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Abstract

This study explores the effects of macroeconomic policies on measures of macroeconomic performance such as growth and inflation by setting up a dynamic post-Keynesian model with government and central bank interventions. In doing so, this study reconsiders the arguments in favor of a policy regime.

The model in this paper generates several varieties of economic growth regimes and inflation dynamics. The economic growth regimes are defined by the relationship between economic growth, the income distribution, and government debt finance. In this paper, the income distribution-growth regimes are the wage-led and profit-led growth regimes. The debt-growth regimes are the debt-led and debt-burdened growth regimes. Moreover, the inflation dynamics are derived from the institutional configuration of the labor market. Specifically, the relevant labor market institutions are the bargaining position of workers and employment security.

In this setting, this paper reconsiders the discussion of the policy regime. According to Adam Przeworski, a policy regime is defined as an equilibrium in which policies are similar across different parties. To examine whether such a political constellation has a favorable effect on macroeconomic performance, this paper considers macroeconomic policies based on different types of monetary and fiscal policy rules. Specifically, this paper compares three types of post-Keynesian interest rate policy rules, the Smithin rule, the Pasinetti rule, and the Kansas City rule.

Using a theoretical analysis, this paper reveals that these interest rate policy rules and fiscal policies have different impacts on inflation and the economic growth rate. Moreover, this result has an important implication for the discussion of the policy regime. If the policy regime is defined as an equilibrium in which policies are similar across different parties, such a regime may not always improve macroeconomic performance. A macroeconomic policy should be compatible with the type of growth regime and inflation dynamics. An economic policy may be effective under one economic growth regime but not under another, so always sticking to the same policy may not produce optimal results. This implication questions the desirability of a policy regime. This paper concludes that there is no one best policy for growth and inflation and that a policymaker should choose economic policies by considering the economic growth regime. In this sense, the economic growth regime and the policy regime are interdependent.

1 Introduction

This paper investigates the relationship between economic policy and macroeconomic performance. Thus, the purpose of this paper is to contribute to current research on the policy regime from the viewpoint of post-Keynesian economics.

The mechanisms of growth and business cycles have been revealed by post-Keynesian economics based on the income distribution and finance. Since Rowthorn (1981), a number of post-Keynesian models have examined the relationship between the income distribution and aggregate demand. It has been almost fully shown that there are two types of growth and demand regimes, wage-led (stagnationist) and profit-led (exhilarationist), according to the parameter constellation of the investment and saving functions. A wage-led growth regime indicates an economy in which a rise in the profit share (a fall in the wage share) lowers the rate of output growth, and a profit-led regime indicates an economy in which a rise in the profit share raises the rate of output growth. Representative theoretical analyses include Bhaduri and Marglin (1990), Lavoie (1992), and Dutt (2012). Moreover, recent empirical studies include Stockhammer and Onaran (2004), Naastepad and Storm (2007) and Nishi (2011), which show that the income distribution-growth regime differs across countries and periods.

Post-Keynesians have also examined macroeconomic performance in terms of the link between firm or government debt accumulation and economic growth. When increases in the debt-capital ratio and the interest rate raise the rate of output growth, economic growth is debt-led. The economy is correspondingly called debt-burdened if increases in the debt-capital ratio and the interest rate decrease the rate of output growth. Theoretical models that consider the effect of firms' debt accumulation on economic growth include Taylor (2004), Hein (2007), and Sasaki and Fujita (2012). You and Dutt (1996) examines the effect of government debt on macroeconomic performance. Hein and Schoder (2011) empirically investigates whether the debt-growth regime of Germany is a debt-burdened growth regime. Nishi (2012) also finds that Japan has a debt-burdened growth regime.

Most of these studies do not investigate the effect of policy interventions. However, some recent post-Keynesian studies do reveal the relationship between economic performance and economic policy, especially by focusing on the monetary policy rule and on fiscal policy (Rochon and Setterfield (2007); Setterfield (2009b); Rochon and Setterfield (2012)).

With regard to monetary policy, Rochon and Setterfield (2007), Gnos and Rochon (2007) and Rochon and Setterfield (2012) argue that there are two post-Keynesian approaches. One is the activist approach, which advocates the use of fiscal policy

and believes in the ability of central banks to fine-tune economic outcomes using a pro-cyclical interest policy. This type of policy is discussed in Moore (1988). The other is the parking-it approach, which proposes to park the interest rate at a given level. According to this view, monetary policy is not an appropriate tool for controlling aggregate output but rather is primarily a distributive variable operating on the income distribution. Instead, real stabilization of GDP growth and employment control should be delegated to fiscal policy.

The representative parking-it approaches are the Kansas City, Smithin, and Pasinetti rules. These three rules have different and important implications for the class distribution. The Smithin and Kansas City rules try to euthanize the rentiers class by keeping the interest rate as low as possible, whereas the Pasinetti rule says that rentiers are a necessary evil and that the interest rate should be set to maintain a constant income distribution between rentiers and non-rentiers (Rochon and Setterfield (2007); Rochon and Setterfield (2012)). Post-Keynesians have presented these monetary policy rules as alternatives to the so-called new consensus model.[1] These arguments are also important in comparing the desirability of economic policies for macroeconomic performance.

