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Abstract

This paper examines the possibility that the increases in within-country economic inequality that were observed in many countries since the 1980s were caused by deepening globalization through uneven capital accumulation across households by constructing a model based on the concept of sustainable heterogeneity. The model indicates that unless a government strengthens social welfare measures appropriately as globalization deepens (i.e., increases transfers from more-advantaged households to less-advantaged households), the level of within-country economic inequality will continue to increase. This result indicates the recent increases in within-country economic inequality may have been caused at least partially by the inaction of governments in the face of increasing globalization.

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1 INTRODUCTION

Various empirical studies have concluded that within-country income inequality has increased in many countries since the 1980s (Piketty, 2003, 2013; Piketty and Saez, 2003; Atkinson et al., 2011; Parker, 2014). The income share of the top decile has notably increased, particularly in the United States and other English-speaking developed countries. In addition, within-country wealth inequality has also increased in many countries during the same period (Piketty, 2013; Saez and Zucman, 2016). The large increase in income inequality in the United States seems to be largely a result of substantial increases in the salaries of company executives (Piketty, 2013). However, even after removing the effect of increases in executives' salaries, several of the empirical studies noted above indicate that within-country income inequality has still increased in many countries since the 1980s. This common trend implies that there is some underlying factor that has caused this increase.

Several explanations for the increase in income inequality have been presented. Skill-biased technological change (SBTC) was a favored explanation until the early 2000s (Katz and Murphy, 1992; Autor et al., 1998, 2003). However, SBTC has not been sufficiently supported empirically as a reason (Card and DiNardo, 2002). Explanations based on globalization have been also widely accepted—particularly those based on the Stolper–Samuelson theorem. These argue that globalization has deepened since the 1980s in the sense that more countries have become increasingly open or have substantially reduced regulations on international transactions. However, this explanation also has not been sufficiently supported empirically (Leamer, 1998; Goldberg and Pavcnik, 2007). Hence, since the 2000s, globalization-based explanations have changed their main underlying mechanisms from those based on the Stolper–Samuelson theorem to those based on heterogeneity of firms, labor market frictions, and offshoring of tasks (Helpman, 2016). Recently, Piketty (2013) presented a different explanation for recent increases in income inequality: he attributed increases in income and wealth inequalities to uneven capital accumulation across households.

Piketty (2013) does not necessarily maintain that uneven capital accumulation and deepening globalization are closely related, but they are certainly closely related, because capital accumulation in an open economy is greatly affected by international transactions, and capital can move more freely across national borders as globalization deepens. Hence, it is possible that deepening globalization has made capital accumulation across households more uneven and has thereby increased within-country income inequality. In this paper, this possibility is examined by constructing a model based on the concept of sustainable heterogeneity (SH).

The SH concept was first presented by Harashima (2010, 2017). An important

aspect of SH is that, although households are heterogeneous in preferences and productivity, there is a unique balanced growth path (or steady state) on which all optimality conditions of all heterogeneous households are indefinitely satisfied. However, this path (or state) is politically vulnerable and is not necessarily achieved naturally: interventions by the authority (i.e., government) are required to achieve SH in some cases. Particularly, forced financial transfers from relatively more-advantaged households to less-advantaged households are necessary.

Under floating exchange rates, international SH between two countries is naturally achieved (Harashima, 2015b). Therefore, even if globalization deepens, international SH is guaranteed to be naturally held under floating exchange rates. However, there is no guarantee that SH will hold within each country, even under floating exchange rates. Particularly, if heterogeneous households behave unilaterally, within-country SH will not be naturally achieved. If SH is not achieved, the magnitude of within-country income inequality will continue to increase to an upper limit. In this paper, I examine the possibility that, as globalization deepens, within-country income inequalities will accelerate through uneven capital accumulation because within-country SH is not naturally achieved.

