DISCUSSION PAPER SERIES

Discussion paper No.307

Immigration Analysis in Three Countries Model

Kota Yamada
(Tokoha University)

Masaya Yasuoka
(Kwansei Gakuin University)

March 2026

MASTERY FOR SERVICE

SCHOOL OF ECONOMICS

KWANSEI GAKUIN UNIVERSITY

1-155 Uegahara Ichiban-cho
Nishinomiya 662-8501, Japan

Immigration Analysis in Three Countries Model[†]

Kota Yamada[‡]

Masaya Yasuoka[*]

Abstract

This paper analyzes the effects of immigration on host countries' labor markets and capital accumulation using a dynamic general equilibrium model with two host countries and one sending country. Higher productivity or greater capital accumulation in a country raises wages and attracts more immigrants, whereas an increase in the labor force lowers wages and suppresses inflows. These results have been demonstrated in the existing literature. When we consider capital mobility between two countries that both accept immigrants, how is the number of immigrants admitted by each country determined?

If we consider not only labor mobility but also capital mobility, the inflow of immigrants raises the marginal product of capital, thereby promoting capital inflows. In turn, capital inflows increase the marginal product of labor, which further encourages additional immigration. The findings provide useful policy implications for OECD countries facing declining fertility, population aging, and concerns over future labor shortages.

Keywords：Capital Mobility, Immigration, Multi Immigration-Receiving Countries

JEL: J15, E24,

[†] In preparing this paper, we have benefited from valuable comments from Naoki Shintoyo and the seminar participants, to whom we are deeply grateful. Any remaining errors are, of course, our own responsibilities.

[‡] Tokoha University

[*] Corresponding to: yasuoka@kwansei.ac.jp Kwansei Gakuin University

1. Introduction

Globally, governments frequently reassess immigration policies to mitigate labor supply constraints. This issue is especially salient in OECD countries, where demographic aging and low fertility intensify concerns over workforce sustainability.

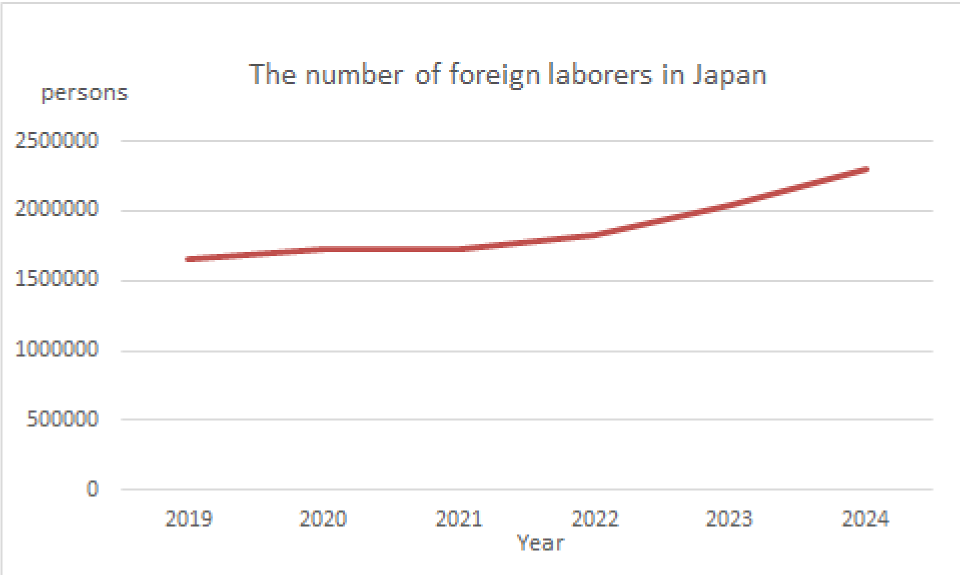

Fig.1：The number of foreign laborers in Japan（Data：Ministry of Health, Labour and Welfare, Japan " Status of Employment of Foreign Workers"[1]）

The purpose of this paper is to theoretically examine how the share of immigrants is determined in each of two host countries. There is a large body of existing literature on the economic analysis of immigration. Within this literature, the originality of this paper lies in its consideration of one migrant-sending country and two migrant-receiving countries, as well as in its analysis that incorporates capital mobility between the two migrant-receiving countries.