This paper examines the effectiveness of economic policy in light of the discussion of the policy regime that originated in Przeworski (2000) and Przeworski (2010). According to Przeworski (2000), the policy regime is a temporary equilibrium in which policies differ little across parties (*ibid*, p.314). For example, Przeworski (2010) summarizes the historical change in the policy regime as follows. Between the end of World War I and the 1930s, the government followed the principle of a balanced budget and deflationary and anti-crisis policies. After World War II, the social democratic idea that capitalist economies can be controlled by active Keynesian demand managing dominated. However, since the end of golden age of capitalism, neoliberals, who suggest privatizing, reducing public expenditures, and letting the market do the rest, have been dominant. According to Przeworski (2010), a change in the policy regime typically occurs due to crisis. For instance, the change to a Keynesian regime was due to the Great Depression of the early 1930s, and the oil crisis of the 1970s brought neoliberalism.[2] In addition, a party needs responsibility, good

[1] According to Rochon and Setterfield (2012) and Lavoie (2009), the theoretical components of the new consensus model are the NAIRU, inflation targeting, and an interest rate policy given by the Taylor rule, which supposes the existence of a Wicksellian natural rate. Post-Keynesians have a critical attitude regarding the existence of supply-side determined NAIRU and the natural interest rate (Gnos and Rochon (2007); Rochon and Setterfield (2012)). As an answer to the Smithin question of what the long-run equilibrium interest rate would be in the absence of a Wicksellian natural rate, post-Keynesians have presented three types of interest rate policy rules.

[2] Glyn (2006) presents historical changes in the political goals in advanced countries. In this con-

ideas, and luck in order to innovate policy (*ibid*, p.7).

Thus, on one hand, there are diverse economic growth regimes, but on the other hand, there is the notion of a policy regime. However, the relationship between the two concepts has not been examined in full detail. This may be partially because the concept of a policy regime is relatively new. It may also be partially because the idea of a policy regime originates from political scientists, whereas that of a growth regime comes from economists. This paper also attempts to theoretically reconsider the role of economic policy in macroeconomic performance, specifically asking whether there are situations in which similar policies are desirable for macroeconomic performance and what the relationship between a policy regime and an economic growth regime is. For these purposes, this paper expands the post-Keynesian growth model by also considering the impacts of various monetary policy rules as well as fiscal policies on macroeconomic performance. This paper concentrates on a theoretical analysis, leaving historical, political, and empirical analysis to other studies.

The organization of this paper is as follows. Section 2 sets-up a dynamic macroeconomic model under different post-Keynesian interest rate rules. Section 3 first considers the dynamic properties of the model and then presents the main results of the comparative statics under different post-Keynesian interest rate rules for each growth regime and type of inflation dynamics. Section 4 summarizes the main results and gives implications for the policy regime. Section 5 concludes.

2 Set-up of the Model

I first list the main notations used in this paper. X is output (total income), $X^*$is potential output, K is capital stock, E is the effective employment level, $1-\pi$ is the wage share, π is the profit share, $X^*/K = \nu$ is the potential output-capital ratio (constant and set as unity for simplicity), $u = X/K$ is the output-capital ratio (effective demand), $r = \pi u$ is the profit rate, C is aggregate consumption, S is total savings, I is investment demand, G is government expenditures, D is government debt, T is tax revenue, g is the rate of capital accumulation, w is the nominal wage, p is the price level, q is labor productivity, i is the nominal interest rate, λ is the government debt-capital ratio, and t is time.

I set up a dynamic post-Keynesian growth model in discrete time. The model considers a closed economy in which workers, capitalist-rentiers, firms, the government, and banks (including the central bank) coexist. Workers supply labor and re-

text, he explains the growth and crises of these countries in the Golden Age and the neoliberal era.

ceive wages, and capitalist-rentiers, who are unproductive, finance-engaging actors, receive the profits. The capitalist-rentiers also have government bonds and receive interest income iD. In this sense, capitalists are also rentiers in this model. Workers and capitalist-rentiers also pay taxes from their incomes. The tax rate for workers' wage income is t_w, and the tax rate for capitalist-rentiers' profit income is t_c. I assume that no tax is imposed on interest income. Workers consume all their disposable income, and capitalist-rentiers save a fraction of s of their profit and interest income. Firms invest and produce a good with a fixed coefficient production function. It is also assumed that the goods market is imperfectly competitive, and firms set prices according to a mark-up pricing rule. The government receives the tax revenues from workers and capitalist-rentiers and makes expenditures. The central bank sets the nominal interest rate according to the rules of monetary policy. The existence of banks is assumed implicitly because their activities are not formalized explicitly in the model.

The model generates the varieties of economic growth regimes and inflation dynamics. The growth regimes are defined by the relationship between income distribution and government debt finance. In this paper, the income distribution-growth regimes are the wage-led and profit-led growth regimes. The debt-growth regimes are the debt-led and debt-burdened growth regimes. Moreover, the inflation dynamics are derived from the institutional configuration of the labor market. Specifically, the model includes workers' bargaining positions and the effectiveness of employment security.

In this setting, the macroeconomic policies considered in this paper include the different types of monetary policy rules as well as fiscal policy. To understand the effect of fiscal policy, I introduce the effects of government expenditures and taxation. The type of taxation depends on the institutional choices of the tax system, as I will explain later. As for monetary policy, I will compare the Smithin rule, the Pasinetti rule, and the Kansas City rule, which are the three types of post-Keynesian interest rate rules. In doing so, this paper reveals which of these rules has the most favorable impact on economic growth and inflation in an economy.

