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Temporary and Permanent Immigration under Unionization

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Abstract

This paper investigates permanent and temporary immigration and remittance under the coexistence of unionized and non-unionized manufacturing firms in a two-sector economy. The impacts of immigration as well as remittance on respectively wages, employment, the union-nonunion wage gap and national welfare are analyzed. It is found that permanent immigration brings positive effects on most variables (except the competitive wage), but enlarges the wage gap and causes income redistribution. The effects of temporary immigration diverge depending on which sector immigrants are allowed to work in and which good is remitted more heavily. In particular, if temporary immigrants work in manufacturing only, then all wages and the union-nonunion wage gap fall.

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1. Introduction

Despite of being an integral part of globalization, immigration is viewed negatively in public opinion. Often when related issues appear in the media, they are about illegal immigration, or some other negative images such as taking jobs away and depressing wages, etc. It seems the imperfections in the labor market, such as unionization, also serve to create the negative images. For instance, it is alleged that, “mass immigration helps employers and hurts workers, and unions flourish when immigration is low and they flounder when immigration is high.” There are also cries that the AFL-CIO has abandoned American workers, because the Executive Council of the AFL-CIO in February 2000 announced a reversal in its posture on immigration, by proclaiming that it now “proudly stands on the side of immigrant workers”(Salt Lake Union Tribune, September 3, 2001). While before that, the AFL-CIO had sought to protect wages of native-born workers by excluding immigrants. However, by making immigrants more vulnerable, such sanctions also helped put pressure on the wages of native-born workers.

In Japan, due to the aging population and the young generation’s tendency to have fewer kids, labor shortage especially in agriculture and heavy manual work is becoming a problem. Already small numbers of seasonal foreign workers are being introduced. Sooner or later more lenient immigration policies like those in Europe may have to be adopted.

Despite the importance of labor market imperfections on immigration issues, theoretical research has been rare. Recently, Schmidt, Stilz and Zimmermann (1994) and Fuest and Thum (2001) analyze immigration in unionized markets, focusing on skill differences. They demonstrate that immigration can be beneficial to the host country due to the complementarity of unskilled immigrants to skilled natives. Fuest and Thum (2000) study the welfare effects of immigration, and show that immigration is beneficial if the wage elasticity of labor demand in the competitive sectors is smaller than in the unionized sectors.

The present paper is closely related to the above, but adopts a different structure and with a different focus. We analyze immigration in a two-sector, host-country economy, by allowing immigration to be permanent and temporary, and incorporating the activities of labor unions. While permanent immigrants are treated identically as residents in the host country and can become union members, temporary immigrants work on contracts and must return to their home countries when their contracts expire. As such, they can only work in the contracted firms and are ineligible to become members of labor unions, even if the contracted firms have unions. Temporary immigrants also remit earnings back to their home countries, which can be done in either or both goods.

Specifically, we consider a host-country economy consisting of two sectors: manufacturing and agriculture. While there is perfect competition in agriculture, the manufacturing sector is characterized by mixed oligopoly – some firms are unionized while others are not, and all firms engage in oligopolistic competition. We investigate the impacts of immigration and remittance on respectively wages, employment, the union-nonunion wage gap and national welfare, and find that an increase in permanent immigration brings positive effects on these variables (except the competitive wage), and raises the wage gap. That is, while permanent immigration increases the welfare of the whole nation, it also causes income redistribution, benefiting relatively the labor unions and landowners, and hurting those receiving the competitive wage. Similar effects are obtained if temporary immigrants can only work in agriculture.

In contrast, if temporary immigrants can only work in manufacturing, then an increase in immigration reduces the competitive wage, the union wage and employment. The union utility falls and the union-nonunion wage gap narrows. Workers become more equally paid but poorer, while firms and landowners become better off. It is perhaps these consequences and the

income redistribution effect of immigration, which cause the media to paint a negative picture of immigration.

Somewhat surprisingly, we also find that an increase in permanent immigration raises union utility, because the positive employment effect dominates possible negative wage effects. Thus, contrary to conventional wisdom, labor unions may gain from immigration. These findings seem to be consistent with the experiences in North America, Australia and Europe, which have recognized the positive effects of immigration on national welfare also and adopted constructive immigration policies.

There is voluminous literature on the impacts of immigration on the host and source countries. In the absence of labor unions, for instance, Either (1985) models immigration and trade; Brecher and Choudhri (1987) investigate the relation between migration and foreign investment; Djajic (1986) and McCormick and Wahba (2000) incorporate the effects of remittance on the source country, while Kondoh (1999) analyzes those on the host country; and Chao and Yu (2002) study the skill difference of migrants under imperfect competition. For studies related to illegal immigration, see Bond and Chen (1987), Djajic (1987), Either (1986), and Tawada and Hiraiwa (2003).

In our model, the unionized sector is assumed to be oligopolistic so that there are positive rents to be split between labor and management. We differentiate between temporary and permanent immigration, and analyze the effects of remittance. The coexistence of unionized and non-unionized firms in manufacturing and the distinction between temporary and permanent immigration present several interesting possibilities that are closer to real world scenarios. Another novelty of the present paper is that both goods can be remitted at the same time under temporary immigration. In the literature, remittance is conducted in only one good, while the other good is assumed to be non-tradable (see for instance, Kondoh, 1999). The

present setup allows us to obtain results that are more detailed and complement those in the literature, which hopefully can help to shed light on future immigration policies.

The rest of the paper is organized as follows. Section 2 sets up the basic model. Section 3 investigates permanent immigration. Section 4 studies temporary immigration in agriculture. Section 5 looks into the case of temporary immigration in manufacturing. And section 6 compares all the cases and provides some concluding remarks.

