide a theoretical framework to help design policies for economies which are hit by a shock of large and long-lasting immigrations flows.

We develop a search and matching model characterized by the presence of firing costs where two goods are produced using skilled and unskilled workers, respectively, and both goods are consumed by all individuals. We analyze the effect of an increase in the supply of unskilled labour not only on the wage level of both skilled and unskilled workers but also for the first time in the literature on unemployment. We find that while the wage level of unskilled workers decrease as a consequence of the increased supply of unskilled workers, the wages of skilled workers are higher due to the lower average price level. On the other hand, unemployment is higher among unskilled workers due to the excess labour supply. We study how the magnitude of these effects differs in economy with rigid versus flexible labour markets. Countries with greater wage rigidity and protective institutions, such as some of the southern European economies, are expected to respond with less flexibility to immigration, resulting in small wage effects and negative employment effects for native workers. Finally, we focus on policy measures that could be implemented to redistribute wealth across workers.

The contribution of this paper to the existing literature is threefold. First, while much of the existing research has concentrated on looking for wage effects of immigration within models where only one good is available, this paper makes a novel contribution to the literature by considering the impact of unskilled immigration on native wages, according to their skill level, and unemployment, when two consumption goods are available within a search and matching
framework. This novel approach allows us to study the impact of an inflow of immigrants on wages while taking into account the adjustments due to the change in the demand and the price of the two goods.

Second, we analyse the role of employment protection legislation (EPL). We investigate how the magnitude of the effects on wages and unemployment changes in more rigid economies, such as Southern European countries, versus more flexible economies, such as the UK and the US.

Finally, we analyse several Pareto efficient policy interventions that could reallocate the wealth across workers. Specifically, we consider changes in the taxation rate, in tax subsidies provided to unskilled workers, as well as in unemployment benefits. As immigrants may affect the unemployment rate in the economy, to study the effect of unemployment benefits and income taxes it is of particular interest.

2 The Model

In this section we develop a search model where individuals differ according to their skill level and according to the country of origin. We distinguish between natives, who are born in the local labour market and immigrant, who are born in an abroad country. Each individual is either high skilled, $h$, or low skilled, $l$.

Firms post a vacancy to fill a job, which is common among natives and immigrants and it is skill-specific, and the cost of keeping a vacancy open per period is denoted by $c$. Firms and workers come together via a matching function $m(v_i, u_i)$ where $u_i$ is the measure of unemployment natives and immigrants) and $v_i$ is the measure of vacancies for $i \in \{h, l\}$. Function $m(v_i, u_i)$ is twice differentiable, increasing in its arguments, and exhibits constant returns to scale. The flow of matches for a vacancy may be defined as $m(u_i, v_i) / v_i = q(\theta_i)$, which is a decreasing function of $\theta_i := v_i / u_i$, representing the tightness of the labour market. The flow of matches for an unemployed worker may be defined as $m(u_i, v_i) / u_i = \theta_i q(\theta_i) \equiv \phi(\theta_i)$, which is an increasing function. It is assumed that $q(\theta) \to 1$ and $\theta q(\theta) \to 0$ as $\theta \to 0$, and $q(\theta) \to 0$ and $\theta q(\theta) \to 1$ as $\theta \to \infty$.

In particular, natives find a job with endogenous probability $\theta q(\theta)$ and loose their job at the exogenous probability $\delta$, which is the parameter of a Poisson process. Immigrants coming from abroad join the regional labour market as unemployment at exogenous rate $\eta$. Hence immigrants can be either employed or unemployed in the regional labour market, or they can be abroad. Immigrants can also leave the regional labour market and go back abroad at exogenous rate $\lambda$.

Figure 1 provides a schematic representation of labor flows in the model, with the probability to change the workers’ status.

We observe that the possibility of immigrants to come back to the RAoL caused a key asymmetry between natives and immigrants.
2.1 Firms

In the economy two goods $y_h$ and $y_l$ are produced. Each firm specializes in the production of one of the two goods and in order to do so it hires either a high-skilled worker $h$, with productivity $x_h$, or a low-skilled worker $l$, with productivity $x_l$, where $x_h > x_l$. Firms which hire high-skilled workers produce good $y_h$, while firms which hire low-skilled workers produce good $y_l$. Goods are sold at price $p_h$ and $p_l$, respectively.

