Title:	Immigration policy in a two sector model
Author(s):	Masatoshi Jinno, Masaya Yasuoka
Article History:	
Received:	September 2023
Accepted:	January 2024

*This article in press is a peer reviewed, accepted article to be published formally in *Hitotsubashi Journal of Economics* Vol.65 No.1 (June 2024). This PDF file will be removed from the website of Hitotsubashi University after the formal publication.

Immigration policy in a two sector model[†]

Masatoshi Jinno[‡]
Masaya Yasuoka[‡]

Abstract

Throughout the world, some countries consider immigration policies to address labor supply difficulties. Particularly because OECD countries typically have an aging society with fewer children, immigration policies are examined continually. Our paper sets a two-sector model, with a high-skill sector and a low-skill sector, for assessment of immigration policies of two types: immigration for the high-skill sector and immigration for the low-skill sector. Results obtained from our study show that immigration has a positive effect on employment of the native people or a negative effect depending on production technologies used in the economy.

JEL Classifications: J15, J61

Keywords: Employment, Immigration, Two sector model

[†] The study described in this paper is financially supported by JSPS KAKENHI No. 22K01547. We would like to thank Koji Kitaura, seminar participants and anonymous reviewers for the beneficial comments. Any errors are our responsibility.

[‡] Nanzan University, email: jimasato@nanzan-u.ac.jp

[‡] Corresponding to: Kwansei Gakuin University, email: yasuoka@kwansei.ac.jp

1. Introduction

Throughout the world, some countries continually consider immigration policies to address labor supply difficulties. In OECD countries, because they typically have an aging society with fewer children, immigration policies are particularly examined.

[Insert Fig.1 around here.]

One important discussion about immigration persists: does immigration bring about job losses of native people or not? The increased labor supply associated with immigration, reduces the labor market wage rate. With wage rate rigidity, the unemployment rate increases because of an increase in the labor supply of immigration.

Regarding the related literature, Borjas (2003), Edo (2017), Dustmann et al. (2017), and others describe negative effects of immigration on the employment of the native people. By contrast, Basten (2019), Fulanetto and Robstad (2019), Esposito et al. (2020), and others have described positive effects of immigration on the employment of the native people. Razin and Sadka (1999, 2000) examined immigration policy for low-skill labor and examined how pension benefits are determined in a small open economy and in a closed economy.

After setting a two-sector model with a high-skill sector and a low-skill sector, we consider immigration policies of two types: for immigration in the high-skill sector and for immigration in the low-skill sector. This setting resembles that used by Cassarico and Devillanova (2003). Results of these analyses are presented as shown below, depending on production technology and on whether immigration has a positive effect or a negative effect on the employment of the native people. If the sector has decreasing marginal productivity of labor, then immigration for the sector reduces the employment of the native people. However, even if the employment of native people is reduced in the sector, the two-sector model shows that the employment of native people increases in the other sector.

If immigration is considered in the sector of the linear production function, then the employment of native people does not change: production technologies affect immigration and the employment of the native people. This discussion emphasizes consideration of capital accumulation. By virtue of capital accumulation, savings by immigration raise capital accumulation. Then increased capital accumulation raises the wage rate of the sector, thereby pulling up employment of the native people. Our paper presents both positive and negative effects of immigration on the employment of native residents. As demonstrated by Krieger (2004), immigration for the low-skill sector can raise employment of native people in the high-skill sector. This result depends on the production technology. Therefore, given the production technology, immigration in the high-skill sector can raise the employment of native residents in the high-skill sector.

The impact on native residents, especially regarding inter-sector mobility and wage rates, differs based on the specification of the production function. Nevertheless, in many instances, the productivity of the unskilled labor sector is presumed constant (as seen in Razin and Sadka (1999, 2000)), and this matter has not been adequately addressed until now. Consequently, this paper considers various specific production functions for each sector and examines their effects.

The remainder of the discussion on this topic consists of the following. Section 2 sets the model. Section 3 derives the equilibrium. Section 4 presents the respective examinations of immigration policy for the high-skill sector and low-skill sector. Sections 5 and 6 respectively describe production technologies of other types and describe examinations of how immigration affects employment of the native residents. Section 7 sets the model with pension and examines how the immigration policy affects on the pension benefit. Section 8 discusses the contributions of this paper based on the relevant literature. Section 9 concludes our manuscript.

2. Model

The model economy in this paper consists of agents of two types: households and firms.

