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Abstract

In this paper, I analyse the consequences of immigration and protection for the host country when there is discrimination against immigrants in a dual labour market. Discrimination is of the type "equal pay for equal work, but unequal work", and is caused by the employers' preference for native workers, due to legal regulations or to the higher quit rates of immigrants. In that case, immigration enhances the natives' chances of finding a good job and produces therefore an aggregate gain for natives. However, this gain should be put into balance with the increase in inequality that results from immigration of unskilled workers. Protection of sectors that use unskilled labour intensively has the opposite effects.

These issues are discussed in the context of a small open economy, using an efficiency-wage model of the dual labour market. A simulation model for Switzerland is used to assess the impact of immigration and protection on the social welfare of natives, taking income distribution into account.

JEL classification numbers: F22, J42, D63.

1 Introduction

In most European countries, liberal immigration policies came to a halt in the 1970s. More recently, hostility towards immigrants seems to be growing again and immigration is increasingly seen as having negative consequences for the host country, especially if immigrants are unskilled. This attitude is in contrast to the "guest-worker" policy of the 1950s and 1960s when large numbers of unskilled workers migrated to North-European countries. At that time, their arrival was seen as largely beneficial for the host countries. Entrepreneurs in labour-intensive industries saw immigration as an alternative to protection, in the context of increasing import competition from developing economies (Bhagwati, 1982). The shift towards more restrictive immigration policies in the 1970s was accompanied by a resurgence of protection. Indeed, the steady reduction in tariff protection since 1947 was offset in the 1970s and 1980s by the growth of nontariff barriers (Bhagwati, 1988).

How can these changes in migration and trade policies be explained? They are often imputed to the macroeconomic difficulties and to rising unemployment in Europe. However, there is no obvious relation between protection and unemployment and most empirical analyses fail to find a link between immigration and unemployment. In this paper, I explore an alternative explanation of these developments. Starting from Bhagwati's (1982) discussion of the choice between protection and immigration policy, I extend his analysis by focusing on a more complete representation of the "guest-worker" system[1] and by taking income distribution explicitly into account.

Indeed, the standard welfare analysis of migration fails to explain the observed attitudes towards immigration. According to the utilitarian welfare criterion, immigration yields a surplus to the host country. Thus, utilitarianism cannot justify restrictive immigration quotas. From a different perspective, it is often acknowledged that unskilled immigration increases income inequality among natives. According to this argument, the guest-worker policy, favouring the immigration of unskilled workers, would be rejected. As a description of the guest-worker system, the standard analysis is deficient in two respects. First, it neglects the existence of discrimination against immigrants, which is common especially in countries favouring temporary immigration. Second, the impact of immigration on income distribution is generally analysed separately from efficiency considerations. Therefore, the question whether the aggregate gain from unskilled immigration prevails over its unfavourable influence on income distribution cannot be answered. In this paper, these two issues are addressed. Efficiency and distributional aspects are considered in an integrated framework by using Atkinson's (1970) social welfare function. Discrimination is modelled in the framework of a segmented labour market, and the legal restrictions faced by immigrants in the labour market are taken explicitly into account.

In most European countries, discrimination against immigrants manifests itself as "equal pay for equal work, but unequal work" (Hammar, 1985). Trade unions usually demand that all workers, regardless of nationality, be offered the same wage. However, in countries having implemented a guest-worker system, immigrants are directed towards certain occupations, characterised by low wages and bad work

conditions. The immigrants' access to stable jobs with good work conditions is often limited by legal discrimination, since some countries restrict work permits to certain occupations or sectors, or allow firms to hire immigrants only if no native worker can be found. The behaviour of employers often also appears to be discriminatory against immigrants, who usually have less country-specific human capital and higher expected quit rates than natives. In quantitative studies, however, the evidence on discrimination against immigrants is not as clear-cut. Dustmann (1993) reports for Germany that earnings of foreign workers are not only initially lower (by 13–19%) than those of natives; he does not find any convergence over time towards the earnings level of natives. However, not all studies on German data confirm these results (see Zimmermann (1993) for a survey). For Switzerland, preliminary results by de Coulon and Flückiger (1995) indicate that immigrants with the same characteristics than natives receive 10% lower wages.

In the model presented below, I assume that discrimination against immigrants takes place in a dual labour market (Piore, 1979). Wages in the primary sector are determined by efficiency-wage considerations. Therefore, primary sector jobs are rationed and immigrants have only limited access to them. However, immigrants can always find a job in the secondary sector where the wage rate is set at the market-clearing level. Discrimination implies that immigrants receive the same wage as natives for a given job, but they have a smaller probability of finding a job in the primary sector. In this case, immigration increases the natives' chances of finding a primary-sector job. From the viewpoint of social welfare, however, this gain is tempered with an increase in income inequality, since immigration tends to reduce the wage rate relative to the return to capital. On the other hand, protection of sectors that are intensive in unskilled labour expands the output of the secondary sector and diminishes therefore the natives' chances of finding a primary-sector job.

This model is closely related to those developed by Ethier (1985), Schmidt et al. (1994) and Winter-Ebmer and Zweimüller (1996), who take into account the specific position of immigrants in the labour market. Their approaches are complementary to the efficiency-wage model used here. 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 labour contracts, whereas immigrants are hired freely at the current wage rate. Schmidt et al. (1994) analyse the impact of immigration in the presence of trade unions. There is discrimination against immigrants in the sense that immigrant welfare is not given the same weight in the union's objective function than native welfare. In this model, immigration might lead to higher unskilled employment if skilled and unskilled labour are q-complements. Winter-Ebmer and Zweimüller (1996) use an insider-outsider model of wage bargaining. They assume the existence of a two-tier wage system, where immigrants (outsiders) receive lower wages than native workers (insiders). Because of discrimination, immigration has an ambiguous effect on native wages.

The remainder of the paper is organised as follows. In the next section, the impact of immigration and protection on social welfare is discussed, assuming that there is no discrimination against immigrants. Then, an open-economy efficiency-

wage model of a dual labour market is presented and the impact of immigration and protection is analysed from a theoretical standpoint. Finally, the dual labour market model is integrated into a simulation model for Switzerland and the impact of immigration and protection on social welfare is simulated for different labour market closures. The evolution of Swiss immigration policy is interpreted in that context.

2 Social welfare effects of migration and protection

Standard welfare analysis shows that natives, as a group, gain from immigration (Berry and Soligo, 1969). The gain is the higher, the more the immigrants' relative factor endowment differs from the natives'. However, by contrast with the debate on trade liberalisation, nobody seriously proposes to allow free international migration. One of the main reasons for this attitude is that immigration, especially unskilled immigration, tends to increase income inequality, since it reduces the wage rate and rises the return to capital. The widespread intuition assuming that the redistributive impact of unskilled immigration is stronger than the efficiency gain is confirmed by the following result (Müller, 1997a): if (physical or human) capital is unequally distributed among natives, and if immigrants hold less capital than natives, infinitesimal immigration decreases social welfare.[2] This implies that the generalised Lorenz curve representing the income distribution before immigration dominates the generalised Lorenz curve after immigration.

At first sight, this result seems to contradict the standard analysis showing the welfare gains from immigration. In fact, the standard analysis uses implicitly a particular form of the social welfare function, often called the utilitarian or Benthamite social welfare function, which takes only mean income into account. It is the only form of the social welfare function for which infinitesimal immigration has no impact on social welfare. This is due to the fact that the efficiency gain, which is only of second order, disappears when immigration is infinitesimal. In order to avoid confusion, I will denote hereafter the utilitarian welfare criterion by U-welfare, whereas the term "social welfare" will refer to the more general social welfare function of the Atkinson (1970) type.

The social welfare functions underlying the result quoted above are often criticised because of the assumption that utility is cardinal and that interpersonal comparisons of utility levels are possible. These restrictive assumptions are however necessary if one wants to be able to rank situations for which the criterion of Pareto optimality is not conclusive. On the other hand, it is important to stress that the utilitarian social welfare criterion, which is routinely used in most discussions of welfare effects, is even more restrictive than the class of social welfare functions defined above. The utilitarian criterion would only be pertinent if any change in immigration policy were accompanied by non distortionary redistribution measures which would compensate the losers. This is not a very realistic assumption.

In view of these considerations, what kind of immigration policies would governments be expected to establish? If the objective of the government were to maximise social welfare, it would not allow any unskilled immigrants to enter the country, but

might welcome skilled immigrants for two reasons. First, unskilled immigration tends to increase income inequality, whereas the impact of skilled immigration on inequality is ambiguous. Second, the efficiency gain is probably greater in the case of skilled immigration, because of the complementarity between capital and skilled workers (Borjas, 1995).

In short, the guest-worker system of immigration does not look attractive at all from the perspective of social welfare. Of course, the view that governments act according to a social welfare criterion is simplistic. Nevertheless, a social welfare function is a convenient and rigorous way of considering efficiency and equality aspects in a common framework. Moreover, more elaborate theories of political economy seem to lead to similar conclusions. For example, Benhabib's (1992) direct democracy model of immigration policy shows that unskilled immigration would only be accepted in a national referendum if the median capital-labour ratio is greater than the capital-labour ratio of the person who is indifferent to immigration. If immigration is infinitesimal, the latter is equal to the average capital-labour ratio. Therefore, if the distribution of capital is asymmetric and skewed to the right (a plausible assumption), unskilled immigration would be rejected in a referendum.

