ECONOMIC RESEARCH CENTER
DISCUSSION PAPER

E-Series

No.E16-5

Who Should Bear the Pain of Price Competition? A Kaleckian Approach

by

Shinya Fujita

July 2016

ECONOMIC RESEARCH CENTER
GRADUATE SCHOOL OF ECONOMICS
NAGOYA UNIVERSITY

Who should bear the pain of price competition? A Kaleckian approach

Shinya Fujita[†]

Abstract

Ongoing globalization and the rise of neoliberalism have intensified price competition in both domestic and international markets. If we consider a cost reduction owing to price competition, the question inevitably becomes who suffers the pain of reducing costs. By constructing a Kaleckian model with an intermediate goods sector and a final goods sector, we investigate which economic agent, firms or workers in either sector, should take responsibility for the cost reduction to maintain aggregate demand and growth. Our results show that firms in the final goods sector should be targeted, as cutting the mark-up rate in that sector is likely to promote capacity utilization and capital accumulation. Moreover, we show that forcing the burden of the cost reduction onto workers in the intermediate goods sector is undesirable because it decreases demand as well as the growth rate.

Keywords: Mark-up pricing, Vertical transaction, Cost reduction, Wage standardization
JEL Classification: E11, O41, J5

[†] Graduate School of Economics, Nagoya University. Furo-cho, Chikusa-ku, Nagoya-shi, 464-8601, Japan. E-mail: fujita@soec.nagoya-u.ac.jp

1 Introduction

Behind the progress of economic globalization, emerging countries tend to dominate the goods market, exacerbating the severity of international price competition. At the same time, neoliberalism, which relies heavily on the market mechanism, gains power, thus increasing the competitiveness of the market structures in advanced countries. Such an intensification of price competition in both domestic and international markets increasingly forces firms to reduce their production costs.[1]

When firms cannot avoid the pain of price competition, the problem inevitably becomes the question of who takes responsibility for the resulting cost reduction. In the absence of technological progress, such a cost reduction can only be accomplished at the expense of somebody's income. For instance, let us consider the situation where firms in the final goods sector aim to reduce their prices. Most final goods production passes through vertical transactions in which intermediate goods-producing firms supply intermediate input goods to final goods-producing firms. It follows that to reduce the final goods price, any one of the firms in the final goods sector, workers in the final goods sector, firms in the intermediate goods sector, or workers in the intermediate goods sector is required to reduce its income. Thus, the cost reduction owing to price competition is inseparable not only from the functional income distribution between firms and workers but also from vertical relation between firms.

Studies that focus on the effects of price competition on the functional income distribution are mainly based on the open economy version of the Kaleckian model.[2] By adding net exports into the demand components, the pioneering work of Blecker (1989) shows that a fall in the wage share can strengthen international price competitiveness and positively affect aggregate demand. Missaglia (2007) assumes that the price equation of firms depends on the real exchange rate (i.e., when the terms of trade deteriorate, firms control their prices) and investigates whether the paradox of cost is valid in the open economy. Blecker (2011) and Cassetti (2012) indicate that it is effective to cut not only the nominal wage rate but also the mark-up rate to survive in international price competition. This finding implies that firms as well as workers have to share the pain of price competition. Sasaki et al. (2013b) show that, taking into account international trade, an increase in the negotiation power of firms does not raise aggregate demand even if the domestic economy exhibits a profit-led demand regime.

All these open economy models, however, are one-sector ones and thus abstract from the

[1] Such views on institutional change in the market structure are stressed mainly in the French régulation school. See, for example, Amable (2004), Boyer (2000, 2005), and Nishi (2010).

[2] Regarding the fundamental structure of the Kaleckian model, see Rowthorn (1981), Taylor (2004), and Lavoie (2014). As for empirical studies that consider the functional income distribution and macroeconomic performance in the open economy, see Bowles and Boyer (1995), Stockhammer and Onaran (2004), and Storm and Naastepad (2012).

following point: final goods-producing firms not only share the pain of the cost reduction between themselves and their workers, but also shift the burden to firms that produce intermediate goods. In the real economy, final goods-producing firms are likely to impose a cost reduction on intermediate goods-producing firms.

Taking into account this point, we construct a two-sector Kaleckian model with an intermediate goods sector and a final goods sector. In our model, there are four ways in which to reduce the final goods price: cutting the mark-up rate in either sector and cutting nominal wage rate in either sector. Our model clarifies which economic agent should take responsibility for the cost reduction in order to maintain aggregate demand and growth. In contrast to the above studies, however, we do not consider the factors of an open economy because price competition does not appear only in the international goods market. Consumers have a reservation price that they are willing to pay and producers such as manufacturing firms set the product price/cost target that is required for market success by applying the "target costing" method.[3] Accordingly, even domestic or Kaleckian oligopolistic firms give top priority to reducing the goods price/cost below its target.

In line with Kaleckian tradition, some two-sector models investigate the impact of a change in the sectoral mark-up rate on macroeconomic performance.[4] Dutt (1987) considers a model with an investment goods sector and a consumption goods sector and shows that a rise in the mark-up rate in the latter sector reduces the rate of capital accumulation, whereas the effect of a rise in the mark-up rate in the former sector on capital accumulation is ambiguous. Lavoie and Ramírez-Gastón (1997), using a two-sector model with target-return pricing, show that increases in the mark-up rates in two sectors negatively affect both sectors' rates of capacity accumulation and the macroeconomic rate of capital accumulation. However, these studies abstract from the role of the intermediate goods sector for the sake of simplicity, which differs from the contribution of our model.

Our findings are summarized as follows. First, provided that certain realistic conditions are satisfied, a relative fall in the mark-up rate in the final goods sector tends to increase the short-run rate of capacity utilization, which implies that firms in the final goods sector should take responsibility for reducing costs. Second, workers in the intermediate goods sector should not bear the pain of price competition; compared with cutting the mark-up rate in either sector,

[3] As for the cost targeting method, see, for example, Hiromoto (1988) and Fujitmoto (2012).

[4] There are other interesting two-sector models. Dutt (1988, 1990) demonstrates that in a Kaleckian monopoly economy the sectoral rate of profit never converges to the equal rate of profit, even in the long run. Taylor (1989) supposes that one sector produces goods purchased from wages, while another produces investment goods as well as goods purchased from profits, and considers how a demand composition change affects capital accumulation. Franke (2000) introduces the optimal use of capital and the financial sector in the price adjustment economy to conduct a stability analysis.

cutting the nominal wage rate in the intermediate goods sector is likely to reduce the rate of capacity utilization in the short run. Third, owing to the short-run effects, cutting the mark-up rate in the final goods sector is likely to increase long-run capital accumulation on the balanced growth path (BGP). Thus, to promote economic growth, firms in the final goods sector should reduce costs.