2   ALTERNATIVE THEORIES

2.1   *Skill-biased technological change (SBTC)*

In the last decade of the 20th century and in the early 2000s, SBTC was the most favored explanation for increasing within-country wage inequality (Katz and Murphy, 1992; Autor et al., 1998, 2003). SBTC means that technological progress has been biased in favor of skilled workers as compared with unskilled workers. In this explanation, because SBTC induced changes in the demand for workers, the wages for skilled workers increased and those for unskilled workers decreased; therefore, inequality widened. SBTC was often combined with globalization as the mechanism to explain the increase in inequality; in particular, it was combined with the Stolper–Samuelson theorem (see Section 2.2.1). However, SBTC as an explanation has not been sufficiently supported empirically (Card and DiNardo, 2002). For example, the predictions based on SBTC are not sufficiently consistent with actual productivity growth in the 1980s and 1990s.

2.2   *Globalization*

2.2.1   The Stolper–Samuelson theorem

Globalization has been regarded as another important source of increases in within-country wage inequality. In the last few decades of the 20th century, the causality between

inequality and globalization was explained mainly on the basis of the Heckscher–Ohlin model—or more specifically, the Stolper–Samuelson theorem (Stolper and Samuelson, 1941). It predicts that because workers in developing countries are generally low skilled, opening trade between developed and developing countries results in a decrease in wages for low-skilled workers relative to high-skilled workers in developed countries.

However, as with SBTC, the combined effect of globalization and the Stolper–Samuelson theorem has not been sufficiently supported empirically (e.g., Goldberg and Pavcnik, 2007). Leamer (1998) concluded that this effect could be observed in the 1970s, but not in the 1980s. In addition, a crucial problem is that wage inequalities in many developing countries have also increased after trade liberalization, even though the Stolper–Samuelson theorem predicts that they should decrease in these countries.

2.2.2 Other theories on globalization and inequality

Other channels that link globalization with within-country inequality have also been explored (Helpman, 2016). These include:

(1) Heterogeneity of firms

Firms are heterogeneous, particularly among exporters and non-exporters. Melitz (2003) constructed a model that describes this heterogeneity, and on the basis of the model, showed that globalization caused increases in within-country wage inequality.

(2) Labor-market frictions

There are frictions, such as minimum wages, firing costs, and the cost of finding a job, in the labor market. If the mobility of labor is limited across industries by some of these frictions, wages will differ across industries. In addition, the impacts of globalization will vary across industries. Therefore, globalization will influence within-country wage inequality (Goldberg and Pavcnik, 2005).

(3) Offshoring of tasks (outsourcing)

Many firms that are headquartered in developed countries produce intermediate goods in developing countries: that is, they outsource the production of intermediate goods. This outsourcing will change the demands for skilled and unskilled workers in opposite directions and will therefore result in increases in within-country wage inequalities (Feenstra and Hanson, 1997).

2.3 Divergence in capital accumulation

Piketty (2013) showed that the recent increases in within-country income and wealth

inequalities were a result of uneven capital accumulation across households (i.e., the rich are getting richer). Piketty (2013) showed that the wealth share of the top 1% or 10% of wealth holders has increased in the U.S. and Europe since the 1980s.

3   SUSTAINABLE HETEROGENEITY

3.1   *Sustainable heterogeneity (SH)*

SH is defined as the state in which all optimality conditions of all heterogeneous households are indefinitely satisfied. Three heterogeneities—time preference, risk aversion, and productivity—are considered. Suppose that there are H ($\in N$) economies that are identical except for the rate of time preference, the degree of risk aversion, and productivity. Each economy is interpreted as representing a group of identical households, and the population in each economy is constant. The economies are fully open to each other, and goods and services and capital are freely transacted among them, but labor is immobilized in each economy. Note that households also provide laborers whose abilities are one of the factors that determine the productivity of each economy. Each economy can be interpreted as representing either a country or a group of identical households in a country.