Figure 1 shows the number of foreign workers in Japan has been increasing and given the

---

[1] URL is shown as https://www.mhlw.go.jp/stf/newpage_50256.html .

ongoing decline in fertility. Therefore, further expansion of immigration will likely be necessary. However, the demand for foreign workers is not unique to Japan. As shown in Figure 2, there is also the possibility that workers may move to countries with higher wage levels. Therefore, it is important to consider the immigration policies of other countries when designing Japan's own policies for the planned acceptance of foreign workers.

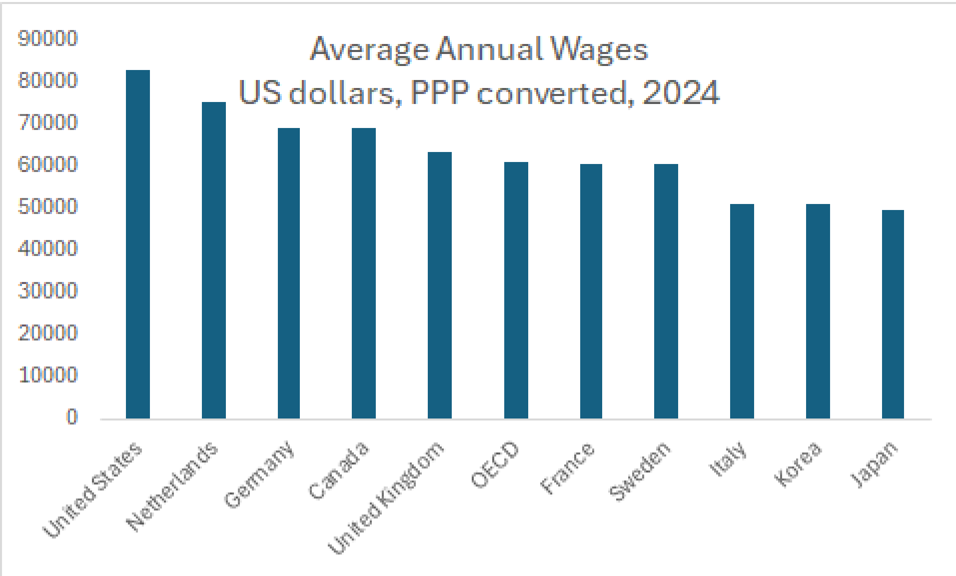

Fig.2：Average annual wages in some OECD countries

(Data:OECD "Average annual wages"[2])

Since many countries are also implementing immigration policies, it is necessary to go beyond the conventional setting of a single host country used in earlier studies and instead consider two host countries. This allows for a more realistic analysis of how many immigrants will enter a given country as foreign workers.

The results of this paper are as follows. We theoretically examine the effects of immigration on the labor market and capital accumulation of host countries using a multi-country dynamic general equilibrium model. The framework assumes two host countries, A and B, and one

---

[2] URL is shown as https://www.oecd.org/en/data/indicators/average-annual-wages.html .

sending country, C, with migrants choosing the destination offering higher wages. This paper considers not only the movement of migrants but also capital mobility between migrant-receiving countries. When capital inflows occur, the capital stock increases, which raises the marginal product of labor. This leads to higher wages and, consequently, may induce further immigration. Given that capital mobility occurs in reality, an analysis based on a model incorporating capital mobility provides a more realistic framework. In such a model, this paper successfully derives explicitly the number of immigrants admitted by each of the two migrant-receiving countries.

Immigration has both negative and positive effects. With the admission of immigrants, labor supply in the labor market increases, and therefore wages are expected to decline. Likewise, if labor demand remains constant, an increase in labor supply may lead to higher unemployment. These can be regarded as the negative effects of immigration.

Regarding these negative effects, Borjas (2003), Casarico and Devillanova (2003), and Edo (2020) show that immigration reduces wages in the host country and may widen wage inequality. Dustmann, Schönberg, and Stuhler (2017) demonstrate that immigration can suppress employment and lower wages in the receiving country. Razin and Sadka (2000) show that the desirability of immigration for the host country depends on the degree of access to international capital markets.

On the other hand, there are also positive effects of immigration. Basten and Siegenthaler (2019) show that immigration reduces unemployment and encourages native workers in the host country to move into more highly skilled jobs. Furlanetto and Robstad (2019) likewise find that immigration lowers unemployment. However, they also point out a potential negative effect in the form of reduced productivity due to a decline in capital intensity.

