

International Migration, Internal Migration, and Substitute and Complement Industries

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Abstract

By assuming an economy that comprises substitute and complement industries with efficiency wages, we investigate the effects of immigrants on native workers and firms. Each industry accepts immigrants and employs them in addition to native workers. In a substitute (complement) industry, the marginal product of one input is negatively (positively) related to employment of another input. We show that under no internal migration, native worker employment and utility decrease (increase), whereas the profits of the firms increase (decrease) in the substitute (complement) industry as more immigrants are accepted. Accordingly, in both industries, the interests of native workers and firms are always in conflict. However, if native workers internally migrate between industries, there are cases where both native worker utility and the profits of the firms in the same industry become larger by accepting more immigrants or fewer immigrants. Accordingly, under internal migration, the interests of native workers and firms in the same type of industry are not always in conflict. Our results suggest that conflicts also exist within each type of industry and that internal migration can relieve such conflicts.

JEL Classification: F22; J23; J41; J42; J61

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1. Introduction

In this paper, we investigate how changes in the number of immigrants affect native workers and firms in an economy where there are substitute and complement industries and wages are determined according to the efficiency wage hypothesis. We assume two cases, one where there is no internal migration and one where native workers migrate between the two types of industry to attain higher utility. We show how internal migration changes the effects of immigrants on native worker utility and the profits of the firms in each industry and infer from these results whether or not internal migration helps to relieve conflicts of interests between native workers and firms in each industry.

One of the most contentious issues related to international migration is the effects of immigrants on native workers. Whether or not we accept immigrants or how many immigrants are accepted is usually determined by taking into account their effects on native workers. Accordingly, a large number of theoretical and empirical studies on the effects of immigrants on native workers of their host countries have been conducted. Greenwood and McDowell (1986), Borjas (1999), and Stark (1991) are early contributors.

The effects on native workers differ, depending on whether native workers and immigrants are substitutes or complements as factors of production. When both native workers and immigrants are unskilled, it is likely that they are substitutes. In this case, we intuitively consider that increased immigration will have negative impacts on native worker employment. On the other hand, when native workers are skilled and immigrants are unskilled, it is likely that they are complements. In this case, we intuitively consider that increased immigration will have positive impacts on native worker employment (Straubharr and Zimmermann 1993, Zimmermann 1995, 1996).

However, empirical results on the effects of immigrants on native workers are not as conclusive as intuition suggests. Borjas (1997) showed that the entry of large numbers of less skilled immigrants has an adverse impact on the labor market opportunities of less skilled U.S. native workers. On the other hand, Grossman (1982) concluded that although she verified that native workers and immigrants are substitutes, moderately large inflows of immigrants do not pose serious economic threats to native workers. Friedberg and Hunt (1995) argued that even if immigrants and native workers are close substitutes, it was not found that native workers suffer significantly from increased immigration. Moreover, Zorlu and Hartog (2005) did not even find dominant robust patterns of substitution and complementarity between native workers and immigrants.

By utilizing the monopoly union model, Schmidt, Stilz, and Zimmermann (1994) and Zimmermann (1996) analyzed this problem theoretically. They showed that, even if native workers and immigrants are substitutes, the job replacement effects of immigration might lead to wage restraint and thereby a higher employment of native workers.

The results of these previous studies are suggesting that the intuitive conclusions mentioned above cannot always be endorsed, either empirically or theoretically.

Moreover, as pointed out by Greenwood and Hunt (1995), immigrants influence native workers, not only through the production channel, but also through other channels, which may offset or reinforce the production channel effects.

However, even if the conclusions on the effects of immigrants on native workers are not uniform across various studies, as pointed out by Bodvarsson et al. (2007), it is certain that immigrants have different effects on different individuals or different groups in the same economy, with some losing and others gaining. In other words, their interests conflict when immigrants are

received. If not, accepting immigrants would not be so controversial. This suggests that we have to make clear how we can reconcile the conflicting interests among different agents.

Many researchers have dealt with this problem by considering the political process of immigration quota determination. Shughart et al. (1986) employed the interest group theory of government. Benhabib (1996) investigated the determinants of an immigration policy that specifies minimum or maximum skill or wealth requirements for immigrants under the majority voting. Flores (1997) constructed a single sector general equilibrium model to argue that whether a country admits further immigration depends on the country's factor ownership distribution, the level of transfers, and the prejudices held by individuals against immigrants. Amegashie (2004) built a model in which the number of immigrants is determined through the lobbying. Bodvarsson et al. (2007) determined the immigration quota endogenously by assuming a political market for it.

However, many of the previous studies on quota determination did not pay sufficient attention to the possibility that the conflicting interests among different agents may change when accepting immigrants. They determined the quota implicitly assuming that how the interests of different agents are related would not be affected by immigration.

These analyses also did not include the possibility of native worker internal migration, which might be induced by immigration. In other words, native worker behavior is not unaffected by immigrants. Many native workers actually move to the other domestic labor markets when immigrants enter their labor markets. In his theoretical analysis, Rivera-Batiz (1981) assumed internal migration in an economy that accepts immigrants. There are many empirical studies on this issue. For example, Hatton and Tani (2005) investigated whether internal migration is beneficial to the British labor market for adjusting to immigration, and concluded that it is one of the mechanisms through which regional labor markets adjust to immigration shocks. Borjas

(2005) showed that the native workers' response to migration reduces the impacts of immigration on wages in a local labor market. Accordingly, internal migration seems to be beneficial to native workers even if its effects are limited.¹

This suggests that internal migration may alleviate the conflicts of interests among different agents arising from immigration. Therefore, in order to relieve such conflicts when accepting immigrants, we have to make clear how the conflicts of the interests will be affected by internal migration.

For this purpose, following the model by Bodvarsson et al. (2007), we assume an economy consisting of substitute and complement industries, each of which produces goods by employing both native workers and immigrants.

However, this paper is markedly different from Bodvarsson et al. (2007) in that there exists involuntary unemployment, since wages are determined according to the efficiency wage hypothesis. In Bodvarsson et al. (2007), wages are determined to make the demand for and supply of labor equal in each industry. Accordingly, native workers' preferences toward immigration policies and their conflicting interests between industries mainly come from the effects of immigration on native worker wages. On the other hand, in this paper, immigration affects both native worker wages and employment so that their interests and preferences toward immigration policies are determined by both of them. In addition, we focus on the conflicts of interests within each industry whereas Bodvarsson et al. (2007) dealt with the problem of the conflicts across industries.