The model shown by Harashima (2010, 2017) indicates that if and only if

$$\lim_{t \to \infty} \frac{\dot{c}_{i,t}}{c_{i,t}} = \left(\frac{\sum_{q=1}^{H} \varepsilon_q \omega_q}{\sum_{q=1}^{H} \omega_q} \right)^{-1} \left\{ \left[\frac{\varpi \alpha \sum_{q=1}^{H} \omega_q}{Hmv(1-\alpha)} \right]^{\alpha} - \frac{\sum_{q=1}^{H} \theta_q \omega_q}{\sum_{q=1}^{H} \omega_q} \right\} \tag{1}$$

for any economy i (= 1, 2, … , H), all the optimality conditions of all heterogeneous economies are satisfied, and

$$\lim_{t \to \infty} \frac{\dot{c}_{i,t}}{c_{i,t}} = \lim_{t \to \infty} \frac{\dot{k}_{i,t}}{k_{i,t}} = \lim_{t \to \infty} \frac{\dot{y}_{i,t}}{y_{i,t}} = \lim_{t \to \infty} \frac{\dot{A}_t}{A_t} = \lim_{t \to \infty} \frac{\dot{\tau}_{i,j,t}}{\tau_{i,j,t}} = \lim_{t \to \infty} \frac{\frac{d \int_0^t \tau_{i,j,s} ds}{dt}}{\int_0^t \tau_{i,j,s} ds}$$

for any i and j ($i \neq j$), where $c_{i,t}$, $k_{i,t}$, and $y_{i,t}$ are per capita consumption, capital, and output of economy i in period t, respectively; θ_i, ε_i, and ω_i are the rate of time preference, degree of risk aversion, and productivity of economy i, respectively; A_t is the technology in period t; and α, m, v, and ϖ are constants. In addition, $\tau_{i,j,t}$ is the current account balance of economy i with economy j, where i = 1, 2, … , H, j = 1, 2, … , H, and $i \neq j$. SH is the

state that satisfies equation (1).

3.2 SH with government intervention

If the exchange rates between two countries are floating, SH between the two countries is naturally achieved and maintained (Harashima, 2015b), but SH is not necessarily naturally achieved within each country if economies (i.e., the households that make up the economies) behave unilaterally (Harashima, 2010, 2017). However, if the government of a country appropriately intervenes (e.g., it properly transfers money from some economies to other economies in the country), SH within each country can be achieved even though economies behave unilaterally.

3.2.1 Heterogeneous time preference model

I first examine the case where $H = 2$ in a country (i.e., a country is made up of Economies 1 and 2). The government intervenes in the activities of Economies 1 and 2 by transferring money from Economy 1 to Economy 2. The transfer amount in period t is g_t, it is assumed that g_t depends on capital such that

$$g_t = \bar{g}_t k_{1,t} \; .$$

$\bar{g}_t$ is an exogenous variable for households and is appropriately adjusted by the government in every period so as to achieve SH. Harashima (2012) showed that if a government appropriately intervenes such that

$$\lim_{t \to \infty} \bar{g}_t = \frac{\theta_2 - \theta_1}{2} \; ,$$

then

$$\lim_{t \to \infty} \frac{\dot{c}_{1,t}}{c_{1,t}} = \lim_{t \to \infty} \frac{\dot{c}_{2,t}}{c_{2,t}} = \varepsilon^{-1} \left[\left(\frac{\varpi \alpha}{mv} \right)^\alpha (1 - \alpha)^{-\alpha} - \frac{\theta_1 + \theta_2}{2} \right] \tag{3}$$

can be achieved. Equation (3) is identical to the condition for SH between Economies 1 and 2.

3.2.2 Multi-economy heterogeneous time preference model

Next, I examine the case where the number of economies is more than two in a country. If SH is achieved among Economies 1, 2, … , and $(H - 1)$, these economies can be seen

as a combined economy. Let Economy $1+2+\cdots+(H-1)$ be such a combined economy. If a government appropriately intervenes by transferring money from Economy $1+2+\cdots+(H-1)$ to Economy H such that

$$\lim_{t\to\infty} \overline{g}_t = \frac{\theta_H - \dfrac{\sum_{q=1}^{H-1} \theta_q}{H-1}}{H} \, , \tag{4}$$

then

$$\lim_{t\to\infty} \frac{\dot{c}_{i,t}}{c_{i,t}} = \varepsilon^{-1}\left[\left(\frac{\varpi\alpha}{mv}\right)^{\alpha}(1-\alpha)^{-\alpha} - \frac{\sum_{q=1}^{H}\theta_q}{H}\right] \tag{5}$$

can be achieved for any $i \,(= 1, 2, \cdots, H)$. Equation (5) is identical to the condition for SH among H economies.

