CCES Discussion Paper Series
Center for Research on Contemporary Economic Systems

Graduate School of Economics
Hitotsubashi University

CCES Discussion Paper Series, No.50
September 2013

Profit Sharing and its Effect on Income Distribution and Output: A Kaleckian Approach

Hiroaki Sasaki
(Kyoto University)

Naka 2-1, Kunitachi, Tokyo 186-8601, Japan
Phone: +81-42-580-9076 Fax: +81-42-580-9102
URL: http://www.econ.hit-u.ac.jp/~cces/index.htm
E-mail: cces@econ.hit-u.ac.jp

Profit Sharing and its Effect on Income Distribution and Output: A Kaleckian Approach

Hiroaki Sasaki*

Graduate School of Economics, Kyoto University

Abstract

This paper investigates the effect of profit sharing on the economy by using a Kaleckian model. Unlike exiting studies, we endogenize the profit share. Our analysis shows that if the size of the productivity-enhancing effect of profit sharing is small, profit sharing decreases the equilibrium rate of capacity utilization whereas if the size is large, profit sharing increases the equilibrium rate of capacity utilization.

Keywords: profit sharing; income distribution; regular and non-regular employment; wage-gap; cyclical fluctuations; demand-led growth

JEL Classifications: E12; E24; E25; E32; J31; J33; J53; J82; J83

1 Introduction

How does profit sharing affect the economy? Does profit sharing stimulate the economy? Does profit sharing stabilize the economy? Who benefits from profit sharing? By using a Kaleckian model that focuses on the relationship between income distribution and output/growth,[1] this paper investigates the effect of profit sharing on the steady state equilibrium and the stability of the equilibrium.

In this paper, we define profit sharing as a policy that redistributes a fraction of profits to workers.[2] The subjects that perform profit sharing are firms. Firms decide the rule of profit sharing and propose it to workers. The reason why firms perform profit sharing is that profit

---

* I would like to thank Shinya Fujita and seminar participants at Nagoya University for their helpful comments and suggestions. I would also like to thank lectureres and students who attended the 3rd Summer School on Analytical Political Economy at Hitotsubashi University for their useful comments.
E-mail: sasaki@econ.kyoto-u.ac.jp

[1] For the framework of the Kaleckian model, see Rowthorn (1981) and Lavoie (1992).

[2] For differences in the form of and the significance of profit sharing by countries, see Blinder ed. (1990). For the economic rationality of the bonus system in Japan, see Owan and Suda (2009).

sharing increases profits by giving an incentive to workers and raising labor productivity. If workers obtain profits, total income of workers will increase and if so, they will agree to profit sharing.

A typical example of studies that examine profit sharing is Weitzman (1985). By extending a monopolistic competition model, he shows that profit sharing can increase employment as long as profit sharing lowers basic salaries of workers.[3]

Only a few studies investigate profit sharing by using Kaleckian models. To our knowledge, only Lima (2010) and Lima (2012) are Kaleckian approaches that consider profit sharing, and Lima (2010) is closely related to the present paper.[4]

Lima (2010) investigates the effect of profit sharing on macroeconomic variables based on a Kaleckian model in which the mark-up rate of firms is constant and hence, the profit share (the ratio of profit to national income) is also constant. He considers some extended cases: a case where the specification of the investment function is modified; a case where workers as well as capitalists save; and a case where labor productivity increases with the introduction of profit sharing. For example, under the standard setting in which workers do not save and investment demand depends positively on both the profit rate and the capacity utilization rate, profit sharing increases the equilibrium value of the rate of capacity utilization. In this sense, profit sharing has a stimulative effect on the economy. However, this result depends on the specification of the model. He also shows that if workers do not save and investment demand depends positively on both the profit share and the rate of capacity utilization à la Marglin and Bhaduri (1990), profit sharing increases the capacity utilization if the effect of the profit share on investment is large while decreases the capacity utilization if the effect is small.

Lima's (2010) results are very interesting but there is room for improvement: the

---

[3] According to Cahuc and Dormont (1997), a profit sharing rule discussed by Weitzman (1985) is not consistent with the profit sharing rule in France, where a law inhibits the substitution of profit sharing for basic salaries.

[4] Lima (2012) investigates an economy in which firms with profit sharing and firms with no profit sharing coexist. Then, he assumes that the labor productivity of firms with profit sharing is higher than that of firms with no profit sharing. This labor productivity enhancing effect is important in considering a country such as France where a law inhibits the substitution of profit sharing for basic salaries. In this case, profit sharing inevitably becomes an additional cost and hence, firms do not adopt profit sharing unless higher labor productivity compensates the cost (Cahuc and Dormont, 1997).

assumption that the mark-up rate of firms is fixed. As stated above, in the Kaleckian model, a constant mark-up rate means a constant profit share. However, when considering profit sharing, it is unreasonable to assume that the profit share remains constant. With profit sharing, firms anticipate a decrease in their profits that remain after profit sharing, and then, are likely to add the decrement to the price of goods that they sell. On the other hand, labor unions anticipate an increase in income owing to profit sharing, and then, may not conduct active wage bargaining. With these behaviors of firms and labor unions, profit sharing is likely to change the profit share. Therefore, we endogenize the profit share.

This paper investigates the effect of profit sharing on macroeconomic variables by using a Kaleckian model in which income distribution is endogenously determined through wage bargaining. In addition, based on the observation that some workers receive profit sharing and other workers do not, we extend a model of Sasaki, Matsuyama, and Sako (2013) that considers two types of workers.

To analyze how the wage gap between regular and non-regular workers affects the economy, Sasaki, Matsuyama, and Sako (2013) introduce the wage gap into a Kaleckian model based on Rowthorn (1981) and Raghavendra (2006) in which both variable labor and fixed labor are considered. Then, they analytically show that an increase in the wage gap destabilizes the dynamics of the economy.

However, they do not consider profit sharing. Moreover, they assume that both regular and non-regular workers spend all their wages on consumption and only capitalists save. In contrast, in the present paper, we assume the following: non-regular workers obtain only wage incomes and entirely spend them on consumption; regular workers obtain both wage incomes and profits owing to profit sharing and save a constant fraction of their total incomes; and capitalists save a constant fraction of profits after profit sharing.

Furthermore, based on empirical evidence that the introduction of profit sharing increases labor productivity (Weitzman and Kruse, 1990; Dube and Freeman, 2008), we assume that profit sharing increases the labor productivity of regular workers. As stated above, only regular workers obtain profits owing to profit sharing whereas non-regular workers do not. Accordingly, this assumption is reasonable.

As exiting studies that consider profit sharing by using macrodynamic models, we can cite Ninomiya and Takami (2010), Mainwaring (1993), and Fanti and Manfredi (1998).

Ninomiya and Takami (2010) introduce profit sharing into a Keynesian dynamic model and analytically show that profit sharing destabilizes the equilibrium.

Mainwaring (1993) extends Pohjola's (1981) discrete-time version of Goodwin' s (1967) model and shows that income transfer from capitalists to workers, equivalent to profit sharing, decreases the equilibrium employment rate and increases the equilibrium profit share.

Fanti and Manfredi (1998) build a continuous-time version of Goodwin model and show that profit sharing stabilizes the economy. In addition, they show that profit sharing does not change the equilibrium profit share and decreases the equilibrium employment rate. Accordingly, the result concerning to the employment rate is the same as that of Mainwaring (1993).

Summarizing these studies, we can say that it is not certain whether or not profit sharing has a stabilizing effect but it does not stimulate the economy.

In contrast, we show that if the productivity enhancing effect of profit sharing is large, profit sharing increases the equilibrium rate of capacity utilization. In addition, the effect of profit sharing on income distribution differs depending on conditions.

The rest of the paper is organized as follows. Section 2 presents our model. Section 3 examines the local stability of the steady-state equilibrium. Section 4 presents comparative static analysis and numerical simulations, and compares our results with those of existing studies. Section 5 concludes.