¹However, results by Kritz and Gurak (2001) do not support the claim that native workers make migratory response to immigration. They suggested that internal migration dynamics are governed by factors other than recent immigration.

All native workers are assumed to be identical, which suggests that they may migrate internally to a different industry from the one initially assigned and can be employed there. All immigrants are also assumed to be identical. These two kinds of workers are imperfect substitutes in the substitute industry, whereas they are complements in the complement industry. Native workers and immigrants do the same job in the substitute industry, but their productivities are different. Accordingly, even in the substitute industry, their wages are determined in such a manner as to satisfy their respective non-shirk conditions. Native worker wages and immigrant wages in the complement industry are determined to satisfy their respective non-shirk conditions. In order to investigate the effects of changes in the number of immigrants on native workers and firms, we assume two cases. In one case, there is no internal migration. Native workers are always in the industry to which they were initially assigned, and immigrants are always in the industry into which they were accepted. In another case, native workers internally migrate to achieve a higher steady state expected lifetime utility, whereas immigrants do not internally migrate. Accordingly, the actual number of native workers in each industry can be different from its initial number in each industry.

We demonstrate that in the case where native workers do not internally migrate, native worker employment and their steady state expected lifetime utility are smaller, whereas the profits of the firms are larger in the substitute industry when it accepts more immigrants, suggesting that in the substitute industry we cannot improve native worker utility and the profits of the firms at the same time by manipulating the number of their own immigrants. Likewise, native worker employment and their steady state expected lifetime utility are larger, whereas the profits of the firms are smaller in the complement industry when it accepts more immigrants, suggesting that in the complement industry we likewise cannot improve native worker utility and the profits of the firms at the same time by manipulating the number of their own immigrants. Therefore, in both

industries, when there is no internal migration, the interests of native workers and firms are always in conflict.

On the other hand, under internal migration of native workers, native worker employment in the substitute industry does not necessarily decrease even if it accepts more immigrants. Similarly, native worker employment in the complement industry does not necessarily increase even if it accepts more immigrants. This is because native worker employment in each industry is affected, not just by the number of immigrants in that industry, but also by the number of immigrants accepted into the other industry. Native worker steady state expected lifetime utility is higher if the sum of their employment in both industries increases, and immigrants into the substitute industry and those into the complement industry have different impacts on the sum of native worker employment. Accordingly, we can simultaneously improve native worker utility and the profits of the firms in the substitute industry by accepting more immigrants into the substitute industry, if the complement industry significantly increases the number of its own immigrants. This is because large increases in the number of immigrants in the complement industry can make native worker employment, and thereby their steady state expected lifetime utility, larger, and increases in the number of immigrants in the substitute industry make the profits of the firms in that industry larger although this partly offsets increases in the native worker utility. Likewise, we can simultaneously improve native worker utility and the profits of the firms in the complement industry by accepting fewer immigrants into the complement industry, if the substitute industry significantly decreases the number of its own immigrants. This can be explained in a similar manner. Large decreases in the number of immigrants in the substitute industry can make native worker employment, and thereby their steady state expected lifetime utility, larger, and decreases in the number of immigrants in the complement industry make the profits of the firms in that industry larger although this partly offsets increase in the native worker

utility. Therefore, when native workers internally migrate, the interests of native workers and firms in the same industry are not always in conflict.

Our results suggest that internal migration can relieve the conflicts between native workers and firms in each industry.

The remainder of this paper is organized as follows: Section 2 presents an economy comprised of the substitute industry and the complement industry, into which immigrants are accepted. Section 3 examines the effects of changes in the number of immigrants on native workers and firms when there is no internal migration. We try to make clear that the interests of native workers and firms in each industry are in opposition when accepting immigrants. Section 4 examines the effects of changes in the number of immigrants on native workers and firms when native workers internally migrate between the industries. We try to find the possibilities that internal migration alleviates conflicts in each industry. Concluding comments are presented in Section 5.

2. The Model

In this section, we model an economy consisting of the substitute and complement industries. There are no transactions of goods between the two industries. They are become interdependent when native workers migrate between them. Firms in each industry are perfectly competitive and they use two inputs in production – native labor and immigrant labor. As mentioned, all native workers are identical, whichever industry they belong to. All immigrants are also identical, whichever industry they are accepted into. We do not make a specific assumption on the skill of native and immigrant workers. Physical capital is fixed and we do not assume it explicitly as an input in the production function. In both industries, wages are determined according to the efficiency wage hypothesis.

When the two inputs are substitutes as factors of production, the marginal product of one input is negatively related to employment of the other input. We assume that native labor and immigrant labor are imperfect substitutes in the substitute industry. To capture these ideas most simply, we assume that firms in the substitute industry are faced with the following production function:

$$Y_S = F_S(N_S + \theta M_S), \quad 0 < \theta < 1, \quad F'_S > 0, \quad F''_S < 0,$$

where N_S is the number of employed native workers in the substitute industry, M_S is the number of employed immigrants in the substitute industry, and θ is a constant. Per capita effective labor of immigrants is assumed to be smaller than that of native workers. This paper assumes that immigrants do not affect the product demand. Their effects are only through the production.

Firms demand native workers and immigrants to maximize their profits. Native workers and immigrants are demanded to satisfy the following conditions:

$$F'_S = w_{SN}, \tag{1sn}$$

$$\theta F'_S = w_{SM}, \tag{1sm}$$

where w_{SN} is native worker wages in the substitute industry, and w_{SM} is immigrant wages in the substitute industry.²

Firms in both industries set native worker wages and immigrant wages in such a manner as to prevent shirking by employed native workers and immigrants, respectively (Shapiro and Stiglitz 1984).

²The profits of the firms in the substitute industry are defined as,

$$\pi_S \equiv F_S(N_S + \theta M_S) - w_{SN}N_S - w_{SM}M_S,$$

where the product price is assumed to be one throughout the analysis.

The instantaneous utility of a representative employed native worker in the substitute industry who does not shirk is equal to $w_{SN} - e_N$, where e_N , that is a constant, is effort exerted by him. We assume that effort exerted by a representative employed native worker who does not shirk is identical in the substitute and complement industries. If a representative employed native worker in the substitute industry shirks, his instantaneous utility is equal to w_{SN} . However, in such a case, he will be detected and fired by firms at the probability, i.e., the detection rate, ρ_N , which is a constant and is assumed to be identical for all employed native workers in the substitute and complement industries who shirk. Moreover, even if employed native workers in the substitute industry are not fired on the grounds of shirking, some of them separate from their jobs at the probability, i.e., the separation rate, β_N , which is a constant and is defined as a ratio of separations of employed native workers in the substitute industry due to reasons other than shirking to the number of employed native workers in this industry. We assume that employed native workers in the complement industry also separate at the same probability.