2. Basic Model Setup

2.1 Consumers

Consider a host-country economy consisting of two sectors: Manufacturing (x) and Agriculture (y), with y as the numeraire good. While perfect competition prevails in agriculture, manufacturing is characterized by Cournot-Nash competition of a fixed number of n firms. We assume that a typical consumer maximizes the following homothetic utility function,

$$\mu = C_x^\alpha C_y^{1-\alpha}, \quad (1)$$

where C_x and C_y are respectively the domestic consumption of goods x and y , and α is a positive constant. Utility maximization subject to the standard budget constraint yields the following inverse demand function,

$$p(C_x, C_y) = \frac{\alpha}{(1-\alpha)} \frac{C_y}{C_x}. \quad (2)$$

We assume that the host country is import competing in manufacturing, that is, it imports good x and exports good y . The host country is small and takes world price as given. However, it imposes a quota, q , on foreign imports. The choice of a quota instead of a tariff is

based on the simplifying assumption that labor is the only factor of production in manufacturing and that this sector is imperfectly competitive. As is well known that under a non-prohibitive tariff, the market power of the domestic firm disappears and there is no rents left for the union to bargain over with management. Another justification for this assumption might be that under the WTO system, while tariffs are on the decrease, non-tariff barriers still exist in various forms, which limit the volume of trade.

To maintain balanced trade, the following must be satisfied

$$C_x = x + q, \quad C_y = y - p^* q, \quad (3)$$

where x and y denote the total outputs of respectively manufacturing and agriculture produced in the host country, and p^* is the world price.

2.2 Agriculture

In agriculture, the production of good y uses labor and land.

$$y = y(L_y, T), \quad (4)$$

where y is output, L_y and T are inputs of labor and land respectively. Perfect competition prevails in this sector. The profit function of a typical perfectly competitive firm is:

$$\pi^y = y - w_0 L_y - rT. \quad (5)$$

where w_0 is the competitive wage paid to workers in agriculture, and r is the rental to land.

Labor is hired until the following condition is satisfied:

$$w_0 = y_1(L_y, T). \quad (6)$$

2.3 Manufacturing

This sector is characterized by mixed oligopoly. There are n oligopolistically competitive firms, m of which are unionized, and the rest, $n-m$, are non-unionized. The number of each type of firms is exogenous. In a typical unionized firm, employment and wages are determined by negotiation. All firms behave as Cournot-Nash oligopolists and take the actions of their competitors as given.

The production of good x uses labor only. The production function of a typical manufacturing firm i is:

$$x^i = L_x^i, \quad (7)$$

where x^i is output, and L_x^i is the labor input in manufacturing.

A typical non-unionized firm maximizes profits and pays its workers the reservation wage, w_0 . Its profit function can be written as

$$\pi_0^j = (p - w_0)L_0^j. \quad (8)$$

where the superscript j indexes non-unionized firm j . All $n-m$ non-unionized firms maximize profits in a Cournot fashion, which results in the following first order conditions:

$$w_0 = p + p_1 L_0^j, \quad (9)$$

where $p_1 = \frac{\partial p}{\partial L_0^j} = -\frac{p}{C_x}$.

In contrast, the profit function of a typical unionized firm k is:

$$\pi_u^k = (p - w^k)L_u^k, \quad (10)$$

where w^k is the wage paid to union members in firm k , and L_u^k is the union employment. In a unionized firm, all domestic workers join in the union. In other words, the unionized firm does not hire non-unionized domestic workers. For instance, most unionized firms in Japan only hire non-unionized workers as part-timers, not regular employees.

A typical union k , has a Stone-Geary type utility function (see Calvo, 1978, and Mezzetti and Dinopoulos, 1991):

$$u^k(w^k, L_u^k) = (w^k - w_0)L_u^k. \quad (11)$$

Thus, the union is interested in employment as well as a union wage premium above the competitive wage.

The wages and employment in unionized firms are determined through negotiations. The solution concept we adopt is Nash bargaining. The union and the firm jointly maximize the following Nash product, choosing employment and wages:

$$G(L_u^k, w^k) = \pi_u^k u^k. \quad (12)$$

The equilibrium satisfies the following first order conditions:

$$2(p - w^k) + L_u^k p_1 = 0, \quad (13a)$$

$$p - 2w^k + w_0 = 0, \quad (13b)$$

where $p_1 = \frac{\partial p}{\partial L_u^k} = -\frac{p}{C_x}$. In equilibrium, we seek a symmetric solution. That is, we assume all the non-unionized firms are identical, and the same applies to all the unionized firms. Thus, each non-unionized firm in manufacturing employs $L_0^j = L_0$ of labor and pays the competitive wage w_0 , while each unionized firm employs $L_u^k = L_u$ of labor and pays the union wage $w^k = w$.

And finally, there is full employment and full mobility of labor among non-unionized firms between the two sectors:

$$L_y + \sum_m L_u + \sum_{n-m} L_0 = L, \quad (14)$$

where $\sum_m L_u + \sum_{n-m} L_0 = L_x$ is the total employment in manufacturing.

Combining conditions (9), (13a) and (13b), we obtain

$$L_0 = L_u, \quad (15)$$

which says that in equilibrium, a unionized firm and a non-unionized firm employs identical number of workers. This arises because the union utility function in (11) implies that the union is not biased toward either employment or wage premium. Hence unionization does not cause employment distortion in this model (see the neutral union case in Zhao, 2001). The firm and the union negotiate to maximize the profits by choosing employment first, and then divide the realized profits by choosing a wage jointly, as shown in (13a) and (13b).