Now turn to the social welfare impact of protection. On the one hand, if importables are labour-intensive, a tariff will in general increase the wage rate relative to the return to capital and therefore reduce income inequality. On the other hand, the efficiency loss induced by a tariff is small for low tariff levels, since a tariff has no first-order effect on U-welfare if the initial situation is free trade (Neary 1988). Consequently, in terms of social welfare the efficiency loss of protection tends to be outweighed by reduced inequality if the initial tariff level is not too high.

To sum up, a government acting according to the social welfare criterion would hardly implement a policy of free trade combined with large-scale immigration of unskilled workers. Then why did some European countries allow immigration in the form of the guest-worker system? As many observers have suggested, this question cannot be answered without taking into account the fact that there is discrimination against immigrants in the dual labour markets of the host countries. This issue is taken up below.

3 A model of dual labour markets and discrimination

This section describes the model of a dual labour market which is used below to reconsider the impact of immigration and of trade policy on the welfare of natives. In this analysis, the role of discrimination against immigrants is highlighted.

The dual labour market is modelled in a standard efficiency-wage framework.[3] Work conditions in the primary and the secondary sectors are not identical. The primary sector offers jobs with good working conditions, stable employment relationships and good chances for internal promotion. By assumption, workers in this sector cannot be perfectly monitored. Thus, firms in the primary sector 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. In this sector, the wage rate is set competitively. Thus, there is no unemployment.[4]

For the sake of simplicity, the instantaneous utility function of a representative worker is assumed to have the following separable structure:

$$u(c_1, c_2, e) = \mu(c_1, c_2) - e, \tag{1}$$

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. A worker's indirect utility function, derived from (1), is given by:

$$v(p_1, p_2, w, y_o, e) = \frac{w + y_o}{\pi(p_1, p_2)} - e, \tag{2}$$

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 (capital income, transfers).

Natives are assumed to maximise expected utility over their infinite life horizon:

$$U = E\left(\int_0^\infty v(p_1, p_2, w, y_o, e)\exp(-rt)\mathrm{d}t\right), \tag{3}$$

where r is the natives' discount rate. A worker who shirks faces a probability d of being discovered and fired. Moreover, an exogenous proportion q of workers quit primary jobs in each period.

All native workers in the secondary sector have the same probability of finding a primary-sector job. This is not necessarily the case for immigrants: different cases will be examined below. The problem of a native worker in the primary sector, who has to decide whether to shirk or not, can be analysed by relating the utility levels that he can attain in the two cases. Let V_1^n denote the expected present value of utility of a non-shirking native worker holding a primary-sector job. If he shirks, the expected present value of utility is V_1^s. Let V_2 denote the present value of utility of a secondary-sector job. To relate these three situations, I follow the asset-equation approach introduced by Shapiro and Stiglitz (1984). If a worker has a job in the primary sector, he will receive wage w_1. He has an exogenous probability q of quitting that job. In that case, he will loose, in terms of utility, the difference between V_1^n and V_2. If a worker does not shirk, the return to a primary-sector job is therefore equal to:

$$rV_1^n = \frac{w_1 + y_o}{\pi(p_1, p_2)} - e - q\left(V_1^n - V_2\right). \tag{4}$$

If the worker decides to shirk, his instantaneous utility is greater because he does not supply any effort. However, he faces a higher probability of loosing his job in the primary sector since he might be detected as a shirker and fired. For a shirking worker, the return to a primary sector job is therefore given by:

$$rV_1^s = \frac{w_1 + y_o}{\pi(p_1, p_2)} - (q + d)\left(V_1^s - V_2\right). \tag{5}$$

A worker in the primary-sector does not shirk if $V_1^n \geq V_1^s$. Using equations (4) and (5), this condition can be rewritten as follows:

$$d\left(V_1^n - V_2\right) \geq e, \tag{6}$$

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.

In steady state, if a worker decides not to shirk, he will never shirk in a primary-sector job. For such a worker, the return to a job in the secondary sector is equal to:

$$rV_2 = \frac{w_2 + y_o}{\pi(p_1, p_2)} - e + a\left(V_1^n - V_2\right), \tag{7}$$

where a is the probability of moving from a secondary-sector to a primary-sector job. (Conversely, for a worker who always shirks, V_1^n must be replaced by V_1^s in equation (7)).

Using (4) and (7), the no-shirking condition (6) can also be expressed as:

$$\frac{w_1 - w_2}{\pi(p_1, p_2)} \geq \frac{e}{d}(r + a + q) \tag{8}$$

At equilibrium, there is no shirking and condition (8) holds with equality, since there is no reason for a primary-sector firm to pay a higher wage.

To derive an expression for the probability of moving from a secondary-sector to a primary-sector job, a, assume first that no immigrants are present in the country. The flow out of the primary sector is qL_1, where L_1 is native employment in the primary sector. The flow into the primary sector is $a(L - L_1)$, where L is total native employment. At equilibrium, these two must be equal. Thus, if all native workers have the same probability of finding a primary-sector job, a is given by:

$$a = qL_1/(L - L_1), \tag{9}$$

When immigrants arrive in a dual labour market, the economic outcome depends on social and institutional arrangements. In order to highlight these differences, I will discuss two extreme cases.

First, I assume that the law does not allow employers to recruit immigrants if suitable native candidates can be found. Consequently, all immigrants are forced to accept jobs in the secondary sector. This can be seen as a simplified view of a guest-worker system. In this case, all primary-sector jobs are held by natives. Therefore, the natives' probability of finding a primary-sector job (a) only depends on native employment and is given by equation (9).

Alternatively, I assume that immigrants are identical to natives in all respects. In that case, immigrants cannot be distinguished from natives and there is no discrimination against them. In a certain sense, this represents the ideal case of a "melting pot", where immigrants are expected to stay in the host country and where they have the same rights as natives. Thus, immigrants have the same probability as

natives of finding a job in the primary sector, i.e. $L_1/L = L_1^*/L^*$, where L^* is total employment of immigrants and L_1^* is primary-sector employment of immigrants. Therefore a is given by:

$$a = \frac{q(L_1 + L_1^*)}{L + L^* - L_1 - L_1^*} = \frac{qL_1}{L - L_1},$$

Obviously, this expression is identical to the guest-worker case. However, the structure of employment is different in the two cases. Indeed, in the melting-pot case, $L_1^* = L^*(L_1/L)$ is immigrant employment in the primary sector, whereas no immigrants are employed in the primary-sector in the guest-worker system. Secondary employment of immigrants is $L_2^* = L^*(1-L_1/L)$ in the melting-pot case, and $L_2^* = L^*$ in the guest-worker system.

In order to compare the effects of immigration and protection in a small open economy, the relation between the dual labour market and goods trade must be specified. I will procede in two steps. First, I discuss the effects of immigration and protection on U-welfare from a theoretical viewpoint, using a simple two-sector model. However, in the choice between tariffs and immigration, there remains a trade-off between efficiency and equity. This issue is taken up in section 5, with the help of a multi-sector, three-factor simulation model.

4 Labour market effects of immigration and protection

In a standard small-country model, immigration yields a U-welfare gain, whereas protection induces a loss. Does the segmentation of the labour market change this result? In this section, I discuss this question by considering small (infinitesimal) immigration flows or tariff changes and by using the utilitarian welfare criterion. Distributional issues and social welfare considerations are postponed until section 5.

I assume that capital is specific to the primary and the secondary sectors.[5] Both sectors exhibit constant returns to scale and produce traded goods. The country is a price-taker on goods markets. The primary sector offers only "good" jobs, paying efficiency-wages w_1, whereas the secondary sector offers only "bad" jobs, paying the competitive wage w_2. Firms are assumed to maximise profits, so that wage rates are equal to the marginal product of labour in each sector. The relation between wage rates in the two sectors is given by equations (8), holding with equality, and (9). Assuming to begin with that immigrant employment is exogenous, equilibrium in the dual labour market can thus be described by the two following equations, which are represented diagrammatically in figure 1:

$$w_1 = \pi(p_1, p_2)\frac{e}{d}\left(r + \frac{qL}{L - L_1}\right) + p_2 f_L^2(K_2, L + L^* - L_1 - L_1^*) \qquad (10)$$

$$w_1 = p_1 f_L^1(K_1, L_1 + L_1^*), \qquad (11)$$

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. Equation (10) reflects both the no-shirking constraint and the marginal product of labour in the secondary sector. Since the derivative of the

right hand side with respect to L_1 is positive, this equation is represented by the upward-sloping curve, labelled $NSC{+}MPL_2$, in figure 1. The marginal product of labour in the primary sector is depicted by the downward-sloping curve, labelled MPL_1.

