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# Native Welfare Losses from High Skilled Immigration

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# Native Welfare Losses from High Skilled Immigration

## Abstract

This paper explores the effects of high skilled immigration to a host country with unionized low skilled labor and an unemployment insurance scheme. We show that such immigration can create a negative immigration surplus due to adverse effects on low skilled employment, provided that fiscal redistribution is not too intense and the elasticity between high and low skilled labor is high as empirical evidence suggests.

JEL Code: F22, J5, H53, J61, J65.

Keywords: immigration, trade union, unemployment, welfare state, elasticity of substitution.

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## I. Introduction

While the impact of the international mobility of the highly skilled on sending countries is disputed continuously (Bhagwati & Hamada, 1974; Mountford, 1997; Haupt & Janeba, 2008), positive effects on receiving countries are taken more or less for granted. High skilled immigrants are most welcomed; not only because of their fiscal contributions, but also because of the expected creation of employment in other, in particular distorted, labor market segments (OECD, 2002, Chiswick, 2007).<sup>1</sup>

Somewhat surprisingly, the interaction between high skilled immigration and distortions in other labor market segments has received little investigation hitherto. The present paper builds a simple model addressing the question how high skilled immigration affects a host economy with low skilled unemployment. Featuring some fundamental characteristics of European labor markets, unemployment results from the existence of trade unions and an unemployment insurance scheme.

Within this framework, we show that high skilled immigration is not necessarily beneficial, but can indeed impose a burden on the aggregate income of the native population. This loss is based on the empirically corroborated fact that high and low skilled labor are close, albeit imperfect substitutes in the production process (Johnson, 1997; Card & Lemieux, 2001). With this property, we find that a higher number of high skilled workers reduces total low skilled employment as low skilled labor demand, determining unions' wage markup, becomes less elastic. This rise in unemployment is even reinforced by additional fiscal redistribution exerted by the high skilled. The resulting loss in aggregate native gross income dominates the direct fiscal contributions by the high skilled when fiscal redistribution is not too high.

To the best of our knowledge, these insights are novel to the literature. The only other study exhibiting negative effects of high skilled immigrants we are aware of is Michael (2006). However, that result is based on a quite different mechanism. In a

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1 However, the materialization of these virtues hinges on the high skilled really coming to the respective country which obviously depends on its economic appeal. The international competition for the high skilled is therefore expected to reduce equilibrium redistribution and hence fiscal effects in the receiving countries as well (Wildasin, 2000; Poutvaara, 2000; Andersson & Konrad, 2003). This adjustment, which would render the above-mentioned employment aspect even more relevant, is not our concern here. Rather, we investigate how high skilled immigration operates on a country which is appealing enough to attract these people.

full employment setting, Michael (2006) shows that the admittance of high skilled immigrants can trigger additional low skilled immigration on such a scale that the positive fiscal effects of the former group are dominated by the negative fiscal effects of the latter. Our result is however not based on these fiscal, but on the employment consequences instead.

The paper is organized as follows. Section II derives the labor market equilibrium of the host economy. Section III addresses the effects of high skilled immigration on the labor market and the overall position of natives. Section IV offers some concluding remarks.

## II. The Host Economy

Consider an economy where competitive firms produce the output with the inputs high and low skilled labor  $H$  and  $L$  according to a CES production function:

$$Y = A [\alpha H^\rho + (1 - \alpha)L^\rho]^{1/\rho}, \quad (1)$$

where  $\rho > 0$ , which is the empirically more relevant case of gross substitutability of skills (Johnson, 1997; Card & Lemieux, 2001).

The native population comprises high and low skilled workers in amounts  $N_H$  and  $N_L$ , respectively. The number of high skilled immigrants is  $M_H$ . The labor market for the high skilled is perfectly competitive, ensuring full employment for these people by full flexibility of the wage  $w_H$ . Hence, the following results are not based on some malfunctioning in this labor market segment.

The low skilled labor market, however, is distorted. The low skilled wage  $w_L$  is determined by a standard monopoly union model (Layard et al., 1991), where unions act at the firm level in order to maximize a weighted surplus of members' per capita net income and employment  $L$  relative to the reference situation. As both unions and firms are small relative to the economy, this reference situation is characterized by full lay-off with all members receiving an unemployment benefit  $b$ . Letting  $\tau$  denote the contribution rate to unemployment insurance, the union objective reads:

$$\Omega = \log[(1 - \tau)w_L - b] + \log L. \quad (2)$$

Once the union has determined the low skilled wage, the firm hires both types of labor according to the respective marginal productivity conditions:

$$\frac{\partial Y}{\partial H} = A[\alpha(N_H + M_H)^\rho + (1 - \alpha)L^\rho]^{\frac{1}{\rho}-1} \alpha(N_H + M_H)^{\rho-1} = w_H, \quad (3)$$

$$\frac{\partial Y}{\partial L} = A[\alpha(N_H + M_H)^\rho + (1 - \alpha)L^\rho]^{\frac{1}{\rho}-1} (1 - \alpha)L^{\rho-1} = w_L, \quad (4)$$

where both  $L$  and  $w_H$  adjust for equilibrium, the high skilled wage warranting  $H = N_H + M_H$ . It is straightforward to show that both  $L$  and  $w_H$  decrease in the low skilled wage.