Equations (6), (9), (13a), (13b) and (14) determine the five endogenous variables of the model, L_y , L_0 , L_u , w and w_0 . This completes the setup of the basic model. In the next sections, we shall conduct comparative statics studies on L_y , L_u , w , and w_0 .

3. Permanent Immigration

We first investigate the case of permanent immigration, under which immigrants are treated identically with home workers in the host country. Immigrants can work in both sectors, and can become union members if they work in manufacturing. Let L_M denote the total number of immigrants. Under permanent immigration, using (15), condition (14) becomes

$$L_y + L_x = L + L_M . \quad (14')$$

where $L_x = nL_u = mL_u + (n - m)L_0$.

By total differentiation, we derive the following comparative statics results (see Appendix 1 for detailed calculations): $\frac{dL_x}{dL_M} > 0$, $\frac{dL_y}{dL_M} > 0$, and $\frac{dw_0}{dL_M} < 0$. While the sign of $\frac{dw}{dL_M}$ is ambiguous, the union wage premium over the competitive wage increases, i.e.,

$$\frac{d(w - w_0)}{dL_M} = \frac{pL_u}{\Delta} \left\{ \frac{py_1}{C_y} - \frac{(A - C_x)y_{11}}{C_x} \right\} > 0 \quad (16)$$

Thus, we can establish

Proposition 1: *Under permanent immigration, an increase in immigration raises employment in both sectors and the union wage gap over the competitive wage, but reduces the competitive wage.*

The effects of immigration on the competitive wage and employment in each sector are as expected. In general, it is unclear if immigration raises or reduces the union wage, because the union wage is affected in three ways. The first is that an increase in permanent immigration causes a reduction in the marginal product of labor in agriculture. In turn the competitive wage decreases, putting downward pressure on the union wage; The second comes from the increase in manufacturing output, reducing the relative price; The third is that the output of agriculture increases, raising the relative price. However, as shown in (a5) in appendix 1, if $y_{11} \approx 0$, i.e., if the marginal product of agricultural labor y_1 does not fall too fast, then an increase in immigration raises the union wage. This could arise, for instance, in countries richly endowed with land such as Australia, Canada and the US. In any case, even if the union wage decreases, the decrease in the competitive wage outweighs it, leading to a widening of the union-nonunion wage gap. Thus, permanent immigration causes income redistribution, relatively benefiting the union members while hurting those earning the competitive wage. As a consequence, landowners also gain.

Using Appendix 1, the impact on union utility of immigration can be obtained as

$$\begin{aligned} \frac{du}{dL_M} &= \left(\frac{dw}{dL_M} - \frac{dw_0}{dL_M} \right) L_u + (w - w_0) \frac{dL_u}{dL_M} \\ &= \frac{pL_u}{\Delta} \left\{ \frac{py_1}{C_y} - \frac{(A - C_x)y_{11}}{C_x} \right\} + (w - w_0) \frac{dL_u}{dL_M} > 0 \end{aligned} \tag{17}$$

Condition (17) follows naturally from proposition 1, stating that a rise in permanent immigration leads to increases in union employment and the union wage premium over the competitive wage, resulting in higher utility for the union.

Similarly, the effects on profits are

$$\begin{aligned}\frac{d\pi}{dL_M} &= (p - w + L_u p_1) \frac{dL_u}{dL_M} + L_u \left(p_2 \frac{dL_y}{dL_M} - \frac{dw}{dL_M} \right) \\ &= \frac{y_{11}}{\Delta} \{ 2(p - w) + \frac{p_1 L_u}{C_x} (3C_x - 2nL_u) \} + \frac{p_2}{\Delta C_x} (C_x - nL_u) \{ 2(p - w) - p_1 L_u \} > 0\end{aligned}\tag{18}$$

To investigate the impact of immigration on national welfare, let us define the indirect utility function as

$$v \equiv v(p, I),\tag{19}$$

where $I = px + y$ is national income. From (2) and (3), total differentiation of (19) yields

$-v_1 / v_2 = C_x$, using which we derive:

$$\begin{aligned}\frac{dv}{dL_M} &= \frac{v_1 dp}{dL_M} + v_2 \left(\frac{C_x dp}{dL_M} + \frac{pdx}{dL_M} + \frac{dy}{dL_M} \right) \\ &= \frac{v_2}{\Delta} \left(\frac{pdx}{dL_M} + \frac{dy}{dL_M} \right) > 0\end{aligned}\tag{20}$$

Summarizing the above, we establish

Proposition 2: *An increase in permanent immigration raises the utility of the union, the profits of the manufacturing firms and national welfare.*

Under labor market imperfections such as unionization in some manufacturing firms, permanent immigration unambiguously benefits the host country. Even though the competitive wage decreases, the combined effect of increased output and employment more than offsets the loss in wages. As a result, union utility, firm profits and national welfare all increase. Only those earning the competitive wage lose. The experiences in America, Australia and Europe seem to have provided justification to this result.

4. Temporary Immigration into Agriculture

In this case, foreign workers sign short-term contracts to work in agriculture only. And upon completion of their contracts, they must return to their home countries. They are ineligible to become members of labor unions in the host country because they are on short-term contracts and work in agriculture only. An example is that farms in the U.S. employ temporary Mexican workers during busy seasons.

