



Can migration solve income inequality problem?

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Abstract

Income inequality is one of the serious threats to many developing countries. Income inequality causes public concern because it leads to crime, disease, and environmental degradation. The United Nations considered this issue as one of its top priorities and included income inequality as one of its strategic sustainable development goals.

When considering income disparity between regions, one common solution is migration from low-income regions to high-income regions, hoping for a better life. The governments also support this solution through the elimination of the administrative process of relocation. The effectiveness of using a migration to solve income inequality is still in doubt. Research is required to prove or disprove it.

This research aims to examine the effectiveness of migration in solving the income inequality problem. Such issue is complicated as there are many related factors and stakeholders. In addition, the impact of migration on income inequality does not happen immediately. The effect takes a significant amount of time to arise. In order to deal with this complexity, a system dynamics approach was used to create a simulated situation. This simulation was then used to analyze the impact of migration and the impact of other factors on income inequality.

The results show that migration can reduce income inequality as expected. When adjusting the level of migration, however, we found that the changes to income inequality were minor. It shows that although migration can reduce the income inequality problem, it is not an effective measure when used alone. In order to solve an income inequality problem, migration must be supported by other policies as well.

Keywords: Income inequality, migration, system dynamics, foreign investment, sustainable development goals

Article history: Received 12 January 2019, Accepted 30 August 2019

1. Introduction

Economic growth is a desirable situation that every country aims to create. However, economic growth can have drawbacks, one which is income inequality.

Income inequality is a situation that the income distribution is not equal among different groups of people, which can be divided by age, gender, race, or location. Many research works have shown that income inequality is related to the speed and size of economic development. Economic development leads to wider income inequality if the country's economic level is low. On the other hand, if the economic level is high, economic development can ease an income inequality problem. This inverse-U curvilinear relationship is called the Kuznets curve, and it is used widely in many articles on income distribution and income inequality [1-3].

One of the key factors that can stimulate economic growth as well as drive up an income inequality is foreign investment. Many articles have proven that foreign investment can boost up countries' economy [4-8]. Foreign investment also benefits different group of people unequally, leading to higher income inequality [9-13].

Income inequality causes internal conflict within the country [14]. Besides, countries with a high level of income equality tend to have a higher crime rate, disease outbreak, and environmental degradation. Due to such seriousness, the United Nations included an income inequality problem into its global strategic sustainable development goal to create a sustained income growth of the bottom 40 percent of the population at a higher-than-average rate.

One phenomenon that we can expect to see when there is an income difference between the two regions is a migration from low-income regions to high-income regions. People in a low-income region move to regions with higher income, hoping that they can

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get a better paid so the quality of life of themselves and their families will be improved.

This belief is not only for an individual. Governments and international bodies also consider migration as a solution to solve income disparity. UN includes a migration issue and migration policy into its targets that should be achieved to fulfill the inequality goal. This target selection shows the UN's perception that migration is a remedy for the inequality problem.

Although it makes sense that migration can ease an inequality problem, no one has examined its effectiveness before. Based on my knowledge, there is no study on the effectiveness of encouraging migration to reduce income inequality. This lack is a missing piece that is very important in solving an inequality issue. If migration can effectively reduce an income inequality problem, migration should be a key policy for all governments facing an inequality problem. On the other hand, if a migration policy is less effective than other measures, migration policy should have lower priority. Without knowing its effectiveness, governments cannot prioritize their policies, and the overall effectiveness of their policies is low. Therefore, this paper sheds light on this important but unexplored area by analyzing the effectiveness of migration policy on reducing an income inequality problem.

It is methodologically challenging to study the effectiveness of a policy. The scientific method of analyzing the effectiveness of one thing is to alter independent variables, control other variables, and observe the change in the dependent variable. However, this approach is almost impossible when analyzing the policy because the policy is hard to change after implementation, and we cannot control other relating factors. To solve this methodological difficulty, we use a simulation method. We create a model from relationships among relating factors, simulate it, adjust the migration factors, and observe the change in income inequality.

We are surprised to find that encouraging migration is not an effective measure to solve an income inequality problem. When we reduced the migration barrier by half, an income difference between regions is reduced by about five percent. However, the impact of migration on an income difference is more significant in the long run. We can imply that a migration policy cannot be used as a fire extinguisher to fight a fire, but it is more like an interior design that can limit the fire in the long run.

