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Effects of Relaxing Residence Status for Foreign Workers on Native Residents

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Abstract

This paper analyzes the impact of accepting foreign workers, not just from the perspective of an increase in imperfect substitute labor supply, but also including the indirect aspect of an increased educational burden due to the expansion of residency rights. The results lead to the conclusion that the conditions for improving the welfare of native residents, due to the increase in the supply of labor that cannot be perfectly substituted, may not only be met through this increase but also may be relaxed owing to labor movement between industries, which is facilitated by the increased educational burden resulting from the easing of residency rights. This indicates that the improvement in the utility of native residents could potentially be achieved under more relaxed conditions.

Keywords: Foreign workers, Burden of schooling, Substitutability, Complementarity.

JEL Codes: J61, H52, H55.

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During the preparation of this work, we used Chat GPT 4.0 for proofreading purposes.

1. Introduction

The International Organization for Migration (IOM, 2021) estimates that the global number of international migrants in 2020 reached 281 million, representing an average annual growth rate of 2.45% since 2000. This rate is more than double the world's average annual population growth rate of 1.18%. The influence of international migrants has significantly increased in this century. Conversely, the Organization for Economic Co-operation and Development (OECD, 2023) reports that the number of new permanent-type immigrants in OECD countries peaked at 6.1 million in 2022, while the count of temporary-type immigrant workers was 2.4 million. The proportion of temporary-type workers among all immigrants stood at 28.2%. It's noteworthy that immigrants, even those classified as permanent-type, may return to their home countries.

Many economic studies have often neglected the significant role of temporary migrants. Dustmann and Görlach (2016) address this oversight by introducing a model that examines the impact of migrants' temporary status on their economic decisions. Their research highlights how the temporary nature of immigration can lead migrants to accept lower wages and less desirable jobs, a situation that might change if their status were permanent. The study specifically looks at how this temporariness influences immigrants' choices, particularly in terms of savings and consumption patterns, taking into account factors like differences in consumption preferences and the purchasing power of currencies between their home and host countries.

Dustmann and Görlach (2016) presented a model illustrating that many foreign workers are in host countries temporarily, leading to different job and savings choices compared to long-term immigrants. While they highlighted these individual differences, the broader effects on host nations from short- versus long-term labor acceptance weren't explored. Additionally, certain countries, like Singapore, repatriate foreign workers after short terms without their families, whereas others, such as Japan, facing labor shortages from declining birthrates and aging, have shifted policies to support family reunions and longer stays. This study delves into how such policy shifts—from short-term to more inclusive long-term labor acceptance, factoring in family

and retirement—impact host countries, considering labor's imperfect substitutability highlighted by the "Downgrade" concept discussed later.

In countries such as Singapore and Japan, temporary unskilled immigrants are often not permitted to bring their families with them[1]. In Singapore, particularly, there is a strict policy regarding family accompaniment for foreign workers. Over 70% of these workers are holders of a Work Permit which does not permit family accompaniment[2]. In Japan, as indicated in footnote 1, while 67.3% of the foreign workers hold residency statuses with relatively short periods of stay, a portion of them are permitted to have their families accompany them. Moreover, recent policy revisions have allowed for changes in residency statuses, leading to an easing of residence periods and enabling more permanent settlement[3]. Various countries have different approaches to foreign labor. Some accept short-term workers with restricted rights, whereas others are relaxing rights and residency requirements. This paper explores the effects of these diverse foreign worker policies on the welfare of native residents in the host nations[4].

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[1] Singapore Department of Statistics (2021) reports that the proportion of non-residents among permanent residents and non-residents exceeded 75% in 2021. As per the Ministry of Manpower's 'Foreign Workforce Numbers' (https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers), among non-residents, the number of foreign workers holding Work Permits, which do not permit family accompaniment, stands at 1,084,600. This figure represents over 72.9% of the total foreign workforce." On the other hand, Japan's residency rules for foreigners, notably the 'settled' status born out of post-war turmoil and policies for Japanese descendants, reflect its complex historical background. Please see Jinno and Yasuoka (2023) for more detail. According to the Immigration Services Agency of Japan's "Statistics on Foreign Nationals Residing in Japan," which is written in Japanese (https://www.moj.go.jp/isa/policies/statistics/index.html), in 2022, 47.3% of foreign nationals held "status-based residency permits" that allow for long-term residence. On the other hand, the Ministry of Health, Labour and Welfare's "Report on Employment of Foreign Nationals" which is written in Japanese (https://www.mhlw.go.jp/stf/newpage_30367.html), indicates that, for the same year, the proportion of foreign nationals with "status-based residency permits" decreased to 32.7%. This decline suggests a greater acceptance of short-term foreign workers.

[2] As per the Ministry of Manpower's 'Foreign Workforce Numbers' (https://www.mom.gov.sg/documents-and-publications/foreign-workforce-numbers), among non-residents, the number of foreign workers holding Work Permits, which do not permit family accompaniment, stands at 1,084,600. This figure represents over 72.9% of the total foreign workforce.

[3] In 2019, the introduction of a novel system marked a significant shift. It allowed foreign technical interns to elevate their status to 'Special Skilled Workers.' This change not only extended their permissible stay but also granted them the opportunity to bring their families. Please see the detail of the law at https://www.japaneselawtranslation.go.jp/en/laws/view/3624.

[4] There are several studies focused on the impact of accepting foreign workers on the fiscal situation of the host country (such as Lee and Miller (2000), Storesletten (2000), and Chojnicki et al. (2011)). While their analytical methods vary, they generally suggest that, depending on the conditions, accepting workers from overseas tends to improve the fiscal situation. However, because they conceptualize the increase in workers as based on perfect substitution, they do not take into account the imperfect substitution between workers based on a "Downgrade" perspective, which this paper considers to be a problem. Nor do they consider the impact of labor mobility in the labor market through the increase in educators to support the education of foreign workers' children.

Recent research examining immigration's effects has mainly looked at how it influences local wages and job availability. For detailed insights, see works by Dustmann et al. (2016), Edo (2019), and Llull (2020). These papers highlight the significance of capital inflow elasticity and labor market adaptability in relation to immigration. Low elasticity suggests a short-term perspective on immigration's effects, focusing on the potential substitutability between immigrant and native labor. Conversely, high elasticity indicates a long-term view, where swift market adjustments can mitigate immigration's impacts, regardless of the degree of labor substitutability between immigrants and natives.

However, in the long term, although the inflow of capital will adjust to restore the ratio of capital to total-labor to its previous levels, in cases where there is an imperfect substitution relationship within similar educational and experience history, as posited by Ottaviano and Peri (2008, 2012)[5], the substitution effect of foreign workers will be realized locally within those identical categories. Therefore, the acceptance of foreign workers will impact the wage rates of native residents in a cumulative manner through local effects.

Furthermore, as pointed out by Dustmann et al. (2016), if foreign workers are evaluated as 'downgraded' compared to native residents when they immigrant to the host country, measuring their effect as complementary in the way Ottaviano and Peri (2008, 2012) estimated might lead to an overestimation of their complementary effect. Therefore, instead of assuming imperfect substitution within local categories such as identical education and experience histories, it may be more analytically accurate to assume imperfect substitution between the total labor of native residents and that of foreign workers, considering the 'downgrade' evaluation like Llull (2020).

