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IMMIGRATION AND SKILL
FORMATION IN UNIONISED
LABOUR MARKETS

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Abstract

This paper analyses the impact of immigration on the welfare of the native population in an economy that consists of skilled and unskilled workers. Due to unionisation, the wage rate in the market for unskilled labour is above the competitive level. For a given skill endowment of the native population, we show that immigration reduces the welfare of the host country up to a certain threshold and then increases it with further immigration. For the case of endogenous skill formation, an increase in expected immigration raises the number of skilled individuals in the native population. If the government can credibly commit itself to a certain immigration policy, skill formation of the native population will adjust, so that immigration maybe strictly welfare increasing.

Keywords: Immigration policy, trade unions, occupational choice

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1. INTRODUCTION

The considerable differences in wage levels across countries create incentives for international migration. For the host countries, the potential for mass migration raises complex economic and non-economic problems. One important economic issue is the impact of immigration on the labour market. Here, much of the debate concentrates on the market for low skilled labour because the majority of immigrants typically compete with domestic unskilled workers.[1] This competitive pressure raises the question of whether the native population benefits or loses as a consequence of immigration. Earlier contributions to the literature have mostly focused on the welfare effects of immigration with competitive labour markets and conclude that a laissez-faire immigration policy is optimal for the host country [Berry and Soligo (1969)]. The problem with this approach is that labour markets in most industrialised countries are not competitive, i.e. they are characterised, for instance, by statutory minimum wages, unionisation and regulations of all kinds.

The present paper analyses the impact of immigration in the presence of labour market unionisation. It is the aim of the analysis to shed some light on the effects of immigration on the welfare of the host countries' native populations, given that wage bargaining between unions and firms raises the wage rate in some sectors of the economy above the competitive level. A second key feature of our analysis is that, rather than taking the endowment of the host countries with unskilled labour as given, we take into account the effect of immigration on skill formation. We thus focus on two key aspects of the debate: firstly, immigrants typically compete with domestic unskilled workers in labour markets where wages are above the competitive level; secondly, skill formation is endogenous and may be affected by migration, at least in the long term. We develop a model with two types of labour - skilled and unskilled. Immigrants are assumed to be unskilled and perfect substitutes for domestic unskilled labour. In some sectors of the economy, the unskilled workers are represented by trade unions.

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[1] Immigrants to the US had on average two years less educational attainment than native workers; see Smith and Edmonston (1997, p. 183).

It turns out that for a given skill distribution in the native population, immigration unambiguously reduces domestic welfare up to a certain threshold. Beyond this threshold, welfare increases with further immigration. Things are different, however, if skill formation is endogenous. Educational decisions then depend on expectations of future migration policies. In general, immigration encourages skill formation and, hence, reduces the domestic supply of unskilled labour. If the government can commit itself credibly to an immigration policy (e.g. laissez-faire, quotas), we show that immigration increases domestic welfare.

In the literature, the impact of immigration on the welfare of the host country in the presence of labour market imperfections has been analysed by Brecher and Choudri (1987), Burda and Funke (1993), and Schmidt et al. (1994).[2] Brecher and Choudri (1987) consider a two-country model with capital and labour as factors of production. In the capital-abundant (high-wage) country, the government is assumed to run a transfer system that guarantees a minimum income to all native workers. In equilibrium, this minimum income equals the wage rate and causes unemployment. In this framework, it is unambiguously optimal for the high-wage country to pursue a no-immigration policy. Burda and Funke (1993) use a two-country-model with labour mobility and unionised labour markets to analyse the interaction between migration and wage setting in Germany after unification. The paper concentrates on explaining the steep wage increases that occurred in Eastern Germany despite high rates of unemployment.

The paper most closely related to our approach is Schmidt et al. (1994). These authors analyse the effect of immigration on the welfare of the recipient country in a model where a nation-wide monopoly union represents both skilled and unskilled workers. As in our model, immigrants are assumed to be unskilled. The government taxes capital and income from skilled and unskilled labour. Unemployed workers - native as well as migrant - receive tax financed unemployment benefits. The main result emerging from this model is that the impact of immigration on the welfare of the native population can be decomposed into three effects. First, immigrants may replace native workers and raise the rate of unemployment among the

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[2] Earlier contributions to the theory of migration with labour market imperfections include the seminal paper by Harris and Todaro (1970) and Calvo (1978), who extends the Harris-Todaro framework to a model where the labour market is unionised and the wage rate is endogenous.