I briefly summarize the relationship between the existing literature and the current study. The model is developed based on Setterfield (2009a) and Rochon and Setterfield (2012). This paper contains a novel dynamic analysis of the various economic growth regimes and inflation dynamics given the institutional foundations of the economy. Although Setterfield (2009a) and Rochon and Setterfield (2012) consider varieties of inflation dynamics, they do not take the different varieties of economic growth into account. That is, their models describe only wage-led and debt-

burdened economies. This formalization has two major problems. First, it cannot explain the mechanisms of debt-led and profit-led economies, although the studies cited in the introduction demonstrate that these growth regimes exist theoretically and empirically. Second, the models of Setterfield (2009a) and Rochon and Setterfield (2012) focus only on the steady state of the economy and do not investigate the transitional dynamics outside of the steady state. Therefore, they cannot examine in detail the stability of an economy following a shock. Moreover, these models do not sufficiently consider the institutional foundations of the economy but rather only consider wage-price bargaining. However, other institutional foundations, such as the tax system and employment security, are also important for macroeconomic performance. For instance, Blecker (2002) shows that the tax system plays an important role in the income distribution-growth regime. Moreover, Nishi (2010) explains that the degree of employment security affects the shape of the Phillips curve. The importance of changes in these two institutions after the 1970s can also be found in Bresser-Pereira (2012). He explains, for example, that the tax system became less progressive and the labor market was deregulated in the neoliberal era. Thus, the rentier-financier coalition attacked the workers and the welfare state.

In order to overcome these problems, this paper extends a dynamic macroeconomic model that generates not only wage-led and debt-burdened growth regimes but also profit-led and debt-led growth regimes. In addition, this study considers the dynamic process of an economy leading to a steady state. Furthermore, this paper introduces the tax system and employment security as important institutions of an economy, both of which impact the determination of effective demand and inflation dynamics. In doing so, this paper investigates the effect of each type of macroeconomic policy on macroeconomic performance in a dynamic context.

2.1 Income Distribution, Employment System, and Inflation

The model of income distribution and inflation is based on the following wage and price equations:

$$\hat{w}_t = \mu\left(\pi_t - \pi_w + \hat{q}_t + \hat{p}^E_{t+1}\right) \tag{1}$$

$$\hat{p}_t = \psi(\pi_F - \pi_t) + \hat{w}_{t-1} - \hat{q}_{t-1} \tag{2}$$

where the hat symbol on a variable denotes its growth rate in difference form. For example, $\hat{w}_t = \Delta w_t / w_t$ is the growth rate of nominal wages; π_W is the target profit share of workers; $\pi \in (0, 1)$ is the actual profit share; $\hat{q}_t$ is the growth rate of labor productivity; $\hat{p}^E_{t+1}$ and $\hat{p}_t$ denote the expected and actual rates of inflation, respectively; and π_F is the target profit share of firms. In the following analysis, we assume

that $\pi_F > \pi_W$. This assumption is reasonable, as firms attempt to set their targets as high as possible, whereas workers attempt to set their targets as low as possible. $\mu \in (0,1)$ denotes the relative power of workers in wage bargaining, and $\psi \in (0,1)$ reflects the monopoly power of firms vis-a-vis the goods market (specifically, their ability to increase prices in excess of increases in unit labor costs).

Equation (1) shows that the growth rate of nominal wages is increasing in productivity growth, expected inflation, and the difference between workers' target profit share and their actual profit share. Equation (2) shows that inflation varies in proportion to the growth rate of unit labor costs in the previous period and is also influenced by any discrepancy between the actual and target profit shares of firms. The assumptions that $\mu \in (0,1)$ and $\psi \in (0,1)$ mean that there is an absence of full indexation in both wage- and price-setting behavior, although we assume that firms can adjust the growth rate of price based on changes in unit labor costs in the previous period. These formalizations imply that the determination of the income distribution is conflictive. If the actual profit share is larger than workers' desired share, they attempt to increase their wage share by raising the wage rate. In contrast, if the actual profit share is smaller than firms' desired share, they attempt to increase their profit share by raising the price.

The steady state of distribution is defined as the state in which the profit share is constant and the price dynamics remain constant, i.e., for any t, $\hat{w} - \hat{q} = \hat{p}$ and $\hat{p}^E_{t+1} = \hat{p}_t$ are satisfied.[3] Equation (2) gives $\hat{p}_t = \psi(\pi_F - \pi_t) + \hat{p}_t$ in the steady state. Therefore, $\pi^*_t = \pi_F$, which is given exogenously. By using equation (1), the wage dynamics can be obtained from the following equation:

$$\hat{w_t} = \frac{\mu}{1-\mu}(\pi_F - \pi_w) \tag{3}$$

Using these equations, the price dynamics in the steady state follows

$$\hat{p}_t = \frac{\mu}{1-\mu}(\pi_F - \pi_w) - \hat{q}_{t-1} \tag{4}$$

The relationship between the income distribution, inflation, and the employment system is explored in this paper. To consider the effect of the employment system on the other two variables, I introduce the following equation:

$$\hat{E}_t = \gamma_0 \hat{X}_t, \tag{5}$$

[3]This paper derives the inflation dynamics on the condition that the income distribution share becomes constant in the steady state. In the stable case, the inflation rate also becomes constant at the steady state, which is consistent with this assumption. However, this result does not hold in the unstable case. I will show these results in section 3.

in which the degree of employment security is measured by the value of $\gamma_0 \in (0, 1)$. If employment security is high, the value of γ_0 is small. In this case, employment changes less than the change in output fluctuation. In contrast, when employment security is small and the labor market is fluid, γ_0 takes a large value. In this case, employment changes as much as output fluctuation. That is, employment adjustment occurs almost in accordance with the business cycle.