2. Foreign Investment and Income Inequality

Foreign investment stimulates economic growth, and every government encourages foreign investment into their countries. However, foreign investment can have a negative side effect on income distribution [13].

Based on the Kuznets curve, a higher level of economy is related to a higher income inequality [4, 5, 15].

Foreign investment can improve host countries' economy in many aspects. First, a foreign investment will improve the employment rate because foreign firms offer jobs to local as well as an increase in employment from local firms due to technology transfer [7, 8, 16-20]. Moreover, jobs offered by foreign firms tend to pay better which pressure local firms to increase wages as well [6, 8, 21-28].

Besides the effect of economic growth on income inequality, foreign investment can also directly impact income distribution. Foreign firms tend to locate in specific areas such as capital cities or special economic zones. The investment will boost up the average income of people in those areas, making the difference of income between areas with foreign investment and other areas wider [10-12, 29-31]. Besides, foreign investment also creates income inequality within the same region. Foreign firms prefer to hire qualified and skilled workers. Therefore, there are wider income gaps between qualified and skilled workers and others in the same region [27, 28].

3. Migration and Income Inequality

Policymakers perceived migration as a remedy for the income inequality problem. A migration can reduce an income difference between regions because people from lower-income regions can have an opportunity to improve their income to match with others. Most of the time, migrants are qualified, educated, and skilled people. Therefore, people in a low-income region tend to invest more in education, which also increases their income [32-34].

However, there is a debate that the migration worsens income inequality. Migrants compete in the labor market with locals, and weak locals may lose their jobs. It results in a wider income difference [35]. For example, Singapore had around 2.5 million immigrants in 2017, but the income gap has been increasing continuously.

Even though there is both a positive and negative impact of migration on income inequality, migration is still promoted to ease an income distribution problem. Even said that there is no study examining the effectiveness of migration in reducing income disparity. The closest papers studying on this issue focused only on the effect of migration on inequality, but not its effectiveness in reducing an inequality problem (for example, see Barham and Boucher's paper [36]). This finding is important for governments in prioritizing their policies, and this is the area that this paper will answer.

4. System Dynamics

Examining the effectiveness of migration on income inequality is hard. To measure the effectiveness of

