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Abstract

Industrial development is often accompanied by massive migration from agricultural to industrial areas. This paper compares two steady states, the first and the second, which emerge before and after the termination of such migration, respectively. The paper shows that 1) the employment rate must be lower in the second steady state, and that 2) while every household increases individual assets in the first steady state, households may polarise into the poor and the rich in the second steady state. By examining the effects of fiscal policy, the paper also shows that the balanced budget multiplier exceeds unity, and accordingly, fiscal policy raises households' disposable income and consumption.

1. Introduction

Industrial development is often accompanied by massive migration from agricultural to industrial areas. Figure 1 indicates that this type of migration to the industrial areas terminated in the early 1970s in Japan. This termination of migration coincided with the end of that country's rapid economic growth. Remarkably, the employment rate also declined after the termination of migration. The first aim of this paper is to provide a simple framework that is consistent with these phenomena.

The framework that we present is a modified Harrod-Domar model. Although this model might be regarded as an elementary framework in old textbooks, this paper demonstrates that it still gives insights into dynamic economies. In his seminal paper, Harrod (1939) argues that the warranted growth rate does not coincide with the natural rate of growth.[1] Even though the warranted rate exceeds the natural rate, an industrial economy can grow at the warranted rate so long as large numbers of migrants flow into the industrial areas. However, once this migration terminates, a discrepancy between the warranted rate and the natural rate inevitably emerges as an actual disparity requiring resolution.[2] The current paper suggests that in these circumstances, a fall in the employment rate may play a central role in adjusting the warranted rate of growth.

Using a model with fixed coefficients, Kaldor (1956) proposes an adjustment mechanism through income distribution. He argues that the rate of savings is higher out of profits than out of wages; as a result, the average saving rate positively relates to the profit share in income. If the profit share moves adequately, the warranted rate becomes equal to the natural rate through a change in the average savings rate. The adjustment mechanism proposed by the current paper is similar to Kaldor's, to the extent that the savings rate is variable. However, profit share is constant in our model. We emphasise that the consumption of individual households is not proportional to their income. Accordingly, the average savings rate of the whole economy decreases with a fall in income per household, which depends on the employment rate. Thus, a fall in employment rate can reduce the savings rate, and thereby adjust the warranted rate to the natural rate.

The second aim of this paper is to investigate the dynamics of individual assets in industrial development. It is shown that while individual households can continually increase their assets in the first steady state, households may polarise in the second steady state; i.e. the rich become richer and the poor become poorer. Stiglitz (1969) used a neoclassical growth model to prove that a stable steady state has a tendency to distribute all assets evenly. His model always assumes full employment; therefore, capital accumulation causes an increase in wage rates and a reduction in interest rates. Both the wage rate increase and the interest-rate reduction contribute to the equal distribution of assets among households.[3] In contrast, our steady states are characterised by underemployment, and no guarantee exists of equal distribution.[4] In our case, the key to preventing polarisation is to levy a tax on asset income and redistribute the tax revenue.

Finally, the paper investigates the multiplier effect of government spending in the circumstance of underemployment. Ono (2011) provides a clear explanation of the balanced budget multiplier, which is unity in the short run. Our comparative statics show that the balanced budget multiplier exceeds unity, and accordingly, government spending enhances households' disposable income and consumption.

2. The Model

Let us consider a simple model consisting of two economies: an agricultural economy and an industrial economy. Suppose that each economy is self-sufficient and has no connection to the other except with regard to possible migration. Our focus is upon economic growth in the industrial economy where a market economy prevails. For the agricultural economy, we assume that local communities guarantee individual households a living standard that slightly exceeds the subsistence level. When jobs are available in the industrial economy and the wage rates are more satisfactory than the earnings in the agricultural economy, migration occurs from the agricultural to the industrial economy. We also assume that one household has n successors in both economies; consequently, the total population grows at the gross rate of n.

