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Migration, unemployment and discrimination[†]

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Abstract

This paper uses a dynamic efficiency-wage model to analyze the consequences of immigration for a small country when there is discrimination against immigrants in a dual labor market with unemployment. Discrimination is of the type "equal pay for equal work, but unequal work" which is characteristic of economies with "guest-worker" systems. The model exhibits three regimes for rising immigration levels. Immigration is most beneficial for natives in the intermediate regime. An analysis of regime switches shows that changes attributable to "globalization" and technical progress are consistent with growing opposition to immigration.

JEL classification: F22; J41; J42; J71.

Keywords: Migration; Dual labor market; Efficiency wages; Discrimination.

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1 Introduction

Attitudes towards immigration are shaped, to a great extent, by its economic consequences for residents of the host country. In the 1970s, it was often argued that migrants do not compete with natives on the labor market as they are forced to hold unattractive jobs. More recently, in a context of high and persistent unemployment in Europe, the fear of increased unemployment is often invoked in public discussions on immigration. Was the rise in unemployment responsible for the turn towards more restrictive immigration policies in Europe, or are there other factors, such as "globalization", to be blamed? According to standard models of immigration, unemployment seems to be the ideal culprit. Indeed, if the labor market is competitive with full employment, immigration yields a surplus for the host country (Berry and Soligo, 1969). By contrast, if unemployment occurs due to a minimum-income guarantee, immigration increases unemployment and reduces the natives' income (Brecher and Choudhri, 1987, and Faini and Grether, 1997).

These approaches remain, however, unsatisfying not only with respect to their explanation of unemployment, but also because they neglect the existence of covert discrimination against immigrants. Indeed, it is often argued that immigrants and natives do not have equal access to "good" jobs, especially in countries having adopted a "guest-worker" system. This form of discrimination against immigrants has been documented in many studies (e.g. Piore, 1979 and Hammar, 1985).[1]

The objective of this paper is to explore the welfare consequences of immigration in the context of a "representative" European labor market by using a dynamic efficiency-wage model of a dual labor market in the tradition of Shapiro and Stiglitz (1984), Bulow and Summers (1986) and Kimball (1994). In this model, unem-

[1]One consequence of this form of discrimination is the different sectoral distribution of natives and immigrants. Zimmermann (1994) documents this fact for the "guest-worker" countries Germany and Switzerland where immigrants are heavily represented in construction and manufacturing. By contrast, the sectoral distribution of natives and immigrants are very similar in the United States.

ployment results from the assumption that primary-sector employers hire only the unemployed, but not workers holding secondary-sector jobs. Instead of postulating that native and foreign labor are imperfect substitutes, I assume in this paper that migrants differ from natives only by a positive probability of return to their home country[2]; in all other respects, they are assumed to be identical to natives. As firms perceive the difference between the two groups, this leads to discriminatory hiring behavior in an efficiency-wage model, because the incentive not to shirk depends on the expected time-horizon of workers, and therefore on their return probability. Since competition ensures that firms do not pay different wage rates to different groups of workers, discrimination against immigrants shows up as unequal access to "good" jobs. In such a context, immigration affects not only factor prices, as in the neoclassical model of immigration, but also employment opportunities of natives. One might expect immigration to reduce the share of natives working in the secondary sector. On the other hand, native unemployment is also likely to increase.

It turns out that this efficiency-wage model, embedded in a standard Ricardo-Viner model with sector-specific capital, provides a plausible representation of the European policy stance towards immigrants. In particular, natives benefit most from immigration when there is sectoral segregation between immigrants and natives. The critical level of the immigration stock at which maximum segregation occurs depends on structural parameters and on the economic environment. The rising opposition to immigration can be linked to a fall in this critical level, which is due in particular to increased international integration, to technical progress in the primary sector and, albeit to a smaller extent, to the rise in unemployment.

In an independent contribution which appeared while this paper was under re-

[2]The empirical evidence on return migration is discussed below in section 4. In guest-worker countries, immigrants expect to remain a limited time in the host country because of the risk that the work permit is not renewed. Other motives for return migration would include: life in the host country turns out to be different from expectations; the migrant's family in the source country experiences problems.

vision, Carter (1999) analyzes the role of (illegal) immigration in an efficiency-wage model with dual labor markets. While they are close in spirit, there are important differences between the two papers. Most importantly, the welfare analysis is carried out below in a dynamic framework, assuming gradual employment changes, which leads to different results from Carter (1999) who compares aggregate welfare indicators across steady states and thereby neglects the issue of transition. Other authors have accounted either for unemployment or for discrimination in the analysis of immigration, though in a different framework.[3]

The remainder of this article is organized as follows. Section 2 presents the dynamic efficiency-wage model of a dual labor market with unemployment and derives the model's regimes that appear with the presence of immigrants. Section 3 discusses the welfare consequences of immigration in each model regime within a dynamic framework. In Section 4, the model is calibrated and its empirical implications are discussed. Section 5 examines the influence of increased unemployment, globalization and technical progress on the attitudes towards immigration.

2 A model of dual labor markets and unemployment

Here, the distinctive characteristic of migrants is their probability of return migration to their home country; in all other respects, they are assumed to be identical to natives. The return probability, θ, is assumed to be exogenous and constant through time.[4] Thus, the migrants' expected time of stay in the host country is $(1/\theta)$. More-

[3]Ethier (1985) shows how the hiring of immigrants can insulate native workers from employment fluctuations. There is discrimination against immigrants in the sense that only natives have long-term, implicit labor contracts, whereas immigrants are hired freely at the current wage rate. Schmidt et al. (1994) analyze the impact of immigration in the presence of trade unions in the market for unskilled labor. Winter-Ebmer and Zweimüller (1996) use an insider-outsider model of wage bargaining to evaluate the impact of immigration on wages of young natives. By contrast to the present paper, they assume the existence of a two-tier wage system, where immigrants (outsiders) receive lower wages than native workers (insiders).

[4]Note that this simplifying assumption is a continuous-time version of the hypothesis adopted by Galor and Stark (1990, 1991) in a discrete-time overlapping-generations framework. They discuss the impact of the probability of return on migrants' savings decisions and work effort.

over, at any instant of time, new immigrants arrive and replace those who leave, so that the total stock of migrants remains constant (steady-state assumption).

The dual labor market is modeled in a dynamic efficiency-wage framework.[5] Work conditions in the primary and the secondary sectors are not identical. The primary sector offers jobs with good working conditions and stable employment relationships. By assumption, workers in this sector cannot be perfectly monitored. Thus, firms prefer to pay wages above market-clearing levels in order to induce workers to supply effort. As a consequence, jobs are rationed in the primary sector and workers are queuing up for them. However, they can always find jobs in the secondary sector. These jobs are much less attractive and consist in repetitive tasks that can be monitored without cost. The wage rate is set competitively in this sector. Unemployment is introduced into the model by assuming that primary-sector firms hire only unemployed workers.[6] In this model unemployment is involuntary in the sense that the unemployed would prefer to hold primary-sector jobs. However, the unemployed can always find jobs in the secondary sector.