The degree of employment security affects labor productivity. The growth rate of labor productivity at $t-1$ is given by $\hat{q}_{t-1} = \hat{X}_{t-1} - \hat{E}_{t-1}$. With equation (5), it is written as

$$\hat{q}_{t-1} = (1 - \gamma_0)\hat{X}_{t-1} \tag{6}$$

Since capacity utilization u is assumed to be adjusted simultaneously and is constant at each time, as I will explain in the next section, $\hat{X}_{t-1} = \Delta K_{t-1}/K_{t-1} = g_{t-1}$ is satisfied. Therefore, the dynamics of labor productivity are derived as follows:[4]

$$\hat{q}_{t-1} = (1 - \gamma_0)g_{t-1} \tag{7}$$

Finally, workers' target share of profit is assumed to depend on the economic growth rate in the previous period. When an economy is booming and the growth rate is high, the labor market becomes tight and workers have more bargaining power. Therefore, they can set their target profit share at a lower level (target wage share at a higher level). This relationship can be summarized as follows:

$$\pi_W = \pi(g_{t-1}), \tag{8}$$

where $d\pi_W/dg_{t-1} = \pi'(g_{t-1}) < 0$. It is also assumed for simplicity that $d^2\pi_W/dg_{t-1}^2 = \pi''(g_{t-1}) = 0$.

Using equations (3), (4) and (7), the price dynamics follow the following equation:

$$\hat{p}_t = \frac{\mu}{1-\mu}(\pi_F - \pi(g_{t-1})) - (1 - \gamma_0)g_{t-1} \tag{9}$$

Following Setterfield (2009a) and Rochon and Setterfield (2012), I call this the inflation frontier equation. This frontier will be depicted in the $(\hat{p}, g)$ plane. The slope of this frontier depends on the relative strength of workers' bargaining power

[4]Setterfield (2009a) and Rochon and Setterfield (2012) derive the dynamics of labor productivity on the basis of the technological progress function. However, productivity is affected not only by this technical aspect but also by institutional factors in the labor market such as employment security. I emphasize the latter in this paper for the determination of labor productivity, although the derived equation takes the same form.

and the degree of employment security. Differentiating equation (9) with respect to g_{t-1}, I obtain:

$$\frac{d\hat{p}_t}{dg_{t-1}} = -\left(\underbrace{\frac{\mu}{1-\mu}\pi'(g_{t-1}) + (1-\gamma_0)}_{(-)+(+)} \right) \tag{10}$$

If workers' bargaining power is strong (i.e., a large value of μ and a large absolute value of $\pi'(g)$) and employment security is weak (i.e., a large value of γ_0), then the sign of equation (10) tends to be positive. In this case, when the economy is booming and the growth rate is high, the product of the high growth rate will be absorbed by the change in employment because employment is flexible because of a low degree of employment security. As a result, the change in labor productivity will be small. In addition, as workers' bargaining power grows stronger, a small rise in the growth rate easily raises the target wage share of workers (i.e., lowers the target profit share of workers), which in turn raises the change in the wage rate. As a result of the rise in unit labor costs, the inflation rate becomes higher. In this case, the slope of the inflation frontier becomes positive in the ($\hat{p}$, g) plane. Thus, it is clear that both wage bargaining and employment security are important institutional factors for determining inflation dynamics.

2.2 Effective Demand and the Tax System

Workers obtain wages $(1-\pi)X$, pay taxes at the rate t_w, and spend all their disposable income. Capitalist-rentiers receive profit income πX and interest income iD from holding government debt. They also pay taxes on profit income at the rate t_c and spend a constant fraction of their income $1-s$. The total consumption is then:

$$C_t = (1-t_w)(1-\pi)X_t + (1-s)[(1-t_c)\pi X_t + iD] \tag{11}$$

Firms are the actors of productive investment. We assume that the firms' investment function increases with capacity utilization:

$$\Delta K_t = I_t = (\alpha_0 + \alpha_1 u_t)K_t \tag{12}$$

where $\alpha_0 > 0$ represents the Keynesian animal spirits of entrepreneurs or the state of business confidence. This is a basic investment function that depends only on the capacity utilization rate where $\alpha_1 > 0$.[5] Such a model is used in Dutt (2011),

[5]If we take $\alpha_0 = -\alpha_1 u_N$, where u_N is the normal rate of capacity utilization, equation (12) can be seen as an investment function that positively depends on the gap between the actual rate of capacity utilization and the normal rate. This formalization is used in post-Keynesian models that consider the long-run properties of the economy (Lavoie (2010))

although other formalizations, like Bhaduri and Marglin (1990), which includes both capacity utilization and profit share, are used widely. However, as the Bhaduri and Marglin type of investment gives complicated results and calculations, this paper uses a simple accelerator principle for the investment function.

I introduce the following government spending function:

$$G_t = \gamma_1 K_t - \gamma_2 iD \tag{13}$$

The effect of expansive fiscal policy is captured by a rise in γ_1, and that of the debt burden is captured by γ_2. This formalization means that the government increases its expenditures using fiscal policy, whereas it restrains its expenditures when there is a rise in the interest rate or government debt, for example, so as to avoid future government deficits. Thus, a rise in debt lowers government expenditures.

As a fiscal policy, the tax system is also introduced into the model according to the formalization from Blecker (2002). As assumed above, the government levies income taxes at the rate t_c on profits and t_w on wages. Then, the tax revenue is equal to:

$$T_t = t_w(1-\pi)X_t + t_c \pi X_t \tag{14}$$

Finally, the goods market-clearing condition is defined as follows:

$$\frac{X_t}{K_t} = \frac{C_t + I_t + G_t}{K_t} \tag{15}$$

By substituting equations (11), (12), and (13) into equation (15), the equilibrium condition is obtained as follows:

$$u_t = \frac{\alpha_0 + \gamma_1 + (1 - s - \gamma_2) i\lambda}{t_w - \alpha_1 + \pi\sigma} \tag{16}$$

where $\sigma(t_c, t_w) = t_c - t_w + s(1 - t_c) \gtrless 0$. Given t_c, an increase in t_w reduces the value of σ, and given t_w, an increase in t_c increases the value of σ. As I will explain below, the tax system concerns the types of demand and economic growth regimes. I also assume that $Z = t_w - \alpha_1 + \pi\sigma > 0$ by the Keynesian stability condition and that the numerator takes a positive value. I assume that the capacity utilization is adjusted simultaneously in each time period.

