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Increased Shareholder Power, Income Distribution, and Employment in a Neo-Kaleckian Model with Conflict Inflation

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Abstract

By using a Kaleckian model with firms' debt accumulation, we investigate how increased shareholder power defined by a decrease in firms' retention ratio and a monetary policy defined by interest controlled by a central bank affect macroeconomic variables. The long-run equilibrium can be stable even if the short-run equilibrium exhibits debt-burdened growth. In addition, the long-run equilibrium can be unstable even if the short run equilibrium exhibits debt-led growth. Increased shareholder power can increase both rentiers and workers' income shares. A monetary easing policy has an expansionary effect on the economy. However, it decreases both workers and rentiers' income shares and thus has a negative effect on income distribution.

Keywords: financialization; income distribution; employment; firms' debt

JEL Classification: E12, E21, E22, E32, E44

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1 Introduction

This study is part of a series of studies on financialization. Specifically, by using a Kaleckian model with firms' debt accumulation, we investigate how increased shareholder power defined by a decrease in firms' retention ratio and a monetary policy defined by interest controlled by a central bank affect macroeconomic variables.

There are many related studies in this field.[1)] The main contribution of our study is in endogenizing income distribution and employment that are exogenously given in almost all related studies of financialization using Kaleckian models. That is, we investigate the effects of financialization on the income distribution, employment rate, capacity utilization rate, capital accumulation rate, and debt-capital ratio. To our knowledge, few studies endogenize income distribution and employment in Kaleckian models of financialization.

Our starting point is a Kaleckian model with firms' debt accumulation, such as in Lavoie (1995), Hein (2007), and Sasaki and Fujita (2012). We endogenize income distribution by introducing the conflict theory of inflation into a basic model. Dünhaupt (2016) conducts empirical analysis on OECD data to reveal that dividend payments and debt servicing increase and thus wage share declines with financialization. To theoretically investigate such a phenomenon, we build a model that endogenizes income distribution.

Moreover, we endogenize the employment rate by introducing the "reserve army effect" and "reserve army creation effect" suggested by Sasaki (2013).[2)] According to the reserve army effect, the growth rate of nominal wage is increasing in the employment rate, whereas according to the reserve army creation effect, the growth rate of labour productivity is increasing in the employment rate.

Hein (2007) is a representative work that considers financial aspects such as the interest rate and firms' debt accumulation in the Kaleckian framework. Hein (2007) introduces the effect of debt-capital ratio on the investment function and conducts short-run and long-run analyses.[3)] Hein's model defines the short-run as a situation in which the debt-capital ratio remains constant and the long-run as a situation in which the ratio changes thorough time.

With regard to the short run, we investigate how an increase in the debt-capital ratio affects the capacity utilization and capital accumulation rates. In this analysis, the debt-capital ratio is given exogenously. In debt-led growth in an economy, an increase in the debt-capital ratio leads to increases in both the capacity utilization and capital accumulation

1) For related studies that consider financialization by using post-Keynesian models, see Dallery (2009), Hein (2010, 2012), Hein and van Treeck (2010), Nishi (2012, 2013), Ryoo and Skott (2008), Sasaki and Fujita (2014a, 2014b), Skott and Ryoo (2008), and Stockhammer (2004).

2) For Kaleckian models with the reserve army creation effect, see also Sasaki (2010, 2011).

3) For macrodynamic models that consider firms' debt accumulation, see Asada (2006), Lima and Meirelles (2007), and Charles (2008a, 2008b, 2010).

rates, whereas in debt-burdened growth, such an increase leads to decreases in both these rates. As regards the long run, Hein (2007) shows that the long-run equilibrium is stable when the short-run equilibrium exhibits debt-led growth, whereas it is unstable when the short-run equilibrium exhibits debt-burdened growth.

Then, in both the short and long runs, Hein (2007) introduces an assumption that the profit share depends positively on the interest rate that is given exogenously. In addition, he examines the income distribution.

However, Hein (2007) has three serious problems. First, his assumption that the profit share depends on the interest rate that is given exogenously is equivalent to treating the profit share as an exogenous variable. Accordingly, Hein's model does not determine income distribution endogenously.

Second, his conclusion that the long-run equilibrium is stable only when the short-run equilibrium exhibits debt-led growth is questionable. We have to await the results of the empirical analysis to determine whether the real economy exhibits debt-led growth or debt-burdened growth.[4)] If the real economy exhibits debt-burdened growth, it is difficult to believe that such an economy diverges to infinity. Even a debt-burdened growth economy can be stable.

Third, Hein (2007) assumes that the retention ratio of firms is unity, that is the dividend payout ratio is zero. However, as Sasaki and Fujita (2012) point out, the main results of Hein (2007) depend crucially on this assumption. Sasaki and Fujita (2012) show that by making the retention ratio less than unity, that is making the dividend payout ratio greater than zero, we can build a more realistic model both qualitatively and quantitatively.[5)]

Based on the above observation, we present a more realistic model that endogenizes income distribution and makes firms' retention ratio less than unity. By explicitly considering the retention ratio, we can examine the effect of a decrease in the retention ratio due to financialization on macroeconomic variables.

In addition, we discuss the determination of income distribution and employment rate in the long-run equilibrium and investigate how increased shareholder power and monetary policy affect income distribution and employment.[6)] Surprisingly, few studies treat the endogenous determination of income distribution and employment in the context of financialization.

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4) Hein and Schoder (2011) use an extended version of Hein's (2007) model and conduct an empirical analysis to determine whether the U.S. and Germany exhibit debt-led growth or debt-burdened growth. Their results suggest that both economies show debt-burdened growth. In addition, Hein and Ochsen (2003) conduct a similar analysis.

5) Hein (2013) contradicts Sasaki and Fujita (2012). In addition, Franke (2016) admits the appropriateness of Sasaki and Fujita (2012) and extends Hein's (2013) model.

6) For analysis of the employment rate using Kaleckian models, see also Sasaki (2010, 2011, 2013).

Hein (2005) analyses the effect of monetary policy on the employment rate. However, to simplify the analysis, he assumes that the capacity utilization rate is equal to the employment rate, which lacks strictness.[7)] Our model strictly separates the capacity utilization and employment rates. Indeed, in our model, the effect of a parameter change on the capacity utilization and employment rates can be very different.

Isaac (2009) presents an eclectic model that introduces both New Keynesian (NK) and Post Keynesian (PK) elements. Wage determination follows the efficiency wage hypothesis (NK), a change in price follows the conflict inflation theory (PK), monetary policy follows the Taylor rule (NK), and an independent investment function exists (PK). In the short run, capital stock and labour supply are fixed, whereas in the long run, capital stock accumulates and labour supply grows at a constant rate. The employment rate in the long-run equilibrium is not necessarily equal to the full employment level, and thus unemployment occurs. Isaac (2009) investigates which mix of monetary and fiscal policies can stabilise the economy. However, he does not investigate income distribution[8)]

Here, we note the definition of monetary policy used in this study. We adopt a horizontal approach in which the central bank sets the nominal interest rate (Moore, 1988; Rochon, 1999). Accordingly, interest rate becomes an exogenous variable, and money supply becomes an endogenous variable instead.