Because temporary immigrants return to their home countries after the contract is finished, their income is excluded from the national income of the host country; that is, under temporary immigration in agriculture, the national income of the host country becomes

$$I_y = npL_u + y - w_0L_M . \quad (21)$$

4.1 Remittance

Under temporary immigration, an immigrant worker sends a fraction of the earnings back to the source (home) country, and consumes the other fraction in the host country. Remittance can be done in either good x or good y , or a combination of them. Suppose each

immigrant worker sends back home respectively θ units of good x and γ units of good y . Since good y is the numeraire, wages are expressed in units of good y , which implies

$$p\theta + \gamma \leq w_0 \leq p, \quad (22)$$

i.e., the worker cannot remit more than the net earnings, and the competitive wage cannot exceed the price of good x . Then using (3), the demand function in (2) can be rewritten as

$$p(x, y) = \frac{\alpha}{1-\alpha} \frac{y(L_y) - p^* q - \gamma L_M}{x + q - \theta L_M} \equiv \frac{\alpha}{1-\alpha} \frac{Y}{X}, \quad (23)$$

where $Y = y(L_y) - p^* q - \gamma L_M$, and $X = x + q - \theta L_M$. The terms θL_M and γL_M indicate respectively the total amounts of good x and good y the temporary workers remit.

Partial differentiation of (23) gives rise to

$$\frac{\partial p}{\partial \theta} = \frac{p L_M}{X} > 0, \quad (24a)$$

$$\frac{\partial p}{\partial \gamma} = -\frac{p L_M}{Y} < 0, \quad (24b)$$

$$\frac{\partial p}{\partial L_M} = \left(\frac{\theta}{X} - \frac{\gamma}{Y} \right) p. \quad (24c)$$

Condition (24a) says that an increase in the amount of good x remitted raises the relative price of good x , while condition (24b) states that an increase in the amount of good y remitted reduces the relative price of good x . And condition (24c) implies that if the ratio of remittance to net consumption in the host country is higher (lower) for good x than for good y , then an

increase in immigration raises (reduces) the relative price of good x . In the extreme case when only good x is remitted, an increase in immigration always raises the relative price. The opposite arises if only good y is remitted.

Under temporary immigration into agriculture, labor-management bargaining in manufacturing is affected not directly, but only indirectly through adjustments in the labor market, i.e., the full employment condition (14'), and the competitive wage in (6). It follows that under temporary immigration into agriculture, the endogenous variables L_y , L_u , w , and w_0 are determined by equations (6), (13a), (13b) and (14'), with the inverse demand function given by (23).

The detailed comparative statics calculations of the effects of immigration and remittance are reported in Appendix 2, from which we can establish:

Proposition 3: *Under temporary immigration in agriculture, (i) an increase in immigration reduces the competitive wage, but raises the intersectoral wage gap if remittances are done in the same ratio in both goods. It also raises the union employment and total employment in both sectors. National welfare increases if immigration does not cause large changes to domestic prices; (ii) an increase in manufacturing remittance raises wages in both sectors, the utility of the union and employment in manufacturing, but reduces employment in agriculture; (iii) an increase in agricultural remittance has completely opposite effects to (ii); (iv) an increase in the remittance of either good reduces national welfare.*

Now we provide some intuition for proposition 3. Part (i) is similar to permanent immigration. When temporary immigrants can only work in agriculture, domestic workers will

migrate to manufacturing to clear the labor market (see Filer, 1992, for empirical evidence). And if remittance does not distort domestic prices by too much, then the effects are close to permanent immigration, under which national welfare rises.

In part (ii), an increase in remittance across borders causes several distortions. For instance, production of the remitted good must increase, which implies that available resources devoted to the production of the other good must fall. When manufacturing remittance goes up, this sector gains in terms of wages and employment, while the output of agriculture falls and the competitive wage rises. As a consequence, landowners also lose. In part (iii), if agriculture remittance increases, then the opposite to part (ii) arises. And finally, part (iv) says that as remittance increases, national income falls, which reduces national welfare.

The implications of proposition 3 are: (i). If there are sufficient adjustments in the labor market, then both permanent and temporary immigration in agriculture causes identical effects on employment, wages and the intersectoral wage gap. (ii). Remittance of temporary immigrants could distort domestic prices and wages, which gives rise to further changes in the incomes of factor (land) owners.

5. Temporary Immigration into Manufacturing and Remittance

In this case, foreign workers sign short-term contracts to work in manufacturing only. Being on short-term contracts, they cannot become members of labor unions in the host country. And upon completion of the short-term contracts, they must return to their home countries. An example is that Chinese workers were hired for construction in Nagano, Japan, before the Nagano Winter Olympics in 1998. Zimmermann (1995) shows that in Europe, guest workers are more likely to work in construction and manufacturing. Again, temporary immigrant workers remit a portion of their wage earnings back to their home countries.

Let the number of temporary, contractual foreign workers in a typical firm be L_m . Because there are n firms in manufacturing, the total number of immigrants is $L_M = nL_m$, and the employment conditions in (14') becomes

$$L_y + L_x = L + nL_m. \quad (25)$$

Accordingly, a typical unionized firm hires L_u of union members and L_m of immigrant workers. And with remittance considered, the inverse demand function becomes

$$p(x, y) = \frac{\alpha}{1-\alpha} \frac{y(L_y) - p^* q - n\gamma L_m}{\sum_n (L_u + L_m) + q - n\theta L_m} \equiv \frac{\alpha}{1-\alpha} \frac{Y}{X}, \quad (26)$$

where $n\theta L_m$ and $n\gamma L_m$ indicate respectively the total amounts of good x and good y the temporary workers remit back to their home countries.

