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## Legal and Illegal Immigration in an Efficiency Wage Model

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# **International Immigration, Economic Welfare in an Efficiency Wage Model**

The Co-existence Case of Both Legal and Illegal Foreign Workers

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## **1. Introduction**

After the collapse of the so-called Bubble Economy, the labour market of Japan seems to have been changed drastically. High wages and low unemployment because of the structural shortage of workers, and discussions on various social troubles caused by an increasing number of illegal workers who are attracted by the Japanese economic boom, are things of the past. Now, owing to the serious failure of governmental financial management, the unemployment rate has reached about 5%, which is the highest since 1955. However, it is remarkable that the high unemployment rate has not prevented the Japanese people from enjoying their relatively established lifestyle. Although individuals have no chance of becoming regular members of a company after graduation, they can gain sufficient wealth to enjoy life by working part-time. Some middle-aged workers have been dismissed because of the recent serious depression, but, on the other hand, some younger people voluntarily choose to be unemployed or to support themselves by part-time jobs, and wait to obtain much better regular jobs. The phenomenon during the last two years of an increasing number of job offers with a constant unemployment rate shows that people in Japan are “luxuriously” particular about their jobs.

However, both total employment and the number of foreign workers are not decreasing drastically. Most legal foreign workers are skilled and their positions are threatened by the recent depression, as are those of Japanese citizens. On the other hand, illegal unskilled foreign workers are still engaged in dangerous, gruelling and dirty jobs at the bottom of the social pyramid. As affluent young native people avoid competing with

the foreign workers for the unattractive jobs, there is a great demand for unskilled foreign workers in this serious depression. As a result, the structure of the Japanese labour market has recently developed as follows. There exist three types of natives and legal workers, namely, those who succeed in obtaining high-wage jobs, those who obtain low-wage jobs, and those who are unemployed and make their living by obtaining unemployment allowances but look for opportunities to obtain high-wage jobs. On the other hand, illegal workers can obtain low-wage jobs with lower possibilities of unemployment.

The standard and basic economic analysis of native workers, associated with introducing foreign workers, can be summarized as follows. In the case of full employment, introducing workers who are perfectly substitutable for natives may reduce the wages of native workers because this merely results in increasing the population. On the other hand, introducing workers who are complementary to natives may be much better for native workers because the foreign workers, rather than native workers, will undertake low-wage jobs. In the case where there exists unemployment caused by fixed wages, the introduction of substitutable workers may have a bad influence because they will compete for the limited number of job opportunities. Introducing complementary workers to low-wage jobs may also be harmful to natives who are employed there. However, if the native workers are absorbed in high-wage jobs by expanding job opportunities (although the fixed wage is lower than before), this immigration may be beneficial. Therefore, without considering non-economic factors such as social unrest,

complementary workers, such as illegal immigrants, seem to be preferable to substitutable workers, such as legal immigrants, so far as native workers in Japan are concerned.

The pioneering economic study on migration and unemployment is Harris and Todaro (1970). Ethier (1985), Djajic (1985) and Carter (1999) are remarkable recent studies. Ethier (1985) and Djajic (1985) discuss the economic welfare of the host country that confronts the inflow of unskilled foreign workers. However, these studies, like that of Harris and Todaro (1970), attribute the origin of unemployment to fixed wages, so that some workers are forced to be unemployed. On the other hand, Carter (1999) studies the economic effects of international migration by applying, for the first time, the efficiency wage model adopted by Shapiro and Stiglitz (1984). In this model, some workers are unemployed voluntarily, and Carter discusses the effectiveness of restriction policies on the inflow of illegal workers. However, some subjects in Carter's study remain to be considered. Firstly, it is not clear in Carter (1999) why foreign workers should be illegal. Secondly, the possibility of the existence of legal workers is not considered, and, therefore, the economic effects of legitimizing illegal workers are not investigated. To examine the optimal immigration policy for Japan with low unemployment, we construct our model by modifying the Shapiro and Stiglitz model to accord with the basic static model adopted by Milgrom and Roberts (1992). In our model, both types of foreign workers—legal ones who are substitutable for natives and illegal ones who are complementary—exist simultaneously. Moreover, we modify some of the unreasonable

assumptions of Carter (1999) about the Japanese modern economy, namely that some illegal workers choose to go back to their home country of their own accord and that some of them also intend to return to the host country as legal immigrants.