In the long term, considering the impact of capital inflows, while capital inflows adjust the ratio between the amount of capital and the total labor force, they do not fully adjust the wage

[5] Although using similar method, analyses that assume perfect substitutability between native residents and foreign workers are presented in Borjas (2003) and Borjas and Katz (2007). These studies conclude that foreign workers lower the wages of native residents. However, as Powell (2015) points out, the language skills of foreign workers, among other factors, are typically lower than those of native residents. This makes the assumption of perfect substitutability between the two groups within the same category an overly strong assumption.

ratio between native residents and foreign workers back to its original level. Consequently, the wage disparity between native residents and foreign workers becomes dependent on the number of foreign workers accepted. Such a mechanism is not considered at all in studies assuming perfect substitution (Razin and Sadka (2000), Borjas (2003), and Borjas and Katz (2007)) and cannot be fully captured in studies assuming imperfect substitution within similar educational and experience history (Ottaviano and Peri (2008, 2012)). Hence, this paper assumes imperfect substitution between the total labor of native residents and foreign workers and analyzes its impact.

In the case of short-term acceptance, i.e., regulations that only allow for the period of employment, the substitutability in the amount of labor becomes the only significant factor. This is because, with the residency being short-term, expenses such as child-rearing costs and savings for old age are likely to be remitted to the home country and would not affect the economy of the host country. As a result, short-term labor acceptance regulations would only impact the wage rates of the original residents. However, in the case of long-term acceptance, which includes family accompaniment and retirement periods, the impact of savings during the working period and the burden of children's education also become significant for the economy of the host country.

The Organization for Economic Cooperation and Development (OECD, 2019) reported that approximately 48% of 15-year-old first- and second-generation immigrant students in OECD countries did not use the language of the PISA test at home. This resulted in an average reading score of 452, which is 42 points lower than that of their non-immigrant counterparts. In some nations, students who perform poorly are often required to repeat a year. The OECD (2020) found that in 2018, 11% of 15-year-olds in these countries had repeated a grade at least once during their mandatory education. Moreover, the OECD (2020) highlighted a negative correlation between repeating grades and the development of a growth mindset[6]. In contrast, countries like Japan

[6] In addition to these studies, there are many that show that the academic performance of children of foreign workers is often unfavorable. Zinovyeva et al. (2014) and Bernhofer and Tonin (2022) discovered that children of immigrants and students educated in a language other than their mother tongue tend to perform worse academically compared to native students or those taught in their native language.

report almost no instances of 15-year-olds repeating grades. The OECD (2016) credits this to Japan's educational strategy, which involves teachers identifying and providing extra support to students who are struggling, both during and outside of regular school hours[7].

Thus, the educational burden of teaching the children of foreign workers who are accepted is heavy, and much of this burden is in the form of human support, which is likely to involve labor mobility in the labor market. However, while the direct impact of accepting foreign labor on wages has been analyzed and demonstrated, such additional burdens (the aspect of labor mobility in the labor market) have not been considered in theoretical models. Therefore, this paper aims to analyze the impact of accepting foreign workers from abroad while also focusing on these additional burdens[8].

Thus, this study investigates the economic effects of accommodating temporary versus permanent migrants on the welfare of natives, emphasizing the imperfect substitutability between native and migrant labor forces and the financial implications of educational services for immigrant children.

The remainder of this paper is organized as follows. Sections 2 present the model and a discussion. Section 3 concludes.

2. The model

This model posits that labor substitutability between native and foreign workers is imperfect under full employment conditions. It further explores the impact of allowing foreign temporary workers to have children and reside permanently in the host country post-retirement. We consider two scenarios:

[7] For fiscal year 2023, the budget allocated to Foreign National Coexistence Policies is 177.5 billion yen. Part of this budget covers personnel costs, including expenses for hiring extra teachers to assist students in need of Japanese language lessons. This represents an increase of 12.5% compared to last year's budget.

[8] As Powell (2015) mentions using Vigor (2014) as an example, various aspects such as urban redevelopment, including the formation of "Chinatown" and "Little Italy" by foreign workers, should be considered. This point should be addressed as a future research topic.

1. Restricted residence status: Foreign workers contribute to the labor force during their working years and return to their home country upon retirement.
2. Unrestricted residence status: Foreign workers participate in the labor force, have the freedom to raise children, and continue living in the host country during retirement.

This paper contrasts these scenarios in a steady-state context, highlighting the effects of relaxing residence restrictions for foreign workers.

An overlapping-generations model is employed, wherein individuals experience three life stages: childhood, working age, and retirement. Children necessitate education, and native workers in their productive years possess one unit of labor, which is dedicated unconditionally to either consumption or education. Foreign workers, however, allocate only a portion of their labor to the consumption sector during their working years. This limitation is due to the need for cultural and environmental adaptation in the host country, potentially reducing work efficiency. Under restricted residence conditions, foreign workers are prohibited from having children and must return to their home country upon retirement[9]. In contrast, relaxed residence conditions allow them to raise children during their working years and remain in the host country after retirement.

There is a distinct lack of perfect substitutability between native and foreign workers in the consumption sector. Native workers make decisions regarding consumption, savings, and family size, eventually using their savings in retirement. Conversely, foreign workers' behaviors vary based on their residence status, as previously described.

2.1. Admitting foreign workers in the working period

In each period, λ_t represents the proportion of foreign workers, who continuously immigrate without bringing capital, to native workers in period t. The equation is expressed as:

[9] Jinno and Yasuoka (2021) discovered that in Japan, the productivity of foreign workers compared to native workers is 0.61, indicating a lower efficiency than natives. This conclusion stems from the "Basic Survey on Wage Structure" conducted by the Ministry of Health, Labour and Welfare in 2021. For further details, refer to Jinno and Yasuoka (2021).

$$N_t^{IM} = \lambda_t N_t^N, \quad (1)$$

where N_t^{IM} denotes the number of foreign workers in period *t*, and N_t^N denotes the number of native working people in the same period. The superscripts 'IM' and 'N' indicate foreign and native workers, respectively. Thus, the population of the t^{th} generation, including foreign workers, is given by $N_t^T = N_t^N + N_t^{IM} = (1 + \lambda_t)N_t^N$. Assuming the work hours of the native residents as a standard of 1, the work hours of immigrants are hypothesized to $P < 1$. Consequently, the total work hours provided by the native residents, L_t^N, are $L_t^N = N_t^N$, and those provided by the immigrants, L_t^{IM}, are $L_t^{IM} = \mathrm{P}N_t^{IM} = \mathrm{P}\lambda_t N_t^N$.

2.2. Child-rearing and education

Native children require a specified number of educators, denoted as h^N, for child-rearing and education. In the scenario with restricted residency, foreign workers are not permitted to have children, eliminating the need for additional educators. Conversely, in scenarios with open residency, as foreign workers have children, the demand for extra educators increases. Therefore, the number of educators needed for the children of foreign workers in open residency cases, h^{IM}, , exceeds that for native children, h^N.

The relationship between the required number of educators for each child of native or foreign workers is formulated as follows:

$$h^N < h^{IM} = qh^N \quad (2)$$

where $q > 1$. The total number of educators needed for both native and foreign worker children in period *t*, H_t, is calculated as: $H_t = h^N n_t^N + h^{IM} n_t^{IM}$. n_t^N and n_t^{IM} represents the number of children per native and per foreign worker in the open residency case, respectively. In the restricted residency case, n_t^{IM} is zero. For ease of explanation, subsequent equations are developed based on the open residency scenario, assuming foreign workers have children. In the restricted case, it is suggested that the number of children foreign workers have should be considered zero.