2.1 Households

Individuals live in two periods: young and old periods. The utility function u_t is assumed as

$$u_t = \alpha ln c_{1t} + (1-\alpha) ln c_{2t+1}, 0 < \alpha < 1. \tag{1}$$

Therein, c_{1t} and c_{2t+1} respectively denote consumption in the young period and old period.

Individuals work in the young period to obtain wage income and obtain capital income in the old period. Then the budget constraint in young and old period are shown respectively as follows:

$$\bar{w}_t = c_{1t} + s_t, \tag{2}$$

$$(1 + r_{t+1})s_t = c_{2t+1}. \tag{3}$$

In those equations, $\bar{w}_t$ denotes the wage income. Also, s_t denotes savings. Older people obtain the capital income at the rate of interest rate r_{t+1}. The optimal allocations of household are given as

$$c_{1t} = \alpha\bar{w}_t, \tag{4}$$

$$c_{2t+1} = (1 + r_{t+1})(1 - \alpha)\bar{w}_t. \tag{5}$$

2.2 Firms

Firms of two types are assumed to exist. The production functions of firms are assumed as follows.

High skill sector $\qquad Y_{1t} = AK_t^{\theta} L_{1t}^{1-\theta}, 0 < A, 0 < \theta < 1. \qquad (6)$

Low skill sector $\qquad Y_{2t} = BL_{2t}, 0 < B. \qquad (7)$

Both high-skill and low-skill sectors produce the final goods, which are homogeneous between two sectors. However, in the high-skill sector, final good Y_{1t} is produced by inputting capital stock K_t and labor L_{1t}. However, in the low-skill sector, final good Y_{2t} is produced by inputting only labor L_{2t}

This paper assumes that the training cost σ is necessary to work in the high-skill sector. The training cost differs between individuals. The distribution of training cost is assumed to be $[0, \bar{\sigma}]$ and is assumed to be distributed uniformly.

3. Equilibrium

The wages in the high-skill and low-skill sectors are shown respectively as follows in the competitive market.

$$w_{1t} = A(1-\theta)K_t^{\theta}L_{1t}^{-\theta}, \tag{8}$$
$$w_{2t} = B. \tag{9}$$

We assume the case of $w_{1t} > w_{2t}$. Individuals with low training cost σ can work in the high-skill sector as demonstrated by the model of Caselli (1999). Razin and Sadka (1999, 2000) consider the training cost.[1] However, because of high training costs, individuals with high training cost σ do not work in the high-skill sector. Then, the training cost of indifferent individuals between high-skill and low-skill sectors is given as

$$A(1-\theta)AK_t^{\theta}L_{1t}^{-\theta} - \sigma_t^* = B. \tag{10}$$

That is, the individuals of $[0, \sigma^*]$ work in the high-skill sector. Individuals of $[\sigma^*, \bar{\sigma}]$ work in the low-skill sector. Then, if the population size of younger people is L, the labor supply in the respective sectors is given as

$$L_{1t} = \frac{\sigma_t^*}{\bar{\sigma}}L, \text{ and} \tag{11}$$
$$L_{2t} = \frac{\bar{\sigma} - \sigma_t^*}{\bar{\sigma}}L. \tag{12}$$

Then, considering (10) and (11), one obtains the following equation:

$$A(1-\theta)K_t^{\theta}\left(\frac{\sigma_t^*}{\bar{\sigma}}L\right)^{-\theta} = B + \sigma_t^*. \tag{13}$$

Defining the left-hand-side and the right-hand-side of (13), respectively, as L and R, one can obtain the unique σ_t^*; σ_t^* rises with an increase in the capital stock.

[1] On the other hand, Razin and Sadka (1999, 2000) also recognize the costs involved in becoming a skilled worker. However, they view these training costs not as direct financial outlays, but as opportunity costs related to the time invested in education, which precludes engaging in labor. Despite this distinction, the fundamental mechanisms in both scenarios are fundamentally identical.

[Insert Fig. 2 around here.]

Assuming full depreciation of capital stock in a period, capital accumulation can be shown as

$$K_{t+1} = (1-\alpha)\left(L\int_0^{\sigma_t^*}\left(A(1-\theta)K_t^\theta\left(\frac{\sigma_t^*}{\bar{\sigma}}L\right)^{-\theta} - \sigma\right)\frac{1}{\bar{\sigma}}d\sigma + \frac{\bar{\sigma}-\sigma_t^*}{\bar{\sigma}}LB\right). \tag{14}$$

Considering (10) and (14), one can obtain the dynamics of capital stock as

$$K_{t+1} = (1-\alpha)L\left(\frac{\sigma_t^{*2}}{2\bar{\sigma}} + B\right). \tag{15}$$

Because σ_t^* rises with K_t and diminishing marginal productivity of K_t, the unique steady state can be obtained as shown by the following Fig. 3.

