Foreign Worker Participation in Labor Markets and Its Effects on the Economy's Welfare

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Abstract

Using a small open economic model with dual labor markets, we investigate how changes in foreign workers' accessibility to labor markets affect the economy's welfare. We assume that only a part of the foreign workers can enter the labor markets due to impediments to foreign worker participation in labor markets. In actual economies, foreign workers cannot participate in the labor markets as freely as native workers. We assume two cases, one in which the union and the policy authority behave non-cooperatively, and another in which they behave cooperatively. We show that the economy's welfare, i.e., the sum of the union's and policy authority's utilities, increases in both cases, as more unskilled foreign workers enter the secondary labor market, while the economy's welfare does not always increase as more skilled foreign workers enter the primary labor market. This is because, in the case of cooperation, it is possible that the decreases in the union's utility are larger than the increases in the policy authority's utility. Our results imply that if we want to increase the economy's welfare by increasing unskilled foreign worker participation in the secondary labor market, we have to eliminate the discriminations that prevent their participation in this labor market. We also have to implement policies that mitigate the decreases in the union's utility caused by the increases in union membership of skilled foreign workers, in order to encourage their employment.

JEL Classification: F41, F22, J42

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1. Introduction

Today, many countries are experiencing large inflows of foreign workers.[1] Foreign worker inflow influences receiving countries in a variety of ways. It affects not only native worker employment, but also aggregate supply through changes in employment and aggregate demand through changes in private and public spending. Therefore, analyzing the impact of foreign worker inflow on the receiving countries has become an important economic issue.

Although conclusions pertaining to the effects of foreign worker inflow are not uniform, it is often argued that the negative effects are larger than the positive effects. Many countries are attempting to reduce the inflow of foreign workers.[2] For this purpose, they are mainly implementing immigration control laws and government regulations. However, such measures are not always effective in reducing the inflow because workers are moving across different countries to seek better working conditions and it is very difficult to manipulate workers' rational behavior.[3] This implies that the foreign worker inflow cannot be easily controlled.

Then, if foreign worker inflow has larger negative effects than positive effects on the receiving countries and we only have imperfect control of foreign worker inflow, is it impossible for us to alleviate its negative effects and improve the economy's welfare?

Previous studies on the economic impact of immigration have assumed that although foreign workers are not always employed; however, once they enter a country, all of them can freely enter

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[1]See Böhning and Oishi (1995), Zlotnik (1998), and Stalker (1994, 2000) for a discussion of trends in international migration of labor.

[2]It is far more difficult to let immigrated foreign workers leave the country than to reduce their inflow.

[3]Shimada (2003) discussed the possibility of reducing the inflow of unskilled foreign workers by considering the rationality of their behavior.

labor markets of the immigrated country.[4] However, in practice, many impediments such as the discriminatory behavior of unions or the discriminatory structure of labor markets against foreign workers makes it difficult for them to participate in labor markets of the immigrated country. Therefore, foreign workers only have a limited access to labor markets.[5] Several studies on the economic impact of immigration do not take sufficient account of this fact.

Foreign worker employment depends not only on the amount of foreign worker inflow but also on the number of workers who can enter labor markets. In other words, foreign worker employment is affected by the ratio of foreign workers entering labor markets to those entering a country as well as the amount of foreign worker inflow. Even if the size of foreign worker inflow is large, their employment will be small in a case where their access to the labor market is limited.

Moreover, today, many policy authorities cannot completely ignore the interest of foreign workers and therefore, pay some attention to their employment.[6] Even if we accept foreign workers

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[4]It is assumed in Agiomirgianakis (1998, 2000) that all foreign workers can gain union membership, and the union tries to attain full employment for all union members. Shimada (2003) follows this assumption and assumes that all unskilled foreign workers can enter the competitive labor market of the immigrated country.

[5]In actual economies, many unions are unwilling to grant membership to foreign workers, because the objectives of foreign workers tend to be different from those of the native workers. Even if the foreign workers can gain union membership, their interest will rarely be reflected in the union's objective.

[6]It goes without saying that we are speaking about the foreign workers who have immigrated legally. As Agiomirgianakis (2000) indicates, the policy authorities may ignore the interest of foreign workers giving priority to the interest of native workers, and it is true that policy authorities in some countries

reluctantly and if their existence might have negative economic effects, it is undesirable for the society to leave many of them jobless. A large number of unemployed foreign workers have negative non-economic effects on the society. They might lead to worsening of the public order.

Accordingly, foreign workers' accessibility to labor markets affects the policy authority's utility, and thus the behavior, leading to changes in the union's behavior. This implies that the economy's welfare, i.e., the sum of the union's and the policy authority's utilities, depends on the degree of foreign workers' accessibility to labor markets. Even if foreign worker inflows in the two countries are same in size, each economy's welfare will be affected in different ways depending on those workers' accessibility to those countries' labor markets.

Therefore, this paper focuses on the effects of foreign workers' accessibility to labor markets on the economy's welfare. In particular, we consider whether it is possible or not to improve the economy's welfare by encouraging foreign workers' participation in labor markets.

For this purpose, we utilize an open macroeconomic model for the analysis because international migration of labor is closely connected with open macroeconomies. However, till date, international migration has been mainly studied by approaches that do not use macroeconomic models and it has not been sufficiently analyzed in the context of macroeconomics, except by Agiomirgianakis (1998, 2000) and Agiomirgianakis and Zervoyianni (2001).[7]

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have a discriminatory attitude toward foreign workers. However, in the days of growing international mobility of labor, the policy authorities cannot continue to have such attitudes.

[7]Main approaches that explain international migration without using macroeconomic models are as follows: Microeconomic studies of migration by Todaro (1969), Harris and Todaro (1970), Todaro and Maruszko (1987) assume that international migration occurs as a result of individual optimization. Partial equilibrium studies on migration by Greenwood and McDowell (1986) and chapters 2, 3, and 6

We assume a small open economy with dual labor markets where two kinds of labor, skilled and unskilled, are traded. We give the amount of foreign worker inflow exogenously. Although we should examine how changes in the size of foreign worker inflow affect receiving countries, which is an important problem, the size of foreign worker inflow remains constant throughout the analysis because this paper aims at clarifying how changes in foreign workers' accessibility to labor markets affect the economy's welfare. We assume two cases - in one case the union and the policy authority behave non-cooperatively and in another case they behave cooperatively.