Workers are assumed to be risk-neutral and to have identical instantaneous utility functions, of the following form: $u(c_1, c_2, e) = \mu(c_1, c_2) - e$, where c_1 and c_2 are the consumption levels of the two traded goods, μ is a homothetic quasi-concave function, and e denotes effort. The variable e can take only two values: 0 if the worker does not make an effort (i.e. if he "shirks"), and $e > 0$ if he does not shirk. The indirect utility function is given by $v(p_1, p_2, w, y_o, e) = [(w + y_o)/\pi(p_1, p_2)] - e$, where π is a price index dual to μ, p_1 and p_2 are goods prices, w is the wage rate, and y_o is income from other sources (e.g. capital income). Workers are assumed to

[5]The basic structure of this model builds on Kimball (1994), who analyzed the dynamics of the Shapiro-Stiglitz (1984) model. By contrast to Kimball, I assume the simultaneous existence of a dual labor market and of unemployment, as proposed (in a static framework) by Bulow and Summers (1986), Jones (1987) and Perrot and Zylberberg (1989).

[6]This formulation has been suggested by Bulow and Summers (1986) who argue that if there are unobservable differences between workers (with respect to their quit rates, or their preferences for primary-sector work), signaling considerations would lead primary-sector firms to hire only the unemployed.

maximize expected utility over their infinite life horizon, using discount rate r.[7]

The problem of a worker in the primary sector, who has to decide whether to shirk or not, can be analyzed by relating the utility levels that he can attain in the two cases. Let V_1^s (V_1^n) denote the expected present value of utility of a shirking (non-shirking) worker holding a primary-sector job. Likewise, V_2 denotes expected utility of a secondary-sector job, V_u the corresponding value if the worker is unemployed, and V^* the (exogenous) utility of living in the home country (only for migrants). To relate these situations, the asset-equation approach introduced by Shapiro and Stiglitz (1984) is followed. Following Kimball (1994), it is assumed that primary-sector employment, and thus utility, change gradually (see section 3 for further discussion of this issue). A worker who shirks faces a probability d per unit time of being discovered and fired. There is an exogenous probability q per unit time for each primary-sector job to end; in that case the worker becomes unemployed. The probability of leaving the country is Θ (where $\Theta = 0$ for natives and $\Theta = \theta$ for migrants). If a worker has a job in the primary sector, he receives wage w_1 and expects a utility gain of $\dot{V}_1$ (where the dot designates a derivative with respect to time). He will earn the following return, according to whether he shirks or not:

$$rV_1^n = (w_1 + y_o)/\pi(p_1, p_2) - e - q\,(V_1^n - V_u) - \Theta\,(V_1^n - V^*) + \dot{V}_1^n, \qquad (1)$$

$$rV_1^s = (w_1 + y_o)/\pi(p_1, p_2) - (q + d)\,(V_1^s - V_u) - \Theta\,(V_1^s - V^*) + \dot{V}_1^s. \qquad (2)$$

A worker in the primary-sector does not shirk if $V_1^n \geq V_1^s$. At equilibrium, there is no shirking and this condition holds with equality since there is no reason for a primary-sector firm to pay a higher wage. Using equations (1) and (2), it can be rewritten as follows:

$$d\,(V_1^n - V_u) = e. \qquad (3)$$

[7]For simplicity, agents are assumed to consume their entire current income at each period. Thus the influence of the return probability on the savings decision is neglected (on this issue, see Galor and Stark, 1990).

The term on the left represents the cost of shirking, equal to the expected utility loss of a shirker whose probability of being detected and fired is equal to d. A worker does not shirk if this cost is greater than the immediate benefit of shirking, which consists in avoiding any effort.

If workers are unemployed, they receive unemployment compensation $\bar{w}$ and have probability α per unit time of finding a primary-sector job (α will take different values for natives and migrants, as shown below), and probability α_2 of finding a secondary-sector job. For simplicity, I assume that unemployment compensation is financed by a non distortionary tax on capital income. For an unemployed worker, the return is:[8]

$$rV_u = \frac{\bar{w} + y_o}{\pi(p_1, p_2)} - e + \alpha\left(V_1^n - V_u\right) + \alpha_2\left(V_2 - V_u\right) - \Theta\left(V_u - V^*\right) + \dot{V}_u, \qquad (4)$$

If a worker holds a secondary-sector job, he is (by assumption) not able to find a job in the primary sector. Therefore, the return to a secondary-sector job is given by:

$$rV_2 = \frac{w_2 + y_o}{\pi(p_1, p_2)} - e - q_2\left(V_2 - V_u\right) - \Theta\left(V_2 - V^*\right) + \dot{V}_2, \qquad (5)$$

where q_2 is the exogenous probability of job breakup in the secondary sector.

Using (1) and (4), and noting that (3) implies $\dot{V}_1^n = \dot{V}_u$, the no-shirking condition can also be expressed as:

$$\frac{w_1 - \bar{w}}{\pi(p_1, p_2)} = \frac{e}{d}(r + \Theta + \alpha + q). \qquad (6)$$

A worker only accepts a job in the secondary sector if $V_2 \geq V_u$. If this condition is satisfied, it holds with equality because of competition among workers. Using (4)

[8]It is assumed here that the unemployed supply the same effort as employed workers (e.g. training programs, mandatory public work, job search efforts). No qualitative result depends on this assumption (which is adopted implicitly by Bulow and Summers, 1986). Indeed, the case where the unemployed do not make any effort can be obtained simply by assuming that unemployment benefits are given in real terms by $\tilde{w}/\pi = (\bar{w}/\pi) - e$, instead of $\bar{w}/\pi$.

and (5), this condition becomes:

$$\frac{w_2 - \bar{w}}{\pi(p_1, p_2)} = \frac{e\alpha}{d}. \tag{7}$$

The probability of moving from unemployment to a primary-sector job, α, can be related to the variables of the model through flow conditions. Because of the probability of return migration, this probability differs for the two population groups Let a (a^*) denote the value α takes for natives (migrants). For native workers, the flow out of the primary sector is qL_1, where L_1 is native employment in the primary sector. Thus new hirings in the primary sector are $qL_1 + \dot{L}_1$. These must be equal to aU, the flow out of unemployment, where U is native unemployment. A native worker's probability of finding a primary-sector job is therefore given by:

$$a = (qL_1 + \dot{L}_1)/U. \tag{8}$$

Taking into account the return probability, the analogous condition for migrants is:

$$a^* = [(q + \theta)L_1^* + \dot{L}_1^*]/U^*, \tag{9}$$

where $L_1^*(U^*)$ is primary-sector employment (unemployment) of migrants.

Finally, the efficiency-wage model is embedded in a specific-factors (Ricardo-Viner) model, often believed to be the privileged model to study the impact of international trade or factor movements on income distribution. The sector-specific factor is assumed to be capital. Labor is mobile between the two sectors, but the primary sector offers only "good" jobs, paying efficiency-wages w_1, whereas the secondary sector offers only "bad" jobs, paying wages w_2. Both sectors are characterized by representative firms with constant returns to scale producing traded goods. Following the small country assumption, relative prices of traded goods are

given. With profit maximization by firms, and assuming that gross hiring never becomes negative, wage rates are equal to the marginal product of labor at every point in time:

$$w_i = p_i f_L^i(K_i, L_i + L_i^*), \quad i = 1, 2 \tag{10}$$

where f^i is the production function of sector i and f_L^i denotes the partial derivative of f^i with respect to L. The equilibrium of the model is defined by (un)employment and wage trajectories which satisfy equations (6) to (10), where secondary-sector employment of natives (migrants) is $L_2 = L - L_1 - U$ ($L_2^* = L^* - L_1^* - U^*$).

The capital stocks of both sectors are assumed to be entirely owned by natives. In the absence of financial assets, agents consume their current income and thus trade is balanced at any moment. A convenient choice for the numéraire is $\pi(p_1, p_2) = 1$, implying that unemployment compensation, $\bar{w}$, is fixed in real terms.