Native workers who separate from their jobs and become unemployed in the substitute industry constitute flow into unemployment of native workers in this industry.³ Flow out of unemployment of native workers in the substitute industry arises from reemployment of unemployed native workers in this industry. They are reemployed at the probability, i.e., the accession rate, α_{SN} , which is defined as the ratio of new hires of unemployed native workers in

³Even in a case where native workers migrate internally between the two industries, once native workers become unemployed in either industry, we assume that they do not move to the other industry seeking employment opportunities. However, they can be reemployed in the same industry where they become unemployed. See Section 4 for the assumptions on internal migration by native workers.

the substitute industry to the number of the unemployed native workers in this industry. In steady state, the number of native workers in the substitute industry who flow into unemployment is equal to the number of native workers in the substitute industry who flow out of unemployment.

Under these assumptions, the expected lifetime utility of a representative employed native worker who shirks in the substitute industry $V_{E_{SN}}^S$ is,

$$rV_{E_{SN}}^S = w_{SN} + (\beta_N + \rho_N)(V_{U_{SN}} - V_{E_{SN}}^S),$$

where r is the discount rate. $V_{U_{SN}}$ is the expected lifetime utility of a representative unemployed native worker in the substitute industry, which is given by,

$$rV_{U_{SN}} = \bar{w} + \alpha_{SN}(V_{E_{SN}}^S - V_{U_{SN}}),$$

where \bar{w} is the unemployment benefit, which is a constant and is assumed to be identical for all unemployed native workers and unemployed immigrants in the substitute and complement industries. The expected lifetime utility of a representative employed native worker who does not shirk in the substitute industry $V_{E_{SN}}^N$ is,

$$rV_{E_{SN}}^N = w_{SN} - e_N + \beta_N(V_{U_{SN}} - V_{E_{SN}}^N).$$

Imposing the non-shirk condition $V_{E_{SN}}^N = V_{E_{SN}}^S$ ($\equiv V_{E_{SN}}$) and noticing that in steady state the numbers for the flow into and flow out of unemployment of native workers in the substitute industry are equal, i.e., $\beta_N N_S = \alpha_{SN}(\bar{N}_S - N_S)$, we derive steady state native worker wages in the substitute industry,

$$w_{SN} = \bar{w} + e_N + \frac{\{\bar{N}_S / (\bar{N}_S - N_S)\} \beta_N + r}{\rho_N} e_N. \quad (2sn)$$

where \bar{N}_S is the number of native workers existent in the substitute industry.⁴ Native worker wages increase with their employment and decrease with their number existent in the industry.

⁴If there is no internal migration, the number of native workers existent in the substitute industry

In addition, the steady state expected lifetime utilities of representative employed and unemployed native workers in the substitute industry are derived as follows:

$$V_{E_{SN}} = \frac{\bar{w}}{r} + \frac{1}{\rho_N} \left[1 + \frac{\{N_S / (\bar{N}_S - N_S)\} \beta_N}{r} \right] e_N. \quad (3sn)$$

$$V_{U_{SN}} = \frac{\bar{w}}{r} + \frac{1}{\rho_N} \frac{\{N_S / (\bar{N}_S - N_S)\} \beta_N}{r} e_N. \quad (4sn)$$

No matter whether employed or unemployed, native workers attain higher steady state expected lifetime utilities with increases in their employment.

By a similar argument, we derive steady state immigrant wages in the substitute industry w_{SM} as follows:

$$w_{SM} = \bar{w} + e_M + \frac{\{\bar{M}_S / (\bar{M}_S - M_S)\} \beta_M + r}{\rho_M} e_M, \quad (2sm)$$

where e_M , that is a constant, is effort exerted by a representative employed immigrant in the substitute and complement industries, \bar{M}_S is the number of immigrants accepted into the substitute industry, which is exogenous and manipulated by the industry, M_S is the number of employed immigrants in the substitute industry, β_M is the immigrant separation rate in the substitute and complement industries, and ρ_M is the immigrant detection rate in the substitute and complement industries.

\bar{N}_S is equal to the number of native workers initially assigned to this industry, which does not change throughout the analysis. On the other hand, when native workers internally migrate between the substitute and complement industries, the number of native workers existent in the substitute industry does not remain unchanged. See Section 4 for the case with internal migration of native workers.

In the complement industry, native workers and immigrants perform different jobs that complement each other in production. Accordingly, the marginal product of one input is positively related to employment of the other input. We assume that in the complement industry, goods are produced according to the following production function:

$$Y_C = F_C(N_C, M_C), \quad F_{C1}, F_{C2} > 0, \quad F_{C12}, F_{C21} > 0, \quad F_{C11}, F_{C22} < 0, \quad F_{C11}F_{C22} - F_{C12}F_{C21} > 0,$$

where N_C is the number of employed native workers in the complement industry, and M_C is the number of employed immigrants in the complement industry.⁵

Firms demand native workers and immigrants to maximize their profits, and they are employed to satisfy the following conditions:

$$F_{C1} = w_{CN}, \quad (1cn)$$

$$F_{C2} = w_{CM}, \quad (1cm)$$

where w_{CN} is native worker wages in the complement industry, and w_{CM} is immigrant wages in the complement industry.

We can derive steady state wages and expected lifetime utilities of native workers in the complement industry in a similar manner as in the substitute industry:

$$w_{CN} = \bar{w} + e_N + \frac{\{\bar{N}_C / (\bar{N}_C - N_C)\} \beta_N + r}{\rho_N} e_N, \quad (2cn)$$

$$V_{ECN} = \frac{\bar{w}}{r} + \frac{1}{\rho_N} \left[1 + \frac{\{N_C / (\bar{N}_C - N_C)\} \beta_N}{r} \right] e_N, \quad (3cn)$$

$$V_{UCN} = \frac{\bar{w}}{r} + \frac{1}{\rho_N} \frac{\{N_C / (\bar{N}_C - N_C)\} \beta_N}{r} e_N, \quad (4cn)$$

⁵ $F_{C1} \equiv \partial F_C / \partial N_C$, $F_{C2} \equiv \partial F_C / \partial M_C$, $F_{C12} \equiv \partial(\partial F_C / \partial N_C) / \partial M_C$, $F_{C21} \equiv \partial(\partial F_C / \partial M_C) / \partial N_C$,

$F_{C11} \equiv \partial(\partial F_C / \partial N_C) / \partial N_C$, $F_{C22} \equiv \partial(\partial F_C / \partial M_C) / \partial M_C$.

where \bar{N}_C is the number of native workers existent in the complement industry.⁶

Steady state immigrant wages in the complement industry are also determined as follows:

$$w_{CM} = \bar{w} + e_M + \frac{\{\bar{M}_C / (\bar{M}_C - M_C)\} \beta_M + r}{\rho_M} e_M, \quad (2cm)$$

where \bar{M}_C is the number of immigrants accepted into the complement industry, which is exogenous and manipulated by the industry.