[Insert Fig. 3 around here.]

The labor share of the high-skill sector σ^* and capital stock K at the steady state are given by the following equations.

$$A(1-\theta)K^\theta\left(\frac{\sigma^*}{\bar{\sigma}}L\right)^{-\theta} = B + \sigma^*. \tag{16}$$

$$K = \alpha L\left(\frac{\sigma^{*2}}{2\bar{\sigma}} + B\right). \tag{17}$$

4. Immigration Policy

This section presents consideration of the immigration policy. First, we consider the case of immigration for the low-skill sector. After analysis of this case, we examine immigration for the high-skill sector.

4.1 Immigration for the low-skill sector

We consider the case of immigration for the low-skill sector. The training cost of immigrant is assumed by $\sigma_t = \bar{\sigma}$. If the number of immigrants is given as δL, then, the capital stock in t+1 is given as

$$K_{t+1} = (1-\alpha)\left(L\int_0^{\sigma_t^*}\left(A(1-\theta)K_t^\theta\left(\frac{\sigma_t^*}{\bar{\sigma}}L\right)^{-\theta} - \sigma\right)\frac{1}{\bar{\sigma}}d\sigma + \frac{\bar{\sigma}-\sigma_t^*}{\bar{\sigma}}LB + \delta LB\right). \tag{18}$$

For given K_t, immigrants for the low-skill sector raise the capital stock in $t+1$ because the immigrants provide savings. Immigrants obtain wage income B and allocate αB for savings. Because of immigration size δL, one can obtain the capital stock dynamics as shown by Eq. (18).

Even if one considers immigration for the low-skill sector, the labor share of the high-skill sector does not change during t period, as shown by (13). However, in the $t+1$ period, the capital stock increases, as does the wage rate in the high-skill sector; then the share of the high-skill sector increases. Consequently, the native people who work in the high-skill sector increase. This immigration policy is beneficial for the native residents because many native people can work in the high-skill sector and can obtain a higher wage income than they can from wages earned in the low-skill sector.

4.2 Immigration for the high-skill sector

We consider the case of immigration for the high-skill sector. The immigrant training cost is assumed as $\sigma_t = 0$. If the number of immigrants is given as δL, then the share of the high-skill sector is given as

$$A(1-\theta)K_t^\theta\left(\frac{\sigma_t^*}{\bar{\sigma}}L + \delta L\right)^{-\theta} = B + \sigma_t^*. \tag{19}$$

Because of δL, σ_t^* decreases: immigration for the high-skill sector reduces the labor supply of native people in the high-skill sector. This reduction is not beneficial for native people because of job losses in the high-skill sector of native residents.

Following are the dynamics of capital stock, given as

$$K_{t+1} = (1-\alpha)L\left(\frac{\sigma_t^{*2}}{2\bar{\sigma}} + \delta A(1-\theta)K_t^{\theta}\left(\frac{\sigma_t^*}{\bar{\sigma}}L + \delta L\right)^{-\theta} + B\right). \tag{20}$$

As shown by (20), immigration for the high-skill sector raises the capital stock at $t+1$ period because of an increase in the savings of immigrants for the high-skill sector. Therefore, by virtue of an increase in K_{t+1}, the wage rate of the high-skill sector increases. Then the share of labor supply in the high-skill sector σ_t^* increases: even if the immigration for the high-skill sector reduces the share of labor supply of native people at the high-skill sector, an increase in capital stock recovers the share of labor supply of native people at the high-skill sector. The following proposition can be established.

Proposition 1

Immigration for the low-skill sector raises the share of labor supply of native people at the high-skill sector. However, immigration for the high-skill sector reduces the share of labor supply of native people at the high skill sector if the increase in capital stock is small.

In this model, the production function in the low-skill sector is a linear function of the labor supply. Because of the linear function, an increase in labor supply at the low-skill sector does not change the wage rate of the low-skill sector. However, because of a decrease in marginal productivity of labor supply at the high-skill sector, immigration for the high-skill sector reduces the wage rate of the high-skill sector and reduces the labor share of native people of the high-skill sector because of training costs.