Jinno and Yasuoka (2024) similarly demonstrate that immigration promotes the reallocation of native workers toward high-skilled employment. Razin and Sadka (1999) show that immigration benefits all income groups, highlighting the positive effects of immigration. However, Krieger (2004) points out that this result depends crucially on the underlying assumptions.

Furlanetto and Robstad (2019) show that immigration reduces capital intensity, which in turn lowers productivity. However, when international capital mobility is taken into account, an increase in labor supply due to immigration may raise the marginal product of capital, thereby inducing capital inflows. Such inflows could mitigate the decline in capital intensity. From this perspective, analyzing immigration within a model that incorporates international capital mobility is meaningful, as it allows us to assess the extent to which these offsetting effects may arise.

The remainder of this paper is organized as follows. Section 2 sets the model with three countries, defining households and firms. Section 3 derives the equilibrium in the case of capital mobility between the two host countries. Final section concludes the paper.

2. Model

This economic model consists of three countries: Country A, Country B, and Country C. Migrants from Country C move to either Country A or Country B and earn wages by working there. The economic agents in this model are households and firms.

2.1 Households

Migration from Country C takes place during the young period, and individuals choose either Country A or Country B depending on which offers the higher wage. Each individual lives for two periods, youth and old age. The utility function U_t is assumed as follows.

$$U_t = \alpha ln c_{1t}^i + (1-\alpha) ln c_{2t+1}^i, 0 < \alpha < 1, i = A, B \tag{1}$$

c_{1t}^i and c_{2t+1}^i denotes consumption in young period and old period, respectively.

Each country consists of both natives and immigrants. Let i denote the country, where $i = A$ represents consumption in Country A and $i = B$ represents consumption in Country B, respectively. Individuals consume in both the young and old periods. The budget constraint of individuals is given as follows.

$$c_{1t}^i + \frac{c_{2t+1}^i}{1 + r_{t+1}^i} = w_t^i, i = A, B \tag{2}$$

r_{t+1}^i and w_t^i denote interest rate in country i, and wage rate in country i, respectively.

In this basic model, there is no capital mobility between Countries A and B, and each country is treated as a closed economy. Solving the utility maximization problem, the household saving level s_t^i can be expressed as follows.

$$s_t^i = (1-\alpha)w_t^i, 0 < \alpha < 1, i = A, B \tag{3}$$

2.2 Firms

In this economic model, firms as producers exist in both Country A and Country B. The production function of Country A, Y_t^A, is assumed as follows.

$$Y_t^A = A^A (K_t^A)^\theta (L^A + \sigma_t N)^{1-\theta}, 0 < \theta < 1, 0 < A^A. \tag{4}$$

K_t^A and L^A denote capital stock in Country A and native labor force of Country A, respectively. N and σ_t denote total number of migrants from Country C and share of immigrants flowing into Country A, respectively.

The production function of Country B, Y_t^B, is assumed as follows.

$$Y_t^B = A^B (K_t^B)^\theta (L^B + (1-\sigma_t) N)^{1-\theta}, 0 < \theta < 1, 0 < A^B. \tag{5}$$

K_t^B and L^B denote capital stock in Country B and native labor force of Country B, respectively. $1-\sigma_t$ denotes share of immigrants flowing into Country B.

Here, Countries A and B are assumed to have similar industrial structures and to employ the same production technology. This assumption is reasonable because the paper considers a situation resembling competition among advanced economies for immigrant labor.

Under the assumption of a perfectly competitive market, the profit-maximizing condition implies that the wage level equals the marginal product of labor, leading to the following expression.

$$w_t^A = (1-\theta) A^A (K_t^A)^\theta (L^A + \sigma_t N)^{-\theta}. \tag{6}$$

$$w_t^B = (1-\theta) A^B (K_t^B)^\theta (L^B + (1-\sigma_t) N)^{-\theta}. \tag{7}$$

The interest rate will be given by the marginal product of capital stock as shown by the following equations because of the profit-maximizing condition at a competitive market.

$$1 + r_t^A = \theta A^A (K_t^A)^{\theta-1} (L^A + \sigma_t N)^{1-\theta}. \tag{8}$$

$$1 + r_t^B = \theta A^B (K_t^B)^{\theta-1} (L^B + (1-\sigma_t) N)^{1-\theta}. \tag{9}$$