3. Effects of Immigrants on Native Workers and Firms without Internal Migration

In this section, we examine how changes in the number of immigrants affect native workers and firms when there is no internal migration.

To see their effects in the substitute industry, we combine Equations (1sn) and (2sn) and Equations (1sm) and (2sm) and totally differentiate them:

$$(F_S'' - E_{SN1})dN_S + \theta F_S'' dM_S = E_{SN2} d\bar{N}_S, \quad (5sn)$$

$$\theta F_S'' dN_S + (\theta^2 F_S'' - E_{SM1})dM_S = E_{SM2} d\bar{M}_S, \quad (5sm)$$

where $E_{SN1} \equiv \frac{\partial w_{SN}}{\partial N_S} = \frac{\bar{N}_S}{(\bar{N}_S - N_S)^2} \frac{\beta_N}{\rho_N} e_N > 0$, $E_{SN2} \equiv \frac{\partial w_{SN}}{\partial \bar{N}_S} = -\frac{N_S}{(\bar{N}_S - N_S)^2} \frac{\beta_N}{\rho_N} e_N < 0$,

⁶Similar to the definition of \bar{N}_S , if there is no internal migration, the number of native workers existent in the complement industry \bar{N}_C is equal to the number of native workers initially assigned to this industry, which does not change throughout the analysis. On the other hand, when native workers internally migrate between industries (see Section 4), the number of native workers existent in the complement industry will be different from the number of initially assigned native workers. However, even under internal migration, the sum of native workers existent in the two industries does not change.

$$E_{SM1} \equiv \frac{\partial w_{SM}}{\partial M_S} = \frac{\bar{M}_S}{(\bar{M}_S - M_S)^2} \frac{\beta_M}{\rho_M} e_M > 0, \quad E_{SM2} \equiv \frac{\partial w_{SM}}{\partial M_S} = -\frac{M_S}{(\bar{M}_S - M_S)^2} \frac{\beta_M}{\rho_M} e_M < 0,$$

and $d\bar{N}_S = 0$ from the assumption.

Solving Equations (5sn) and (5sm) for dN_S , we see that as the substitute industry accepts more immigrants, native worker employment in this industry becomes smaller:

$$\frac{dN_S}{d\bar{M}_S} = -\frac{\theta F_S'' E_{SM2}}{E_{SN1} E_{SM1} - F_S'' (E_{SM1} + \theta^2 E_{SN1})} < 0. \quad (6sn)$$

Since native worker employment in the substitute industry is independent of the number of immigrants accepted into the complement industry, it always becomes smaller when the substitute industry accepts more immigrants.⁷

Since firms set higher wages to prevent shirking as more native workers are employed, i.e., $E_{SN1} > 0$, their wages also decrease as more immigrants are accepted:

$$\frac{dw_{SN}}{d\bar{M}_S} = E_{SN1} \frac{dN_S}{d\bar{M}_S} < 0. \quad (7sn)$$

These results are easily confirmed by drawing the curves for the total differentiation of the native worker non-shirk condition (Equation 2sn) and the total differentiation of the demand for native workers. The former curve is upward sloping on the coordinates, where dw_{SN} is taken on the vertical axis and dN_S is taken on the horizontal axis. By substituting the solution of Equations (5sn) and (5sm) for dM_S into the total differentiation of Equation (1sn), we derive the total differentiation of the demand for native workers,

⁷This result does not hold if native workers migrate internally. See Section 4 for effects of immigrants on native worker employment in the substitute industry under internal migration.

$$F_S'' dN_S + \frac{\theta F_S'' (F_S'' - E_{SN1}) E_{SM2}}{E_{SN1} E_{SM1} - F_S'' (E_{SM1} + \theta^2 E_{SN1})} d\bar{M}_S = dw_{SN}.$$

This equation shows that the demand curve is downward sloping and shifts downward to the left with increases in $d\bar{M}_S$, which makes both dN_S and dw_{SN} lower in equilibrium.

As shown by Equations (3sn) and (4sn), the steady state expected lifetime utilities of representative employed and unemployed native workers in the substitute industry are increasing with respect to native worker employment in this industry. Accordingly, their utilities decrease with increases in the number of immigrants accepted into the substitute industry:

$$\frac{\partial V_{E_{SN}}}{\partial \bar{M}_S} < 0, \quad \frac{\partial V_{U_{SN}}}{\partial \bar{M}_S} < 0. \quad (8sn)$$

Equations (6sn), (7sn), and (8sn) suggest that in the substitute industry, native worker welfare worsens as more immigrants are accepted. Since their employment, wages, and utility do not depend on the number of immigrants accepted into the complement industry, increases in the number of immigrants accepted into the substitute industry always make their welfare worse. We can infer from this result that native workers in the substitute industry may prefer strict immigration restrictions.

On the other hand, immigrants in the substitute industry have positive impacts on firms in this industry. In other words, their profits increase as they accept more immigrants. This is because,

$$\frac{d\pi_S}{d\bar{M}_S} = -\frac{dw_{SN}}{d\bar{M}_S} N_S - \frac{dw_{SM}}{d\bar{M}_S} M_S,$$

and immigrant wages as well as native worker wages in the substitute industry are decreasing with respect to the number of immigrants, i.e., $dw_{SM}/d\bar{M}_S = \theta dw_{SN}/d\bar{M}_S < 0$. This suggests that firms in the substitute industry may prefer loose immigration restrictions.

We can infer from the above results that the interests of native workers and firms in the substitute industry do not coincide when accepting immigrants. This suggests that if firms have more influence over the immigration policy than native workers, the substitute industry will accept more immigrants. On the other hand, if native workers have more influence than firms, it will accept fewer immigrants.