The following section presents consideration of the other types of production function to examine how the assumptions of production functions in high-skill and low-skill sectors affect the results.

5. Case of linear function of the high-skill sector

This section presents consideration of a case in which the production function of the high-skill sector is the linear technology. The production function of each sector is assumed as shown below.

High skill sector $$Y_{1t} = AL_{1t}, 0 < A. \tag{21}$$

Low skill sector $$Y_{2t} = BK_t^{\theta} L_{2t}^{1-\theta}, 0 < B, 0 < \theta < 1. \tag{22}$$

We consider the high skill sector as the R&D sectors as the endogenous growth theory considers.

Then, considering the competitive market, the wage rates of the respective sectors are

$$w_{1t} = A, \tag{23}$$

$$w_{2t} = B(1-\theta)K_t^{\theta} L_{2t}^{-\theta}. \tag{24}$$

Assuming the case of $w_{1t} > w_{2t}$, σ^* is given such that the following equation holds:

$$B(1-\theta)K_t^{\theta}\left(\frac{\bar{\sigma}-\sigma^*}{\bar{\sigma}}L\right)^{-\theta} = A - \sigma_t^*. \tag{25}$$

An increase in capital stock K_t reduces the labor share of the high-skill sector because the wage rate of the low-skill sector increases. The dynamics of capital stock follows:

$$K_{t+1} = (1-\alpha)L\left(\frac{\sigma_t^{*2}}{2\bar{\sigma}} + B(1-\theta)K_t^{\theta}\left(\frac{\bar{\sigma}-\sigma_t^*}{\bar{\sigma}}L\right)^{-\theta}\right). \tag{26}$$

5.1 Immigration for the high-skill sector

Next, immigration for the high-skill sector is examined. The training cost of immigration is assumed as $\sigma_t = 0$. If we consider the immigration size for the high-skill sector as δL, then the labor share given by (25) does not change because of the linear technology of the high-skill sector. The following shows the capital stock dynamics as

$$K_{t+1} = (1-\alpha)L\left(\frac{\sigma_t^{*2}}{2\bar{\sigma}} + B(1-\theta)K_t^{\theta}\left(\frac{\bar{\sigma}-\sigma_t^*}{\bar{\sigma}}L\right)^{-\theta} + \delta A\right). \tag{27}$$

Therefore, immigration for the high-skill sector increases the capital stock in *t*+1 period because of savings deriving from immigration. Because of capital stock in *t*+1 period, the wage rate of the low-skill sector rises. This effect decreases the labor share of the high-skill sector of native people.

5.2 Immigration for the low-skill sector

Conversely, we consider the case of immigration for the low-skill sector. The training cost of immigration is assumed as $\sigma_t = \bar{\sigma}$. If one considers the immigration size for the low-skill sector as δL, then the labor share is determined such that the following condition holds:

$$B(1-\theta)K_t^{\theta}\left(\frac{\bar{\sigma}-\sigma_t^*}{\bar{\sigma}}L + \delta L\right)^{-\theta} = A - \sigma_t^*. \tag{28}$$

Therein, δL reduces the marginal productivity of labor and wage rate of the low-skill sector. Then the labor share of the high-skill sector σ_t^* rises. The following shows the dynamics of capital stock:

$$K_{t+1} = (1-\alpha)L\left(\frac{\sigma_t^{*2}}{2\bar{\sigma}} + (1+\delta)B(1-\theta)K_t^{\theta}\left(\frac{\bar{\sigma}-\sigma_t^*}{\bar{\sigma}}L + \delta L\right)^{-\theta}\right). \tag{29}$$

In that equation, δL raises the capital stock in $t+1$ period directly. However, an increase in σ_t^* raises the capital stock in $t+1$. Then, the following proposition can be established.

Proposition 2

If the high-skill sector is the linear production technology and if the low-skill sector has decreasing marginal productivity of labor, then immigration for the high-skill sector raises the high-skill labor supply provided by the native people.

It is noteworthy that Prop1 and Prop2 depend on the production technology of linear production function. The following section describes consideration of the case of decreasing marginal productivity of labor in both skill sectors, as assumed by Caselli (1999).

6. Case of decreasing marginal productivity of labor in both sectors

As the model set by Caselli (1999), we consider the following model.