2 Model

Consider an economy with two types of workers (regular workers and non-regular workers) and capitalists. For analytical convenience, we abstract government and international trade. Workers supply labor to firms and obtain wages. Capitalists supply capital to firms and obtain profits. Let L_R and L_{NR} denote the employment of regular workers and that of non-regular workers, respectively. We assume that the regular employment L_R is related to the potential output Y^C, while the non-regular employment L_{NR} is related to the actual output Y.

$$L_R = \alpha Y^C, \quad \alpha > 0, \tag{1}$$

$$L_{NR} = \beta Y, \quad \beta > 0, \tag{2}$$

where α and β are labor input coefficients. From equations (1) and (2), the ratio of the non-regular employment to the regular employment is given by $L_{NR} / L_R = \beta u / \alpha$.

Here, we assume that according to some empirical studies that the introduction of profit sharing increases labor productivity, the labor input coefficient of regular workers decreases with the introduction of profit sharing. Then, we can write α as follows:

$$\alpha = \alpha(\sigma), \quad \alpha_\sigma \leq 0, \tag{3}$$

where $\alpha_\sigma = d\alpha / d\sigma$ and σ denotes a sharing parameter that is the ratio of profits received by regular workers to all profits ($0 < \sigma < 1$). Hereafter, we denote the derivative or partial derivative of a function with respect to a variable as a subscript. Since we assume that only regular workers receive profit sharing, only the labor productivity of regular workers increases whereas that of non-regular workers stays constant.

Denoting the total employment as $L = L_R + L_{NR}$, using equations (1) and (2), we obtain the average labor productivity $a = Y / L$ as follows:

$$a = \frac{Y}{L_R + L_{NR}} = \frac{Y}{\alpha(\sigma)Y^C + \beta Y} = \frac{u}{\alpha(\sigma) + \beta u} \equiv a(u;\sigma), \quad a_u > 0, \quad a_\sigma > 0. \tag{4}$$

That is, the average labor productivity is increasing in the rate of capacity utilization $u = Y / Y^C$ and increasing in the sharing parameter σ. In other words, first, there exists an increasing returns to scale effect in the economy in that the average labor productivity increases with an increase in the output, and second, profit sharing increases the average labor productivity with an increase in the labor productivity of regular workers. Differentiating equation (4) with respect to time, we obtain the rate of change in the average labor productivity.

$$\frac{\dot{a}}{a} = \frac{\alpha(\sigma)}{\alpha(\sigma) + \beta u} \cdot \frac{\dot{u}}{u}. \tag{5}$$

Since u is constant at the steady state equilibrium ($\dot{u} = 0$) as will be explained later, the corresponding average labor productivity is also constant. Thus, there is no perpetual technical progress in our model.

The nominal wage of the regular employment w_R is supposed to be higher than that of the non-regular employment w_{NR} at a constant rate γ.

$$w_R > \gamma w_{NR}, \quad \gamma \geq 1. \tag{6}$$

Then, the average wage of the economy is given by

$$
\begin{aligned}
w &= \frac{L_R}{L} w_R + \frac{L_{NR}}{L} w_{NR} = \frac{\alpha(\sigma)}{\alpha(\sigma)+\beta u} w_R + \frac{\beta u}{\alpha(\sigma)+\beta u} w_{NR} \\
&= \left\{ \frac{\gamma\alpha(\sigma)+\beta u}{\gamma[\alpha(\sigma)+\beta u]} \right\} w_R = \Gamma(u;\sigma) w_R, \quad \Gamma_u < 0, \quad \Gamma_\sigma < 0.
\end{aligned} \tag{7}
$$

The average wage is given by the weighted average of the regular and non-regular employment wages. Each weight corresponds to the corresponding employment share.

The distribution of national income leads to

$$
\begin{aligned}
pY &= \underbrace{wL + \sigma rpK}_{\text{workers}} + \underbrace{(1-\sigma)rpK}_{\text{capitalists}} \\
&= \underbrace{w_{NR}L_{NR}}_{\text{non-regular workers}} + \underbrace{w_R L_R + \sigma rpK}_{\text{regular workers}} + \underbrace{(1-\sigma)rpK}_{\text{capitalists}},
\end{aligned} \tag{8}
$$

where p denote the price of goods; r, the profit rate; and K, capital stock. Let m denote the profit share ($m = rpK/(pY)$). Then, the wage share is given by $1-m = wL/(pY)$. In addition, considering profit sharing, we define λ as the ratio of capitalists' income to national income and $1-\lambda$ as the ratio of the sum of regular and non-regular workers' income to national income. Then, we have

$$
\lambda = (1-\sigma)m, \quad 0 < \lambda < 1. \tag{9}
$$

Hereafter, we call λ capitalists' income share.

If we assume that the ratio of capital stock to the potential output Y^C is equal to unity, that is, $K/Y^C = 1$, then we can write the rate of capacity utilization as $u = Y/K$, and accordingly, we obtain $r = um$.

As stated above, only regular workers obtain profit sharing whereas non-regular workers do not. Suppose that non-regular workers spend all wage income $w_{NR}L_{NR}$ on consumption, regular-workers save a constant fraction s_w of the sum of wage income and profit income, that is, $w_R L_R + \sigma rpK$, and capitalists save a constant fraction s_c of profit income after profit sharing, that is, $(1-\sigma)rpK$. Suppose also that $0 \le s_w \le s_c < 1$, that is, the saving rate of capitalists is higher than that of regular workers.[5] Then, the saving function g_s is given by

[5] If workers save, they indirectly own capital stock (Pasinetti, 1962). However, for simplicity, we do not consider it.

$$g_s = s_w\left(\frac{w_R L_R + \sigma rpK}{pK}\right) + s_c\left[\frac{s_c(1-\sigma)rpK}{pK}\right] = s(\sigma)um + s_w\psi(u)(1-m),$$
$$s(\sigma) = (1-\sigma)s_c + \sigma s_w, \quad \psi(u;\sigma) = \frac{\gamma\alpha(\sigma)u}{\gamma\alpha(\sigma)+\beta u}, \tag{10}$$

where the following relations hold.

$$s_\sigma = -(s_c - s_w) \le 0, \tag{11}$$

$$\psi_u > 0, \quad \psi_\sigma < 0. \tag{12}$$

Following Marglin and Bhaduri (1990), we assume that the firms' investment demand function g_d is an increasing function of the capacity utilization rate u and the capitalists' income share λ. In Marglin and Bhaduri (1990), the profit share m is an explanatory variable of the investment function. However, if we want to consider profit sharing, it is reasonable to use the share of profits after profit sharing, that is, capitalists' income share as an explanatory variable of the investment function.[6]

$$g_d = g_d(u,\lambda) = g_d(u,(1-\sigma)m), \quad g_{du} > 0, \quad g_{d\lambda} > 0, \tag{13}$$

where g_{du} denotes the partial derivative of the investment function with respect to the capacity utilization, and $g_{d\lambda}$ denotes the partial derivative of the investment function with respect to the capitalists income share. Note that we have $g_{dm} = (1-\sigma)g_{d\lambda}$.

We assume a quantity adjustment that the capacity utilization rate increases (decreases) in accordance with an excess demand (supply) in the goods market.

$$\dot{u} = \phi(g_d - g_s), \quad \phi > 0, \tag{14}$$

where the parameter ϕ denotes the speed of adjustment of the goods market.

Unlike Lima (2010), we assume that the profit share is endogenously determined through labor-management negotiations. In usual Kaleckian models, the mark-up rate is assumed to be constant, and then, the profit share becomes constant. With profit sharing, firms anticipate a decrease in profits that remain after profit sharing, and then, are likely to add the decrement to the price of goods that they sell. On the other hand, labor unions anticipate an increase in incomes from profit sharing, and then, are not likely to conduct active wage bargaining. With these behaviors of firms and labor unions, profit sharing is likely to change the profit share.