3. Equilibrium in the Case of Capital mobility between Country A and Country B

We consider the case in which capital mobility between Countries A and B is perfect. Capital flows between the two countries and moves to the country with the higher return on capital. Capital movement ceases when the returns on capital in both countries are equal—that is, when the interest rate equalization condition holds. The interest rate equalization condition, $r_t^A = r_t^B$, can be expressed as follows.

$$\frac{L^B + (1-\sigma_t)N}{L^A + \sigma_t N} = \left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} \frac{K_t^B}{K_t^A}. \tag{10}$$

(10) represents the interest rate equalization condition. Both Country A and Country B accept immigrants, but we assume that choosing to work in Country A requires an additional cost of ε. In this case, the wage equalization condition becomes $w_t^A - \varepsilon = w_t^B$, and the following expression holds.[3]

$$\frac{A^A}{A^B}\left(\frac{K^A}{K^B}\right)^{\theta}\left(\frac{L^B + (1-\sigma_t)N}{L^A + \sigma_t N}\right)^{\theta} = 1 + \frac{\varepsilon}{(1-\theta)A^B (K_t^B)^{\theta}(L^B + (1-\sigma_t)N)^{-\theta}}. \tag{11}$$

Equation (11) represents the condition for equalization of net wages. Taking the interest rate equalization condition (10) into account, equation (11) becomes the following expression.

$$K_t^B = \left(\frac{\varepsilon}{(1-\theta)A^B} \frac{1}{\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} - 1}\right)^{\frac{1}{\theta}} (L^B + (1-\sigma_t)N). \tag{12}$$

This result is intuitive. If the number of immigrants accepted by country B, $(1-\sigma_t)N$,

[3] This setting follows Caselli (1999). While Caselli (1999) considered labor mobility between two sectors within a single country and assumed that working in the high-skill sector requires a certain training cost, this paper assumes that immigration to Country A entails relatively higher costs than to Country B and incorporates this by introducing ε. Such migration costs may include not only administrative or screening fees but also expenses associated with meeting required skill levels.

In this paper, we assume that immigrants face relatively higher costs in country A than in country B. This assumption is intended to capture factors such as higher immigration-related costs in country A, for example due to stricter entry screening, as well as the possibility that jobs in country A are more skill-intensive than those in country B, requiring immigrants to incur higher costs to acquire the necessary skills.

decreases, the capital stock in country B also declines. This is because a reduction in labor input lowers the marginal product of capital, which in turn reduces the interest rate in country B and causes capital to flow out to country A. Considering $w_t^A - \varepsilon = w_t^B$, the dynamic equation of capital can then be expressed as follows.

$$\begin{aligned} K_{t+1}^A + K_{t+1}^B = (1-\alpha)L^A w_t^A + (1-\alpha)\sigma_t N(w_t^A - \varepsilon) \\ + (1-\alpha)(L^B + (1-\sigma_t)N)w_t^B. \end{aligned} \tag{13}$$

Savings in period t become the capital stocks of Countries A and B in period $t+1$, with the allocation of each determined by the interest rate equalization condition (10). Substituting equation (10) into equation (13) in the steady state yields the following expression.

$$\left(1 + \left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} \left(\frac{L^A + \sigma_t N}{L^B + (1-\sigma_t)N}\right)\right) K_t^B = (1-\alpha)\left(L^A + \frac{(L^A + L^B + N)}{\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} - 1}\right)\varepsilon. \tag{14}$$

This equation holds in any period t. Here, it follows that σ is determined by equations (12) and (14). That is, σ can be derived as shown below, and the following proposition can be obtained.

$$\sigma_t = \frac{1}{\left(\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} - 1\right)N} \left(\frac{\varepsilon^{1-\frac{1}{\theta}}(1-\alpha)\left(L^A + \frac{L^A + L^B + N}{\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} - 1}\right)}{\left(\frac{1}{(1-\theta)A^B}\frac{1}{\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} - 1}\right)^{\frac{1}{\theta}}} - \left(L^B + \left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} L^A + N\right)\right). \tag{15}$$

This equation holds for any period t. Therefore, in the steady state, it can also be expressed by the same equation with $t$omitted. Note that, for an equilibrium in which immigrants are present in both countries A and B, that is, an equilibrium satisfying $0 < \sigma_t < 1$, it is necessary that the right-hand side of (15) lie between 0 and 1. In addition, when $0 < \sigma_t < 1$, an increase in the immigration acceptance cost εreduces the share of immigrant inflows to country A, σ_t. We therefore obtain the following proposition.