native population. Second, as jobless immigrants are assumed to be eligible for unemployment benefits, they constitute a burden for the government budget. Although these two effects reduce domestic welfare, immigration also has a third, positive effect. As unions tend to reduce wages in response to immigration, employment of unskilled labour and the wages of skilled labour increase. The overall effect of immigration on the welfare of the native population is thus ambiguous.[3]

Our approach differs from that of Schmidt et al. in several respects. Firstly, the endowment of workers with skills is exogenous in their model while we also consider the case with endogenous skill formation. It turns out that this extension has important consequences for the results. Secondly, we consider a different model of wage and employment determination, namely an efficient bargaining model. This approach allows us to focus on the redistributive role of unions while abstracting from the issue of inefficiently low employment levels. We will show that the redistributive effect of union power alone has a significant impact on the welfare consequences of immigration. Finally, we abstract from the role of the public tax and transfer system.

We proceed as follows. Section 2 will develop the framework for our analysis. Section 3 analyses wage determination and employment in our model of a (partly) unionised labour market. In Section 4, we will discuss the welfare effects of low-skilled immigration. Section 5 shows how immigration policies affect domestic welfare when skill formation is endogenous. Section 6 concludes.

2. THE MODEL

We consider a small open economy where all firms are identical. Each firm produces output Q by employing low skilled labour L:

$$Q = L^{\alpha} \qquad\qquad \text{with } 0 < \alpha < 1. \qquad\qquad (1)$$

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[3] A similar theoretical framework is developed in Bauer and Zimmermann (1997). These authors also discuss some empirical issues on migration in Europe, such as East-West wage differentials and the overall number of immigrants to Western European countries that should be expected in the future.

There are *H* high skilled individuals who represent the class of entrepreneurs. Each high skilled individual runs his own firm. The output price is given by the world market price which is normalised to unity.

Figure 1 illustrates the sequence of decisions. In the first stage, the domestic population decides on the skill formation through education. *Ex ante* all individuals are identical. At cost *c*, each individual can acquire human capital and can become an entrepreneur. Without this acquisition of human capital, individuals become low skilled workers who will later be employed in the entrepreneurs' firms.
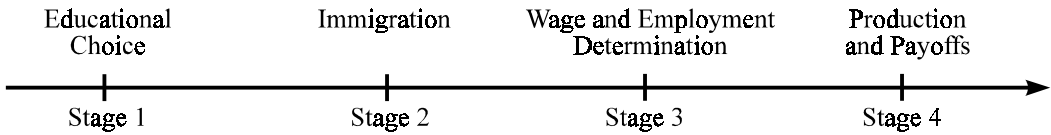
Educational Choice	Immigration	Wage and Employment Determination	Production and Payoffs
Stage 1	Stage 2	Stage 3	Stage 4

Figure 1: Time Structure

In the second stage, the population decides on whether to allow the immigration of additional workers. For simplicity, we will focus solely on the immigration of low skilled workers. Whether a country closes its borders to potential immigrants or has an active immigration policy will largely depend on the cost and benefits for the domestic population. We will determine the immigration policy of a social planner who maximises the native population's income.[4]

In the third stage, wages and employment are determined. The labour market consists of two sectors: a unionised sector and a competitive sector. In the competitive labour market sector, both entrepreneurs and workers earn their marginal products. In the unionised sector, trade unions and entrepreneurs bargain over the wages and the employment of unskilled labour. Each union is organised at the firm level and takes the overall level of employment as given.

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[4] This is simply a positive description of the fact that immigrants have no voice in domestic elections and, therefore, are not represented in a policymaker's objective function. Naturalisation of immigrants typically takes many years, some migrants leave the country before becoming eligible for naturalisation, others never seek naturalisation. See, however, Mazza and van Winden (1996) who consider a public choice model of income redistribution where immigration affects the composition of the political constituency.

In the fourth and final stage, the output is produced according to the above production function and all members of the society receive their payoffs.

3. WAGES AND EMPLOYMENT

We solve the game in reverse and start by determining wages and employment in the competitive and unionised segments of the labour market. The whole economy consists of H firms which operate according to the previously introduced production function Q. In a share γ of the firms the union has the power to bargain over wages and employment; these $\gamma \cdot H$ firms constitute the unionised segment of the labour market. In the remaining $(1-\gamma) \cdot H$ firms, the workers are not organised; wages and employment are determined competitively. The union and the firm take the level of employment and the level of immigration as given. In the following analysis, we first assume that the union coverage parameter γ is exogenously given. One may argue, however, that union coverage will be negatively affected by immigration because it may be more difficult to organise non-domestic workers. In Sections 4 and 5, we will therefore also consider the case where γ declines in response to immigration.