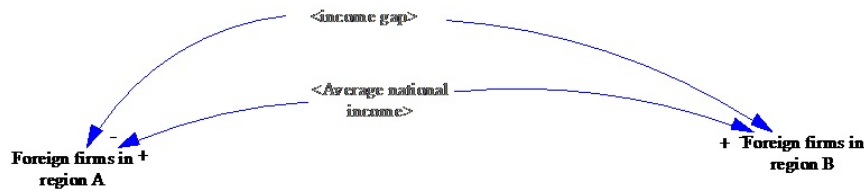


Figure 1: Foreign firm investment

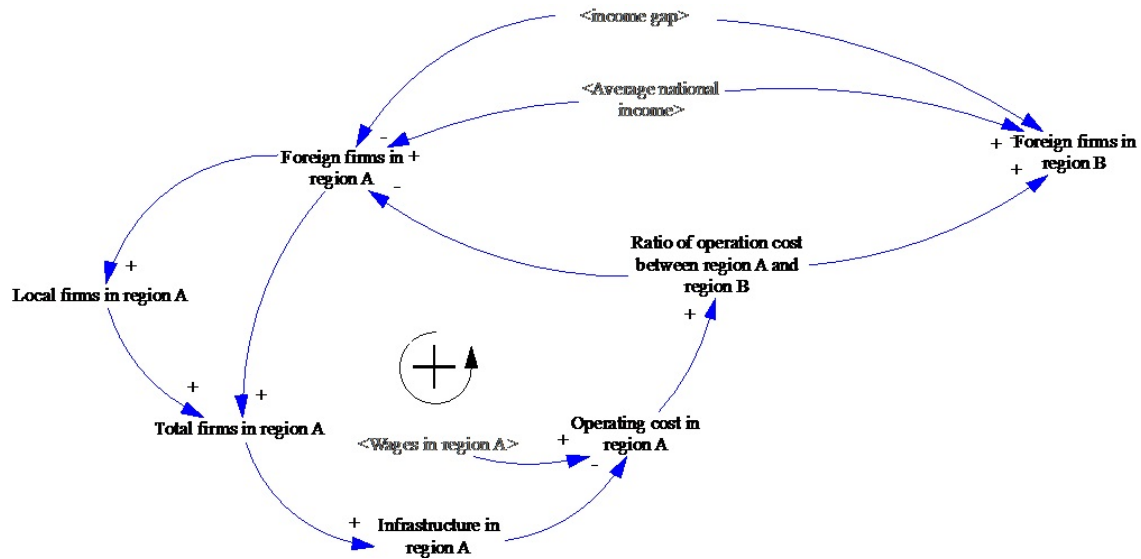


Figure 2: Firms and infrastructure development

one thing, we have to change the value of independent variables, holding others constant, and measure the changes in the dependent variable. However, it is almost impossible when measuring the effectiveness of a policy because the policy is hard to adjust after implementation, and we cannot control other factors. To overcome this difficulty, we use System dynamics method.

System dynamics is the mathematical simulation method, developed from the causal relationship of multiple factors relating to the focused issue. This method is suitable for complex situations with multiple dynamical factors [37]. Besides, it is applicable when the relationship is non-linear and recursive, which is the limitation of other approaches [38, 39].

Because of its simulation power that all factors can be adjusted, this method has been used tremendously in policy analysis and policy design in many fields such as oil and gas industry projection, electricity and carbon emission, and natural resource management [40-42].

5. Model

The model in this paper bases on the model used by Teekasap [13]. The model is shown using the Causal Loop Diagram. Due to space limitation, equations used in the model are available upon request.

We divided the model into a foreign investment module and migration module. A foreign investment module illustrates the flow of foreign investment and location selection. The migration module presents the income-based people movement.

A foreign investment module starts with foreign investment. We assume that there are two areas with different factor endowment, namely region A and region B. A foreign investment in both regions will increase when the nation's GDP is high [43]. We use the average national income as a proxy of GDP. On the other hand, an investment in both regions will drop if there is income inequality, showing with an income gap between two regions [14]. This explanation is illustrated using a diagram in Figure 1.

When foreign firms invest, they will attract local firms in the supply chain to set up their businesses in the nearby areas and become a cluster. When firms locate together, they can develop basic infrastructure which will reduce their operation cost. Besides the cost of infrastructure, wages are also a major cost for firms. If the cost is high relative to other areas, foreign firms will prefer other areas. Therefore, the relative cost will affect foreign investment, as shown in Figure 2. These relationships reinforce each other. When foreign firms invest in this region, there are more local firms, which leads to better infrastructure development. A well-developed infrastructure will reduce firms' operation cost, which will attract more foreign

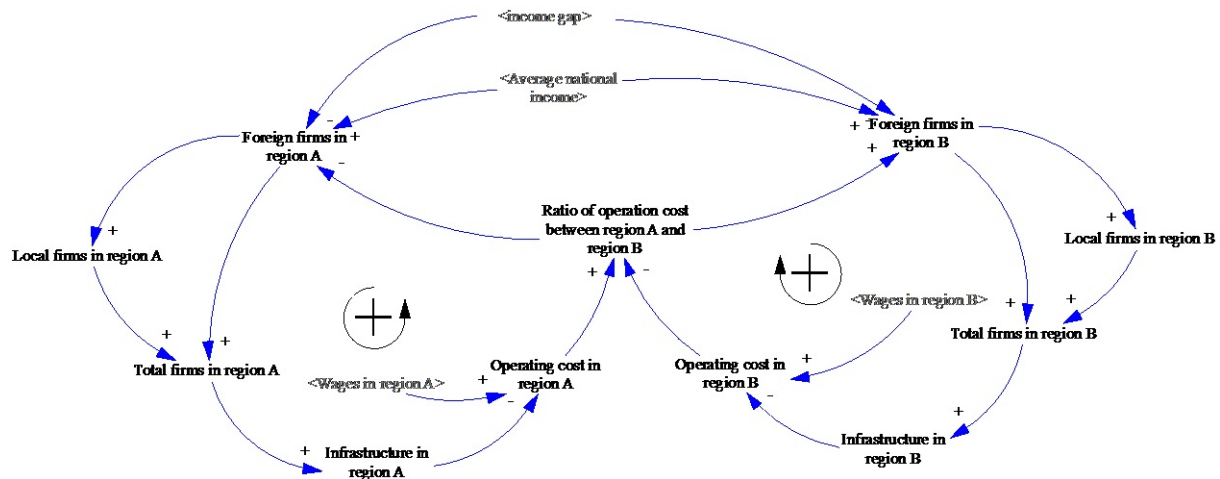


Figure 3: Foreign investment module

firms to invest.