In order to simplify the welfare analysis, I assume that the capital stocks of both sectors are entirely owned by natives and that the new immigrants do not bring any capital with them. I assume furthermore that there are initially no tariffs and no immigrants present in the host country. It is well known since Grubel and Scott (1966) that infinitesimal immigration has no impact on the natives' U-welfare in a model without distortions. This would also be true in the present model if the proportion of natives working in the primary sector remained constant after the arrival of immigrants.[6] Consequently, the equivalent variation of native U-welfare caused by immigration is equal to:

$$EV = \frac{w_1 \mathrm{d}L_1 + w_2 \mathrm{d}L_2}{\pi(p_1, p_2)} = \frac{w_1 - w_2}{\pi(p_1, p_2)} \, \mathrm{d}L_1.$$

Native U-welfare improves if the probability for natives of finding a primary-sector job increases as a consequence of immigration. Thus the qualitative U-welfare consequences of infinitesimal immigration can be analysed simply by determining the sign of the change in native primary-sector employment. The case of tariffs is similar. As mentioned above, a tariff has no first-order effect on U-welfare if the initial situation is free trade. Therefore, the U-welfare effect of a small tariff on imports depends crucially on the variation of native employment in the primary sector.

Now turn to the impact of immigration on U-welfare of natives. Assume first that immigrants cannot be distinguished from natives, so that they are not discriminated in the host country (the melting-pot case). Figure 1 illustrates the ambiguous impact of immigration on native employment in the primary sector. Immigration shifts the MPL_1-curve to the left and the $NSC{+}MPL_2$-curve to the right. The primary-sector wage unambiguously falls, but the impact of immigration on native employment in the primary sector, and thus on native U-welfare, is ambiguous. It can be shown that the natives' probability of finding a primary-sector job only rises if the elasticity of labour demand is (much) greater in absolute value in the primary sector than in the secondary sector (see Müller, 1997b).

This uncertain outcome of immigration would obviously be changed if immigrants could be prevented from penetrating the primary sector. In countries having implemented the guest-worker system, there is occupational segregation because immigrants do not have the same chances as natives of finding a primary-sector job. Discrimination might be explicit, as in legal dispositions limiting the rights of immigrants, or it might be due to the fact that employers perceive immigrants as a distinct group with characteristics that differ from the natives' (e.g. different quit rates). The latter case will be discussed below in section 5. Here I simply assume that the host country does not grant the same rights to immigrants as to natives. In Switzerland, for example, employers who want to obtain a work permit for an immigrant must prove that they are unable to recruit a native worker (or a foreigner with a permanent residence permit). In the present model of a dual labour mar-

ket, the consequence of such a regulation is that immigrants are not able to obtain primary-sector jobs, since natives always prefer those to secondary-sector jobs.

The U-welfare impact of guest-worker immigration can be seen in figure 2. Since immigrants are confined to the secondary sector, immigration does not affect the MPL_1-schedule, but shifts the curve $NSC+MPL_2$ to the right. Therefore, native employment in the primary sector rises unambiguously and primary-sector wages decline.

As in a standard specific-factors model, returns to capital rise in both sectors and the two wage rates fall. However, the wage differential increases. Indeed, since the probability of being hired in the primary-sector has risen for natives, the wage differential must be higher in order to prevent them from shirking. Interestingly, it is possible in this model that immigration increases the natives' expected labour income even if both wage rates fall (see Müller, 1997b). However, natives who work in the secondary sector and who do not receive any capital income are necessarily worse off *ex post*. Therefore, *ex post* there is necessarily a conflict between the aggregate gain from immigration and a more unequal income distribution.

What is the welfare impact of a tariff if the labour market is segmented? The implementation of a tariff increases output in the secondary sector and moves labour from the primary to the secondary sector. Indeed, the $NSC+MPL_2$-schedule shifts to the left; the MPL_1-curve is not affected by the tariff. Obviously, the tariff has the opposite effect of guest-worker immigration. In particular, primary-sector employment diminishes and the tariff induces a U-welfare loss for natives. The impact of a tariff on income distribution is ambiguous in this model. Protection increases the return to capital in the protected sector and lowers it in the other sector. The primary-sector wage rises, but proportionally less than the price of the importable good.

5 Immigration, protection and social welfare: a simulation analysis

From the discussion in the preceding sections it follows that in the case of protection and immigration, the government faces a trade-off between efficiency and equality. On the one hand, guest-worker immigration entails a first-order efficiency gain, since it increases the proportion of natives holding primary-sector jobs, but it also leads to a more unequal income distribution. On the other hand, protection produces a first-order efficiency loss, but might well reduce income inequality. Under what conditions does the efficiency gain of immigration outweigh its adverse distributional impact? When is the efficiency loss due to protection compensated by its favourable impact on income distribution? Which option would be preferred by a decision-maker motivated by social welfare? In this section, I consider these questions from an empirical perspective with the help of a simulation model which is calibrated on Swiss data. Of course, the answers to the questions above depend strongly on value judgements, in particular on the degree of "inequality-aversion" of decision makers.

5.1 The simulation model

In the simulation model, capital is sector-specific[7] and there are two skill categories of labour, mobile between sectors. Since the simulations focus on the immigration of unskilled workers, I assume, for simplicity, that the skilled labour market is competitive (for a similar hypothesis in a model with trade unions for unskilled workers, see Schmidt et al., 1994). By contrast, the unskilled labour market is segmented and there are good and bad jobs, as described above in section 3. Markets for goods are assumed to be competitive and the firms' production functions are nested CES functions. Because of the small-country assumption, the domestic prices of traded goods are fixed. Some sectors, however, produce non-traded goods. Since their prices are endogenous, the demand side matters in the simulation model (the equations of the model are given in the appendix).

Obviously, the simulation model differs only very little from the theoretical model used in section 4. The main differences are the presence of two labour categories and of non-traded goods. Furthermore, in the simulation model all industries offer good and bad jobs; however, the proportion of good jobs varies from one industry to the other.

Preferences of all households are described by Cobb-Douglas utility functions. Moreover, I assume that all households have identical utility functions. Since the conditions of exact linear aggregation are satisfied in this case, domestic demand depends only on aggregate income and is not affected by a change in the distribution of income. As a consequence, income distribution issues can be considered independently from the determination of equilibrium.

In order to model immigration as well as income distribution among natives, three types of households are distinguished in the model: (i) immigrant households, who do not own any capital; (ii) native households endowed with unskilled labour; (iii) native households endowed with skilled labour. All native households receive some income from capital. For simplicity, I assume that the share of capital income received by a native household is equal to its share of native labour income. Tariff revenues are redistributed to all households (including immigrants) according to their share in total income. Thus, a change in tariffs does not affect income inequality.

These assumptions imply that native income inequality depends only on relative income from skilled and unskilled labour. In particular, a rise in the return to capital does not increase income inequality. This is, of course, a conservative assumption since it tends to understate the rise in income inequality due to guest-worker immigration. However, this treatment of income distribution captures the main source of income inequality, as the following result in Flückiger and Silber (1995) shows. Decomposing the overall Gini index by income source, these authors conclude that the contribution of labour income to an overall Gini index of 0.40 is estimated to be equal to 0.24.

The main indicator used to evaluate the impact of immigration and tariff policies is the social welfare of natives. I assume thereby that the government does not redistribute income in order to compensate native households for any losses due to those

policies. Social welfare depends on the individual utility levels of natives. Because of the Cobb-Douglas specification, indirect utility is equal, by appropriate normalisation, to real income, i.e. nominal income deflated by a geometric price index. The measure of social welfare used in the simulations is Atkinson's (1970) equally distributed equivalent income, y_e. It defines the level of per capita real income which if equally distributed would provide the same level of social welfare as the actual distribution. The degree of inequality-aversion is captured by a parameter, ε, which allows to cover a large range of value judgements. If $\varepsilon = 0$, the decision-maker is completely insensitive to distribution issues, since in this case y_e is equal to average income (the utilitarian case). With increasing ε, the decision-maker attaches more and more weight to lower incomes.

5.2 Policy experiments and labour market specifications

To analyse the effects of immigration and protection on social welfare in Switzerland, three main policy experiments are carried out using four different specifications of the labour market (see table 1). In a first set of simulations, immigration quotas and tariff rates are fixed. Then, the consequences of varying immigration and protection levels and of different skill-levels of immigrants are analysed.

In the first set of simulations, the impact of migration policy is simulated by assuming that 200,000 unskilled immigrants arrive to Switzerland (M). This can be interpreted as an estimation of the number of "guest workers" in Switzerland since it is approximately the number of low-skill foreigners who had temporary working permits in 1985, the base year of the model (foreigners holding a permit of residence are treated as natives).

The effects of protection are captured through two policy experiments. First, I consider the effects of sector-specific protection by simulating a tariff on imports of Textile and Clothing (P-1). The ad valorem equivalent of tariff barriers in these sectors is not far from 10 percent in Switzerland. It is, however, difficult to compare simulations M and P-1 because of their different sectoral impact. In the two-sector framework of Bhagwati (1982), immigration and protection can be considered as being equivalent in the sense that a same output level of the importable good can be achieved by both policy instruments. Simulations P-1 and M are not equivalent according to that definition since the former increases the output level of the two protected sectors in very large proportions, whereas the latter increases moderately the output of all low-skill sectors.