We aim to draw conclusions as to whether increases in skilled (unskilled) foreign worker participation in the primary (secondary) labor market increase the economy's welfare. From these conclusions, we attempt to derive implications as to how skilled and unskilled foreign workers should be treated in order to increase the economy's welfare.

Our analysis shows that given the size of unskilled foreign worker inflow, we can increase the economy's welfare as more unskilled foreign workers enter the secondary labor market in both non-cooperative and cooperative regimes. This can be explained as follows: In the non-cooperative regime, both the union's utility and the policy authority's utility increase as more unskilled foreign workers enter the secondary labor market. In the cooperative regime, although there are cases where

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by Stalker (2000) focus on the labor markets of different countries and provided an explanation that international migration is generated by wage differentials among countries. According to new economics of migration by Stark (1991), international migration is determined not by an individual but by a family. Stark (1984) and Stark and Taylor (1991) advocate the relative deprivation hypothesis. Other approaches for explaining the international migration include the dual labor market theory, the world systems theory, the network theory, and the cumulative causation. See Massey, Arango, Hugo, Kouaouci, Pellegrino, and Taylor (1993, 1998) for a survey of theories in international migration.

the policy authority's utility decreases as more unskilled foreign workers enter the secondary labor market, effects of increases in unskilled foreign workers' accessibility on the union's utility are stronger than those on the policy authority's utility, making the economy's welfare higher as more unskilled foreign workers enter the secondary labor market.

Our analysis also shows that given the size of skilled foreign worker inflow, the economy's welfare does not always increase as more skilled foreign workers enter the primary labor market and gain union membership. This can be explained as follows: The policy authority's utility increases as more skilled foreign workers enter the primary labor market and gain union membership in both non-cooperative and cooperative regimes. In the non-cooperative regime, decreases in the union's utility are smaller than increases in the policy authority's utility due to increases in the skilled foreign workers' participation in the primary labor market, which implies that the economy's welfare increases as more skilled foreign workers enter the primary labor market and gain union membership. However, in the cooperative regime, there are cases where decreases in the union's utility are larger than increases in the policy authority's utility; hence, the economy's welfare decreases as more skilled foreign workers enter the primary labor market and gain union membership.

These results imply that the impediments for unskilled foreign workers should be removed to allow them to enter the secondary labor market and encourage their participation in this market rather than keeping them away. By doing so, we can increase the economy's welfare in both the regimes. These results also imply that if we want to increase the economy's welfare by increasing skilled foreign worker participation and their employment in the primary labor market, the policy authority should implement policies that mitigate decreases in the union's utility arising from increases in skilled foreign workers' membership. Such policies are required to encourage the employment of highly skilled foreign workers who cannot be replaced by the skilled native workers.

The rest of this paper is organized as follows: Section 2 presents a small open economic model

with primary and secondary labor markets. We assume that only a few of skilled (unskilled) foreign workers can enter the primary (secondary) labor market. Section 3 examines the effects of changes in foreign workers' accessibility to labor markets on the economy's welfare in the case where the union and the policy authority behave non-cooperatively. Section 4 examines those effects assuming that the union and the policy authority behave cooperatively. Section 5 contains the concluding comments.

2. The Model

We assume a small open economy with dual labor markets, where skilled labor is traded in the primary labor market and unskilled labor is traded in the secondary labor market. The small open economy interacts with the rest of the world through international trade of goods and international migration of labor. The small open economy consists of skilled workers, unskilled workers, a firm, and a policy authority.

In the primary labor market, all skilled workers are organized in a single union that sets nominal wages unilaterally. Skilled worker employment is determined by the profit-maximizing conditions of the firm.[8] On the other hand, in the secondary labor market, nominal wages and employment of unskilled labor are determined competitively, since on an average, unskilled workers are less unionized than skilled workers.[9]

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[8]In other words, nominal wages and employment of skilled workers are determined in such a way as assumed in the monopoly union model. See Dunlop (1944) and Oswald (1985) for the monopoly union model.

[9]This paper follows the assumption made by Agiomirgianakis and Zervoyianni (2001). However, skilled (unskilled) labor is not always traded in the non-competitive (competitive) labor market.

Since the workers are divided into skilled and unskilled workers, we assume two kinds of international labor flows. Skilled workers move between the primary labor markets and unskilled workers move between the secondary labor markets of the small open economy and the rest of the world. These flows are usually generated by differentials of real-consumption wages (nominal wages divided by the consumer price index) or expected real-consumption wages (real-consumption wages multiplied by the employment probability), as assumed by Agiomirgianakis (1998, 2000), Agiomirgianakis and Zervoyianni (2001), and Shimada (2003). However, this paper restricts the analysis to immigration and assumes that fixed amounts of skilled and unskilled foreign workers flow into the small open economy.[10]

The firm in the small open economy employs skilled and unskilled workers and produces a single kind of product that is not only demanded in the small open economy but also in the rest of the world.

The small open economy has a money market. Money is the only financial asset held by the residents of the small open economy. We disregard international mobility of financial capital and the holdings of interest-bearing assets.

Kemnitz (2003) assumes that high-skilled labor is traded in the competitive labor market, while nominal wages and employment of low-skilled labor are determined by bargaining between the union and the firm.

[10]In an analysis of the welfare consequences of international migration of labor in a small open economy, Agiomirgianakis (2000) restricted the analysis to emigration to avoid complications arising from discrimination against immigrants. However, the purpose of this paper is to investigate how the economy's welfare is affected by immigrants' accessibility to labor markets that is dependent on discrimination against them. Therefore we consider the case of immigration.