3.2.3 Multi-economy multiple-element model

Similarly, if a government appropriately intervenes by transferring from Economy $1+2+\cdots+(H-1)$ to Economy H such that

$$\lim_{t\to\infty} \overline{g}_t = \left(\frac{\sum_{q=1}^{H}\varepsilon_q\omega_q}{\omega_H}\right)^{-1}\left\{\frac{\varepsilon_H\sum_{q=1}^{H}\omega_q - \sum_{q=1}^{H}\varepsilon_q\omega_q}{\sum_{q=1}^{H-1}\omega_q}\left[\frac{\varpi\alpha\sum_{q=1}^{H}\omega_q}{Hmv(1-\alpha)}\right]^{\alpha} - \frac{\varepsilon_H\sum_{q=1}^{H}\theta_q\omega_q - \theta_H\sum_{q=1}^{H}\varepsilon_q\omega_q}{\sum_{q=1}^{H-1}\omega_q}\right\},$$

then

$$\lim_{t\to\infty} \frac{\dot{c}_{i,t}}{c_{i,t}} = \left(\frac{\sum_{q=1}^{H}\varepsilon_q\omega_q}{\sum_{q=1}^{H}\omega_q}\right)^{-1}\left\{\left[\frac{\varpi\alpha\sum_{q=1}^{H}\omega_q}{Hmv(1-\alpha)}\right]^{\alpha} - \frac{\sum_{q=1}^{H}\theta_q\omega_q}{\sum_{q=1}^{H}\omega_q}\right\} \tag{6}$$

can be achieved for any $i \,(= 1, 2, \cdots, H)$. Equation (6) is identical to the condition for SH among H economies.

4 THE IMPACT OF GLOBALIZATION ON INEQUALITY

4.1 *The model*

For simplicity, a two-country heterogeneous time preference model is used to examine the impact of globalization on within-country inequality. This model can be easily

extended to a multi-country, multiple-element model as was shown in Section 3. There are two countries (Country X and Country Z) and each country consists of two economies (Economy 1 and Economy 2). Let Economy i, j be Economy j in Country i where $i = X$ or Z and $j = 1$ or 2. The populations, productivities, and preferences of the economies are identical except for the rate of time preference. Let $\theta_{i,j}$ be the rate of time preference of Economy i, j, and $\theta_{i,1} < \theta_{i,2}$. In addition, for simplicity, suppose that $\theta_{X,1} < \theta_{X,2} = \theta_{Z,1} < \theta_{Z,2}$. Any economy in both countries behaves unilaterally.

Initially the two countries are closed, but they are later opened to trade with each other. After the opening, goods, services, and capital move freely between the two countries but labor is still immobilized within each economy. Before the opening, the equilibrium amounts of per capita capital are different between the two countries. Let k_X and k_Z be the per capita capital before the opening in Countries X and Z, respectively. After the opening, the equilibrium amounts of per capita capital in both countries become identical through arbitrage. Let $\bar{k}$ be the common per capita capital after the opening. Because $\theta_{X,1} < \theta_{X,2} = \theta_{Z,1} < \theta_{Z,2}$, then $k_X > \bar{k} > k_Z$.

Because any economy in both countries behaves unilaterally regardless of whether it is before and after the opening, each government has to appropriately intervene (i.e., transfer money from one economy to the other within each country) to achieve SH within the country. Let $\bar{g}_{i,j}$ be $\lim_{t \to \infty} \bar{g}_t$ with regard to the (positive or negative) transfer to Economy i, j.