In Section 2, we show the basic idea of the efficiency wage and the equilibrium of the labour market. Sections 3 and 4 investigate the optimal economic policies to improve the economic welfare of natives in two different cases. In the first case (Section 3), restriction policies for illegal workers are quite successful and the number of them is sufficiently small. In the second case (Section 4), restriction policies for illegal immigrants are almost out of control. Section 5 contains concluding remarks. Firstly, we show that to improve the economic welfare of the natives, the most effective policy is to restrict illegal workers by border or internal enforcement policies when they first arrive. Moreover, introducing legal workers is a preferable policy only to reduce the unemployment rate of natives. These conclusions are quite different from those obtained by adopting the standard full-employment model or the fixed-wage model, as mentioned above. Secondly, in the case where the restriction of illegal workers is out of control, the most preferable policy for natives is to exclude legal workers who are substitutable for natives.

## **2. Labour Market**

We consider a developed small country that is confronted by the inflow of legal and illegal foreign workers. As in MacDougall (1960), we assume that in this country, only

one good is produced with two factors, capital and labour. We also assume that there are two departments of production and that the same single good is produced in each department. We assume that capital is a specific factor in both departments and that international capital movements are freely permitted. On the other hand, any workers may be hired in either department. We take the price of the good as the numeraire.

Following Milgrom and Roberts (1992),  $w_i$  denotes the wage rate of a department  $i$  ( $i = 1, 2$ ). The government imposes an income tax  $t$  on all employed workers and all of the collected taxes are distributed equally to unemployed workers as unemployment allowances. In our model, those who cannot obtain jobs in either department support themselves solely with the allowance. In other words, there are no part-time jobs. Let  $\bar{w}$  be the per capita unemployment allowance. Workers intend to shirk if and only if shirking is possible and it yields them profit. Let  $g_i$  be the amount of this profit, which includes leisure obtained by going slow during working hours and cash income such as bribes. Let  $p_i$  be the probability of detection of any kind of shirking. Let  $N_i$  be the coefficient of the value of long-term employment, which depends on both the length of a worker's period of hire without detection of shirking, and the interest rate. If only one period of employment is systemized and there is no opportunity of extending one's period of employment, then  $N_i = 1$ . On the contrary, if non-shirking workers can extend their contracts of employment, then  $N_i$  would be greater than one.

Shirking is preferred if

$$g_i > p_i(w_i - t - \bar{w})N_i \quad (1)$$

is satisfied. Employers do not have to pay more than necessary to workers, so the efficiency wage rate by which shirking is prevented is

$$w_i - t = \bar{w} + \frac{g_i}{N_i p_i}. \quad (2)$$

In Department 1, skilled workers mainly do office work and, therefore, detecting shirking by its workers is more difficult and its profit is larger compared with Department 2, whose workers are unskilled and engaged in physical jobs. Under the assumption that  $N_1 = N_2 \equiv N$  and  $p_2 > p_1$ ,  $g_1 > g_2$ , we obtain  $w_1 > w_2$ . This means that the real-wage rate in Department 1 is larger than that in Department 2. If both  $p_2$  and  $g_2$  are sufficiently large and small, respectively, then the difference between  $w_2 - t$  and  $\bar{w}$  should be very small. In the case where  $p_2 = 1$ , the advantage of shirking disappears and then  $w_2 - t = \bar{w}$ . Thus, workers in Department 2 are indifferent to being unemployed. This is the “luxurious” unemployment situation mentioned in the Introduction.