The model is summarized by Eqs. (1) - (7).[11] Variables are expressed in logs unless otherwise defined.

$$y = a_1 l_1 + a_2 l_2, \quad a_1, a_2 > 0, \quad a_1 + a_2 < 1. \tag{1}$$

$$l_1 = \ln a_1^{\frac{1-a_2}{1-a_1-a_2}} a_2^{\frac{a_2}{1-a_1-a_2}} - \frac{1-a_2}{1-a_1-a_2}(w_1 - p) - \frac{a_2}{1-a_1-a_2}(w_2 - p). \tag{2}$$

$$l_2 = \ln a_1^{\frac{a_1}{1-a_1-a_2}} a_2^{\frac{1-a_1}{1-a_1-a_2}} - \frac{1-a_1}{1-a_1-a_2}(w_2 - p) - \frac{a_1}{1-a_1-a_2}(w_1 - p).$$

$$z \equiv e + p^* - p. \tag{3}$$

$$q \equiv p + cz, \quad 0 < c < 1/2. \tag{4}$$

$$w_{ic} \equiv w_i - q, \quad i = 1,2. \tag{5}$$

$$m = p + y. \tag{6}$$

$$y = bz, \quad b > 0. \tag{7}$$

Eq. (1) is the production function, where y is output, l_1 is skilled worker employment, l_2 is unskilled worker employment, and a_1, a_2 are constants not expressed in logs. Assuming Cobb-Douglas production technology and a fixed amount of capital, output of a small open economy is positively related to skilled and unskilled labor employed. Eqs. (2) is the labor demand functions for skilled and unskilled workers, where w_1 is skilled worker nominal wages, w_2 is unskilled worker nominal wages, and p is the price of product produced in the small open economy. They are derived from the profit maximization of the firm. Eqs. (2) shows the complementary relationship between skilled and unskilled workers. Eq. (3) is the definition of the real exchange rate, where e is the nominal exchange rate measured as units of domestic currency per unit of foreign currency, p^* is the price of the product produced in the rest of the world. Eq. (4) is the definition of the consumer price index, where c is a constant not expressed in the log. The consumer price index is a weighted

[11]Structural equations of this paper are based on Agiomirgianakis and Zervoyianni (2001). They assume a small open economy with dual labor markets for the analysis of macroeconomic consequences of illegal immigration.

average of the price of the product produced in the small open economy and the domestic currency price of imports. Eqs. (5) is the definitions of real-consumption wages where skilled worker real-consumption wages is w_{1c}, and unskilled worker real-consumption wages is w_{2c}. Eq. (6) is the money market equilibrium condition, where m is the money stock. The policy authority manipulates the money stock. Eq. (7) implies that aggregate demand for output in the small open economy is positively related to the real exchange rate, where b is a constant not expressed in the log. A depreciation of the real exchange rate, that is increases in z, by improving competitiveness, shifts the world demand toward the product produced in the small open economy. We assume that b is larger than 1.[12]

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[12]We have another interpretation of Eq. (7). The trade balance of the small open economy TB can be expressed as,

$$TB = \alpha_1 z - \alpha_2 (y - y^*), \quad \alpha_1, \alpha_2 > 0,$$

where y^* is the output of the rest of the world on which the small open economy has no influences and α_1, α_2 are constants not expressed in logs. If the real exchange rate has stronger (weaker) effects on the trade balance than the difference in output, α_1 is larger (smaller) than α_2. Assuming no capital mobility, trade must be balanced, which requires the following equation:

$$y - y^* = bz,$$

where b denotes α_1/α_2. Since output of the rest of the world is given to the small open economy, we can assume y^* to be 0 without qualitative changes in the results. This gives us Eq. (7).

Whether b is larger than 1 or not is an empirical problem. However, according to Agiomirgianakis (1998, footnote 9), for most countries empirical evidence suggests that real exchange rate has stronger effects on the trade balance than the difference in output and this allows us to assume that $b > 1$.

In this paper, as mentioned already, factors that initiate labor migration are not assumed and the amounts of foreign worker inflow are given exogenously.[13] In particular, the small open economy experiences skilled foreign worker inflow by Δ_1 and unskilled foreign worker inflow by Δ_2, where Δ_1 and Δ_2 are positive constants not expressed in logs. We assume that all foreign workers are legal.

We also assume that all skilled foreign workers cannot enter the primary labor market and all unskilled foreign workers cannot enter the secondary labor market, regardless of their willingness to do so. In other words, only a fraction of θ_1, $0 < \theta_1 < 1$ of skilled foreign workers can enter the primary labor market and gain union membership and only a fraction of θ_2, $0 < \theta_2 < 1$ of unskilled foreign workers can enter the secondary labor market.[14] These assumptions reflect on the fact that in actual economies there are barriers that make it difficult for foreign workers to enter the labor markets. The coefficients θ_1 and θ_2 measure the degree of skilled and unskilled foreign workers' accessibility to the primary and secondary labor markets respectively.

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[13]It is probable that foreign workers' accessibility to labor markets affects the amount of foreign worker inflow. For example, higher accessibility to labor markets may attract more foreign workers. However, this paper does not assume such a possibility, since accessibility to labor markets is not the most important factor that changes the size of foreign worker inflow.

[14]It is probable that the size of foreign worker inflow changes foreign workers' accessibility to labor markets. For example, the larger size of foreign worker inflow may increase foreign workers' accessibility to labor markets, since foreign workers may have larger influence on labor market as the size of foreign worker inflow becomes larger. However, in this paper, we have no need to consider such a possibility, since the size of foreign worker inflow is assumed to be constant throughout this analysis.

Assumptions of labor immigration and foreign workers' limited accessibility to labor markets lead to the following definitions of the effective skilled labor force (union membership) l_1^S and the effective unskilled labor force l_2^S:

$$l_1^S \equiv \ln(\bar{L}_1 + \theta_1 \Delta_1),$$

$$l_2^S \equiv \ln(\bar{L}_2 + \theta_2 \Delta_2),$$

where $\bar{L}_1$ is the effective native skilled labor force (union membership in the absence of skilled foreign workers' immigration) and $\bar{L}_2$ is the effective native unskilled labor. $\bar{L}_1$ and $\bar{L}_2$ are positive constants not expressed in logs.