Competition between firms in each sector ensures that firms do not pay different wage rates to different groups of workers. As a consequence, natives and migrants cannot both be simultaneously in the primary and secondary sectors, since equations (6) and (7) cannot be satisfied simultaneously for natives ($\alpha = a,\ \Theta = 0$) and migrants ($\alpha = a^\star,\ \Theta = \theta$). This can be seen by considering the following three cases. First, if secondary-sector jobs are held by migrants and natives, equation (7) implies $a^* = a$. Then equations (6) cannot hold for both natives and migrants, since $\theta > 0$. In this case, primary-sector firms prefer to hire only natives because the wage level that prevents them from shirking is lower. Second, there is the possibility of complete segregation where all natives work in the primary sector and all migrants in the secondary sector. Third, primary-sector firms hire migrants alongside natives if $a^* + \theta = a$. Then the condition $\theta > 0$ implies $a > a^*$ and secondary-sector firms hire only migrants (assuming there are enough migrants) since they would have to offer higher wages in order to attract natives. No other constellations than these three are compatible with the constraints of the model.

An obvious question is whether the three cases indicate the existence of multiple steady states. In Müller (2000) it is shown that these cases are mutually exclusive. Thus they represent different model regimes; for a given level of immigration, only one regime applies. Indeed, rising immigration levels lead to the following steady-state outcomes. Immigrants first drive natives out of the secondary sector, then spread from the secondary sector to the primary sector (and thus to unemployment). The resulting model regimes can be described as follows (see also figure 1).

Regime I (immigrants in secondary sector). If only a small number of immigrants are present in the host country, the wage differential between the two sectors is not sufficient to induce immigrants not to shirk. Thus primary-sector firms will not hire them and, having no incentive to become unemployed, they all work in the secondary sector. With increasing immigration levels native employment in the secondary sector falls and ultimately the economy will reach a point where only immigrants work in the secondary sector. This is due to the fixed wage differential between the two sectors.

Regime II (immigrants in secondary sector and natives in primary sector). In this regime there is complete segregation between natives, all of whom work in the primary sector or are unemployed, and immigrants who only work in the secondary sector. The wage differential is no longer fixed and the immigrants' (secondary-sector) wage falls with immigration, because of decreasing marginal labor productivity, whereas the primary-sector wage remains constant, since natives are not affected by immigration. This regime rationalizes the commonplace argument that immigrants do jobs that natives don't want to do.

Regime III (no natives in secondary sector). At a certain immigration level primary-sector employers agree to hire immigrants because the wage differential is sufficiently large to prevent them from shirking. Therefore, in the third regime immigrants work in both sectors (and are unemployed) whereas natives work only

in the primary sector and are unemployed.

It is now clear that migrants as a group suffer from sectoral segregation, despite the fact that natives and migrants are equally productive. Moreover, segregation results in discrimination, as the migrants' average wage is lower than the natives'.

Note that in regimes I and III, wage rates in the primary and secondary sectors are linked. Deducting equation (7) from (6) yields a fixed wage differential between the primary and the secondary sector, as follows:

$$\frac{w_1 - w_2}{\pi(p_1, p_2)} = \frac{e}{d}(r + q + \Theta), \tag{11}$$

with $\Theta = 0$ ($\Theta = \theta$) in the first (third) regime. In regime II, there is no such relation.

3 Dynamics and welfare consequences of immigration

It is well known that in an efficiency-wage model, the equilibrium is inefficient since primary-sector employment is too low and unemployment too high (Bulow and Summers, 1986). While an employment subsidy in the primary sector would increase national income, it would not necessarily be Pareto-improving (Shapiro and Stiglitz, 1984) and is not generally adopted because of its inequitable nature. Hence it is assumed that no such scheme is implemented at the initial equilibrium; there is thus scope for immigration to have a first-order effect on the welfare of natives.[9]

However, the welfare impact depends on the adjustment path towards the new steady state. As Kimball (1994) showed, the dynamic Shapiro-Stiglitz (1984) model has a multiplicity of equilibria. Which equilibrium (path) should be selected? Bulow and Summers (1986) assume implicitly that employment variables jump instanta-

[9]Moreover, it is assumed that the "immigration surplus", which appears because of the variation of factor prices due to the fixed supply of capital, cannot be redistributed from capital owners to workers. Indeed, if the redistribution scheme is not discriminatory, i.e. if migrant workers are entitled to the same benefits as native workers, the surplus vanishes and immigration produces a net loss (Razin and Sadka, 1995, and Wellisch and Walz, 1998).

neously to their new steady states. The problem with this assumption is that it is not robust with respect to the introduction of adjustment costs. Thus Kimball (1994) argues that, among the multiplicity of equilibria, the one equilibrium where (primary-sector) employment changes gradually can be singled out, because it represents the unique limit of a model with adjustment costs, as these adjustment costs go to zero (Georges, 1995). In this section, this equilibrium path is derived for the three regimes[10] and its reaction to an exogenous arrival of immigrants is analyzed.

The result of this section can be summarized as follows (see also table 1). The impact of immigration on native welfare is similar in regimes I and III, despite important differences in steady-state properties. In both regimes, the welfare of native workers (owning no capital) falls with immigration as wages decrease, despite the fact that native primary-sector employment increases with immigration in regime I, but falls in regime III. By contrast, in regime II immigration has a positive effect on capital income without deteriorating the situation of native workers.

Regime I. Wage differentials are determined by the behavior of natives, as immigrants only hold secondary-sector jobs. Thus the first regime can be described by equations (6), (8), (10), and (11), with $\Theta = 0$, $\alpha = a$, and $L_1^* = U^* = 0$. The evolution of primary-sector employment can be derived from (6) and (8), as follows:

$$\dot{L}_1 = \left[\frac{d}{e}(w_1 - \bar{w}) - (r+q)\right] U - qL_1. \tag{12}$$

This equation reflects the intuition that primary-sector firms delay the hiring of new workers in an expansion (induced by immigration, for example) because of efficiency-wage considerations: if all firms increased their hirings simultaneously, firms would have to pay higher wages to induce their workers not to shirk.

A few manipulations are needed in order to express the right-hand side of (12)

[10]Note that equations (1), (2), (4) and (5) were written assuming a continuous adjustment of primary-sector employment.

as a sole function of L_1. Note first that $U = L - L_1 - L_2$. Inverting (10) yields $L_2 = g_2(w_2/p_2) - L_2^*$, where g_2 denotes the inverse function of f_L^2. Furthermore, from (11), $w_2 = w_1 - (e/d)(r+q)$, such that $L_2 = g_2\{[p_1 f_L^1 - (r+q)e/d]/p_2\} - L_2^*$. Since in this regime $L_2^* = L^*$, the evolution of L_1 can be expressed as follows:

$$\dot{L}_1 = \left[\frac{d}{e}\left(p_1 f_L^1 - \bar{w}\right) - (r+q)\right]\left[L + L^* - L_1 - g_2\left(\frac{p_1 f_L^1 - (e/d)(r+q)}{p_2}\right)\right] - qL_1, \tag{13}$$

where $f_L^1 = f_L^1(K_1, L_1)$.