Union-Firm Bargaining

The union serves a clientele of low skilled workers consisting of native workers and migrants. The number of native workers is denoted by N, the number of immigrants by M. We assume that, in each firm, a union representing the unskilled workers bargains with the entrepreneurs for the wages and employment of unskilled labour. Neither the entrepreneurs nor the union discriminate between native workers and immigrants.[5] The union's objective is to maximise the income of unskilled workers which is $w^U \cdot L$; w^U is the wage rate and L is the number of unskilled employees. If there is disagreement between the union and the firm, we assume that

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[5] This is consistent with the institutional setting in many countries. The same assumption is made in, e.g., Calvo (1978) and Schmidt et al. (1994). The results of the paper will not change qualitatively if it is assumed that immigrants face inferior labour market prospects compared to native workers (though immigration will *ceteris paribus* become more beneficial).

the workers could find jobs in the competitive segment of the labour market at a wage rate w^C. The union's reservation utility is therefore $w^C \cdot L$. For bargaining at the firm level, w^C is taken as given; for the economy as a whole, w^C is determined endogenously, as will be explained further below.

The entrepreneurs in the unionised sector maximise their income, which is $Q - w^U L$; the reservation income of the entrepreneurs is assumed to be zero.[6] We derive the outcome of the bargaining process using the Nash bargaining solution [Nash (1950)]. The Nash maximand (Ω) can be written as

$$\Omega = \beta \cdot \log\left(L \cdot (w^U - w^C)\right) + (1-\beta) \cdot \log(Q - w^u L) \tag{2}$$

Maximising (1) over L and w^U yields

$$\frac{\partial Q}{\partial L} = w^C \tag{3}$$

and

$$w^U = w^C + \frac{\beta}{1-\beta} \cdot \frac{(Q - w^U \cdot L)}{L} \tag{4}$$

From (3), we get the labour demand of a single firm in the unionised segment as $L = (w^C / \alpha)^{1/(\alpha-1)}$. As there are $\gamma \cdot H$ firms where the unions have a say in the employment decision, the total labour demand of the unionised segment amounts to

$$L^U = \gamma \cdot H \cdot L = \gamma \cdot H \cdot \left(\frac{w^C}{\alpha}\right)^{\frac{1}{\alpha-1}} \tag{5}$$

The Competitive Segment of the Labour Market

For the economy as a whole the unionised workers' outside option w^C is determined in the competitive segment of the labour market. The total labour supply for the competitive segment is $N + M - L^U$. With $(1-\gamma) \cdot H$ firms in the competitive segment, each firm will

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[6] This assumption is made to keep the analysis simple and is frequently used in models with wage bargaining; see, for instance, Agell and Lommerud (1997). It implies that the entrepreneurs' human capital is firm specific. What is crucial for our results is that the outside option of the entrepreneurs is given and is independent of immigration.

employ $[N + M - L^U]/[(1-\gamma) \cdot H]$ workers. As these firms remunerate the workers with their marginal product, it is straightforward to show, using (5), that the competitive wage rate becomes

$$w^C = \alpha \cdot \left(\frac{N+M}{H}\right)^{\alpha-1}. \tag{6}$$

In equilibrium, each firm in the competitive segment employs $(N+M)/H$ workers.

Labour Market Equilibrium

Substituting (6) into (3) and (4) yields

$$L = (N+M)/H \tag{7}$$

and

$$w^U = w^C \cdot \left[1 + \beta \cdot \frac{1-\alpha}{\alpha}\right] \tag{8}$$

Equation (7) implies that unionised firms employ the same number of workers as the firms in the competitive segment of the labour market. This is a well-known implication of the efficient bargaining model [McDonald and Solow (1981)].[7] The impact of union power is reflected in equation (8). In the polar case of $\beta = 0$, where the union has no bargaining power, the wage rate equals the marginal productivity of unskilled labour (w^C) as in the competitive labour market segment. If the union does have some bargaining power ($\beta > 0$), the wage rate exceeds w^C. The higher β, the higher the wage rate that emerges from the bargaining process.