In the primary labor market, the union tries to maximize its utility function of the form,

$$U = -\{l_1 - \ln(\bar{L}_1 + \theta_1 \Delta_1)\}^2 + g w_{1c}, \quad g > 0, \tag{8}$$

where g, which is a constant not expressed in the log, reflects the relative weight assigned by the union to employment versus skilled worker real-consumption wages. Eq. (8) says that the union attempts to attain full employment for its membership and also make skilled worker real-consumption wages as high as possible. The union's employment target is equal to its membership. This implies that once skilled foreign workers get union membership, they are treated as equally as skilled native workers by the union.

We assume that the policy authority tries to provide employment to not only all workers in labor markets but also to a part of foreign workers who cannot enter labor markets. This assumption reflects on the fact that, today, it is necessary for many policy authorities to pay some attention to foreign worker employment for non-economic reasons, although foreign worker employment might lead to negative effects on the native worker employment. It also attempts to accomplish the consumer price index target, which is assumed to be 0. The policy authority's objective function is of the form,

$$V = -\{l_1 - \ln(\bar{L}_1 + \tau_1 \Delta_1)\}^2 - \{l_2 - \ln(\bar{L}_2 + \tau_2 \Delta_2)\}^2 - h q^2, \quad \theta_1 < \tau_1 < 1, \theta_2 < \tau_2 < 1, \ h > 0, \tag{9}$$

where h, which is a constant not expressed in the log, reflects the relative weight assigned by the policy authority to employment versus the consumer price index. Eq. (9) says that the policy authority disapproves of the deviation of skilled worker employment from the sum of all skilled workers in the primary labor market (the effective skilled labor force) and a part of skilled foreign workers not in the primary labor market $\left|l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1)\right|$, the deviation of unskilled worker employment from the sum of all unskilled workers in the secondary labor market (the effective unskilled labor force) and a part of unskilled foreign workers not in the secondary labor market $\left|l_2 - \ln(\bar{L}_2 + \tau_2\Delta_2)\right|$, and the deviation of the consumer price index from its target $|q|$.

Through appropriate substitutions, the model of Eqs. (1)-(7) can be solved for l_1, l_2, y, p, z, q, w_{1c} and w_{2c} as functions of w_1, w_2 and m.

$$l_1 = \ln a_1^{\frac{1-a_2}{1-a_1-a_2}} a_2^{\frac{a_2}{1-a_1-a_2}} - A + m - w_1,\ A \equiv a_1 \ln a_1^{\frac{1-a_2}{1-a_1-a_2}} a_2^{\frac{a_2}{1-a_1-a_2}} + a_2 \ln a_1^{\frac{1-a_1}{1-a_1-a_2}} a_2^{\frac{a_1}{1-a_1-a_2}}. \quad (10.1)$$

$$l_2 = \ln a_1^{\frac{a_1}{1-a_1-a_2}} a_2^{\frac{1-a_1}{1-a_1-a_2}} - A + m - w_2. \quad (10.2)$$

$$y = a_1(m - w_1) + a_2(m - w_2) + (1 - a_1 - a_2)A. \quad (10.3)$$

$$p = -a_1(m - w_1) - a_2(m - w_2) + m - (1 - a_1 - a_2)A. \quad (10.4)$$

$$z = \frac{a_1}{b}(m - w_1) + \frac{a_2}{b}(m - w_2) + \frac{1 - a_1 - a_2}{b}A. \quad (10.5)$$

$$q = \left(-a_1 + \frac{a_1 c}{b}\right)(m - w_1) + \left(-a_2 + \frac{a_2 c}{b}\right)(m - w_2) + m + (1 - a_1 - a_2)\left(-1 + \frac{c}{b}\right)A. \quad (10.6)$$

$$w_{1c} = \left(1 - a_1 + \frac{a_1 c}{b}\right)(w_1 - m) + \left(-a_2 + \frac{a_2 c}{b}\right)(w_2 - m) - (1 - a_1 - a_2)\left(-1 + \frac{c}{b}\right)A. \quad (10.7)$$

$$w_{2c} = \left(-a_1 + \frac{a_1 c}{b}\right)(w_1 - m) + \left(1 - a_2 + \frac{a_2 c}{b}\right)(w_2 - m) - (1 - a_1 - a_2)\left(-1 + \frac{c}{b}\right)A. \quad (10.8)$$

Substituting the labor demand functions (Eqs. 2) into the production function (Eq. l), we obtain the aggregate supply function that positively relates the product price to output. As the money stock

increases, the curve equilibrating the money market (Eq. 6) shifts upward to the right, resulting in increases in output and the product price (see Eqs. 10.3 and 10.4). Increases in the nominal wages of skilled and/or unskilled workers shift the aggregate supply curve upward to the left, causing decreases in output and increases in the product price (see Eqs. 10.3 and 10.4).

Increases in the money stock increase skilled and unskilled worker employment, since increases in the money stock increase the product price and decrease skilled and unskilled worker real-product wages $w_1 - p$, $w_2 - p$ (see Eqs. 10.1 and 10.2). Increases in skilled (unskilled) worker nominal wages decrease skilled (unskilled) worker employment directly, while they increase skilled (unskilled) worker employment indirectly, since increases in skilled and/or unskilled worker nominal wages shift the aggregate supply curve upward to the left and the product price increases. Since the former effects are stronger than the latter effects, skilled (unskilled) worker employment decreases by increases in skilled (unskilled) worker nominal wages (see Eqs. 10.1 and 10.2). Increases in skilled (unskilled) worker nominal wages decrease unskilled (skilled) worker employment directly, while they increase unskilled (skilled) worker employment indirectly by increasing the product price. Since the former and latter effects offset each other, unskilled (skilled) worker employment does not change by increases in skilled (unskilled) worker nominal wages (see Eqs. 10.1 and 10.2).

Increases in the money stock and/or decreases in skilled and/or unskilled worker nominal wages increase output. Accordingly the aggregate demand must increase if the money stock increases and/or if skilled and/or unskilled worker nominal wages decrease. To increase the aggregate demand, the price of the product produced in the small open economy has to become relatively lower to the price of the product produced in the rest of the world in terms of domestic currency. Therefore increases in the money stock and/or decreases in skilled and/or unskilled worker nominal wages have to be accompanied with depreciation, in other words, increases in z (see Eq. 10.5).