In experiment P-2, the tariff structure is designed in such a way that the output levels of all low-skill traded goods are equal to their output levels in experiment M. Thus, comparability between immigration and protection in the sense of Bhagwati (1982) is ensured (however, firms in skill-intensive sectors prefer option M to P-2, since their production rises in the first case and falls in the second). The tariff rates in experiment P-2 range from 1.0 percent (Beverages) to 2.6 percent (Agriculture).

In order to highlight the role of a segmented labour market and of discrimination against immigrants, the experiments are carried out using four alternative labour market specifications. The first case represents the standard specific-factors model

(STD) where the labour market is integrated and wages are set competitively. There is no discrimination against immigrants. This specification is useful as a benchmark for the other simulations. In the second case, the labour market is assumed to be segmented, with efficiency-wages in the primary sector, but discrimination does not take place because immigrants and natives are indistinguishable. In particular, their quit rates are perceived to be identical by employers. This is the melting-pot (M-P) specification discussed above. In the third case, I assume that immigrants face legal discrimination, preventing them from entering the primary sector. Since employers must prove that they cannot find a native worker to fill a job vacancy and since primary jobs are preferred to secondary jobs, immigrants are stuck in the secondary sector. This is the guest-worker (G-W) specification.

In the fourth case, discrimination originates in the fact that immigrants are perceived as having, on average, higher quit rates than natives. Empirically, this assumption can be justified by the observation that many immigrants intend to return to their home country in the near future. This is even true for immigrants who arrived in the host country a long time ago. For Germany, Dustmann (1993) reports that 55% of all immigrants intend to return to their country of origin within the next ten years. Among them, 85% have been living in Germany for more than ten years. If quit rates are different, discrimination even occurs if immigrants have the same legal rights as natives in the labour market. It is a form of statistical discrimination (S-D) because the membership in a group (natives, immigrants) determines an individual's probability of finding a primary-sector job. This can be seen from the no-shirking conditions for natives and immigrants (see equations (40) and (41) in the appendix). Because of competition between firms, natives and immigrants are paid the same wage in the primary sector. Since immigrants expect to stay a shorter time in primary-sector jobs than natives, primary-sector employers will hire proportionally less immigrants in order to induce them not to shirk. Note that this treatment of discrimination follows very closely Bulow and Summers (1986), who apply it to the case of discrimination against women. In the simulations, I assume that the immigrants' quit rates are three times higher than the natives'.

The simulation model is calibrated on Swiss data for the year 1985 (see the appendix), taking into account the presence of immigrants and the fact that the Textile and Clothing sectors are protected. Then a hypothetical free-trade, no-immigration situation is simulated; this is the starting point for all policy experiments.

5.3 Simulation results

The policy experiments described above shed new light on Bhagwati's (1982) discussion of tariff and immigration policies in the context of increased import competition. First, I follow his analysis by assuming that the two policy options have the same objective: to achieve a given output level in low-skill sectors. Second, the consequences of different protection and immigration levels are discussed. Finally, an informal sensitivity analysis of the model is carried out.

The choice between protection and immigration

The results of the policy experiments described above suggest that, from the perspective of native social welfare, immigration might be preferred to protection only if there is discrimination against immigrants or if the government is completely insensitive to the distribution of income among natives (see table 2).

Consider first the case of an integrated, competitive labour market (STD). In this context, unskilled immigration (M) is not an attractive policy option from the viewpoint of social welfare. As expected from the discussion in section 2, the U-welfare gain from immigration is very small and the adverse impact on income distribution prevails even for low levels of inequality-aversion. On the other hand, protection of low-skill sectors increases the unskilled wage relative to the skilled wage (see table 3) and thus has a favourable impact on income distribution. The efficiency loss from protection is relatively small, especially in the broad-based approach with moderate tariffs applying to many goods (P-2). Consequently, protection is preferred to immigration unless the degree of inequality-aversion is very small.

What if the labour market is segmented? If there is no discrimination against immigrants (M-P), both immigration and protection induce a shift of native unskilled employment from the primary to the secondary sector. However, this effect is so small that it hardly influences the social welfare outcome.

If there is discrimination against immigrants, natives will find unskilled immigration more profitable. In the guest-worker system (G-W), secondary-sector employment of natives declines by more than a sixth as a consequence of immigration. By contrast, the impact of immigration on average native income is surprisingly small (it rises by only 0.2 percent). This is due to the fact that only a small share (9 percent) of native workers hold secondary-sector jobs. Moreover, the sign of the social welfare effect depends on the inequality-aversion parameter. Therefore, if the government is insensitive to distribution issues, it would favour guest-worker immigration. On the other hand, if the government is characterised by an inequality-aversion parameter greater than 0.7, it would be hostile to unskilled immigration and prefer protection.

If discrimination has its source in different quit rates (S-D), the outcome lies in between the M-P and the G-W cases. Indeed, the U-welfare gain for natives is smaller than in the guest-worker case since only 7 percent of native workers in the secondary sector succeed in moving to the primary sector.

The welfare impact of different immigration or protection levels

In the simulations above, it is assumed that the government considers only two policy options with predetermined levels of immigration or protection. Obviously, these levels might also be chosen by the government. In particular, to counter the continued pressure of import competition from developing countries, the government might envisage large-scale immigration or high tariff rates.

The impact of varying immigration levels on the social welfare of natives is depicted in figure 3. As expected from the simulations above, large-scale immigration is beneficial for natives only if the degree of inequality aversion is low. But figure 3 reveals two more striking features. First, successive immigration waves become

increasingly beneficial, or less unfavourable, for natives (the curves are concave). Second, the difference between the G-W and the M-P cases increases with rising immigration levels. An intuitive understanding of the first observation can be obtained by considering the impact of immigration when some immigrants are already living in the host country. Each new arrival of unskilled immigrants prompts, over and above the second-order U-welfare gain, a redistribution of income from earlier unskilled immigrants towards natives, because of the fall of unskilled wages relative to skilled wages and to the return to capital. Thus, the more unskilled immigrants reside in the country the more beneficial a new arrival of unskilled immigrants is for natives. Obviously, the increasing gain for natives is obtained at the expense of immigrants.

However, in a M-P system, this redistribution effect is quite small. In terms of native social welfare, it outweighs the increase in income inequality among natives only if the degree of inequality aversion is small. If $\varepsilon = 1$ or 2, the social welfare effect remains negative even for high levels of unskilled immigration. Compared to the M-P case, immigration is doubly beneficial for natives in a G-W system. On the one hand, immigration enables more natives to find a job in the primary sector and, on the other hand, it increases the wage gap between the primary and the secondary sectors. The influence of the first effect gradually diminishes with rising immigration levels, since there are less and less natives in the secondary sector who could gain from shifting to the primary sector.[8] The second effect, however, becomes increasingly favourable to natives, because it reinforces the redistribution effect mentioned above. Indeed, the drastic fall in secondary-sector wages hurts especially immigrants, whereas primary-sector wages, which most natives receive, fall less than in the M-P case. In other words, the segregation of the work force is reinforced with rising immigration: almost all natives have a primary-sector job, whereas all immigrants have secondary-sector jobs.

Assuming that the government aims at maximising social welfare[9], what are the implications of these observations for migration policy? If no other policy instruments are available, the government would choose either free immigration or no immigration, depending in particular on the degree of inequality-aversion. Furthermore, if the government pursues only the interests of natives, it would opt for a guest-worker system, which is more advantageous than the melting-pot system in two respects. First, its impact on social welfare is more favourable for natives for a given level of immigration, as shown above. Second, the immigration pressure is likely to be smaller than in the melting-pot case, since the immigrants' wages decrease more rapidly with rising immigration levels, the immigrants being confined to a small labour market segment. Moreover, the bad working conditions in the secondary sector discourage many potential immigrants.

It might seem unrealistic that the model contains no mechanism which would limit the usefulness of increasing immigration levels for natives. However, if a low degree of inequality aversion is assumed, the guest-worker specification of the model reflects quite well Swiss immigration policy until the first half of the 1960s (Hoffmann-Nowotny, 1985): this policy was liberal towards the exterior and restrictive towards the interior. Borders were open to migrants, but migrants met hard restrictions once

inside the country. As a result of that policy, the number of foreigners in Switzerland increased from 285,000 in 1950 to 810,000 in 1965.