The remainder of the paper is organised as follows. Section 2 explains the elements that constitute our model. Section 3 investigates the short-run equilibrium. Section 4 investigates the long-run equilibrium. Section 5 conducts numerical simulations to illustrate some examples. Section 6 concludes the paper.

2 Model

Suppose a closed economy in which four types of agents, workers, rentiers, firms, and the central bank exist. Workers obtain wage income by working. Rentiers supply capital stock to firms and obtain interest income. Firms conduct production activity and finance funds needed for investment by retaining earnings, borrowing, and sharing issues. The central bank sets the nominal interest rate level. Only one good is produced and used for both consumption and investment. The goods market is oligopolistic, and firms are the price

7) With the help of Okun's law, Tavani, Flaschel, and Taylor (2011) assume that the capacity utilization rate has a positive correlation with the employment rate. However, as Okun's law does not always hold, we should treat the capacity utilization rate and employment rate separately.

8) Michl (2008) also introduces monetary policy based on a Taylor rule into a Kaleckian model and investigates the employment rate. However, he does not analyse income distribution. Setterfield (2009) introduces a monetary policy called the Pasinetti rule into a Kaleckian model. The Pasinetti rule controls the interest rate in order to keep income distribution constant through time.

setters.

As in the usual Kaleckian model, we assume the Leontief production function.

$$Y = \min\{aE, uK\}, \tag{1}$$

where Y denotes the output; E, employment; and K, capital stock. Here, we assume that the capital-potential output ratio is constant through time. From this, the capital-output ratio u can be regarded as the capacity utilization rate. Moreover, $a = Y/E$ denotes labour productivity. Firms implement cost-minimising behaviour and operate in a situation in which $aE = uK$. From this, we obtain $E = (u/a)K$.

Denoting $g_d = I/K$ as firms' real investment normalised by capital stock, we specify firms' planned investment function as

$$g_d = g_d(m, u, i\ell), \quad \frac{\partial g_d}{\partial m} > 0, \ \frac{\partial g_d}{\partial u} > 0, \ \frac{\partial g_d}{\partial (i\ell)} < 0, \tag{2}$$

where m denotes the profit share, and i, the nominal interest rate. Moreover, $\ell = L/(pK)$ denotes the debt-capital ratio; L, nominal debt; and p, the price. Partial derivatives show that firms' planned investment function is increasing in the profit share and capacity utilization rate and decreasing in the interest burdened. The specification that the planned investment function is increasing in both the profit share and capacity utilization rate is based on the work of Marglin and Bhaduri (1990). The specification that the planned investment function is decreasing in the interest burdened is based on the work of Hein (2007).[9)]

Consider real saving normalised by capital stock, that is $g_s = S/K$. We assume that workers consume all wage income and thus do not save, rentiers save dividend and interest income at a constant rate s_c, and firms save the remaining profits minus interest payments at a constant rate s_f. That is, s_f denotes the retention rate. Therefore, total saving of the economy leads to

$$\begin{aligned} g_s &= s_f(um - i\ell) + s_c[(1 - s_f)(um - i\ell) + i\ell], \quad 0 < s_c < 1, \ 0 < s_f < 1 \\ &= \sigma um - (1 - s_c)s_f i\ell, \quad \sigma \equiv s_f + s_c(1 - s_f) > 0, \end{aligned} \tag{3}$$

where r denotes the profit rate, and we obtain $r = mu$.

We specify the dynamics of nominal wage and price. In this study, we use the theory of

9) Hein (2006) uses the investment function that is increasing in the profit rate and not the profit share, increasing in the capacity utilization rate, and decreasing in the interest burdened.

conflict inflation to specify those dynamics.[10)]

$$g_w = \theta_w(m - m_w), \quad \theta_w > 0, \tag{4}$$

$$g_p = \theta_f(m_f - m), \quad \theta_f > 0, \tag{5}$$

where g_w denotes the growth rate of nominal wage w, and g_p, the growth rate of price p. Moreover, θ_w and θ_f denote the coefficients of adjustment. In addition, m_w denotes the target profit share of labour unions, and m_f, the target profit share of firms. As the adjustment coefficients, θ_w and θ_f, can be interpreted as capturing the bargaining powers of labour unions and firms, we assume $\theta_w + \theta_f = 1$ and $\theta_f = \theta$ $(0 < \theta < 1)$. In addition, we assume that the target profit share of labour unions is a decreasing function of the employment rate and that of firms is an increasing function of the interest burden.

$$m_w = m_w(e), \quad m'_w < 0, \tag{6}$$

$$m_f = m_f(i\ell), \quad m'_f > 0, \tag{7}$$

where $e = E/N = uK/(aN)$ denotes the employment rate, and N, exogenous labour supply that grows at a constant rate n ($\dot{N}/N = n > 0$). We explain equations (6) and (7) in order. To begin with, an increase in the employment rate raises the bargaining power of labour unions, which leads to a rise in the level of aspiration. Equation (6) shows this process, which can be called the "reserve army effect." Substituting equation (6) into equation (4) produces a nominal wage Phillips curve, so that the growth rate of nominal wage is an increasing function of the employment rate (i.e. a decreasing function of the unemployment rate). Next, in the face of an increase in the interest burden, firms attempt to pass the burden onto the price to check a decline in profits. Equation (7) shows this process, which can be called the "interest burden price pass effect."[11)].

Finally, we assume that the growth rate of labour productivity depends positively on the employment rate.

$$g_a = g_a(e), \quad g'_a > 0, \tag{8}$$

where $g_a = \dot{a}/a$ denotes the growth rate of labour productivity. An increase in the employment rate puts upward pressure on wages, which makes firms adopt labour saving technology. If the output of firms is constant, then this process intentionally creates unemploy-

10) For a Kaleckian model with the theory of conflict inflation, see also Cassetti (2003).

11) Dutt and Amadeo (1993) assume that the target profit share of firms is an increasing function of the nominal interest rate i instead of $i\ell$.

ment.[12)]

3 Short-run analysis

We define the short run as the period when the capacity utilization rate and profit share are endogenous variables, while the debt-capital ratio and employment rate are fixed.

First, we assume that in the goods market, quantity adjustment works according to excess demand or excess supply.

$$\dot{u} = \varepsilon(g_d - g_s), \quad \varepsilon > 0, \tag{9}$$

where ε denotes the adjustment speed of the goods market.

Next, by differentiating the definition of the profit share, we obtain the following relation:

$$\frac{\dot{m}}{1-m} = g_p - g_w + g_a. \tag{10}$$

Substituting equations (2), (3), (4), (5), (6), (7), and (8) into equations (9) and (10), we obtain the system of differential equations of u and m as follows:

$$\dot{u} = \varepsilon\{g_d(m, u, i\bar{\ell}) - [\sigma um - (1 - s_c)s_f i\bar{\ell}]\}, \tag{11}$$
$$\dot{m} = (1 - m)\{\theta[m_f(i\bar{\ell}) - m] - (1 - \theta)[m - m_w(\bar{e})] + g_a(\bar{e})\}. \tag{12}$$

Bars over ℓ and e indicate that these variables are fixed in the short run.