6 A similar specification is adopted in Lima (2010).

Taking the derivative of the definition of the profit share $m = 1 - [w/(pa)]$ with respect to time, we obtain

$$\frac{\dot{m}}{1-m} = \frac{\dot{p}}{p} - \frac{\dot{w}}{w} + \frac{\dot{a}}{a}. \tag{15}$$

That is, the rate of change in the profit share is decomposed into the rate of change in the price, the rate of change of the average wage in the whole economy, and the rate of change of the average labor productivity. Here, we formalize the equation of the price of goods and the equation of the regular employment wage by using Rowthorn's (1977) theory of conflicting-claims inflation.[7]

First, firms set their price so as to narrow the gap between firms' target income share λ_f and the actual income share λ, and accordingly, the price changes. Second, labor unions negotiate so as to narrow the gap between the labor unions' target income share λ_w and the actual income share λ, and accordingly, the nominal regular employment wage changes. Note that only regular workers engage in wage bargaining. These two assumptions can be written as follows:

$$\frac{\dot{p}}{p} = \theta_f(\lambda_f - \lambda) = \theta_f[\lambda_f - (1-\sigma)m], \quad \lambda_f = \lambda_f(\xi), \quad \lambda_{f\xi} > 0, \quad \theta_f > 0, \tag{16}$$

$$\frac{\dot{w}_R}{w_R} = \theta_w(\lambda - \lambda_w) = \theta_w[(1-\sigma)m - \lambda_w], \quad \lambda_w = \lambda_w(u;\eta), \quad \lambda_{wu} < 0, \quad \lambda_{w\eta} < 0, \quad \theta_w > 0, \tag{17}$$

where θ_f denote the speed of adjustment of the price; θ_w, the speed of adjustment of regular workers wage; ξ, the bargaining power of firms; and η, the bargaining power of labor unions. We assume that the target income share of firms is increasing in the bargaining power of firms while the target income share of labor unions is decreasing in the bargaining power of labor unions. When the target income share of labor unions is decreasing in the rate of capacity utilization, the rate of change in nominal/real wage is increasing in the rate of capacity utilization. This effect corresponds to the Marxian reserve army effect. As the rate of capacity utilization (a proxy of the rate of employment) increases, the bargaining power of labor unions increases, and they demand a higher wage share (i.e., a lower profit share). Other things being equal, this leads to an increase in the rate of change in the nominal wage. In addition, partially differentiating equations (16) and (17) with respect to the sharing parameter,

---

[7] For a Kaleckian model with conflicting-claims inflation, see Cassetti (2003).

we find that profit sharing increases the rate of change in the price and decreases the rate of change in wage.

Note that in the usual conflicting-claims inflation theory, not the capitalists' income share λ but the profit share m is used. However, if we want to consider profit sharing, we should use the capitalists' income share as described by equations (16) and (17). Some might think that equation (17) has some problems. Since it is regular workers who engage in wage bargaining, their target must be $(w_R L_R + \sigma rpK)/(pY)$, and not $(wL + \sigma rpK)/(pY)$. However, we can think that equation (17) is an equation that determines the wage of leading-sectors' labor unions that influence the wage determination of the whole economy and that leading-sectors take the workers' income share (i.e., the capitalists income share λ) into consideration.

By substituting equations (10) and (13) into equation (14), and equations (5), (16), and (17) into equation (15), we can obtain the following dynamic equations with respect to the capacity utilization rate and the profit share.

$$\dot{u} = \phi[g_d(u,(1-\sigma)m) - s(\sigma)um - s_w\psi(u;\sigma)(1-m)], \tag{18}$$

$$\dot{m} = -(1-m)[(1-\sigma)(\theta_f + \theta_w)m - \theta_f\lambda_f(\xi) - \theta_w\lambda_w(u;\eta) - f(u;\sigma)\dot{u}],$$
$$\text{where} \quad f(u;\sigma) = \frac{\gamma\alpha(\sigma)}{[\gamma\alpha(\sigma)+\beta u]u}, \quad f_u < 0, \quad f_\sigma < 0. \tag{19}$$

The steady state equilibrium is an equilibrium such that $\dot{u} = \dot{m} = 0$. From this, the equilibrium values of u and m satisfy the following equations.[8]

$$g_d(u,(1-\sigma)m) = s(\sigma)um + s_w\psi(u;\sigma)(1-m), \tag{20}$$

$$(1-\sigma)(\theta_f + \theta_w)m = \theta_f\lambda_f(\xi) + \theta_w\lambda_w(u;\eta). \tag{21}$$

In the following analysis, we assume that there exists a unique pair of $u^* \in (0,1)$ and $m^* \in (0,1)$ that simultaneously satisfy equations (20) and (21), where the asterisk "$*$" denotes the equilibrium value.

From equations (20) and (21), we find that the steady state equilibrium does not depend on the parameter ϕ that represents the speed of adjustment of the goods market. This property is

[8] Of course, $m = 1$ is a steady state equilibrium. However, we focus our attention on interior solutions.

used in the stability analysis in the next section.

Finally, we summarize the notion of income distribution in this paper. National income is decomposed into

$$
\begin{aligned}
pY &= \underbrace{wL}_{\text{wages}} + \underbrace{rpK}_{\text{profits}} \\
&= (1-m)\cdot pY + m\cdot pY \\
&= \underbrace{wL + \sigma rpK}_{\text{workers}} + \underbrace{(1-\sigma)rpK}_{\text{capitalists}} \\
&= \sigma m\cdot pY + (1-\sigma)m\cdot pY \\
&= \underbrace{w_{NR}L_{NR}}_{\text{nonregular workers}} + \underbrace{w_R L_R + \sigma rpK}_{\text{regular workers}} + \underbrace{(1-\sigma)rpK}_{\text{capitalists}} \\
&= [1-\psi(u;\sigma)](1-m)\cdot pY + [\psi(u;\sigma)+\sigma m]\cdot pY + (1-\sigma)m\cdot pY.
\end{aligned} \tag{22}
$$

The non-regular workers' income share and the regular workers' income share are respectively given by

$$\frac{w_{NR}L_{NR}}{pY} = [1-\psi(u;\sigma)](1-m), \tag{23}$$

$$\frac{w_R L_R + \sigma rpK}{pY} = \psi(u;\sigma)(1-m) + \sigma m\,. \tag{24}$$

The rear wage of non-regular workers and that of regular workers are respectively given by

$$\frac{w_{NR}}{p} = \frac{u}{\gamma\alpha(\sigma)+\beta u}(1-m)\,, \tag{25}$$

$$\frac{w_R}{p} = \frac{\gamma u}{\gamma\alpha(\sigma)+\beta u}(1-m)\,. \tag{26}$$

When u and m are determined, these distributive variables are also determined.

3 Stability analysis

To investigate the stability of the steady state equilibrium, we analyze the Jacobian matrix $\mathbf{J}$ of the system of the differential equations (18) and (19).

$$\mathbf{J} = \begin{pmatrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{pmatrix}, \tag{27}$$

where the elements of $\mathbf{J}$ are given by as follows:

$$J_{11} = \frac{\partial \dot{u}}{\partial u} = \phi[g_{du} - s(\sigma)m - s_w(1-m)\psi_u]\,, \tag{28}$$

$$J_{12} = \frac{\partial \dot{u}}{\partial m} = \phi[(1-\sigma)g_{d\lambda} - s(\sigma)u + s_w \psi(u;\sigma)], \tag{29}$$

$$J_{21} = \frac{\partial \dot{m}}{\partial u} = (1-m)[\theta_w \lambda_{wu} + f(u;\sigma)J_{11}], \tag{30}$$

$$J_{22} = \frac{\partial \dot{m}}{\partial m} = -(1-m)[(1-\sigma)(\theta_f + \theta_w) - f(u;\sigma)J_{12}]. \tag{31}$$

All the elements of $\mathbf{J}$ are evaluated at the steady state equilibrium though asterisks are not added for simplicity.