Households in the industrial economy

Let us specify the behaviour of households living in the industrial economy. Each household lives for one period. A household indexed by i maximises the following utility u_t^i:

$$u_t^i = (c_t^i - \bar{c})^{\alpha} (B_t^i)^{1-\alpha}, \quad 0 < \alpha < 1$$

where c_t^i denotes consumption at period t and B_t^i denotes a transfer from household i to its successors. Constant $\bar{c}$ reflects the minimum level of consumption. Each household is endowed with one unit of labour. In real terms, the budget constraint is given by

$$c_t^i + B_t^i = wx_t + \pi_t^i,$$

where w denotes the real wage rate; π_t^i denotes the asset income that is proportional to the share of own asset $b_{t-1}^i / \sum_{i=1}^{L_t} b_{t-1}^i$; b_{t-1}^i denotes the transfer received by household i; L denotes the number of households located in the industrial economy; and x denotes the employment rate. When the quantity of employed labour is denoted by N, the employment rate is given by $x = N / L$.[5]

As a result of maximisation, the consumption and transfer become

$$c_t^i = \alpha(wx_t + \pi_t^i) + (1-\alpha)\bar{c}, \tag{1}$$

$$B_t^i = (1-\alpha)(wx_t + \pi_t^i - \bar{c}). \tag{2}$$

Note that owing to $\bar{c}$, individual consumption given by (1) is not proportional to income.[6]

Firms

Let us adopt a familiar monopolistic competition model. Industrial firm j maximises its profit $P^j Y^j - WN^j$, subject to the demand function $Y^j = (P^j / P)^{-\eta} Y$ and the labour input function $N^j = \tau Y^j$, where P^j denotes the price of good j; Y^j the quantity of produced good j; W the nominal wage rate; N^j the employed labour for producing good j; P the price index; Y the aggregate demand; and τ the labour coefficient.[7] As a result of profit maximisation, the price of good j becomes $P^j = \eta W\tau /(\eta - 1)$. In a symmetric equilibrium, $P^j = P$ (and therefore $Y^j = Y$). Thus, we obtain the real wage rate in the industrial economy:

$$w \equiv W / P = \theta / \tau , \tag{3}$$

where $\theta (= (\eta - 1) / \eta)$ implies labour share in income.

Furthermore, let us assume that investment I_{t-1} is planned exactly for realising the above profit, i.e. $I_{t-1} = K_t = \nu Y_t$, where K_t denotes the quantity of capital, and ν the capital coefficient. It is assumed that capital depreciates completely in one period.

Lastly, let us assume that firms distribute the whole profit to households, and therefore,

$$\sum_{i=1}^{L_t} (wx_t + \pi_t^i) = Y_t . \tag{4}$$

3. First Steady State with Migration

Now, consider the first stage of industrial development, when an abundant supply of labour is available through migration from the agricultural economy. We assume that

$$w > \overline{w} > \bar{c} . \tag{5}$$

Wage rate w given by (3) is higher than reservation wage $\overline{w}$ that is based on earnings in the agriculture economy. Then, equilibrium employment rate x^* would be determined by the well-known Harris-Todaro mechanism:[8]

$$x^* = \overline{w} / w = \overline{w}\tau / \theta . \tag{6}$$

Taking (1) and (6) into account, aggregate consumption is given by

$$C_t = \sum_{i=1}^{L_t} c_t^i = \alpha Y_t + (1-\alpha)\bar{c}L_t = \left(\alpha + (1-\alpha)\frac{\bar{c}\tau}{x_t} \right) Y_t = \left(\alpha + (1-\alpha)\frac{\theta\bar{c}}{\overline{w}} \right) Y_t . \tag{7}$$

Note that the aggregate consumption is proportional to aggregate income, while the individual consumption given by (1) involves a positive constant $(1-\alpha)\bar{c}$.

Now, let us investigate the warranted rate of growth. The goods market equilibrium is given by $Y_t = C_t + I_t$. Then, using (7), we have

$$Y_t = I_t / s^*, \tag{8}$$

where s^* denotes the saving rate: $s^* = (1-\alpha)\left(1-(\theta\bar{c}/\bar{w})\right)$. Then, from (8) and $Y_t = K_t / v$, we obtain the warranted growth rate:

$$I_t / K_t = s^* / v. \tag{9}$$

Following Harrod, let us assume that this warranted rate is higher than the natural rate of growth. Since we ignore technical progress, it implies that $s^*/v > n$, i.e.,

$$\frac{(1-\alpha)\left(1-(\theta\bar{c}/\bar{w})\right)}{v} > n. \tag{10}$$

Even if this inequality holds, the industrial economy can grow at the rate of s^*/v as long as the inflow of migrants continues.

4. Second Steady State without Migration

Since $s^*/v > n$, the industrial economy growing at the rate of s^*/v will completely absorb agricultural labour sooner or later. After the agricultural economy disappears, the industrial economy can grow at the rate of *n* in the long run. Now, let us examine how the warranted growth rate can be adjusted to natural rate *n*.