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[7] A popular objection to using the efficient bargaining model points to the empirical fact that, in most cases, unions and employers bargain for wages only, as in the right-to-manage model [Oswald (1993)]. However, this does not rule out implicit bargaining over employment. Empirical evidence in favour of the efficient bargaining model is provided by MaCurdy and Pencavel (1986) and Svejnar (1986). Moreover, Espinosa and Rhee (1989) and Strand (1989) show that the efficient bargaining outcome can be achieved in a repeated bargaining framework if discount rates are not too high. Another objection is that the partial equilibrium from efficient bargaining in general does not carry over to a general equilibrium setting [Layard and Nickell (1990)]. The union should anticipate that, if someone loses a job in the unionised sector, he will with some probability earn the union wage again. Hence, the outside option will exceed the competitive wage and, therefore, employment in unionised firms will be below the efficient level. Only for infinite bargains and a zero turnover rate, partial and general equilibrium frameworks will coincide. Though this is a valid objection against the general applicability of the efficient bargaining model, it is convenient to use this special case here as it allows us to isolate the consequences of the unions' power to redistribute. The consequences of the additional distortion arising from an inefficient allocation of labour across firms (as in the right-to-manage approach or the general efficient bargaining model) are discussed in Fuest and Thum (1999).

In the other polar case, where the entrepreneurs have no bargaining power ($\beta = 1$), the union captures the whole surplus, which means that the wage rate equals the average product of unskilled labour.[8] In the following, we will concentrate on intermediate cases for the distribution of bargaining power ($0 < \beta < 1$).

The equilibrium values for employment and remuneration [(7) and (8)] highlight the two central features of our union model. Firstly, there is full employment as in the competitive case, i.e. all $N+M$ low skilled workers find jobs, and the distribution of workers across firms is efficient.[9] Secondly, despite full employment, there is a redistribution of rents from entrepreneurs to low skilled workers. In addition to the marginal product w^C which would be earned in a competitive labour market, the low skilled workers receive additional income that would accrue to entrepreneurs in a competitive environment.

Finally, we will define domestic welfare Y as the sum of all rents that accrue to the native population, i.e. entrepreneurial compensation and wage income of the native workers:

$$
\begin{aligned}
Y = H \cdot Q - M \cdot Ew = \\
= H \cdot Q \cdot \left\{ 1 - \frac{M}{N+M} \cdot \left[\alpha + (1-\alpha) \cdot \gamma \cdot \beta \right] \right\}
\end{aligned}
\tag{9}
$$

where $Ew \equiv \gamma \cdot w^U + (1-\gamma) \cdot w^C$ is the expected income of workers. This type of welfare measure implicitly assumes that redistribution between natives is feasible at no cost. If immigration leads to a loss of one dollar for workers and a gain of more than one dollar for entrepreneurs, this is counted as a welfare improvement for the native population. To achieve a strict Pareto improvement the government would have to redistribute at least one dollar from entrepreneurs to native workers. If such redistribution is very costly, our simple welfare measure that neglects the distributional impact may reach its limits.[10] However, to keep the analysis tractable, we will focus solely on the sum of the native workers' incomes as the government's objective function. A government that maximises the income of its electorate

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[8] Of course, this is not a possible equilibrium in this model since $H > 0$ requires $\beta < 1$.

[9] The results of our paper will, therefore, also apply to other types of rent redistribution, as discussed, for instance, in the literature on rent-sharing; see Oswald (1996).

[10] For an explicit treatment of distributional objectives in labour market politics, see Saint-Paul (1994).

highlights the political economy aspect of immigration policy, as immigrants typically have a fairly small stake in domestic politics (e.g. due to high hurdles for naturalisation).

4. CAN AN ECONOMY WITH A UNIONISED LABOUR MARKET BENEFIT FROM IMMIGRATION?

Immigration affects the remuneration of all factors of production. As in a competitive labour market, factors that are substitutes (native workers) lose from immigration and factors that are complements (entrepreneurs) gain. While in a competitive labour market the overall effect of immigration on welfare is clearly positive, the outcome is not so obvious in the case of a unionised labour market because there are two opposing effects from the immigration of low skilled labour. Firstly, total output increases when immigration adds to the labour force and thus creates additional entrepreneurial rents. Secondly, immigrants not only receive their marginal products but also capture some of the rents in union contracts. *Ceteris paribus* this second effect makes immigration reduce domestic welfare. Overall, we obtain

Proposition 1. *In a unionised labour market, welfare decreases with immigration up to a threshold and thereafter increases again with further immigration:*

$$\frac{\partial Y}{\partial M} \gtreqless 0 \qquad \Leftrightarrow \qquad M \gtreqless \frac{\gamma \cdot \beta}{\alpha \cdot (1 - \gamma \cdot \beta)} \cdot N. \qquad (10)$$

Proof. Taking the derivative of domestic income (9) with respect to the number of immigrants yields

$$\partial Y / \partial M = H^{1-\alpha} \cdot (N + M)^{\alpha-2} \cdot (1 - \alpha) \cdot [\alpha \cdot (1 - \gamma \cdot \beta) \cdot M - \gamma \cdot \beta \cdot N] = 0 \qquad (11)$$

as the first order condition. Because of $\partial Y^2 / \partial M^2 > 0$, the domestic income reaches a minimum with an immigration of $M = \beta \cdot \gamma / [\alpha \cdot (1 - \beta \cdot \gamma)] \cdot N$ workers.