We continue to assume that the unionized firm does not hire non-unionized domestic workers. However, it hires temporary immigrant workers on short-term contracts, who return to their home countries when the contracts are finished.¹ The union members receive the union wage w , while the immigrant workers receive the competitive wage w_0 . It follows that the profit function of a typical unionized firm becomes

$$\tilde{\pi}(L_u, w) = (p - w)L_u + (p - w_0)L_m. \quad (27)$$

When a unionized firm also hires temporary immigrant workers, then the payoff at the threat point changes for the firm, but not for the union. If bargaining breaks down, the union

¹ Here the crucial difference is that immigrants are guest workers, whom the firm can refuse to rehire, whereas domestic workers cannot subject to such 'discrimination'. Thus the firm rather chooses to hire 'foreigners'.

still obtains zero employment and zero wages, but the firm now employs immigrant workers on short-term contracts. In this case, the firm's profit (threat-point payoff) becomes

$$\tilde{\pi}_0(L_m, w_0) = (p_0 - w_0)L_m, \quad (28)$$

where p_0 ($> p$) is the price if bargaining breaks down, i.e., if only immigrant workers are hired in the unionized firms. p_0 can be obtained by substituting $L_u = 0$ into (26). Because temporary immigrants are on short-term contracts, the firm does not re-choose the number of immigrant workers to hire if bargaining with the union breaks down; that is, the firm employs the same number of temporary immigrant workers regardless bargaining breaks down or not. However, the price of good x rises to p_0 because output is lower at the threat point. Thus, $\tilde{\pi}_0$ can be treated as a constant from now on.

As such, the Nash product in (12) can be rewritten as

$$\tilde{G}(L_u, w) = (\tilde{\pi} - \tilde{\pi}_0)u, \quad (29)$$

where $\tilde{\pi} - \tilde{\pi}_0$ is the firm's net gain from the bargaining game.

Maximizing (29) with respect to L_u and w gives rise to the following first order conditions:

$$2(p - w) + (L_u + L_m)p_1 + (p - p_0)L_m / L_u = 0, \quad (30a)$$

$$(p - 2w + w_0) + (p - p_0)L_m / L_u = 0. \quad (30b)$$

If temporary immigrants work only in manufacturing, in which some firms are unionized, then interesting consequences arise. To see this, we compare conditions (30a) and

(30b) with (13a) and (13b). The former two equations contain extra terms, which are negative. This implies, union wages and employment both are driven down by temporary immigrant employment in manufacturing. This arises because firms hire a positive number of immigrant workers even if bargaining with the unions break down, which improves the threat-point payoff of the firms and puts them in a stronger bargaining position.

Under temporary immigration in manufacturing, the national income of the host country becomes

$$I_x = (L_u + L_m)np + y - w_0 n L_m. \quad (31)$$

And the corresponding national welfare can be obtained by substituting (31) into (19).

It follows that under temporary migration into manufacturing, the endogenous variables L_y , L_u , w , and w_0 are determined by equations (6), (30a), (30b) and (25), with the inverse demand function given by (26). The detailed comparative statics calculus is reported in Appendix 3, from which we can establish:

Proposition 4: *Under temporary immigration in manufacturing only, (i) an increase in immigration raises employment in agriculture but reduces the competitive wage. It also reduces the union wage and employment, and the union-nonunion wage gap. National welfare increases if the unionized firm employs more temporary immigrants than union workers; (ii) an increase in manufacturing remittance raises union employment and the competitive wage, but reduces employment in agriculture; (iii) an increase in agricultural remittance raises agricultural employment but reduces union employment and the competitive wage; (iv) an increase in*

remittance could either reduce or raise national welfare, depending on which good is remitted and whether the unionized firm employs more temporary immigrants than union workers.

The intuition for proposition 4 is in order. Part (i) says that when temporary immigrants can only work in manufacturing, domestic workers will migrate to agriculture to clear the labor market, which leads to decreases in the competitive wage and increases in agricultural output. Immigration also puts downward pressure on the union wage and employment, narrowing the union-nonunion wage gap. This arises in two channels. One is the fall of the competitive wage, and the other is the improvement of the unionized firm's threat-point payoff, which leaves the union in a weaker bargaining position. The former is dominated by the latter.

In part (ii), when there is an increase in manufacturing remittance, employment in this sector rises, while the output of agriculture falls and the competitive wage rises. As a consequence, landowners also lose. In part (iii), if agriculture remittance increases, then the opposite to part (ii) arises. And finally, part (iv) includes several cases. Suppose the manufacturing good is remitted. As remittance increases, national income falls (rises) if the unionized firm employs more (less) temporary immigrants than union workers, which reduces (raises) national welfare. The opposite arises if the agriculture good is remitted.

Similar to proposition 3, proposition 4 also implies that the remittance of temporary immigrants could distort domestic prices and wages, leading to further changes in the incomes of factor (land) owners. More importantly, temporary immigration in manufacturing reduces not only all wages, but also the union-nonunion wage gap. That is, workers become more equally paid, but poorer. Nonetheless, national welfare increases if the unionized firm employs more temporary immigrants than union workers, in which case the increase in output and profits offsets the fall in wages.

6. Concluding Remarks

We have investigated cases of permanent and temporary immigration, with some firms unionized and others non-unionized in manufacturing. Under temporary immigration, immigrants sign short-term contracts to work in either agriculture or manufacturing. They also remit a fraction of their income home. The different effects of immigration and remittance are summarized in Table 1. As detailed in the appendices, circled signs are obtained conditionally. We hope these results could help to explain the experience in North America, Australia and Europe,² to shed light on the negative images of immigration in the media, and most importantly to provide some guidance to immigration policy in other host countries.

From Table 1, the following conclusions can be drawn. (i) Permanent immigration increases outputs in both sectors, the utility of the union and national welfare, but decrease the competitive wage. It also increases the union-nonunion wage gap and causes income redistribution. (ii) Under temporary immigration, consequences are very different depending on which sector immigrants are allowed to work in. If they can only work in agriculture, then employment in both sectors increase and the union-nonunion wage gap may also increase, but the competitive wage decreases; if they can only work in manufacturing, then agricultural employment increases while union employment decreases. The union-nonunion wage gap narrows, because while the competitive wage falls, the union wage falls even harder. Furthermore, the utility of the union also decreases. (iii) Regardless of which good is remitted, an increase in remittance raises output (employment) in the remitted good and reduces that in

² Two recent books present contrasting current immigration conditions in Europe and the U.S. (see Borjas, 1999; Boeri, Hanson and McCormick, 2002).

the other good. (iv) National welfare increases under permanent immigration, and under temporary immigration conditionally.