Increases in the money stock increase the consumer price index not only by increasing the product

price and but also by increasing output and bringing about depreciation (increases in z) (see Eq. 10.6).

On the other hand, decreases in skilled and/or unskilled worker nominal wages decrease the consumer price index by decreasing the product price, while they increase the consumer price index by depreciation (increases in z) brought about by increases in output. Accordingly effects of decreases in skilled and/or unskilled worker nominal wages on the consumer price index are ambiguous (see Eq. 10.6). However, under the assumption of $b > 1$, decreases in skilled and/or unskilled worker nominal wages decrease the consumer price index.

Increases in the money stock decrease skilled and unskilled worker real-consumption wages by increasing the consumer price index (see Eqs. 10.7 and 10.8).

Increases in skilled (unskilled) worker nominal wages increase skilled (unskilled) worker real-consumption wages directly (see Eqs. 10.7 and 10.8). Increases in skilled (unskilled) worker nominal wages increase skilled (unskilled) worker real-consumption wages indirectly by decreasing output, bringing about appreciation (decreases in z) and decreasing the consumer price index. On the other hand, increases in skilled (unskilled) worker nominal wages decrease skilled (unskilled) worker real-consumption wages by increasing the product price and the consumer price index. Since the former two effects are stronger than the latter effects, increases in skilled (unskilled) worker nominal wages increase the skilled (unskilled) worker real-consumption wages (see Eqs. 10.7 and 10.8).

Since the effects of increases in skilled (unskilled) worker nominal wages on the consumer price index are ambiguous, those effects on unskilled (skilled) worker real-consumption wages are also ambiguous (see Eqs. 10.7 and 10.8). However, under the assumption of $b > 1$, increases in skilled (unskilled) worker nominal wages decrease unskilled (skilled) worker real-consumption wages. This is because under this assumption, increases in skilled and/or unskilled worker nominal wages increase the consumer price index.

3. Effects of Foreign Worker Participation in Labor Markets on the Economy's Welfare under Non-Cooperation between the Union and the Policy Authority

In this section, we examine how changes in foreign workers' accessibility to labor markets affect the economy's welfare in a case where the union and the policy authority behave non-cooperatively.

In a non-cooperative environment, the union will set skilled worker nominal wages so as to maximize its utility treating m and w_2 as given, that is, it will solve,

$$\max_{w_1} U \quad \text{subject to (10.1), (10.7),} \quad \partial m/\partial w_1 = 0 \quad \text{and} \quad \partial w_2/\partial w_1 = 0.$$

This gives us the condition,

$$l_1 - \ln(\bar{L}_1 + \theta_1\Delta_1) = -\frac{g}{2}\left(1 - a_1 + \frac{a_1 c}{b}\right). \tag{11}$$

The policy authority will set the money stock so as to maximize its utility treating w_1 and w_2 as given, that is, it will solve,

$$\max_{m} V \quad \text{subject to (10.1), (10.2), (10.6),} \quad \partial w_1/\partial m = 0 \quad \text{and} \quad \partial w_2/\partial m = 0.$$

This gives us the condition,

$$l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1) + l_2 - \ln(\bar{L}_2 + \tau_2\Delta_2) + h\left(1 - a_1 + \frac{a_1 c}{b} - a_2 + \frac{a_2 c}{b}\right)q = 0. \tag{12}$$

The equilibrium condition of the secondary labor market is,

$$l_2 = \ln(\bar{L}_2 + \theta_2\Delta_2). \tag{13}$$

We obtain the effects of changes in skilled foreign workers' accessibility to the primary labor market on the economy's welfare from Eqs. (11), (12) and (13).

$$\frac{\partial U^N}{\partial \theta_1} < 0, \quad \frac{\partial V^N}{\partial \theta_1} > 0, \quad \frac{\partial U^N}{\partial \theta_1} + \frac{\partial V^N}{\partial \theta_1} > 0. \tag{14}$$

Eqs. (14) can be explained as follows: According to Eq. (11), the deviation of skilled worker employment from union membership $\left|l_1 - \ln(\bar{L}_1 + \theta_1\Delta_1)\right|$ is a constant. On the other hand, as shown by Eqs. (11) and (10.1), increases in θ_1 decrease skilled worker nominal wages, since increases in θ_1

increase union membership, that is, the target of skilled worker employment, which brings about higher employment and lower nominal wages of skilled workers. Decreases in skilled worker nominal wages decrease skilled worker real-consumption wages (see Eq. 10.7). These imply that in the non-cooperative regime the union's utility decreases as more skilled foreign workers enter the primary labor market and gain union membership, i.e., $\partial U^N / \partial \theta_1 < 0$.

The deviation of skilled worker employment from the sum of all skilled workers in the primary labor market and a part of skilled foreign workers not in the primary labor market $\left| l_1 - \ln(\bar{L}_1 + \tau_1 \Delta_1) \right|$ decreases as we increase θ_1, since increases in θ_1 increase l_1 by Eq. (11) and $l_1 < \ln(\bar{L}_1 + \tau_1 \Delta_1)$. This makes the policy authority's utility higher. The deviation of unskilled worker employment from the sum of all unskilled workers in the secondary labor market and a part of unskilled foreign workers not in the secondary labor market $\left| l_2 - \ln(\bar{L}_2 + \tau_2 \Delta_2) \right|$ is independent of θ_1 (see Eq. 13). The deviation of the consumer price index from its target $|q|$ decreases as we increase θ_1, since the consumer price index decreases as we increase θ_1 by Eq. (12) and the consumer price index is positive.[15] This also makes the policy authority's utility higher. These imply that in the non-cooperative regime the policy authority's utility increases as more skilled foreign workers enter the primary labor market and gain union membership, i.e., $\partial V^N / \partial \theta_1 > 0$.