4.2 Transfers before the opening

Let $\breve{g}_{i,j}$ be $\bar{g}_{i,j}$ when SH is achieved within a country before the opening. By equation (2), the necessary transfer to Economy X, 1 to achieve SH in Country X before the opening is

$$k_X \breve{g}_{X,1} = -k_X \frac{\theta_{X,2} - \theta_{X,1}}{2} < 0 , \tag{7}$$

and that to Economy X, 2 is

$$k_X \breve{g}_{X,2} = k_X \frac{\theta_{X,2} - \theta_{X,1}}{2} > 0 . \tag{8}$$

That is, the government of Country X transfers

$$k_X \frac{\theta_{X,2} - \theta_{X,1}}{2}$$

from Economy X, 1 to Economy X, 2 to achieve SH in Country X.

Similarly, by equation (2), the necessary transfer to Economy Z, 1 to achieve SH in Country Z before the opening is

$$k_Z \breve{g}_{Z,1} = -k_Z \frac{\theta_{Z,2} - \theta_{Z,1}}{2} < 0 \ , \tag{9}$$

and that to Economy Z, 2 is

$$k_Z \breve{g}_{Z,2} = k_Z \frac{\theta_{Z,2} - \theta_{Z,1}}{2} > 0 \ . \tag{10}$$

The government of Country Z transfers

$$k_Z \frac{\theta_{Z,2} - \theta_{Z,1}}{2}$$

from Economy Z, 1 to Economy Z, 2 to achieve SH in Country Z.

Suppose that, before the opening, each government appropriately intervenes to achieve within-country SH, i.e., it completely implements the transfers as shown above.

4.3   Transfers after the opening

Even after the opening, government intervention is still necessary for SH to be maintained within each country, because all economy still behaves unilaterally. On the other hand, if the exchange rates are floating, SH between the two countries is naturally achieved and maintained (Harashima, 2015b), although within-country SH is not necessarily guaranteed. Nevertheless, because this naturally established SH between the countries is equivalent to a forced SH through transfers by an international authority, as shown by Harashima (2012), it is assumed for simplicity that SH between the two countries is established through transfers between the two countries by some international authority. As will be shown in Section 4.3.2, money is transferred from Country X to Country Z to achieve SH between the two countries. Let $T_{X \to Z}$ be this positive transfer from Country X to Country Z.

The economy burdened with the transfer contribution from Country X and the one that receives the transfer within Country Z differ depending on how each government

behaves.

4.3.1 Necessary transfers for SH among economies

First, I examine the case in which both governments behave so as to achieve SH within their countries considering $T_{X \to Z}$. In this case, the allocation of $T_{X \to Z}$ between the economies within each country is made by each government; that is, each government determines which economy is burdened with, or receives, $T_{X \to Z}$ and how much they either pay or receive. Therefore, the transfer to each economy consists of a within-country transfer by the government and the allocated transfer of $T_{X \to Z}$. Let $\tilde{g}_{i,j}$ be $\bar{g}_{i,j}$ when SH is achieved within a country in this case. By equation (4), the necessary transfer to Economy X, 1 to achieve within-country SH is

$$\bar{k}\tilde{g}_{X,1} = \bar{k}\frac{\theta_{X,1} - \dfrac{\theta_{X,2} + \theta_{Z,1} + \theta_{Z,2}}{3}}{2} \; , \qquad (11)$$

that to Economy X, 2 is

$$\bar{k}\tilde{g}_{X,2} = \bar{k}\frac{\theta_{X,2} - \dfrac{\theta_{X,1} + \theta_{Z,1} + \theta_{Z,2}}{3}}{2} \; , \qquad (12)$$

that to Economy Z, 1 is

$$\bar{k}\tilde{g}_{Z,1} = \bar{k}\frac{\theta_{Z,1} - \dfrac{\theta_{X,1} + \theta_{X,2} + \theta_{Z,2}}{3}}{2} \; , \qquad (13)$$

and that to Economy Z, 2 is

$$\bar{k}\tilde{g}_{Z,2} = \bar{k}\frac{\theta_{Z,2} - \dfrac{\theta_{X,1} + \theta_{X,2} + \theta_{Z,1}}{3}}{2} \; . \qquad (14)$$

To achieve SH within each country, each government allocates part of $T_{X \to Z}$ to each economy consistently with equations (11) and (12) or (13) and (14), respectively.