Let x^{**} denote the employment rate in the second steady state without migration. Aggregate consumption can be indicated by

$$C_t = \sum_{i=1}^{L_t} c_t^i = \alpha Y_t + (1-\alpha)\bar{c}L_t = \left(\alpha + (1-\alpha)\frac{\bar{c}\tau}{x^{**}}\right)Y_t. \tag{11}$$

Accordingly, the equilibrium output becomes

$$Y_t = I_t / s^{**}, \tag{12}$$

where $s^{**} = (1-\alpha)\left(1-(\bar{c}\tau/x^{**})\right)$. Then, from (12) and $Y_t = K_t / v$, the warranted rate of growth is $I/K = s^{**}/v$. However, the growth rate in the steady state is bound to be *n*, and therefore it must hold that $s^{**}/v = n$. This means that x^{**} has to be

$$x^{**} = \frac{(1-\alpha)\bar{c}\tau}{(1-\alpha) - vn}. \tag{13}$$

Comparing (6) and (13) under condition (10), we obtain the following proposition.

Proposition 1: The employment rate in the second steady state is lower than the employment rate in the first steady state: $x^{**} < x^{*}$.

This examination reveals that the warranted growth rate can be adjusted toward the natural growth rate by a decrease in the employment rate. A fall in output Y raises consumption rate C/Y $(= \alpha + (1-\alpha)\bar{c}L/Y)$, and thereby reduces the saving rate. Further, the fall in Y decreases employment N. Hence, a particular employment rate exists under which $s^{**}/v = n$. Note that there is a paradoxical aspect: the higher the growth rate of population, the higher the employment rate: $\partial x^{**}/\partial n > 0$.

5. Effects of Technical Progress

Let us compare the effects of technical progress in the above two steady states. From (6), (9) and (13), we have the following proposition.

Proposition 2: In the first steady state, capital-saving technical progress enhances growth rate, and labour-saving technical progress reduces the employment rate:

$$\partial(I/K)/\partial v < 0, \;\; \partial x^{*}/\partial \tau > 0.$$

In the second steady state, these technical progresses reduce the employment rate:

$$\partial x^{**}/\partial v > 0, \;\; \partial x^{**}/\partial \tau > 0.$$

6. Inequality in Individual Households

Behaviour of individual assets

As shown in the Appendix, the dynamics of individual assets is indicated by

$$b_t^i = \frac{(1-\alpha)}{n}\left(wx_t + \frac{(1-\theta)}{v} b_{t-1}^i - \bar{c} \right). \tag{14}$$

Given (14), let us examine the two steady states.

Asset dynamics in the first steady state

In the first steady state, (5) and (6) imply that $wx^* > \bar{c}$. Then, taking (14) into account, together with the following relationship

$$\frac{\partial b_t^i}{\partial b_{t-1}^i} \underset{<}{\overset{>}{-}} 1 \quad \Leftrightarrow \quad \frac{(1-\alpha)(1-\theta)}{v} \underset{<}{\overset{>}{-}} n, \tag{15}$$

figures 2-1 and 2-2 depict two cases. The criterion dividing the two cases is whether capital accumulation based on the savings out of profits is faster than population growth. In both cases, individual asset b^i increases over the average asset level: $K/L = vx^*/\tau$. Thus, we have the following proposition.

Proposition 3: Individual assets can continually increase in the first steady state.

Note that new migrants who have no assets come to the industrial economy continually. Then, the fact that the average asset level is fixed at vx^*/τ does not contradict the continual increase in individual assets.

If θ is relatively low, so that $(1-\alpha)(1-\theta)/v > n$, inequality will expand. In order to confirm this, suppose that household i_1 had more assets than household i_2 at period t-1: $b_{t-1}^{i_1} > b_{t-1}^{i_2}$. Further, let us indicate their successors at period t by i_1 and i_2, respectively. Then, according to (14), the difference in transfers received by each successor at period t is

$$b_t^{i_1} - b_t^{i_2} = \frac{(1-\alpha)(1-\theta)}{nv}\left(b_{t-1}^{i_1} - b_{t-1}^{i_2}\right). \tag{16}$$

Thus, asset inequality widens at period t. In contrast, asset inequality decreases if θ is relatively large, so that $(1-\alpha)(1-\theta)/v < n$. Therefore, the difference in asset holdings will diminish, as shown by (16).