In the non-cooperative regime, the economy's welfare, i.e., the sum of the union's and policy authority's utilities, increases as we increase θ_1. This comes from the fact that increases in the policy authority's utility due to decreases in the deviation of skilled worker employment from the sum of all skilled workers in the primary labor market and a part of skilled foreign workers not in the primary labor market outweigh decreases in the union's utility due to decreases in skilled worker

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[15] $q = \{1/h(1 - a_1 + a_1 c/b - a_2 + a_2 c/b)\}\{\ln(\bar{L}_1 + \tau_1 \Delta_1) - \ln(\bar{L}_1 + \theta_1 \Delta_1)$
$+ (g/2)(1 - a_1 + a_1 c/b) + \ln(\bar{L}_2 + \tau_2 \Delta_2) - \ln(\bar{L}_2 + \theta_2 \Delta_2)\}$.

real-consumption wages, that is, $\partial[-\{l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1)\}^2]/\partial\theta_1 > |\partial(gw_c)/\partial\theta_1|$. This makes increases in the policy authority's utility larger than decreases in the union's utility when more skilled foreign workers enter the primary labor market and gain union membership, implying $\partial U^N/\partial\theta_1 + \partial V^N/\partial\theta_1 > 0$.

We also obtain the effects of changes in unskilled foreign workers' accessibility to the secondary labor market on the economy's welfare from Eqs. (11), (12) and (13).

$$\frac{\partial U^N}{\partial\theta_2} > 0, \quad \frac{\partial V^N}{\partial\theta_2} > 0, \quad \frac{\partial U^N}{\partial\theta_2} + \frac{\partial V^N}{\partial\theta_2} > 0. \tag{15}$$

Eqs. (15) can be explained as follows: As Eq. (11) shows, the deviation of skilled worker employment from union membership $|l_1 - \ln(\bar{L}_1 + \theta_1\Delta_1)|$ is independent of θ_2. On the other hand, increases in θ_2 decrease unskilled worker nominal wages, since increases in θ_2 make the effective unskilled labor force larger (see Eqs. 13 and 10.2). According to Eq. (10.7), decreases in unskilled worker nominal wages increase skilled worker real-consumption wages under the assumption of $b > 1$.[16] These imply that in the non-cooperative regime the union's utility increases as more unskilled foreign workers enter the secondary labor market, i.e., $\partial U^N/\partial\theta_2 > 0$.

As Eq. (11) shows, the deviation of skilled worker employment from the sum of all skilled workers in the primary labor market and a part of skilled foreign workers not in the primary labor market $|l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1)|$ is independent of θ_2. The deviation of unskilled worker employment from the sum of all unskilled workers in the secondary labor market and a part of unskilled foreign workers not in the secondary labor market $|l_2 - \ln(\bar{L}_2 + \tau_2\Delta_2)|$ decreases as we increase θ_2, since increases in θ_2 increase unskilled worker employment by Eq. (13) and $l_2 < \ln(\bar{L}_2 + \tau_2\Delta_2)$. This makes the

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[16] According to Agiomirgianakis (1998, footnote 9), for most countries empirical evidence suggests that the real exchange rates have stronger effects. This allows us to assume $b > 1$.

policy authority's utility higher. The deviation of the consumer price index from its target $|q|$ decreases as we increase θ_2, since increases in θ_2 decrease the consumer price index from Eq. (12). This also makes the policy authority's utility higher. These imply that in the non-cooperative regime the policy authority's utility increases as more unskilled foreign workers enter the secondary labor market, i.e., $\partial V^N / \partial \theta_2 > 0$.

The economy's welfare increases as more unskilled foreign workers enter the secondary labor market, i.e., $\partial U^N / \partial \theta_2 + \partial V^N / \partial \theta_2 > 0$, since $\partial U^N / \partial \theta_2$ and $\partial V^N / \partial \theta_2$ are both positive.

To summarize the results on the economy's welfare in the non-cooperative environment, the union's utility decreases as more skilled foreign workers enter the primary labor market and gain union membership, while it increases as more unskilled foreign workers enter the secondary labor market. The policy authority's utility increases as more skilled foreign workers enter the primary labor market and gain union membership, and it also increases as more unskilled foreign workers enter the secondary labor market. The economy's welfare increases as more skilled foreign workers enter the primary labor market and gain union membership, and it also increases as more unskilled foreign workers enter the secondary labor market. Therefore our results imply that under non-cooperative behavior by the union and the policy authority, we should remove the discriminatory behavior of the union and the discriminatory structure of labor markets against skilled and unskilled foreign workers and encourage their participation to primary and secondary labor markets, since by doing so more foreign workers participate in labor markets and the economy's welfare increases.

4. Effects of Foreign Worker Participation in Labor Markets on the Economy's Welfare under Cooperation between the Union and the Policy Authority

In this section, we examine how changes in foreign workers' accessibility to labor markets affect the economy's welfare in a case where the union and the policy authority behave cooperatively.

In a cooperative environment, the union and the policy authority will set skilled worker nominal

wages and the money stock so as to maximize the sum of their utilities treating w_2 as given, that is, they will solve,

$$\max_{w_1, m} U + V \quad \text{subject to (10.1), (10.7), (10.2), (10.6),} \quad \partial w_2 / \partial w_1 = 0 \quad \text{and} \quad \partial w_2 / \partial m = 0.$$

This gives us the conditions,

$$l_1 - \ln(\bar{L} + \theta_1 \Delta) + l_1 - \ln(\bar{L}_1 + \tau_1 \Delta_1) + \frac{g}{2}\left(1 - a_1 + \frac{a_1 c}{b}\right) + h\left(-a_1 + \frac{a_1 c}{b}\right) q = 0, \tag{16}$$

$$\begin{aligned} &l_1 - \ln(\bar{L} + \theta_1 \Delta) + l_1 - \ln(\bar{L}_1 + \tau_1 \Delta_1) + l_2 - \ln(\bar{L}_2 + \tau_2 \Delta_2) \\ &+ \frac{g}{2}\left(1 - a_1 + \frac{a_1 c}{b} - a_2 + \frac{a_2 c}{b}\right) + h\left(1 - a_1 + \frac{a_1 c}{b} - a_2 + \frac{a_2 c}{b}\right) q = 0, \end{aligned} \tag{17}$$

As in a case of non-cooperation, equilibrium in the secondary labor market requires Eq. (13).