4.3.2 Transfers between countries

By equations (11), (12), (13), and (14), the amount of $T_{X \to Z}$ can be calculated. By equations (11) and (12),

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$$T_{X \to Z} = \bar{k}\tilde{g}_{Z,1} + \bar{k}\tilde{g}_{Z,2} = \frac{\bar{k}}{3}\left(\theta_{Z,1} + \theta_{Z,2} - \theta_{X,1} - \theta_{X,2}\right) > 0. \qquad (15)$$

This corresponds to the negative transfer from Country Z to Country X ($T_{Z \to X}$), which is calculated by equations (13) and (14) such that

$$T_{Z \to X} = \bar{k}\tilde{g}_{X,1} + \bar{k}\tilde{g}_{X,2} = -\frac{\bar{k}}{3}\left(\theta_{Z,1} + \theta_{Z,2} - \theta_{X,1} - \theta_{X,2}\right) = -T_{X \to Z} < 0. \qquad (16)$$

Inequalities (15) and (16) mean that Country Z is aided by Country X financially when SH between the two countries is achieved.

4.3.3   Transfers if the government does not change the intervention

Next, I examine the case where, even after the opening, both governments do not change the degree of intervention, such that $\bar{g}_{i,j}$ is not changed and is kept equal to $\check{g}_{X,1}$, $\check{g}_{X,2}$, $\check{g}_{Z,1}$, and $\check{g}_{Z,2}$. In this case, the governments relinquish the task of allocating $T_{X \to Z}$ (or $T_{Z \to X}$) to their within-country economies. Suppose for simplicity that $T_{X \to Z}$ (or $T_{Z \to X}$) is instead allocated randomly to either economy in each country in each period. As a result, $T_{X \to Z}$ (or $T_{Z \to X}$) eventually will be controlled by the more-advantaged economies in each country (i.e., Economy X, 1 and Economy Z, 1) because, if economies behave unilaterally, the most-advantaged economy eventually takes everything (Becker 1980). That is, Economy X, 1 can force Economy X, 2 to be burdened with $T_{Z \to X} = -T_{X \to Z} = \bar{k}\tilde{g}_{X,1} + \bar{k}\tilde{g}_{X,2}$ (i.e., it can force it to transfer all of the necessary money to Country Z) by unilaterally setting the initial level of consumption of Economy X, 1. On the other hand, Economy Z, 1 can monopolize $T_{X \to Z} = \bar{k}\tilde{g}_{Z,1} + \bar{k}\tilde{g}_{Z,2}$ (i.e., it can receive all of the monetary transfer from Country X) by also unilaterally setting its initial level of consumption.

Let $\hat{g}_{i,j}$ be $\bar{g}_{i,j}$ in this case. Because each country's degree of government intervention is kept the same as it was before the opening (i.e., they are equal to $\check{g}_{X,1}$, $\check{g}_{X,2}$, $\check{g}_{Z,1}$, and $\check{g}_{Z,2}$), the transfer to Economy X, 1 is, by equation (7),

$$\bar{k}\hat{g}_{X,1} = \bar{k}\check{g}_{X,1} = -\bar{k}\frac{\theta_{X,2} - \theta_{X,1}}{2} . \qquad (17)$$

Conversely, the transfer to Economy X, 2 is

$$\bar{k}\hat{g}_{X,2} = \bar{k}\check{g}_{X,2} - T_{X \to Z} = \bar{k}\frac{\theta_{X,2} - \theta_{X,1}}{2} - \bar{k}\tilde{g}_{Z,1} - \bar{k}\tilde{g}_{Z,2}$$

$$= \bar{k}\frac{\theta_{X,2} - \theta_{X,1}}{2} - \frac{\bar{k}}{3}\left(\theta_{Z,1} + \theta_{Z,2} - \theta_{X,1} - \theta_{X,2}\right) \tag{18}$$

by equations (8) and (16), because Economy X, 2 is burdened with $T_{Z \to X} = -T_{X \to Z} = \bar{k}\tilde{g}_{X,1} + \bar{k}\tilde{g}_{X,2}$. The transfer to Economy X, 2 consists of not only the within-country transfer by the government $(\bar{k}\check{g}_{X,2})$ but also the burden of $T_{X \to Z}$ on Country X.