Let us assume the following condition:

Assumption 1. *The condition* $g_{du} < s(\sigma)m + s_w(1-m)\psi_u$ *holds.*

This means that the response of savings to the capacity utilization rate is larger than that of investments. This assumption makes the quantity adjustment of the goods market stable. Assumption 1 is sometimes called the Keynesian stability condition (Marglin and Bhaduri, 1990), which is often imposed in Kaleckian models.[9] With Assumption 1, from equation (28), we can obtain $J_{11} < 0$.

Let us classify the regime according to the effect of a profit share increase on the capacity utilization.

Definition 1. *If the relation* $(1-\sigma)g_{d\lambda} > s(\sigma)u - s_w\psi(u;\sigma)$ *holds, the steady state equilibrium is called the profit-led demand regime. If, on the other hand, the relation* $(1-\sigma)g_{d\lambda} < s(\sigma)u - s_w\psi(u;\sigma)$ *holds, the steady state equilibrium is called the wage-led demand regime.*

If the investment response to the profit share is more than the saving response, then the steady state equilibrium exhibits the profit-led demand regime. On the other hand, if the investment response to the profit share is less than the saving response, then the steady state equilibrium exhibits the wage-led demand regime. From equation (29), we have $J_{12} > 0$ in the profit-led demand regime while $J_{12} < 0$ in the wage-led demand regime.

From Assumption 1 and Definition 1, the sign structure of the Jacobian matrix $\mathbf{J}$ is given as follows:

---

[9] However, Skott (2010, 2012) criticizes the Keynesian stability condition.

$$\mathbf{J} = \begin{pmatrix} - & \pm \\ - & ? \end{pmatrix}. \tag{32}$$

The steady state equilibrium is locally stable if and only if the determinant $\det \mathbf{J}$ of the Jacobian matrix $\mathbf{J}$ is positive and the trace $\mathrm{tr}\,\mathbf{J}$ is negative. Let us confirm whether or not these conditions are satisfied in our model.

$$\mathrm{tr}\,\mathbf{J} = \underbrace{J_{11}}_{-} - (1-\sigma)(\theta_f + \theta_w)(1-m) + (1-m) f(u;\sigma) \underbrace{J_{12}}_{+/-}, \tag{33}$$

$$\det \mathbf{J} = -(1-m)[(1-\sigma)(\theta_f + \theta_w) \underbrace{J_{11}}_{-} + \theta_w \underbrace{\lambda_{wu}}_{-} \underbrace{J_{12}}_{+/-}]. \tag{34}$$

First, we examine the sign of $\mathrm{tr}\,\mathbf{J}$. When the equilibrium exhibits the profit-led demand regime, that is, $J_{12} > 0$, we obtain $\mathrm{tr}\,\mathbf{J} > 0$ if the size of $f(u;\sigma) > 0$ is large. When the equilibrium exhibits the wage-led demand regime, that is, $J_{12} < 0$, we always obtain $\mathrm{tr}\,\mathbf{J} < 0$.

Next, we examine the sign of $\det \mathbf{J}$. When the equilibrium exhibits the profit-led demand regime, that is, $J_{12} > 0$, we always obtain $\det \mathbf{J} > 0$. When the equilibrium exhibits the wage-led demand regime, that is, $J_{12} < 0$, we obtain $\det \mathbf{J} < 0$ if the reserve army effect is large, that is, the absolute value of $\lambda_{wu} < 0$ is large.

From the above analysis, we obtain the following propositions.

Proposition 1. *Suppose that the steady state equilibrium exhibits the wage-led demand regime. If the reserve army effect is small, then the steady state equilibrium is locally stable. On the other hand, if the reserve army effect is large, then the steady state equilibrium is locally unstable.*

Proposition 2. *Suppose that the steady state equilibrium exhibits the profit-led demand regime. Then, the steady state equilibrium can be locally unstable.*

As stated above, the steady-state equilibrium values do not depend on the parameter ϕ. Accordingly, if we choose ϕ as a bifurcation parameter, by using the Hopf bifurcation theorem, we can prove the occurrence of limit cycles.

Proposition 3. *Suppose that the steady state exhibits the profit-led demand regime. Then, a* *limit cycle occurs when the speed of adjustment of the goods market lies within some range.*

Proof. Choose ϕ as a bifurcation parameter. If we define

$$\Lambda = [g_{du} - s(\sigma)m - s_w(1-m)\psi_u] + (1-m)f(u;\sigma)[(1-\sigma)g_{d\lambda} - s(\sigma)u + s_w\psi(u;\sigma)], \tag{35}$$

then we can rewrite the trace of $\mathbf{J}$ as follows:

$$\mathrm{tr}\,\mathbf{J} = \phi\Lambda - (1-\sigma)(\theta_f + \theta_w)(1-m). \tag{36}$$

Suppose that $\Lambda > 0$. Indeed, we can obtain $\Lambda > 0$ if the steady state equilibrium exhibits the profit-led demand. In addition, Λ is independent of ϕ. Moreover, the equilibrium values of the rate of capacity utilization and the profit share are independent of ϕ. Define that $\phi_0 \equiv (1-\sigma)(\theta_f + \theta_w)(1-m)/\Lambda > 0$. Then, for $\phi = \phi_0$, we obtain, $\mathrm{tr}\,\mathbf{J} = 0$, for $\phi < \phi_0$, we obtain $\mathrm{tr}\,\mathbf{J} < 0$, and for $\phi > \phi_0$, we obtain $\mathrm{tr}\,\mathbf{J} > 0$. Therefore, $\phi = \phi_0$ is a Hopf bifurcation point. That is, there exists a continuous family of non-stationary, periodic solutions of the system around $\phi = \phi_0$. □

4 Analysis

4.1 Comparative static analysis

We investigate the effect of profit sharing on the equilibrium values of the rate of capacity utilization and the profit share. For comparative static analysis, we need the stability of the steady state equilibrium. Thus, we assume $\det\mathbf{J} > 0$ in the following analysis.

First, we investigate the effect of profit sharing on the rate of capacity utilization. Totally differentiating equations (20) and (21) and rearranging the resultant expressions, we obtain

$$\frac{du^*}{d\sigma} = \frac{s_w(\theta_f + \theta_w)\dfrac{\beta u^2}{\gamma\alpha + \beta u}\left[m + \dfrac{\alpha_\sigma(1-\sigma)(1-m)\gamma\beta}{\gamma\alpha + \beta u}\right]}{(1-\sigma)(\theta_f + \theta_w)[g_{du} - sm - s_w\psi_u(1-m)] + \theta_w\lambda_{wu}[(1-\sigma)g_{d\lambda} - su + s_w\psi]}. \tag{37}$$

The sign of the denominator of the right-hand side is opposite to the sign of $\det\mathbf{J}$. Thus, its sign is negative. Therefore, if the productivity enhancing effect of profit sharing is large, that is, the absolute value of $\alpha_\sigma < 0$ is large, the sign of the numerator of the right-hand side is negative, and consequently, we obtain $du^*/d\sigma > 0$. In contrast, if the productivity enhancing effect of profit sharing is small, that is, the absolute value of $\alpha_\sigma < 0$ is small, the sign of the numerator of the right-hand side is positive, and consequently, we obtain $du^*/d\sigma < 0$.

Next, we investigate the effect of profit sharing on the profit share. Define $du^*/d\sigma = \Omega$.

Then, we obtain

$$\frac{dm^*}{d\sigma} = \frac{(\theta_f + \theta_w)m + \theta_w \lambda_{wu} \Omega}{(1-\sigma)(\theta_f + \theta_w)}. \tag{38}$$

Then, when $du^* / d\sigma = \Omega < 0$, that is, the productivity enhancing effect of profit sharing is small, we obtain $dm^* / d\sigma > 0$, which implies that profit sharing increases the profit share. In contrast, when $du^* / d\sigma = \Omega > 0$, that is, the productivity enhancing effect of profit sharing is large, the sign of equation (38) is ambiguous.