Consider first the steady state. Immigration "crowds out" native employment in the secondary sector because immigrants are forced to work there. Thus immigration increases primary-sector employment of natives, as can be seen by differentiating equation (13) at the steady state ($\dot{L}_1 = 0$):

$$\frac{\mathrm{d}L_1}{\mathrm{d}L^*} = \frac{\lambda_1}{\Phi_1 |\varepsilon_w^1|} > 0, \qquad \Phi_1 = \left(1 + \frac{U}{L_1}\right)\left(\frac{\lambda_1}{|\varepsilon_w^1|} + \frac{\lambda_1}{\beta_1}\right) + (1 + \Delta_w)\frac{\lambda_2}{|\varepsilon_w^2|}, \tag{14}$$

where λ_i is the share of sector i employment in total labor force, $\varepsilon_w^i = p_i f_{LL}^i (L_i + L_i^*)/w_i$ is the elasticity of inverse labor demand in sector i, β_1 is the elasticity of w_1 with respect to L_1 in the no-shirking condition[11], and $\Delta_w = (w_1/w_2) - 1$. Through its impact on total labor supply, immigration pushes wage rates down: $\mathrm{d}\log w_1/\mathrm{d}\log(L + L^*) = -1/\Phi_1 < 0$. The intuition for these results can be gained from the conventional specific-factors model without distortions, which can be obtained as a special case of (14) by setting $U = \Delta_w = 0$ and $\beta_1 \to \infty$. In such a model, the elasticity of primary-sector employment with respect to an increase in the labor force is, loosely speaking, equal to the ratio of the elasticity of labor demand in the primary sector (in fact, $1/\varepsilon_w^1$) to the average labor demand elasticity ($\lambda_1/\varepsilon_w^1 + \lambda_2/\varepsilon_w^2$). Note that Φ_1 is greater than the latter expression in absolute

[11] In the definition of β_1, L_2 is assumed constant. The no-shirking condition (6) can be written as $w_1 = (e/d)[r + q(L - L_2)/(L - L_1 - L_2)] + \bar{w}$, such that $\beta_1 = eqL_1(L - L_2)/(U^2 w_1 d)$.

value, because the increase in unemployment mitigates the employment and wage effects of immigration. Indeed, native unemployment increases proportionally even more than primary-sector employment, ensuring that natives do not shirk in spite of the fall in primary-sector wages. Because of the change in composition of native employment, the average native wage decreases less with immigration than sectoral wage rates; in some cases it might even rise.[12]

The impact of different policies on native welfare can be evaluated by considering the reaction of a primary-sector worker's expected life-time utility to a marginal increase in the stock of immigrants at time t_0. Indeed, the natives' indifference between secondary-sector jobs and unemployment and equation (3) imply that $\mathrm{d}V_u = \mathrm{d}V_2 = \mathrm{d}V_1$. The path of a primary-sector worker's expected utility can be described by the following equation, derived from (1) and (3):

$$\dot{V}_1^n = rV_1^n - (p_1 f_L^1 + y_o) + (e/d)(q + d). \tag{15}$$

The dynamics of primary-sector employment and native welfare can be analyzed in a phase diagram (figure 2), depicting equations (13) and (15). Immigration shifts the $\dot{L}_1 = 0$ locus to the right without affecting the $\dot{V}_1 = 0$ locus. Thus the slope of the latter is decisive for the welfare impact of immigration: if it is positive (negative), immigration has a beneficial (detrimental) impact on the welfare of native workers. This slope depends on the assumptions about the distribution of capital among natives. I will consider the following two polar assumptions: (a) workers do not own any capital ($y_o = 0$) and owners of capital form a separate population group; (b) capital is distributed equally among native workers, such that $y_o = (p_1 f_K^1 K_1 + p_2 f_K^2 K_2)/L$.

Under assumption (a), the slope of the $\dot{V}_1 = 0$ locus is unambiguously negative

[12]From this steady-state property, one may be tempted to conclude (Carter, 1999) that in regime I immigration could enhance the welfare of native workers. Such a result is, however, based on the questionable assumption that the variables jump instantaneously to their new steady state values.

since $f^1_{LL} < 0$. It is clear from figure 2 that in this case native workers unambiguously lose from immigration (and capital owners gain). Under assumption (b), the slope of the $\dot{V}_1 = 0$ locus is equal to:[13]

$$\mathrm{d}V_1^n/\mathrm{d}L_1 = (1/r)[\mathrm{d}(w_1 + y_o)/\mathrm{d}L_1] = -(1/r)p_1 f^1_{LL}[(L^*/L) - (U/L)] \qquad (16)$$

To put this result into perspective, recall that in a conventional specific-factors model without distortions, $\mathrm{d}(w_1 + y_o)/\mathrm{d}L_1 = -p_1 f^1_{LL}(L^*/L)$, reflecting the fact that in the presence of L^* immigrants at the initial equilibrium, additional (infinitesimal) immigration leads to a redistribution of income from these immigrants towards native capital owners, through the variation of factor prices. This is the mechanism that underlies the Berry and Soligo (1969) result saying that finite immigration yields an aggregate gain for natives. Thus a distinguishing feature of the efficiency-wage model is the presence of the unemployment rate in equation (16). In the redistribution process induced by immigration, unemployment represents a "leak" since the unemployed receive (by assumption) a share of the increased capital income. As a consequence, the smaller the unemployment rate, the greater chances are that additional immigration has a beneficial impact on the welfare of natives.

Now turn to the dynamic adjustment process. Assume that the economy is initially in a steady state (L^0_1, V^0_1). A sudden arrival of immigrants (instantaneous increase in L^*) has the following immediate effects. Primary-sector employment is not affected upon impact. Thus, (10) and (11) imply that in both sectors wage rates do not move, and that total secondary-sector employment does not change either. However, the welfare of native workers drops upon impact (see figure 2). The new immigrants are hired immediately in the secondary sector, whereas an

[13] Indeed, $\mathrm{d}(w_1 + y_o) = p_1\left[f^1_{LL} + (K_1/L)f^1_{KL}\right]\mathrm{d}L_1 + p_2(K_2/L)f^2_{KL}(\mathrm{d}L_2 + \mathrm{d}L^*_2)$. Because of constant returns to scale: $K_1 f^1_{KL} = -L_1 f^1_{LL}$ and $K_2 f^2_{KL} = -(L_2 + L^*_2)f^2_{LL}$. Furthermore, $\mathrm{d}L_2 + \mathrm{d}L^*_2 = g'_2(\cdot)(p_1/p_2)f^1_{LL}\mathrm{d}L_1$, where $g'_2(\cdot) = (1/f^2_{LL})$. Thus: $\mathrm{d}(w_1 + y_o)/\mathrm{d}L_1 = (p_1 f^1_{LL}/L)(L - L_1 - L_2 - L^*_2)$, leading to (16).

identical number of native secondary-sector workers become unemployed. Indeed, in contrast to migrants who have no chance of finding a primary-sector job, natives are indifferent between unemployment and secondary-sector jobs. According to (6), the natives' probability of finding a primary-sector job, a (or its inverse, the expected duration of unemployment) is not affected by immigration in the very short run, as primary-sector firms immediately start to expand their demand for labor such that, in equation (8), the rise in $\dot{L}_1$ offsets exactly the increase in U.

Over time, employment expands in both sectors and wage rates fall in the process. Unemployment decreases steadily towards a steady-state level which remains, however, higher than the pre-immigration level.