The remainder of the paper is organized as follows. Section 2 presents the proposed two-sector model. Section 3 assumes that capital stocks do not accumulate and investigates the short-run effect of changes in the mark-up rate and in the parameter representing wage standardization on capacity utilization. Section 4 assumes that capital stocks accumulate and investigates the long-run effect of the same parameter changes on capital accumulation and capacity utilization. Section 5 concludes.

2 Model

2.1 Basic settings

We consider a closed economy with no government sector. The economy is composed of an intermediate goods sector (sector 1) and a final goods sector (sector 2). Sector 1 produces intermediate goods by using fixed capital stocks and labor. Sector 2 produces final goods for consumption and investment by using fixed capital stocks, intermediate input goods, and labor. Each sector is assumed to have a Leontief-type fixed coefficient production function. Fixed capital stocks and labor are sector-specific, which implies that there are sectoral differentials in both the rate of profit and the rate of nominal wage. In addition, there are no labor supply constraints.

Moreover, we assume that oligopolistic firms control each market and adopt mark-up pricing in both sectors. Both sectors also have excess capacity, and the supply of output can be immediately adapted to demand. Value added is distributed to workers as wages and to firms as profits. Workers spend all their wage income on final goods, whereas firms save all their profit income.[5] Neither sector's investment behavior necessarily coincides because each is an independent economic agent. Finally, we ignore technological progress and the depreciation of fixed capital stocks.

Let us consider the price system. We assume that the prices in each industry are marked up on prime costs as follows:[6]

[5] We assume that firms' propensity to save out of profits is unity because we do not consider the paradox of thrift. Even if firms were assumed to consume a constant proportion of profits, our results change little.

[6] See Lavoie (1992), Lee (1998), and Coutts and Norman (2013) on post-Keynesian price theory. For the sake of simplicity, we assume the most familiar pricing rule.

$$p_1 = (1+\mu_1)w_1 b_1, \tag{1}$$

$$p_2 = (1+\mu_2)(p_1 a_{12} + w_2 b_2), \tag{2}$$

where p_i denotes the price of good i, μ_i the mark-up rate in sector i, and w_i the nominal wage rate in sector i. In addition, a_{12} is the coefficient of intermediate inputs in sector 2 and b_i is the labor input coefficient in sector i.[8] μ_i, a_{12}, and b_i are assumed to be positive constants. In the following, $i=1$ represents the intermediate goods sector and $i=2$ represents the final goods sector.

The mark-up rate represents the monopoly power in the market as well as the relative bargaining power of the firm. The higher the monopoly power or stronger the bargaining power of the firm, the higher the mark-up rate is (Kalecki, 1971; Sen and Dutt, 1995). Thus, the level and transition of the mark-up rate vary by industry.

In equations (1) and (2), we assume $w_1 \neq w_2$. However, in the case where the labor union becomes centralized, one sector's nominal wage rate can be affected by that in another sector. Taking into account this respect, we assume that there exists proportionality between both sector's nominal wage rates:[7]

$$w_1 = \theta w_2, \tag{3}$$

where θ represents the degree of wage standardization. It is appropriate to assume that this positive parameter is smaller than unity, that is, $0<\theta<1$. This is because the final goods sector is the main customer of the intermediate goods sector and thus the latter is inclined to decrease the nominal wage rate because of the former's request for a cost reduction. Thus, the nominal wage rate in sector 1 is smaller than that in sector 2. Moreover, the smaller θ implies that the responsibility for the cost reduction is shifted to the workers in sector 1.

Next, we consider the quantity system. Demand for intermediate goods is equal to intermediate demand in sector 2:

$$p_1 D_1 = p_1 a_{12} X_2, \tag{4}$$

where D_i denotes real aggregate demand and X_i real output.

Demand for final goods is composed of investment and consumption demand:

$$p_2 D_2 = p_2 (I_1 + I_2) + p_2 C, \tag{5}$$

where I_i denotes real investment and C real consumption. Here, we assume that investment is independent of firms' saving (Keynes, 1930; Kalecki, 1971).

We assume that workers spend all their wage income on final goods, whereas firms save all their profit income, which implies that macroeconomic consumption is equal to workers' wage income:

[7] We hardly find a Kaleckian model that considers the sectoral wage differential. By contrast, Lavoie (2009) and Sasaki et al. (2013a) consider the wage differential between two types of workers in the macroeconomy. Our model refers to their formulations.

$$p_2 C = w_1 b_1 X_1 + w_2 b_2 X_2 . \tag{6}$$

These price and quantity equations are summarized in Table 1.

(Table 1 here)

2.2 Price system

Equations (1), (2), and (3) provide the following relative price and real wage rate:

$$p \equiv \frac{p_1}{p_2} = \frac{(1+\mu_1) b_1 \theta}{(1+\mu_2)\left[b_2 + (1+\mu_1) a_{12} b_1 \theta\right]}, \tag{7}$$

$$\omega_1 \equiv \frac{w_1}{p_2} = \frac{\theta}{(1+\mu_2)\left[b_2 + (1+\mu_1) a_{12} b_1 \theta\right]}, \tag{8}$$

$$\omega_2 \equiv \frac{w_2}{p_2} = \frac{1}{(1+\mu_2)\left[b_2 + (1+\mu_1) a_{12} b_1 \theta\right]}, \tag{9}$$

where p denotes the ratio of the intermediate goods price and final goods price (i.e., the relative price) and ω_i the nominal wage rate in sector i divided by the final goods price (i.e., the real wage rate in sector i).

We obtain the following proposition regarding the relative price and real wage rate.

Proposition 1. A rise in the mark-up rate in sector 1 increases the relative price and decreases both sectors' real wage rates. Moreover, a rise in the mark-up rate in sector 2 decreases the relative price and both sectors' real wage rates. Furthermore, wage standardization increases the relative price and real wage rate in sector 1 and decreases the real wage rate in sector 2.

Proof. See Appendix A, which is available on request.

Wage standardization, that is, a rise in θ, has contrary effects on the real wage rates in sector 1 and sector 2. A rise in the nominal wage rate in sector 1 with wage standardization increases the final goods price by increasing the intermediate goods price. In sector 1, a rise in the nominal wage rate covers the rise in the final goods price and thus the real wage rate increases, whereas in sector 2 a rise in the final goods price decreases the real wage rate.