From the above analysis, we obtain the following two propositions:

Proposition 4. *Suppose that the productivity enhancing effect of profit sharing is large. Then, an increase in the sharing parameter increases the equilibrium rate of capacity utilization. In contrast, suppose that the productivity effect of profit sharing is small. Then, an increase in the sharing parameter decreases the equilibrium rate of capacity utilization.*

Proposition 5. *Suppose that the productivity enhancing effect of profit sharing is large. Then, the effect of an increase in the sharing parameter on the equilibrium profit share is ambiguous. In contrast, suppose that the productivity effect of profit sharing is small. Then, the effect of an increase in the sharing parameter on the equilibrium profit share is positive.*

We further investigate the following special cases.

- $\alpha_\sigma = 0$

  In this case, we obtain $du^* / d\sigma < 0$ and $dm^* / d\sigma > 0$. Therefore, if profit sharing does not increase the labor productivity of regular workers, profit sharing decreases the rate of capacity utilization and increases the profit share.

- $s_w = 0$

  In this case, we obtain $du^* / d\sigma = 0$ and $dm^* / d\sigma > 0$. Therefore, if regular workers do not save, profit sharing does not affect the rate of capacity utilization and increases the profit share.

4.2 Numerical simulations

This subsection investigates how an increase in the sharing parameter affects the steady-state equilibrium values of the rate capacity utilization and the profit share by using numerical simulations. Here, we consider four cases. Case 1/Case 2 is a case where the steady-state equilibrium is the profit-led demand regime and the productivity enhancing effect is weak/strong. Case 3/Case 4 is a case where the steady-state equilibrium is the wage-led demand regime and the productivity enhancing effect is weak/strong.[10,11]

For numerical simulations, we specify the investment function, the labor input coefficient of regular workers, and the target income share of labor unions as follows:[12]

$$g_d = g_0 u^{\delta} \lambda^{\varepsilon} = g_0 u^{\delta}[(1-\sigma)m]^{\varepsilon}, \quad g_0 > 0, \quad 0 < \delta < 1, \quad \varepsilon > 0, \tag{39}$$

$$\alpha = \alpha_0 - \alpha_1 \sigma, \quad \alpha_0 > 0, \quad \alpha_1 > 0, \tag{40}$$

$$\lambda_w = \rho_0 - \rho_1 u, \quad \rho_0 > 0, \quad \rho_1 > 0, \tag{41}$$

where g_0 denotes the shift parameter of the investment function; δ, the elasticity of investment with respect to the rate of capacity utilization; ε, the elasticity of investment with respect to the profit share; α_0, a positive constant; α_1, a positive parameter that denotes the size of the productivity enhancing effect of profit sharing; ρ_0, a positive constant; and ρ_1, a positive parameter that shows the size of the reserve army effect.

In addition, by numerical simulations, we investigate the effects of profit sharing on the capitalists' income share, non-regular workers' income share, regular workers' income share, non-regular workers' real wage, regular workers' real wage, the profit rate, and the rate of capital accumulation.

Case 1: Profit-led demand and weak productivity enhancing effect

Case 1 is a case where the productivity enhancing effect of profit sharing is small. We set the parameters and the initial values of u and m as follows. Then, we increase the sharing parameter from $\sigma = 0.1$ to $\sigma = 0.12$.

$g_0 = 1.3$, $\delta = 0.2$, $\varepsilon = 2$, $s_c = 0.6$, $s_w = 0.1$, $\phi = 2$, $\theta_f = 0.4$, $\theta_w = 0.6$, $\lambda_f = 0.7$,

[10] Many empirical studies that examine the demand regime of Japan based on Kaleckian models show that the Japanese economy exhibits the profit-led demand regime (Azetsu, Koba, and Nakatani, 2010; Sonoda, 2007, 2013; Nishi, 2010).

[11] The effects of an increase in the sharing parameter on the relative employment L_{NR} / L_R are summarized in Table 6.

[12] Cobb-Douglas investment functions like this are also adopted by Blecker (2002) and Sasaki (2010, 2013).

$\rho_0 = 0.1$, $\rho_1 = 0.1$, $\gamma = 2$, $\alpha_0 = 1.8$, $\alpha_1 = 0.1$, $\beta = 1$, $u(0) = 0.4$, $m(0) = 0.3$.

Table 1 summarizes the results of Case 1. As shown analytically in Section 4.1, an increase in the sharing parameter decreases the rate of capacity utilization and increases the profit share. In this case, the steady-state equilibrium is defined as the profit-led demand regime, but the profit share increases and the rate of capacity utilization decreases, and hence, the equilibrium is apparently characterized as a wage-led demand regime.

Both capitalists' income share and regular workers' income share increase while the non-regular workers' income share decreases. In addition, both regular and non-regular workers' real wages decrease.

Moreover, the profit rate increases whereas the rate of capital accumulation decreases.

Figures 1 and 2 show the time series of the rate of capacity utilization and the profit share in Case 1. The real and dashed lines correspond to $\sigma = 0.1$ and $\sigma = 0.12$, respectively. With the increase in the sharing parameter, the sizes of fluctuations diminish. Therefore, profit sharing stabilizes business cycles.

[Table 1, Figures 1, 2, and 3 around here]

Case 2: Profit-led demand and strong productivity enhancing effect

Case 2 is a case where the productivity enhancing effect of profit sharing is large. In this case, we use $\alpha_1 = 2$ instead of $\alpha_1 = 0.1$, and leave the other parameters unchanged. Then, we increase the sharing parameter from $\sigma = 0.1$ to $\sigma = 0.12$.

Table 2 summarizes the results of Case 2. The increase of the sharing parameter increases both rate of capacity utilization and profit share. In this case, both the profit share and the rate of capacity utilization increase, and hence, the equilibrium is apparently characterized as a profit-led growth regime.

Unlike in Case 1, the capitalists' income share decreases, and both regular and non-regular workers' real wages increase. Moreover, both the profit rate and the rate of capital accumulation increase.

Figures 3 and 4 show the time series of the rate of capacity utilization and the profit share in Case 2. As in Case 1, with the increase in the sharing parameter, the sizes of fluctuations diminish. Therefore, profit sharing stabilizes business cycles.

[Table 2, Figures 4 and 5 around here]

Case 3: Wage-led demand and weak productivity enhancing effect

Case 3 is a case where the productivity enhancing effect is weak. We set the parameters and the initial values of u and m as follows. Then, we increase the sharing parameter from $\sigma = 0.1$ to $\sigma = 0.12$.

$$g_0 = 0.3,\ \delta = 0.4,\ \varepsilon = 0.2,\ s_c = 0.7,\ s_w = 0.1,\ \phi = 2,\ \theta_f = 0.3,\ \theta_w = 0.7,\ \lambda_f = 0.3,$$

$$\rho_0 = 0.4,\ \rho_1 = 0.1,\ \gamma = 1.5,\ \alpha_0 = 1,\ \alpha_1 = 0.05,\ \beta = 1,\ u(0) = 0.4,\ m(0) = 0.3.$$

The increase of the sharing parameter decreases the rate of capacity utilization and increases the profit share. The steady-state equilibrium is defined as the wage-led demand regime. In this case, the profit share increases and the rate of capacity utilization decreases, and hence, the definition and the numerical result are consistent.

[Table 3 around here]

Case 4: Wage-led demand and strong productivity enhancing effect

Case 4 is a case where the productivity enhancing effect is strong. We set the parameters and the initial values of u and m as follows. We use $\alpha_1 = 2$ instead of $\alpha_0 = 0.05$. Then, we increase the sharing parameter from $\sigma = 0.1$ to $\sigma = 0.12$.

The increase of the sharing parameter increases both the profit share and the rate of capacity utilization. In this case, the steady-state equilibirum is defined as the wage-led demand regime, but it is apparently characterized as a profit-led demand regime.