It is assumed that only natives are employed as educators, as they are responsible for teaching both foreign worker and native children the host country's language, culture, etc. Utilizing Equations (1) and (2), the number of educators can be calculated as:

$$H_t^N = h^N(n_t^N + \lambda_t q n_t^{IM})N_t^N. \quad (3)$$

With an increased number of educators, the children of foreign workers will be capable of fully realizing their potential, akin to native children, when they reach adulthood[10]. For simplification, children of foreign workers are considered as natives in period $t + 1$. Consequently, the generational population transition, inclusive of foreign workers, is as follows:

$$N_{t+1}^N = n_t^N N_t^N + n_t^{IM} N_t^{IM} \quad (4)$$

This implies that the children of foreign workers become completely assimilated in the host country. From Equation (1), the generational population transition per Equation (4) is reformulated as:

$$\frac{N_{t+1}^N}{N_t^N} = \bar{n}_t = (n_t^N + \lambda_t n_t^{IM}) \quad (4')$$

Here, $\bar{n}_t$ represents the average population growth rate of natives, which includes the children of foreign workers. In this study, it is assumed that the education of foreign worker children elevates their productivity to match that of natives in adulthood. Therefore, the growth rate in Equation (4') is interpreted not from a nationality perspective but in terms of productivity.

2.3. Firms in the consumption sector

The production function is defined as $Y_t = (K_t^T)^{\delta}(L_t^T)^{(1-\delta)}$, where $\delta \in (0, 1)$. Here, Y_t represents the output produced, K_t the capital, and L_t the labor. The superscript T denotes the total number of variables, such as total capital or labor.

[10] This assumption, identical to that in Storesletten (2000), is considered strong. The Organization for Economic Cooperation and Development's (OECD) PISA results from 2019 indicate that immigrant children generally score lower than native children, despite often receiving more educational support in some host countries. As discussed in Jinno (2011, 2013), the extra burden of assimilation into the host country should be explicitly acknowledged. This aspect, however, extends beyond the scope of this paper.

To analyze the relationship between natives and foreign workers, characterized by either perfect or imperfect substitution (complementarity), we utilize the following labor supply function:[11]

$$L_t^T = \left[\psi(L_t^N)^\phi + (1-\psi)(L_t^{IM})^\phi\right]^{\frac{1}{\phi}}, \quad if\ \phi \leq 1, or\ \phi \neq 0 \text{ or}$$
$$L_t^T = (L_t^N)^\psi (L_t^{IM})^{1-\psi}, \quad if\ \phi = 0, \tag{5}$$

where L_t^N and L_t^{IM} are the labor forces supplied by natives and foreign workers, respectively. ψ represents the distribution rate to the native labore force. The elasticity of substitution between these groups is $\frac{1}{1-\phi}$. The relationship becomes perfectly substitutable when $\phi = 1$, imperfectly substitutable when $0 < \phi < 1$, and complementary when $\phi < 0$. Henceforth, we assume $\phi \neq 0$.

Capital K_t is expressed as $K_t = s_t^N N_t^N + s_t^{IM} N_t^{IM}$, where s_t^X $(X = N\ or\ IM)$ is the amount of savings per native or foreign worker. The savings of foreign worker are assumed to be zero in the restricted case, as they return to their home country upon retirement. All capital is presumed to depreciate fully in one period.

According to profit maximization theory, we derive the following equations:

$$(1 + r_t) = \delta(k_t^N)^{\delta-1}\left[\psi(\epsilon_t^N)^\phi + (1-\psi)(\lambda_t \mathrm{P})^\phi\right]^{\frac{1-\delta}{\phi}} \tag{6-a}$$

$$w_t^N = (1-\delta)\psi(k_t^N)^\delta\left[\psi(\epsilon_t^N)^\phi + (1-\psi)(\lambda_t \mathrm{P})^\phi\right]^{\frac{1-\delta-\phi}{\phi}}(\epsilon_t^N)^{\phi-1} \tag{6-b}$$

$$w_t^{IM} = (1-\delta)(1-\psi)(k_t^N)^\delta\left[\psi(\epsilon_t^N)^\phi + (1-\psi)(\lambda_t \mathrm{P})^\phi\right]^{\frac{1-\delta-\phi}{\phi}}(\lambda_t \mathrm{P})^{\phi-1} \tag{6-c}$$

where $\epsilon_t^N = \frac{E_t^N}{N_t^N}$, and E_t^N is the number of natives employed in the consumption sector. The total effective labor supply per native $\left(\frac{L_t^T}{N_t^N}\right)$ in consumption sector as l_t^T and calculated as

[11] This CES production function, adapted from Llull (2020) who investigated the impact of immigration on productivity, allows for a relationship between natives and foreign workers that is minimally substitutable, or even complementary through "Downgrading" discussed in Dustmann et al. (2016), in contrast to the highly substitutable skills-based approach of Ottaviano and Peri (2012).

$$l_t^T = \left[\psi(\epsilon_t^N)^\phi + (1-\psi)(\lambda_t \mathrm{P})^\phi\right]^{\frac{1}{\phi}}. \quad (7)$$

ϵ_t^N can be calculated using Equation (3) as:

$$\epsilon_t^N = 1 - (n_t^N + \lambda_t q n_t^{IM}) h^N \quad (8)$$

Logarithmically differentiating Equations (6-b) and (6-c) with respect to L_t^{IM} and L_t^N, respectively, we find:

$$\frac{d\, ln\, w_t^N}{d\, ln\, L_t^{IM}} \gtrless 0 \text{ and } \frac{d\, ln\, w_t^{IM}}{d\, ln\, L_t^N} \gtrless 0 \quad \text{if } \phi \lessgtr (1-\delta) \quad (9)$$

Case I) if $1-\delta \leq \phi \leq 1$, the relationship is imperfectly or perfectly substitutable, and an increase in foreign workers (natives) decreases the wage rate of natives (foreign workers).

Case II) if $0 \leq \phi < 1-\delta$, the relationship is imperfectly substitutable, and an increase in foreign workers (natives) increases the wage rate of natives (foreign workers).

Case III) if $\phi < 0$, the relationship is complementary, and an increase in foreign workers (natives) increases the wage rate of natives (foreign workers)[12].

Using Equations (6-b) and (6-c), the relative wage rate is calculated as:

$$\frac{w_t^{IM}}{w_t^N} = \Psi \left(\frac{\epsilon_t^N}{\lambda_t \mathrm{P}}\right)^{1-\phi} \quad (10)$$

where $\Psi = \frac{(1-\psi)}{\psi}$. The average income among natives and foreign workers, $\overline{w}_t$, is

$$\overline{w}_t = \left(\frac{w_t^N + \lambda_t \mathrm{P} w_t^{IM}}{1+\lambda_t}\right) \quad (11)$$

by applying Equation (1).

2.4. Education sector

The wages of educators are funded through common educational expenses shared by natives and foreign workers, denoted as z_t^E. Variables with a superscript of E represent common factors for

[12] When considering a small open economy, the condition in Equation (9) modifies to $\phi \lessgtr \frac{(1+\kappa)(1-\delta)}{1-\delta+\kappa}$. In this context, capital is assumed to be supplied in accordance with $1 + r_t = (K_t)^\kappa$, where $\left(\frac{1}{k}\right)$ is the capital supply elasticity. This supported by the findings of Dustmann et al. (2016) and Llull (2020)). For a detailed discussion, refer to Jinno and Yasuoka (2023).

both natives and foreign workers. The budget constraint for educational expenses is given by: $z_t^E(n_t^N N_t^N + n_t^{IM} N_t^{IM}) = w_t^{edu} H_t^N$, where w_t^{edu} is the wage rate for educators. Natives have the flexibility to work either as educators in the education sector or as laborers in the consumption sector. Due to this fluid movement between sectors, the wage rate for educators aligns with that of workers in the consumption sector: $w_t^N = w_t^{edu}$.