Asset dynamics in the second steady state

Let us examine the second steady state, where $x_t = x^{**}$ in (14). We have the following relationship:

$$\frac{\partial b_t^i}{\partial b_{t-1}^i} \underset{<}{\overset{>}{-}} 1 \quad \Leftrightarrow \quad wx^{**} \underset{>}{\overset{<}{-}} \bar{c} \quad \Leftrightarrow \quad \frac{(1-\alpha)(1-\theta)}{v} \underset{<}{\overset{>}{-}} n. \tag{17}$$

Figure 3-1 draws the case of a small θ, in which $(1-\alpha)(1-\theta)/v > n$. In contrast, figure 3-2 draws the case of a large θ, in which $(1-\alpha)(1-\theta)/v < n$. The results are summarised as follows:

Proposition 4: If labour share in income θ is relatively small, so that $(1-\alpha)(1-\theta)/\nu > n$, households polarise into the rich and the poor in the second steady state. Conversely, if labour share in income θ is relatively large, so that $(1-\alpha)(1-\theta)/\nu < n$, individual assets converge to a stationary state indicated by

$$b^{**} = \frac{(1-\alpha)\bar{c}\nu}{(1-\alpha)-\nu n}. \tag{18}$$

Note that b^{**} is equal to average asset K/L.

7. Policies in the Second Steady State

Taxation on asset income

First, let us demonstrate that asset-income taxation combined with a lump-sum transfer can prevent polarisation even though $(1-\alpha)(1-\theta)/\nu > n$ or equivalently $R \equiv (1-\alpha)(1-\theta)/\nu n > 1$.

Let z denote the tax rate on asset-income and T be the lump-sum transfer. The balanced budget implies $T = \frac{z(1-\theta)Y}{L} = \frac{z(1-\theta)K}{\nu L} = \frac{z(1-w\tau)b^{**}}{\nu}$. Then, instead of (14), we obtain

$$b_t^i = (1-z)Rb_{t-1}^i + \big(1-(1-z)R\big)b^{**}. \tag{19}$$

Thus, we have the following proposition.

Proposition 5: When labour-share θ is small, so that $R \equiv (1-\alpha)(1-\theta)/\nu n > 1$, the polarisation of households is avoided if the tax rate on asset-income satisfies

$$z > (R-1)/R. \tag{20}$$

Note that, due to linear consumption and saving functions, this redistribution policy does not affect macroeconomic performance.[9]

Government spending

Secondly, we investigate how government spending affects macroeconomic performance. Let g denote per capita government spending. Aggregate spending G is given by $G = gL$, and the goods market equilibrium is indicated by $Y = C + I + G$. We examine a simple balanced budget policy, i.e. the government levies a lump-sum tax g on each household. Then, instead of (11), aggregate consumption is

$$C_t = \alpha Y_t - \alpha g L_t + (1-\alpha)\bar{c} L_t . \tag{21}$$

Taking (21) into account, we can derive the following employment rate in the second steady state:

$$x^{**} = \frac{(1-\alpha)(\bar{c}+g)\tau}{(1-\alpha) - \nu n}, \tag{22}$$

which means that government spending g raises the employment rate through its demand-expansion effect.

Per capita output y is given by

$$y = \frac{Y}{L} = \frac{N}{\tau L} = \frac{x^{**}}{\tau} = \frac{(1-\alpha)(\bar{c}+g)}{(1-\alpha) - \nu n} . \tag{23}$$

Note that $\partial y / \partial g = (1-\alpha)/(1-\alpha-\nu n) > 1$: the balanced budget multiplier exceeds unity. This is because government spending enhances investment as well as consumption in the steady state. Defining per capita disposable income as $\tilde{y} \equiv y - g$, we have $\partial \tilde{y} / \partial g = \partial y / \partial g - 1 > 0$. Thus, the following proposition is obtained.

Proposition 6: The balanced budget multiplier is greater than unity. Accordingly, government spending increases households' disposable income and consumption.

8. Conclusion

By taking into account individual consumption that is not proportional to income, the current paper examines two steady states: one is characterised by a high employment rate accompanied by rapid economic growth with migration; the other is characterised by a lower employment rate accompanied by slower economic growth without migration.[10] In the first steady state, every household can increase individual assets, whereas in the second steady state, polarisation among individual households may occur. In order to avoid polarisation, labour share in income has to be relatively high. In other words, the product of wage and employment rate must be large enough to afford minimum consumption. When these conditions do not hold, taxation on asset-income, combined with a lump-sum transfer, becomes an adequate scheme for avoiding polarisation.