Let $\tilde{p}_i \equiv p_i/p$ be the real price of good $i$ and $\tilde{w}_{i,N} \equiv w_{i,N}/p$ and $\tilde{w}_{i,I} \equiv w_{i,I}/p$ be the real wage paid to native and immigrant workers by a firm producing good $i$, where $p$ is an appropriate price index for our economy. Following Pissarides (2000), the firm’s Bellman’s equation for a filled position, i.e. for a firm with a worker, satisfies (see in particular Eq. (9.9) in Pissarides, 2000):

$$rJ_{i,N} = (1 - t)(\tilde{p}_i x_i - \tilde{w}_{i,N}) + \delta [V_i - J_{i,N} - \tilde{p}_i x_i F]$$ (1)

and

$$rJ_{i,I} = (1 - t)(\tilde{p}_i x_i - \tilde{w}_{i,I}) + \delta [V_i - J_{i,I} - \tilde{p}_i x_i F]$$ (2)

where $i \in \{l, h\}$. The firm profit $(\tilde{p}_i x_i - \tilde{w}_{i,N})$, computed as the firm productivity minus the salary paid to the native worker (in real terms), is taxed at the flat tax rate $t$. The same applies to the profit of firms hiring an immigrant worker. The parameter $\delta$ is an idiosyncratic shocks which terminates the match, leaving the firm with an open vacancy.

The firm value function in Eq. (2) takes into account the presence of firing costs. In particular, every time a shock destroys a match, the employer is required to pay firing costs.
$F$, which are proportional to the worker’s salary (differently [Pissarides 2000] assumes that it is proportional to the productivity of the worker). This formulation of firing costs should be more adherent to actual legislation on firings.

The firm’s Bellman’s equation for hiring a worker, i.e. the value of a vacancy for an entrepreneur, is given by:

$$ rV_i = -c + q(\theta_i) [\pi_N J_{i,N} + (1 - \pi_N) J_{i,I} - V_i] $$  \hspace{1cm} (3)

where $q(\theta_i)$ is the rate at which a vacancy is filled, $c$ is the vacancy cost, and $\pi_N = u_{i,N}/(u_{i,N} + u_{i,I})$ is the probability for a firm to meet a native versus an immigrant worker.

### 2.2 Workers

All workers consume both goods, which enter a Cobb-Douglas utility function

$$ Y_i = y_{hi}^{\gamma} y_{li}^{1-\gamma}, $$  \hspace{1cm} (4)

subject to the budget constraint

$$ p_h y_{hi} + p_l y_{li} = \begin{cases} 
(1 - t) (w_i + \tau_{1i}) & \text{if the worker is employed} \\
 b (1 - t) (w_i + \tau_{1i}) & \text{if the worker is unemployed} 
\end{cases} $$  \hspace{1cm} (5)

where

$$ 1_i = \begin{cases} 
0 & \text{if } i = h \\
1 & \text{if } i = l 
\end{cases} $$  \hspace{1cm} (6)

The workers’ wage is taxed at the proportional rate $t$. In order to introduce the possibility of progressive taxation, we assume that workers receive a tax subsidy $\tau$ if they are low skilled. Unemployed workers receive unemployment benefits which are a proportion $b$ of their net wage (see [Pissarides 2000] p. 206).

From the maximization of utility the quantity demanded of each good are:

$$ y_{hi}^e = \frac{\gamma (1 - t) (w_i + \tau_{1i})}{p_h}, $$  \hspace{1cm} (7)

$$ y_{li}^e = \frac{(1 - \gamma) (1 - t) (w_i + \tau_{1i})}{p_l}, $$

if the worker is employed or

$$ y_{hi}^u = \frac{b \gamma (1 - t) (w_i + \tau_{1i})}{p_h}, $$  \hspace{1cm} (8)

$$ y_{li}^u = \frac{b (1 - \gamma) (1 - t) (w_i + \tau_{1i})}{p_l}, $$
if the worker is unemployed.

The indirect utility of employed worker can be written as

\[ Y^e_i = \left[ \frac{(1-t)(w_i + \tau 1_i)}{p_h} \right]^\gamma \left[ \frac{(1-\gamma)(1-t)(w_i + \tau 1_i)}{p_l} \right]^{(1-\gamma)} \] (9)

while for unemployed worker:

\[ Y^u_i = \left[ \frac{b[(1-t)(w_i + \tau 1_i)]}{p_h} \right]^\gamma \left[ \frac{(1-\gamma)b[(1-t)(w_i + \tau 1_i)]}{p_l} \right]^{(1-\gamma)} \] (10)

which can be expressed as

\[ Y^e_i = \psi (1-t) (\bar{w}_i + \bar{\tau} 1_i) \] (11)
\[ Y^u_i = b\psi (1-t) (\bar{w}_i + \bar{\tau} 1_i) \] (12)

where \( p \equiv p_h^\gamma p_l^{1-\gamma} \) is the definition on the appropriate price index, \( \bar{\tau} \) is the real level of tax subsidy, and \( \psi \equiv \gamma(1-\gamma)^{1-\gamma} \) is a parameter depending on preferences.