By differentiating equation (16) with respect to the profit share, the relationship between income distribution and capacity utilization can be obtained:

$$\frac{\partial u_t}{\partial \pi} = -\frac{1}{Z^2}\left[\alpha_0 + \gamma_1 + (1 - s - \gamma_2) i\lambda\right]\sigma \tag{17}$$

Therefore, if $\sigma > 0$, then $\partial u_t / \partial \pi_t < 0$. I call this case wage-led capacity utilization (WLCU), which tends to occur when the tax rate on profits is relatively high. On

the contrary, if $\sigma < 0$, then $\partial u_t/\partial \pi_t > 0$. I call this case profit-led capacity utilization (PLCU), which tends to occur when the tax rate on wages is relatively high. Thus, the demand formation is not independent of the institutional structure of the tax system. If wages are taxed at a higher rate than profit income, the economy tends to be a PLCU regime, but if profits are taxed at a higher rate, the economy tends to be a WLCU regime.[6]

Similarly, it is possible to obtain the relationship between capacity utilization and government debt ratio:

$$\frac{\partial u_t}{\partial \lambda} = \frac{(1 - s - \gamma_2)i}{Z} \tag{18}$$

This equation shows that a rise in the debt ratio leads to an increase in the capacity utilization rate in the case where $1 - s - \gamma_2 > 0$, and it leads to a decrease in the capacity utilization rate in the case where $1 - s - \gamma_2 < 0$. I call the former case a debt-led capacity utilization (DLCU) regime and the latter case a debt-burdened capacity utilization (DBCU) regime. These conditions directly affect the debt-growth regimes that will be shown below.

When the capacity utilization rate is constant, the capital accumulation rate can also be determined as follows:

$$\frac{\Delta K_t}{K_t} = \frac{I_t}{K_t} = g_t = \alpha_0 + \alpha_1 \left(\frac{\alpha_0 + \gamma_1 + (1 - s - \gamma_2)i\lambda}{Z} \right) \tag{19}$$

From equation (17), it is clear that the WLCU conditions lead to a wage-led growth (WLG) regime and that the PLCU conditions lead to a profit-led growth (PLG) regime. Therefore, the institutional structure of the tax system also affects the income distribution-growth regime.

I rewrite this equation as follows:

$$g_t = \alpha_0 + \frac{\alpha_1(\alpha_0 + \gamma_1)}{Z} + \frac{\alpha_1(1 - s - \gamma_2)}{Z} i\lambda = A + Bi\lambda \tag{20}$$

where $A = \alpha_0 + \alpha_1(\alpha_0 + \gamma_1)/Z > 0$ and $B = \alpha_1(1 - s - \gamma_2)/Z \gtrless 0$. The sign of B determines the debt-growth regime. If $B > 0$, an increase in government debt or the interest rate leads to an increase in the growth rate. I call this case a debt-led growth regime (DLG regime). In contrast, when $B < 0$, an increase in government debt or the interest rate leads to a fall in the growth rate. I call this case a debt-burdened growth regime (DBG regime). These results also correspond to DLCU

[6]Blecker (2002) calls the case where wage and profit income are taxed at relatively similar rates a regressive tax system, and he calls the case where the tax rates are not unequal a progressive tax system. His model also shows that a more regressive tax system makes the economy more likely to be a PLCU regime.

and DBCU, respectively. The former is established when capitalist-rentiers consume their interest payments. In contrast, the latter is established when government debt burdens its expenditures.

Economic growth is not yet fully determined in this formalization, which just deals with interest rate determination and inflation dynamics. In the next subsection, I will investigate this issue by focusing on the types of monetary policy.

2.3 Types of Monetary Policy Rule and Economic Growth

Monetary policy is set in an endogenous money environment in which the long-run interest rate is set by the central bank's policy instrument.[7] Based on the following benchmark interest rate rule, I can derive the three types of interest rate policy rules:

$$i = \beta_q \hat{q}_t + \beta_p \hat{p}_t$$

As the growth rate of labor productivity is affected by the degree of employment security through equation (7), this equation can be rewritten as follows:

$$i = \beta_q (1 - \gamma_0) g_t + \beta_p \hat{p}_t \tag{21}$$

Following Rochon and Setterfield (2007), three types of post-Keynesian interest rate setting rules are introduced. First, the Smithin rule suggests that the nominal interest rate should be set to be just equal to the inflation rate. In equation (21), this rule is given by $\beta_p = 1$ and $\beta_q = 0$. Therefore, the interest rate is set as $i = \hat{p}_t$. In this setting, the real interest rate is targeted to be zero. In doing so, the Smithin rule advocates eliminating the rentiers while realizing stable inflation and high economic growth (Atesoglu and Smithin (2006)).[8]

Second, the Kansas City rule suggests that the nominal interest rate should be zero, leaving the real rate negative. That is, $\beta_p = \beta_q = 0$. Consequently, the interest rate is set as $i = 0$. Under the Kansas City rule, the economic growth pattern is independent of financial factors because the nominal interest rate is set to zero and

[7] In an endogenous money environment, any creditworthy demand for loans from the non-financial sector elicits a supply response from commercial banks that results in an endogenous variation of the money supply, which is accommodated by the central bank at an interest rate (Fontana and Setterfield (2009b)).