Since insufficient demand for goods restricts the economy in the second steady state, it might not be surprising that Keynesian fiscal policy improves the situation. However, it would be worth noting that the balanced budget multiplier exceeds unity in the second steady state.

Appendix

Derivation of (14)

From (1), (2), (4), and $Y_{t-1} = C_{t-1} + I_{t-1}$, we can confirm that

$$\sum_{i=1}^{L_{t-1}} B_{t-1}^{i} = (1-\alpha)(Y_{t-1} - \bar{c}L_{t-1}) = I_{t-1}. \tag{A-1}$$

When capital K completely depreciates in one period, we have

$$K_t = I_{t-1}. \tag{A-2}$$

Further, the total amount of transfers received by generation t must be equal to the total amount of transfers supplied by generation t-1:

$$\sum_{i=1}^{L_t} b_{t-1}^{i} = \sum_{i=1}^{L_{t-1}} B_{t-1}^{i}. \tag{A-3}$$

From (A-1)-(A-3), we have the asset income of household i given by

$$\pi_t^i = (1-\theta)Y_t\left(b_{t-1}^i / \sum_{i=1}^{L_t} b_{t-1}^i \right) = (1-\theta)Y_t \frac{b_{t-1}^i}{K_t} = \frac{(1-\theta)}{v} b_{t-1}^i. \tag{A-4}$$

Let us assume that household i divides B_t^i equally to its successors so that $b_t^i = B_t^i / n$.

Then, from (2) and (A-4), we have

$$b_t^i = \frac{(1-\alpha)}{n}\left(wx_t + \frac{(1-\theta)}{v} b_{t-1}^i - \bar{c} \right).$$

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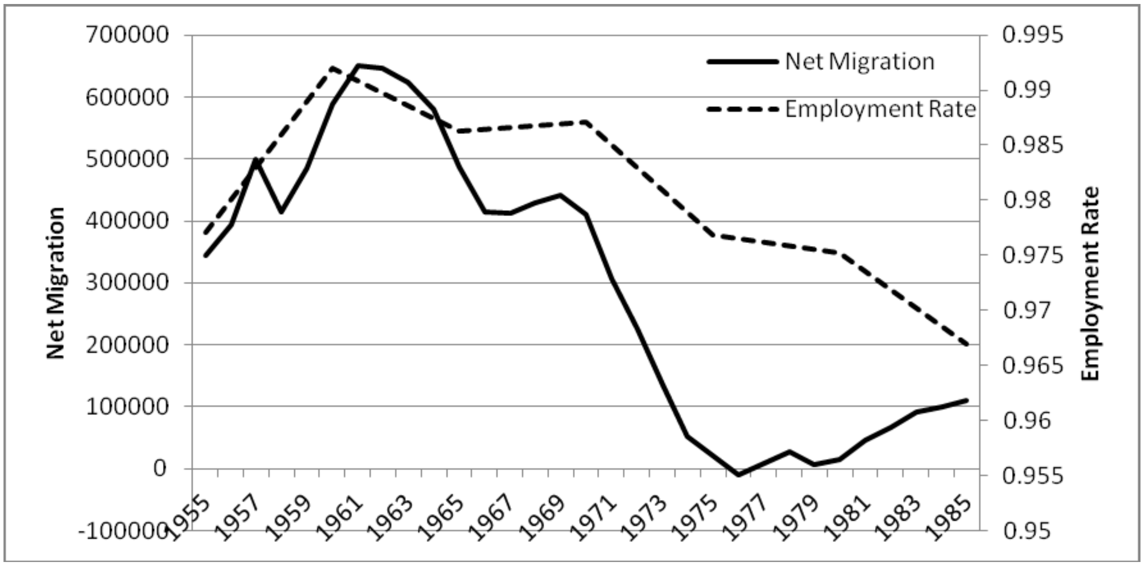

FIGURE 1

Net migration to Tokyo, Osaka, and Nagoya areas (three large industrial areas in Japan), and employment rates in these areas. Source: Report on Internal Migration, and Population Census, Statistics Bureau, Japan.