Consequently, by applying Equations (1) and (2) and considering the arbitrage movement by natives, the educational expenses are formulated as follows:

$$z_t^E = \left(\frac{n_t^N + \lambda_t q n_t^{IM}}{n_t^N + \lambda_t n_t^{IM}}\right) w_t^N h^N. \tag{12}$$

An increase in the value of q leads to higher education expenses. Consequently, admitting foreign workers whose children necessitate greater educational resources results in an escalation of education costs.

2.5. Consumption utility

We examine the utilities of natives in both restricted and open residency scenarios[13]. An individual's utility depends on the consumption of goods in their youth and old age, as well as the number of children they have. Their utility function is defined as:

$$U_t^X = \alpha \ln c_t^X + \beta \ln d_{t+1}^X + \gamma \ln n_t^X, \tag{13}$$

where $\alpha + \beta + \gamma = 1$, and $X = N \; or \; IM$. The budget constraints for individuals in their youth and old age are:

$$c_t^X + z_t^E n_t^X + s_t^X = In_t^X, \text{ and} \tag{14}$$

$$d_{t+1}^X = (1 + r_{t+1}) s_t^X \tag{15}$$

where $In_t^n = w_t^N$ and $In_t^{IM} = \mathrm{P}w_t^{IM}$.

[13] In the scenario with restricted residency, it is assumed that immigrants return to their home countries upon retirement. Consequently, they use all their earned wages for the purchase of consumption goods, and any savings not utilized during their working period are sent as remittances to their families back home to support their retirement. As a result, the savings accumulated by immigrants during their working years do not contribute to the overall savings in the host country.

Individuals optimize their savings and the number of children during their working period to maximize utility. This leads to the following optimal solutions:

$$\hat{s}_t^X = \beta In_t^X, \tag{16-s}$$

$$\hat{n}_t^X = \frac{\gamma}{z_t} In_t^X. \tag{16-n}$$

Capital accumulation is given by $K_{t+1} = \hat{s}_t^N N_t^N + \hat{s}_t^{IM} N_t^{IM}$, where capital is completely depleted in one period. The capital-labor ratio per native in period $t+1$ is calculated as:

$$k_{t+1}^N = \frac{\hat{s}_t^N + \lambda_t \hat{s}_t^{IM}}{\hat{n}_t^N + \lambda_t \hat{n}_t^{IM}}. \tag{17}$$

With these variables, we can estimate the impact of foreign workers.

2.7 Effects of admitting foreign workers in the restricted case

In this subsection, we analyze the impact of admitting foreign workers on the welfare of natives in the restricted case. In this scenario, foreign workers are presumed to provide labor without having children during their working years and to return to their home country upon retirement. For simplicity, it is hypothesized that foreign workers in the regulated case remit all savings, which would have been used for retirement and childbirth expenses, back to their home country, except for what is spent on consumption during their working period[14]. Hence, in this case $n_t^{IM} = s_t^{IM} = d_t^{IM} = 0$. The variables with superscripts R and UnR denote one in the restricted and opened cases, respectively.

Based on the aforementioned assumptions about foreign workers, the optimal savings and number of children can be determined by substituting equation (12) and $w_t^N = w_t^{edu}$ into Equation (16) as follows:

[14] To comprehensively understand the utility maximization problem for short-term foreign immigrant workers, factors such as consumption, number of children, and savings should be considered, as detailed in studies like Dustmann et al. (2016) and Bossavie et al. (2021). These values would be crucial for a complete analysis. However, this paper focuses on analyzing the impact of lifting restrictions on short-term foreign immigrant workers. Consequently, it does not delve into the complexities of these aspects, which we aim to explore in future research.

$$\hat{s}_t^{N_R} = \beta w_t^{N_R}, \tag{16-s^R}$$

$$\hat{n}_t^{N_R} = \frac{\gamma}{h^N}. \tag{16-n^R}$$

In this model, the optimal number of children becomes constant. By incorporating Equation (16$-n^R$) into Equation (8), we can determine the ratio of native employees in consumption sector as:

$$\epsilon_t^{N_R} = 1 - \gamma \tag{8-R}$$

Consequently, the ratio of native employees in the consumption sector in the restricted case remains constant.

Next, by substituting Equations (8-R), (16-s^R), and (16-n^R) into Equation (13) and Equation (17), we derive the indirect utility function of natives and the transition of the capital-labor ratio per native in the restricted case as follows:

$$U_t^{N_R} = (\alpha + \beta)\ln\left(w_t^{N_R}\right) + \beta \ln\left((1 + r_{t+1}^R)\right) + V, \tag{13-R}$$

$$k_{t+1}^{N_R} = \left(\frac{\beta(1-\delta)\psi h^N}{\gamma(1-\gamma)^{1-\phi}}\right)\left(l_t^T|_{\epsilon_t^{N_R}=1-\gamma}\right)^{1-\delta-\phi}\left(k_t^{N_R}\right)^{\delta}, \tag{18}$$

where $V \equiv \alpha\ln(\alpha) + \beta\ln(\beta) + \gamma\ln\left(\frac{\gamma}{h^N}\right)$.

In the restricted case, we define the steady-state as $k_*^R = k_{t+1}^R = k_t^R$ and $\lambda_* = \lambda_{t+1} = \lambda_t$. At the steady-state in the restricted case, the capital-labor ratio, the wage rate of natives, and the rate of return on savings (denoted by "*") are expressed as follows:

$$k_*^{N_R} = \left(\frac{\beta(1-\delta)\psi h^N}{\gamma(1-\gamma)^{1-\phi}}\right)^{\frac{1}{1-\delta}}\left(l_*^T|_{\epsilon_*^R=1-\gamma}\right)^{\left(\frac{1-\delta-\phi}{1-\delta}\right)}, \tag{19-R*}$$

$$w_*^{N_R} = \left(\frac{\beta h^N}{\gamma}\right)^{\frac{\delta}{1-\delta}}\left(\frac{(1-\delta)\psi}{(1-\gamma)^{1-\phi}}\right)^{\frac{1}{1-\delta}}\left(l_*^T|_{\epsilon_*^R=1-\gamma}\right)^{\frac{1-\delta-\phi}{1-\delta}}, \tag{6-b-R*}$$

$$(1 + r_*^R) = \left(\frac{\gamma\delta(1-\gamma)^{1-\phi}}{\beta(1-\delta)\psi h^N}\right)\left(l_*^T|_{\epsilon_*^R=1-\gamma}\right)^{\phi}. \tag{6-c-R*}$$