The short-run equilibrium is a situation in which $\dot{u} = \dot{m} = 0$. Let u^* and m^* denote the short-run equilibrium values. Then, u^* and m^* satisfy the following two equations.

$$g_d(m^*, u^*, i\bar{\ell}) = \sigma u^* m^* - (1 - s_c)s_f i\bar{\ell}, \tag{13}$$
$$m^* = \theta m_f(i\bar{\ell}) + (1 - \theta)m_w(\bar{e}) + g_a(\bar{e}). \tag{14}$$

Below, we assume that there exist unique pair of (u^*, m^*) that simultaneously satisfies equations (13) and (14) and that $u^* \in (0, 1)$ and $m^* \in (0, 1)$.

We examine whether the short-run equilibrium is stable. Let $\mathbf{J_S}$ denote the 2×2 Jacobian

12) This process is also consistent with Kalecki's argument that unemployment is a disciplinary measure to control workers. See the article "Political aspects of full employment" published in Kalecki (1971).

matrix that corresponds to the short-run model. Then, the elements of $\mathbf{J_S}$ are given by

$$a_{11} = \frac{\partial \dot{u}}{\partial u} = \varepsilon\left(\frac{\partial g_d}{\partial u} - \sigma m\right), \tag{15}$$

$$a_{12} = \frac{\partial \dot{u}}{\partial m} = \varepsilon\left(\frac{\partial g_d}{\partial m} - \sigma u\right), \tag{16}$$

$$a_{21} = \frac{\partial \dot{m}}{\partial u} = 0, \tag{17}$$

$$a_{22} = \frac{\partial \dot{m}}{\partial m} = -(1-m) < 0. \tag{18}$$

All elements are evaluated at the short-run equilibrium values. Our model has a slightly special structure: in the short run, m affects u, whereas u does not affect m.

Here, we introduce the following assumption:

Assumption 1.

$$\sigma m > \frac{\partial g_d}{\partial u}. \tag{19}$$

This is called a Keynesian stability condition that shows that saving reacts to the capacity utilization more than the investment. From this, we have $a_{11} < 0$.

The sign of a_{12} indicates that the short-run equilibrium shows a wage-led or profit-led demand regime. We introduce the following definition.

Definition 1. *In the short-run equilibrium, we define $a_{12} > 0$ as a profit-led demand regime and $a_{12} < 0$ as a wage-led demand regime.*

The necessary and sufficient conditions for the short-run equilibrium to be stable are that the sum of diagonal elements ($\mathrm{tr}\,\mathbf{J_S} = a_{11} + a_{22}$) is negative and the determinant ($\det \mathbf{J_S} = a_{11}a_{22} - a_{12}a_{21}$) is positive. From the analysis, we obtain the following proposition.

Proposition 1. *Under assumption 1, the short-run equilibrium is locally stable.*[13)]

We investigate the effect of an increase in the nominal interest rate on short-run equilibrium values.

First, the effect of an increase in the nominal interest rate on the profit share is given by

$$\frac{dm^*}{di} = \theta\ell m_f' > 0. \tag{20}$$

13) In addition, the discriminant of the characteristic equation of $\mathbf{J_S}$ leads to $\mathcal{D} = (\mathrm{tr}\,\mathbf{J_S})^2 - 4\det\mathbf{J_S} = (a_{11} - a_{22})^2 > 0$, which implies that the short-run equilibrium is a stable node.

That is, an increase in the nominal interest rate raises the profit share in the short-run equilibrium. Hein (2007) assumes that the profit share is an increasing function of the interest rate. In our model, we consequently reach the same conclusion.

Next, the effects of an increase in both the nominal interest rate and debt-capital ratio are given by

$$\frac{du^*}{di} = \frac{\ell\left\{\theta m_f'\left(\frac{\partial g_d}{\partial m} - \sigma u\right) + \left[\frac{\partial g_d}{\partial(i\ell)} + (1 - s_c)s_f\right]\right\}}{\sigma m - \frac{\partial g_d}{\partial u}}, \tag{21}$$

$$\frac{du^*}{d\ell} = \frac{i\left\{\theta m_f'\left(\frac{\partial g_d}{\partial m} - \sigma u\right) + \left[\frac{\partial g_d}{\partial(i\ell)} + (1 - s_c)s_f\right]\right\}}{\sigma m - \frac{\partial g_d}{\partial u}}. \tag{22}$$

The denominators of equations (21) and (22) are positive because of Assumption 1. Therefore, signs of the numerators on the right-hand sides determine the signs of those derivatives. For convenience, we introduce the following definition:

Definition 2. *We define* $du^*/d\ell > 0$ *as debt-led demand and* $du^*/d\ell < 0$ *as debt-burdened demand.*

The signs of the numerators on the right-hand sides of equations (21) and (22) are dependent on whether the short-run equilibrium exhibits wage-led or profit-led demand. If it exhibits profit-led demand, the sign of the numerator on the right-hand side is likely to be positive, and thus the short-run equilibrium is likely to exhibit debt-led demand. On the other hand, if it exhibits wage-led demand, the sign of the numerator on the right-hand side is likely to be negative, and thus the short-run equilibrium is likely to exhibit debt-burdened demand.

If $m_f' = 0$, an increase in the interest rate has a negative (positive) effect on the capacity utilization when the negative effect of the interest burden $i\ell$ on firms' investment is large (small) and/or when the saving rate of rentiers s_c is large (small). As $m_f' > 0$ in our model, further effect, that is $(\partial g_d/\partial m) - \sigma u$ is added. This shows the gap between the impact of profit share on investment and saving. If this gap is positive, that is investment reacts to the profit share more than to saving, an increase in the interest rate is likely to increase the capacity utilization rate. On the other hand, if this gap is negative, that is saving reacts to the profit share more than to investment, an increase in the interest rate is likely to decrease the capacity utilization rate. This result is consistent with that of Hein (2007).

Finally, the effects of increases in the interest rate and debt-capital ratio on the capital accumulation rate are given by

$$\frac{dg^*}{di} = \sigma\ell\theta u^* \underbrace{m_f'}_{+} + \sigma m^* \underbrace{\frac{du^*}{di}}_{+/-} - (1 - s_c)s_f\ell, \tag{23}$$

$$\frac{dg^*}{d\ell} = \sigma i\theta u^* \underbrace{m_f'}_{+} + \sigma m^* \underbrace{\frac{du^*}{d\ell}}_{+/-} - (1 - s_c)s_f i. \tag{24}$$

If $\partial u^*/\partial i > 0$, we are likely to have $\partial g^*/\partial i > 0$, whereas if $\partial u^*/\partial i < 0$, we are likely to have $\partial g^*/\partial i < 0$. This also holds for the debt-capital ratio. Here, we introduce the same definition as in Hein (2007):

Definition 3. *We define* $dg^*/d\ell > 0$ *as debt-led growth and* $dg^*/d\ell < 0$ *as debt-burdened growth.*

The result is that an increase in the interest rate increases the capacity utilization rate, and the capital accumulation rate seems counterintuitive at a glance. However, this result holds for the following reason. For ease of exposition, we assume $m_f' = 0$. An increase in the interest rate increases firms' interest burden, leading to a decline in investment of firms, which has a negative effect on effective demand. On the other hand, an increase in the interest rate increases the income of rentiers, leading to an increase in their consumption, consequently leading to a positive effect on effective demand. Depending on which effect is larger, an increase in the interest rate has a positive/negative effect on the capacity utilization rate and capital accumulation effect. We have a debt-led case when the positive effect dominates and a debt-burdened case when the negative effect dominates.