We represent the profit share in each sector, m_1 and m_2, as follows:

$$m_1 = \frac{\mu_1 w_1 b_1 X_1}{\mu_1 w_1 b_1 X_1 + w_1 b_1 X_1} = \frac{\mu_1}{1+\mu_1}, \tag{10}$$

$$m_2 = 1 - \frac{\omega_2 b_2}{1 - p a_{12}} = \frac{\mu_2 b_2 + \mu_2 (1+\mu_1) a_{12} b_1 \theta}{(1+\mu_2) b_2 + \mu_2 (1+\mu_1) a_{12} b_1 \theta}. \tag{11}$$

Equation (10) shows that the profit share in sector 1 is positive and smaller than unity. In

addition, since the numerator on the RHS is smaller than the denominator on the RHS of equation (11), the profit share in sector 2 is also positive and smaller than unity.

We thus obtain the following proposition regarding the profit share.

Proposition 2. A rise in the mark-up rate in sector 1 increases both sectors' profit shares. Moreover, a rise in the mark-up rate in sector 2 increases the profit share in sector 2. Furthermore, wage standardization increases the profit share in sector 2.

Proof. See Appendix B, which is available on request.

Because our model considers intermediate inputs, a change in the mark-up rate in sector 1 affects the profit shares in both sectors. In addition, since wage standardization decreases the real wage rate in sector 2, it increases the profit share in sector 2.

2.3 Quantity system

Our model assumes that nominal investment normalized by the capital stocks in each sector is an increasing function of both the profit share and the rate of capacity utilization (Bhaduri and Marglin, 1990):

$$g_1 \equiv \frac{I_1}{K_1} = \alpha_1 + \beta_1 m_1 + \gamma_1 u_1, \tag{12}$$

$$g_2 \equiv \frac{I_2}{K_2} = \alpha_2 + \beta_2 m_2 + \gamma_2 u_2, \tag{13}$$

where g_i denotes the rate of capital accumulation, K_i fixed capital stocks, and $u_i (\equiv X_i / K_i)$ the rate of capacity utilization.[8] In addition, α_i represents the firm's animal spirits, β_i the coefficient of capital accumulation to the profit share, and γ_i the coefficient of capital accumulation to capacity utilization. α_i, β_i, and γ_i are assumed to be positive constants. Contrary to previous two-sector models such as Dutt (1987, 1988), and Lavoie and Ramírez-Gastón (1997), we emphasize that the demand regime is diverse and thus we do not consider the negative impact of the rate of profit on capital accumulation, but rather consider the effect of profitability on capital accumulation.

By dividing both sides of equation (4) by K_1, we obtain

$$\frac{D_1}{K_1} = \frac{a_{12}}{k} u_2, \tag{14}$$

[8] We assume that the ratio of the potential output to capital stocks is constant. Accordingly, the ratio of output X to capital stocks K is a proxy variable of the capacity utilization rate.

where $k(\equiv K_1 / K_2)$ denotes the sectoral ratio of capital stocks.

Since excess demand (supply) leads to a rise (decline) in capacity utilization, the dynamics of the rate of capacity utilization in sector 1 are

$$\dot{u}_1 = \phi_1\left(\frac{D_1}{K_1} - u_1\right) = \phi_1\left(\frac{a_{12}}{k}u_2 - u_1\right), \tag{15}$$

where $\phi_i (> 0)$ denotes the adjustment speed of the intermediate goods market. Hereafter, the dot over the variable represents its time derivative.

Equation (6) is rewritten as[9]

$$\frac{C}{K_2} = p(1-m_1)ku_1 + (1-pa_{12})(1-m_2)u_2, \tag{16}$$

where $1 - pa_{12} > 0$.[10] By using equations (12), (13), and (16), we rewrite equation (5) as

$$\frac{D_2}{K_2} = k(\alpha_1 + \beta_1 m_1 + \gamma_1 u_1) + \alpha_2 + \beta_2 m_2 + \gamma_2 u_2 + p(1-m_1)ku_1 + (1-pa_{12})(1-m_2)u_2. \tag{17}$$

As in the intermediate goods market, we assume that quantity adjustment works in the final goods market; thus, the dynamics of the rate of capacity utilization in sector 2 are

$$\begin{aligned}\dot{u}_2 &= \phi_2\left(\frac{D_2}{K_2} - u_2\right) \\ &= \phi_2\{[\gamma_1 + p(1-m_1)]ku_1 + [\gamma_2 + (1-pa_{12})(1-m_2) - 1]u_2 + k(\alpha_1 + \beta_1 m_1) + \alpha_2 + \beta_2 m_2\}\end{aligned}. \tag{18}$$

Finally, taking the logarithmic derivative with respect to the time of the sectoral ratio of capital stocks yields

$$\dot{k} = (g_1 - g_2)k = (\gamma_1 u_1 - \gamma_2 u_2 + \alpha_1 + \beta_1 m_1 - \alpha_2 - \beta_2 m_2)k. \tag{19}$$

This leads to a dynamical system composed of equations (15), (18), and (19) with endogenous variables u_1, u_2, and k.

3 Short-run dynamics

3.1 Stability analysis

Quantity adjustment in the goods market is practiced more rapidly than capital accumulation. Accordingly, this section investigates only the dynamics of the rate of capacity utilization while leaving capital stocks unchanged. We consider the case where the rates of capacity

---

[9] From equation (10) and (11), we obtain the following equations.

$$\omega_1 b_1 = p(1-m_1),$$
$$\omega_2 b_2 = (1-pa_{12})(1-m_2).$$

Substituting these equations into equation (6) yields equation (16).

[10] By using equation (7), we obtain

$$1 - pa_{12} = \frac{(1+\mu_1)b_2 + \mu_2(1+\mu_1)a_{12}b_1\theta}{(1+\mu_2)[b_2 + (1+\mu_1)a_{12}b_1\theta]} > 0.$$

utilization and the sectoral ratio of capital stocks simultaneously change in Appendix C, which is available on request.

We define as the short-run equilibrium the situation where $\dot{u}_1 = \dot{u}_2 = 0$ holds with constant k, that is, demand meets supply in both markets. In the short-run equilibrium, we obtain the rate of capacity utilization as follows:

$$u_1 = \frac{[\alpha_1 + \beta_1 m_1 + (\alpha_2 + \beta_2 m_2)/k]a_{12}}{pa_{12}m_1 + (1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2}, \tag{20}$$

$$u_2 = \frac{k(\alpha_1 + \beta_1 m_1) + \alpha_2 + \beta_2 m_2}{pa_{12}m_1 + (1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2}, \tag{21}$$

where p, m_1, and m_2 are given by equations (7), (10), and (11).