By substituting Equations (19-R*), (6-b-R*), and (6-c-R*) into the Equation (13-R), we derive the indirect utility function at the steady-state:

$$U_*^{N_R} = \left\{(\alpha + \beta)\left(\frac{1-\delta-\phi}{1-\delta}\right) + \beta\phi\right\}\ln\left(l_*^T|_{\epsilon_*^R=1-\gamma}\right) + W, \tag{13-R*}$$

where $W \equiv V + (\alpha+\beta)\ln\left(\left(\frac{(1-\delta)\psi}{(1-\gamma)^{1-\phi}}\right)^{\frac{1}{1-\delta}}\left(\frac{\beta h^N}{\gamma}\right)^{\frac{\delta}{1-\delta}}\right) + \beta\ln\left(\left(\frac{\gamma\delta(1-\gamma)^{1-\phi}}{\beta(1-\delta)\psi h^N}\right)\right)$. Differentiating Equation (13-R*) at the steady-state with respect to λ_* and substituting Equations (6) and (19-R), we obtain:

$$\frac{dU_*^{N_R}}{d\lambda_*} = \left\{(\alpha+\beta)\left(\frac{1-\delta-\phi}{1-\delta}\right) + \beta\phi\right\}\frac{d\ln\left(l_*^T|_{\epsilon_*^R=1-\gamma}\right)}{d\lambda}, \tag{20}$$

where $\frac{d\ln l_*^T|_{\epsilon_*^R=1-\gamma}}{d\lambda_*} = \left(\frac{(1-\psi)\mathrm{P}^\phi}{\psi(1-\gamma)^\phi+(1-\psi)(\lambda_*\mathrm{P})^\phi}\right)\left(\frac{1}{\lambda_*}\right)^{1-\phi} > 0.$

Equation (20) leads to the following relation:

$$\frac{dU_*^{N_R}}{d\lambda_*} \gtreqless 0 \text{ if } \phi \lesseqgtr (1-\delta)\Phi, \tag{21}$$

where $\Phi \equiv \left(\frac{\alpha+\beta}{\alpha+\beta\delta}\right) > 1$. This condition suggests that if the elasticity of substitution between natives and foreign workers is sufficiently small, indicating a relatively complementary relationship, admitting foreign workers improves the utility of natives.

Comparing Equation (9) with Equation (21) also suggests that admitting foreign workers can enhance the utility of natives even if the wage rate of natives does not increase. This is because the positive effects of admitting foreign workers through the rate of return from savings, $\frac{d\ln(1+r^*)}{d\lambda} = \left(\frac{\gamma\delta(1-\gamma)^{1-\phi}}{\beta(1-\delta)\psi h^N}\right)\cdot\frac{d\ln l_*^T|_{\epsilon_*^R=1-\gamma}}{d\lambda_*} > 0$, may outweigh the negative effects of a wage rate decrease caused by admitting foreign workers.

The acceptance of foreign workers is often evaluated based on whether it leads to an increase in wages for native residents. However, the impact of accepting foreign workers extends beyond the direct effect on wage rates, encompassing also the influence on interest rates. A comprehensive view, as demonstrated by this analysis, is essential to understand how these combined effects affect the welfare of native residents.

Based on Equations (9) and (21), we arrive at Proposition 1:

Proposition 1:

Even in scenarios where the residence status of foreign workers in the host country is restricted and they are not highly complementary, admitting foreign workers can still improve the utility of the native population.

Proposition 1 emerges from the analysis in the restricted case, focusing on the admission of temporary workers. However, some countries, like Japan, are transitioning to accept foreign workers from a long-term perspective, moving beyond the confines of temporary labor migration.

Adopting a long-term outlook, foreign workers accepted into a country are likely to continue residing there. In such a scenario, foreign workers who stay in the host country might also have children. Consequently, the host country would need to bear the responsibility of educating these children. We will analyze the effects of admitting foreign workers on the host country when the residence status of foreign workers is open in the subsequent subsection.

2.8 Effects of admitting foreign workers in the unrestricted case

In the unrestricted case scenario, foreign workers are allowed to have children during their working period and continue living in the host country upon retirement. Consequently, in this case, we observe $n_t^{IM} > 0$, $s_t^{IM} > 0$, and $d_t^{IM} > 0$.

By incorporating Equations (10) and (16-n) into Equation (12), we have

$$z_t^{UnR} = \eta_t^{UnR} w_t^N h^N, \tag{22}$$

where $\eta_t^{UnR} \equiv \frac{1+q\lambda_t \mathrm{P}\Psi\left(\frac{\epsilon_t^{UnR}}{\lambda_t \mathrm{P}}\right)^{1-\phi}}{1+\lambda_t \mathrm{P}\Psi\left(\frac{\epsilon_t^{UnR}}{\lambda_t \mathrm{P}}\right)^{1-\phi}} > 1$. η_t^{UnR} represents the increase in education costs resulting from admitting immigrants whose children necessitate greater educational resources. Substituting Equation (16-n) and Equation (22) into Equation (8), we establish the following relationship:

$$\epsilon_t^{N_{UnR}} + \gamma\Psi(\lambda_t \mathrm{P})^{\phi}\left(\epsilon_t^{N_{UnR}}\right)^{1-\phi} = 1 - \gamma. \tag{23}$$

While the left side of Equation (23) increases monotonously with respect to $\epsilon_t^{N_{UnR}}$, the left side of Equation (23) remains constant. Thus, the ratio of native employees in the consumption sector $\left(\epsilon_t^{N_{UnR}}\right)$ is determined endogenously and uniquely, which we define as $\hat{\epsilon}_t^{N_{UnR}}$. These relationships are summarized in Figure 1.

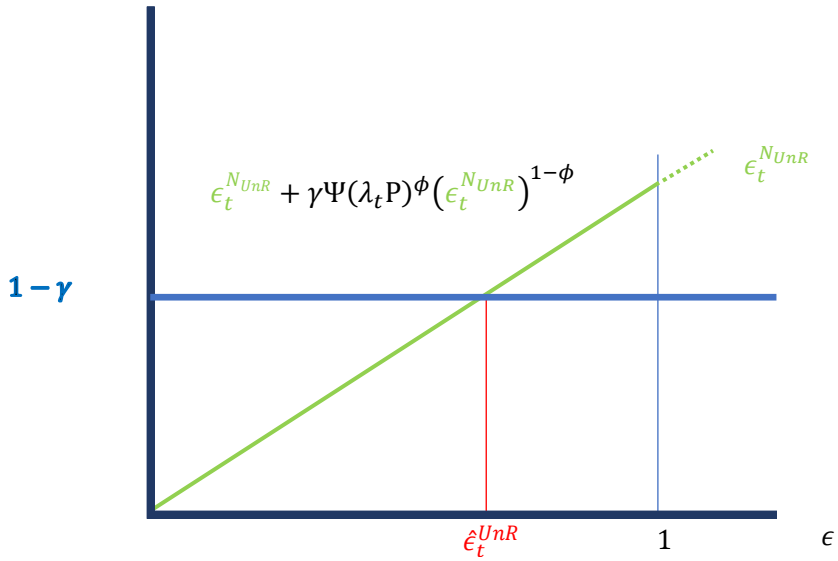

Figure 1 The relation between the left side and the right side of Equation (23).

We can also determine the endogenously set cost of education by substituting $\hat{\epsilon}_t^{N_{UnR}}$ into Equation (22), which is then defined as $\hat{z}_t^{UnR}$.