High skill sector $$Y_{1t} = AK_{1t}^{\theta}L_{1t}^{1-\theta}, 0 < A. \tag{30}$$

Low skill sector $$Y_{2t} = BK_{2t}^{\theta}L_{2t}^{1-\theta}, 0 < B. \tag{31}$$

Considering the competitive market, the interest rate is equal to the marginal productivity of capital stock of both sectors, as

$$1 + r_t = \theta A K_{1t}^{\theta} L_{1t}^{1-\theta} = \theta B K_{2t}^{\theta} L_{2t}^{1-\theta}, \tag{32}$$

where $K_t = K_{1t} + K_{2t}$.

The wage rates of the respective sectors are presented below.

High skill sector $$w_{1t} = (1-\theta) A K_{1t}^{\theta} \left(\frac{\sigma_t^*}{\bar{\sigma}} L\right)^{-\theta}, \tag{33}$$

Low skill sector $$w_{2t} = (1-\theta) B K_{2t}^{\theta} \left(\frac{\bar{\sigma} - \sigma_t^*}{\bar{\sigma}} L\right)^{-\theta}. \tag{34}$$

The labor share σ_t^* is determined such that the following equation holds.

$$(1-\theta) A K_{1t}^{\theta} \left(\frac{\sigma_t^*}{\bar{\sigma}} L\right)^{-\theta} - \sigma_t^* = B(1-\theta) K_t^{\theta} \left(\frac{\bar{\sigma} - \sigma_t^*}{\bar{\sigma}} L\right)^{-\theta}. \tag{35}$$

The following shows the dynamics of capital stock:

$$K_{t+1} = \alpha L \left(\frac{\sigma_t^{*2}}{2\bar{\sigma}} + B(1-\theta) K_t^{\theta} \left(\frac{\bar{\sigma} - \sigma_t^*}{\bar{\sigma}} L\right)^{-\theta}\right). \tag{36}$$

In this case, immigration for the high-skill sector reduces the labor share of native people in the high-skill sector because of a decrease in the marginal productivity of labor and the wage rate of the high-skill sector. If we consider immigration for the low-skill sector, then the labor share of native people in the low-skill sector decreases because of a decrease in marginal productivity of labor and wage rate of the low-skill sector. However, an increase in labor supply in low-skill sector raises the capital stock in low-skill sector because of an increase in the marginal productivity of capital stock. Then, this effect raises the wage rate at low-skill sector and the movement of native workers from low-skill to high skill sector is less than the model of section 4.

As presented in the discussion presented above, whether immigration reduces the labor opportunities of native residents depends on the production technologies used in the economy.

7. Pension

Many reports have described pensions and immigration. As described in this section, based on the model of section 4, we set the immigration model with a pension. Then, the household budget constraint is shown as follows.

$$c_{1t}+\frac{c_{2t+1}}{1+r_{t+1}}=(1-\tau)w_{it}+\frac{p_{t+1}^{i}}{1+r_{t+1}},i=l,h \tag{37}$$

The pension benefit p_{t+1}^{i} depends on the wage income obtained during the younger period. In the equation, τ denotes the contribution rate. The benefit rate is defined as ε^{i}. The pension benefit in the old period is shown by $\varepsilon^{i}w_{it+1}$. Then, utility maximization can be reduced to the following household saving as

$$s_{t}^{i}=(1-\alpha)(1-\tau)w_{it}-\frac{\alpha p_{t+1}^{i}}{1+r_{t+1}},i=1,2. \tag{38}$$

Subsequently, considering capital accumulation and immigration for the low-skill sector, we can obtain the following capital accumulation equation as

$$\begin{aligned}K_{t+1}=(1-\alpha)L\Bigg(\int_{0}^{\sigma_{t}^{*}}\left((1-\tau)A(1-\theta)K_{t}^{\theta}\left(\frac{\sigma_{t}^{*}}{\bar{\sigma}}L\right)^{-\theta}-\sigma\right)\frac{1}{\bar{\sigma}}d\sigma+\frac{\bar{\sigma}-\sigma_{t}^{*}}{\bar{\sigma}}B\\+\delta B\Bigg)-\alpha L\left(\frac{p_{t+1}^{h}}{1+r_{t+1}}+\frac{(1+\delta)p_{t+1}^{l}}{1+r_{t+1}}\right).\end{aligned} \tag{39}$$

The government budget constraint of the pension system can be presented as

$$\sigma_t^* p_{t+1}^h + (\bar{\sigma} - \sigma_t^*) p_{t+1}^l = \tau(\sigma_{t+1}^* w_{1t+1} + (\bar{\sigma} - \sigma_{t+1}^*) w_{1t+1}). \tag{40}$$