The effect of an increase in the employment rate on the profit share in the short-run equilibrium is given by

$$\frac{dm^*}{de} = (1 - \theta)m_w' + g_a' \equiv \Gamma(e; \theta). \tag{25}$$

The term Γ is composed of the strengths of the relative bargaining power of firms, reserve army effects, and reserve army creation effects. As we have $m_w' < 0$ and $g_a' > 0$, Γ can be positive or negative.[14)]

The effect of an increase in the employment rate on the capacity utilization in the short-

14) Here, Γ is the same as the term Γ used in Sasaki (2013). For details on the argument, see Sasaki (2013).

run equilibrium is given by

$$\frac{du^*}{de} = \frac{\overbrace{\left(\sigma m^* - \frac{\partial g_d}{\partial u}\right)}^{+}}{\underbrace{\left(\frac{\partial g_d}{\partial m} - \sigma u^*\right)\Gamma}_{+/-}}. \tag{26}$$

The numerator on the right-hand side will be positive when the Keynesian stability condition holds. The sign of the denominator on the right-hand side depends on whether the short-run equilibrium exhibits wage-led or profit-led demand as well as on whether Γ is positive or negative. Accordingly, if the short-run equilibrium exhibits wage-led demand and $\Gamma > 0$, or if it exhibits profit-led demand and $\Gamma < 0$, then we obtain $du^*/de < 0$. On the other hand, if the short-run equilibrium exhibits wage-led demand and $\Gamma < 0$, or if it exhibits profit-led demand and $\Gamma > 0$, we obtain $du^*/de > 0$.

[Table 1 around here]

This analysis implies that, as the numerical simulation will show later, the capacity utilization and employment rates can change in the opposite direction when a parameter changes.

The effect of an increase in the employment rate on the capital accumulation rate in the short-run equilibrium is given by

$$\frac{dg^*}{de} = \sigma\left(m^* \underbrace{\frac{du^*}{de}}_{+/-} + u^*\Gamma\right). \tag{27}$$

This suggests that, in the short-run equilibrium, the effect of an increase in the employment rate on the capital accumulation rate depends in the effect of an increase in the employment rate on the capacity utilization rate and the sign of Γ.

When $du^*/de < 0$ and $\Gamma < 0$, that is the short-run equilibrium exhibits profit-led demand and $\Gamma < 0$, we have $dg^*/de < 0$: an increase in the employment rate has a negative effect on the capital accumulation rate. When $du^*/de > 0$ and $\Gamma > 0$, that is the short-run equilibrium exhibits profit-led demand and $\Gamma > 0$, we have $dg^*/de > 0$: an increase in the employment rate has a positive effect on the capacity utilization.

Except for these cases, when $du^*/de < 0$ and $\Gamma > 0$, that is the short-run equilibrium exhibits wage-led demand and $\Gamma > 0$, or when $du^*/de > 0$ and $\Gamma < 0$, that is the short-run equilibrium exhibits wage-led demand and $\Gamma < 0$, the sign of dg^*/de will be undetermined.

[Table 2 around here]

4 Long-run analysis

In the long run, the employment rate and debt-capital ratio are endogenous variables that are fixed in the short run. We assume that in the long run, the short-run equilibrium is always attained. We will derive each dynamic equation.

First, differentiating the definition of the employment rate $e = E/N = uK/(aN)$, we obtain

$$\frac{\dot{e}}{e} = \frac{\dot{u}}{u} + g - g_a - n. \tag{28}$$

Here, we assume that $e \neq 0$. As we assume that the short-run equilibrium is always attained in the long run, we have $g = g^*$. Moreover, as g^* depends on e and ℓ, we have $g^* = g(e, \ell)$. Here, note the term $\dot{u}/u$. From the short-run analysis, we have $u^* = u(e, \ell)$, and thus the capacity utilization rate in the long run changes with the employment rate and debt-capital ratio. More precisely, we have $\dot{u} = (\partial u/\partial e)\dot{e} + (\partial u/\partial \ell)\dot{\ell}$. Therefore, until the economy reaches the long-run equilibrium, we have $\dot{u} \neq 0$. However, strictly considering this effect will complicate the analysis significantly; therefore, we assume that $\dot{u} = 0$ in the following analysis. Note that numerical simulations that will be introduced later use the dynamical system in a way that all endogenous variables in the model are simultaneously adjusted.

Second, differentiating the definition of the debt-capital ratio, we obtain

$$\frac{\dot{\ell}}{\ell} = \frac{\dot{L}}{L} - g - g_p. \tag{29}$$

Here, we assume that $\ell \neq 0$. The flow of nominal debt of firms follows the following equation.

$$\dot{L} = pI - s_f(rpK - iL) = pgK - s_f(rpK - iL). \tag{30}$$

The term $s_f(rpK - iL)$ shows firms' nominal retained earnings, that is firms' finance funds needed for investment by retained earnings and borrowing from banks.

Substituting the above equation into equation (29), we obtain

$$\dot{\ell} = (1 - \ell)g - s_f r + s_f i\ell - g_p\ell. \tag{31}$$

With the assumption that the short-run equilibrium is always attained in the long run, we have $g = \sigma r - (1 - s_c)s_f i\ell$. Solving this equation for r and substituting the resultant expression into equation (31), we obtain the dynamical equation of the debt-capital ratio.

$$\dot{\ell} = \left(1 - \ell - \frac{s_f}{\sigma}\right)g - \left[\frac{(1 - s_c)s_f^2 i}{\sigma} - s_f i + g_p\right]\ell. \tag{32}$$

Here, g_p is given by.

$$\begin{aligned} g_p &= \theta[m_f(i\ell) - m^*] \\ &= \theta(1 - \theta)[m_f(i\ell) - m_w(e)] - \theta g_a(e). \end{aligned} \tag{33}$$

That is, we have $g_p = g_p(e, \ell; i)$.

From the above analysis, the long-run system is composed of the following two differential equations.

$$\dot{e} = e[g(e, \ell) - g_a(e) - n], \tag{34}$$

$$\dot{\ell} = \left(1 - \ell - \frac{s_f}{\sigma}\right)g(e, \ell) - \left[\frac{(1 - s_c)s_f^2 i}{\sigma} - s_f i + g_p(e, \ell)\right]\ell. \tag{35}$$

The long-run equilibrium is a situation in which $\dot{e} = \dot{\ell} = 0$. Let e^{**} and ℓ^{**} denote the long-run equilibrium values of e and ℓ, respectively. Then, these values satisfy the following two equations.

$$g(e^{**}, \ell^{**}) - g_a(e^{**}) - n = 0, \tag{36}$$

$$\left(1 - \ell^{**} - \frac{s_f}{\sigma}\right)g(e^{**}, \ell^{**}) - \left[\frac{(1 - s_c)s_f^2 i}{\sigma} - s_f i + g_p(e^{**}, \ell^{**})\right]\ell^{**} = 0. \tag{37}$$

Equation (36) implies that the economic growth rate in the long-run equilibrium is equal to the natural growth rate. Below, we assume that there exists a unique pair of (e^{**}, ℓ^{**}) that satisfies equations (36) and (37) and that $0 < e^{**} < 1$ and $0 < \ell^{**} < 1$.