Total differentiation of the Equation (23) with respect to λ and ϵ leads to the following relationship.

$$\frac{d\hat{\epsilon}_t^{N_{UnR}}}{d\lambda_t} = -\frac{P^{\phi}\gamma\Psi\phi(\lambda_t)^{\phi-1}}{1+(1-\phi)\frac{(\lambda_t)^{\phi}P^{\phi}\gamma\Psi}{\left(\hat{\epsilon}_t^{N_{UnR}}\right)^{\phi}}}\left(\hat{\epsilon}_t^{N_{UnR}}\right) < 0. \tag{24}$$

This equation indicates that the ratio of native employees in the consumption sector, $\hat{\epsilon}_t^{N_{UnR}}$, decreases as λ_t increases, implying an inverse relationship between the number of foreign workers and the employment ratio of natives in the consumption sector. According to Equation (24), we derive the logarithmic differential expression of the relationship between λ and ϵ as

$\frac{d\ln \hat{\epsilon}_t^{N_{UnR}}}{d\lambda} \equiv \sigma_\lambda^{\epsilon} = -\frac{P^{\phi}\gamma\Psi\phi(\lambda_t)^{\phi-1}}{1+(1-\phi)\frac{(\lambda_t)^{\phi}P^{\phi}\gamma\Psi}{\left(\hat{\epsilon}_t^{N_{UnR}}\right)^{\phi}}} < 0$. This represents the elasticity of the number of natives employed in the consumption sector with respect to λ.

By substituting $\hat{\epsilon}_t^{UnR}$, $\hat{z}_t^{UnR}$, Equations (6-b) and (16) into Equation (13) and Equation (17), we can derive the indirect utility function of natives and the transition of capital-labor ratio per native in the opened case as follows:

$$U_t^{N_{UnR}} = (\alpha+\beta)\ln\left(w_t^{N_{UnR}}\right) + \beta\ln\left((1+r_{t+1}^{UnR})\right) + \gamma\ln\left(\frac{1}{\hat{\eta}_t^{UnR}}\right) + V \tag{13-UnR}$$

$$k_{t+1}^{UnR} = \frac{h^N}{\gamma}\beta(1-\delta)\psi\left(k_t^{UnR}\right)^{\delta}\left(\left[\psi\left(\hat{\epsilon}_t^{N_{UnR}}\right)^{\phi} + (1-\psi)(\lambda_t \mathrm{P})^{\phi}\right]^{\frac{1}{\phi}}\right)^{1-\delta-\phi}\left(\hat{\epsilon}_t^{N_{UnR}}\right)^{\phi-1}\hat{\eta}_t^{UnR}. \tag{25}$$

In the opened case scenario, we define the steady-state as $k_*^{UnR} = k_{t+1}^{UnR} = k_t^{UnR}$ and $\lambda_* = \lambda_{t+1} = \lambda_t$. At the steady-state in the opened case, the capital-labor ratio, the wage rate of natives, and the rate of return on savings are expressed as follows:

$$k_*^{UnR} = \left(\frac{\beta(1-\delta)\psi h^N}{\gamma\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{1-\phi}}\right)^{\frac{1}{1-\delta}}\left(\hat{l}_*^{T_{UnR}}\right)^{\left(\frac{1-\delta-\phi}{1-\delta}\right)}\left(\hat{\eta}_*^{UnR}\right)^{\frac{1}{1-\delta}}, \tag{19-UnR}$$

$$w_*^{No} = (1-\delta)\psi\left(k_*^{No}\right)^{\delta}\left(\hat{l}_*^{To}\right)^{(1-\delta-\phi)}\left(e_*^{N}\right)^{(\phi-1)}, \tag{6-b-UnR*}$$

$$(1+r_*^{O}) = \delta\left(k_*^{N_O}\right)^{\delta}\left(\hat{l}_*^{T_O}\right)^{1-\delta}, \tag{6-c-UnR*}$$

where $\hat{l}_*^{T_{UnR}} = \left[\psi\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{\phi} + (1-\psi)(\lambda_* \mathrm{P})^{\phi}\right]^{\frac{1}{\phi}}$, $\hat{\eta}_*^{UnR} = \frac{1+q\Psi(\lambda_* \mathrm{P})^{\phi}\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{1-\phi}}{1+\Psi(\lambda_* \mathrm{P})^{\phi}\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{1-\phi}}$, and $\hat{\epsilon}_*^{N_{UnR}} = \hat{\epsilon}_t^{N_{UnR}}\big|_{\lambda_t=\lambda_*}$.

By substituting Equations (19-UnR*), (6-b-UnR*), and (6-c-UnR*) into the Equation (13-UnR), we derive the indirect utility function at the steady-state:[15]

[15] In this model, the effect of the additional educational burden, denoted as q, is consolidated into $\ln\eta$. Since $\left(\frac{d\ln\hat{\eta}_*^{O}}{dq} > 0\right)$, if a heavier additional educational burden were imposed, its impact on utility would be encapsulated by the sign of $\left\{(\alpha+\beta)\left(\frac{\delta}{1-\delta}\right) - (\beta+\gamma)\right\}$. This means that whether the preference parameter γ, which evaluates the decrease in utility due to indirectly being unable to have children because of the heavier additional educational burden, exceeds the increase in utility through wage rates and interest rates, depends on it.

$$U_*^{N_{UnR}} = \left\{(\alpha+\beta)\left(\frac{1-\delta-\phi}{1-\delta}\right)+\beta\phi\right\}\ln\left(\hat{l}_*^{T_{UnR}}\right) - (1-\phi)\left(\frac{\alpha+\beta\delta}{1-\delta}\right)\ln\left(\hat{\epsilon}_*^{N_{UnR}}\right) + \left\{(\alpha+\beta)\left(\frac{\delta}{1-\delta}\right)-(\beta+\gamma)\right\}\ln\left(\hat{\eta}_*^{UnR}\right)+V. \quad \text{(13-O*)}$$

Differentiating Equation (13-O*) at the steady-state with respect to λ_*, we obtain:

$$\frac{dU^{N_{UnR}}}{d\lambda_*} = \left\{(\alpha+\beta)\left(\frac{1-\delta-\phi}{1-\delta}\right)+\beta\phi\right\}\frac{d\ln\left(\hat{l}_*^{T_{UnR}}\right)}{d\lambda_*} - (1-\phi)\left(\frac{\alpha+\beta\delta}{1-\delta}\right)\hat{\sigma}_\lambda^\epsilon + \left\{(\alpha+\beta)\left(\frac{\delta}{1-\delta}\right)-(\beta+\gamma)\right\}\frac{d\ln(\tilde{\eta}_*^{UnR})}{d\lambda_*}. \quad (26)$$

where $\frac{d\ln\left(\hat{l}_*^{T_{UnR}}\right)}{d\lambda_*} = \left(\frac{1}{\hat{l}_*^{T_{UnR}}}\right)^\phi(1-\psi)\mathrm{P}^\phi(\lambda_*)^{\phi-1} + \left(\frac{1}{\hat{l}_*^{T_{UnR}}}\right)^\phi\psi\left(\hat{\epsilon}_*^{N_{UnR}}\right)^\phi\hat{\sigma}_\lambda^\epsilon$, $\frac{d\ln(\tilde{\eta}_*^O)}{d\lambda_*} = \left(\frac{\Psi(\lambda_*\mathrm{P})^\phi\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{1-\phi}}{1+\Psi(\lambda_*\mathrm{P})^\phi\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{1-\phi}}\right)\cdot\left(\frac{q-1}{1+q\Psi(\lambda_*\mathrm{P})^\phi\left(\hat{\epsilon}_*^{N_{UnR}}\right)^{1-\phi}}\right)\cdot\left(\frac{\phi}{\lambda}+(1-\phi)\hat{\sigma}_\lambda^\epsilon\right)$ and $\hat{\sigma}_\lambda^\epsilon \equiv \frac{d\ln\left(\hat{\epsilon}_*^{N_{UnR}}\right)}{d\lambda_*}$.