Often the wage is higher in the host country than in the source country, sometimes substantially higher. When introducing temporary immigration, the host country government could adopt some policy to tax the earnings of immigrants. Adequate policies increase the earnings of the immigrants as well as the welfare of the host country, and help to create positive images of immigration in the media.

It is argued that in countries with stricter immigration rules, immigrants are 'segregated' to the service sector, such as restaurants, ethnic grocery, babysitting, etc., in which the services of immigrants are usually non-traded. The present model can be extended to cover such a non-traded goods sector. For instance, suppose sector X produces non-tradable services instead of manufacturing, then the import quota q becomes zero. Because non-tradable goods cannot be remitted, the parameter θ also becomes zero. These can be readily incorporated and become a special case in our model. One can immediately see that remittance (done only in the other good) will change domestic prices, which will have additional impacts on other variables. These can be calculated straightforwardly using our model.

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Appendix 1

This appendix deals with the case of permanent migration. Totally differentiating (13a), (13b), (6) and (14'), using inverse demand (2), yields the following matrix.

$$\begin{pmatrix} -\frac{p}{C_x} & 1 & -2 & \frac{py_1}{C_y} \\ -\frac{(A+C_x)p}{C_x} & 0 & -2C_x & \frac{Apy_1}{C_y} \\ 0 & 1 & 0 & -y_{11} \\ 1 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} dL_u \\ dw_0 \\ dw \\ dL_y \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 1 \end{pmatrix} dL_M$$

where $A = 2C_x - L_u > 0$. The determinant of this matrix is

$$\Delta = -2C_x y_{11} + 2p \left\{ \frac{A}{C_x} + \frac{y_1(A - C_x)}{C_y} \right\}, \quad (\text{a1})$$

which is positive provided $A - C_x = C_x - L_u \geq 0$. A sufficient condition for this is: $q \geq \theta L_M$,

which is satisfied by the assumption that the host country is a net importer of good x .

Straightforward calculations yield:

$$\Delta \frac{dL_u}{dL_M} = -2C_x y_{11} + \frac{2py_1}{C_y} (A - C_x) > 0, \quad (\text{a2})$$

$$\Delta \frac{dw_0}{dL_M} = \frac{2Apy_{11}}{C_x} < 0, \quad (\text{a3})$$

$$\Delta \frac{dL_y}{dL_M} = \frac{2Ap}{C_x} > 0, \quad (\text{a4})$$

$$\Delta \frac{dw}{dL_M} = p \left\{ \frac{(A + C_x)y_{11}}{C_x} + \frac{py_1}{C_y} \right\}. \quad (\text{a5})$$

Appendix 2

This appendix deals with the case of temporary immigration in agriculture only. Totally differentiating (13a), (13b), (6) and (14'), using demand function (22), yields the following matrix.

$$\begin{pmatrix} \frac{-p}{X} & 1 & -2 & \frac{py_1}{Y} \\ -\frac{(A'+X)p}{X} & 0 & -2X & \frac{A'py_1}{Y} \\ 0 & 1 & 0 & -y_{11} \\ 1 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} dL_u \\ dw_0 \\ dw \\ dL_y \end{pmatrix} = \frac{pL_M}{Y} \begin{pmatrix} 1 \\ A' \\ 0 \\ 0 \end{pmatrix} d\gamma - \frac{pL_M}{X} \begin{pmatrix} 1 \\ A' \\ 0 \\ 0 \end{pmatrix} d\theta - \begin{pmatrix} \frac{\partial p}{\partial L_M} \\ \frac{A'\partial p}{\partial L_M} \\ 0 \\ -1 \end{pmatrix} dL_M$$

where $A' = 2X - L_u > 0$, and $\frac{\partial p}{\partial L_M}$ is given in (23c). The determinant of this matrix is

$$\Delta_y = -2Xy_{11} + 2p\left\{\frac{A'}{X} + \frac{y_1(A'-X)}{Y}\right\}, \quad (\text{a6})$$

which is positive provided $A' - X = X - L_u \geq 0$. A sufficient condition for this is: $q \geq \theta L_M$, which is satisfied by the assumption that the host country is a net importer of good x .

Straightforward calculations yield:

$$\Delta_y \frac{dL_u}{d\theta} = \frac{2(A'-X)pL_M}{X} > 0, \quad (\text{a7})$$

$$\Delta_y \frac{dw_0}{d\theta} = \frac{-2(A'-X)pL_M y_{11}}{X} > 0, \quad (\text{a8})$$

$$\frac{dL_y}{d\theta} = -\frac{dL_u}{d\theta} < 0, \quad (\text{a9})$$

$$\Delta_y \frac{dw}{d\theta} = \frac{pL_M}{X} (p - A' y_{11}) > 0, \quad (\text{a10})$$

$$\Delta_y \frac{du}{d\theta} = \frac{pL_M}{X} \{y_{11}(A' - 2X) + p\} + (w - w_0) \frac{dL_u}{\Delta_y d\theta} > 0, \quad (\text{a11})$$

$$\frac{d\pi}{d\theta} = \frac{du}{d\theta} > 0, \quad (\text{a12})$$

$$\frac{\Delta_y}{v_2} \frac{dv}{d\theta} = -2(A' - X)pL_M \left\{ \frac{(p + y_1)}{X} + \frac{py_1}{Y} - \frac{Xy_{11}}{A' - X} \right\} < 0. \quad (\text{a13})$$