Native workers are hired in both departments. In Department 1, we assume that all foreign workers are legal. Unlike illegal foreign workers, legal foreign workers have enough skills—such as language—to enable them be hired. Legal foreign workers are perfectly substitutable for native workers, and they must pay income taxes, but can also obtain unemployment allowances, the same as natives.



In Department 2, both types of foreign worker can work, but it is impossible to distinguish them from legal workers because illegal workers disguise themselves as legal workers. Employers must offer common working conditions to all foreign workers. Unlike legal foreign workers, illegal ones will be deported to their home country by the government of the host country if they are reported to the government on being detected by their shirking. Furthermore, illegal workers can also be deported in accordance with the internal enforcement policies adopted by the government. We use  $\bar{w}^*$  to denote the wage rate of an illegal foreign worker if he stays in the home country, and  $q$  to denote the probability of detection by the internal enforcement policy. The efficiency wage rate that employers in Department 2 offer to illegal workers (and also to legal workers) can then be expressed as

$$w_2^* = \bar{w}^* + \frac{g_2}{N(p_2 + q)}, \quad (3)$$

where  $\bar{w}^*$  is constant and sufficiently small to satisfy  $\bar{w} > w_2^*$ .<sup>1</sup> In this situation, because legal foreign workers have the right to accept unemployment allowances, they prefer being unemployed to being employed in Department 2 along with illegal workers. Therefore, a legal foreign worker chooses to be unemployed if he fails to gain employment in Department 1.

Because  $w_2 > w_2^*$ , employers in Department 2 should initially employ low-priced foreign workers and later employ additional native workers. Illegal foreign workers are

therefore complementary to native workers because they have no strong preference for either department and are prepared to work under severe conditions (they accept quite low wage rates which natives and legal workers will not.)

We consider two possible cases concerning employment in Department 2. In Case 1, the total number of illegal foreign workers is strictly controlled to satisfy  $L_2 > L'$ , where  $L_2$  denotes the total employment in Department 2 and  $L'$  denotes the total number of illegal foreign workers, respectively. All illegal workers are employed in Department 2, together with some native workers. In Case 2, restrictive policies on the inflow of illegal immigrants are out of control and satisfy  $L' > L_2$ . No native worker is employed in Department 2. Furthermore, the number of illegal foreign workers is too large to be absorbed in Department 2 and some are unemployed.

We note that in Case 1, employers exploit workers by employing illegal workers cheaper than natives and each worker is worth  $w_2 - w_2^*$ . Therefore, employers make a total profit of  $L'(w_2 - w_2^*)$ . Under the perfect competition model, it is well known that other firms will enter the market until this profit disappears. The entrants try to poach illegal workers from existing firms by offering higher wages than  $w_2^*$  and this type of competition ends when the illegal workers are employed at the wage rate  $w_2$ , the same as that for natives. However, in our model, we assume that an employer reports illegal workers to the government if they resign to work for another employer. Detection means deportation to the home country. Therefore, the only option for illegal foreign workers is to keep working for the first employer, and there is no possibility of their switching jobs.

Consequently, employers do not have to pay more than  $w_2^*$  to illegal workers.

### 3. Case 1: The number of illegal workers is strictly controlled

Let  $L^0$ ,  $L^M$ , and  $L^I$  be the total numbers of native workers, legal foreign workers and illegal foreign workers, respectively.  $L_1^0, L_2^0$ , and  $L_U^0$  denote the numbers of native workers who are employed in Department 1, employed in Department 2 and unemployed, respectively. Similarly,  $L_1^M$  and  $L_U^M$  denote the numbers of legal foreign workers who are employed in Department 1 and unemployed, respectively.

Because we assume  $w_2^* > \bar{w}^*$  and in our model there are no travel costs and penalty fines, in the case of free immigration, the total number of illegal foreign workers increases if equation (3) is satisfied. However, in Case 1, owing to detective efforts by employers in Department 2 and to internal and border enforcement adopted by the government of the host country, the number of illegal foreign workers is controlled to satisfy  $L_2 > L^I$ . Now we may express  $L^I$  as

$$L^I = L^I(p_2, q, X), \quad L_1^I < 0, L_2^I < 0, L_3^I < 0, \quad (4)$$

where  $X$  is the parameter that indicates the strictness of the border enforcement policy.