In Equation (26), the first term on the right-hand side estimates the impact of admitting foreign workers on the utility of natives in the restricted case. This impact arises from changes in the effective labor force per native. The second term reflects the positive effect of the employment shift in the consumption sector for natives due to admitting immigrants. The final term accounts for the impacts arising from increased education costs, which occur when admitting immigrants whose children require more educational resources. This effect can be either positive or negative as it not only reduces the number of children but also influences utility through changes in labor supply and the capital-labor ratio in the consumption sector.

The sign of $\frac{d\ln(\hat{\eta}_*^{UnR})}{d\lambda_*}$ is determined as follows:

$$\frac{d\ln(\hat{\eta}_*^{UnR})}{d\lambda_*} \gtrless 0 \quad if \quad |\hat{\sigma}_\lambda^\epsilon| \lessgtr \frac{1}{(1-\phi)}\cdot\left(\frac{\phi}{\lambda}\right). \quad (27)$$

According to Equation (27), if the absolute value of the elasticity of the number of natives employed in the consumption sector with respect to the proportion of foreign workers to native workers, $|\hat{\sigma}_\lambda^\epsilon|$, is relatively smaller than the elasticity of substitution between natives and foreign workers, $\left(\frac{1}{1-\phi}\right)$. This implies that η represents an increase when the impact of labor mobility across sectors, caused by admitting foreign workers whose children require more educational resources, does not exceed the substitution effects on the labor force between natives and foreign

workers. The direction of these effects $\left(\frac{d\ln(\hat{\eta}_*^{UnR})}{d\lambda_*}\right)$ being positive or negative depends on the sign of $(\alpha+\beta)\left(\frac{\delta}{1-\delta}\right)-(\beta+\gamma)$, which represents the relationship among utility preferences and distribution rates in the production function. As a result, the sign of Equation (26) becomes indeterminate[16].

It can be shown that under certain conditions, despite being a sufficient condition, improvements in the utility of natives can be realized compared to scenarios with restricted residency qualifications for foreign workers.

To clarify the comparative results, the employment rate of the natives will be approximated using the value $1-\gamma$, representing the scenario where the acceptance of foreign workers is restricted[17]. In this approximated case, Equation (26) can be modified as follows:

$$\left.\frac{dU^{N_{UnR}}}{d\lambda_*}\right|_{\hat{\epsilon}_*^{N_{UnR}}=1-\gamma}=\frac{dU^{N_R}}{d\lambda_*}+\left\{(\alpha+\beta)\left(\frac{1-\delta-\phi}{1-\delta}\right)+\beta\phi\right\}\psi\left(\frac{\hat{\epsilon}_*^{N_{UnR}}}{l_*^T}\right)^{\phi}\hat{\sigma}_\lambda^{\epsilon}$$
$$-(1-\phi)\left(\frac{\alpha+\beta\delta}{1-\delta}\right)\hat{\sigma}_\lambda^{\epsilon}+\left\{(\alpha+\beta)\left(\frac{\delta}{1-\delta}\right)-(\beta+\gamma)\right\}\frac{d\ln(\hat{\eta}_*^{UnR})}{d\lambda_*}. \quad (26')$$

Equation (26') encompasses the impacts on the utility of natives due to admitting foreign workers under conditions where their residency qualifications are restricted, along with additional effects stemming from opening these qualifications. The second term on the right-hand side quantifies changes in native labor employment in the consumption sector caused by the admission of foreign workers. This term is positive. According to the analysis of Equation (27) , the last term can also be positive. Therefore, if the sum of the first and second terms is positive, admitting foreign workers can enhance the utility of natives. This condition is summarized as $|\hat{\sigma}_\lambda^{\epsilon}|<$

[16] When $q=1$ holds, indicating that immigrant children require the same amount of educational resources as native children, the derivative $\frac{d\ln(\hat{\eta}_*^{O})}{d\lambda_*}$ becomes 0. Consequently, admitting immigrant workers whose children do not require any additional educational resources can enhance the utility of natives more in scenarios where the residency qualifications of foreign workers are more open, compared to scenarios with restricted residency qualifications.

[17] In Subsection "2.9 Numerical Example", we conduct an analysis using specific numerical values. In this context, the difference between the employment rate of the natives under the relaxed policy and that under the restricted policy $(1-\gamma)$ is less than 1.71%. From this, we consider it acceptable to use the value of $1-\gamma$ as an approximation of the employment rate.

$\left(\frac{1-\psi}{\psi}\right)\left(\frac{\lambda_* \mathrm{P}}{\hat{\epsilon}_*^{N_{UnR}}}\right)^{\phi}\left(\frac{1}{\lambda_*}\right)$, according to Equation (26). This implies that the absolute value of the elasticity of the number of natives employed in the consumption sector with respect to the proportion of foreign workers to native workers is sufficiently small. In summary, policies that relax residency qualifications for foreign workers fundamentally improve the utility of natives, provided the children of foreign workers do not diminish native employment in the consumption sector or impose a significant educational burden.

Moreover, there are notable effects associated with opening residency qualifications for foreign workers. When ϕ is greater than $(1-\delta)\Phi$, admitting foreign workers decreases the utility of natives when their residency qualifications are restricted, as per Equation (21). This case suggests that the relationship between native and foreign workers is relatively substitutable. In such instances, the second term on the right-hand side of Equation (26') is positive. Thus, in these scenarios, policies that relax residency qualifications for foreign workers improve the utility of natives more effectively than when these qualifications are restricted[18].

The results from Equations (20) and (26) leads to the following proposition and remma:

Proposition 2:

Even in scenarios where the residence status of foreign workers in the host country is relaxed and their labor is not highly complementary, admitting foreign workers can still enhance the utility of natives under certain conditions.

[18] This condition is met only when the last term in Equation (26') is positive or when the value of $|\hat{\sigma}_{\lambda}^{\epsilon}|$ is sufficiently small. What is more, the analysis in this paper is based on sufficient conditions, not on necessary and sufficient conditions. This point remains a topic for future research.

Lemma:

Furthermore, even in situations where relatively substitutable foreign workers do not improve the utility of natives in the restricted case, their admission can still lead to an overall improvement in native utility.

From the Proposition 2, it can be considered that when accepting foreign workers, adopting long-term relaxation policies rather than imposing short-term restrictions is more likely to lead to an overall improvement in welfare.

2.9 Numerical Example

In this subsection, we aim to present a comparison between cases where restrictions on the right of residence are imposed and where they are relaxed, focusing on the steady state and using specific numerical values[19].

We focus on specific calculations related to the parameters outlined in Table 1. We assume a subjective discount rate per year of exp (-0.01). Given that one period is equivalent to 30 years, we calculate the subjective discount rate for each period to be 0.741. Productivity per working hour is determined by dividing scheduled cash earnings by the actual number of hours worked, according to data from "*the Basic Survey on Wage Structure"* published by the Ministry of Health, Labour and Welfare in 2021. The productivity rates for natives and immigrants are found to be 2.061 and 1.659, respectively, leading to a productivity ratio of 0.805, which we denote as P. The ratio of the total number of faculty members to the total number of students, as reported in "*the Statistical Abstract of Education*", is 0.102, denoted as h^N. Aichi Prefecture, noted for its large population of foreign workers and advanced education system for foreign

[19] The numerical examples are based on Jinno and Yasuoka (2023). For more details, please refer to Jinno and Yasuoka (2023).

children in Japan, is highlighted as a critical case in our analysis. To estimate the most comprehensive educational burden, we adopt the value of q based on the scenario in Aichi Prefecture for our study. Based on the *"Notification of the Employment Status of Foreign Workers*," the number of foreign workers was calculated, and using the number of employed individuals from the "*Labor Force Survey*," the proportion of foreign workers in the total workforce was determined (both using values from October 2023). Additionally, due to the lack of appropriate values for substitutability, the value from the framework of imperfect substitution was used[20]. Under the value of imperfect substitution as described, the acceptance of foreign workers leads to a reduction in wages and utility, as $\phi > (1-\delta)\Phi$ are satisfied.