[8] This rule is suggested in Smithin (2004), for example. To be more precise, he suggests that the real interest rate should be set at a low but still positive value. However, because the result does not change even if we consider a positive exogenous value of the real interest rate, the real interest rate is set at zero for simplicity.

changes in government debt or the interest rate do not affect the real side of the economy.[9] [10]

Finally, the Pasinetti rule stipulates that the real rate should be set to equal to labor productivity growth. $\beta_p = \beta_q = 1$. As the result, the interest rate is set as $i = \hat{p}_t + (1 - \gamma_0)g_t$. The essential purpose of the Pasinetti rule is to set the interest rate to keep the value of any initially outstanding debt stock measured in wage units constant over time.[11]

By substituting equation (21) into equation (20) and arranging it with respect to g_t, I obtain the equation that describes the relationship between economic growth and inflation:

$$\begin{aligned} g_t &= A + B[\beta_q(1 - \gamma_0)g_t + \beta_p\hat{p}_t]\lambda \\ &= \frac{1}{1 - B\beta_q(1 - \gamma_0)\lambda}\left(A + B\beta_p\lambda\hat{p}_t\right) \end{aligned} \tag{22}$$

where it is assumed that $1-B\beta_q(1-\gamma_0)\lambda > 0$ in order to obtain economically meaningful solutions. Following Setterfield (2009a), I call this equation the growth frontier.

Although the models of Setterfield (2009a) and Rochon and Setterfield (2007) generate only a negative or independent relationship between economic growth and inflation, this model allows them to have a negative, positive, or neutral relationship depending on the debt-growth regime and the monetary policy rule. By differentiating equation (22) with respect to $\hat{p}_t$, I obtain:

$$\frac{dg_t}{d\hat{p}_t} = \frac{B\beta_p\lambda}{1 - B\beta_q(1 - \gamma_0)\lambda} \tag{23}$$

Since the denominator of this equation is positive by assumption, the sign depends on that of $B = \alpha_1(1 - s - \gamma_2)/Z$ and the type of monetary policy β_p. Under the Kansas City rule, the growth rate is independent of the inflation rate, as $\beta_p = 0$, but it is not so under the Pasinetti and Smithin rules. Under the Keynesian stability condition, the sign of B depends on $(1 - s - \gamma_2)$, which determines whether the capacity utilization

[9] The Kansas City rule is so named because of its advocates at Missouri University in Kansas City, such as Wray. For example, Wray (2007) insists that a nominal interest rate target is the best because it is the relevant variable for economic decisions and it is a rate the central bank can hit with perfect accuracy.

[10] Policies setting the interest rate at almost zero also have empirical relevancy, as many advanced countries are using an almost zero interest rate policy after the subprime crisis and government deficits in Europe.

[11] This rule originates from Pasinetti (1981) and is also called the fair interest rate rule. The Pasinetti rule sets the interest rate to keep constant the quantity of labor time that creditors can purchase in an economy characterized by constant wages and profit shares. Here I show only the resulting formula. For the derivation of the condition, see Setterfield (2009b).

is led or restrained by an increase in the government debt ratio in equation (18). If $(1-s-\gamma_2) > 0$ and economy is a DLG regime, then with $\beta_p \neq 0$, $dg_t/d\hat{p}_t > 0$ and the growth frontier is upward sloping. In contrast, if $(1-s-\gamma_2) < 0$ and the economy is a DBG regime, then with $\beta_p \neq 0$, $dg_t/d\hat{p}_t < 0$ and the growth frontier is downward sloping. As the second derivative of equation (22) is zero, this curve is straight in the $(\hat{p}, g)$ plane.

3 Dynamic Properties of The Model

3.1 Dynamic Stability and Comparative Statics

3.1.1 Dynamic Stability Analysis

The dynamics of the economy are described by the following two equations:

$$\hat{p}_t = \frac{\mu}{1-\mu}(\pi_F - \pi(g_{t-1})) - (1-\gamma_0)g_{t-1} \tag{24}$$

$$g_t = \frac{1}{1 - B\beta_q(1-\gamma_0)\lambda}\left(A + B\beta_p\lambda\hat{p}_t\right) \tag{25}$$

where it is assumed that $A + B\beta_p\lambda\hat{p}_t$ is always positive. From the intersection of the growth frontier and the inflation frontier under the different interest rate rules, the steady state values of output growth and inflation, where the economy is stable, can be obtained. The steady state values of the productivity growth rate and the interest rate can then be obtained from equations (7) and (21), respectively. In the steady state, the values of all variables remain constant over time. That is, g, $\hat{p}$, $\hat{q}$, and i are all constant.

Let the steady state values be denoted with a $*$. In the following analysis, I assume that there exist unique steady state values of output growth and the inflation rate. Given this assumption, by checking the local stability condition, I obtain the following proposition:

Proposition 1. *The steady state of the economy is stable if the absolute value of the slope of the growth frontier is less than that of the inflation frontier.*

Proof. See Appendix. □

In terms of the types of monetary policy rules, the following corollary of Proposition 1 is obtained:

Coro 1 (Corollary of Proposition 1)**.** *The economic dynamics are always stable under the Kansas City rule. However, the dynamics may not always be stable under the Pasinetti and Smithin rules.*