The intuition is straightforward. The first foreign worker reduces domestic welfare because he receives an expected income above his marginal product. For each additional migrant the expected income continues to exceed the marginal product of labour. However, as the additional labour supply reduces both the union wage and the competitive wage, the remuneration of entrepreneurs rises at the expense of the workers. If the reduction of income

hit the native workers only, it would simply be a redistribution from workers to entrepreneurs. However, as the number of workers grows, there are more and more (intramarginal) foreign workers who lose from additional immigration. As their income is not accounted for in the welfare measure of domestic income, the country, *cet. par.*, benefits from further immigration. With a sufficiently large number of foreign workers, the first effect, namely that the marginal immigrant receives an expected income above his marginal product, is less than the wage reduction for intramarginal migrants.[11]

This result suggests that a government that focuses strictly on the native population's aggregate income will carry out one of two extreme strategies. As domestic income is U-shaped in the number of immigrants, the government either completely closes the border to foreign workers or it follows a laissez-faire policy towards immigration which will maximise the number of foreign workers.[12] What we do not yet know is how many immigrants are needed to raise domestic welfare above the autarky level where no foreign workers are admitted. To give an answer to this question we compare the welfare in autarky $[Y(0) = N^{\alpha} \cdot H]$ with the domestic income if immigration is allowed $[Y(M)$, cf. (9)]. The critical level of immigration above which it becomes advantageous for the native population to have an open labour market is implicitly given by

$$Y(M) = Y(0).$$ (12)

To illustrate the magnitude of the necessary inflow of foreign workers, the welfare of the native population is evaluated numerically in Figure 2 for different sizes of the unionised labour market segment γ and for a set of relevant values of the union's relative bargaining

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[11] Note that relaxing the assumption that the entire immigration takes place at once would not alter our conclusion. If immigration takes place as a steady inflow of workers, the country still has to suffer temporary losses in the native population's incomes. Even if previous migrants are naturalised, the overall picture will not change. Once they become part of the electorate, they will join forces with the low skilled native workers opposing further immigration. From the point of view of a government that maximises the income of its electorate, naturalisation implies an increase in *N* that makes open borders even less attractive. The only requirement for our result is that, at the time of immigration, immigrants are not yet part of the policymakers' objective function.

[12] For the clarity of the argument, we abstract from social costs of immigration such as the burden on the transfer system, the costs of social integration or the effects on the housing market, which would in practice limit the amount of feasible immigration.

power β.[13] The production parameter α is set to .7. The share of foreign workers $m = M / (N + M)$ is denoted on the horizontal axis, and the vertical axis measures the welfare level. Welfare in autarky, i.e. without any immigration, is normalised to 100.

The critical immigration level above which welfare is higher than under autarky is sensitive to the unions' bargaining power. From Figure 2 it also becomes clear that, in a unionised labour market, a large number of foreign workers may be needed to raise welfare above the autarky level. For instance, if the union can redistribute 20 percent of high skilled rents to its clientele ($\beta = .2$) and 60 percent of the firms are unionised ($\gamma = .6$), the share of immigrants among the workers has to exceed 30% to make a laissez-faire policy welfare enhancing. If the bargaining power is $\beta = .1$, the necessary share of low skilled immigrants amounts only to 16%. For lower shares of unionised firms or weaker bargaining positions, immigration becomes beneficial even with low immigration rates.[14]
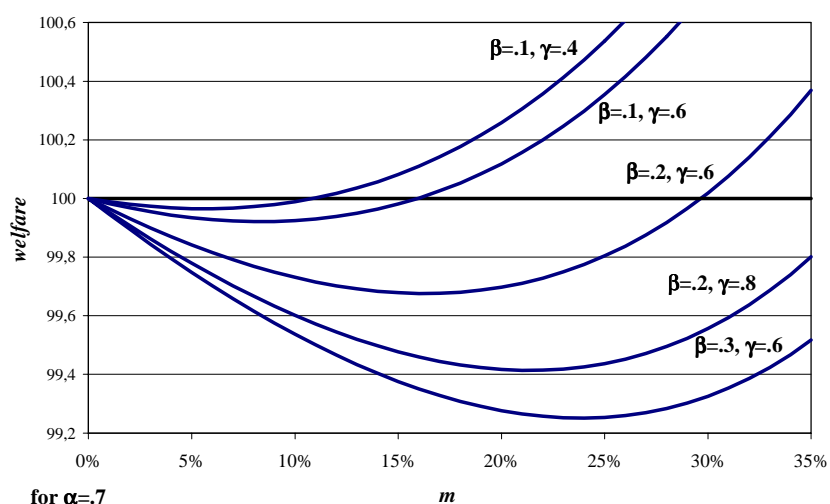