Swiss immigration policy underwent an important turnaround in 1970 when restrictive immigration quotas were introduced. According to Hoffmann-Nowotny (1985), this change in policy was "not dictated by economic interests at all, it was instead the result of grassroots pressure based mainly on the issue of 'over-foreignization'". The fear of "over-foreignization" (*Überfremdung* — an unpalatable German word which evokes the Swiss' fear of losing their cultural identity because of the presence of foreigners) can be linked to the failure of the policy of "rotation". Instead of returning to their home country, as had been expected, many immigrants decided to stay on in Switzerland. This observation suggests an alternative interpretation, which does not refer to the concept of cultural identity, of the shift towards a restrictive immigration policy. As discussed above, the G-W system was advantageous for natives because of the legal discrimination against immigrants. By contrast, there is no legal discrimination against foreigners holding a permit of residence, since they have the same rights in the labour market than natives. Thus, when it became clear that many immigrants would in fact become permanent residents, unskilled immigration appeared much less attractive from the perspective of native social welfare (see the M-P specification in figure 3). It is therefore likely that further immigration would be halted in these conditions.

Moreover, if immigrants are expected to become permanent residents, it is difficult for the government to argue that it is completely indifferent to their welfare. Yet, if immigrants are included in the government's social welfare objective, the social welfare implications of immigration are very different from what is outlined above. On the one hand, the arrival of unskilled immigrants is likely to decrease social welfare because it diminishes average income (of natives and immigrants) and it increases income inequality. Thus, further unskilled immigration will be stopped a fortiori. On the other hand, from the perspective of social welfare it is not advisable to discriminate against immigrants who are expected to become permanent residents (interestingly, since 1970 the Swiss government has improved the legal position of immigrants and lifted some of the discriminatory restrictions). Indeed, the M-P policy performs better than the G-W system with respect to the social welfare of natives *and* immigrants, for any degree of inequality aversion. If 1 million immigrants are present in Switzerland (the actual number of foreigners in 1985), social welfare is 0.5 percent higher if $\varepsilon = 0$ (2.4 percent if $\varepsilon = 1$) in the M-P system. This is hardly surprising. Since in the G-W case immigrants are confined to the secondary sector, total secondary-sector employment expands more, relative to primary-sector employment, than in the M-P case. Moreover, overall income inequality is greater in the G-W system because immigrants receive lower wages.

Now turn to the consequences of rising tariff levels. It is well known that the efficiency cost of protection increases with initial tariff levels (Neary, 1988). In terms of social welfare, the improvement in income distribution induced by protection is therefore less likely to compensate for the deadweight loss when tariff rates reach high levels. This can be seen in figure 4, which depicts the social welfare effects of a uniform proportional increase in tariffs on low-skill goods (the tariff structure is the

same as in experiment P-2). Optimal tariff rates are quite low for moderate levels of inequality aversion. Would protection of low-skill sectors have been an alternative to large-scale immigration in Switzerland? The arrival of almost 1 million immigrants in the 1950s and 1960s had an important impact on the output levels of low-skill sectors. If the government had tried to achieve a similar impact by tariff policy, the required tariff rates would have exceeded 10 percent on average. Figure 4 shows that, for moderate levels of ε, such a policy would have been less beneficial than guest-worker immigration for the social welfare of natives.

Discrimination hardly affects the impact of protection on social welfare (see table 2). Even if immigrants are included in the social welfare function, the impact of protection is not altered significantly, since all unskilled workers, natives and immigrants, gain from the redistribution of income resulting from a rise in tariffs. Thus, if the failure of the policy of rotation is acknowlegded, protection appears more advantageous than immigration.

Sensitivity analysis

Since the model has been calibrated using many simplifying assumptions, it is useful to test the sensitivity of the results to some of them. For comparability, all simulations are carried out using the G-W specification (see table 4). Of course, this is no full-fledged sensitivity analysis since every change in parameters or in model structure is simulated separately. Overall, the qualitative welfare results of the model are quite robust and all model variants give similar estimates of the variation of average native income (U-welfare). By contrast, results differ significantly as to the impact of immigration on native income inequality.

Income distribution (I-D). The assumption that capital income is distributed to natives in proportion to their labour income tends to underestimate the impact of immigration on income inequality. In order to test the sensitivity of results to this assumption, I recalculated the social welfare measure using the extreme alternative assumption that all income from capital is paid to native skilled households. In this case, which certainly overestimates the impact of immigration on inequality, the level of inequality-aversion at which a decision-maker would be indifferent to G-W immigration is around 0.3, down from 0.7 in the original simulation.

Labour market segmentation (LMS). In the treatment of the primary and secondary sectors, several crucial assumptions rely on very little information. I will test the sensitivity of results to three of them. First, some authors interpret the dual labour market hypothesis as implying that "good" and "bad" jobs are located in different firms. To test this assumption, I recalibrate the model assuming that three industries (i.e. Construction, Arrangement and Hotels and restaurants) offer only "bad" jobs for unskilled workers, whereas the others offer only "good" jobs. The results are surprisingly similar to the original version of the model (LMS-1).

Second, the wage differential between jobs in the primary and secondary sectors is not estimated directly. In the model it is calibrated using the average wage

differential between unskilled natives and immigrants (15 percent). Doubling this latter number increases the U-welfare gain from immigration by only a third (LMS-2).

Third, there is no reliable information on the share of unskilled natives working in the secondary sector. Assuming that this share is only half as large as in the original model (where it is 16 percent) yields results that differ very little from the original model (LMS-3). This is due to the fact that the wage differential between unskilled natives and immigrants is given (see above).

Skill-mix of immigrants (S). In the simulations above, all immigrants were assumed to be unskilled. Yet, in recent years, the Swiss government has tried to facilitate the immigration of highly skilled workers. Such a policy has many advantages. Skilled immigrants pay higher taxes and are less likely to be unemployed than unskilled migrants. Moreover, their human capital might have external effects in production. Here I focus on another issue: their impact on income distribution and social welfare.

I simulate this immigration policy by assuming that either 25 percent (S-25) or 50 percent (S-50) of immigrants are skilled. Since skilled labour and capital are complements in production, the immigration of skilled workers increases the return to capital even more than the arrival of unskilled workers. Hence, the assumption on the distribution of capital income among natives becomes a more sensitive issue. Thus, I report also the social welfare effect under the alternative hypothesis that all capital income is paid to skilled workers (I-D). The results show that the presence of skilled immigrants attenuates the adverse impact of immigration on income inequality. On the other hand, the U-welfare gain from immigration is reduced because there is no discrimination against skilled workers.

Therefore, a government entirely insensitive to income distribution would admit only unskilled "guest workers". By contrast, a government concerned with income inequality would rather try to attract skilled immigrants. Nevertheless, it would not abolish legal discrimination against the unskilled immigrants if it expects them to return to their country of origin. Recent Swiss immigration policy bears a strong resemblance to the latter option. Indeed, an important share of recently arrived immigrants are highly skilled (see table 5). However, the proportion of immigrants with elementary education remains high and intermediate education levels are underrepresented. This suggests that recent policy is a typical Swiss compromise: part of the immigration quota is allocated to highly skilled workers, while the remainder is used to pursue the traditional guest-worker policy.

6 Conclusions

From the results above, it appears that immigration of unskilled workers seems advantageous to natives only if immigrants ultimately return to their home country. If, however, immigrants acquire the status of permanent residents and thereby the same rights as natives in the labour market, unskilled immigration is likely to meet with much more resistance. In that case, natives might find protection the better

response to increased import competition, from the perspective of social welfare. In this view, the failure of the rotation system might be one of the causes of the switch to restrictive immigration policies in the 1970s. In turn, this change in immigration policy may have contributed to the resurgence of protectionism in Europe.

Swiss immigration policy today seems to hesitate between a narrow view of national interest, which favours a guest-worker system, and a broader view of social welfare, focusing on the economic and social integration of immigrants. The fact that an increasing share of foreigners hold permanent residence permits shows that the guest-worker system has not worked as expected. Nevertheless, many discriminatory aspects of this system have been maintained. As a consequence, further immigration of unskilled workers is still perceived as being advantageous for natives, at least in the short run. This would probably change if the government put more emphasis on the better integration of foreigners. However, it is clear that if the economic consequences of immigration shape the natives' attitudes towards immigrants, the choice between a discriminatory guest-worker system and a policy oriented towards the integration of immigrants is largely determined by ethical values.

Appendix

A.1 The simulation model

The model is disaggregated into 28 production sectors, indexed over i or j. Some of the goods and services that are produced are not traded internationally (see table A.3). The production functions are nested CES functions. Their structure is depicted in figure A.1. Skilled labour and capital, which is specific to each sector, are assumed to be separable from other inputs since empirical evidence seems to indicate that these factors are p-complementary (see Hamermesh, 1993). Unfortunately, such evidence is completely lacking for the relation between (unskilled) primary and secondary jobs, which I assume to be separable from other production factors.

Firms minimise costs subject to the production function. The derived demand equations resulting from this problem are equations (12) to (16). Equation (17) is marginal cost (table A.1 contains all equations of the model and table A.2 lists the variables of the model).

Equations (18) to (27) define the distribution of income to households. Subscripts s and u designate skilled and unskilled labour, superscripts (or subscripts) n and f designate native and foreign (immigrant) households or labour supply. Subscripts 1 and 2 refer to primary and secondary-sector jobs. Native households own all domestic capital and also receive some capital income from abroad (equation (18)). The variable ϕ_s determines the share of capital income distributed to skilled households, which is equal to their share in native labour income. The variable ψ_n determines the share of net tariff income distributed to (skilled and unskilled) native households. It is equal to the natives' share in capital and labour income. The variable s_1 designates the share of (native) unskilled labour income that (native) primary-sector workers receive.