The left-hand-side of (40) denotes the total pension benefit. The right-hand-side shows the total revenue for pension benefit. We assume the benefit rule as the respective expressions of

$$p_{t+1}^h = \varepsilon^h w_{1t+1}, \tag{41}$$
$$p_{t+1}^l = \varepsilon^l w_{2t+1}. \tag{42}$$

If the benefit rates ε^h and ε^l are fixed (we assume $\varepsilon^h w_{1t+1} > \varepsilon^l w_{2t+1}$), then the contribution rate τ is determined to satisfy (40). If individuals work in the high-skill sector during the younger period, then they can obtain pension benefit (41). Otherwise, they obtain pension benefit (42).

Immigration for the low-skill sector raises capital accumulation in $t+1$ period. Then, the wage income of the high-skill sector in $t+1$ period rises. A pensioner of the high-skill sector can obtain a greater pension benefit.

8. Discussion

In this section, we explain the originality of this paper and its relation to related literatures. When capital and labor are used in the high-skill sector and only labor is used in the low-skill sector, this paper shows that immigration in the low-skill sector increases the number of native workers in the high-skill sector due to the wage increase effect of immigration. In addition, immigration in the high-skill sector leads to diminishing marginal productivity of labor, resulting in lower wage levels for high-skill workers and consequently. As a result, the number of native workers in low-skill sector increases. However, because capital accumulation increases the wage level in the high-skill sector, then the effect has the effect of an increase in the number of native workers in the high-skill sector. Thus, this paper shows that which effect is greater determines the share of native workers in both sectors.

Razin and Sadka (1999) do not consider capital accumulation, and the final goods are produced only with both labor inputs (high-skill workers and low-skill workers) and with linear production technology. In this paper, on the other hand, capital accumulation is considered and we examine the model economy with diminishing marginal productivity of labor. The endogenous change in the share of native workers in both sectors due to immigration was not shown in Razin and Sadka (1999). In this paper, we show that this occurs by taking into account capital accumulation and the marginal productivity of labor.

As an example, the high-skill sector can be assumed to be the manufacturing, construction, and information and communication industries, while the low-skill sector can be assumed to be the nursing care sector. As shown by Ministry of Health, Labour and Welfare "Basic survey on wage structure 2022," compared to wage levels in the manufacturing, construction, and information and telecommunications industries, wage levels in the healthcare and welfare sectors are low. We show the wage levels in this model economy, and it can be said that the model economy is consistent with the real economy. Japanese government has been accepting highly skilled human resources while also accepting nursing care workers from abroad, and it would be meaningful to analyze the economic effects of the current policy.[2]

Razin and Sadka (2000) consider fully substituted labor inputs between high-skill and low-skill labor and analyze them in a model economy where production takes place in one sector. According to Razin and Sadka (2000), immigration has the effect of lowering wage rates through lowering the capital-labor ratio. However, when production in two sectors is considered, as in this paper, the decline in the capital-labor ratio is limited, and as a result, the wage-increasing effect of capital accumulation appears.

Dustman et al. (2006) presents empirical literatures how the presence of immigrants affects wages. On the other hand, this paper sets the theoretical model to show that wages change with immigration. Kemnitz (2009) assumes a model economy in which production takes place solely by labor, and considers how immigration of high-skill workers affects wage rates and other factors. The elasticity of substitution between high-skill and low-skill workers is examined by Kemnitz (2009) and this is the contribution of his paper. In this paper, high-skill and low-skill workers work in different sectors, and elasticities of substitution are not considered. Instead, the analysis in this paper takes into account the effect of capital accumulation. We consider that elasticity of substitution with respect to labor is an issue that should be studied in the future work.

---

[2] Ministry of Health, Labour and Welfare "Acceptance of foreign caregivers" and Ministry of Health, Labour and Welfare "Highly skilled foreign human resources."

Casarico and Devillanova (2003) assumes a Cobb=Douglas production function with high-skill and low-skill workers as input factors (elasticity of substitution is 1) and analyzes the case of low-skill immigration. Casarico and Devillanova (2003) assumes a small open economy. On the other hand, our paper deals with capital accumulation in a closed economy model.

As shown by related literatures, there are few papers that analyze immigration with an analytical analysis that takes capital accumulation into account, and the contribution of our paper is that it explicitly includes capital accumulation in our model economy.