$$\Delta_y \frac{dL_u}{d\gamma} = -\frac{2(A' - X)pL_M}{Y} < 0, \quad (\text{a14})$$

$$\Delta_y \frac{dw_0}{d\gamma} = \frac{2(A' - X)pL_M y_{11}}{Y} < 0, \quad (\text{a15})$$

$$\frac{dL_y}{d\gamma} = -\frac{dL_u}{d\gamma} > 0, \quad (\text{a16})$$

$$\Delta_y \frac{dw}{d\gamma} = -\frac{pL_M}{Y} (p - A' y_{11}) < 0. \quad (\text{a17})$$

$$\Delta_y \frac{du}{d\gamma} = \frac{pL_M}{Y} \{y_{11}(A' - 2X) + p\} + (w - w_0) \frac{dL_u}{\Delta_y d\gamma} < 0, \quad (\text{a18})$$

$$\frac{du}{d\gamma} = \frac{d\pi}{d\gamma} < 0, \quad (\text{a19})$$

$$\frac{\Delta_y}{v_2} \frac{dv}{d\gamma} = -(A' - X) p L_M \left\{ \frac{4p}{X} + \frac{py_1 + 2(p - y_1)}{Y} - \frac{2y_{11}X}{A' - X} \right\} < 0. \quad (\text{a20})$$

$$\Delta_y \frac{dL_u}{dL_M} = 2p(A' - X) \left(\frac{\theta}{X} + \frac{y_1 - \gamma}{Y} \right) - 2Xy_{11} > 0, \quad (\text{a21})$$

$$\Delta_y \frac{dw_0}{dL_M} = 2py_{11} \left\{ \frac{A'}{X} - (A' - X) \left(\frac{\theta}{X} - \frac{\gamma}{Y} \right) \right\} < 0, \quad (\text{a22})$$

$$\Delta_y \frac{dL_y}{dL_M} = 2p \left\{ \frac{A'}{X} - (A' - X) \left(\frac{\theta}{X} - \frac{\gamma}{Y} \right) \right\} > 0, \quad (\text{a23})$$

$$\Delta_y \frac{dw}{dL_M} = py_{11} \left\{ A' \left(\frac{\gamma}{Y} + \frac{2 - \theta}{X} \right) - 1 \right\} + \frac{p^2}{X} (A' - X) \left(\frac{\theta}{X} - \frac{\gamma}{Y} \right) - \frac{p^2 y_1}{XY} (A' + X), \quad (\text{a24})$$

$$\Delta_y \left\{ \frac{dw}{dL_M} - \frac{dw_0}{dL_M} \right\} = y_{11} \left\{ p_1 (A' - X) - (2X - A') \frac{p \partial p}{\partial L_m} \right\} - p_1 p_2 X - p_1 X \frac{p \partial p}{\partial L_m}, \quad (\text{a25})$$

where $p_1 = -\frac{p}{X} < 0$, $p_2 = \frac{py_1}{Y} > 0$, and $\frac{\partial p}{\partial L_m} = \frac{\theta}{X} - \frac{\gamma}{Y}$, given in (23c). Condition (a25) is

positively signed if an increase in immigration does not distort the domestic price by too much,

i.e., $\frac{\partial p}{\partial L_m} \approx 0$. This arises if remittances of both goods are done in the same ratio.

$$\begin{aligned}
\frac{1}{v_2} \frac{dv}{dL_M} &= \frac{pdX}{dL_M} + \frac{dy}{dL_M} - \frac{L_M dw_0}{dL_M} - w_0 \\
&= \frac{2py_1}{Y} (A' - X)(p - w_0) - 2(p - w_0)Xy_{11} \\
&\quad + 2p(p - y_{11})(A' - X)\left(\frac{\theta}{X} - \frac{\gamma}{Y}\right) .
\end{aligned} \tag{a26}$$

Condition (a26) is positively signed if an increase in immigration does not change the domestic

price by too much, i.e., $\frac{\partial p}{\partial L_m} \approx 0$.

Appendix 3

This appendix deals with the case of temporary immigration in manufacturing only.

Totally differentiating (30a), (30b), (6) and (25), using demand function (26), yields the following matrix.

$$\begin{pmatrix} a & L_u & -2L_u & b \\ c & 0 & -2L_u & d \\ 0 & 1 & 0 & -y_{11} \\ 1 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} dL_u \\ dw_0 \\ dw \\ dL_y \end{pmatrix} = \begin{pmatrix} e \\ f \\ 0 \\ 0 \end{pmatrix} dL_m + \begin{pmatrix} g \\ h \\ 0 \\ 0 \end{pmatrix} d\theta + \begin{pmatrix} i \\ j \\ 0 \\ 0 \end{pmatrix} d\gamma$$

where $p_1 = -\frac{p}{X} < 0$, $p_2 = \frac{py_1}{Y} > 0$, $p_{11} = -\frac{p_1}{X} > 0$, $p_{12} = -\frac{p_2}{X} < 0$;

$$a = p - 2w + w_0 + (L_u + L_m)p_1,$$

$$b = (L_u + L_m)p_2,$$

$$c = 2(p - w) + 2(2L_u + L_m)p_1 + (L_u + L_m)L_up_{11},$$

$$d = (2L_u + L_m)p_2 + (L_u + L_m)L_up_{12},$$

$$e = -(p - p_0) - (L_u + L_m)\{(1 - \theta)p_1 - \gamma p_2\},$$

$$f = -(p - p_0) - L_up_1 - (2L_u + L_m)\{(1 - \theta)p_1 - \gamma p_2\} - (L_u + L_m)L_u\{(1 - \theta)p_{11} - \gamma p_{12}\},$$

$$g = (L_u + L_m)L_mp_1,$$

$$h = (2L_u + L_m)L_mp_1 + (L_u + L_m)L_mL_up_{11},$$

$$i = (L_u + L_m)L_mp_2,$$

$$j = (2L_u + L_m)L_mp_2 + (L_u + L_m)L_mL_up_{12}.$$

The determinant of the matrix above is

$$\Delta_x = -2L_u^2 y_{11} + 2L_u(a - c) + 2L_u(d - b), \quad (\text{a27})$$

which is positively signed provided $A' - X = X - nL_u \geq 0$ and $y_{11} < -\frac{p - w_0}{L_u}$. As stated in