[Table 4 around here]

4.3 Comparisons with previous studies

In the Keynesian model of Ninomiya and Takami (2010), the profit share is exogenously given. If the sharing parameter increases, the output decreases.

In addition, they show that an increase in the sharing parameter destabilizes the steady state equilibrium. In their numerical example, an exogenous increase in the profit share decreases the equilibrium output, which implies that the equilibrium exhibits the wage-led demand regime. Therefore, we can say that in the wage-led demand regime, profit sharing destabilizes the equilibrium.

Mainwaring (1993) presents a discrete-time version of Goodwin model and investigates how income transfer from capitalists to workers affects the economy. Although the word "profit sharing" is not used in his paper, his analysis is similar to the one in the present paper. According to Mainwaring, an increase in the sharing parameter decreases the employment rate and increases the profit share.

For the stability analysis, in Mainwaring (1993), an increase in the sharing parameter decreases a bifurcation parameter η that determines the stability of the model. Note that in his model, the parameter η is decreasing in the sharing parameter. Suppose that the initial value of η is more than 2 and hence, the economy converges to the equilibrium with oscillations. Then, if the sharing parameter increases and η becomes less than 2 (but more than unity), then the economy converges monotonically to the equilibrium. In this sense, an increase in the sharing parameter stabilizes the economy. In contrast, if the initial value of the bifurcation parameter is $1 < \eta < 2$ and if η becomes less than unity with an increase in the sharing parameter, then the employment rate converges monotonically to zero.

Fanti and Manfredi (1998) build a continuous-time version of Goodwin model and investigate the effect of profit sharing on the equilibrium value and the dynamical stability. In the usual Goodwin model, it is assumed that the rate of change in the real wage depends positively on the employment rate. On the other hand, in their model, it is assumed that the rate of change in the real wage depends positively on both the employment rate and the profit rate with consideration for profit sharing.[13] They call a coefficient of the profit rate the sharing parameter. In their model, dynamical equations of the employment rate and wage

[13] A wage equation like this is also used in Lordon (1997), where endogenous technical change due to the Kaldor-Verdoorn law is considered.

share are obtained, and $\mathrm{tr}\mathbf{J} < 0$ and $\det \mathbf{J} > 0$ are obtained, which implies that the steady state is always locally stable. In other words, profit sharing stabilizes the dynamical system. Moreover, in their model, profit sharing decreases the equilibrium employment rate and does not affect the equilibrium profit share.

When comparing Fanti and Manfredi's (1998) results with ours, we must be careful of the assumption with regard to saving. They assume that profits are all saved, which amounts to saying in our model that capitalists and regular workers save all their profits after profit sharing, that is, $s_c = s_w = 1$. It is because this assumption of savings that in Fanti and Manfredi's (1998) model, profit sharing does not affect the equilibrium profit share. Instead, if we assume that $0 < s_w < s_c < 1$ as in our model and recalculate the resultant model, we find that profit sharing increases the equilibrium profit share and decreases the equilibrium employment rate. Added to this, even if we assume that $0 < s_w < s_c < 1$, stability analysis does not change: the introduction of profit sharing always stabilizes the dynamics of the model.

Lima (2010) investigates the profit sharing by using a Kaleckian model. His results are summarized in Table 5, which shows that when the MB investment function is used with the assumption $s_w = 0$, an increase in the sharing parameter increases the equilibrium value of the rate of capacity utilization. In our model, in contrast, when the MB investment function is used with the assumption $s_w = 0$, an increase in the sharing parameter does not affect the equilibrium value of the rate of capacity utilization. This difference depends on whether the profit share is fixed or endogenized.

[Table 5 around here]

5 Conclusions

In this paper, we have presented a Kaleckian model with profit sharing and investigated the effect of profit sharing on the economy. Unlike the existing literature, we endogenize income distribution.

The comparative static analysis shows that if the productivity enhancing effect of profit sharing is large, profit sharing increases the equilibrium rate of capacity utilization whereas if the productivity enhancing effect is small, profit sharing decreases the equilibrium rate of capacity utilization.

Numerical simulations show that depending on the size of productivity enhancing effect of profit sharing, the effects of profit sharing on income distributions are different.

In addition, numerical simulations show that if steady state equilibrium exhibits the profit-led demand regime and if limit cycles occur, profit sharing diminishes cyclical fluctuations and hence, stabilizes the economy.

Needless to say, these results depend on the specification of the model: whether or not workers save; what is an explanatory variable of the investment function; and whether or not the reserve army effect works. To know what specification has relevancy to reality will be left for a future research.

References

Azetsu, K., Koba, T., and Nakatani, T. (2010) "Empirical Analysis of a Kaleckian-type Model of Growth and Distribution," *Political Economy Quarterly* 47 (1), pp. 56–65 (in Japanese).

Blecker, R. A. (2002) "Distribution, Demand and Growth in Neo-Kaleckian Macro-Models," in M. Setterfield (ed.) *The Economics of Demand-led Growth, Challenging the Supply-side Vision of the Long Run*, Cheltenham: Edward Elgar, pp. 129–152.

Blinder, A. S., ed. (1990) *Paying for Productivity: A Look at the Evidence*, Washington, D.C.: The Brookings Institution.

Cahuc, P. and Dormont, B. (1997) "Profit-sharing: Does it Increase Productivity and Employment? A Theoretical Model and Empirical Evidence on French Data," *Labour Economics* 4, pp. 293–319.

Cassetti, M. (2003) "Bargaining Power, Effective Demand and Technical Progress: A Kaleckian Model of Growth," *Cambridge Journal of Economics* 27 (3), pp. 449–464.

Dube, A. and Freeman, R. B. (2008) "Complementarily of Shared Compensation and Decision-Making Systems," in D. L. Kruse, R. B. Freeman, and J. R. Blasi (eds.) *Shared Capitalism at Work: Employee Ownership, Profit and Gain Sharing, and Broad-based Stock Options*, Chicago: Chicago University Press, pp. 167–199.

Fanti, L. and Manfredi, P. (1998) "A Goodwin-type Growth Cycle Model with Profit-Sharing," *Economic Notes* 27 (3), pp. 371c402.

Goodwin, R. (1967) "A Growth Cycle," in C. H. Feinstein (ed.) *Socialism, Capitalism and Economic Growth, Essays Presented to Maurice Dobb*, Cambridge: Cambridge University Press, pp 54–58

Lavoie, M. (1992) *Foundations of Post-Keynesian Economic Analysis*, Cheltenham: Edward Elgar.

Lima, T. L. (2010) "Profit Sharing, Capacity Utilization and Growth in a Post-Keynesian Macromodel," in M. Setterfield (ed.) *Handbook of Alternative Theories of Economic Growth*, Cheltenham: Edward Elgar.

Lima, T. L. (2012) "A Neo-Kaleckian Model of Profit Sharing, Capacity Utilization and Economic Growth," *Metroeconomica* 63 (1), pp. 92–108.

Lordon, F. (1997) "Endogenous Structural Change and Crisis in a Multiple Time-Scales Growth Model," *Journal of Evolutionary Economics* 7 (1), pp. 1–21.

Mainwaring, L. (1993) "Inter-Class Transfers in a Goodwin-Type Growth Model," *Metroeconomica* 44 (1), pp. 65–77.

Marglin, S. and Bhaduri, A. (1990) "Profit- Squeeze and Keynesian Theory," in S. Marglin and J. Schor (eds.) *The Golden Age of Capitalism: Reinterpreting the Postwar Experience*, Oxford: Clarendon Press.

Ninomiya, K. and Takami, H. (2010) "Profit Sharing, Stagnationist Regime and Financial Instability," *Political Economy Quarterly* 47 (3), pp. 58–66 (in Japanese).

Nishi, H. (2010) "An Empirical Analysis of Income Distribution and Demand Formation Pattern of the Japanese Economy Using Vector Autoregressive Model," *Political Economy Quarterly* 47 (3), pp. 67–78 (in Japanese).