Unions anticipate this behavior when setting  $w_L$ . Hence, they maximize (2) subject to (4) which leads to the first-order condition:<sup>2</sup>

$$\frac{(1 - \tau)}{(1 - \tau)w_L - b} + \frac{\partial L}{\partial w_L} \frac{1}{L} = 0. \quad (5)$$

Considering the fact that aggregate low skilled labor demand cannot exceed aggregate supply, (5) can be written as the aggregate wage setting equation:

$$WS = (1 - \tau)w_L(1 + \varepsilon) - \varepsilon b \leq 0, \text{ with } = 0 \text{ if } w_L \geq w_L^*, \quad (6)$$

where  $w_L^*$  denotes the full employment wage and:

$$\varepsilon = \frac{\partial L}{\partial w_L} \frac{w_L}{L} = \frac{\alpha H^\rho + (1 - \alpha)L^\rho}{(\rho - 1)\alpha H^\rho} \quad (7)$$

is the (own) wage elasticity of low skilled labor demand. Due to the gross substitutability property ( $\rho > 0$ ), low skilled labor demand is always elastic ( $\varepsilon < -1$ ), but is the less elastic the more high skilled labor exists:

$$\frac{\partial \varepsilon}{\partial H} = \frac{(1 - \alpha)\rho L^\rho}{\alpha(1 - \rho)H^{\rho-1}} > 0. \quad (8)$$

Equation (6) has the well known interpretation that the low skilled net wage is a markup  $\varepsilon/((1 - \tau)(1 + \varepsilon))$  on the unemployment benefit, the income in the reference situation. As a higher labor demand elasticity implies higher employment losses from a given wage increase, the markup - and hence the gross wage - is inversely related to  $\varepsilon$ .

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2 Simple, but tedious algebra shows that the second-order condition is fulfilled.

Accordingly, both an increase of the unemployment benefit and the tax rate reduce the preferred employment level, as either the reference payment or the markup itself increases:

$$\frac{\partial L}{\partial b} \Big|_{WS} = - \underbrace{\frac{\partial WS/\partial b}{\partial WS/\partial L}}_{(>0)} < 0, \quad \frac{\partial L}{\partial \tau} \Big|_{WS} = - \underbrace{\frac{\partial WS/\partial \tau}{\partial WS/\partial L}}_{(>0)} < 0. \quad (9)$$

While the unemployment benefit is exogenous from the perspective of the small unions, it has to be funded in the aggregate. This is accomplished by taxing low and high skilled earnings at rates  $\tau \in [0, 1)$  and  $\delta\tau, \delta \in [0, 1/\tau)$ , respectively. Thus, the welfare state is actuarial unfair if  $\delta > 0$  for in that case the high skilled pay contributions to a scheme from which they never receive any benefits.

Utilizing (3), the unemployment insurance budget constraint  $b(N_L - L) = \tau w_L L + \delta\tau w_H H$  can be written as a budget balance equation:

$$BB = b - \frac{\tau w_L L}{(N_L - L)} \left[ 1 + \frac{\delta\alpha}{1 - \alpha} \left( \frac{H}{L} \right)^\rho \right] = 0. \quad (10)$$

The unemployment benefit equals the contributions by the low skilled workers per unemployed, augmented by the income share of the high skilled as far as is fiscally relevant ( $\delta > 0$ ).

The reaction of the unemployment benefit on a rise in low skilled employment for a given contribution/tax rate  $\tau$ :

$$\frac{\partial b}{\partial L} \Big|_{BB} = - \frac{\partial BB}{\partial L} = \frac{b}{N_L - L} + \frac{b}{L} \left( 1 + \frac{1}{\varepsilon} \right) - b \frac{\rho\delta\alpha H^\rho}{L(\delta\alpha H^\rho + (1 - \alpha)L^\rho)} \quad (11)$$

results from the interplay of a number of effects. The first term in (11) reflects the fact that each low skilled leaving unemployment allows the existing welfare state revenue to be spread among less recipients. Ceteris paribus, this increases the benefit per unemployed. The second term measures the effect of this additional worker on total low skilled contributions. This effect is also positive because labor demand is elastic ( $\varepsilon < -1$ ). But third, the income share of the high skilled decreases with low skilled employment:

$$\frac{\partial(w_H H)/(w_L L)}{\partial L} = - \frac{\rho\delta\alpha}{(1 - \alpha)L} \left( \frac{H}{L} \right)^\rho < 0. \quad (12)$$

This has negative repercussions for welfare state revenues to the extent that the high skilled contribute. As a consequence, the effect of a marginal rise in low skilled employment on the unemployment benefit can not be unambiguously signed. Nevertheless, the benefit becomes infinitely high as the economy approaches full low skilled employment as the number of recipients boils down to zero. Hence, a sufficiently large employment increase must increase  $b$ .