The Bellman’s equations for employed (native and immigrate) worker read:

\[ rW^e_{i,N} = Y^e_i + \delta (W^u_{i,N} - W^e_{i,N}) \] (13)
\[ rW^e_{i,I} = Y^e_i + \delta (W^u_{i,I} - W^e_{i,I}) \] (14)

Employed workers, both natives and immigrants, enjoy the indirect utility of being employed \( (Y^e_i) \) and at rate \( \delta \) lose their job and become unemployed.

The Bellman’s equations for unemployed (native and immigrate) worker read:

\[ rW^u_{i,N} = Y^u_i + \theta_i q(\theta_i) (W^e_{i,N} - W^u_{i,N}) \] (15)
\[ rW^u_{i,I} = Y^u_i + \lambda W^u_{i,A} + \theta_i q(\theta_i) (W^e_{i,I} - W^u_{i,I}) \] (16)

While both natives and immigrants find a job with probability \( \theta q(\theta) \), immigrants can also leave the local labour market at rate \( \lambda \), and enjoy utility \( W^u_{i,A} \) abroad. We can interpret \( \lambda \) both as the individual decision to go back home or a government policy, which forces immigrants without a job to be expelled.
2.3 The Wage Bargaining

Both the (nominal) wages for natives and immigrants are chosen to maximize the Nash product:

\[
(W_{e,i,N}^u - W_{u,i,N}^u)^\beta (J_{i,N} + F\tilde{p}_i x_i - V_i)^{1-\beta},
\]

and

\[
(W_{e,i,I}^u - W_{u,i,I}^u)^\beta (J_{i,I} + F\tilde{p}_i x_i - V_i)^{1-\beta},
\]

where \(\beta\) is the bargaining power of workers. It is worth remarking that the maximization with respect to (nominal) wages amounts to maximize the Nash product with respect to \(\tilde{w}_i\) being the price index \((p)\) taken as given in competitive markets.

Firing costs \(F\) enter into the maximization since firms internalize the cost they will have to pay in case of match destruction. The wage paid to native and immigrant workers differs for the different outside options.

Firms and workers take \(V_i, W_{e,i,N}^u\) and \(W_{e,i,I}^u\) as given in the bargaining process. This implies that the FOC for the maximization of the Nash product for native workers in Eq. (17) reads:

\[
\beta (J_{i,N} + F\tilde{p}_i x_i - V_i) \frac{\partial W_{e,i,N}^u}{\partial \tilde{w}_i} + (1 - \beta) \left( W_{e,i,N}^u - W_{u,i,N}^u \right) \frac{\partial J_{i,N}}{\partial \tilde{w}_i} = 0,
\]

i.e.

\[
W_{e,i,N}^u - W_{u,i,N}^u = \left( \frac{\beta \psi}{1 - \beta} \right) (J_{i,N} + F\tilde{p}_i x_i - V_i).
\]

In the same way we can derive the following condition for immigrants:

\[
W_{e,i,I}^u - W_{u,i,I}^u = \left( \frac{\beta \psi}{1 - \beta} \right) (J_{i,I} + F\tilde{p}_i x_i - V_i).
\]

We observe that the presence of firing costs changes the standard condition for the sharing of surplus between firms and workers. Moreover, the wages of natives and immigrants differ as a result of different outside options (compare the right hand side of Eqq. (20) and (21) taking into account Eqq. (13)-(16)).

2.4 The Equilibrium

2.4.1 The Free Entry Condition in Labour Market

In equilibrium, assuming that the real wage of natives will be not lower than the one og immigrants, i.e. \(\tilde{w}_{i,N}^E \geq \tilde{w}_{i,I}^E\), the free-entry condition in the labor market for firms implies that \(J_{i,N}^E \leq J_{i,N}^E = 0\), otherwise for \(J_{i,N}^E < 0\) no firms would hire natives, and \(J_{i,N} > 0\) would incentive firms to enter labor market driving \(J_{i,N}^E\) toward zero. Therefore, from Eq. (3) the
value of a vacancy in equilibrium is greater than zero and equal to:

\[ V_i^E = F \check{p}_ix_i. \] (22)

Since \( \check{w}_{i,N}^E \geq \check{w}_{i,I}^E \) and therefore \( J_{i,N}^E \leq J_{i,N}^E = 0 \), after the match with a native a firm could decide of not starting production and to maintain open a vacancy and, as result, no native workers would work. In equilibrium, we therefore should observe that:

\[-c + q(\theta)(\pi_I(rJ_{i,I}) + (1 - \pi_I)rJ_{i,N})) = rJ_{i,N}, \] (23)

where the left hand side of Eq. (23) is the value for a firm to refuse the match with a native worker and to maintain open a vacancy, while the right hand side is the value to start production. In particular, if \(-c + q(\theta)(\pi_I(rJ_{i,I}) + (1 - \pi_I)rJ_{i,N})) > rJ_{i,N} \) would result in a relative increase of native workers among the unemployed workers leading to a decrease of \( \pi_I \), while the opposite happens if \(-c + q(\theta)(\pi_I(rJ_{i,I}) + (1 - \pi_I)rJ_{i,N})) > rJ_{i,N} \).