Similarly, the transfer to Economy Z, 1 is

$$\bar{k}\hat{g}_{Z,1} = \bar{k}\check{g}_{Z,1} + T_{X \to Z} = -\bar{k}\frac{\theta_{Z,2} - \theta_{Z,1}}{2} + \bar{k}\tilde{g}_{Z,1} + \bar{k}\tilde{g}_{Z,2}$$

$$= -\bar{k}\frac{\theta_{Z,2} - \theta_{Z,1}}{2} + \frac{\bar{k}}{3}\left(\theta_{Z,1} + \theta_{Z,2} - \theta_{X,1} - \theta_{X,2}\right) \tag{19}$$

by equations (9) and (15) because Economy Z, 1 monopolizes $T_{X \to Z} = \bar{k}\tilde{g}_{Z,1} + \bar{k}\tilde{g}_{Z,2}$. The transfer to Economy Z, 1 consists of not only the within-country transfer by the government $(\bar{k}\check{g}_{Z,1})$ but also the transfer to Country Z from Country X (i. e. , $T_{X \to Z}$). Finally, the transfer to Economy Z, 2 is, by equation (10),

$$\bar{k}\hat{g}_{Z,2} = \bar{k}\check{g}_{Z,2} = \bar{k}\frac{\theta_{Z,2} - \theta_{Z,1}}{2}. \tag{20}$$

4.4 Within-country inequality after the opening

4.4.1 When the government strengthens its intervention

If a government strengthens its intervention so as to satisfy equations (11) and (12) or (13) and (14), within-country SH is achieved. Even if SH is achieved within the country through government intervention, some inequality in the level of consumption between the economies within the country still exists. An important point, however, is that the degree of inequality neither increases nor decreases in the future; in other words, it is stabilized. Furthermore, even though inequality exists, all optimality conditions of all heterogeneous households are equally satisfied indefinitely.

4.4.2. When the government does not change the intervention

If a government does not change the intervention after the opening, the difference in the transfers to Economy X, 1 is, by equations (11) and (17),

$$\bar{k}\hat{g}_{X,1} - \bar{k}\tilde{g}_{X,1} = \frac{\bar{k}}{6}\left(\theta_{Z,2} - \theta_{Z,1}\right) > 0. \tag{21}$$

Inequality (21) indicates that Economy X, 1 owes a greater amount if the government strengthens the intervention to achieve SH than if it does not. Conversely, the difference in the transfers to Economy X, 2 is, by equations (12) and (18),

$$\bar{k}\hat{g}_{X,2} - \bar{k}\tilde{g}_{X,2} = -\frac{\bar{k}}{6}\left(\theta_{Z,2} - \theta_{Z,1}\right) < 0. \tag{22}$$

Inequality (22) indicates that Economy X, 2 receives more transfers if the government strengthens the intervention than if it does not.

The difference in the transfers to Economy Z, 1 is, by equations (13) and (19),

$$\bar{k}\hat{g}_{Z,1} - \bar{k}\tilde{g}_{Z,1} = \frac{\bar{k}}{6}\left(\theta_{X,2} - \theta_{X,1}\right) > 0. \tag{23}$$

Inequality (23) indicates that Economy Z, 1 owes a greater amount if the government strengthens the intervention than if it does not. Conversely, the difference in the transfers to Economy Z, 2 is, by equations (14) and (20),

$$\bar{k}\hat{g}_{Z,2} - \bar{k}\tilde{g}_{Z,2} = -\frac{\bar{k}}{6}\left(\theta_{X,2} - \theta_{X,1}\right) < 0. \tag{24}$$

Inequality (24) indicates that Economy Z, 2 receives more transfers if the government strengthens the intervention than if it does not.