We are now in the position to derive the labor market equilibrium which is characterized by the mutual compatibility of (6) and (10).

**Proposition 1.** *For every  $\tau \in [0, 1)$ , there exists at least one labor market equilibrium. There is low skilled unemployment in equilibrium whenever  $\tau > 0$ .*

**Proof.** follows from the fact that WS is a continuous function in  $(L, b)$ -space, with  $L = N_L$  for  $b < \max[b^*, 0]$  where  $b^*$  denotes the benefit level for which  $w_L = w_L^*$  according to WS. For  $b \geq \max[b^*, 0]$ ,  $L$  decreases continuously in  $b$ , see (9), with  $\lim_{b \rightarrow \infty} L = 0$ . For  $\tau = 0$ , BB coincides with the  $L$ -axis, hence equilibrium employment amounts to  $N_L$ . For  $\tau > 0$ , BB is continuous in  $(L, b)$ -space, with  $b = \frac{\delta\tau\alpha^{1/\rho}}{N_L}$  for  $L = 0$  whereas  $\lim_{L \rightarrow N_L} b = \infty$ . Hence, BB must cut WS at least once from below in  $(L, b)$ -space and all intersections must feature  $L < N_L$ .  $\square$

Hence, the welfare state scheme is ultimately responsible for equilibrium unemployment. Without any social protection, full employment would arise because the union objective would be equivalent to the low skilled wage bill. Labor demand being elastic everywhere, the wage bill increases monotonously in the low skilled employment level and would consequently be maximized by the full employment wage. But whenever the tax rate is positive, some low skilled must be jobless in any equilibrium. This holds because full employment would imply an infinitely high benefit. This in turn would induce unions to set an infinitely high wage. Thus, full employment can never constitute an equilibrium.

Due to the properties of the government budget constraint, multiple equilibria can not be ruled out. However, the argumentation in the above proof reveals that there must be at least one equilibrium where BB intersects WS from below in  $(L, b)$ -space. Analytically speaking, the determinant of the system is negative for that equilibrium:



$$\begin{aligned}
 |D| &= \frac{\partial WS}{\partial b} \frac{\partial BB}{\partial L} - \frac{\partial BB}{\partial b} \frac{\partial WS}{\partial L} \\
 &= \frac{\tau w_L}{(N_L - L)^2} [(1 + \varepsilon)N_L - L] \left( 1 + \frac{\delta \alpha}{1 - \alpha} \left( \frac{H}{L} \right)^\rho \right) \\
 &\quad + \frac{\varepsilon \tau w_L}{(N_L - L)^\rho} \frac{\delta \alpha}{1 - \alpha} \left( \frac{H}{L} \right)^\rho - \frac{(1 - \tau)w_L}{L} \left[ \frac{1 + \varepsilon}{\varepsilon} - \frac{\partial \varepsilon}{\partial L} \frac{L}{\varepsilon} \right] < 0. \quad (13)
 \end{aligned}$$

In what follows, we confine our attention to an equilibrium of this type and omit the case  $|D| > 0$ . This can be justified by two reasons. First, existence of equilibrium is ensured for (13) but not for the opposite case. Second, a negative determinant leads to conventional economic effects in the absence of immigration whereas a positive determinant does not. To illustrate, consider a decrease of actuarial fairness ( $\delta \uparrow$ ), boosting welfare state revenues for given employment levels. According to the intuition behind (6), low skilled employment should decline because unions charge higher wages as the reference situation improves ceteris paribus. However, this happens only when (13) holds:

$$\frac{\partial L}{\partial \delta} = \frac{1}{|D|} \left[ - \underbrace{\frac{\partial WS}{\partial b}}_{(>0)} \underbrace{\frac{\partial BB}{\partial \delta}}_{(<0)} \right] \stackrel{\leq}{\geq} 0 \quad \iff \quad |D| \stackrel{\leq}{\geq} 0.$$

Hence, by restricting the consideration to an equilibrium with a negative determinant, the upcoming results are derived in a setup which delivers economic mainstream results in other dimensions.

### III. The Effects of Immigration

This section addresses the consequences of high skilled immigration for employment and the total income of natives.