We obtain the effects of changes in skilled foreign workers' accessibility to the primary labor market on the economy's welfare from Eqs. (16), (17) and (13).

$$\frac{\partial U^C}{\partial \theta_1} < 0, \quad \frac{\partial V^C}{\partial \theta_1} > 0, \quad \frac{\partial U^C}{\partial \theta_1} + \frac{\partial V^C}{\partial \theta_1} \gtreqless 0. \tag{18}$$

Eqs. (18) can be explain as follows: Increases in θ_1 decrease skilled worker nominal wages by Eqs. (16) and (17), since increases in θ_1 increase the target value of skilled worker employment bringing about higher employment and lower nominal wages of skilled workers.[17] Decreases in

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[17] From Eqs. (16) and (17), we can get the consumer price index.

$$\begin{aligned} q = &-(g/2)(-a_2 + a_2 c/b)/\{h(1 - a_2 + a_2 c/b)\} \\ &+ \{\ln(\bar{L}_2 + \tau_2 \Delta_2) - \ln(\bar{L}_2 + \theta_2 \Delta_2)\}/\{h(1 - a_2 + a_2 c/b)\}. \end{aligned}$$

The consumer price index does not depend on θ_1. Therefore, as Eq. (16) shows, increases in θ_1 increase skilled worker employment. This can be confirmed by differentiating skilled worker employment,

$$\begin{aligned} l_1 = &(1/2)[\ln(\bar{L}_1 + \theta_1 \Delta_1) + \ln(\bar{L}_1 + \tau_1 \Delta_1) \\ &- \{(-a_1 + a_1 c/b)/(1 - a_2 + a_2 c/b)\}\{\ln(\bar{L}_2 + \tau_2 \Delta_2) - \ln(\bar{L}_2 + \theta_2 \Delta_2)\}] \\ &- (g/4)\{(1 - a_1 + a_1 c/b - a_2 + a_2 c/b)/(1 - a_2 + a_2 c/b)\}, \end{aligned}$$

skilled worker nominal wages decrease skilled worker real-consumption wages by Eq. (10.7), leading to decreases in the union's utility. Increases in θ_1 make the deviation of skilled worker employment from union membership $\left|l - \ln(\bar{L}_1 + \theta_1\Delta_1)\right|$ larger, since both skilled worker employment and union membership increase by increases in θ_1 and the former increases are smaller than the latter increases.[18] This also makes the union's utility lower.[19] These imply that in the cooperative regime the union's utility decreases as we increase θ_1, i.e., $\partial U^C/\partial\theta_1 < 0$.

Increases in θ_1 make the deviation of skilled worker employment from the sum of all skilled workers in the primary labor market and a part of skilled foreign workers not in the primary labor market $\left|l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1)\right|$ smaller, since, as mentioned earlier, skilled worker employment increases by increases in θ_1. This makes the policy authority's utility higher. The deviation of unskilled worker employment from the sum of all unskilled workers in the secondary labor market and a part of unskilled foreign workers not in the secondary labor market $\left|l_2 - \ln(\bar{L}_2 + \tau_2\Delta_2)\right|$ and the deviation of the consumer price index from its target $|q|$ are independent of θ_1.[20] These imply that in the cooperative regime the policy authority's utility increases as we increase θ_1, i.e., $\partial V^C/\partial\theta_1 > 0$.

Increases in θ_1 decrease the union's utility, while they increase the policy authority's utility. We are not able to determine which of these two effects are stronger. Therefore effects of increases in θ_1

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with respect to θ_1.

[18] $\partial l_1/\partial\theta_1 = (1/2)\{\Delta_1/(\bar{L}_1 + \theta_1\Delta_1)\}$. $\partial \ln(\bar{L}_1 + \theta_1\Delta_1)/\theta_1 = \Delta_1/(\bar{L}_1 + \theta_1\Delta_1)$.

[19] This contrasts with the effects on the union's utility in the non-cooperative regime where the deviation of skilled worker employment from union membership is independent of θ_1.

[20] This contrasts with the effects on the policy authority's utility in the non-cooperative regime where the deviation of the consumer price index from its target decreases as we increase θ_1 making the policy authority's utility higher.

on the economy's welfare are ambiguous in the cooperative regime, i.e., $\partial(U^C + V^C)/\partial\theta_1 \gtreqless 0$.[21]

We also obtain the effects of changes in unskilled foreign workers' accessibility to the secondary labor market on the economy's welfare from Eqs. (16), (17) and (13),

$$\frac{\partial U^C}{\partial \theta_2} > 0, \quad \frac{\partial V^C}{\partial \theta_2} \gtreqless 0, \quad \frac{\partial U^C}{\partial \theta_2} + \frac{\partial V^C}{\partial \theta_2} > 0. \tag{19}$$

Eqs. (19) can be explained as follows: Increases in θ_2 increase skilled worker nominal wages by Eqs. (16) and (17), since increases in θ_2 bring about the lower consumer price index lower, lower employment and higher nominal wages of skilled workers under the assumption of $b > 1$. Increases in skilled worker nominal wages increase skilled worker real-consumption wages by Eq. (10.7). This makes the union's utility higher. On the other hand, increases in θ_2 make the deviation of skilled worker employment from union membership $\left|l_1 - \ln(\bar{L}_1 + \theta_1\Delta_1)\right|$ larger, since increases in θ_2 decrease skilled worker employment under the assumption of $b > 1$. This makes the union's utility lower.[22] The former effects are stronger than the latter effects. Therefore in the cooperative regime the union's utility increases as we increase θ_2, i.e., $\partial U^C/\partial\theta_2 > 0$.