Let  $L_1$  and  $L_2$  be the total numbers of workers employed in Departments 1 and 2, respectively. Then we have following four equations:

$$L_1^0 + L_1^M = L_1, \quad (5)$$

$$L_2^0 + L^I = L_2, \quad (6)$$

$$L_1^0 + L_2^0 + L_U^0 = L^0, \quad (7)$$

$$L_1^M + L_U^M = L^M. \quad (8)$$

Whether a native worker (or a legal foreign worker) will be employed in Department 1 or will be unemployed depends only on the law of probability. Therefore, we can assert that

$$L_1^0 = \left( \frac{L^0}{L^0 + L^M} \right) L_1. \quad (9)$$

Concerning the total of the unemployment allowances, to satisfy the financial balance of the government, the following relation should be satisfied:

$$\bar{w} = \frac{t(L_1^0 + L_2^0 + L_1^M)}{L_U^0 + L_U^M}. \quad (10)$$

In both departments, we assume that there is perfect competition. Because of the profit-maximizing tendency of firms, wage rates in both departments should be equal to the marginal products of labour, namely

$$F_L^i(K_i, L_i) \equiv \partial F^i / \partial L_i = w_i, \quad (11)$$

where  $F_i(K_i, L_i)$   $i = 1, 2$  denotes the production function of a department  $i$ .<sup>2</sup>

Now we have twelve equations, (2)–(11). If  $L^0, L^M, X, t, g_1, g_2, p_1, p_2, q, N$ , and  $\bar{w}^*$  are exogenously given, then the twelve unknowns,  $w_1, w_2, \bar{w}, L_1^0, L_2^0, L_U^0, L_1^M, L_U^M, w_2^*, L_1, L_2$ , and  $L^I$  are determined endogenously.

### 3.1 An increase in the probability of detection

The effects of an increase in  $p_i$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dp_1} > 0, \frac{dL_2^0}{dp_1} < 0, \frac{dL_U^0}{dp_1} > 0, \frac{dw_1}{dp_1} < 0, \frac{dw_2}{dp_1} > 0, \frac{d\bar{w}}{dp_1} > 0, \quad (12)$$

$$\frac{dL_1^0}{dp_2} < 0, \frac{dL_2^0}{dp_2} > 0, \frac{dL_U^0}{dp_2} < 0, \frac{dw_1}{dp_2} > 0, \frac{dw_2}{dp_2} > 0, \frac{d\bar{w}}{dp_2} > 0. \quad (13)$$

The employment of native workers should increase in the department where the probability of detection is increased. In Department 1, the effects of an increase in the probability of detection,  $p_1$ , must reduce the wage rate,  $w_1$ . However, in Department 2, the effects of an increase in the probability of detection,  $p_2$ , (which will increase the total employment of native workers in this department,  $L_2^0$ ) may increase the wage rate,  $w_2$ , owing to the decrease in the employment of illegal foreign workers. On the other hand, an increase in the probability of detection in one department surely increases the wage

rate of another department and reduces the employment of native workers. In equilibrium, the total unemployment allowance increases. In the case of an increase in the probability of detection in Department 2, because of the decrease in unemployed native workers, both the total amount and the average income of native lower income groups will be increased.<sup>3</sup> In the case of an increase in the probability of detection in Department 1, on the other hand, the number of unemployed native workers does not always decrease. As a result, employers should reward efforts to detect shirking workers in Department 2 in order to improve the economic welfare of native workers.