We examine whether the long-run equilibrium is stable. Let $\mathbf{J_L}$ denote the 2×2 Jacobian matrix that corresponds to the long-run model. Then, each element of $\mathbf{J_L}$ is given by

$$b_{11} = \frac{\partial \dot{e}}{\partial e} = e\left(\frac{\partial g}{\partial e} - g_a'\right), \tag{38}$$

$$b_{12} = \frac{\partial \dot{e}}{\partial \ell} = e\frac{\partial g}{\partial \ell}, \tag{39}$$

$$b_{21} = \frac{\partial \dot{\ell}}{\partial e} = \left(1 - \ell - \frac{s_f}{\sigma}\right)\frac{\partial g}{\partial e} - \ell\,\frac{\partial g_p}{\partial e}, \tag{40}$$

$$b_{22} = \frac{\partial \dot{\ell}}{\partial \ell} = \left(1 - \ell - \frac{s_f}{\sigma}\right)\frac{\partial g}{\partial \ell} - \ell\,\frac{\partial g_p}{\partial \ell} - \left(1 - \frac{s_f}{\sigma}\right)\frac{g}{\ell}. \tag{41}$$

All the elements are evaluated at the long-run equilibrium values. Here, we have

$$\frac{s_f}{\sigma} = \frac{s_f}{s_f + s_c(1 - s_f)} < 1. \tag{42}$$

In addition, note that

$$\frac{\partial g_p}{\partial \ell} = i\theta(1 - \theta)m_f' > 0. \tag{43}$$

The necessary and sufficient conditions for the long-run equilibrium to be stable are that $\mathrm{tr}\,\mathbf{J_L} = b_{11} + b_{22} < 0$ and $\det \mathbf{J_L} = b_{11}b_{22} - b_{12}b_{21} > 0$. Then, we have

$$\mathrm{tr}\,\mathbf{J_L} = e\left(\frac{\partial g}{\partial e} - g_a'\right) + \left(1 - \ell - \frac{s_f}{\sigma}\right)\frac{\partial g}{\partial \ell} - \ell\,\frac{\partial g_p}{\partial \ell} - \left(1 - \frac{s_f}{\sigma}\right)\frac{g}{\ell}, \tag{44}$$

$$\det \mathbf{J_L} = -e\left(\frac{\partial g}{\partial e} - g_a'\right)\left[\ell\frac{\partial g_p}{\partial \ell} + \left(1 - \frac{s_f}{\sigma}\right)\frac{g}{\ell}\right] + e\,\frac{\partial g}{\partial \ell}\left[\ell\,\frac{\partial g_p}{\partial e} - g_a'\left(1 - \ell - \frac{s_f}{\sigma}\right)\right]. \tag{45}$$

Here, we assume that the following condition holds.

Assumption 2.

$$\frac{\partial g}{\partial e} < 0. \tag{46}$$

From the short-run analysis, we certainly obtain $\partial g/\partial e < 0$ when the short-run equilibrium exhibits profit-led demand and $\Gamma < 0$. Even if the short-run equilibrium exhibits wage-led demand and $\Gamma > 0$ or if it exhibits wage-led demand and $\Gamma < 0$, we can obtain $\partial g/\partial e < 0$.

Ryoo and Skott (2008), Sasaki and Fujita (2014a), and Skott and Zipperer (2012) assume that in the firms' planned investment function, the capital accumulation rate is a decreasing function of the employment rate. In their models, this assumption helps stabilise the long-run equilibrium. In our model, the assumption $\partial g/\partial e < 0$ corresponds to the above-mentioned assumption. In those studies, this assumption about the investment function is justified as follows. An increase in the employment rate increases the bargaining power of labour unions, which increases the real wage rate through the reserve army effect. This, in turn, decreases profits of firms and, consequently, the investment of firms. However, this justification has a problem: When the real wage rate increases, the profit share decreases if the labour productivity is constant. Nevertheless, in their models, the profit share is assumed to be constant, and thus a contradiction arises. In our model, in contrast, the profit share is an endogenous variable, and thus such a contradiction never arises.

Further, we assume that the following condition holds.

Assumption 3.

$$\ell^{**} > \frac{s_c(1 - s_f)}{s_f + s_c(1 - s_f)}. \tag{47}$$

This assumption means that the debt-capital ratio in the long-run equilibrium has a lower limit and that $1 - \ell^{**} - (s_f/\sigma) < 0$. When the retention ratio is equal to unity ($s_f = 1$), we obtain $1 - \ell^{**} - (s_f/\sigma) = -\ell^{**} < 0$. Therefore, Assumption 3 ensures that $1 - \ell^{**} - (s_f/\sigma) < 0$, even if the retention ratio is less than unity.

The effect of an increase in the employment rate on the growth rate of price is given by

$$\frac{\partial g_p}{\partial e} = -\theta\Gamma. \tag{48}$$

From the short-run analysis, we know that Γ can be positive or negative.

In what follows, we examine whether the long-run equilibrium is stable or can be stable. We follow the concern of Hein (2007) and classify our analysis according to whether the short-run equilibrium exhibits debt-led or debt-burdened growth.

4.1 Case of debt-led growth

When the short-run equilibrium exhibits debt-led growth, we have $\partial g/\partial \ell > 0$. From the above assumptions, with regard to the signs of $\operatorname{tr} \mathbf{J_L}$ and $\det \mathbf{J_L}$, we obtain the following information:

$$\operatorname{tr} \mathbf{J_L} = e\underbrace{\left(\frac{\partial g}{\partial e} - g_a'\right)}_{-} + \underbrace{\left(1 - \ell - \frac{s_f}{\sigma}\right)}_{-}\underbrace{\frac{\partial g}{\partial \ell}}_{+} - \ell\underbrace{\frac{\partial g_p}{\partial \ell}}_{+} - \underbrace{\left(1 - \frac{s_f}{\sigma}\right)}_{+}\frac{g}{\ell}, \tag{49}$$

$$\det \mathbf{J_L} = -e\underbrace{\left(\frac{\partial g}{\partial e} - g_a'\right)}_{-}\underbrace{\left[\ell\frac{\partial g_p}{\partial \ell} + \left(1 - \frac{s_f}{\sigma}\right)\frac{g}{\ell}\right]}_{+} + e\underbrace{\frac{\partial g}{\partial \ell}}_{+}\left[\ell\underbrace{\frac{\partial g_p}{\partial e}}_{+/-} - \underbrace{g_a'\left(1 - \ell - \frac{s_f}{\sigma}\right)}_{-}\right]. \tag{50}$$

First, we pay attention to $\operatorname{tr} \mathbf{J_L} < 0$, which is one of the necessary and sufficient conditions for long-run stability. In the debt-led growth case, we always have $\operatorname{tr} \mathbf{J_L} < 0$.