The explained relationships are also applied to region B, as illustrated in Figure 3. An investment of foreign firms in region B will lead to more local firms in region B and become a cluster. A cluster will develop supporting infrastructure, which will reduce firms' operating cost. When cost is low comparing with another region, foreign firms will invest more.

Next is the migration module. We assume that wages drive the migration. Wages come from the balance between labor supply, presented by the number of people in region A, and labor demand, which is represented using work in region A. Number of works comes from number of firms in region A. If wages in this region is higher than another region, people will migrate from other regions into this region. This loop works to balance itself. When wages are high, people will move into this region, causing the labor supply to increase. When labor supply increase, wages will be dropped, as shown in Figure 4.

The same relationships are also applied to region B, as shown in Figure 5. Higher wages will attract people to move into region B. When labor supply increases, wages will drop.

Lastly, wages in both regions will be used to calculate the average national income and income gap, which will affect the foreign investment in the previous module. We illustrate the average national income and income gap in the diagram, as in Figure 6.

6. Dynamics of Income Inequality

To study the effect of migration on income inequality, we set a base scenario to be a control scenario. Then, the factor relating to migration will be changed. We will compare the results after changing the migration factor with the results in the base scenario.

The data used in a control scenario is simulated data. The focus of this paper is on the trend and relative changes in income inequality from adjusting the

migration level. Therefore, the simulated data can appropriate. However, this is a limitation of this study that it does not represent any specific country.

In this model, all numbers, including time, are hypothetical number and do not provide any meaning. Therefore, the focus will be on a trend and pattern of graphs in the short run and a long run.

In the base scenario, we design both regions to be the same by using the same value on all factors, except an infrastructure. We assume that the region A has better infrastructure than region B. Due to better infrastructure in region A, more firms invest in region A as shown in Figure 7.

Foreign firms offer better paid than local firms. Therefore, we expect to see wages in region A to be higher than that in region B. The results shown in Figure 8 illustrate exactly as the expectation. Wages in region A increase at a higher rate than that in region B.

7. Effect of Migration on Income Inequality

We examine the effect of migration on income inequality by adjusting the value of factor relating to migration, and we measure an income gap in each scenario. In this study, we changed the migration level by adjusting a migration cost. The migration cost is one of the key factors determining the level of migration, and changing the cost of migration will directly affect the migration level. In addition to the base scenario, we create two additional scenarios. The first scenario is when we reduce the migration cost by half, and another scenario is when the cost of migration is increased by 50 percent. We name the first scenario “-50,” and the second scenario is called “50.”

Even though we adjust the migration cost since the start of the simulation, the differences take time to emerge, as shown in Figure 9. We can see that when we reduce the migration by 50 percent, the number of