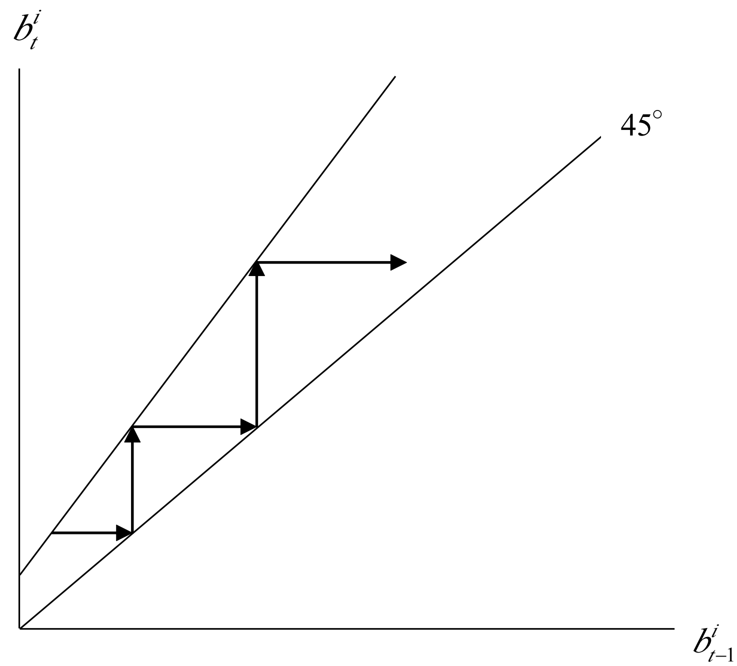

FIGURE 2-1

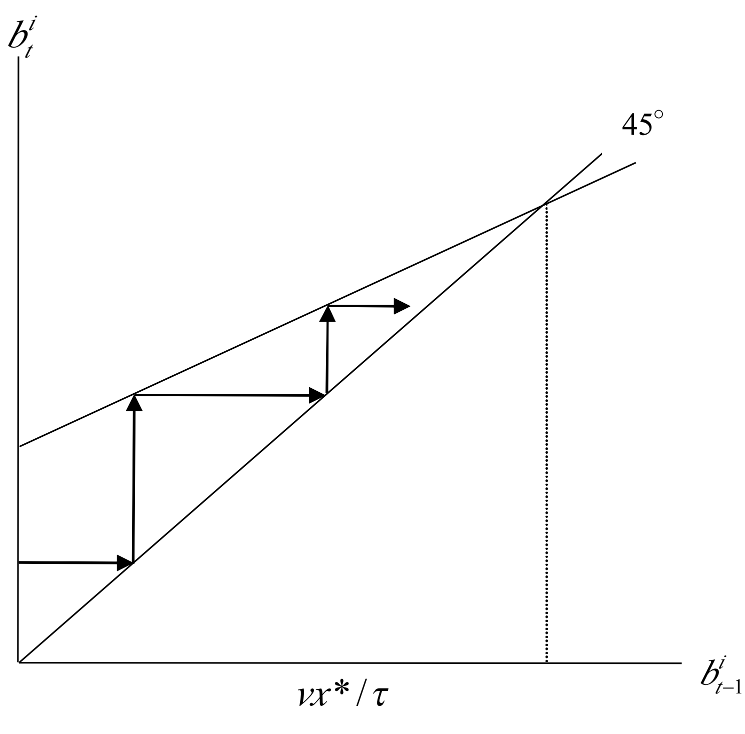

FIGURE 2-2

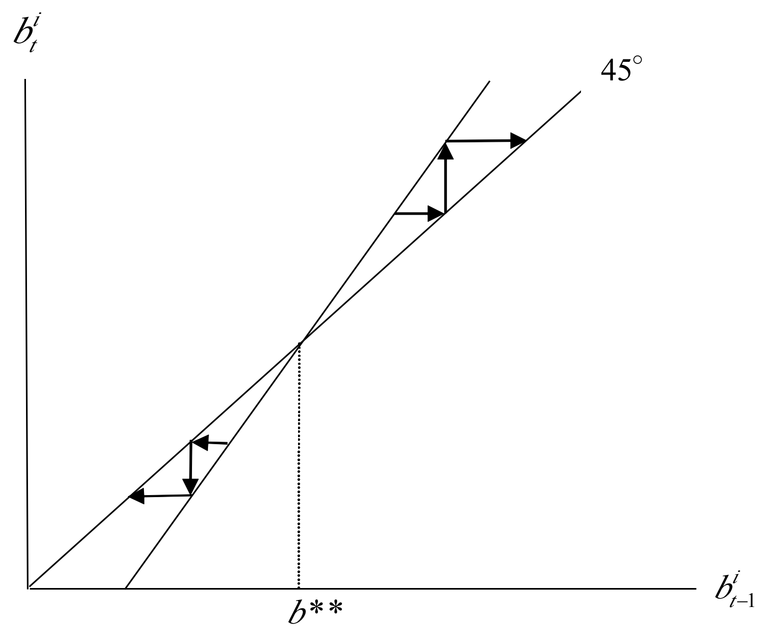

FIGURE 3-1

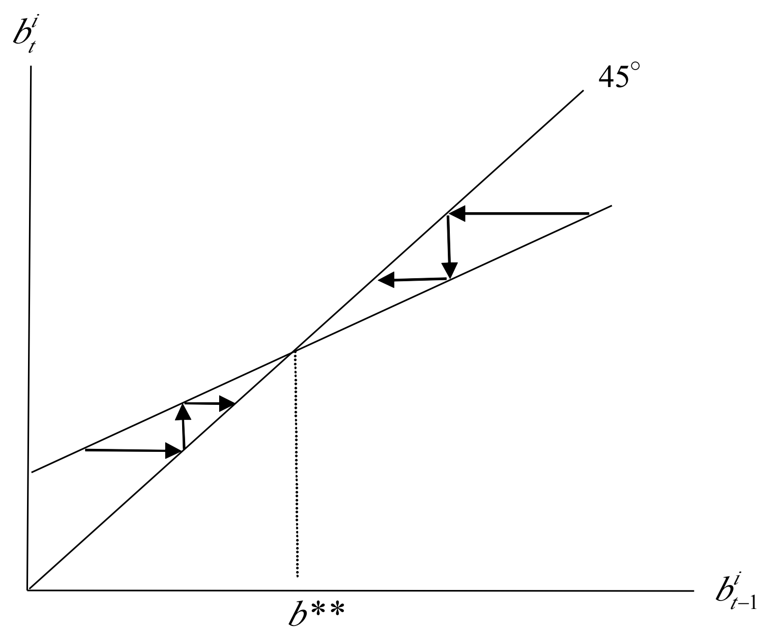

FIGURE 3-2

Notes

1 The former is the rate that warrants the full utilisation of capital, and the latter is the sum of the growth rates of the working population and labour productivity.
2 Although one of Harrod's points of emphasis is premised on the instability of warranted growth, the current paper focuses on another issue: the discrepancy between the warranted rate and the natural rate of growth. Domar's (1946) main interest seems to be in characterising the warranted rate rather than the discrepancy between the warranted rate and the natural rate of growth.
3 The same mechanism works for equal distribution in Galor and Moav (2004).
4 Extending Stiglitz' model to the case of a non-linear saving function, Bourguignon (1981) examines unegalitarian steady states under full employment.
5 To simplify the analysis, we assume underemployment instead of unemployment.
6 The transfer implies savings, and owing to $\bar{c}$, the saving function becomes convex with respect to income. Recently, Moav (2002), Galor and Moav (2004), and Nakajima and Nakamura (2009) adopt similar saving functions.