Second, we consider $\det \mathbf{J_L}$. In $\det \mathbf{J_L}$, if $\partial g_p/\partial e = -\theta\Gamma > 0$, that is if $\Gamma < 0$, then we always have $\det \mathbf{J_L} > 0$.

To sum up, for $\operatorname{tr} \mathbf{J_L} < 0$ and $\det \mathbf{J_L} > 0$, it is necessary that the short-run equilibrium exhibit profit-led growth and $\Gamma < 0$. Accordingly, we obtain the following proposition:

Proposition 2. *If $dg/de < 0$ and $\Gamma < 0$, then the long-run equilibrium is stable.*

In Hein (2007), when the short-run equilibrium exhibits debt-led growth, the long-run equilibrium is always stable. In our model, when the short-run equilibrium exhibits debt-led growth, the long-run equilibrium will be stable if $dg/de < 0$ and $\Gamma < 0$. In other words, the debt-led growth case is not necessarily stable.

4.2 Case of debt-burdened growth

When the short-run equilibrium exhibits debt-burdened growth, we have $\partial g/\partial \ell < 0$. From the above assumptions, with regard to the signs of $\operatorname{tr} \mathbf{J_L}$ and $\det \mathbf{J_L}$, we obtain the following information:

$$\operatorname{tr} \mathbf{J_L} = e\underbrace{\left(\frac{\partial g}{\partial e} - g_a'\right)}_{-} + \underbrace{\left(1 - \ell - \frac{s_f}{\sigma}\right)}_{-}\underbrace{\frac{\partial g}{\partial \ell}}_{-} - \ell\underbrace{\frac{\partial g_p}{\partial \ell}}_{+} - \underbrace{\left(1 - \frac{s_f}{\sigma}\right)}_{+}\frac{g}{\ell}, \tag{51}$$

$$\det \mathbf{J_L} = -e\underbrace{\left(\frac{\partial g}{\partial e} - g_a'\right)}_{-}\underbrace{\left[\ell\frac{\partial g_p}{\partial \ell} + \left(1 - \frac{s_f}{\sigma}\right)\frac{g}{\ell}\right]}_{+} + e\underbrace{\frac{\partial g}{\partial \ell}}_{-}\left[\ell\underbrace{\frac{\partial g_p}{\partial e}}_{+/-} - g_a'\underbrace{\left(1 - \ell - \frac{s_f}{\sigma}\right)}_{-}\right]. \tag{52}$$

In the debt-burdened growth case, the sign of $\operatorname{tr} \mathbf{J_L}$ can be positive or negative. For $\det \mathbf{J_L}$, if $\partial g_p/\partial e = -\theta\Gamma < 0$, that is if $\Gamma > 0$, then we always have $\det \mathbf{J_L} > 0$.

Proposition 3. *When $dg/de > 0$ and $\Gamma > 0$, the long-run equilibrium can be stable depending on conditions.*

In Hein (2007), when the short-run equilibrium exhibits debt-burdened growth, the long-run equilibrium is always unstable. However, if income distribution and employment are endogenously determined, the long-run equilibrium can be stable even in the debt-burdened growth case. We briefly explain the mechanism.

For ease of exposition, we fix the employment rate. In equation (35), when the short-run equilibrium exhibits debt-burdened growth, the effect of an increase in ℓ on g is negative, which decreases the capital stock that appears in the denominator of the debt-capital ratio, leading to further increase in the debt-capital ratio. This makes the long-run equilibrium unstable in the debt-burdened growth case in Hein (2007). However, if the interest burden price pass effect works, an increase in ℓ increases the price. This effect decreases the debt-capital ratio. If the latter effect exceeds the former effect, the long-run equilibrium can be stable even in the debt-burdened growth case.

5 Numerical simulations

This section conducts numerical simulations to prove that the stationary equilibrium actually exists and the equilibrium can be stable. In the foregoing analysis, we separate the short run and long run. In this section, we consider the adjustment processes of four endogenous variables all together: u, m, e, and ℓ.

For the numerical simulation, we specify the functional forms of equations as follows:[15)]

$$g_d = Am^{\alpha}u^{\beta}(i\ell)^{-\gamma}, \quad A > 0,\ \alpha > 0,\ \beta > 0,\ \gamma > 0, \tag{53}$$

$$m_w = \phi_0 - \phi_1 e, \quad \phi_0 > 0,\ \phi_1 > 0, \tag{54}$$

$$m_f = \psi_0 + \psi_1 i\ell, \quad \psi_0 > 0,\ \psi_1 > 0, \tag{55}$$

$$g_a = \lambda e, \quad \lambda > 0. \tag{56}$$

The system of four differential equations is given by

$$\dot{u} = \varepsilon[g_d(m,u,\ell) - g_s(m,u,\ell)], \tag{57}$$

$$\dot{m} = (1-m)[g_p(m,\ell) - g_w(m,e) + g_a(e)], \tag{58}$$

$$\dot{e} = e\left\{\frac{\varepsilon[g_d(m,u,\ell) - g_s(m,u,\ell)]}{u} + g_d(m,u,\ell) - g_a(e) - n\right\}, \tag{59}$$

$$\dot{\ell} = (1-\ell)g_d(m,u,\ell) - s_f(mu - i\ell) - g_p(m,\ell)\ell. \tag{60}$$

We set parameters and initial conditions as follows:

$$A = 0.25,\ \alpha = 0.04,\ \beta = 0.02,\ \gamma = 0.03,\ s_c = 0.6,\ s_f = 0.7,\ i = 0.02,$$
$$\phi_0 = 0.3,\ \phi_1 = 0.1,\ \psi_0 = 0.2,\ \psi_1 = 0.1,\ \lambda = 0.3,\ \theta = 0.5,\ \varepsilon = 0.05,\ n = 0.02,$$
$$u(0) = 0.5,\ m(0) = 0.4,\ e(0) = 0.4,\ \ell(0) = 0.2.$$

Figures 1–8 show the results of the numerical simulation. We make sure that an arbitral initial condition converges to the long-run equilibrium. Figure 7 shows the time path of

15) The Cobb-Douglas investment function is suggested by Blecker (2002).

rentiers' income share given by

$$\text{Rentiers' income share} \equiv \frac{(1 - s_f)(rpK - iL) + iL}{pY} = \frac{(1 - s_f)um + s_f i\ell}{u}. \tag{61}$$

By comparing figures 7 and 8, we find interesting facts. The wage share soon converges to a constant value, whereas rentiers' income share takes a long time to converge. This implies that there exists a period when the wage share and rentiers' income share do not trade off. In the conventional Kaleckian model, wage share corresponds to workers' income share, profit share corresponds to capitalists' income share, and the income shares of the two classes necessarily trade off. However, as our model includes retained earnings of firms, the income shares of workers and rentiers do not necessarily trade off.