Key parameter	Value	Key parameter	Value
α	0.548	P	0.805
β	0.741α	ψ	0.750
γ	$1-\alpha-\beta$	h^N	0.062
δ	0.499	q	1.506
λ	0.030	ϕ	0.900

Table 1. Key parameters.

Note: The preferences from α to γ are adjusted to get the fertility rate as 0.65 per capita. The value of δ is obtained from Japan Institute for labour Policy and Training (JILPT; 2023), and it is calculated by dividing the labor costs by the total added value.

Using the values from Table 1, we calculated the steady-state values for the cases where restrictions on the right of residence are imposed and relaxed, and summarized the results in Table 2.

[20] Ottaviano and Peri (2008, 2012) analyzed the interaction between native residents and foreign workers, characterizing it as an imperfect substitution. However, their analysis concentrated on the lowest level of the labor force, diverging from the assumptions of this study. Consequently, the values obtained from their analysis are not applicable to the research presented in this paper.

Restricted case		Opened case	
Endogenous variables	**Value**	**Endogenous variables**	**Value**
$U_*^{N_R}$	-3.3671	$U_*^{N_{UnR}}$	-3.2967
$\epsilon_*^{N_R} = 1 - \gamma$	0.9540	$\epsilon_*^{N_{UnR}}$	0.9376
$k_*^{N_R}$	0.0152	$k_*^{N_{UnR}}$	0.0194
$w_*^{N_R}$	0.0279	$w_*^{N_{UnR}}$	0.0319
$(1 + r_*^R)$	2.4050	$(1 + r_*^{UnR})$	2.1118

Table 2. Endogenously calculated variables at the steady state.

The first noteworthy result from Table 2 is that relaxing the restrictions on the right of residence results in a higher steady-state utility value than imposing constraints. As implied by the analysis of Equation (26'), under a policy of relaxation, it is easier to improve utility. Furthermore, increasing the acceptance rate of foreign workers from 3% to 4% worsens the utility under both policies, but the rate of deterioration is lower under relaxation, with -0.07% under restrictions and -0.04% under relaxation.

A comparative analysis is conducted on the substitutability (ϕ) between native residents and foreign workers. The analysis uses values that represent different scenarios: $\phi = 0.6$, where welfare improves despite a decrease in wages; $\phi = 0.3$, representing a state of improved wage rates and imperfect substitutability; and $\phi = -0.3$, representing a complementary state. It compares situations where residency rights are restricted versus relaxed. In cases where restrictions are relaxed, the welfare of native residents improved by 6.2%, 15.1%, and 47.2%, respectively. With ϕ set at 0.9, the improvement was only 0.1%, suggesting that accepting more complementary foreign workers leads to greater improvements in welfare through relaxation. This analysis of specific numerical examples leads to the conclusion that relaxing the restrictions on the right of residence is preferable to imposing them.

Accepting foreign workers leads to an increase in the amount of labor in an imperfectly substitutable relationship. However, if the right of residence is restricted, the impact is likely to be limited. Relaxing the right of residence not only increases the labor supply in the next period but also induces inter-industry labor mobility in the current period. This labor mobility has the effect of increasing the wage rate in the consumer goods industry, which determines wage rates. However, if the impact of this inter-industry mobility is too large, the burden of educational expenses may become heavier, potentially negating the benefits of improved wage rates.

2.10 Discussion

In analyzing the impact of accepting foreign workers, previous theoretical analyses have assumed perfect substitution, examining the effects of increases in either skilled or unskilled workers (Razin and Sadka (1999, 2000), Kemnitz (2003), Kemnitz (2009), and so on). On the other hand, quantitative analyses have focused solely on the impact on the wages of original residents. This paper extends the analysis to not only wage increases or decreases but also changes in welfare by focusing on "Downgrading" and treating foreign workers as an imperfect substitute for other factors of production. Furthermore, the paper highlights the indirect impact of an increase in the number of children due to family reunification enabled by relaxed residency rights, beyond the direct increase in labor.

The analysis, both theoretical and numerical, suggests that rather than restricting residency rights, it is more desirable to relax them to allow for sustainable acceptance of future generations. This is demonstrated through Equation (26), which suggests that the direct impact of increased labor (first term) and the natural shift of labor from the consumer goods industry to the education industry due to the increase in children (second term) are beneficial. However, the additional burden (q) arising from these children being of foreign workers (third term) depends on the preference parameter for having children.

Current Japanese policies tend toward expanding the acceptance of foreigners and relaxing residency rights, directions considered favorable by this paper's analysis. Additionally, Jinno (2024)'s analysis infers a complementary relationship between original residents and foreign workers in Japan, supporting the relaxation of acceptance policies. However, the increase in the number of foreign children, due to relaxed residency rights, could impose indirect educational burdens. If the preference parameter for having children is high, this indirect burden could increase the cost of having children, potentially lowering welfare. This paper treats education as a necessity for becoming a worker but also recognizes its role in improving productivity. The increase in foreign workers could improve welfare through short-term labor input but might lead to a future decline in productivity and welfare due to excessive consumption of educational resources by the increased number of foreign children. To analyze this aspect, it would be necessary to consider labor movement between industries and internalize educational investment, as treated by Casarico and Devillanova (2003).

3. Conclusion

This paper explores the impact of admitting foreign workers on the welfare of native residents, considering the imperfect substitutability between native and foreign worker labor under an education system burdened with the additional task of educating foreign worker children. The analysis presented in this paper suggests that admitting foreign workers, even when they are not perfectly complementary and the additional educational costs for their children are not excessively high, could potentially lead to increased wages and enhanced utility for the native population. This analysis also contrasts the scenarios of restricted versus relaxed residency rights. Through this comparison, the policy effects of relaxation are made more evident, emphasizing the impact on labor movement between industries. The findings reveal that if inter-sector movement is minimal, the influx of foreign workers, who cannot be perfectly substituted, could potentially improve the welfare of native residents.

Generally, it is considered undesirable to relax immigration policies due to the additional costs associated with children. However, the analysis in this paper shows that even if the acceptance of labor is not limited to complementary labor that would increase wage rates, welfare can improve in the short term. This implies that rather than solely focusing on whether the acceptance of foreign workers leads to an increase in wage rates, attention should be given to the overall impact on welfare of natives through other channels. It suggests that a comprehensive evaluation of welfare implications, beyond the immediate effects on wages, is essential. Moreover, it has been demonstrated that welfare can improve through the relaxation of policies that allow for longer stays and family reunification. It is noteworthy that even if welfare does not improve with short-term acceptance, the potential for welfare improvement through policy relaxation is suggested.

In this analysis, impacts such as those on the unemployment rate and through the pension system have not been considered. As suggested by Casarico and Devillanova (2003), it seems that there is an endogenous response in the accumulation of human capital due to the acceptance of foreign workers. This paper does not take into account the pension systems that are adopted in many developed countries. Ideally, when analyzing welfare, it is considered necessary to include the pension system in the analysis. These aspects, through their effects, are important elements to consider when thinking about the impact on welfare. These issues are intended to be addressed in future research.

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