Regime II. In this regime, immigration has no impact on the natives' employment situation and labor income, since there is no link between the secondary sector, where all immigrants work, and the primary sector, where firms hire only natives. In terms of the model equations, the only change from the first regime is that equation (11) is replaced by: $L_2 = 0$. A sudden arrival of immigrants leads to an immediate fall of the secondary-sector wage such that all new immigrants are hired in that sector. Since there is complete segregation between natives and migrants, the model "jumps" to the new steady state. Depending on the distribution of capital income, native workers are either indifferent (assumption (a)) or favorable towards immigration (assumption (b)), since the reduction of secondary-sector wages implies a rise in the return to capital in that sector. Moreover, the discounted sum of future gains from capital income is greater than in the two other model regimes, because factor prices adjust instantaneously.

Regime III is attained when the differential between primary and secondary sector wages is sufficiently large to incite immigrants not to shirk if they work in the primary sector. As immigrants work in both sectors and are unemployed, the wage

differential is determined by their behavior. Formally, this regime is described by equations (6) both for natives ($\Theta = 0$, $\alpha = a$) and for migrants ($\Theta = \theta$, $\alpha = a^*$), (8), (9), (10), (11) for migrants ($\Theta = \theta$), and $L_2 = 0$. The no-shirking constraint of natives is identical to (12), with $U = L - L_1$. For migrants, it is given by:

$$\dot{L}_1^* = \left[\frac{d}{e}(w_1 - \bar{w}) - (r + q + \theta)\right] U^* - (q + \theta) L_1^*, \tag{17}$$

where $U^* = L^* - L_1^* - L_2^*$. Inverting (10) and using (11) yields $L_2^* = g_2\{[p_1 f_L^1 - (r + q + \theta)e/d]/p_2\}$, with $f_L^1 = f_L^1(K_1, L_1 + L_1^*)$. For the analysis of welfare, however, it is the evolution of total primary-sector employment, $\mathcal{L}_1 \equiv L_1 + L_1^*$, that matters. The dynamic behavior of $\mathcal{L}_1$ can be characterized by adding equations (12) and (17):

$$\dot{\mathcal{L}}_1 = \left[\frac{d}{e}\left(p_1 f_L^1 - \bar{w}\right) - (r + q)\right][L + L^* - \mathcal{L}_1 - g_2] - q\mathcal{L}_1 - \theta\,(L^* - g_2)\,, \tag{18}$$

where $g_2 = g_2\{[p_1 f_L^1 - (r + q + \theta)e/d]/p_2\}$ and $f_L^1 = f_L^1(K_1, \mathcal{L}_1)$.

Whereas in the first regime immigrants "crowd out" natives in the secondary sector, in the third regime a similar mechanism takes place in the primary sector. A steady-state relationship between primary-sector employment of natives and migrants can be established by differentiating the natives' no-shirking constraint (12):

$$\mathrm{d}L_1 = -C\mathrm{d}L_1^*, \quad C = \frac{|\varepsilon_w^1|}{|\varepsilon_w^1| + \beta_1(1 + L_1^*/L_1)}, \quad 0 < C < 1. \tag{19}$$

To evaluate the impact of immigration on total primary-sector employment, differentiate (18) in the steady state. This yields: $\mathrm{d}\mathcal{L}_1/\mathrm{d}L^* = \lambda_1/(\Phi_3|\varepsilon_w^1|) > 0$, where

$$\Phi_3 = \left(1 + \frac{U^*}{L_1^*}\right)\left(1 + \frac{U^*}{U}C\right)\left(\frac{\lambda_1}{|\varepsilon_w^1|} + \frac{\lambda_1}{\beta_1(1 + L_1^*/L_1)}\right) + (1 + \Delta_w)\frac{\lambda_2}{|\varepsilon_w^2|}. \tag{20}$$

Thus total primary-sector employment reacts similarly to immigration in regimes I

and III, which is not surprising as the wage differential is fixed in both cases.[14] By contrast to regime I, however, this result implies (together with (19)) that native primary-sector employment diminishes with immigration. Moreover, this loss is not compensated by a fall in secondary-sector employment, and native unemployment increases as wages fall. Are the welfare effects therefore different in the two regimes?

The welfare of natives is captured, as in regime I, by equation (15), with $f_L^1 = f_L^1(K_1, L_1+L_1^*)$. Thus, native welfare depends only on the evolution of total primary-sector employment, described by equation (18). It is striking that, with the exception of the last term (which is small if L^* is close to $\bar{L}^*$, the immigration level delimiting regimes II and III), this equation is equivalent to (12), with $\mathcal{L}_1$ playing the role of L_1. Therefore, the dynamic impact of immigration can be analyzed with the help of a phase diagram analogous to figure 2, where the X-axis is re-labeled $\mathcal{L}_1$.

It appears now that regime III does not differ qualitatively from regime I with respect to the dynamic adjustment of welfare, despite the differences in steady-state behavior. As in regime I, the welfare effect of immigration depends on the assumptions concerning the distribution of capital. Under assumption (a), the slope of the $\dot{V}_1 = 0$ locus is negative. Under assumption (b), it is straightforward to show that the slope is equal to the expression given in (16), where U is replaced by $(U + U^*)$. Thus, as in regime I, the welfare impact of immigration is more likely to be beneficial for natives if total unemployment is low.

If one assumes that both L_1 and L_1^* evolve gradually towards the new equilibrium, then a sudden arrival of migrants does not affect wage rates (nor native unemployment) "upon impact". Thus new immigrants start off as unemployed. Over time, native employment falls and native unemployment increases progressively.

[14] Note the similarity between Φ_1 and Φ_3. Indeed, Φ_3 converges towards Φ_1 if $L_1^*, U^* \to 0$ and $(U^*/L_1^*) \to (U/L)$. In the model, however, there is no smooth transition between regimes I and III since (U^*/L_1^*) is always greater than (U/L) by a finite amount.

4 Calibrating the model

For policy discussion it matters not only whether immigration decreases wages and increases unemployment, but by how much. Thus it is useful to calibrate the model to check whether it is consistent with the empirical evidence. It is then possible to evaluate quantitatively the welfare implications of immigration.

Empirical evidence on the probability of return, a central parameter of the model, is scarce. Recent statistics on emigration, available in SOPEMI (1999) for some European countries and Japan, indicate that return rates vary not only between countries, but also among different groups of migrants.[15] Return rates can be approximated by the ratio of emigration by foreigners to their stock in the host country. In 1997, average return rates were higher in traditional guest-worker countries (4.7% in Switzerland; 8.6% in Germany) than in other North European countries (2.4–3.2% in Denmark, Netherlands, Sweden). Much higher values are attained for particular national groups (25% for Polish migrants in Germany) or for certain legal categories (10% for foreigners holding annual work permits in Switzerland). As most temporary migrants are excluded from these statistics (such as workers holding short-term or seasonal permits, and frontier workers), the probability of return migration, θ, is set at 10% in the simulations, slightly higher than currently observed values. The other parameters are chosen so as to describe a typical European economy, such as France or Germany, around 1980 (for details, see table 2 and Müller, 2000).

Consider first the quantitative effects of immigration on wages and unemployment. Most empirical studies in the United States and in Europe find that these two variables are rather insensitive to immigration (Borjas, 1994; Zimmermann, 1994). In regimes I and III of the calibrated model, a 1% increase in the labor force induced

[15]For the United States, see the survey by Lalonde and Topel (1997) who conclude that 30-40% of immigrants eventually return to their home country. Evidence on subjective return intentions of migrants is given by Dustmann (1993) for Germany. He reports that 55% of all immigrants intend to return to their country of origin within the next ten years.

by immigration leads to a steady-state fall in wage rates of 0.3%.[16] Because of the higher proportion of good jobs, the average native wage in regime I is only reduced by 0.2%. These values are consistent with Borjas' (1994) survey of the literature, where he concludes that the elasticity of native wages with respect to the number of immigrants is equal to -0.02 (p. 1698). Indeed, with immigrants representing 8% of the US population in 1990, a 1% population increase through immigration leads according to this estimate to a variation of -0.24% of native wages.