We derive the effects of immigrants on native workers and firms in the complement industry utilizing Equations (1cn) and (2cn) and Equations (1cm) and (2cm):

$$(F_{C11} - E_{CN1})dN_C + F_{C12}dM_C = E_{CN2}d\bar{N}_C, \quad (5cn)$$

$$F_{C21}dN_C + (F_{C22} - E_{CM1})dM_C = E_{CM2}d\bar{M}_C, \quad (5cm)$$

where $E_{CN1} \equiv \frac{\partial w_{CN}}{\partial N_C} = \frac{\bar{N}_C}{(\bar{N}_C - N_C)^2} \frac{\beta_N}{\rho_N} e_N > 0$, $E_{CN2} \equiv \frac{\partial w_{CN}}{\partial \bar{N}_C} = -\frac{N_C}{(\bar{N}_C - N_C)^2} \frac{\beta_N}{\rho_N} e_N < 0$,

$$E_{CM1} \equiv \frac{\partial w_{CM}}{\partial N_C} = \frac{\bar{M}_C}{(\bar{M}_C - M_C)^2} \frac{\beta_M}{\rho_M} e_M > 0$$
, $E_{CM2} \equiv \frac{\partial w_{CM}}{\partial \bar{M}_C} = -\frac{M_C}{(\bar{M}_C - M_C)^2} \frac{\beta_M}{\rho_M} e_M < 0$,

and $d\bar{N}_C = 0$ from the assumption.

Solving Equations (5cn) and (5cm) for dN_C , we obtain the results on the effects of accepting immigrants into the complement industry on native worker employment and wages of the same industry:

$$\frac{dN_C}{d\bar{M}_C} = -\frac{E_{CM2}F_{C12}}{F_{C11}F_{C22} - F_{C12}F_{C21} - (F_{C11}E_{CM1} + F_{C22}E_{CN1}) + E_{CN1}E_{CM1}} > 0. \quad (6cn)$$

$$\frac{dw_{CN}}{d\bar{M}_C} = E_{CN1} \frac{dN_C}{d\bar{M}_C} > 0. \quad (7cn)$$

According to Equations (6cn) and (7cn), as the complement industry accepts more immigrants, native worker employment and wages in this industry become larger. Since native worker employment and wages are independent of the number of immigrants accepted into the substitute

industry, they always become larger when the complement industry accepts more immigrants.⁸

These results can be confirmed in a similar manner as in the substitute industry. Increases in the number of immigrants accepted into the complement industry shift the demand curve for native workers in the complement industry upward to the right. On the other hand, the curve for the non-shirk condition (Equation 2cn) does not shift.

From Equations (6cn), (3cn), and (4cn), the expected lifetime utilities of representative employed and unemployed native workers in the complement industry become higher as more immigrants are received into this industry:

$$\frac{\partial V_{E_{CN}}}{\partial M_C} > 0. \quad \frac{\partial V_{U_{CN}}}{\partial M_C} > 0. \quad (8cn)$$

Equations (6cn), (7cn), and (8cn) suggest that in the complement industry, native worker welfare improves as more immigrants are accepted. Since their employment, wages, and utility do not depend on the number of immigrants accepted into the substitute industry, increases in the number of immigrants accepted into the complement industry always improve their welfare. We can infer from this result that in the complement industry, native workers may prefer loose immigration restrictions.

In contrast to the substitute industry case, the effects of immigrants on the profits of the firms in the complement industry are ambiguous, since,

⁸In the complement industry also, the resulting effects of accepting immigrants on native worker employment and wages do not hold if native workers migrate internally. See Section 4 for effects of immigrants on native worker employment and wages in the complement industry under internal migration.

$$\frac{d\pi_C}{d\bar{M}_C} = -\frac{dw_{CN}}{d\bar{M}_C} N_C - \frac{dw_{CM}}{d\bar{M}_C} M_C,$$

and $dw_{CN}/d\bar{M}_C > 0$ and $dw_{CM}/d\bar{M}_C < 0$. However, if the number of employed immigrants are sufficiently small compared with the number of employed native workers, it is likely that in the complement industry, the profits of the firms decrease as they accept more immigrants. This suggests that firms in the complement industry may prefer strict immigration restrictions.

We can infer from the above results that in the complement industry also, the interests of native workers and firms do not coincide when accepting immigrants. This suggests that if firms have more influence over the immigration policy than native workers, the complement industry will accept fewer immigrants. On the other hand, if native workers have more influence than firms, it will accept more immigrants.

To summarize the results derived in this section, in the substitute industry native workers are negatively impacted by the inflow of immigrants and in the complement industry they are positively impacted by the inflow of immigrants. On the other hand, the profits of the firms increase in the substitute industry and they are likely to decrease in the complement industry as each industry accepts more immigrants. Therefore, in each industry, the interests of native workers and firms are in opposition when accepting immigrants, which implies that it is impossible for each industry to simultaneously improve native worker utility and the profits of the firms by controlling the number of its own immigrants.

4. Effects of Immigrants on Native Workers and Firms under Internal Migration

In this section, we examine how changes in the number of immigrants affect native workers and firms when native workers migrate between the substitute and complement industries.

In actual economies, not only do native workers migrate internally between these industries, but

so do immigrants. However, immigrants are not as mobile as native workers since, compared with native workers, it is not easy for immigrants to find jobs at a different industry from the one into which they were initially accepted. Therefore, we consider the simplest situation where only native workers internally migrate.

We assume that they migrate to the other industry without any costs if they can attain higher expected lifetime utility there that takes the possibilities into account that they are employed at the probability N_i/\bar{N}_i and unemployed at the probability $1 - N_i/\bar{N}_i$, $i = S, C$, where under internal migration \bar{N}_S and \bar{N}_C are different from the numbers of native workers initially assigned in substitute and complement industries, respectively. Once internally migrated, native workers are assumed not to leave that industry even if they are not employed there.

Specifically, if the native worker steady state expected lifetime utility in the substitute industry that takes the possibilities of employment and unemployment there into account V_{SN} ,

$$\frac{N_S}{\bar{N}_S} V_{E_{SN}} + \left(1 - \frac{N_S}{\bar{N}_S}\right) V_{U_{SN}},$$

is larger (smaller) than the native worker steady state expected lifetime utility in the complement industry that takes the possibilities of employment and unemployment there into account V_{CN} ,

$$\frac{N_C}{\bar{N}_C} V_{E_{CN}} + \left(1 - \frac{N_C}{\bar{N}_C}\right) V_{U_{CN}},$$

then native workers in the complement industry (the substitute industry) migrate to the substitute industry (the complement industry).