In this paper, we consider the high-skill sector as a production sector using capital and labor and the low-skill sector as a production sector using only labor, but as shown in this paper, the low-skill sector can be considered as capital and labor and the high-skill sector as production using only labor. In this case, the high-skill sector would be the R&D sector, as shown in Romer (1990). This paper also analyzes a model that includes capital and labor in both sectors, which is shown the model by Caselli (1999). However, one of contributions of our paper is that we consider the migration in the model of Caselli (1999).

9. Conclusion

Our paper presents examination of whether the immigration policy brings about a job loss of native residents or not. The results depend on the production technology. If one considers the decreasing marginal productivity of labor, then the immigrant for the sector with decreasing marginal productivity of labor reduces the labor supply of native residents. However, these analyses use linear production function technology; an immigrant for the sector of linear production technology does not reduce the labor supply of native people. Even if the immigrant causes a decrease in the labor supply, the labor supply of native residents in the sector with decreasing marginal productivity can be increased by virtue of an increase in capital accumulation brought about by the savings provided by the immigrant.

From the above analysis, it is evident that considering the variations in production technologies across different sectors is crucial. However, detailed analysis of the specific forms of production functions in each sector, including in Japan and other countries, is notably scarce. This gap highlights an area for future research.

References

Basten, C. and M. Siegenthaler (2019) "Do Immigrants Take or Create Residents' Jobs? Evidence from Free Movement of Workers in Switzerland," *Scandinavian Journal of Economics* 121(3), pp. 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.

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

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

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

Edo, A. (2017) "The Impact of Immigration on Wage Dynamics: Evidence from the Algerian Independence War," Working Papers 2017-13, CEPII Research Center.

Esposito, P., S. Collignon and S. Scicchitano (2020) "The Effect of Immigration on Unemployment in Europe: Does the Core-Periphery Dualism Matter?" Economic Modelling 84(C), pp. 249-258.

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

Kemnitz, A. (2009) "Native Welfare Losses from High Skilled Immigration," International Tax and Public Finance 16(4), pp. 560-570.

Krieger, T. (2004) "Fertility Rates and Skill Distribution in Razin and Sadka's Migration-Pension Model: A Note," Journal of Population Economics 17(1), pp. 177-182.

Ministry of Health, Labour and Welfare "Gaikokujin Kaigojinzai no Ukeire ni Tsuite [Acceptance of Foreign Caregivers],"
https://www.mhlw.go.jp/stf/newpage_28131.html (2024/1/20 check)

Ministry of Health, Labour and Welfare “Chingin Kouzou Kihon Chosa [Basic Survey on Wage Structure 2022],” https://www.mhlw.go.jp/toukei/itiran/roudou/chingin/kouzou/z2022/dl/05.pdf (2024/1/20 check)

Ministry of Health, Labour and Welfare “Koudo Gaikoku Jinzai ni Tsuite [Highly Skilled Foreign Human Resources],” https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/koyou_roudou/koyou/jigyounushi/page11_00028.html (2024/1/20 check)

OECD Data "Permanent-Type Migration,"’ International Migration Outlook 2022’ https://www.oecd-ilibrary.org/social-issues-migration-health/international-migration-outlook-2022_30fe16d2-en (2022/11/10 check)

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

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

Romer, P. M, (1990) "Endogenous Technological Change," Journal of Political Economy 98(5), pp.71-102.