By using equations (15) and (18), we obtain the trace and determinant of Jacobian matrix $\mathbf{J}$:

$$\text{trace}\mathbf{J} = -\phi_1 - \phi_2[1 - \gamma_2 - (1 - pa_{12})(1 - m_2)], \tag{22}$$

$$\det \mathbf{J} = \phi_1\phi_2[pa_{12}m_1 + (1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2]. \tag{23}$$

Here, we assume that γ_i is sufficiently small, which leads to $\text{trace}\mathbf{J} < 0$ and $\det\mathbf{J} > 0$. The negative trace and positive determinant of the Jacobian matrix mean that the short-run equilibrium is locally stable. Moreover, we find from equations (20) and (21) that the positive determinant of the matrix is equivalent to a positive rate of capacity utilization.

3.2 Comparative static analysis in the short run

This subsection considers the effect of changes in the mark-up rate and wage standardization on the short-run equilibrium rate of capacity utilization. By substituting $\dot{u}_1 = 0$ into equation (15), we obtain $u_1 = (a_{12}u_2/k)$. This equation indicates that the rate of capacity utilization in sector 1 is proportionate to that in sector 2 in the short run. Since the changes in the mark-up rate and wage standardization shift both sectors' rates of capacity utilization in the same direction, this section considers only the rate of capacity utilization in sector 2.

Before starting the analysis, we introduce the following definition regarding the demand regime.

Definition 1. When a rise in the mark-up rate in one sector increases (decreases) the short-run equilibrium rates of capacity utilization in both sectors, the economy is called a profit-led (wage-led) demand regime.

The effect of a rise in the mark-up rate in sector 1 on the short-run equilibrium rate of capacity utilization in sector 2 is represented by

$$\frac{\partial u_2}{\partial \mu_1} = \frac{\sigma_1}{[pa_{12}m_1 + (1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2]^2}, \tag{24}$$

where

$$\begin{aligned}\sigma_1 = {} & \underbrace{\frac{\partial m_1}{\partial \mu_1}}_{+}\{k\beta_1[(1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2] - pa_{12}(k\alpha_1 + \alpha_2 + \beta_2 m_2)\} \\ & + \underbrace{\frac{\partial m_2}{\partial \mu_1}}_{+}\{\beta_2(pa_{12}m_1 - a_{12}\gamma_1 - \gamma_2) - (1 - pa_{12})[k(\alpha_1 + \beta_1 m_1) + \alpha_2]\}. \\ & + \underbrace{\frac{\partial p}{\partial \mu_1}}_{+} a_{12}\underbrace{(m_2 - m_1)}_{+}[k(\alpha_1 + \beta_1 m_1) + \alpha_2 + \beta_2 m_2]\end{aligned} \tag{25}$$

Equation (24) shows that σ_1 determines the sign of $\partial u_2 / \partial \mu_1$. In turn, the sign of σ_1 depends on the following five effects. The first term on the RHS of equation (25) includes two types of effects: via a rise in the profit share in sector 1, the effect of a rise in the mark-up rate in sector 1 on investment in sector 1[11] and the negative effect of a rise in the mark-up rate in sector 1 on the consumption of workers in sector 1. The second term also includes two types of effects: via a rise in the profit share in sector 2, the effect of a rise in the mark-up rate in sector 1 on investment in sector 2 and the negative effect of a rise in the mark-up rate in sector 1 on the consumption of workers in sector 2. The third term represents the positive effect of a rise in the mark-up rate in sector 1 on consumption via a rise in the relative price when $m_2 > m_1$ holds.[12] Note here that supposing $m_2 > m_1$ is realistic. By using equations (10) and (11), this inequality is rewritten as $(\mu_1 - \mu_2)b_2 < \mu_2(1 + \mu_1)a_{12}b_1\theta$. In reality, sector 1 is more competitive than sector 2, which implies that $\mu_1 - \mu_2 < 0$. Thus, we make the following assumption.

---

[11] Inequalities $\det \mathbf{J} > 0$ and $(1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2 < 0$ are compatible and thus the effect of a rise in the mark-up rate in sector 1 on investment in sector 1 is not always positive. Similarly, the effect of a rise in the mark-up rate in sector 1 on investment in sector 2, the effect of a rise in the mark-up rate in sector 2 on investment in sector 2, and the effect of wage standardization on investment in sector 2 are ambiguous. As a result, in contrast to the one-sector Kaleckian model (Blecker, 2002; Lavoie and Stockhammer, 2013), even if β_i is sufficiently large, a fall in the mark-up rate does not necessarily increase the rate of capacity utilization in our model. For instance, when $(1 - pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2 < 0$ holds, a larger β_1 tends to produce a wage-led demand regime.

[12] A rise in the mark-up rate in sector 1 increases the intermediate goods price, which in turn increases nominal income and accordingly raises workers' consumption in sector 1. On the contrary, a rise in the intermediate goods price decreases value added and thus workers' consumption in sector 2. When $m_2 > m_1$ holds, an increase in workers' consumption in sector 1 compensates for the decrease in workers' consumption in sector 2. As a result, a rise in the mark-up rate in sector 1 positively affects the rate of capacity utilization by increasing the relative price.

Assumption 1. Sector 1 is more competitive than sector 2 and thus $m_2 > m_1$ holds.

According to the combination of these five effects, the effect of a rise in the mark-up rate in sector 1 on capacity utilization can be positive or negative. If γ_i is sufficiently small, then the first and second terms on the RHS of equation (25) become positive, which implies that the economy exhibits a profit-led demand regime.

Next, the effect of a rise in the mark-up rate in sector 2 on the short-run equilibrium rate of capacity utilization in sector 2 is represented by

$$\frac{\partial u_2}{\partial \mu_2} = \frac{\sigma_2}{[pa_{12}m_1 + (1-pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2]^2}, \tag{26}$$

where

$$\begin{aligned}\sigma_2 = {} & \underbrace{\frac{\partial m_2}{\partial \mu_2}}_{+}\{\beta_2(pa_{12}m_1 - a_{12}\gamma_1 - \gamma_2) - (1-pa_{12})[k(\alpha_1 + \beta_1 m_1) + \alpha_2]\} \\ & + \underbrace{\frac{\partial p}{\partial \mu_2}}_{-} a_{12}\underbrace{(m_2 - m_1)}_{+}[k(\alpha_1 + \beta_1 m_1) + \alpha_2 + \beta_2 m_2]\end{aligned}. \tag{27}$$

The first term on the RHS of equation (27) includes two types of effects: via a rise in the profit share in sector 2, the effect of a rise in the mark-up rate in sector 2 on investment in sector 2 and the negative effect of a rise in the mark-up rate in sector 2 on the consumption of workers in sector 2. The second term indicates the negative effect of a rise in the mark-up rate in sector 2 on consumption via a fall in the relative price.[13] According to the combination of these three effects, a rise in the mark-up rate in sector 2 positively or negatively affects capacity utilization. If γ_i is sufficiently small, then the first term on the RHS of equation (27) becomes positive and a profit-led demand regime appears.