### 3.2 An increase in internal or border enforcement policy

The effects of an increase in  $q$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dq} < 0, \frac{dL_2^0}{dq} > 0, \frac{dL_v^0}{dq} < 0, \frac{dw_1}{dq} > 0, \frac{dw_2}{dq} > 0, \frac{d\bar{w}}{dq} > 0. \quad (14)$$

The effects of strengthened internal enforcement are quite similar to those caused by strengthened detection of shirking in Department 2. There is only one difference. Detection of shirking has a negative effect on the wage rate of natives, but, on the other hand, because internal enforcement targets illegal foreign workers only, a decrease in foreign workers in Department 2 has a positive effect on wages. Therefore, for native

workers the internal enforcement policy is greatly preferable to the detection of shirking workers in Department 2. Moreover, the effects of a strengthened border enforcement policy are quite similar

A strengthening of internal or border enforcement policy reduces the number of illegal foreign workers, but the employment of native workers in Department 2 increases. This decreases the numbers employed and unemployed in Department 1. The level of employment in Department 2 also decreases because the number of additional native workers who are employed in it does not suffice to compensate for the number of illegal foreign workers who have been deported. Therefore, the wage rates in both departments increase, and increased wages guarantee larger unemployment allowances. Though the level of employment decreases in Department 1 (the department with the highest wage), excluding illegal foreign workers (since they are *complementary* to native workers), it has positive effects on the economic welfare of native workers because of higher wages, higher unemployment allowances and higher employment than before. This explains why the government of the host country dares to make those workers illegal and tries to expose them.

### **3.3 An increase in income tax**

The effects of an increase in  $t$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dt} < 0, \frac{dL_2^0}{dt} < 0, \frac{dL_U^0}{dt} > 0, \frac{dw_1}{dt} > 0, \frac{dw_2}{dt} > 0, \frac{d\bar{w}}{dt} >> 0. \quad (15)$$

An increase in income tax increases the wage rates of both departments to maintain the real incomes of workers and therefore reduces the level of employment. As more natives are unemployed, the per-capita unemployment allowance does not necessarily increase.

### 3.4 An increase in the inflow of legal foreign worker.

The effects of an increase in  $L^M$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dL^M} >> 0, \frac{dL_2^0}{dL^M} > 0, \frac{dL_U^0}{dL^M} < 0, \frac{dw_1}{dL^M} < 0, \frac{dw_2}{dL^M} < 0, \frac{d\bar{w}}{dL^M} < 0. \quad (16)$$

By increasing legal foreign workers who are substitutable for native workers, the opportunity of employment for native workers decreases because of competition. However, on the other hand, an increased total number of workers causes greater employment and smaller unemployment allowances, in equilibrium. Therefore, we cannot predict whether the number of employed native workers in Department 1 will increase or not. However, we predict that the number of unemployed native workers should decrease because of expansion of employment in Department 2.

Concerning the foreign workers, we may conclude that



$$\frac{dL_1^M}{dL^M} > 0, \frac{dL_U^M}{dL^M} < 0 \quad (17)$$

and, therefore, because of increased employment in Department 1 and an increased total number of legal foreign workers, the number of employed legal foreign workers should increase but the level of unemployment would be ambiguous.

In our model, the number of illegal foreign workers is determined endogenously by (4), so there is no difference between the effects of introducing more legal foreign workers and those of legitimizing illegal workers who are already in the host country.

We now assert the following proposition.

**Proposition 1**

(i) In Case 1, in which illegal foreign workers who are complementary to the native workers are well controlled and are all employed in Department 2 along with native workers, adopting a stricter border or internal enforcement policy that excludes illegal foreign workers may be the optimal policy for native workers because it results in a higher level of employment for them, larger wages in both departments and greater unemployment allowances.

(ii) Although legal foreign workers are substitutable for native workers, increasing their numbers may have the effect of reducing total unemployment among the natives.