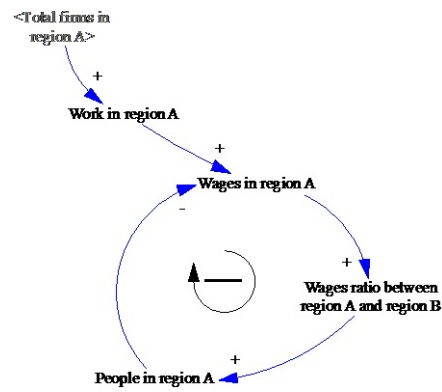


Figure 4: Wages in region A

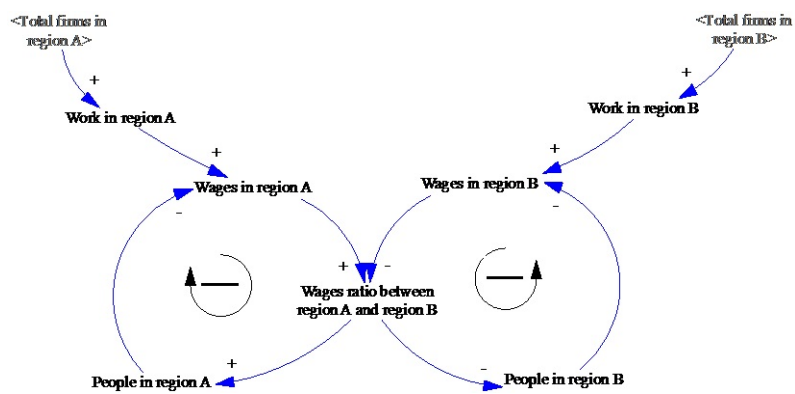


Figure 5: Wages in region B

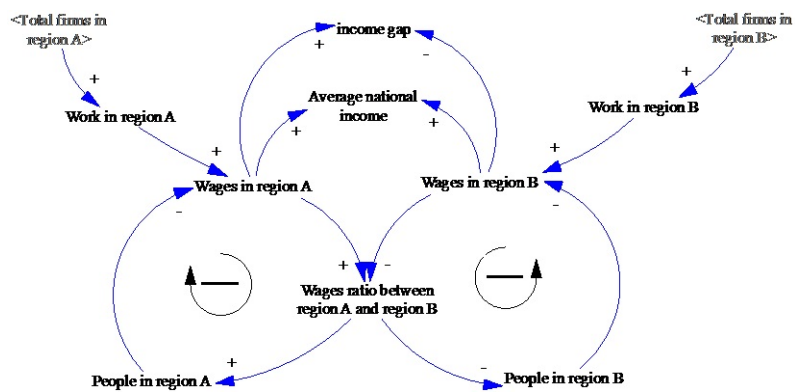


Figure 6: Migration module

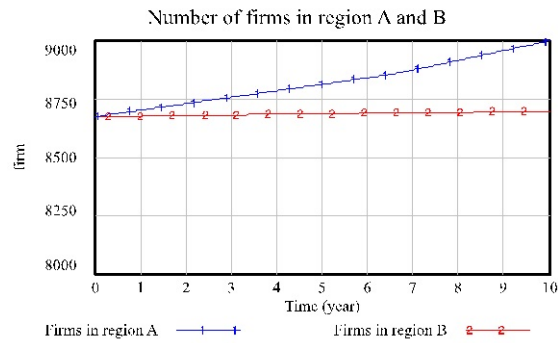


Figure 7: Firms in region A and B

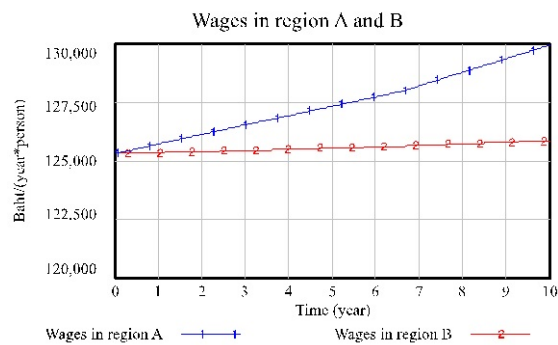


Figure 8: Wages in region A and region B

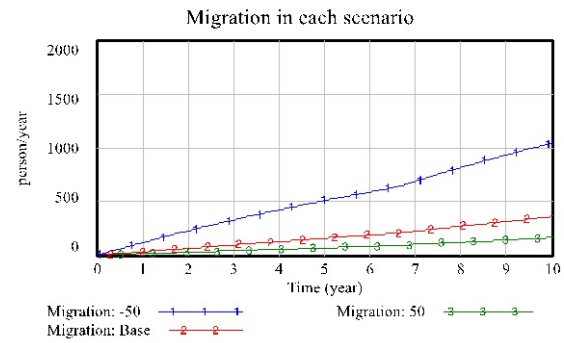


Figure 9: Migration level in each scenario

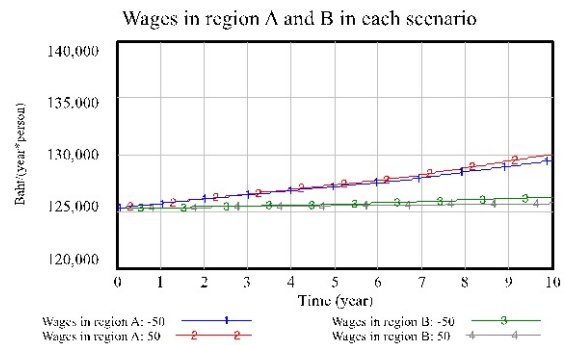


Figure 10: Comparison of wages in region A and region B in each scenario

migrants increases more than double. When we increase the cost of migration by half, the number of migrants is also reduced by half.

The cost of migration also affects the wages in both regions. As shown in Figure 10, the gap between wages in region A and region B is smaller when the cost of migration is reduced by half, and it is larger when the cost of migration is doubled.