**Proposition 2.** *High skilled immigration reduces low skilled employment.*

**Proof.** Low skilled employment reacts according to:

$$\begin{aligned}
 \frac{dL}{dM_H} &= \frac{\partial WS / \partial H \cdot \partial BB / \partial b - \partial WS / \partial b \cdot \partial BB / \partial M_H}{|D|} \\
 &= \underbrace{\frac{1}{|D|}}_{<0} \left[ \underbrace{- \frac{(1 - \tau)w_L}{\varepsilon} \frac{\partial \varepsilon}{\partial H}}_{(>0)} - \delta \underbrace{\frac{\rho \varepsilon \alpha \tau w_L}{(1 - \alpha)(N_L - L)} H^{\rho-1} L^{-\rho-1}}_{(<0)} \right]. \square
 \end{aligned}$$

The economic mechanisms behind this result are simple. First, the stronger presence of the high skilled makes low skilled labor demand less elastic. This increases the markup for a given benefit, hence unions demand higher wages and low skilled employment declines. Second, a higher population share of the high skilled increases their contribution relative to the low skilled:  $(\frac{\partial(w_H H)/(w_L L)}{\partial H} > 0$ , the inverse to (12). Whenever  $\delta > 0$ , this brings about higher fiscal redistribution via unemployment insurance. The concomitant increase in the unemployment benefit generates a further increase in wage demands. Hence both effects work in the same direction.

This employment contraction is contentious for the immigration surplus (Borjas, 1999), measured by the change in aggregate income of natives. The total income of natives for given  $M_H$  amounts to:

$$\begin{aligned} TNI &= (1 - \delta\tau)w_H N_H + (1 - \tau)w_L N_L + (N_L - L)b \\ &= w_H N_H + w_L L + \delta\tau w_H M_H, \end{aligned} \tag{14}$$

the sum of native gross earnings plus immigrants' net fiscal contribution.

**Proposition 3.** *Whenever the welfare state is not too actuarially unfair, marginal immigration decreases total native income.*

**Proof.** The effect of an additional immigrant is:

$$\frac{\partial TNI}{\partial M_H} = \frac{\partial w_H}{\partial H} N_H + \frac{\partial w_L}{\partial H} L + w_L \frac{dL}{dM_H} + \delta\tau \frac{\partial w_H}{\partial H} M_H + \delta\tau w_H. \tag{15}$$

For marginal immigration ( $M_H = 0$ ), using  $H = N_H$  and  $\frac{\partial w_H}{\partial H} H + \frac{\partial w_L}{\partial L} L = 0$ , (15) becomes:

$$w_L \frac{\partial L}{\partial H} + \delta\tau w_H,$$

which is unambiguously negative for  $\delta = 0$ .  $\square$

There are two effects of marginal immigration on aggregate native income. First, there is a negative output effect, as the immigrant receives  $w_H$ , which is more than he adds to total production ( $\partial Y/\partial H + w_L dL/dM_H = w_H + w_L dL/dM_H$ ). Second, he is a net fiscal contributor to an actuarially unfair welfare state. However, this effect vanishes when  $\delta = 0$ ; so the overall impact is negative whenever fiscal redistribution is not too intense, that is  $\delta$  is low.

We have thus identified a situation where high skilled immigration decreases total native income although wages are flexible and the welfare state is outright redistributive. This result differs substantially from a full employment setting. There, marginal immigration would be unambiguously beneficial whenever  $\delta > 0$ , as  $\frac{dL}{dM_H}$  equals zero for  $L = N_L$ .

## IV. Conclusion

This contribution puts some caution on the conventional wisdom that high skilled immigration is unambiguously beneficial for the receiving country. We have presented circumstances under which low skilled labor market distortions render high skilled immigration a burden for the employment of less qualified individuals. This negative effect can translate into a negative immigration surplus.<sup>3</sup> But even if the surplus was positive, it would not be because but rather despite the native employment consequences. Therefore, some scepticism about the popular belief of positive spillovers of high skilled immigrants on low skilled employment seems appropriate.

By changing the perspective to sending countries, our result provides another source for positive effects of a brain drain, complementary to studies emphasizing positive effects on skill formation (Mountford, 1997). In our model, high skilled emigration would have a positive aggregate effect on the source country provided its welfare state has little redistribution. However, acknowledging that migration is driven by redistribution differentials, the consequences of high skilled mobility become much less clear-cut. It is easy to devise of a situation where the migration of high skilled from a high to a low tax country hurts both the home country because of the loss in fiscal contributions, and the receiving country because of higher low skilled unemployment.

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<sup>3</sup> Note that our result does not mean that increasing the number of high skilled natives would have adverse effects on the natives as a whole, as the income gain of the educated would be included in our welfare measure (14).

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