The steady-state unemployment rate is quite insensitive to immigration. Indeed, a 1% increase in the labor force pushes the aggregate unemployment rate up by only 0.04 percentage points in regimes I and III. In regime II, additional immigration has no impact on the level of unemployment, and as the labor force increases by 1% the aggregate unemployment rate is reduced by 0.06 percentage points. This leads to the result that, compared to the base situation ($L^* = 0$) and at constant capital stocks, the unemployment rate is only 0.2 percentage points higher if L^* represents 12.8% of the native labor force (corresponding to the switch between regimes II and III). Considering only the situation of natives, it turns out that their unemployment rate increases more with immigration in regime I than in regime III (+0.1 resp. +0.04 percentage points), which is due to the different reaction of L_1 in the two regimes. Again, these results seem to be in agreement with the empirical literature, where most studies find only a very weak (or no) effect of immigration on unemployment.

Now turn to the welfare effects of immigration. In relative terms, the equivalent variation of native welfare can be measured by $\Delta V_1 (= \Delta V_2 = \Delta V_u)$, divided by the discounted expenditure of an average native in the base situation.[17] As the

[16] In regime II, the primary-sector wage (and thus the average native wage) is not affected by immigration, but the secondary-sector wage decreases by 2.5%.

[17] A worker's instantaneous cost (or expenditure) function is obtained by inversion of the indirect utility function, yielding $c(p_1, p_2, u) = \pi(p_1, p_2)u + e$. Thus, equivalent welfare variation can be defined as: $\Delta_E = \int_0^\infty [c(p_1^0, p_2^0, u^1) - c(p_1^0, p_2^0, u^0) \exp(-rt)] \mathrm{d}t$, where exponents 0 and 1 indicate the situation before and after immigration. Since π is the numéraire, this simplifies to $\Delta_E = U^1 - U^0 = \Delta V_1$. A native's total discounted expenditure in the base situation is $U^0 + (e/r)$. For an average native, this amounts to $(L_1 V_1 + L_1 V_1 + U V_u)/L + (e/r)$.

convergence half-life is only 6–7 months in this model, the adjustment path does not have much weight in the welfare indicator. Thus the intertemporal welfare variations are well approximated by the steady-state effects. It is clear from (1) and (3) that for a native the steady-state welfare variation is: $\Delta V_1 = (1/r)(\Delta w_1 + \Delta y_o)$. Together with the result that unemployment varies little with immigration, this implies that in regimes I and III the impact of immigration on native welfare is close to the effect that would be obtained with a static competitive model.[18] As a result, regimes I and III hardly differ with respect to the welfare consequences of immigration. For a native worker who does not receive any capital income, immigration leads to a welfare loss of 0.3% in both regimes. By contrast, if capital income is distributed equally, the impact on welfare is close to zero (-0.05%). Natives will clearly prefer regime II, where the welfare of an average native increases by 0.2% with a 1% increase in labor force induced by immigration, and native wages are not affected.

Thus one would expect natives to favor immigration if the economy is in regime II, or if further immigration leads it there.[19] Therefore, even if the economy is in regime I, but with L^* close to $\tilde{L}^*$, the immigration level delimiting regimes I and II, additional immigration might be favored by a majority of natives. By contrast, if the immigration stock L^* is greater than $\bar{L}^*$, the immigration level delimiting regimes II and III, most natives are likely to oppose additional immigration.

There is an interesting parallel between the effect of immigration on native welfare and the degree of wage discrimination which can be measured by the difference between the average native wage and the average immigrant wage. To see this, consider the relation between the level of immigration and the degree of discrimination. With a fixed wage differential in regime I, the fact that immigration "pushes"

[18]These results imply also that if aggregate native welfare is measured by $L_1V_1 + L_1V_1 + UV_u$, as in Carter (1999), it is not appropriate to use current employment weights.

[19]This result is reinforced in an alternative model version with non-traded goods, where immigration is beneficial for all natives in regime II as native wages rise and unemployment falls (see Müller, 2000).

natives from the secondary sector into the primary sector, while migrants remain in the secondary sector, implies that wage discrimination increases. This is also the case in regime II, due to the rising wage differential and complete segregation. The maximum of discrimination is reached at $\bar{L}^*$, because beyond that level of immigration, in regime III, migrants penetrate progressively into the primary sector, reducing the gap between the average wages of both groups.

5 The effects of changes in the economic environment

The turn towards restrictive immigration policies in Europe is often linked to the rise in unemployment. In the model, the welfare impact of immigration depends indeed negatively on the unemployment level (see (16)). However, the quantitative influence of the unemployment rate turns out to be rather limited. Indeed, increasing $\bar{w}$ from 50% to 60% of the secondary-sector wage increases the unemployment rate from 7.0% to 8.5%, but the welfare impact of immigration is hardly modified: a 1% increase in the labor force leads to a loss in the average native's welfare of 0.07%.

On a deeper level, the results of the preceding section suggest that regime shifts (i.e. changes in $\tilde{L}^*$ and $\bar{L}^*$) might have played an important role in the change of attitude towards immigration. If the economy is initially in regime II (or in regime I with L^* close to $\tilde{L}^*$), certain shocks might shift the economy into regime III, leading to a significant change in attitudes towards additional immigration.

Three types of shocks are considered. First, an increase in unemployment compensation (as above). Following Rodrik (1998), this can be interpreted as a consequence of globalization since the increasing exposure to external risk has led governments of high-income countries to expand spending on social security and welfare.[20]

[20] In a one-sector dual labor market model taking demand uncertainty explicitly into account, Saint-Paul (1996, chap. 4) shows that when demand becomes more volatile, primary-sector employment decreases and secondary-sector employment increases. This result seems to indicate that if the dual labor market is internal to firms, $\bar{L}^*$ might rise with external risk.

Second, another important aspect of globalization is increased import competition from developing countries, which would be reflected in this model by a fall in the relative price of secondary-sector goods. Third, technical progress has affected labor markets in important ways. It is not unreasonable to assume that productivity has improved more in the primary than in the secondary sector.

It appears that $\tilde{L}^*$ and $\bar{L}^*$ react similarly to the three types of shocks. The variation of $\bar{L}^*$ is given by:[21]

$$\mathrm{d}\bar{L}^* = (p_2 f^2_{LL})^{-1} \left\{ C\mathrm{d}\bar{w} + (1-C)w_1 \mathrm{d}\xi_1 - \left[(1-C)w_1(s_2/s_1) + w_2 \right] (\mathrm{d}p_2/p_2) \right\}, \quad (21)$$

where $s_i = (\partial\pi/\partial p_i)(p_i/\pi)$ is the share of good i in domestic expenditures, and ξ_1 is a Hicks-neutral productivity parameter specific to the primary sector. All three shocks tend to reduce $\bar{L}^*$. A rise in $\bar{w}$ increases the unemployment rate and diminishes employment in both sectors. Therefore natives leave the secondary sector, and immigrants penetrate the primary sector, at lower immigration levels. A fall in the relative price p_2/p_1 acts even more directly on the secondary sector by decreasing its labor demand, thus reducing $\bar{L}^*$. Finally, an increase in the primary sector's productivity has the same qualitative effects as a decline in p_2/p_1.