Appendix 2, the first condition is satisfied by the assumption that the host country is a net importer of good x . And the second condition is satisfied if land endowment T is sufficiently small, such as in Japan.

Straightforward calculations yield:

$$\Delta_x \frac{dL_u}{d\theta} = 2L_u(g - h) > 0, \quad (\text{a28})$$

$$\Delta_x \frac{dw_0}{d\theta} = -2L_u y_{11}(g - h) > 0, \quad (\text{a29})$$

$$\frac{dL_y}{d\theta} = -\frac{dL_u}{d\theta} < 0, \quad (\text{a30})$$

$$\Delta_x \frac{dw}{d\theta} = -\{(gd - bh) - hL_u y_{11}\} - (ah - gc), \quad (\text{a31})$$

$$\frac{\Delta_x}{v_2} \frac{dv}{d\theta} = 2L_u(g - h)(p - y_1 + L_m y_{11}). \quad (\text{a32})$$

From condition (6), $y_1 = w_0$. Using $y_{11} < -\frac{p - w_0}{nL_u}$, we can derive

$p - y_1 + L_m y_{11} < (p - w_0)(1 - L_m / L_u)$, which is negative if $L_m \geq L_u$ and positive otherwise. It

follows that the sign of (a32) can be determined to be negative if $L_m \geq L_u$, and positive

otherwise. In words, if the unionized firm employs more (less) temporary immigrants than unionized workers, then an increase in remittance of the manufacturing good reduces (raises) national welfare.

$$\Delta_x \frac{dL_u}{d\gamma} = 2L_u(i - j) < 0, \quad (\text{a33})$$

$$\Delta_x \frac{dw_0}{d\gamma} = -2L_u y_{11}(i - j) < 0, \quad (\text{a34})$$

$$\frac{dL_y}{d\gamma} = -\frac{dL_u}{d\gamma} > 0, \quad (\text{a35})$$

$$\Delta_x \frac{dw}{d\gamma} = -\{(id - bj) - jL_u y_{11}\} - (aj - ic). \quad (\text{a36})$$

$$\frac{\Delta_x}{v_2} \frac{dv}{d\gamma} = 2L_u(i - j)(p - y_1 + L_m y_{11}) - L_m. \quad (\text{a37})$$

The sign of (a37) is positive if $L_m \geq L_u$, and negative otherwise. In words, if the unionized firm employs more (less) temporary immigrants than unionized workers, then an increase in remittance of the agricultural good raises (reduces) national welfare.

$$\Delta_x \frac{dL_u}{dL_m} = 2L_u(e - f) < 0, \quad (\text{a38})$$

$$\Delta_x \frac{dw_0}{dL_m} = -2L_u y_{11}(e - f) < 0, \quad (\text{a39})$$

$$\frac{dL_y}{dL_m} = -\frac{dL_u}{dL_m} > 0, \quad (\text{a40})$$

$$\Delta_x \frac{dw}{dL_m} = -\{(ed - bf) - fL_u y_{11}\} - (af - ec), \quad (\text{a41})$$

$$\frac{dw - dw_0}{dL_m} = (e - f)(L_u y_{11} + a - b) - e\{(a - c) + (d - b) - L_u y_{11}\}. \quad (\text{a42})$$

As stated in appendix 2, if $y_{11} < -\frac{p - w_0}{nL_u}$, i.e., if the land endowment T is sufficiently small, such as in Japan, then condition (a42) is negatively signed, implying that immigration reduces the intersectoral wage gap if temporary immigrants can only work in manufacturing.

Furthermore, given the negative signs of (a39) and (a42), condition (a41) must also be negatively signed, i.e., an increase in temporary immigration in manufacturing reduces the union wage. And because (a38) states that immigration reduces union employment, it follows that the union utility must decrease.

$$\frac{\Delta_x}{v_2} \frac{dv}{dL_m} = 2L_u(e - f)(p - y_1 + L_m y_{11}) + \{p - (\theta p - \gamma)\} \Delta_x. \quad (\text{a43})$$

Using (6), and $y_{11} < -\frac{p - w_0}{nL_u}$, we find that if $L_m \geq L_u$, the sign of (a43) becomes positive. That is, if the unionized firm employs more temporary immigrants than unionized workers, then an increase in immigration raises national welfare.

Table 1: Comparative Statics Results

		<i>Permanent</i>	<i>y sector only</i>	<i>x sector only</i>	
dL_M	dL_u	+	+	-	
	dw_0	-	-	-	
	dL_y	+	+	+	
	dL_m	+	\oplus	-	
	dv	+	\oplus	\oplus	
		(y, x)	(y, y)	(x, x)	(x, y)
d_2 $d_{(}$	dL_u	+	-	+	-
	dw_0	+	-	+	-
	dL_y	-	+	-	+
	dw	+	-	?	?
	dv	-	-	\pm	\pm

(i, j) : Temporary immigration in sector i and increase in remittance of good j .

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