Proposition 1

The share of immigrants accepted by country A, σ_t, is given by equation (15). An increase in the immigration acceptance cost εreduces the share of immigrant inflows to country A, σ_t.

Note that when $0 < \sigma_t < 1$, both the interest rate equalization condition (10) and the net wage equalization condition (11) hold simultaneously. However, when $\sigma_t = 0$or $\sigma_t = 1$, the net wage equalization condition (11) does not hold. In that case, the dynamic equations for capital in the two countries are given as follows.

$$K_{t+1}^A + K_{t+1}^B = (1-\alpha)L^A w_t^A + (1-\alpha)(L^B + N)w_t^B, if\ \sigma_t = 0 \tag{16}$$

$$K_{t+1}^A + K_{t+1}^B = (1-\alpha)L^A w_t^A + (1-\alpha)N(w_t^A - \varepsilon) + (1-\alpha)L^B w_t^B, if\ \sigma_t = 1 \tag{17}$$

First, we examine the dynamic equation given in (16). Combining the interest rate equalization condition (10) with the dynamic equation (16), we obtain the following equation.

$$K_{t+1}^B = \frac{(1-\alpha)(1-\theta)\left(A^A L^A \left(\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} \frac{1}{L^B + N}\right)^{\theta} + A^B (L^B + N)^{1-\theta}\right)}{1 + \left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} \frac{L^A}{L^B + N}} (K_t^B)^{\theta}, if\ \sigma_t = 0 \tag{18}$$

This dynamic equation is shown to have a unique steady-state equilibrium, and the steady state is locally stable. The steady-state value of K^B is given by:

$$K^B = \left(\frac{(1-\alpha)(1-\theta)\left(A^A L^A \left(\left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} \frac{1}{L^B + N}\right)^{\theta} + A^B (L^B + N)^{1-\theta}\right)}{1 + \left(\frac{A^A}{A^B}\right)^{\frac{1}{1-\theta}} \frac{L^A}{L^B + N}}\right)^{\frac{1}{1-\theta}} , if\ \sigma_t = 0 \tag{19}$$

Next, we consider the dynamic equation in (17). Combining the interest rate equalization condition (10) with the dynamic equation (17), we obtain the following equation.

$$K_{t+1}^{B} = \frac{(1-\alpha)\left((1-\theta)\left(A^{A}(L^{A}+N)\left(\left(\frac{A^{A}}{A^{B}}\right)^{\frac{1}{1-\theta}}\frac{1}{L^{B}}\right)^{\theta} + A^{B}(L^{B})^{1-\theta}\right)(K_{t}^{B})^{\theta} - N\varepsilon\right)}{1+\left(\frac{A^{A}}{A^{B}}\right)^{\frac{1}{1-\theta}}\frac{L^{A}+N}{L^{B}}}, if\ \sigma_{t}=1 \tag{20}$$

When this dynamic equation has a steady state, there are generally two steady-state equilibria, as shown in the following figure.