Proof. See Appendix. □

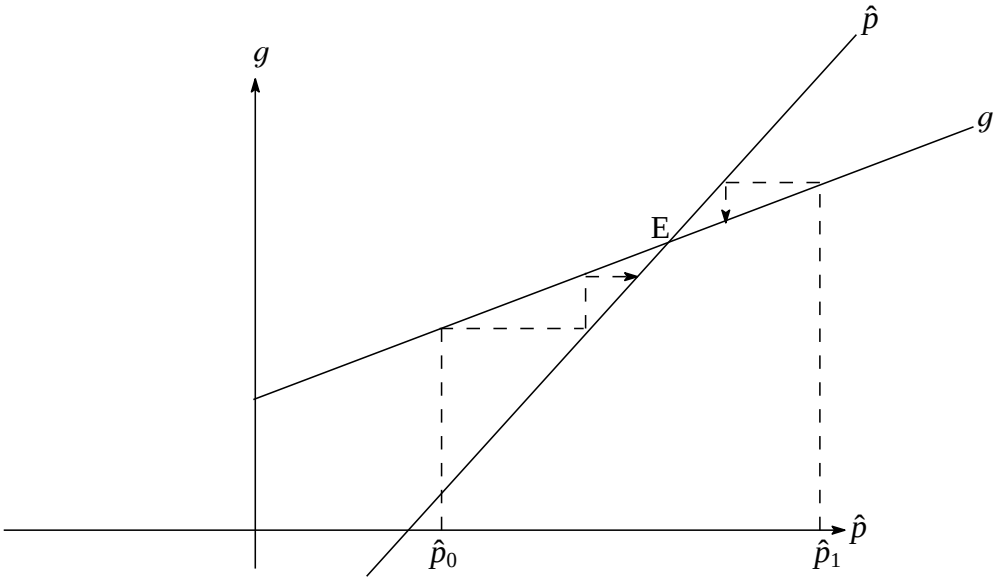

Figure 1: An Example of a Stable Case in a DLG Regime

Note: This configuration can be obtained under the Pasinetti and Smithin rules.

This section illustrates both stable and unstable cases. Figure 1 shows a stable case in a DLG regime with an upward-sloping inflation frontier. This case is possible under the Pasinetti and Smithin rules in which the nominal interest rate changes in accordance with the inflation rate. If the economy starts from an initial inflation rate $\hat{p}_0$, it will converge to the steady state position E. During the transition, the monetary authority raises the nominal interest rate in response to a rise in the inflation rate. The consumption demand of capitalist-rentiers is stimulated by a rise in interest income, which leads to a rise in the output growth rate in a DLG regime. Faster growth causes a larger increase in wage inflation than in productivity growth. As unit labor costs rise, so does inflation. Although both growth and inflation continue to expand, the size of this expansion becomes smaller and smaller, until the economy reaches the steady state. Similarly, if the economy starts from another initial inflation rate $\hat{p}_1$, it will also converge to the steady state position E. The transitional dynamics follow the opposite process from the previous case. A fall in the growth rate leads to a fall in the inflation rate, and their interactive effects become smaller and smaller until the economy reaches the steady state E.

Figure 2 illustrates an unstable case in a DLG regime with a downward-sloping inflation frontier. If the economy starts from an initial inflation rate $\hat{p}_0$, it will never

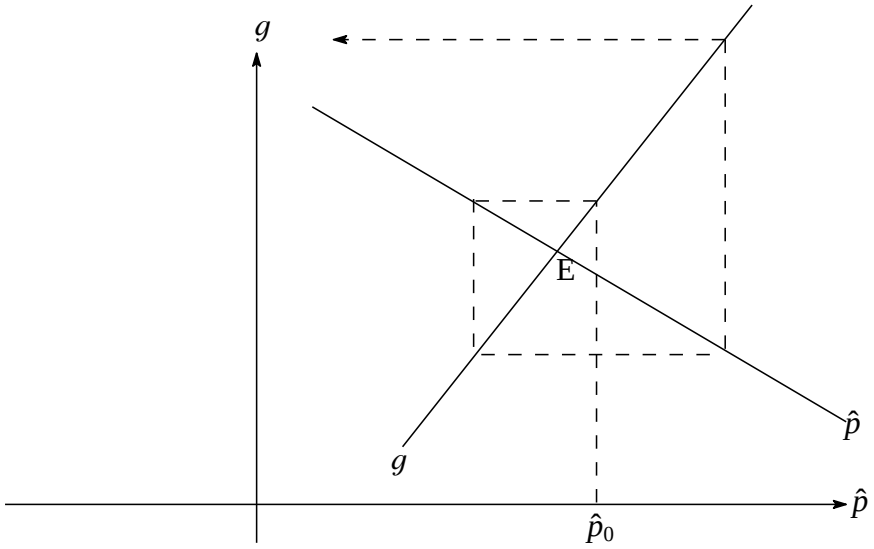

Figure 2: An Example of an Unstable Case in a DLG Regime

Note: This case is possible under the Pasinetti or Smithin rules.

converge to the steady state position E. It diverges as the inflation and output growth rates cycle. As in the above case, the monetary authority raises the nominal interest rate in response to a rise in the inflation rate. Under a DLG regime, consumption demand is stimulated by a rise in interest income, which leads to a rise in the output growth rate. In the case of a downward-sloping inflation frontier, faster growth causes a larger increase in productivity growth than in wage inflation, which reduces the unit labor costs and hence, reduces inflation. The monetary authority sets a lower nominal interest rate in accordance with the lower rate of inflation, which decreases the output growth rate. Slower growth, in contrast, causes a larger decrease in productivity growth than in wage inflation, which increases the unit labor costs, and hence, increases price inflation. A rise in the inflation rate stimulates the output growth rate by increasing the nominal interest rate. These transitional dynamics occur in an amplified form in which growth and inflation both expand in a cyclical manner, and the economy never attains the steady state.