V_{SN} decreases (increases) as more native workers immigrate to (emigrate from) the substitute industry, and V_{CN} increases (decreases) as more native workers emigrate from (immigrate to) the

complement industry.⁹ Accordingly, in equilibrium, the steady state expected lifetime utilities of native workers in the substitute and complement industries are equalized, i.e., $V_{SN} = V_{CN}$.

Utilizing Equations (3sn) and (4sn) and Equations (3cn) and (4cn), this equilibrium condition can be rewritten as,

$$\frac{N_S}{\bar{N}_S} - \frac{N_C}{\bar{N}_C} + \frac{\beta_N}{r} \left(\frac{N_S/\bar{N}_S}{1 - N_S/\bar{N}_S} - \frac{N_C/\bar{N}_C}{1 - N_C/\bar{N}_C} \right) = 0.$$

To establish this condition for any β_N and r ,

$$\frac{N_S}{\bar{N}_S} = \frac{N_C}{\bar{N}_C},$$

has to hold. Therefore, if native workers migrate to the other industry to achieve higher steady state expected lifetime utility, then native workers are employed at the same probability in both industries, which is equal to N/\bar{N} , where $N \equiv N_S + N_C$ and $\bar{N} \equiv \bar{N}_S + \bar{N}_C$.

Accordingly, under internal migration, steady state native worker wages in the substitute and complement industries $w_{SN_{im}}$, $w_{CN_{im}}$ are expressed as follows:

$$w_{SN_{im}} = w_{CN_{im}} = \bar{w} + e_N + \frac{\{\bar{N}/(\bar{N} - N)\}\beta_N + r}{\rho_N} e_N. \quad (9)$$

We derive the employed native worker steady state expected life utility in the substitute and

⁹We can derive $dN_S/d\bar{N}_S < N_S/\bar{N}_S$ from Equations (5sn) and (5sm) and $dN_C/d\bar{N}_C < N_C/\bar{N}_C$ from Equations (5cn) and (5cm). This suggests $d(N_i/\bar{N}_i)/d\bar{N}_i < 0$, $i = S, C$. Moreover, we can also derive $dV_{iN}/d(N_i/\bar{N}_i) > 0$, $i = S, C$ from Equations (3sn) and (4sn) and Equations (3cn) and (4cn). Therefore, $dV_{iN}/d\bar{N}_i < 0$, $i = S, C$. For example, if $V_{SN} > V_{CN}$, then native workers in the complement industry migrate to the substitute industry. As a result, \bar{N}_S increases and \bar{N}_C decreases. This makes V_{SN} smaller and V_{CN} larger.

complement industries under internal migration $V_{E_{SN_{im}}}$, $V_{E_{CN_{im}}}$ and the unemployed native worker steady state expected life utility in the substitute and complement industries under internal migration $V_{U_{SN_{im}}}$, $V_{U_{CN_{im}}}$:

$$V_{E_{SN_{im}}} = V_{E_{CN_{im}}} = \frac{\bar{w}}{r} + \frac{1}{\rho_N} \left[1 + \frac{\{N/(\bar{N} - N)\}\beta_N}{r} \right] e_N. \quad (10)$$

$$V_{U_{SN_{im}}} = V_{U_{CN_{im}}} = \frac{\bar{w}}{r} + \frac{1}{\rho_N} \frac{\{N/(\bar{N} - N)\}\beta_N}{r} e_N. \quad (11)$$

Noticing that $dN = dN_S + dN_C$, we infer from Equations (9), (10), and (11) that under internal migration native worker steady state wages and expected lifetime utilities in each industry increase, not only with native worker employment in its own industry, but also with that in the other industry.

The substitute industry under internal migration can be modeled by Equations (1sn) and (9) and Equations (1sm) and (2sm). We totally differentiate them to derive the following equations:

$$(F'_S - E'_{SCN_{im}})dN_S + \theta F''_S dM_S = E'_{SCN_{im}} dN_C, \quad (5sn')$$

$$\theta F''_S dN_S + (\theta^2 F''_S - E_{SM1})dM_S = E_{SM2} d\bar{M}_S, \quad (5sm)$$

where $E'_{SCN_{im}} \equiv \frac{\partial w_{SN_{im}}}{\partial N_S} = \frac{\partial w_{SN_{im}}}{\partial N_C} = \frac{\partial w_{CN_{im}}}{\partial N_C} = \frac{\partial w_{CN_{im}}}{\partial N_S} = \frac{\bar{N}}{(\bar{N} - N)^2} \frac{\beta_N}{\rho_N} e_N > 0$ and $d\bar{N} = 0$ from

the assumption.

Equations (5sn') and (5sm) are taken as describing how changes in native worker employment and immigrant employment in the substitute industry are related to each other for given changes in the number of immigrants accepted into the substitute industry and native worker employment in the complement industry.

By deleting dM_S from Equations (5sn') and (5sm), we derive the relationship between changes in native worker employment in the substitute and complement industries for given

changes in the number of immigrants accepted into the substitute industry:

$$dN_C = \frac{-\{F_S''(E_{SM1} + \theta^2 E'_{SCN_{im}}) - E'_{SCN_{im}} E_{SM1}\}}{E'_{SCN_{im}} (\theta^2 F_S'' - E_{SM1})} dN_S + \frac{\theta F_S'' E_{SM2}}{E'_{SCN_{im}} (\theta^2 F_S'' - E_{SM1})} d\bar{M}_S \quad (12s)$$

$$(\equiv \phi_{S1} dN_S + \phi_{S2} d\bar{M}_S).$$

Since the coefficients of the first and second terms on the right-hand side of Equation (12s) ϕ_{S1} , ϕ_{S2} are negative, the curve for this equation is downward sloping and shifts downward to the left with increases in $d\bar{M}_S$ on the coordinates where dN_C is taken on the vertical axis and dN_S is taken on the horizontal axis.