Quantitatively, an increase in $\bar{w}$ seems to produce a smaller shift of $\tilde{L}^*$ and $\bar{L}^*$ than the other two shocks (see table 2). Note that the 10% fall in p_2/p_1 corresponds to the observed decline, between 1980 and 1990, of EU import prices (in import-competing sectors) relative to EU export prices (OECD, 1997, table 4.6).

The regime shift produced by these shocks is accompanied by a rise in wage inequality among identical workers (see figure 1). This characteristic is reminiscent of the "fractal" quality of increased earnings dispersion: however narrowly one defines groups, one still finds an increase in dispersion (Atkinson, 1997).

[21] $\bar{L}^*$ is determined (jointly with L_1) by the equations: $p_1 f^1_L(K_1, L_1) - \bar{w} = (e/d)[r + qL/(L - L_1)]$ and $p_1 f^1_L(K_1, L_1) - p_2 f^2_L(K_2, \bar{L}^*) = (e/d)(r + q + \theta)$. Differentiating these equations yields (21).

6 Conclusions

This paper has used an efficiency-wage model of a dual labor market with unemployment to analyze the welfare consequences of immigration, assuming that migrants differ from natives only by their probability of return migration. As a result, there is sectoral segregation, and thus discrimination against immigrants. The model exhibits three regimes, depending on the level of the immigrant stock. When calibrated, the model appears to be consistent with the weak sensitivity of unemployment and wages with respect to immigration found in the literature. However, immigration turns out to be beneficial for all natives only in the intermediate regime. Changes in the economic environment, in particular globalization and technical progress, are found to lower the immigration level beyond which further immigration has a negative effect on the welfare of native workers. This might provide an explanation of the rising opposition to immigration, complementing the contributions on this issue by Razin and Sadka (1995) who use a model with endogeous human capital formation to show that the impact of immigration on native welfare is negative in the presence of wage rigidity or with endogenous redistribution policies. Similarly, Wellisch and Walz (1998) establish in a two-country model with endogenous redistribution policy that social welfare is higher with free trade than with free migration.

In a different perspective, the model of this paper may also help to address the puzzling questions raised by Blanchard and Katz's (1992) empirical study of regional labor market adjustment and by Card's (1990) analysis of the "natural experiment" of the Mariel boatlift. Referring to these two studies, Borjas (1994, p. 1700) states this puzzle as follows: "Why should it be that many other regional variations persist over time, but that the impact of immigration on native workers is arbitraged away immediately?". The arrival of the "Marielitos", most of whom had little education and did not have access to "good" jobs, can indeed be analyzed

in the present model as an instantaneous increase in the number of immigrants in the Miami labor market. With 20% of Miami's population being of Cuban origin in 1980, it seems reasonable to consider regimes II or III of the model. In regime II, immigration has no impact on the wages and unemployment of natives, which is consistent with Card's (1990) observations. Even in regime III, the model predicts that immigration has no instantaneous effect on the situation of natives.

Thus the model suggests that if immigration has no impact on the native labor market, this is not due to "arbitrage" by perfectly mobile workers, but can be explained by the segmentation of labor markets and by the wage rigidity inherent to the dynamic efficiency wage model. Moreover, if workers are imperfectly mobile, as they probably are, the present model is also consistent with Blanchard and Katz's (1992) finding that adverse economic shocks may reduce regional wages for up to 10 years before they are reequilibrated by migration flows.

References

Atkinson, A.B., 1997, Bringing Income Distribution In From the Cold, Economic Journal 107, 297-321.

Berry, R.A. and R. Soligo, 1969, Some Welfare Aspects of International Migration, Journal of Political Economy 77, 778-794.

Blanchard, O.J. and L.F. Katz, 1992, Regional Evolutions, Brookings Papers on Economic Activity 1, 1-61.

Borjas, G.J., 1994, The Economics of Immigration, Journal of Economic Literature 32, 1667-1717.

Brecher, R.A. and E.U. Choudhri, 1987, International migration versus foreign investment in the presence of unemployment, Journal of International Economics 23, 329-342.

Bulow, J.I. and L.H. Summers, 1986, A Theory of Dual Labor Markets with Application to Industrial Policy, Discrimination, and Keynesian Unemployment, Journal of Labor Economics 4, 376-414.

Card, D., 1990, The Impact of the Mariel Boatlift on the Miami Labor Market, Industrial and Labor Relations Review 43, 245-257.

Carter, T.J., 1999, Illegal immigration in an efficiency wage model, Journal of International Economics 49, 385-401.

Dustmann, C., 1993, Earnings adjustments of temporary migrants, Journal of Population Economics 6, 153-168.

Ethier, W.J., 1985, International Trade and Labor Migration, American Economic Review 75, 691-707.

Faini, R. and J.-M. Grether, 1997, L'ouverture au commerce peut-elle réduire la migration Nord-Sud? in: J. de Melo, and P. Guillaumont, eds., Commerce Nord-Sud, migration et délocalisation, Economica, Paris.

Galor, O. and A. Stark, 1990, Migrants' savings, the probability of return migration, and migrants' performance, International Economic Review 31, 463-467.

Galor, O. and A. Stark, 1991, The probability of return migration, migrants' work effort, and migrants' performance, Journal of Development Economics 35, 399-405.

Georges, C., 1995, Adjustment costs and indeterminacy in perfect foresight models, Journal of Economic Dynamics and Control 19, 39-50.

Hammar, T., 1985, European Immigration Policy: A Comparative Study (Cambridge University Press, Cambridge).

Jones, S.R.G., 1987, Minimum wage legislation in dual labor market, European Economic Review 31, 1229-1246.

Kimball, M.S., 1994, Labor-Market Dynamics When Unemployment is a Worker Discipline Device. American Economic Review 84, 1045-1059.

LaLonde, R.J. and R.H. Topel, 1997, Economic Impact of International Migration and of Migrants, in: M.R. Rosenzweig and O. Stark, eds., Handbook of Population and Family Economics, Vol. 1B (North Holland, Amsterdam).

Müller, T., 2000, Migration, unemployment and discrimination, Cahiers du Département d'économétrie N^o 2000.03, Université de Genève.

OECD, 1997, OECD Employment Outlook (OECD, Paris).

Perrot, A. and A. Zylberberg, 1989, Salaire d'efficience et dualisme du marché du travail, Revue économique 1, 5-20.

Piore, M.J., 1979, Birds of passage: Migrant labor and industrial societies (Cambridge University Press, Cambridge).

Razin, A. and E. Sadka, 1995, Resisting Migration: Wage Rigidity and Income Distribution, American Economic Review 85 (P&P), 312-316.

Rodrik, D., 1998, Why Do More Open Economies Have Bigger Governments? Journal of Political Economy 106, 997-1032.

Saint-Paul, G., 1996, Dual Labor Markets: A Macroeconomic Perspective (MIT Press, Cambridge MA).

Schmidt C.M., A. Stilz and K.F. Zimmermann, 1994, Mass migration, unions, and government intervention, Journal of Public Economics 55, 185-201.

Shapiro, C. and J.E. Stiglitz, 1984, Equilibrium Unemployment as a Worker-Discipline Device, American Economic Review 74, 433-444.

SOPEMI, 1999, Trends in International Migration: Annual Report (OECD, Paris).