7 The derivation of the demand function is roughly explained as follows. Let c^i denote the consumption index of household *i*, which is given by $c^i = (\int_0^1 c^{ij^{(\eta-1)/\eta}} dj)^{\eta/(\eta-1)}$. Then, from optimisation, the demand for good *j*, c^{ij}, is derived as $c^{ij} = (P^j / P)^{-\eta} c^i$, where $P = (\int_0^1 P^{j^{1-\eta}} dj)^{1/(1-\eta)}$. In a similar way, let I^k denote the investment index of firm *k*, which is given by $I^k = (\int_0^1 I^{kj^{(\eta-1)/\eta}} dj)^{\eta/(\eta-1)}$. Then, the demand for good *j*, I^{kj}, is derived as $I^{kj} = (P^j / P)^{-\eta} I^k$. Aggregating these results, we obtain demand function $Y^j = (P^j / P)^{-\eta} Y$. For instance, see Blanchard and Kiyotaki (1987).
8 See Harris and Todaro (1970).
9 Stiglitz (1969) points out this neutrality.
10 We only compare two steady states in which capital is fully utilised. The actual process of transition may include trial and error in investment. Then, excessive holdings of capital will occur temporarily. However, if a representative firm decides on investment with perfect foresight, the economy will quickly attain the second steady state.