Similarly, we can model the complement industry under internal migration by using Equations (1cn) and (9) and Equations (1cm) and (2cm). The total differentiation of these equations gives us the following equations that describe how changes in native worker employment and immigrant employment in the complement industry are related to each other for given changes in the number of immigrants accepted into the complement industry and native worker employment in the substitute industry:

$$(F_{C11} - E'_{SCN_{im}})dN_C + F_{C12}dM_C = E'_{SCN_{im}} dN_S, \quad (5cn')$$

$$F_{C21}dN_C + (F_{C22} - E_{CM1})dM_C = E_{CM2}d\bar{M}_C. \quad (5cm)$$

We delete dM_C from Equations (5cn') and (5cm) to derive the relationship between changes in native worker employment in the complement and substitute industries for given changes in the number of immigrants accepted into the complement industry:

$$dN_C = \frac{E'_{SCN_{im}} (F_{C22} - E_{CM1})}{F_{C11}F_{C12} - F_{C12}F_{C21} + E_{CM1}(E'_{SCN_{im}} - F_{C11}) - F_{C22}E'_{SCN_{im}}} dN_S$$

$$+ \frac{-F_{C12}E_{CM2}}{F_{C11}F_{C12} - F_{C12}F_{C21} + E_{CM1}(E'_{SCN_{im}} - F_{C11}) - F_{C22}E'_{SCN_{im}}} d\bar{M}_C \quad (12c)$$

$$(\equiv \phi_{C1} dN_S + \phi_{C2} d\bar{M}_C).$$

Since the coefficient of the first term on the right-hand side of Equation (12c) ϕ_{C1} is negative and the coefficient of the second term ϕ_{C2} is positive, the curve for this equation is downward

sloping and shifts upward to the right with increases in $d\bar{M}_c$.

We are now in position to show how changes in the numbers of immigrants accepted into the substitute and complement industries affect native worker employment in each industry. For this purpose, we solve Equations (12s) and (12c) for dN_s and dN_c .

$$dN_s = \frac{-\phi_{s2}}{-\phi_{c1} + \phi_{s1}} d\bar{M}_s + \frac{\phi_{c2}}{-\phi_{c1} + \phi_{s1}} d\bar{M}_c. \quad (13s)$$

$$dN_c = \frac{\phi_{s1}\phi_{c2}}{-\phi_{c1} + \phi_{s1}} d\bar{M}_c + \frac{-\phi_{s2}\phi_{c1}}{-\phi_{c1} + \phi_{s1}} d\bar{M}_s. \quad (13c)$$

Equations (13s) and (13c) suggest that native worker employment in each industry depends not only on the number of immigrants accepted into that industry but also on the number of immigrants accepted into the other industry. This result is contrasted with the one derived under no internal migration.

Specifically, since $-\phi_{c1} + \phi_{s1} < 0$, which implies that the curve for Equation (12s) is steeper than the curve for Equation (12c), not only do increases in the number of immigrants accepted into the substitute industry make native worker employment in the substitute industry smaller, but so do increases in the number of immigrants accepted into the complement industry, i.e.,

$$\frac{\partial N_s}{\partial \bar{M}_s}, \frac{\partial N_s}{\partial \bar{M}_c} < 0. \quad (14s)$$

Similarly, not only do increases in the number of immigrants accepted into the complement industry make native worker employment in the complement industry larger, but so do increases in the number of immigrants accepted into the substitute industry, i.e.,

$$\frac{\partial N_c}{\partial \bar{M}_c}, \frac{\partial N_c}{\partial \bar{M}_s} > 0. \quad (14c)$$

These results are easily confirmed by drawing the curves for Equations (12s) and (12c). As

mentioned, the curve for Equation (12s) is steeper than the curve for Equation (12c). With increases in the number of immigrants accepted into the substitute industry, the curve for Equation (12s) shifts downward to the left. This makes the intersection of the two curves move upward to the left, resulting in decreases in native worker employment in the substitute industry ($\partial N_s / \partial \bar{M}_s < 0$) and increases in native worker employment in the complement industry ($\partial N_c / \partial \bar{M}_s > 0$). With increases in the number of immigrants accepted into the complement industry, the curve for Equation (12c) shifts upward to the right. This also makes the intersection of the two curves move upward to the left, resulting in decreases in native worker employment in the substitute industry ($\partial N_s / \partial \bar{M}_c < 0$) and increases in native worker employment in the complement industry ($\partial N_c / \partial \bar{M}_c > 0$).

According to Equations (14s) and (14c), accepting more immigrants into the substitute industry negatively impacts its own native worker employment, and accepting more immigrants into the complement industry positively impacts its own native worker employment. These results are the same as those derived without assuming internal migration (see Equations 6sn and 6cn).

However, being different from the case where there is no internal migration, native worker employment in the substitute industry is not always smaller when more immigrants are accepted into the substitute industry. This is because even if the substitute industry increases the number of its own immigrants, native worker employment in that industry may be the same or may possibly be larger when the complement industry significantly decreases the number of its immigrants. Likewise, native worker employment in the complement industry is not always larger when more immigrants are accepted into the complement industry. This is because even if the complement industry increases the number of its own immigrants, native worker employment in that industry may be the same or may possibly be smaller when the substitute industry significantly decreases the number of its immigrants. These results are contrasted with those

obtained under no internal migration.

Moreover, native worker steady state expected lifetime utilities increase with the sum of native worker employment in both industries (see Equations 10 and 11). Being different from the case where there is no internal migration, increases in native worker employment in an industry do not always lead to higher native worker steady state expected lifetime utility in the same industry. For example, even if native worker employment in the substitute industry increases, the sum of native worker employment and thereby the native worker steady state expected lifetime utility in the substitute industry (and in the complement industry also) may be the same or may possibly be lower when native worker employment in the complement industry significantly decreases.¹⁰ The results on native worker steady state expected lifetime utility are also in contrast with those obtained under no internal migration.

Combining Equations (13s) and (13c), we calculate changes in the sum of native worker employment due to changes in the numbers of immigrants:

$$dN = \frac{-\phi_{S2}(1+\phi_{C1})}{-\phi_{C1}+\phi_{S1}} d\bar{M}_S + \frac{\phi_{C2}(1+\phi_{S1})}{-\phi_{C1}+\phi_{S1}} d\bar{M}_C, \quad (15)$$

where $\{-\phi_{S2}(1+\phi_{C1})\}/(-\phi_{C1}+\phi_{S1}) < 0$ and $\{\phi_{C2}(1+\phi_{S1})\}/(-\phi_{C1}+\phi_{S1}) > 0$.