The effect of wage standardization on the short-run equilibrium rate of capacity utilization in sector 2 is represented by

$$\frac{\partial u_2}{\partial \theta} = \frac{\sigma_3}{[pa_{12}m_1 + (1-pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2]^2}, \tag{28}$$

where

[13] A rise in the mark-up rate in sector 2 increases the final goods price, which in turn decreases the real wage rate and accordingly reduces workers' consumption in sector 1. On the contrary, a rise in the final goods price increases value added and thus raises workers' consumption in sector 2. When $m_2 > m_1$ holds, the decrease in workers' consumption in sector 1 exceeds the increase in workers' consumption in sector 2. As a result, a rise in the mark-up rate in sector 2 negatively affects the rate of capacity utilization by decreasing the relative price.

$$\sigma_3 = \underbrace{\frac{\partial m_2}{\partial \theta}}_{+}\{\beta_2(pa_{12}m_1 - a_{12}\gamma_1 - \gamma_2) - (1 - pa_{12})[k(\alpha_1 + \beta_1 m_1) + \alpha_2]\} + \underbrace{\frac{\partial p}{\partial \theta}}_{+} a_{12}\underbrace{(m_2 - m_1)}_{+}[k(\alpha_1 + \beta_1 m_1) + \alpha_2 + \beta_2 m_2] \quad . \tag{29}$$

The first term on the RHS of equation (29) includes two types of effects: via a rise in the profit share in sector 2, the effect of wage standardization on investment in sector 2 and the negative effect of wage standardization on the consumption of workers in sector 2. The second term indicates the positive effect of wage standardization on consumption via a rise in the relative price.[14] If γ_i is sufficiently small, then the first term on the RHS of equation (29) becomes positive, which in turn increases the rate of capacity utilization when wage standardization occurs.

The diverse conditions under which these two types of demand regimes appear are summarized in Table 2. Changes in the mark-up rates in both the intermediate goods sector and the final goods sector can produce a profit-led demand regime as well as a wage-led demand regime.

(Table 2 here)

3.3 Summary

Let us now return to the problem of who should take responsibility for the cost reduction owing to price competition. In our model, there are four ways in which to reduce the final goods price: falls in the mark-up rate and the nominal wage rate in sector 1 and falls in the mark-up rate and the nominal wage rate in sector 2. Among these, a fall in the nominal wage rate in sector 2 does not affect the rate of capacity utilization. This is because a fall in the nominal wage rate in sector 2 decreases the final goods price, which remains both sectors' real wage rates unchanged, and a fall in nominal wage rate in sector 2 decreases both the nominal wage rate in sector 1 and that in sector 2 to the same degree, which keeps the relative price constant.[15] Thus, a cost reduction, which changes the rate of capacity utilization, can occur in

[14] Similar to a rise in the mark-up rate in sector 1, wage standardization, that is, a rise in the nominal wage rate in sector 1, increases the intermediate goods price. According to the mechanism explained in footnote 12, wage standardization positively affects the rate of capacity utilization by increasing the relative price.

[15] Because a fall in w does not always lead to a fall in p_2 to the same degree, the real wage rate can increase or decrease. For instance, when the decrease in w exceeds that in p_2, the real wage rate decreases, which means that either μ_1 or μ_2 increases. As a result, costs can reduce through falls in μ_1, μ_2, and θ.

the following ways: a fall in the mark-up rate in sector 1 (a fall in μ_1), a fall in the nominal wage rate in sector 1 (a fall in θ), and a fall in the mark-up rate in sector 2 (a fall in μ_2). In the following, we consider which of these three parameters should be reduced to positively affect the rate of capacity utilization.

To begin with, we compare the effects of a fall in μ_2 with a fall in θ. We find from equations (27) and (29) that the first terms on the RHS of both equations always show the same sign. For instance, when the first term on the RHS of equation (27) becomes positive, the first term on the RHS of equation (29) becomes positive. By contrast, the second term on the RHS of equation (27) is negative, whereas the second term on the RHS of equation (29) is positive. Therefore, compared with a fall in the nominal wage rate in sector 1, a fall in the mark-up rate in sector 2 is likely to increase the rate of capacity utilization in the short run.

Next, we compare the effects of a fall in μ_1 with a fall in μ_2. Since this comparison is more difficult, we additionally assume that γ_i is sufficiently small. The second term on the RHS of equation (25) shows the same sign as the first term on the RHS of equation (27). Moreover, the third term on the RHS of equation (25) is positive, whereas the second term on the RHS of equation (27) is negative. Furthermore, when γ_i is sufficiently small, we obtain $(1-pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2 > 0$, which makes the first term on the RHS of equation (25) positive. Thus, compared with a fall in the mark-up rate in sector 2, a fall in the mark-up rate in sector 1 is likely to decrease the rate of capacity utilization in the short run.

Finally, we compare the effects of a fall in μ_1 with a fall in θ. Here, we assume that γ_i is sufficiently large. The second term on the RHS of equation (25) shows the same sign as the first term on the RHS of equation (29). Moreover, both the third term on the RHS of equation (25) and the second term on the RHS of equation (29) are positive. Furthermore, if γ_i is sufficiently large, we obtain $(1-pa_{12})m_2 - a_{12}\gamma_1 - \gamma_2 < 0$, which makes the first term on the RHS of equation (25) negative. This means that, in sector 1, compared with a fall in the nominal wage rate, a fall in the mark-up rate is likely to increase the short-run equilibrium rate of capacity utilization.

We summarize the above arguments as follows.

Proposition 3. In the short-run equilibrium, if γ_i is sufficiently small, a fall in the mark-up rate in sector 2 comparatively increases the rate of capacity utilization. By contrast, if γ_i is sufficiently large, a fall in the mark-up rate in either sector is likely to increase the rate of capacity utilization compared with cutting the nominal wage rate in sector 1.

Consider the situation where anyone could be a victim of an income reduction to reduce the

final goods price. From Proposition 3, we find that firms in the final goods sector should take responsibility for the cost reduction by cutting their mark-up rate when γ_i is sufficiently small. On the contrary, when γ_i is sufficiently large, firms in either sector should take responsibility for the cost reduction and not shift their burden to the workers in the intermediate goods sector.