Increases in θ_2 decrease the deviation of unskilled worker employment from the sum of all unskilled workers in the secondary labor market and a part of unskilled foreign workers not in the

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[21] $\partial(U^C + V^C)/\partial\theta_1$
$= \{\ln(\bar{L}_1 + \tau_1\Delta_1) - \ln(\bar{L}_1 + \theta_1\Delta_1)\}\{\Delta_1/(\bar{L}_1 + \theta_1\Delta_1)\} - (g/2)(1 - a_1 + a_1c/b)\{\Delta_1/(\bar{L}_1 + \theta_1\Delta_1)\}.$
As we increase θ_1, the sum of union's and policy authority's utilities increases if,

$$\ln(\bar{L}_1 + \tau_1\Delta_1) - \ln(\bar{L}_1 + \theta_1\Delta_1) - (g/2)(1 - a_1 + a_1c/b) > 0,$$

and decreases if,

$$\ln(\bar{L}_1 + \tau_1\Delta_1) - \ln(\bar{L}_1 + \theta_1\Delta_1) - (g/2)(1 - a_1 + a_1c/b) < 0.$$

[22] This contrasts with the effects on the union's utility in the non-cooperative regime where the

secondary labor market $\left|l_2 - \ln(\bar{L}_2 + \tau_2\Delta_2)\right|$, since unskilled worker employment increases by increases in θ_2 by Eq. (13). They also decrease the deviation of the consumer price index from its target $|q|$, since increases in θ_2 decrease the consumer price index and the deviation of the consumer price index from its target value is positive under the assumption of $b > 1$. These two effects make the policy authority's utility higher. On the other hand, increases in θ_2 make the deviation of skilled worker employment from the sum of all skilled workers in the primary market and a part of skilled foreign workers not in the primary labor market $\left|l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1)\right|$ larger, bringing about the lower policy authority's utility, since skilled worker employment decreases by increases in θ_2 under the assumption of $b > 1$.[23] We are not able to determine whether the former two effects are stronger than the latter effects. Therefore the effects of increases in θ_2 on the policy authority's utility are ambiguous in the cooperative regime, i.e., $\partial V^C / \partial\theta_2 \gtreqless 0$.[24]

Since the effects of increases in θ_2 on the union's utility are stronger than the effects of increases in θ_2 on policy authority's utility, the economy's welfare increases as we increase θ_2 in the cooperative regime, i.e., $\partial(U^C + V^C)/\partial\theta_2 > 0$.

To summarize the results on the economy's welfare in the cooperative environment, the union decreases its utility as more skilled foreign workers enter the primary labor market and gain union membership, while it increases its utility as more unskilled foreign workers enter the secondary labor

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deviation of skilled worker employment from union membership is independent of θ_2.

[23]This contrasts with the effects on the policy authority's utility in the non-cooperative regime where the deviation of skilled worker employment from the sum of all skilled workers in the primary labor market and a part of skilled foreign workers not in the primary labor market is independent of θ_2.

[24]In the case where θ_1, θ_2 and g satisfy $l_1 - \ln(\bar{L}_1 + \tau_1\Delta_1) = 0$, we obtain $\partial V^C/\partial\theta_2 > 0$. In another case where $\theta_2 = 1$ and h is sufficiently large, we obtain $\partial V^C/\partial\theta_2 < 0$.

market. The policy authority increases its utility as more skilled foreign workers enter the primary labor market and gain union membership, while it is ambiguous whether the policy authority increases its utility or not as more unskilled foreign workers enter the secondary labor market. The economy's welfare increases as more unskilled foreign workers enter the secondary labor market in the cooperative environment. The result on the effects of increases in the unskilled foreign worker participation in the secondary labor market is the same as the one derived under non-cooperation. However, it may happen that the economy's welfare decreases as more skilled foreign workers enter the primary labor market and gain union membership in a cooperative regime. This result contrasts with the one derived under non-cooperation.

These results have the following implications: Today, many developed countries are experiencing large inflows of unskilled foreign workers and it is very difficult to control their inflows, since it is very rational for unskilled foreign workers to seek better working conditions. Accordingly many developed countries are accepting unskilled foreign workers willingly or unwillingly. However once we accept unskilled foreign workers, we should try to increase their accessibility to the secondary labor market, since by doing so we can increase the economy's welfare in non-cooperative and cooperative regimes. In other words, once we accept unskilled foreign workers, we should remove the discriminatory structure of the secondary labor market, rather than keeping them away from the secondary labor market because we do not want to accept them.

On the other hand, many developed countries are implementing policies to encourage skilled foreign worker inflow. Our results suggest that such policies do not necessarily lead to increases in skilled foreign worker employment in the primary labor market, since there are cases where the economy's welfare decreases due to increases in union membership of skilled foreign workers in the cooperative regime. This may partly explain why it is difficult for a country like Japan where the union and the policy authority behave cooperatively to increase skilled foreign worker participation

and their employment in the primary labor market. For this purpose, especially to increase highly skilled foreign worker participation and their employment whom we cannot replace with native workers, the policy authority will have to manipulate its instruments to mitigate decreases in the union's utility due to increases in union membership of skilled foreign workers.

5. Conclusions

In this paper, we assumed a small open economy where the labor market has a dual structure. We also assumed that foreign workers are not always able to enter domestic labor markets due to barriers imposed on foreign workers. In such an economy, we examined how changes in foreign workers' accessibility to labor markets affect the economy's welfare and showed that the economy's welfare increases as more unskilled foreign workers enter the secondary labor market in both non-cooperative and cooperative regimes, while the economy's welfare does not always increase with an increase in the number of skilled foreign workers entering the primary labor market.

Our results suggest that in order to increase the economy's welfare, we have to remove impediments for unskilled foreign workers to encourage their participation in the secondary labor market in either regime. Once we accept unskilled foreign workers, they have to be treated as equally as unskilled native workers, even if we do not want to accept them. Discriminatory practices against unskilled foreign workers that prevent them from entering the secondary labor market decrease the economy's welfare.

Moreover, our results provide an explanation for the difficulties observed in increasing skilled foreign worker participation and their employment in the primary labor market. If the policy authority wants to increase the economy's welfare by increasing skilled foreign workers' participation and their employment in the primary labor market, it should implement policies that alleviate decreases in union's utility arising from increases in skilled foreign workers' membership. For example,

policies like giving subsidies to the unions that increase skilled foreign workers' membership might lead to increases in skilled foreign worker participation and their employment in the primary labor market as well as increases in the economy's welfare. Such policies will help increase employment of skilled foreign workers possessing high skills and valuable experiences that skilled native workers do not possess.

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