Equation (28) is Atkinson's (1970) measure of equally distributed equivalent income. The domestic final demand equation (29) is derived from a Cobb-Douglas utility function. Because of the assumption of identical preferences, domestic demand depends only on aggregate income. Equation (31) is the small country assumption. The current account balance (B) is exogenous and the real exchange rate adjusts to ensure external equilibrium. Labour supply by immigrants is proportional to the number of immigrants who live in the host country (equations (35) and (36)). The equilibrium condition (39) for secondary-sector jobs includes also exogenous labour supply by "border workers", i.e. commuters who work in Switzerland but are not allowed to live there. Equations (40) and (41) are the efficiency-wage equations determining the relation between the wage gap and employment in the primary and secondary sectors. They are derived from equations (8) and (9) in the text. Equation (42) defines the geometric consumer price index, which is dual to the Cobb-Douglas utility function, as the numéraire. Thus, all income variables can be interpreted in real terms.

A.2 Data and calibration

The simulation model is calibrated on a social accounting matrix for Switzerland in 1985 (see Antille et al., 1991). The breakdown of wage income by skills is taken from Gaillard et al. (1991). In 1985, the foreign population in Switzerland was 1.02 million or 15.6% of total population. However, the majority of foreigners were in the possession of a permit

of residence, giving them the same rights on the labour market as Swiss citizens. (In the administrative jargon, Swiss citizens and foreigners with residence permits are called the "indigenous work force".) However, foreigners without a residence permit face various restrictions. Therefore, it seems reasonable to define as "guest workers" all unskilled foreigners who do not hold a permit of residence . In 1985, the number of foreigners without a permit of residence was 283,000, or 4.3 % of total population (border workers are not included in this number). Of these, 200,000 are estimated to have low skills.

It is difficult to find an operational definition of the secondary sector in the literature on dual labour markets. Trying to quantify the number and the sectoral distribution of secondary-sector jobs is even more hazardous. In their test of the dual labour market hypothesis for the US, Dickens and Lang (1985) conclude that 12 percent of working male heads of households are employed in the secondary sector. They also note that this proportion is likely to be higher for women. Unfortunately, no such estimates exist for Switzerland. So I assume that 12 percent of the total population (including foreigners) hold a secondary-sector job in the initial equilibrium. As to the sectoral distribution of these jobs, there is no quantitative evidence to my knowledge. I assume that the number of secondary jobs in each industry is proportional to the number of foreign workers without a permit of residence (see table A.3 in the appendix). This assumption ensures that there is no sectoral bias in the distribution of foreigners holding secondary-sector jobs.

In order to calibrate the no-shirking conditions, one needs to know the wage differential between the primary and secondary sectors. The latter can be calculated from the wage differential between indigenous workers and "guest workers", using the shares of natives and immigrants working in the secondary sector (since the proportion of immigrants holding a secondary-sector job is higher than the proportion of natives, a positive wage differential between the primary and the secondary sectors is reflected in lower average wages for immigrants). De Coulon and Flückiger (1995) estimate the wage differential between Swiss and foreign workers to equal approximately 10 percent. This number probably underestimates the wage differential of the present model for two reasons. First, recently arrived immigrants are underrepresented in their data base (the Swiss labour force survey). Second, all foreigners are lumped together in their estimation, in contrast with my definition of immigrants. Foreigners holding a residence permit (and having arrived a long time ago) can be expected to receive higher wages than more recent immigrants. Therefore, I chose to fix the wage differential between indigenous workers and recent immigrants at a slightly higher level, more consistent with the empirical results by Dustmann (1993) for Germany (15 percent).

The quit rate and the discount rate of natives were quantified as indicated in table A.4. In fact, only their ratio matters, since e/d is calibrated from base year data by using equation (40). The substitution elasticities in production (see table A.4) were chosen on the basis of the survey by Hamermesh (1993). The calibration of all other parameters is standard.

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Notes

[1]Unfortunately, the euphemistic term "guest worker" has been used too often to be ignored. Would you ask your guests to clean your bathroom?

[2]The social welfare function is assumed to be of the Atkinson (1970) type: it is individualistic, symmetric, additively separable and inequality-averse. It can be represented as $W = \int u(y)f(y)dy$, where y is income, f is the frequency density function of income, and u is an increasing, strictly concave function.

[3]The basic structure of this model follows Shapiro and Stiglitz (1984). Bulow and Summers (1986) and Jones (1987) adapted it to a dual labour market. More recently, efficiency wages have been integrated into international trade models. Copeland (1989) analyses trade policy issues using a Ricardian trade model with a dual labour market and efficiency wages. Brecher (1992) develops an efficiency-wage model with unemployment and a non-traded good.

[4]Unemployment can be added to this model by assuming that primary-sector firms hire only unemployed workers. In that case, some workers prefer to remain unemployed and to wait for a job in the primary sector, rather than work in the secondary sector. See Bulow and Summers (1986).

[5]The Heckscher-Ohlin case with intersectoral capital mobility is analysed in Müller (1997b).

[6]To see this, differentiate total income of natives, Y_n, holding L_1 constant. Then, because of constant returns to scale:

$$\begin{aligned} \mathrm{d}Y_n &= L_1\mathrm{d}w_1 + K_1\mathrm{d}r_1 + (L - L_1)\mathrm{d}w_2 + K_2\mathrm{d}r_2 \\ &= p_1(L_1 f^1_{LL} + K_1 f^1_{KL})\mathrm{d}L^*_1 + p_2[(L - L_1)f^2_{LL} + K_2 f^2_{KL}](\mathrm{d}L^* - \mathrm{d}L^*_1) \\ &= 0, \end{aligned}$$

where r_i is the return to capital in sector i. Note that this property does not hold if immigrants are present at the initial equilibrium ($L^* > 0$) or if some capital is owned by non residents.

[7]This choice is motivated by empirical evidence. Indeed, Kohli (1993) shows that the specific-factors model performs substantially better than the HOS production structure in explaining the US experience.

[8]However, some natives always remain in the secondary sector, which is expanding with immigration; otherwise natives working in the primary sector would lose the incentive not to shirk.

[9]This is obviously a naive view of policy-making. Social welfare considerations do not constitute a theory of political economy. However, since income distribution issues are prominent in the immigration debate, the concept of social welfare is certainly a better description of a government's objective than the traditional criterion of U-welfare.

Table 1: Policy experiments and labour market specifications

Policy experiment	
M	Immigration of unskilled workers (quota of 200,000 immigrants)
P-1	Protection (10% tariff on Textiles and Clothing)
P-2	Protection (tariffs on all low-skill traded goods)
Labour market specification	
STD	Integrated labour market, no efficiency-wages, no discrimination
M-P	Dual labour market, no discrimination against immigrants
G-W	Dual labour market, legal discrimination against immigrants
S-D	Dual labour market, immigrants and natives have different quit rates

Table 2: The impact of immigration and protection on native social welfare (Percentage changes in equally distributed equivalent income, y_e)

Policy	Labour market	Inequality-aversion parameter (ε)					
experiment	specification	0	0.2	0.5	1.0	2.0	3.0
M	STD	0.05	-0.03	-0.15	-0.35	-0.72	-1.03
	M-P	0.04	-0.04	-0.17	-0.37	-0.75	-1.07
	G-W	0.23	0.16	0.07	-0.10	-0.42	-0.70
	S-D	0.11	0.03	-0.08	-0.27	-0.63	-0.94
P-1	STD,M-P,G-W,S-D	-0.05	-0.04	-0.04	-0.02	0.01	0.04
P-2	STD	-0.02	-0.01	0.02	0.06	0.14	0.21
P-2	M-P,G-W,S-D	-0.03	-0.02	0.01	0.05	0.13	0.19

Table 3: The impact of immigration and protection on output and the labour market
(Percentage changes from base values)

	Unskilled immigration				Protection		
Experiment	M				P-1		P-2
Labour market specification	STD	M-P	G-W	S-D	STD	G-W	G-W
Output: aggregate and selected low-skill sectors							
Aggregate output	2.0	1.9	1.9	1.9	0.1	0.1	0.1
Food	7.0	7.0	5.7	6.5	-1.4	-1.4	5.7
Textile	3.9	3.9	3.9	3.9	79.1	78.9	3.9
Clothing	3.7	3.7	5.5	4.4	30.1	29.7	5.5
Construction	5.7	5.7	9.1	7.0	-1.0	-1.1	9.1
Hotels, restaurants	2.9	3.0	6.5	4.3	-1.4	-1.4	-3.2
Employment, wages and capital income							
Total unskilled employment	6.0	6.0	6.0	6.0	0	0	0
Native unskilled employment	0	0	0	0	0	0	0
– primary sector	—	-0.5	4.1	1.5	—	-0.1	-0.3
– secondary sector	—	2.0	-17.7	-6.5	—	0.5	1.2
Unskilled wage rate[a]	-2.4	-2.4	-1.6	-2.1	0.1	0.0	0.2
– primary sector	—	-2.3	-1.6	-2.0	—	0.0	0.2
– secondary sector	—	-2.4	-4.7	-3.3	—	0.1	0.4
Skilled wage rate	1.0	1.0	1.0	1.0	-0.2	-0.2	-0.5
Capital income	1.1	1.1	1.0	1.1	-0.2	-0.2	-0.0

[a]In the case of dual labour markets, average unskilled wage rate for natives.