4 Long-run dynamics

4.1 Stability analysis

This section considers the long-run dynamics of the sectoral ratio of capital stocks. By substituting equations (20) and (21) into equations (12) and (13), we obtain each sector's rate of capital accumulation in the short run:

$$g_1 = \alpha_1 + \beta_1 m_1 + \gamma_1 \frac{\left[\alpha_1 + \beta_1 m_1 + (\alpha_2 + \beta_2 m_2)/k\right] a_{12}}{p a_{12} m_1 + (1 - p a_{12}) m_2 - a_{12}\gamma_1 - \gamma_2}, \tag{30}$$

$$g_2 = \alpha_2 + \beta_2 m_2 + \gamma_2 \frac{k(\alpha_1 + \beta_1 m_1) + \alpha_2 + \beta_2 m_2}{p a_{12} m_1 + (1 - p a_{12}) m_2 - a_{12}\gamma_1 - \gamma_2}. \tag{31}$$

We obtain the long-run dynamical equation by substituting equations (30) and (31) into equation (19). We define as the long-run equilibrium the situation where $\dot{k} = 0$ holds. In the long-run equilibrium, we find from equation (19) that a BGP, that is, $g_1 = g_2$, appears. Moreover, $dg_1/dk < 0$ and $dg_2/dk > 0$ from equations (30) and (31), and accordingly the following equation holds:

$$\frac{d\dot{k}}{dk} = \frac{dg_1}{dk} - \frac{dg_2}{dk} < 0. \tag{32}$$

Equation (32) shows that the long-run equilibrium is locally stable.

Equations (30) and (31) are depicted in Figure 1, in which the vertical axis indicates the rate of capital accumulation and the horizontal axis indicates the sectoral ratio of capital stocks. At the intersection point, e, between the two curves, we obtain the long-run rate of capital accumulation, that is, the rate of capital accumulation on the BGP, and the long-run sectoral ratio of capital stocks. By using this figure, we investigate the effect of changes in the mark-up rate and wage standardization on the long-run rate of capital accumulation and rate of capacity utilization.

4.2 Comparative static analysis

The long-run dynamics of the rate of capital accumulation are more difficult to investigate than the short-run dynamics of the rate of capacity utilization. In this section, to consider the more plausible case, we assume that γ_i is sufficiently small. Under this condition, as Table 2

shows, falls in the mark-up rate in both sectors and cutting the nominal wage rate in sector 1 (wage non-standardization) are likely to decrease both sectors' short-run equilibrium rates of capacity utilization. In other words, a profit-led demand regime is likely to appear. Moreover, as Proposition 2 shows, a fall in the mark-up rate in sector 1 decreases both sectors' profit shares and accordingly decreases both sectors' short-run rates of capital accumulation. Furthermore, a fall in the mark-up rate in sector 2 and cutting the nominal wage rate in sector 1 decrease the profit share in sector 2 and thus decrease both sectors' short-run rates of capital accumulation.

Figure 1 shows the case where in the profit-led demand regime a fall in the mark-up rate in either sector or cutting the nominal wage rate in sector 1 shifts both sectors' short-run equilibrium rates of capital accumulation downwards. In this figure, the rates of capital accumulation, which shifted after the mark-up rate rise, are represented by the dashed line and the long-run equilibrium moves from e_u to e'. Thus, in the profit-led demand regime, a fall in the mark-up rate in either sector or cutting the nominal wage rate in sector 1 always decreases the long-run equilibrium rate of capital accumulation. In addition, the long-run sectoral ratio of capital stocks depends on the movement of the short-run rate of capital accumulation. In Figure 1, since the rate of capital accumulation in sector 1 decreases more than that in sector 2, the sectoral ratio of capital stocks decreases. Equations (20) and (21) show that a fall in the sectoral ratio of capital stocks has a positive effect on the long-run rate of capacity utilization in sector 1 and a negative effect on that in sector 2. Thus, even if the economy exhibits a profit-led demand regime in the short run, a fall in the mark-up rate or wage *non*-standardization may increase only the long-run equilibrium rate of capacity utilization in sector 1.

(Figure 1 here)

Even if γ_i is small, a profit-led regime does not necessarily appear. We find from Proposition 3 that a fall in the mark-up rate in sector 2 tends to increase the short-run equilibrium rates of capacity utilization in both sectors rather than cutting the mark-up rate and nominal wage rate in sector 1 when γ_i is small. In other words, as for the change in the mark-up rate in sector 2, the economy is likely to exhibit a wage-led demand regime.[16] In such a wage-led demand regime with a fall in the mark-up rate in sector 2, the short-run rate of capital accumulation changes in two ways. The first pattern is that in both sectors the short-run rates of capital accumulation increase with the rising short-run rates of capacity utilization. The second pattern is that only the short-run rate of capital accumulation in sector 2 decreases because of the falling profit share in sector 2.

[16] We show such a case by using numerical simulations in Appendix C, which is available on request.

We consider the first pattern in Figure 2. Because a fall in the mark-up rate in sector 2 shifts both sectors' rates of capital accumulation upwards, which are represented by the dashed line, a long-run equilibrium shifts from e to e' and accordingly the long-run equilibrium rate of capital accumulation increases.

(Figure 2 here)

Next, we consider the second pattern in Figure 2. Since a rise in the mark-up rate in sector 2 increases capital accumulation in sector 1, which is represented by the dashed line, but decreases that in sector 2, which is represented by the dotted line, an equilibrium shifts from e to e'' and accordingly the long-run equilibrium sectoral ratio of capital stocks increases. In this situation, is the new equilibrium rate of capital accumulation larger than the old one?

Equation (30) shows that the larger $\alpha_2 + \beta_2 m_2$, the more quickly g_1 decreases with increasing k. Similarly, equation (31) shows that the larger $\alpha_1 + \beta_1 m_1$, the more quickly g_2 increases with increasing k. Accordingly, if the animal spirits in sector 1 (sector 2) are sufficiently large (small), the rate of capital accumulation in sector 2 (sector 1), which was temporally reduced (raised) by a mark-up rate rise in sector 2, rapidly increases (slackly decreases). According to the combination of such motions in g_1 and g_2, the new equilibrium e'' holds and thus the rate of capital accumulation on the BGP increases. Such a movement is intuitively explained as follows. A fall in the mark-up rate in sector 2 increases the short-run equilibrium rate of capital accumulation in sector 1, while it decreases the short-run equilibrium rate of capital accumulation in sector 2, which implies that capital stocks accumulate in sector 1 rather than in sector 2. Then, if the animal spirits in sector 1 are larger than those in sector 2, capital stocks accumulate in the sector where being eager to invest prevails and accordingly macroeconomic capital accumulation rises.