Owan, H. and Suda, T. (2009) "Why Do Japanese Firms Offer Retirement Allowance and Semiannual Bonus?" *The Japanese Journal of Labour Studies* 51 (4), pp. 18–25 (in Japanese).

Pasinetti, L. L. (1962) "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth," *Review of Economic Studies* 29 (4), pp. 267–279.

Pohjola, M. T. (1981) "Stable, Cyclic and Chaotic Growth: The Dynamics of a Discrete-time Version of Goodwin's Growth Cycle Model," *Journal of Economics* 41 (1–2), pp. 27–78.

Raghavendra, S. (2006) "Limits to Investment Exhilarationism," *Journal of Economics* 87 (3), pp. 257–280.

Rowthorn, R. E. (1977) "Conflict, Inflation and Money," *Cambridge Journal of Economics* 1 (3), pp. 215–239.

Rowthorn, R. E. (1981) "Demand, Real Wages and Economic Growth," *Thames Papers in Political Economy*, Autumn, pp. 1–39.

Sasaki, H. (2010) "Endogenous Technological Change, Income Distribution, and Unemployment with Inter-Class Conflict," *Structural Change and Economic Dynamics* 21 (2), pp. 123–134.

Sasaki, H. (2013) "Cyclical Growth in a Goodwin-Kalecki-Marx Model," *Journal of Economics* 108 (2), pp. 145–171.

Sasaki, H., Matsuyama, J., and Sako, K. (2013) "The Macroeconomic Effects of the Wage Gap between Regular and Non-Regular Employment and of Minimum Wages," *Structural Change and Economic Dynamics*, 26, pp. 61–72.

Skott, P. (2010) "Growth, Instability and Cycles: Harrodian and Kaleckian Models of Accumulation and Income Distribution," in M. Setterfield (ed.) *Handbook of Alternative Theories of Economic Growth*, Cheltenham: Edward Elgar, pp. 108–131.

Skott, P. (2012) "Theoretical and Empirical Shortcomings of the Kaleckian Investment Function," *Metroeconomica*, 63 (1), pp. 109–138.

Sonoda, R. (2007) "Growth Cycles in Japanese Manufacturing after WW2," *Political Economy Quarterly* 44 (3), pp. 55–64 (in Japanese).

Sonoda, R. (2013) "Two Types of Phillips Curves and the Dynamics of Distribution in Japan," chapter 4 of PhD Thesis, Kyoto University, Japan (in Japanese).

Weitzman, M. L. (1985) "The Simple Macroeconomics of Profit Sharing," *American Economic Review* 75 (5), pp. 937–953,

Weitzman, M. L. (1987) "Steady State Unemployment under Profit Sharing," *Economic Journal* 97 (385), pp. 86–105.

Weitzman, M. L., and Kruse, D. (1990) "Profit Sharing and Productivity," in A. S. Blinder (ed.) *Paying for Productivity: A Look at the Evidence*, Washington D.C.: The Brookings Institution, pp. 95–140.

Figures and Tables

Table1: Case 1–Profit-led demand with weak productivity effect

	$\sigma = 0.1$	$\sigma = 0.12$	$+$ or $-$
Capacity utilization rate	0.433848	0.433694	$-$
Profit share	0.348855	0.356794	$+$
Capitalists' income share	0.313969	0.313978	$+$
Non-regular workers' income share	0.399182	0.394424	$-$
Regular workers' income share	0.286849	0.291598	$+$
Non-regular workers' real wage	0.070381	0.06957	$-$
Regular workers' real wage	0.140762	0.13914	$-$
Profit rate	0.15135	0.154739	$+$
Capital accumulation rate	0.108439	0.108437	$-$
Labor productivity	0.195089	0.195209	$+$

Table 2: Case 2–Profit-led demand with strong productivity effect

	$\sigma = 0.1$	$\sigma = 0.12$	$+$ or $-$
Capacity utilization rate	0.435296	0.435451	$+$
Profit share	0.348758	0.356674	$+$
Capitalists' income share	0.313882	0.313873	$-$
Non-regular workers' income share	0.401703	0.397499	$-$
Regular workers' income share	0.284414	0.288628	$+$
Non-regular workers' real wage	0.077981	0.078791	$+$
Regular workers' real wage	0.155962	0.157582	$+$
Profit rate	0.151813	0.155314	$+$
Capital accumulation rate	0.108451	0.108452	$+$
Labor productivity	0.213874	0.218222	$+$

Table 3: Case 3–Wage-led demand with weak productivity effect

	$\sigma = 0.1$	$\sigma = 0.12$	$+$ or $-$
Capacity utilization rate	0.844181	0.842212	$-$
Profit share	0.345453	0.35346	$+$
Capitalists' income share	0.310907	0.311045	$+$
Non-regular workers' income share	0.301615	0.298571	$-$
Regular workers' income share	0.387478	0.390384	$+$
Non-regular workers' real wage	0.236471	0.233379	$-$
Regular workers' real wage	0.354706	0.350069	$-$
Profit rate	0.291624	0.297689	$+$
Capital accumulation rate	0.221933	0.221745	$-$
Labor productivity	0.458998	0.458668	$-$

Table 4: Case 4–Wage-led demand with strong productivity effect

	$\sigma = 0.1$	$\sigma = 0.12$	$+$ or $-$
Capacity utilization rate	0.87017	0.874054	$+$
Profit share	0.343431	0.350928	$+$
Capitalists' income share	0.309088	0.308816	$-$
Non-regular workers' income share	0.325392	0.327954	$+$
Regular workers' income share	0.3655	0.36323	$-$
Non-regular workers' real wage	0.27598	0.281683	$+$
Regular workers' real wage	0.413971	0.422524	$+$
Profit rate	0.298844	0.30673	$+$
Capital accumulation rate	0.224378	0.224738	$+$
Labor productivity	0.521007	0.534899	$+$

Table 5: Results of the case of fixed profit share (Lima, 2010)

Case of fixed profit share	u^*	g^*
Kaleckian investment function $+ s_w = 0$	$+$	$+$
Kaleckian investment function $+ s_w > 0$	$+$	$+$
Robinsonian investment function $+ s_w = 0$	$+$	0
Robinsonian investment function $+ s_w > 0$	$+/-$	$-$
MB investment function $+ s_w = 0$	$+$	$+/-$
MB investment function $+ s_w = 0 + \alpha_\sigma < 0$	$+/-$	$+/-$

Table 6: Effects on non-regular-regular employment ratio

L_{NR} / L_R	$\sigma = 0.1$	$\sigma = 0.12$	$+$ or $-$
Case 1	0.242373	0.242558	$+$
Case 2	0.272060	0.279135	$+$
Case 3	0.848423	0.847296	$-$
Case 4	1.08771	1.15007	$+$