This equation allows us to determine the equilibrium price, which reads:

\[ p_i = \frac{r[q(\theta)\pi_I(1-t)(\check{w}_{i,N} - \check{w}_{i,I}) + (1 - q(\theta))\check{w}_{i,N}] - (r + \delta)c}{x_i(1 - q(\theta))(1 - t)} \] (24)

From the wage bargaining for natives in Eq. (20), using Eqs. (13) and (15), we have the wage-setting condition for natives:

\[ \check{w}_{i,N} = \frac{\beta \check{p}_ix_i [1 + (1-t) rF] + (1 - \beta) rW_{i,N}^u - (1 - \beta)\psi(1-t)\check{\tau}_i}{(1 - \beta) \psi + \beta}; \] (25)

the wage-setting condition for immigrants based on Eq. (21) is instead given by:

\[ \check{w}_{i,I} = \frac{\beta \check{p}_ix_i [1 + (1-t) rF] + (1 - \beta) rW_{i,I}^u - (1 - \beta)\psi(1-t)\check{\tau}_i}{(1 - \beta) \psi + \beta}; \] (26)

The comparison between Eqs. (25) and (26) highlights the crucial asymmetry present in the bargaining between firm and worker when worker is native or immigrant. In particular, while the impact of \( \lambda \) ia ambiguous a lower \( W_{i,A} \), decreasing the bargaining power of immigrants, should reduce their equilibrium wage.

Figure 2 depicts a plausible scenario, where for a sufficiently low value of \( W_{i,A} \), the wage of native is higher than the wage of immigrants.
2.4.2 The Equilibrium Unemployment Rate

In equilibrium, assuming that labor force of natives is equal to 1, employment and unemployment for natives can be computed as:

\[ e_{i,N} = \frac{\theta_i q (\theta_i)}{\delta + \theta_i q (\theta_i)} \] (27)

\[ u_{i,N} = \frac{\delta}{\delta + \theta_i q (\theta_i)} \] (28)

while, assuming that the total amount of potential immigrants is equal to \( \sigma \), the employed and unemployed immigrants are given by:

\[ e_{i,I} = \sigma \left\{ \frac{\eta \theta_i q (\theta_i)}{\lambda \delta + \eta \theta_i q (\theta_i) + \delta} \right\} \] (29)

\[ u_{i,I} = \sigma \left\{ \frac{\eta \delta}{\lambda \delta + \eta \theta_i q (\theta_i) + \delta} \right\} \] (30)

while the mass of potential immigrants in the RSoL not migrated is given by:

\[ A = \sigma \left\{ \frac{\lambda \delta}{\lambda \delta + \eta \theta_i q (\theta_i) + \delta} \right\} \] (31)

We remark that:

\[ \theta_i \equiv \frac{u_{i,N} + u_{i,I}}{v_i} = \ldots \] (32)
2.5 The Government

To conclude the presentation of the model, we assume that Government finances in balanced budget its expenditure. Hence, Government’s revenues come from the taxation of the firm’s profit as well as the taxation of the workers’ income are used to finance the subsidies to unskilled workers as well as the unemployment benefits to all unemployed workers. With a flat tax rate $t$ on profits, the net transfer from each worker to the tax authorities is:

$$T(w_i) = tw_i - (1 - t) \tau 1_i$$  \hspace{1cm} (33)

$$bw_h (1 - t) w_h + b (1 - t)(w_l + \tau) w_l + \tau u_l = t (p_h x_h + p_l x_l) + t (w_h + w_l) - (1 - t) \tau (1 - u_l).$$ \hspace{1cm} (34)

3 Calibration

As standard in the literature (Pissarides 2000), we assume that the matching function is shaped as a Cobb-Douglas, with $\alpha$ being the elasticity with respect to unemployment and $A$ being the matching efficiency:

$$m(v_i, u_i) = Au_i^\alpha v_i^{1-\alpha}.$$ \hspace{1cm} (35)

We can rewrite Eq. (35) as

$$q(\theta_i) = A\theta_i^{-\alpha}.$$ \hspace{1cm} (36)

The rate at which an unemployed worker finds a job $\phi(\theta_i)$ reads:

$$\phi(\theta_i) = \theta_i q(\theta_i) = A\theta_i^{1-\alpha},$$ \hspace{1cm} (37)

with elasticity equal to:

$$\frac{q'(\theta_i)}{q(\theta_i)} = -\alpha$$ \hspace{1cm} (38)

...

4 Conclusions

References