From the graph, the changes in wages difference seem to be relatively small, comparing to the changes in migration level, which is quite large. To be more specific, we calculate the percentage change of migration level, the percentage change in wage difference between two regions, and compute the ratio between the percentage change in wage difference to the percentage change in migration. The results of scenario '-50' and scenario '50' are shown in Table 1 and Table 2 consecutively.

The results for both scenarios show that the change in migration has a small effect on the change in the wage difference between the two regions. In both scenarios, the change of wage difference is less than 5 percent of the change in migration level in a short run, showing that the migration policy can solve income inequality in a relatively small scale.

However, when we consider the change of effectiveness of the migration change on the change of wage difference, we find that its effectiveness is gradually increasing. Therefore, it shows that the migration policy takes time to adjust the differences in income be-

tween regions.

The reason why the effectiveness of using a migration to reduce income inequality is relatively small can be explained through the adjustment of firms. Wages will be increased when the demand is higher than supply. The more mismatch between the demand and supply, the higher an increase in wage. When there are more migrants from region B to region A, the labor supply in region B is reduced, so the wages in region B is increased. The labor supply in region A is also increased from a migration, causing a reduction in wages in region A. However, the change in migration also affects the number of labors. Lower wages in region A will attract more firms to invest due to a lower operating cost. In region B, firms will also invest less due to a higher wage. Because firms' investment is also adjusted according to the wage adjustment by the migration, the demand-supply balance does not significantly change, causing a small change in income distribution.

8. Conclusion and Implication

Income inequality is a chronic problem in many countries, and migration is widely perceived as a measure to ease this problem. Many research articles have proved that migration is a solution for an income inequality issue. However, no one has examined its effectiveness before. Without knowing how effective it

Table 1. Percentage of changes and wage difference comparing to migration in ‘Scenario -50.’

TIME	%MIGRATION CHANGES	%OF WAGE DIFFERENCE CHANGES	% WAGE DIFFERENCE CHANGE RATIO CHANGES TO MIGRATION
0	-	-	-
1	262%	3%	1%
2	251%	6%	2%
3	241%	8%	3%
4	232%	11%	5%
5	222%	13%	6%
6	214%	16%	7%
7	207%	17%	8%
8	202%	19%	9%
9	196%	20%	10%
10	190%	22%	12%

Table 2. Percentage of changes and wage difference comparing to migration in ‘Scenario 50.’

TIME	%MIGRATION CHANGES	%OF WAGE DIFFERENCE CHANGES	% WAGE DIFFERENCE CHANGES TO MIGRATION CHANGE RATIO
0	-	-	-
1	57%	1%	1%
2	57%	1%	2%
3	56%	2%	3%
4	56%	3%	5%
5	56%	3%	6%
6	56%	4%	7%
7	55%	4%	8%
8	55%	5%	9%
9	55%	5%	9%
10	55%	6%	11%

is to reduce an income inequality problem, governments may spend too much effort on an ineffective or less important measure. This paper addresses this research gap.

Using system dynamics methodology, we confirm extant research finding that the migration can reduce an income distribution problem. When we reduce the migration barrier, we observe a lower income gap between regions. On the other hand, when the migration barrier increases, an income gap is widened. It proves that stimulating a migration can reduce an income inequality problem.

Next question that we focus on is the effectiveness of the migration policy on solving an income inequality problem. We find that migration is not an effective measure to solve an income inequality problem. The percentage change in the income gap between regions is less than ten percent of the percentage change of migration level. From this finding, we can answer our question in the research title that the migration can reduce income inequality, but it cannot solve an income inequality problem.

We also consider its effectiveness through time. We find that even though the effectiveness of using a migration to reduce an income inequality problem is

low, its effectiveness increases gradually over time. It shows that the migration policy is a long-term policy.

This finding fills in the theoretical gap of the effectiveness of migration policy on solving an income inequality problem by showing that the migration policy alone is not an effective measure in the short run. It then leads to interesting further research questions on how to improve the effectiveness of the migration policy on solving income inequality.

This finding also has a policy implication. This finding shows that if countries face an income inequality problem, focusing solely on migration is not the right move. Governments should use other measures that can reduce income inequality in the short run. The migration policy is more appropriate for countries that do not have a serious income distribution right now but aim to control the income distribution in the long run.

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