Table 4: Social welfare effects of immigration: sensitivity analysis
(Percentage changes in equally distributed equivalent income, y_e)

Sensitivity	Labour	Inequality-aversion parameter (ε)					
analysis	market	0	0.2	0.5	1.0	2.0	3.0
I-D	G-W	0.23	0.09	-0.15	-0.57	-1.25	-1.58
LMS-1	G-W	0.23	0.18	0.09	-0.05	-0.32	-0.57
LMS-2	G-W	0.30	0.24	0.15	-0.02	-0.36	-0.73
LMS-3	G-W	0.26	0.20	0.10	-0.05	-0.35	-0.61
S-25	G-W	0.16	0.17	0.19	0.22	0.26	0.28
S-25 and I-D	G-W	0.16	0.09	-0.04	-0.27	-0.66	-0.85
S-50	G-W	0.12	0.20	0.33	0.53	0.91	1.23
S-50 and I-D	G-W	0.12	0.11	0.08	0.04	-0.04	-0.09

Table 5: Education level of the work force in Switzerland by nationality (percent of the work force of each category)

Education level	Swiss	Foreigners	
		Permanent residents	Others
Elementary education, compulsory school	14.8	40.7	29.0
Apprenticeship, professional or high school	74.5	50.7	36.1
University	10.1	7.6	26.0
Other training, no answer	0.6	1.0	8.9

Source: Swiss Labour Force Survey 1991.

Table A.1: Equations of the simulation model

Production

$$
\begin{aligned}
K_j &= K_j(r_j, w_s, w_1, w_2, P_1, \ldots, P_M, Q_j) && (12)\\
LS_j &= LS_j(r_j, w_s, w_1, w_2, P_1, \ldots, P_M, Q_j) && (13)\\
LU_j^1 &= LU_j^1(r_j, w_s, w_1, w_2, P_1, \ldots, P_M, Q_j) && (14)\\
LU_j^2 &= LU_j^2(r_j, w_s, w_1, w_2, P_1, \ldots, P_M, Q_j) && (15)\\
I_{ij} &= I_{ij}(r_j, w_s, w_1, w_2, P_1, \ldots, P_M, Q_j) && (16)\\
P_j &= MC_j(r_j, w_s, w_1, w_2, P_1, \ldots, P_M) && (17)
\end{aligned}
$$

Income

$$
\begin{aligned}
Y_K &= \textstyle\sum_i r_i K_i + YKF\ E && (18)\\
Y_L &= w_s(L_s^n + L_s^f) + w_1(L_1^n + L_1^f) + w_2(L_2^n + L_2^f) && (19)\\
Y_T &= \textstyle\sum_i t_i MN_i PW_i E && (20)\\
\psi_n &= (w_s L_s^n + w_1 L_1^n + w_2 L_2^n + Y_K)/(Y_L + Y_K) && (21)\\
\phi_s &= w_s L_s^n/(w_s L_s^n + w_1 L_1^n + w_2 L_2^n) && (22)\\
s_1 &= w_1 L_1^n/(w_1 L_1^n + w_2 L_2^n) && (23)\\
N_s y_s &= \phi_s \psi_n (Y_L + Y_K + Y_T - B)\\
&= w_s L_s^n + \phi_s Y_K + \phi_s \psi_n (Y_T - B) && (24)\\
(L_1^n/L_u^n) N_u y_1 &= s_1(1-\phi_s)\psi_n (Y_L + Y_K + Y_T - B)\\
&= w_1 L_1^n + s_1(1-\phi_s) Y_K + s_1(1-\phi_s)\psi_n (Y_T - B) && (25)\\
(L_2^n/L_u^n) N_u y_2 &= (1-s_1)(1-\phi_s)\psi_n (Y_L + Y_K + Y_T - B)\\
&= w_2 L_2^n + (1-s_1)(1-\phi_s) Y_K + (1-s_1)(1-\phi_s)\psi_n (Y_T - B) && (26)\\
N_f y_f &= (1-\psi_n)(Y_L + Y_K + Y_T - B)\\
&= w_s L_s^f + w_1 L_1^f + w_2 L_2^f + (1-\psi_n)(Y_T - B) && (27)
\end{aligned}
$$

Natives' social welfare (equally distributed equivalent income)

$$
y_e = \begin{cases} \left[f_s y_s^{1-\varepsilon} + (L_1^n/L_u^n) f_u y_1^{1-\varepsilon} + (L_2^n/L_u^n) f_u y_2^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}} \Big/ \prod_i P_i^{b_i} & \text{if} \quad \varepsilon \neq 1 \\ y_s{}^{f_s} y_1{}^{(L_1^n/L_u^n) f_u} y_2{}^{(L_2^n/L_u^n) f_u} \Big/ \prod_i P_i^{b_i} & \text{if} \quad \varepsilon = 1 \end{cases} \qquad (28)
$$

where $f_s = N_s/(N_s + N_u)$and $f_u = N_u/(N_s + N_u)$

Domestic final demand

$$
P_i C_i = b_i(Y_L^n + Y_K + Y_T - B) \qquad (29)
$$

Table A.1: Equations of the simulation model (Continued)

Net imports and equilibrium on goods markets

$$MN_i = C_i + \sum_j I_{ij} - Q_i \tag{30}$$
$$P_i = (1+t_i)PW_iE \qquad \text{if } i \text{ is a traded good} \tag{31}$$
$$MN_i = 0 \qquad \text{if } i \text{ is a non-traded good} \tag{32}$$

Unskilled employment and immigrant labour supply

$$L_u^n = L_1^n + L_2^n \tag{33}$$
$$L_u^f = L_1^f + L_2^f \tag{34}$$
$$L_u^f = a_u^f N_f \tag{35}$$
$$L_s^f = a_s^f N_f \tag{36}$$

Equilibrium on labour markets

$$L_s^n + L_s^f = \sum_j LS_j \tag{37}$$
$$L_1^n + L_1^f = \sum_j LU_j^1 \tag{38}$$
$$L_2^n + L_2^f + L_2^b = \sum_j LU_j^2 \tag{39}$$

Efficiency wages

$$\frac{w_1 - w_2}{\prod_i P_i^{b_i}} = \frac{e}{d}\left(r + \frac{q_n L_u^n}{L_2^n}\right) \tag{40}$$

$$\frac{w_1 - w_2}{\prod_i P_i^{b_i}} = \frac{e}{d}\left(r + \frac{q_f L_u^f}{L_2^f}\right) \tag{41}$$

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$$\prod_i P_i^{b_i} = 1 \tag{42}$$

Alternative labour market specifications

- Standard (STD): $e/d = 0$
- Melting-pot (M-P): $q_n = q_f$
- Guest-worker system (G-W): replace equation (41) by $L_1^f = 0$
- Statistical discrimination (S-D): $q_f > q_n$

Table A.2: Variables of the simulation model

Endogenous variables

P_j	domestic price of good j
r_j	return to capital in industry j
w_s	skilled wage rate
w_1	unskilled wage rate (primary-sector jobs)
w_2	unskilled wage rate (secondary-sector jobs)
Q_j	gross output of industry j
LS_j	skilled labour used in production of industry j
LU_j^1	primary-sector employment (of unskilled workers) in industry j
LU_j^2	secondary-sector employment (of unskilled workers) in industry j
I_{ij}	intermediate good i used in production of industry j
L_1^n	primary-sector employment of unskilled natives
L_2^n	secondary-sector employment of unskilled natives
L_s^f	skilled labour supply by immigrants
L_u^f	unskilled labour supply by immigrants
L_1^f	primary-sector employment of unskilled immigrants
L_2^f	secondary-sector employment of unskilled immigrants
Y_K	total income from capital
Y_L	total labour income accruing to residents (natives and immigrants)
Y_T	tariff income
ψ_n	natives' share in total capital and labour income
ϕ_s	skilled natives' share in native labour income
s_1	share of primary-sector income in native unskilled labour income
y_s	per capita income of skilled natives
y_1	per capita income of unskilled natives working in the primary-sector
y_2	per capita income of unskilled natives working in the secondary-sector
y_f	per capita income of immigrants
y_e	equally distributed equivalent income of natives
C_i	total domestic final demand
MN_i	net imports of good i
E	real exchange rate

Exogenous variables

K_j	capital stock in industry j
N_f	number of immigrants
N_s	number of skilled natives
N_u	number of unskilled natives
L_s^n	skilled labour supply by natives
L_u^n	unskilled labour supply by natives
L_2^b	unskilled labour supply by border workers
YKF	income from capital abroad, held by natives
B	current account balance
t_i	tariff rate on good i
PW_i	world price of good i
q_n	quit rate of natives
q_f	quit rate of immigrants