Figure 2: Welfare and Immigration

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[13] For a survey of union/non union wage differentials, see Booth (1995, ch. 6). In an empirical study for Canada, Abowd and Lemieux (1993) estimate β at approximately 0.2. The recent literature on rent sharing in the labour market is surveyed in Oswald (1996).

[14] An interesting consequence of the U-shaped relationship between immigration and the native population's income emerges if we view the outcome of the political process as a weighted average of the parties' interests, as e.g. in Alesina and Rosenthal (1995). An immigration policy that is between the two extremes of laissez-faire and closed borders in general makes the native population worse off than they would be with the extreme policies.

Proposition 2. *In a unionised labour market, the level of immigration which is needed to make the domestic population better off than in autarky is sensitive to the union's bargaining power. For significant values of bargaining power, large scale immigration is needed for the domestic population to benefit from immigration.*

Endogenous Union Coverage

An assumption underlying the analysis so far has been that the union coverage parameter is unaffected by immigration. As mentioned in section 3, we will now extend the model by assuming that union coverage decreases with immigration because unions have a harder time organising non-domestic workers. We thus assume that $\gamma = \gamma(M)$, with $\gamma'(M) < 0$ and $\gamma(0) = \bar{\gamma}$. The effect of immigration on domestic welfare then becomes

$$\partial Y/\partial M = H^{1-\alpha} \cdot (N+M)^{\alpha-2} \cdot (1-\alpha) \cdot [\alpha \cdot (1-\gamma(M)\cdot\beta)\cdot M - \gamma(M)\cdot\beta\cdot N] - H^{1-\alpha} \cdot (N+M)^{\alpha-1} \cdot (1-\alpha) \cdot \beta \cdot M \cdot \gamma'(M) \tag{13}$$

Note first that, comparing this result to the situation with a given γ, we always have $Y(M, \gamma(M)) \geq Y(M, \bar{\gamma})$ where $\bar{\gamma}$ denotes the case of a given union coverage. Moreover, departing from $M = 0$, marginal immigration always lowers welfare. Hence, it turns out that, if immigration reduces union coverage, the welfare of immigration on domestic welfare is still U-shaped. However, compared to the case of a constant γ, welfare is always higher, and the number of immigrants required to raise welfare above the autarky level is unambiguously lower.

In this section, we have shown that in contrast to competitive labour markets, immigration is not unambiguously beneficial for the welfare of the host country if the labour market is markedly affected by the unions' wage setting. With unionised labour markets, a low level of immigration reduces domestic welfare to below welfare in autarky. Large-scale immigration may be needed for the native population to benefit from immigration.

5. SKILL FORMATION

So far the distribution of skills has been exogenously given. There were N low skilled workers and H high skilled entrepreneurs. In this section, we endogenize the skill distribution by allowing for an educational choice. Initially, the population consists of P identical individuals. At cost c, each individual can acquire human capital and can become an entrepreneur. Individuals become low skilled workers if they do not acquire this human capital. In a first step, we determine the equilibrium distribution of workers and entrepreneurs that comes from the individuals' educational choices.[15] Finally, we will also analyse the impact of a constitutional immigration policy which fixes the future level of immigration *ex ante*, i.e. before the educational choices are made.

What Are the Effects of Immigration on Skill Formation?