Wellisch, D. and U. Walz, 1998, Why do rich countries prefer free trade over free migration? The role of the modern welfare state, European Economic Review 42, 1595-1612.

Winter-Ebmer, R. and J. Zweimüller, 1996. Immigration and the earnings ofyoung native workers. Oxford Economic Papers 48, 473-491.

Zimmermann, K.F., 1994, European Migration: Push and Pull, Proceedings of the World Bank Annual Conference on Development Economics (The World Bank).

Table 1: Qualitative effects of immigration[a]

Variable	Immigration level (L^*)[b]					
	$L^* < \tilde{L}^*$ Regime I		$\tilde{L}^* \leq L^* \leq \bar{L}^*$ Regime II		$L^* > \bar{L}^*$ Regime III	
	$t=0$	$t=\infty$	$t=0$	$t=\infty$	$t=0$	$t=\infty$
Primary-sector wage (w_1)	0	–	0	0	0	–
Second.-sector wage (w_2)	0	–	–	–	0	–
Natives						
Primary employm. (L_1)	0	+	0	0	0	–
Second. employm. (L_2)	–	–				
Unemployment (U)	+	+	0	0	0	+
Immigrants						
Primary employm. (L_1^*)					0	+
Second. employm. (L_2^*)	+	+	+	+	0	+
Unemployment rate (U^*)					+	+

[a]Marginal effects upon impact $(t=0)$ and in the steady state $(t=\infty)$. The sign + indicates that infinitesimal immigration has a positive (– negative; 0 no) impact on a variable. An empty field indicates that the variable is zero in this regime.

[b]$\tilde{L}^*$ and $\bar{L}^*$ designate the immigration levels that delimit the three model regimes.

Table 2: Economic environment and model regimes (percentages)

Simulation[a]		U/L^b	$\tilde{L}^*/L$	$\bar{L}^*/L$
Base	$(\bar{w}=0.5; p_2=1; \xi_1=0)$	7.0	10.5	12.8
High unemployment	$(\bar{w}=0.6; p_2=1; \xi_1=0)$	8.5	10.2	12.5
Globalization	$(\bar{w}=0.6; p_2=0.9; \xi_1=0)$	8.8	6.4	7.8
Technical progress	$(\bar{w}=0.6; p_2=0.9; \xi_1=0.05)$	8.0	5.3	6.4

[a] $\tilde{L}^*$ and $\bar{L}^*$ designate the immigration levels delimiting the three model regimes; $\bar{w}$ is unemployment compensation, p_2 the secondary-sector good price, ξ_1 is an efficiency parameter in the primary sector. The model is calibrated using the following assumptions: migrants' return probability ($\theta = 0.1$), unemployment rate ($U/L = 0.07$), unemployment compensation ($\bar{w}/w_2 = 0.5$), average duration of unemployment ($1/a = 12$ months), annual detection rate ($d = 0.1$), annual discount rate ($r = 0.05$), capital shares ($f_K^1 K/f^1 = 0.3$, $f_K^2 K/f^2 = 0.25$), consumption share ($p_2 c_2/\sum p_i c_i = 0.1$), secondary-sector employment share ($L_2/L = 0.1$). Note that the last two columns of table 2 depend crucially on the initial secondary-sector employment share. The annual quit rate ($q = 0.087$) and the wage differential ($w_1/w_2 - 1 = 0.066$) are calibrated using the equations of the model.

[b] Unemployment rate measured at $L^* = 0$.

Figure 1. Immigration level, wage rates and model regimes.

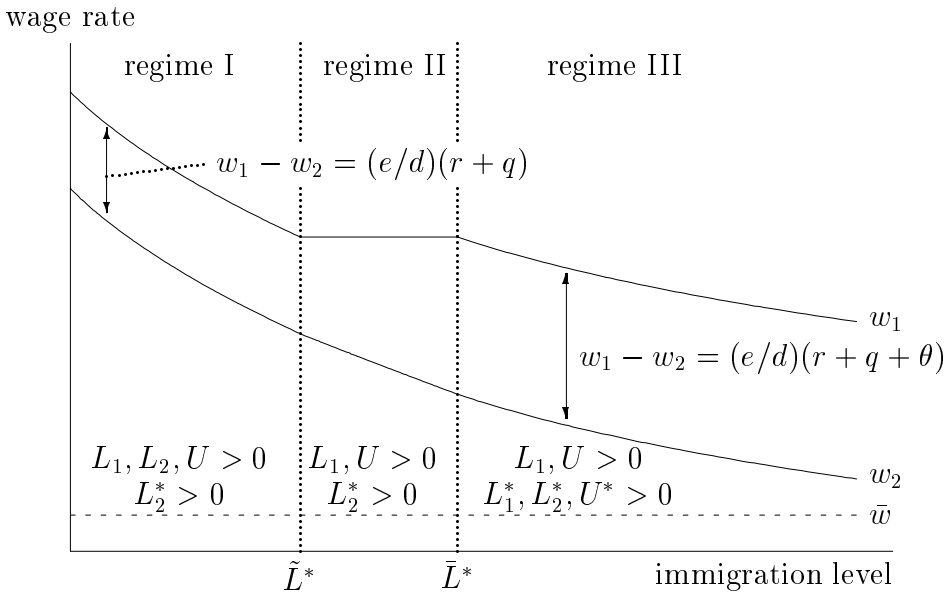
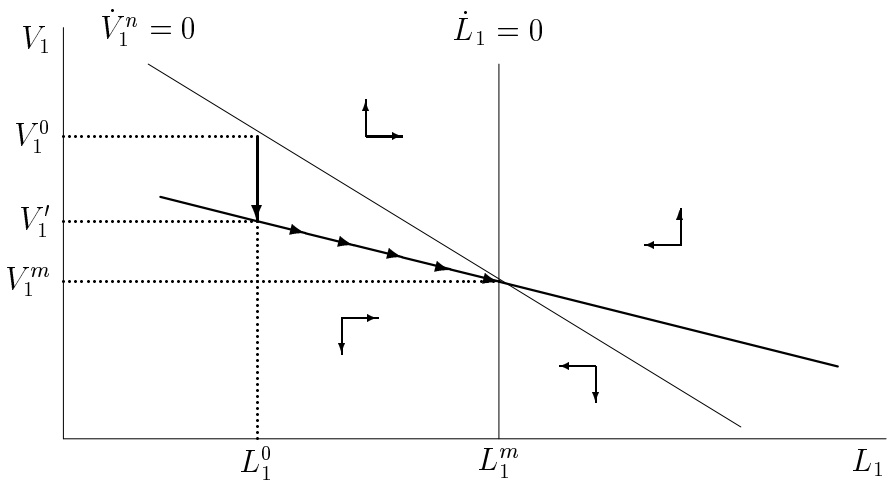

wage rate
regime I
regime II
regime III
$w_1 - w_2 = (e/d)(r+q)$
w_1
$w_1 - w_2 = (e/d)(r+q+\theta)$
w_2
$L_1, L_2, U > 0$
$L_2^* > 0$
$L_1, U > 0$
$L_2^* > 0$
$L_1, U > 0$
$L_1^*, L_2^*, U^* > 0$
$\bar{w}$
$\tilde{L}^*$
$\bar{L}^*$
immigration level

Figure 2. Dynamics of adjustment to immigration (regime I).


V_1
$\dot{V}_1^n = 0$
$\dot{L}_1 = 0$
V_1^0
V_1'
V_1^m
L_1^0
L_1^m
L_1