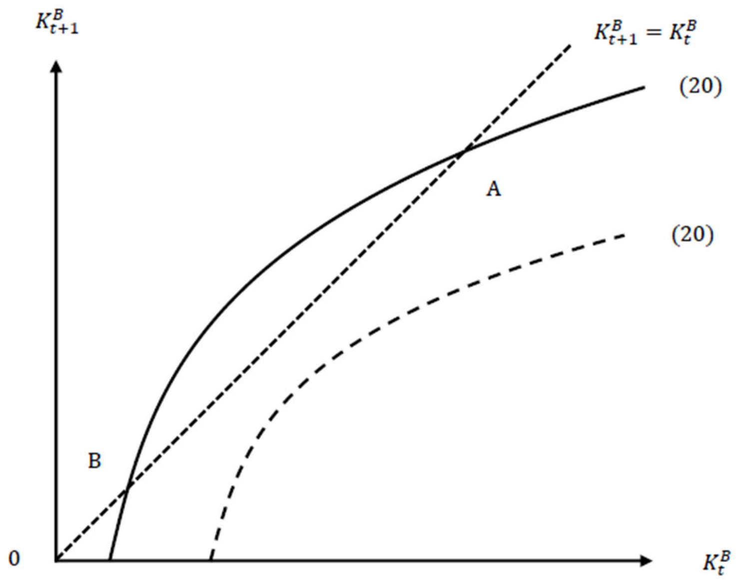

Fig.3：Dynamics of K_{t}^{B}

The solid curve in Fig. 3 shows the capital dynamics of K_{t}^{B} when a steady state exists. Through the interest rate equalization condition, the corresponding capital dynamics of K_{t}^{A} can also be derived from those of K_{t}^{B}. As the immigration cost to country A, ε, rises, the economy ceases to have a steady-state equilibrium, as shown by the dashed curve. The following proposition can thus be established.

Proposition 2

When $0 < \sigma_{t} < 1$, namely, when both countries A and B receive immigrant inflows, capital dynamics do not exist. In contrast, when only country B receives immigrant inflows ($\sigma_t = 0$), capital dynamics exist and the steady-state equilibrium is unique. Meanwhile, when only country A receives immigrant inflows ($\sigma_t = 1$), two steady-state equilibria arise; however, if the immigration cost $\varepsilon$is large, no steady-state equilibrium exists.

This is a particularly interesting proposition, since it implies that different patterns of immigrant acceptance generate different dynamics. Why, then, do capital dynamics fail to arise when both countries accept immigrants? The reason is the net wage equalization condition. Together with the interest rate equalization condition, it determines the capital-labor ratios in both countries as a function of the immigration cost. This appears to be the reason why no dynamics emerge. In contrast, when the net wage equalization condition does not hold, namely when immigrant inflows occur only in one of the two countries, capital dynamics arise.

4. Conclusion

This paper theoretically analyzes the impact of immigration on the labor market and capital accumulation of host countries using a multi-country dynamic general equilibrium model. The framework assumes two host countries, A and B, and one sending country, C, with migrants choosing the destination offering higher wages.

While this paper analyzes how the number of immigrants accepted by each of two host countries is determined, it also incorporates capital mobility between them. As a result, even if immigrant inflows reduce the capital-labor ratio and thereby lower productivity, such a decline in productivity can be mitigated by capital inflows. Therefore, the associated decline in wages may also be avoided.

Furthermore, the analysis reveals that capital dynamics do not arise when both host countries accept immigrants, whereas they do arise when immigrant inflows occur only in one of the two countries.

These findings provide important implications for the design of immigration policy in OECD countries facing population aging and declining fertility.

References

Basten, C., & Siegenthaler, M. (2019). Do Immigrants Take or Create Residents' Jobs? Evidence from Free Movement of Workers in Switzerland. Scandinavian Journal of Economics, 121(3), 994-1019.

Borjas, G.J. (2003), "The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," Quarterly Journal of Economics 118(4), pp.1335 1374.

Caselli, F. (1999). Technological Revolutions, American Economic Review, 89(1), pp.78-102,

Casarico, A. & Devillanova, C. (2003). Social Security and Migration with Endogenous Skill Upgrading. Journal of Public Economics, 87(3-4), 773-797.

Dustmann, C., Schönberg, U., & Stuhler, J. (2017). Labor Supply Shocks, Native Wages, and the Adjustment of Local Employment. Quarterly Journal of Economics, 132(1), 435-483.

Edo, A. (2020). The Impact of Immigration on Wage Dynamics: Evidence from the Algerian Independence War. Journal of the European Economic Association 18(6), pp.3210-3260.

Furlanetto, F., & Robstad, Ø. (2019). Immigration and the Macroeconomy: Some New Empirical Evidence. Review of Economic Dynamics, 34, 1-19.

Jinno, M., & Yasuoka, M. (2024). Immigration Policy in a Two Sector Model. Hitotsubashi Journal of Economics, 65(1), 51-64.

Krieger, T. (2004). Fertility Rates and Skill Distribution in Razin and Sadka's migration-pension model: A Note. Journal of Population Economics, 17(1), 177-182.

Razin, A., & Sadka, E. (1999). Migration and Pension with International Capital Mobility. Journal of Public Economics, 74(1), 141-150.

Razin, A., & Sadka, E. (2000). Unskilled Migration: A Burden or a Boon for the Welfare State? Scandinavian Journal of Economics, 102(3), 463-479.