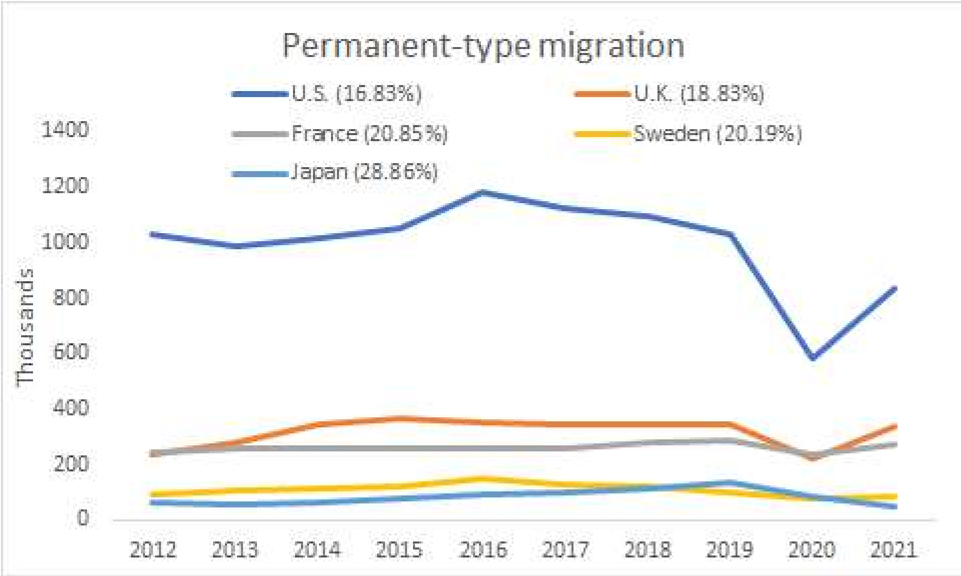

Fig.1: Permanent-type migration (The brackets show the elderly (over 65 years old) population ratio.) (Data: International Migration Outlook 2022, OECD Data.)

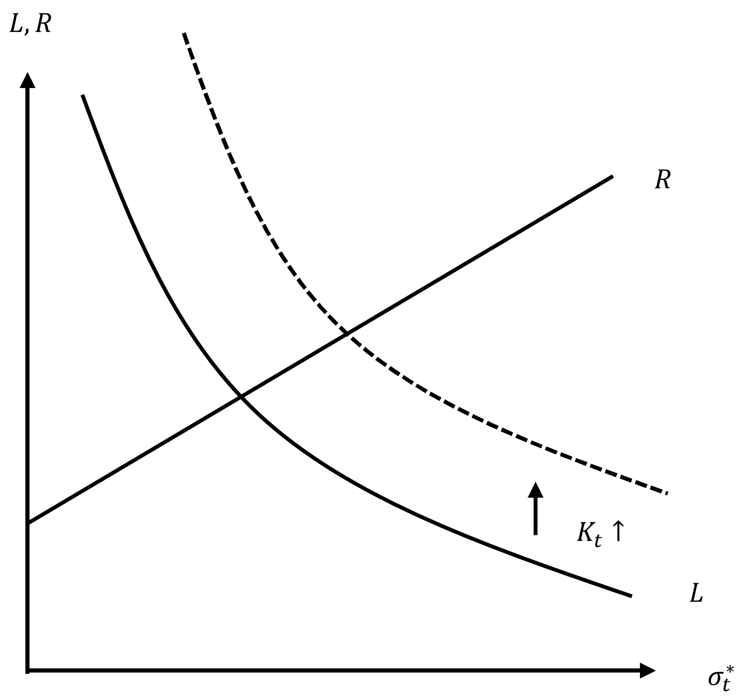

Fig. 2: Labor share of the high-skill sector.

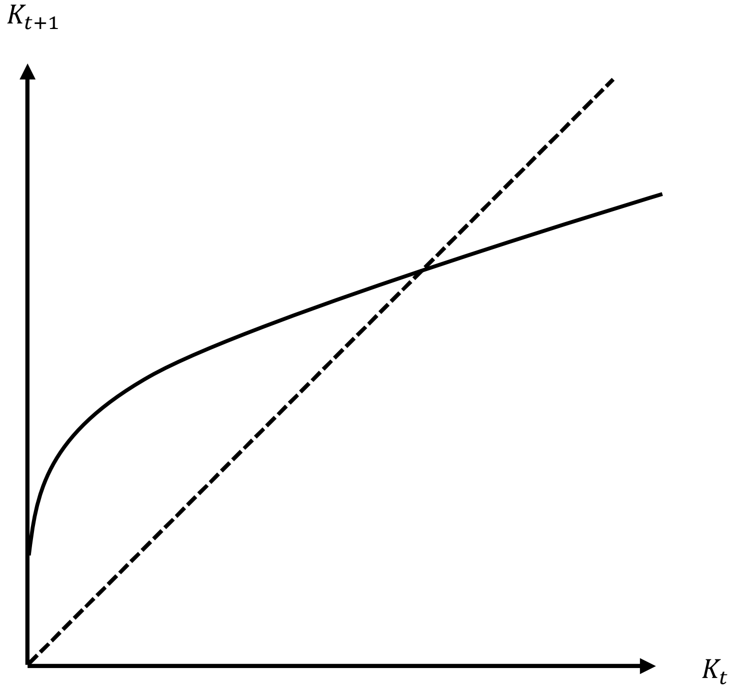

Fig. 3: Dynamics of capital stock.