#### 4. Case 2: The number of illegal workers cannot be controlled

We consider the case where the flood of illegal foreign workers is so powerful that any preventative policies, such as border enforcement, cannot control their inflow to the host country. Provided condition (3) holds, the number of illegal foreign workers increases and all of the workers in Department 2 will be illegal foreigners. If the government of the host country intends to detect and deport illegal immigrants, all it has to do is arrest all the workers in Department 2. However, more illegal immigration will immediately occur and the government's efforts at internal enforcement will therefore be in vain. Then the government will renounce policies preventing illegal foreign workers, and as a result we will have the following two conditions in the labour market instead of (2):

$$w_1 - t = \bar{w} + \frac{g_1}{Np_1}, \quad (18)$$

$$w_2^* = \bar{w}^* + \frac{g_2}{Np_2}. \quad (19)$$

Both native workers and legal foreign workers are either employed in Department 1 or unemployed. As in case 1, the law of probability determines who will be employed. Then we have following four equations:

$$L_1^0 + L_1^M = L_1, \quad (20)$$

$$L_1^M + L_U^M = L^M, \quad (21)$$

$$L_1^0 + L_U^0 = L^0, \quad (22)$$

$$L_1^0 = \frac{L^0}{L^0 + L^1} L_1. \quad (23)$$

Concerning the unemployment allowance, we similarly have

$$\bar{w} = \frac{t(L_1^0 + L_1^M)}{L_U^0 + L_U^M}. \quad (24)$$

Illegal foreign workers try to immigrate until their expected income in the host country should be equal to that in the home country. Therefore, we also have

$$w_2^* L_2 / L^I = \bar{w}^*, \quad (25)$$

where  $L^I > L_2$  and some illegal foreign workers are unemployed and their incomes are assumed to be zero.

Finally, from the profit-maximizing tendency of firms under perfect competition, we have

$$F_L^1 = w_1, \quad (26)$$

$$F_L^2 = w_2^*. \quad (27)$$

Additionally, in case 2 there is no exploitation by employers employing illegal foreign workers.

Now we have 10 equations, (17)–(26). If  $t, g_1, g_2, N, L_M, p_1, p_2$ , and  $\bar{w}^*$  are exogenously given, then ten unknowns  $w_1, w_2^*, \bar{w}, L_1^0, L_U^0, L_1^M, L_U^M, L_1, L_2$ , and  $L^I$  will be determined endogenously.

#### 4.1 An increase in the probability of detection

The effects of an increase in  $p_i$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dp_1} > 0, \frac{dL_U^0}{dp_1} < 0, \frac{dw_1}{dp_1} < 0, \frac{d\bar{w}}{dp_1} > 0, \quad (28)$$

$$\frac{dL_1^0}{dp_2} = 0, \frac{dL_U^0}{dp_2} = 0, \frac{dw_1}{dp_2} = 0, \frac{d\bar{w}}{dp_2} = 0. \quad (29)$$

An increase in the probability of the detection of shirking workers in Department 1 will reduce the wage rate and expand total employment in the department. The number of unemployed workers decreases and unemployed allowances increase. This conclusion is similar to that of Case 1. However, in Department 2 there are no employed native workers and therefore an increase in the probability of detection does not affect native workers.

#### 4.2 An increase in income tax

The effects of an increase in  $t$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dt} < 0, \frac{dL_U^0}{dt} > 0, \frac{dw_1}{dt} > 0, \frac{d\bar{w}}{dt} > < 0 \quad (30)$$

An increase in income tax should increase the wage rate in Department 1 to maintain the real incomes of the workers and, therefore, should reduce the number employed in the department. Because of an increased number of unemployed native workers, per-capita unemployment allowances do not always increase. These results are also similar to those of Case 1.

#### 4.3 An increase in the inflow of legal foreign worker

The effects of an increase in  $L^M$  on the employment and wage rate of native workers are as follows:

$$\frac{dL_1^0}{dL^M} > < 0, \frac{dL_U^0}{dL^M} > < 0, \frac{dw_1}{dL^M} < 0, \frac{d\bar{w}}{dL^M} < 0. \quad (31)$$

By increasing the number of legal foreign workers, who are substitutable for native workers, the opportunity of employment for native workers decreases. On the other hand,

an increased total supply of workers causes greater employment and smaller unemployment allowances than before. Therefore, we cannot predict whether the number of employed native workers in Department 1 will increase or not, as in Case 1. However, as native workers are never employed in Department 2, it is ambiguous whether the number of unemployed native workers decreases or not. Conversely, adopting a policy of excluding legal foreign workers has an effect on both the wage rates and unemployment allowances of native workers and, moreover, there is still the possibility of reducing the unemployment of native workers. A decrease in the inflow of legal foreign workers is profitable for native workers, which differs from Case 1.