Finally, in the second pattern, a rise in the long-run sectoral ratio of capital stocks negatively affects the long-run rate of capacity utilization in sector 1 and positively affects the long-run rate of capacity utilization. Even if the economy exhibits a wage-led demand regime in the short run, a fall in the mark-up rate, especially in sector 2, may decrease only the long-run equilibrium rate of capacity utilization in sector 1. Thus, the short-run results are less reliable in the long run.

5 Conclusion

Even under modern capitalism where oligopolistic firms have dominated the market, price competition in both domestic and international markets does not easily disappear. In this study, we constructed a Kaleckian model with an intermediate goods sector and a final goods sector and considered the problem of who should take responsibility for the cost reduction owing to

price competition to maintain effective demand and economic growth. Our results are summarized as follows.

First, in the short run where capital does not accumulate, if the coefficient of the rate of capacity utilization in the investment function is sufficiently small, a fall in the mark-up rate in the final goods sector tends to increase the short-run rate of capacity utilization. This finding implies that firms in the final goods sector should bear the pain of price competition by cutting their mark-up rates. On the contrary, if the coefficient of the rate of capacity utilization in the investment function is sufficiently large, either firms in the intermediate goods sector or those in the final goods sector should take responsibility for reducing costs.

Second, compared with cutting the mark-up rate in either sector, a fall in the nominal wage rate in the intermediate goods sector is likely to reduce the short-run rate of capacity utilization. In this sense, workers in the intermediate goods sector should not bear the pain of price competition. On the contrary, wage standardization, that is, raising the nominal wage rate of the intermediate goods sector to the level of the final goods sector, positively affects the rate of capacity utilization. Wage standardization, however, requires consensus between workers in the intermediate goods sector and workers of the final goods sector because it raises the real wage rate in the former, but decreases that in the latter.

Finally, in the long run where capital accumulates, owing to the short-run effects, a fall in the mark-up rate in the final goods sector is likely to increase the rate of capital accumulation on the BGP when the coefficient of the rate of capacity utilization in the investment function is sufficiently small. Thus, to promote economic growth, firms in the final goods sector should be targeted for the cost reduction. Moreover, in the long run, a change in the sectoral ratio of capital stocks, which is caused by a change in the mark-up rate or wage standardization, moves each sector's rate of capacity utilization in the opposite direction. This phenomenon indicates that determining distributive policy by taking into account only one sector may be unsuitable for another sector's performance.

References

Amable, B., 2004. The Diversity of Modern Capitalism. Oxford University Press, Oxford.

Blecker, R.A., 1989. International competition, income distribution and economic growth. Camb. J. Econ. 13(3), 395–412.

Blecker, R.A., 2002. Distribution, demand and growth in neo-Kaleckian macro-models, in: Setterfield, A. (Ed.), The Economics of Demand-led Growth: Challenging the Supply-side Vision of the Long Run. Edward Elgar, Cheltenham, pp. 129–152.

Blecker, R.A., 2011. Open economy models of distribution and growth, in: Hein, E.,

Stockhammer, E. (Eds.), A Modern Guide to Keynesian Macroeconomics and Economic Policies. Edward Elgar, Cheltenham, pp. 215–239.

Boyer, R., 2000. Is a finance-led growth regime a viable alternative to Fordism? A preliminary analysis. Econ. Soc. 29 (1), 111–145.

Boyer, R., 2005. Coherence, diversity, and the evolution of capitalism: The institutional complementarity hypothesis. Evol. Inst. Econ. Rev. 2 (1), 43–80.

Bowles, S., Boyer, R., 1995. Wages, aggregate demand and employment in an open economy: An empirical investigation, in: Epstein, G., Gintis, H.E. (Eds.), Macroeconomic Policy after Conservative Era: Studies in Investment, Saving and Finance. Cambridge University Press, Cambridge, pp. 143–171.

Cassetti, M., 2012. Macroeconomic outcomes of changing social bargains: The feasibility of a wage-led demand open economy reconsidered. Metroeconomica 63 (1), 64–91.

Coutts, K., Norman, N., 2013. Post-Keynesian approaches to industrial pricing: A survey and critique, in: Harcourt, G.C., Kriesler, P. (Eds.), The Oxford Handbook of Post-Keynesian Economics Volume 1: Theory and Origins. Oxford University Press, Oxford, pp. 443–466.

Dutt, A.K., 1987. Competition, monopoly power and the uniform rates of profit. Rev. Radic. Polit. Econ. 19 (4), 55–72.

Dutt, A.K., 1988. Convergence and equilibrium in two sector models of growth, distribution and prices. J. Econ. 48 (2), 135–158.

Dutt, A.K., 1990. Growth, Distribution, and Uneven Development. Cambridge University Press, Cambridge.

Franke, R., 2000. Optimal utilization of capital and a financial sector in a classical gravitation process. Metroeconomica 51 (1), 40–60.

Fujimoto, T., 2012. Evolution of firms and industries. Evol. Inst. Econ. Rev. 9 (1), 1–10.

Hiromoto, T., 1988. Another hidden edge: Japanese management accounting. Harv Bus Rev. (July-August), 22-25.

Kalecki, M., 1971. Selected Essays on the Dynamics of the Capitalist Economy. Cambridge University Press, Cambridge.

Keynes, J.M., 1930. A Treatise on Money, Volume 1: The Pure Theory of Money. Macmillan, London.

Lavoie, M., 1992. Foundations of Post-Keynesian Economic Analysis. Edward Elgar, Aldershot.

Lavoie, M., 2009. Cadrisme within a post-Keynesian model of growth and distribution. Rev. Polit. Econ. 21 (3), 369–391.

Lavoie, M., 2014. Post-Keynesian Economics: New Foundations. Edward Elgar, Cheltenham.

Lavoie, M., Ramírez-Gastón, P., 1997. The traverse in a two-sector Kaleckian model of growth with target return pricing. The Manchester School 55 (2), 145–169.

Lavoie, M., Stockhammer, E., 2013. Wage-led growth: Concept, theories and policies, in: Lavoie, M., Stockhammer, E. (Eds.), Wage-led Growth: An Equitable Strategy for Economic Recovery. Palgrave Macmillan, Basingsoke, pp. 13–39.

Lee, F.S., 1998. Post Keynesian Price Theory. Cambridge University Press, Cambridge.

Marglin, S., Bhaduri, A., 1990. Profit squeeze and Keynesian theory, in: Marglin, S., Shor, J. (Eds.), The Golden Age of Capitalism: Reinterpreting the Postwar Experience. Oxford University Press, Oxford, pp. 153–186.

Missaglia, M., 2007. Demand policies for long-run growth: Being Keynesian both in the short and in the long run. Metroeconomica 58 (1), 74–94.