[Figures 1, 2, 3, 4, 5, 6, 7, and 8 around here]

By using numerical analysis, we examine the effect of a decrease in the retention ratio (i.e. increased shareholder power) on the endogenous variables. Even if we specify functional forms, it is very difficult to know the signs of derivatives analytically. Here, we change the retention ratio from 0.7 to 0.69. Table 3 summarises the results. The decrease in the retention ratio increases the capacity utilization rate, decreases the profit share, decreases the employment rate, increases the debt-capital ratio, decreases the capital accumulation rate, and increases the profit rate. These results mean that a decrease in the retention ratio can have different effects on the capacity utilization and employment rates. Moreover, a decrease in the retention ratio can have different effects on the profit and capital accumulation rates. In the conventional Kaleckian model that abstracts firms' debt accumulation, the Cambridge equation, that is $g = sr$ holds, and thus the profit and capital accumulation rates change in the same direction when a parameter changes, as long as capitalists' saving rate s is fixed. However, in our model that considers firms' debt accumulation, when a parameter changes, the profit and capital accumulation rates can change in the opposite direction. This phenomenon, that is an increase in the profit rate does not lead to an increase in the capital accumulation rate, is called the "investment-profit puzzle."[16)]

By using numerical analysis, we examine the effect of a decrease in the interest rate on the endogenous variables. Here, we change the interest rate from 0.02 to 0.019. Table 3 summarises the results. The decrease in the interest rate increases the capacity utilization rate, increases the profit share, increases the employment rate, decreases the debt-capital ratio, increases the capital accumulation rate, and increases the profit rate.

16) For an empirical analysis with regard to the investment-profit puzzle, see van Treeck (2008).

From the analysis of transitional dynamics given above, we know that workers and rentiers' income shares do not necessarily trade off. We can show this in the long-run equilibrium as well. From table 3, we know that workers and rentiers' income shares change in the same direction when both retention ratio and interest rate decrease. Above all, we find it interesting that a decrease in the retention ratio, an index of financialization, decreases the profit share but increases both workers and rentiers' income shares. Dünhaupt (2016), cited in the Introduction, points out that financialization decreases the wage share. Theoretically, however, financialization can lead to an increase in the wage share. This implies that a decrease in the wage share that is observed in reality is not necessarily caused by financialization. In addition, this result is obtained because our model endogenizes income distribution.

[Table 3 around here]

As we say above, numerical simulations do not separate the short run and long run. For this reason, we cannot directly know whether the long-run equilibrium is stable when the short-run equilibrium exhibits debt-led growth and so on. However, we can investigate how the relationship between the debt-capital ratio and capital accumulation rate will be along the transitional path to the long-run equilibrium. Figure 9 shows the relationship between the debt-capital ratio and capital accumulation rate along the transitional dynamics. Point S denotes the starting point, and point P denotes the long-run equilibrium. In figure 9, the upward-sloping parts correspond to debt-led growth while the downward-sloping parts correspond to debt-burdened growth. The economy exhibits debt-burdened growth for a while after starting from point S, turns into debt-led growth after the reversal period, and, after a short time, begins to exhibit debt-burdened growth. Long-run equilibrium P exhibits debt-burdened growth because a decrease in the interest rate decreases the debt-capital ratio and increases the capital accumulation rate.

Figure 9 means two things. First, the long-run equilibrium can be stable even if it exhibits debt-burdened growth. Second, transitional dynamics can show debt-led growth even if the long-run equilibrium exhibits debt-burdened growth. As the real economy is not always located at the long-run equilibrium, we need to pay attention to transitional dynamics as well.[17)]

[Figure 9 around here]

17) Bhaduri (2008) points out that the regime obtained in the equilibrium and one obtained in the transition can differ. For this issue, see also Sasaki (2010).

6 Conclusions

This study builds a Kaleckian model that considers firms' debt accumulation to investigate the stability of the long-run equilibrium and effects of increased shareholder power and interest rate policy on the long-run equilibrium.

Unlike Hein (2007), the long-run equilibrium can be stable even if the short-run equilibrium exhibits debt-burdened growth. In addition, the long-run equilibrium can be unstable even if the short run equilibrium exhibits debt-led growth. The combination of debt-led growth and profit-led growth and that of debt-burdened growth and wage-led growth are likely to stabilise the long-run equilibrium.

Moreover, we examine the effects of increased shareholder power and interest rate policy on income distribution and employment at the long-run equilibrium, which are not adequately investigated by related studies.

Increased shareholder power, which is defined by a decrease in the retention ratio, increases both workers and rentiers' income shares. That is, these income shares do not necessarily trade off. A decrease in the retention ratio increases the capacity utilization rate and decreases the employment rate. That is, the capacity utilization and employment rates do not always change in the same direction. Furthermore, we obtain the investment-profit puzzle: the profit rate and capital accumulation rate can change in the opposite direction.

Monetary policy, which is defined by a decrease in the interest rate, increases the capacity utilization rate, employment rate, capital accumulation rate, and profit rate. In this meaning, a monetary easing policy has an expansionary effect. However, a monetary easing policy decreases both workers and rentiers' income shares, and thus it has a negative effect on income distribution.

The numerical simulations examine the regime along the transitional dynamics as well as at the stationary equilibrium. Even if the stationary equilibrium exhibits debt-burdened growth, transitional dynamics can exhibit debt-led growth. Therefore, empirical studies that classify which regime is attained in reality should consider whether the economy is located at the stationary equilibrium or along the transitional dynamics.

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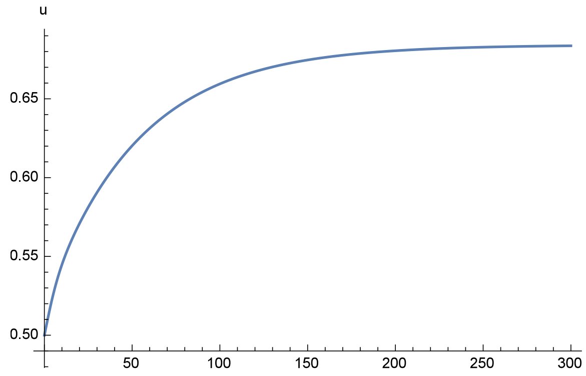