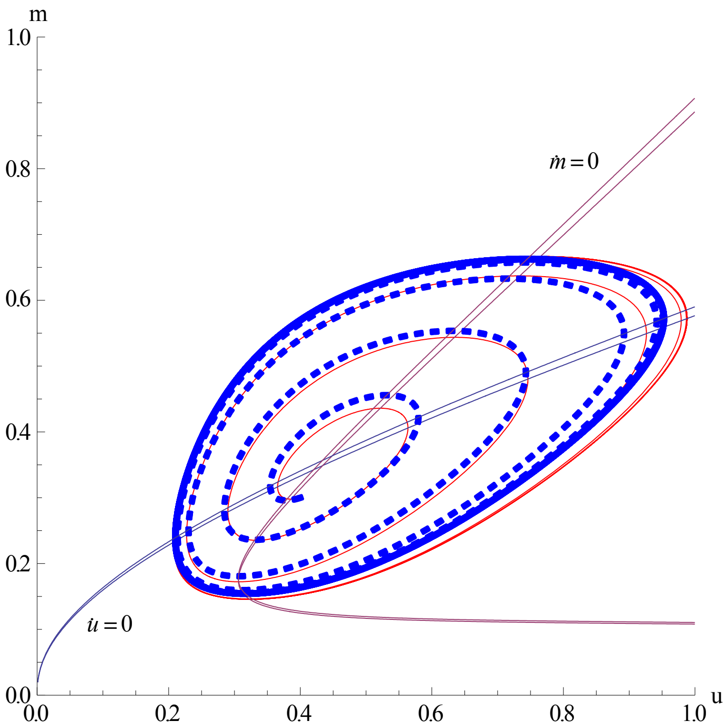

Figure 1: Limit cycles in Case 1

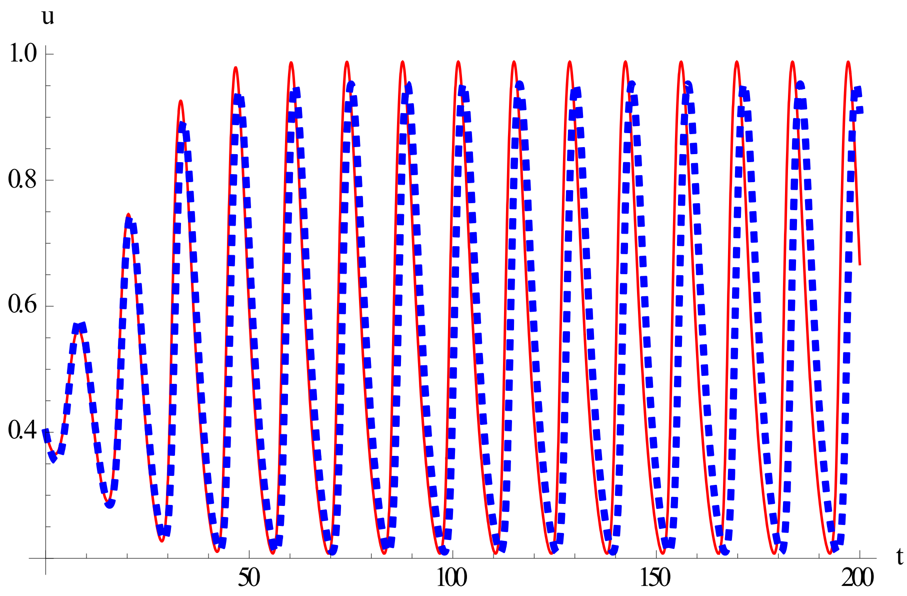

Figure 2: Time series of capacity utilization in Case 1

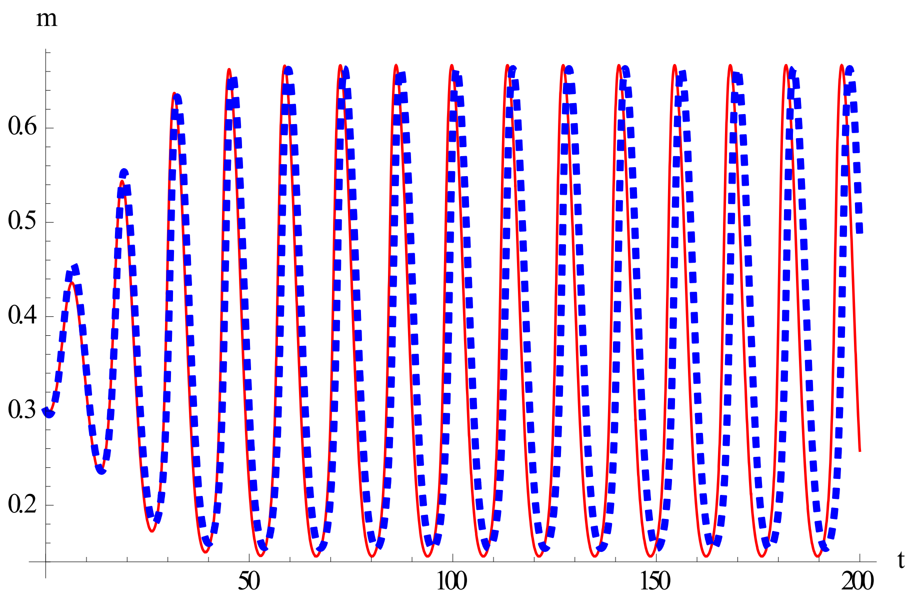

Figure 3: Time series of profit share in Case 1

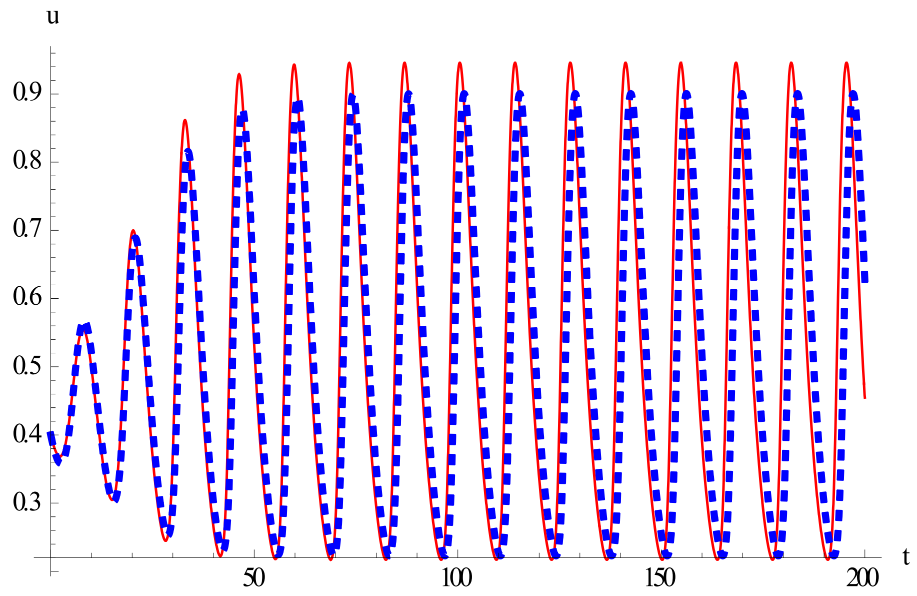

Figure 4: Time series of capacity utilization in Case 2

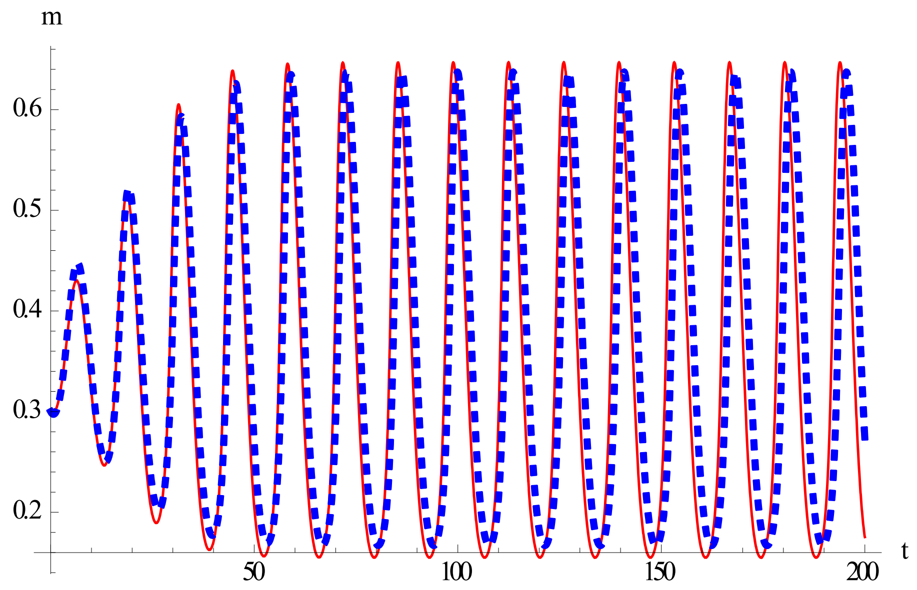

Figure 5: Time series of profit share in Case 2