According to Equation (15), when the complement industry increases the number of its own immigrants sufficiently, the sum of native worker employment will become larger even if the

¹⁰If both industries reduce the number of immigrants, native worker employment increases in the substitute industry (see Equation 14s). However, as will be shown by Equation (15), the sum of native worker employment in both industries and hence the native worker steady state expected lifetime utility in both industries will become smaller if the decrease in the number of immigrants accepted into the complement industry is sufficiently large.

substitute industry increases the number of its own immigrants in order to make the profits of the firms in the substitute industry larger.¹¹ In this case, not only is there an increase in the profits of the firms in the substitute industry but also native worker steady state expected lifetime utility in both industries becomes higher.¹² Therefore, accepting more immigrants into the substitute industry can be beneficial to both native workers and firms in this industry, and there is no conflict of interests between them.

Similarly, when the substitute industry decreases the number of its own immigrants sufficiently, the sum of native worker employment will become larger even if the complement industry decreases the number of its own immigrants in order to make the profits of the firms in the complement industry larger.¹³ In this case, not only is there an increase in the profits of the firms

¹¹As in the case where there is no internal migration, the profits of the firms in the substitute industry increase with the number of its own immigrants, i.e., $d\pi_s/d\bar{M}_s = -(dw_{SN_{im}}/d\bar{M}_s)N_s - (dw_{SM}/d\bar{M}_s)M_s > 0$. This is because under internal migration also, native worker wages and immigrant wages in this industry are decreasing with respect to the number of its own immigrants. In other words,

$$dw_{SN_{im}}/d\bar{M}_s = (1/\theta)(dw_{SM}/d\bar{M}_s),$$

and they are equal to $(dw_{SN_{im}}/dN)(dN/d\bar{M}_s)$, where $dw_{SN_{im}}/dN > 0$, $dN/d\bar{M}_s < 0$.

¹²Native worker employment in the substitute industry is smaller because both industries are accepting more immigrants as suggested by Equation (14s). On the other hand, native worker employment in the complement industry is larger as suggested by Equation (14c). However, as we have already derived, native workers in the substitute industry are employed at the same probability as in the complement industry. This is, of course, due to internal migration.

¹³As in the case where there is no internal migration, the profits of the firms in the complement

in the complement industry but also native worker steady state expected lifetime utility in both industries becomes higher.¹⁴ Therefore, accepting fewer immigrants into the complement industry can be beneficial to both native workers and the firms in this industry, and there is no conflict of interests between them.

These results suggest that under internal migration, the interests of native workers and firms in the same industry do not always conflict.

If native workers in the complement industry have more influence over the immigration policy than firms in this industry, the complement industry will accept more immigrants. This improves the native worker steady state expected lifetime utility in both industries if increases in the number

industry are likely to decrease with the number of its own immigrants, i.e., $d\pi_c/d\bar{M}_c = -(dw_{CN_m}/d\bar{M}_c)N_c - (dw_{CM}/d\bar{M}_c)M_c < 0$. We can explain this as follows: As under no internal migration, native worker wages in the complement industry increase with the number of immigrants accepted into this industry:

$$dw_{CN_m}/d\bar{M}_c = (dw_{CN_m}/dN)(dN/d\bar{M}_c) > 0.$$

On the other hand, immigrant wages in the complement industry decrease with their number:

$$dw_{CM}/d\bar{M}_c = F_{C21}(dN_c/d\bar{M}_c) + F_{C22}(dM_c/d\bar{M}_c) < 0.$$

However, if the number of employed immigrants in the complement industry is sufficiently small compared with that of employed native workers in the complement industry, the profits of the firms in this industry decrease as more immigrants are accepted.

¹⁴Native worker employment in the complement industry is smaller since both industries are accepting fewer immigrants as suggested by Equation (14c). On the other hand, native worker employment in the substitute industry is larger as suggested by Equation (14s). However, internal migration makes the native worker employment probability the same in both industries.

of immigrants into the complement industry are significant. At the same time, this will make it possible for the substitute industry to accept more immigrants in order to increase the profits of the firms in this industry. Accordingly, in such a case, native workers and firms in the substitute industry will agree about increasing the number of immigrants.

Similarly, if native workers in the substitute industry have more influence over the immigration policy than firms in this industry, the substitute industry will accept fewer immigrants. This improves the native worker steady state expected lifetime utility in both industries if decreases in the number of immigrants into the substitute industry are significant. At the same time, this will make it possible for the complement industry to accept fewer immigrants in order to increase the profits of the firms in this industry. Accordingly, in such a case, native workers and firms in the complement industry will agree about decreasing the number of immigrants.

This suggests that if native workers in one industry have more influence over the immigration policy than firms in the same industry, in the other industry native workers and firms can realize higher utility and higher profits simultaneously.

Therefore, we can conclude that internal migration is likely to alleviate internal conflicts in each industry and make it easier for each industry to determine the number of its immigrants.

Moreover, according to the above result, the economy will accept more immigrants if native workers in the complement industry have more influence over the immigration policy than firms in this industry. On the other hand, the economy will accept fewer immigrants if native workers in the substitute industry have more influence over the immigration policy than firms in this industry.

To summarize the results derived in this section, as in the case where there is no internal migration, immigrants negatively impact native workers in the substitute industry and positively impact native workers in the complement industry. However, under internal migration, native

worker employment and utility in the substitute industry are not necessarily smaller when more immigrants are accepted into this industry, and native worker employment and utility in the complement industry are not necessarily larger when more immigrants are accepted into this industry. Consequently, under internal migration, the interests of native workers and firms in the same industry are not always in conflict. In other words, there are cases where native worker utility and the profits of the firms in the same industry become larger simultaneously by accepting more immigrants or by accepting fewer immigrants. In such cases, native workers and firms in the same industry will come to an agreement as to whether they increase or decrease the number of its immigrants.

5. Conclusions

This paper investigated the effects of immigrants on native workers and firms in the substitute and complement industries, assuming a case where there is no internal migration and a case where native workers migrate between these industries.

We demonstrated that when there is no internal migration, native workers and firms are always in conflict in both industries. Accordingly, there is no room to simultaneously have positive impacts on both native workers and firms in the same industry by manipulating the number of immigrants. On the other hand, if native workers migrate internally seeking higher utility, there are cases where native workers and firms in the same industry can simultaneously make their utility and profits larger by manipulating the number of immigrants. In such cases, the interests of native workers and firms in the same industry are not in conflict.

Previous studies on the effects of immigrants, or on the determination of immigration quotas, have highlighted the conflicts among different industries or different sectors. However, conflicts are also existent in each industry or sector and they can be affected by internal migration.

The results of this paper suggest that we should encourage internal migration to relieve such conflicts, and that this will make the manipulation of the number of immigrants easier.

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