Figure 1: Time path of the capacity utilization rate

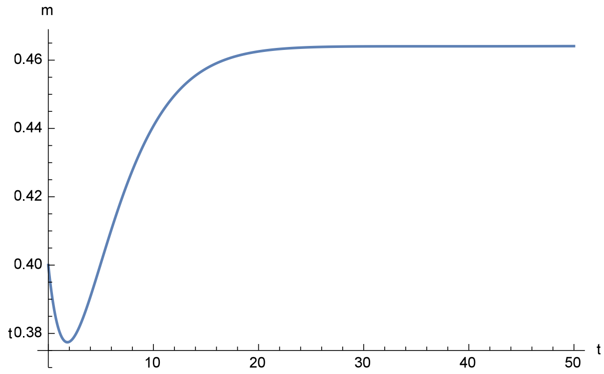

Figure 2: Time path of the profit share

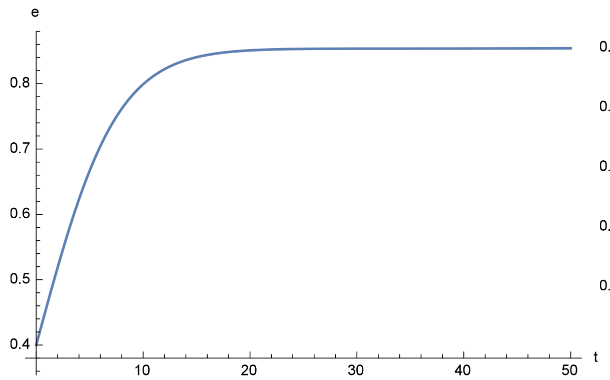

Figure 3: Time path of the employment rate

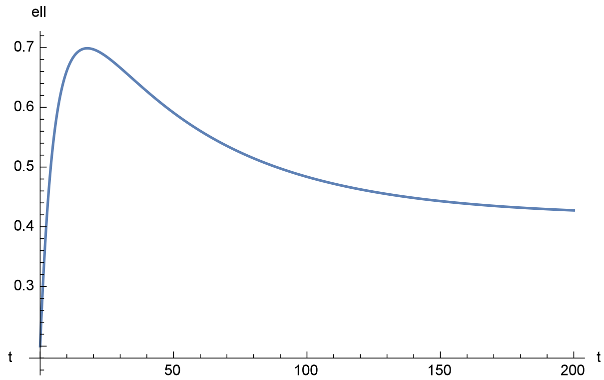

Figure 4: Time path of the debt-capital ratio

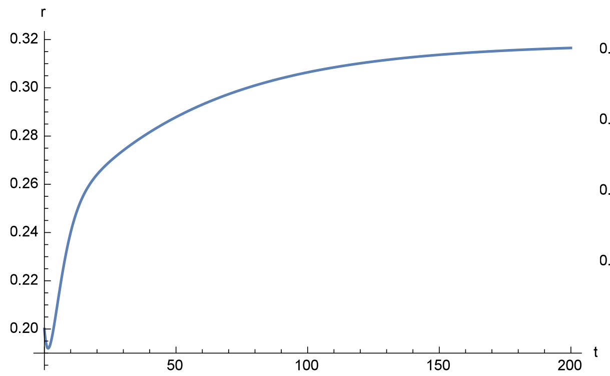

Figure 5: Time path of the profit rate

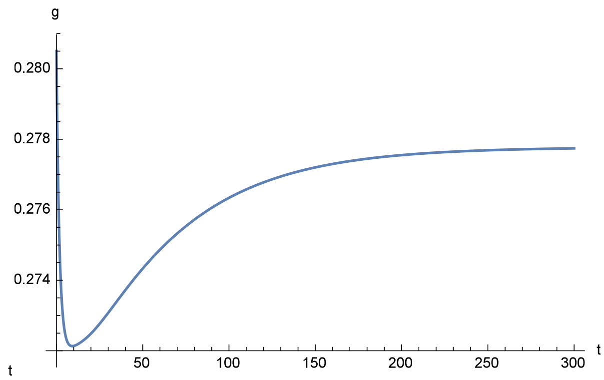

Figure 6: Time path of the capital accumulation rate

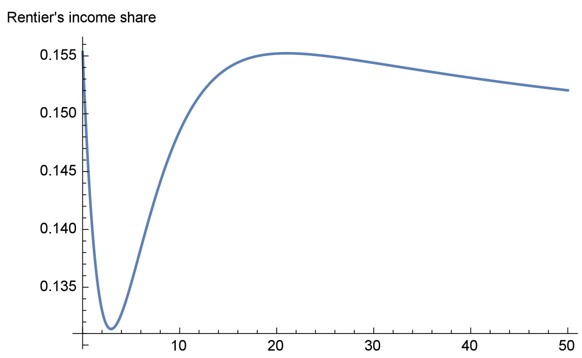

Figure 7: Time path of rentiers' income share

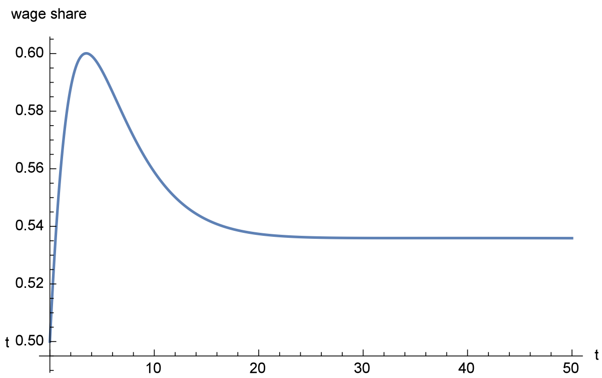

Figure 8: Time path of the wage share

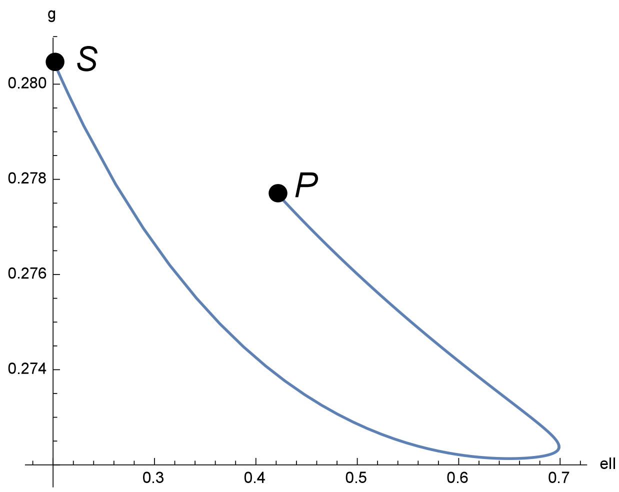

Figure 9: Relationship between the debt-capital ratio and capital accumulation rate

Table 1: Signs of du^*/de in the short-run equilibrium

	$\Gamma > 0$	$\Gamma < 0$
Profit-led demand	$+$	$-$
Wage-led demand	$-$	$+$

Table 2: Signs of dg^*/de in the short-run equilibrium

	$\Gamma > 0$	$\Gamma < 0$
Profit-led demand	$+$	$-$
Wage-led demand	$+/-$	$+/-$

Table 3: Results of comparative statics by numerical analysis

	Benchmark	$s_f \downarrow$	$i \downarrow$
u^{**}	0.6842	0.6871 $\uparrow$	0.6845 $\uparrow$
m^{**}	0.4652	0.4650 $\downarrow$	0.4656 $\uparrow$
e^{**}	0.8593	0.8583 $\downarrow$	0.8608 $\uparrow$
ℓ^{**}	0.4177	0.4333 $\uparrow$	0.4161 $\downarrow$
g^{**}	0.2778	0.2775 $\downarrow$	0.2782 $\uparrow$
r^{**}	0.3183	0.3195 $\uparrow$	0.3187 $\uparrow$
Rentiers' income share	0.1481	0.1529 $\uparrow$	0.1478 $\downarrow$
Wage share	0.5348	0.5350 $\uparrow$	0.5344 $\downarrow$