To find the equilibrium in skill formation, we first rewrite the expected remuneration of workers and entrepreneurs, taking into account the fact that the total population P can be divided into these two subgroups ($P = H + N$). When making their educational choice, neither entrepreneurs nor workers know whether they will end up in the unionised or the competitive segment of the labour market. The low skilled worker receives an expected income of

$$Ew = \left(\frac{H}{P - H + M} \right)^{1-\alpha} \cdot \left[\alpha + \gamma \cdot \beta \cdot (1 - \alpha) \right], \tag{14}$$

and an entrepreneur earns on average

$$Eh = \left(\frac{H}{P - H + M} \right)^{-\alpha} \cdot (1 - \alpha) \cdot (1 - \gamma \cdot \beta) \tag{15}$$

The number of individuals who decide to become high skilled will depend on the type of immigration policy that is expected when the skill decision is made. Denote the expected immigration policy by M^e. For a given M^e, the expected income of the low skilled Ew is increasing in the number of high skilled as their marginal product rises due to the

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[15] For an empirical investigation of how changes in relative wages affect educational choices, see Topel (1997).

complementarity of the factors. The remuneration to the high skilled (net of the cost of education) $Eh - c$ decreases when more individuals decide to become entrepreneurs. Investing in education pays as long as the remuneration to the high skilled exceeds the expected income of the low skilled. The equilibrium is reached where the expected incomes of unskilled workers equal that of skilled workers net of educational costs. With rational expectations, expected and actual immigration levels will coincide ($M^e = M$).The number of people who decide to acquire higher skills via education is implicitly given by

$$Ew(H,M) = Eh(H,M) - c. \tag{16}$$

To find out how the domestic population reacts to an additional inflow of low skilled workers, we implicitly differentiate the equilibrium condition for the educational choice in (16) and obtain

$$\frac{\partial H}{\partial M} = \frac{H}{P + M}. \tag{17}$$

Immigration raises the supply of unskilled labour in the economy.[16] This reduces the expected income of unskilled workers but raises that of entrepreneurs. Increasing immigration therefore induces more individuals in the native population to acquire skills. As the next section will show, taking into account the endogeneity of skill formation also dramatically changes the welfare effects of immigration.

Welfare Effects of Immigration with Endogenous Skill Formation

As we have seen in the previous section, the expectations of the native population concerning future immigration policies will affect their educational choices. The higher the level of expected immigration, the higher the educational efforts of the native population. Assume that a country may stipulate the allowed level of immigration in the constitution. If later changes in the constitution are costly, the initial rule acts as a credible commitment to the future openness

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[16] Note that (17) has been derived assuming a constant union coverage. In the next section, we will extend the analysis of skill formation to the case where γ is endogenous.

of the country. As the immigration rule affects skill formation, the welfare effects of immigration differ from the case with exogenous human capital endowments.

Domestic welfare, which has to be calculated net of the education costs, can be written as

$$Y - c \cdot H = Eh \cdot H + Ew \cdot (P - H) - c \cdot H \ . \tag{18}$$

The country directly controls immigration M via its constitutional rule, and the society's skill distribution, i.e. the number of high skilled H, is now a function of the number of immigrants M. Whatever the constitutional immigration rule states, the individuals' educational choices will adjust the payoffs to both types of labour so that $Ew(H, M) = Eh(H, M) - c$ holds in equilibrium as explained above. Making use of this equilibrium condition, domestic welfare in (18) can be simplified to

$$Y - c \cdot H = Ew \cdot P \ . \tag{18'}$$

To get the welfare effect of a constitutional immigration policy, we evaluate how domestic welfare changes when the number of immigrants is increased. As in our analysis with given skill endowments, we first assume that the union coverage parameter is given and then extend the analysis to the case where union coverage declines in response to immigration. With a constant γ, the first derivative of (18') with respect to M is

$$\frac{\partial(Y - c \cdot H)}{\partial M} = P \cdot (1 - \alpha) \cdot \frac{Ew}{H \cdot (P - H + M)} \cdot \left(\frac{\partial H}{\partial M} \cdot (P + M) - H \right). \tag{19}$$

Substituting the effect of immigration on educational choice [$\partial H / \partial M = H /(P + M)$; see eq. (17)] into the welfare evaluation (19) immediately yields:

$$\frac{\partial(Y - c \cdot H)}{\partial M} = 0 \ . \tag{20}$$

We may thus state

Proposition 3. *With endogenous skill formation and constant union coverage (γ), an increase in the constitutional level of immigration is neutral with respect to domestic welfare.*

The intuition for this result is the following. As immigrants enter the country, the utility of unskilled native workers declines while the utility of entrepreneurs increases. The arbitrage condition for individual educational choice then induces more skill formation. It is now straightforward to show that, for a given number of immigrants who raise the supply of unskilled labour, a corresponding number of native workers will acquire skills so that the ratio between unskilled and skilled labour in the economy always remains constant:

$$\frac{\partial}{\partial M}\left(\frac{H}{P-H+M}\right)=\frac{1}{(P-H+M)^2}\cdot\left(\frac{\partial H}{\partial M}\cdot(P+M)-H\right)=0 \tag{21}$$