Nishi, H., 2010. Institutional hierarchy hypothesis, multilayered adjustment, and economic growth: A post-Keynesian dynamic approach. Evol. Inst. Econ. Rev. 7 (1), 155–171.

Rowthorn, R.E., 1981. Demand, real wages and economic growth. Thames Papers in Political Economy, Autumn.

Sasaki, H., Matsuyama, J., Sako, K. 2013a. The macroeconomic effects of the wage gap between regular and non-regular employment and of minimum wages. Struct. Chang. Econ. Dyn. 26, 61–72.

Sasaki, H., Sonoda, R., Fujita, S., 2013b. International competition and distributive class conflict in an open economy Kaleckian model. Metroeconomica 64 (4), 683–715.

Sen, A., Dutt, A.K., 1995. Bargaining power, imperfect competition and the markup: Optimizing microfoundations. Econ. Lett. 48 (1), 15–20.

Stockhammer, E., Onaran, O., 2004. Accumulation, distribution and employment: A structural VAR approach to a Kaleckian macro model. Struct. Chang. Econ. Dyn. 15 (4), 421–447.

Storm, S., Naastepad, C.W.M., 2012. Macroeconomics Beyond the NAIRU. Harvard University Press, Cambridge MA.

Taylor, L., 1989. Demand composition, income distribution and growth, in: Feiwel, G.R. (Ed.), Joan Robinson and Modern Economic Theory. Macmillan, Basingstoke, pp. 623–637.

Taylor, L., 2004. Reconstructing Macroeconomics: Structuralist Proposals and Critiques of the Mainstream, Harvard University Press, Cambridge MA.

Figures and Tables

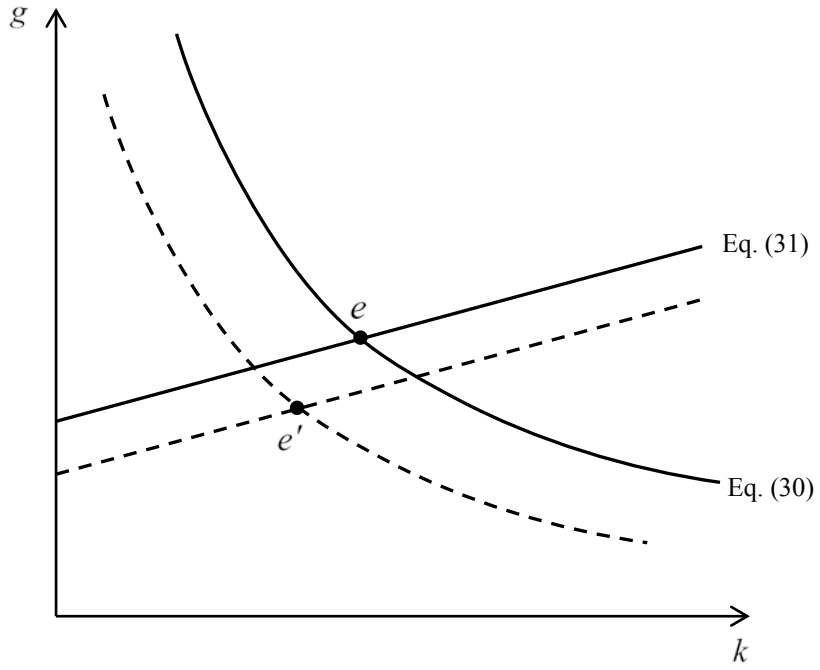

Figure 1: The long-run equilibrium under the profit-led demand regime

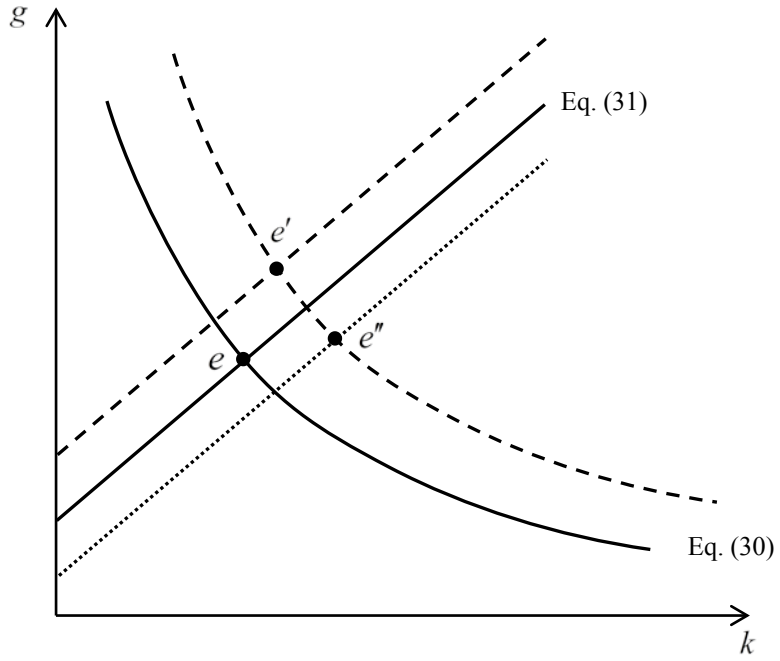

Figure 2: The long-run equilibrium under the wage-led demand regime

		Intermediate demand		Final demand		Total output
		Sector 1	Sector 2	Consumption	Investment	
Intermediate input	Sector 1	0	$p_1 a_{12} X_2$	0	0	$p_1 X_1$
	Sector 2	0	0	$p_2 C$	$p_2 (I_1 + I_2)$	$p_2 X_2$
Value added	Wages	$w_1 b_1 X_1$	$w_2 b_2 X_2$			
	Profits	$\mu_1 w_1 b_1 X_1$	$\mu_2 (p_1 a_{12} + w_2 b_2) X_2$			
Total output		$p_1 X_1$	$p_2 X_2$			

Table 1: Hypothetical two-sector transaction table

	Impact on capacity utilization	Demand regime	Conditions
A rise in μ_1	Rises in u_1 and u_2	Profit-led	γ_1 and γ_2 are small Positive effect of the relative price is likely to raise u_1 and u_2
	Falls in u_1 and u_2	Wage-led	γ_1 and γ_2 are large
A rise in μ_2	Rises in u_1 and u_2	Profit-led	γ_1 and γ_2 are small
	Falls in u_1 and u_2	Wage-led	γ_1 and γ_2 are large Negative effect of the relative price is likely to reduce u_1 and u_2
A rise in θ	Rises in u_1 and u_2		γ_1 and γ_2 are small Positive effect of the relative price is likely to raise u_1 and u_2
	Falls in u_1 and u_2		γ_1 and γ_2 are large

Table 2: Demand regime in the short-run equilibrium