As analysed above, the optimal policy for native workers in Case 2 is to restrict the number of legal foreign workers,  $L^M$ , and the second-best policy is one of stricter detection of shirking workers. The former policy, at least, guarantees higher wages and unemployment allowances and, moreover, it may result in greater employment. Adopting the latter policy is beneficial to unemployed workers because it expands the opportunity for employment and increases unemployment allowances.

We now assert the following proposition.

### **Proposition 2**

(i) In case 2, in which illegal foreign workers, who are complementary to native workers, are free to immigrate, the optimal policy for native workers is to restrict legal foreign workers who are substitutable for native workers.

(ii) With regard to the income redistribution policy, more strictly detecting shirking workers in Department 1 is also preferable.

## **5. Concluding Remarks**

We conclude that introducing foreign workers who are complementary to native workers should be made illegal because of their harmful influence. In the case where some illegal foreign workers are employed in Department 2 along with native workers, the optimal policy to accomplish greater employment, wage rates, and unemployment allowances is to restrict illegal foreign workers by introducing or strengthening border or internal enforcement policies. On the other hand, legal foreign workers, who are substitutable for native workers, should be introduced to reduce the total number of unemployed native workers. This conclusion seems to be paradoxical because legal foreign workers are usually welcomed by developed countries, but with illegal workers, precautions are usually taken because of their competitive ability.

However, once restrictive policies become unworkable and illegal foreign workers can migrate freely, all the jobs in Department 2 will be occupied by illegal workers. In this case, the optimal policy of the host country is to restrict legal foreign workers.

There are issues for further study. Firstly, we assume international capital mobility, and, therefore, we do not consider the economic welfare of native capital owners. It may be worthwhile to investigate the case without international capital mobility. Secondly, instead of a one-good model, the extension to two goods (one of which is non-tradable),

similar to that of River-Batiz (1982), should be studied. Thirdly, instead of using an efficiency wage model, the reason why the wage rates for illegal foreign workers are smaller than those for natives may be attributed to the penalty fines that employers must pay if the illegal workers are detected by the government. Fourthly, there are some limitations in the static model we adopt, so an approach, similar to that of Carter (1999), of introducing a dynamic programming model should be useful for considering the possibility of a worker's losing one job and finding another.

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## Notes

<sup>1</sup> It may be more realistic to assume that the wage rate in the home country is related to the number of emigrants. To simplify our analysis, we assume that the home country is large enough to permit the assumption that  $\bar{w}^*$  is constant and independent of  $L^M$  and  $L^I$ .

<sup>2</sup> We assume that one good is produced in the two departments, so the following two equations should be satisfied:

$$\begin{aligned} a_{L1}(w_1/r_1)w_1 + a_{K1}(w_1/r_1)r_1 &= 1, \\ a_{L2}(w_2/r_2)w_2 + a_{K2}(w_2/r_2)r_2 &= 1. \end{aligned}$$

From (2), we obtain  $w_i$  and, by the free movement of capital,  $r_i$  should be fixed. Making use of the production functions,  $L_i$  will be obtained.



<sup>3</sup> In our model, we can conclude that  $\frac{d(w_2 - \bar{w})}{dt} < 0$ , namely, the economic advantage of being employed in Department 2 rather than being unemployed decreases as the income tax rate increases. We ignore the possibility of workers in either department changing jobs. However, if we assume that  $N$  is sufficiently small, and if we assume that unemployed workers have more chance of being employed in Department 1 than workers employed in Department 2, then the disadvantage of being unemployed should be less for a native worker.

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