Table A.3: Employment, Switzerland 1985 (by sector and by nationality of workers)

	Employment	Share of foreign workers	Foreigners without permit of residence[a]
	(thousands)	(Percent of employment)	
Agriculture, forestry	222	7.9	6.2
Electricity, gas, water	24	4.6	1.0
Food	60	27.1	10.6
Beverage	8	16.9	5.3
Tobacco	4	32.5	8.7
Textiles	32	39.7	13.0
Apparel	37	46.7	21.3
Lumber, furniture	68	20.8	8.1
Paper	17	32.7	9.0
Printing, Graphic arts	63	16.7	3.3
Leather, Shoes	11	43.0	11.2
Chemical industry	70	31.9	15.6
Oil refineries	0	31.9	15.6
Plastics	22	36.1	15.0
Non-ferrous minerals	32	37.3	17.2
Métal	99	34.3	11.9
Machinery	157	26.7	6.3
Electrical machinery, watches, jewelry	257	26.2	9.1
Construction	210	51.0	32.7
Arrangement, installation[b]	139	23.9	15.3
Wholesale and retail trade	494	14.8	4.9
Hotels, restaurants	214	40.1	27.9
Transport	137	13.0	4.6
Communication	65	4.2	1.5
Banking	109	11.6	3.2
Insurances	51	7.6	1.6
Other services[b]	322	17.1	6.4
Government, social security[b]	495	13.2	4.6
Total	3418	21.8	10.1

[a]Foreigners holding seasonal permits, permits of abode and border workers.

[b]Sectors producing non-traded goods or services.

Table A.4: Parameters of the simulation model

Parameter		
Elasticity of substitution: primary jobs – secondary jobs	σ_j^U	2.0
Elasticity of substitution: skilled labour – capital	σ_j^{KS}	0.5
Elasticity of substitution: unskilled labour – capital/skill aggregate	σ_j^{VA}	1.5
Elasticity of substitution: value added – intermediate inputs	σ_j^Z	0.1
Discount rate (efficiency wages)	r	0.05
Native quit rate	q_n	0.1

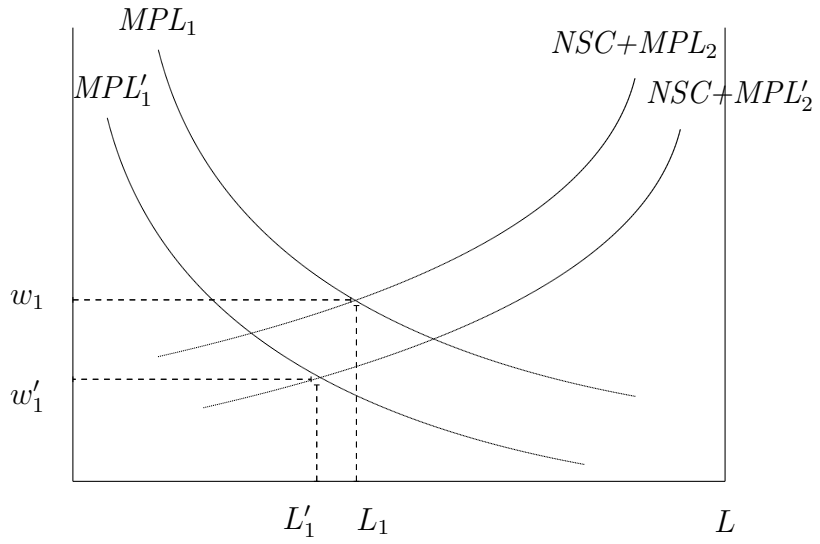

Figure 1: The impact of immigration on native employment: the "melting-pot" case

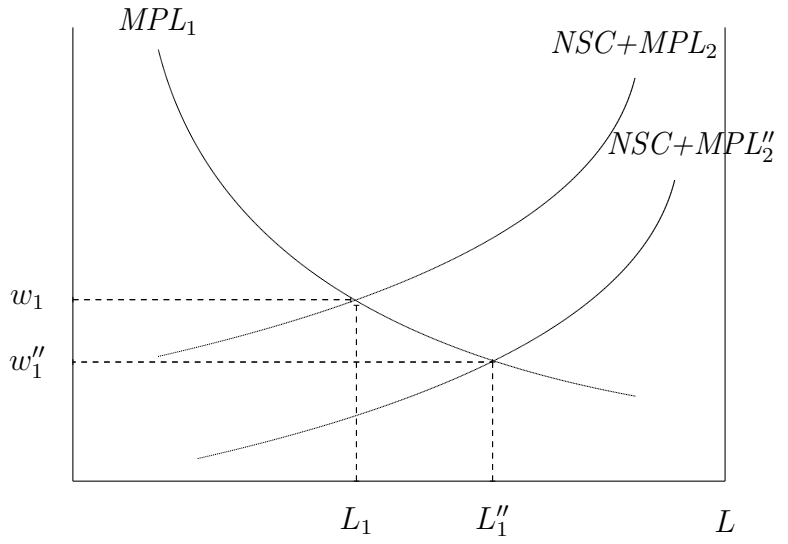

Figure 2: The impact of immigration on native employment: the "guest-worker" case

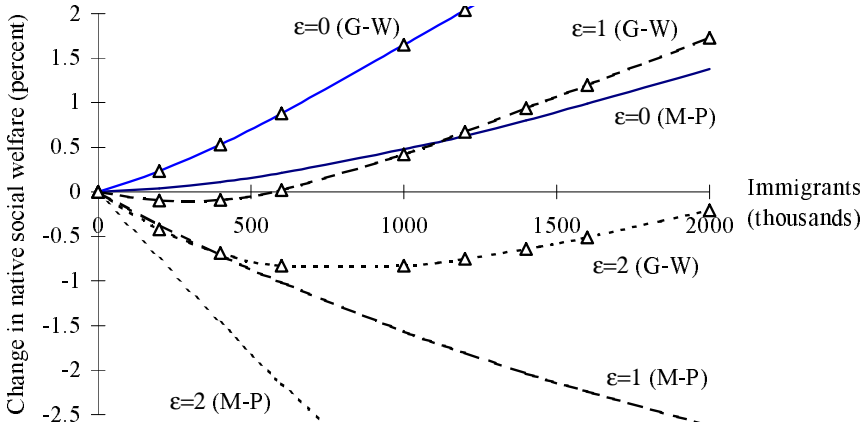

Figure 3: The impact of different immigration levels on native social welfare: the "melting-pot" (M-P) and "guest-worker" (G-W) cases

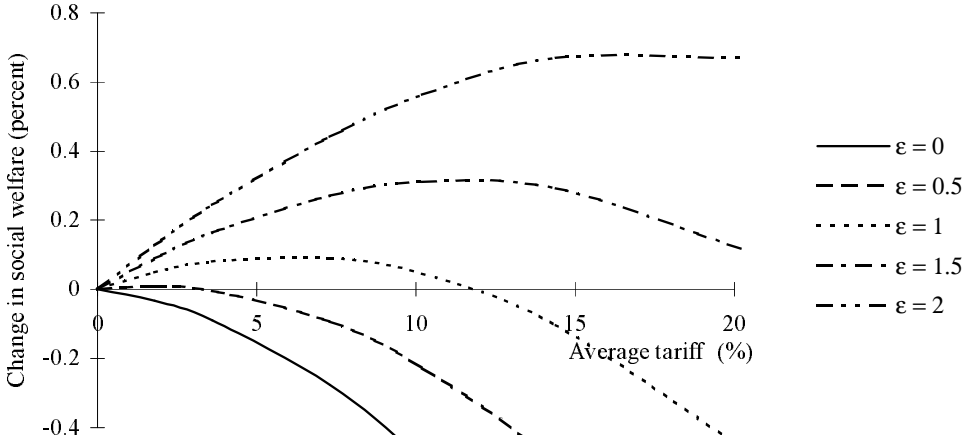

Figure 4: The impact of different tariff levels on social welfare (the G-W case)

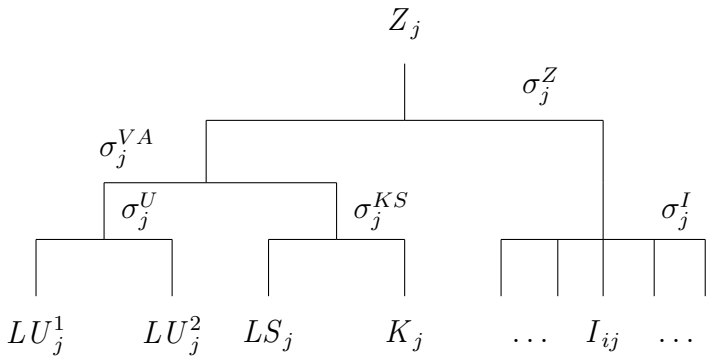

Figure A.1: Structure of nested production functions in the simulation model