Inequalities (21) and (22) indicate that, if the government intervention of Country X does not change after the opening, the positive transfer from Economy X, 1 to Economy X, 2 is not sufficient to achieve SH within Country X. Economy X, 1 will eventually hold all capital in Country X, and its consumption will be far larger than that of Economy X, 2. Inequality within Country X will continue to increase to the limit. In addition, although all optimality conditions of Economy X, 1 are indefinitely satisfied, those of Economy X, 2 cannot be satisfied. Inequalities (23) and (24) indicate that the same holds true for economies 1 and 2 in Country Z.

4.5 The need to strengthen measures for social welfare

The results shown in Section 4.4 clearly indicate that, after the opening, a government

should strengthen its measures for social welfare. Otherwise, within-country income and wealth inequalities will increase. This means that, when facing deepening globalization, government intervention should be enhanced to improve social welfare. In the above-shown two-country model, equations (21) and (22) indicate that, if the government of Country *X* strengthens the measures for social welfare and additionally transfers

$$\frac{\bar{k}}{6}\left(\theta_{Z,2} - \theta_{Z,1}\right)$$

from Economy *X*, 1 to Economy *X*, 2, then SH within Country *X* is achieved. Similarly, equations (23) and (24) indicate that if the government of Country *Z* additionally transfers

$$\frac{\bar{k}}{6}\left(\theta_{X,2} - \theta_{X,1}\right)$$

from Economy *Z*, 1 to Economy *Z*, 2, then SH within Country *Z* is achieved. As globalization deepens, transfers from more-advantaged households to less-advantaged households should be increased.

If a government does not change the social welfare measures even after globalization deepens, discontent among less-advantaged households will gradually increase and may eventually generate a serious political conflict as within-country inequality increases and the optimality conditions of less-advantaged households cannot be satisfied. Furthermore, if a government were to misunderstand globalization as indicating a need for more deregulation and less intervention—that is, if it were to actually weaken social welfare measures—then the situation would get much worse.

An important point is that an increase in within-country inequality occurs equally in Countries *X* and *Z* if a government does not appropriately respond to the opening. This means that increases in within-country inequality can occur in both developed and developing countries as globalization deepens. The potential for political conflicts therefore can also occur in both countries.

The model in this paper also has an important implication for the euro crisis in the 2010s. Equations (15) and (16) indicate that the more-advantaged countries should transfer money to the less-advantaged countries within the euro zone. If the transfer is not sufficient to meet the condition shown by equations (15) and (16), the more-advantaged countries will get richer as the less-advantaged ones become poorer (see also Harashima, 2015a). As a result, SH in the euro zone becomes impossible and political conflicts will be intensified. Nevertheless, if the more-advantaged countries coerce the less-advantaged countries into changing their preferences to be identical to those of the more-advantaged

countries (e.g., coerce them to adopt more severe austerity measures), SH can be achieved in the euro zone, but it is not a "true" SH, because forcing this type of change in preferences will make the less-advantaged countries greatly and persistently unsatisfied.

5   CONCLUDING REMARKS

Various empirical studies have indicated that within-country income inequality has increased in many countries since the 1980s, and many researchers have proposed common underlying factors that have made within-country income inequality increase commonly during this period (see Section 2). Recently, Piketty (2013) argued that increases in income and wealth inequalities were a result of uneven capital accumulation across households.

Uneven capital accumulation is closely related to globalization, because capital accumulation is greatly affected by international transactions and capital can move more freely internationally as globalization deepens. In this paper, this causality was examined on the basis of the concept of SH. Although international SH is naturally achieved under floating exchange rates, within-country SH is not guaranteed as the country is opened to international trade. The model presented in this paper indicates that, if households behave unilaterally and if the government does not strengthen its measures for social welfare appropriately as globalization deepens, more-advantaged households will accumulate more capital than in the case when within-country SH is achieved. Similarly, less-advantaged households will accumulate less, and thereby income inequality between households will increase to the limit. This result indicates that it is extremely important for a government to strengthen social welfare measures appropriately (i.e., increase transfers from more-advantaged to less-advantaged households enough to achieve SH) as globalization deepens to prevent within-country inequality from increasing.

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