This in turn implies that the income of both groups and, hence, domestic welfare, is unaffected by migration. Of course, this result critically depends on the assumption of a linear homogenous production function and, more importantly, on the assumption of constant marginal costs of skill formation.[17]

Endogenous Union Coverage

As in Section 4, we now extend the analysis to include endogenous union coverage. If we assume that γ declines in response to immigration, we get

Proposition 4. *With endogenous skill formation, and assuming that union coverage declines with an increasing number of non-domestic workers, immigration unambiguously raises the welfare of the natives.*

Proof. The proof proceeds in two steps. First, note that the effect of immigration on skill formation changes due to the endogeneity of γ. Totally differentiating the arbitrage condition (16) and making some rearrangements yields

$$\left[\frac{dH\cdot(P+M)-dM\cdot H}{(P-H+M)\cdot H}\right]\cdot\left[Ew\cdot(1-\alpha)+Eh\cdot\alpha\right]=$$
$$=-\gamma'(M)\cdot\left[\frac{(1-\alpha)\cdot Ew}{\alpha+(1-\alpha)\cdot\gamma\cdot\beta}+\frac{Eh}{1-\gamma\cdot\beta}\right]\cdot\beta\cdot dM \tag{22}$$

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[17] If it is assumed that the marginal cost of skill formation increases, which would imply that workers differ with respect to their possibilities of acquiring human capital, the welfare effect may be positive or negative. The proof is available from the authors on request.

In the second step, we totally differentiate the welfare function (18'):

$$d(Y - c \cdot H) = P \cdot Ew \cdot (1-\alpha) \cdot \left[\frac{dH \cdot (P+M) - dM \cdot H}{(P-H+M) \cdot H} + \gamma'(M) \cdot \frac{dM \cdot \beta}{\alpha + (1-\alpha) \cdot \gamma \cdot \beta} \right] \qquad (23)$$

Substituting (22) into (23) leads to

$$\frac{d(Y - c \cdot H)}{dM} = -\gamma'(M) \cdot \frac{(1-\alpha) \cdot Ew}{(1-\alpha) \cdot Ew + \alpha \cdot Eh} \cdot \frac{\beta^2 \cdot \gamma \cdot P \cdot Eh}{[\alpha + (1-\alpha) \cdot \gamma \cdot \beta] \cdot [1 - \gamma \cdot \beta]} > 0. \blacksquare \qquad (24)$$

It thus turns out that if union power, measured by the share of unionised firms in the economy, declines as more immigrants enter the labour market, immigration unambiguously raises welfare. Of course, this result has to be interpreted with caution, given the limiting assumptions of our model. Still, Propositions 3 and 4 make it clear that skill formation is an important way of adjusting to immigration induced pressure in the market for unskilled labour.[18] Studies neglecting this effect may be overly pessimistic concerning the welfare effects of immigration.

6. CONCLUSION

In this paper, we have studied the effect of immigration on the welfare of the native population in an economy where a trade union raises the wage rate of unskilled workers above the competitive level. For a given skill distribution in the domestic population, we have shown that immigration may raise the welfare of the native population only with fairly large immigration rates. Large-scale immigration has to raise the income of skilled labour enough to compensate for the losses suffered by unskilled labour.

For the case of endogenous skill formation, however, things are different. If countries can make credible commitments about their future immigration policy, we have derived a neutrality result. The level of immigration has no effect on domestic welfare because the native population will react to the immigration of unskilled labour with increased skill

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[18] The possibility of evading competition by immigrants through acquisition of human capital may also explain why, empirically, immigration does not seem to have a very strong impact on the wages of unskilled labour, see, e.g., Topel (1997).

formation. If the degree of unionisation declines with the number of foreign workers, immigration turns out to be strictly welfare increasing.

Of course, these results have to be considered in the light of the assumptions underlying our model. There are at least two aspects neglected in our analysis that should briefly be discussed. Firstly, we abstract from taxes and government transfers. It is an obvious drawback to liberal immigration policies if migrants on average receive net benefits from the public tax and transfer system. Secondly, we consider a labour market where, despite unionisation, overall employment is efficient. We thus neglect a potentially positive impact of immigration emphasised, for instance, in Schmidt et al. (1994) and Fuest and Thum (1999): if unions reduce wages in response to immigration, in a situation with inefficiently low employment in the unionised sector, a positive welfare effect emerges, even for a given skill distribution.

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