Equation (42) in the Appendix identifies the factors that bring unstable dynamics. The magnitude of the debt-growth regime, the type of monetary policy rule, workers' bargaining power, and the degree of employment security all affect the local stability condition. Given the growth frontier and an upward-sloping inflation frontier, as workers' bargaining power becomes stronger (i.e., the absolute values of μ and $\pi'(g^*)$ become larger), the economy tends to fall into unstable dynamics. Given the inflation frontier, as the magnitude of debt-growth linkage becomes larger (i.e.,

the absolute value of B becomes larger) and the government accumulates debt stock (i.e., λ becomes larger) in each growth frontier, the economy tends to fall into unstable dynamics. Moreover, changes in employment security may also bring unstable dynamics depending on the slopes of the growth and inflation frontiers. As employment security becomes less effective (i.e., γ_0 becomes larger), the absolute value of the RHS of equation (42) becomes smaller in the case of an upward-sloping inflation frontier (but not in the downward-sloping case), whereas the absolute value of the LHS becomes larger in the case of a DBG regime (but not in a DLG regime) under the Pasinetti rule. Therefore, in some cases, the economy is more likely to become unstable because of the labor market flexibility.

The type of monetary policy rule also affects the local stability, as the Corollary of Proposition 1 indicates. If the monetary authority follows the Kansas City rule (i.e., $\beta_p = 0$), the dynamics are always stable regardless of the debt-growth regime. In a DLG regime, the economy is more unstable under the Pasinetti rule (i.e., $\beta_q = 1$), as the slope of the growth frontier becomes steeper (see Appendix). By contrast, in a DBG regime, the economy is more unstable under the Smithin rule (i.e., $\beta_q = 0$), as the slope of the growth frontier becomes steeper. Last but not least, the type of stability (instability), i.e., monotonically or cyclically convergent (divergent), depends on the slopes of both frontiers. The transitional dynamics are monotonic when the signs of both slopes are the same, whereas they are cyclical when the signs are different.

3.1.2 Comparative Statics

By confining the analysis to the stable cases, this paper also examines the effects of changes in the income distribution, government expenditures, the debt ratio, the working of employment security, and workers' bargaining power on the steady state values of the growth rate and inflation. At the steady state, where the income distribution, inflation, and growth rate of output all remain constant, the following conditions are satisfied:

$$g^* = \frac{1}{1 - B\beta_q(1-\gamma_0)\lambda}\left(A + B\beta_p\lambda\hat{p}^*\right) \tag{26}$$

$$\hat{p}^* = \frac{\mu}{1-\mu}(\pi^* - \pi(g^*)) - (1-\gamma_0)g^* \tag{27}$$

where $*$ denotes the steady state values. By separately considering the types of monetary policy rules, the growth frontiers under different interest rate rules are obtained. The appendix shows them in detail.

This section presents the general results of the comparative statics and shows that the impact of a shock differs depending on the configuration of the variables.

The important factors that determine the economic growth rate and inflation are (1) the income distribution-growth regime affected by the tax system (σ), (2) the debt-growth regime (B), (3) the type of monetary policy rule (β_p and β_q), and (4) the configuration in the labor market (i.e., the degree of workers' bargaining power and employment security, $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$).

By totally differentiating with respect to g^*, $\hat{p}^*$, π^*, μ, λ, γ_1, and γ_0 and arranging them by matrix-vector form, I obtain:

$$\begin{bmatrix} 1 & -\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda} \\ \frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) & 1 \end{bmatrix} \begin{bmatrix} dg^* \\ d\hat{p}^* \end{bmatrix} = \begin{bmatrix} C_1\sigma \\ \frac{\mu}{1-\mu} \end{bmatrix} d\pi^* + \begin{bmatrix} 0 \\ \frac{1}{(1-\mu)^2} \end{bmatrix} d\mu \tag{28}$$
$$+ \begin{bmatrix} C_2 \\ 0 \end{bmatrix} d\lambda + \begin{bmatrix} C_3 \\ 0 \end{bmatrix} d\gamma_1 + \begin{bmatrix} C_4 \\ g^* \end{bmatrix} d\gamma_0$$

where

$$C_1 = \frac{-\alpha_1}{(1-B\beta_q(1-\gamma_0)\lambda)^2 Z^2}\left(\alpha_0 + \gamma_1 + (1-s-\gamma_2)\beta_p\lambda\hat{p^*}\right) < 0,$$

$$C_2 = \frac{B}{(1-B\beta_q(1-\gamma_0)\lambda)^2}\left(\beta_p\hat{p}^* + A\beta_q(1-\gamma_0)\right) \gtreqless 0,$$

$$C_3 = \left(\frac{\alpha_1}{(1-B\beta_q(1-\gamma_0)\lambda)Z}\right) > 0,$$

$$C_4 = -\left(\frac{A + B\beta_p\lambda\hat{p}}{(1-B\beta_q(1-\gamma_0)\lambda)^2}\right) B\beta_p\lambda \gtreqless 0.$$

By assumption, C_1 is negative and C_3 is positive regardless of the debt-growth regime and the monetary policy rule. The signs of C_2 and C_4 depend on the debt-growth regime and the monetary policy rule. If monetary policy follows the Kansas City rule ($\beta_q = \beta_p = 0$), the values of C_2 and C_4 are always zero regardless of the debt-growth regime. If monetary policy is based on the Pasinetti or Smithin rule, C_2 is positive when the economy is a DLG regime, and it is negative when the economy is a DBG regime. On the other hand, the sign of C_4 takes a positive value under a DBG regime and a negative value under a DLG regime.

I denote the LHS of equation (28) in the matrix as $\boldsymbol{J}^*$. The determinant of $\boldsymbol{J}^*$ is

$$\det \boldsymbol{J}^* = 1 + \frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\left(\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)\right)$$

which is always positive whenever the stability conditions are satisfied.

The impact of changes in the income distribution on the economic growth rate is

obtained from the following relationship:

$$\frac{dg^*}{d\pi^*} = \frac{1}{\det \boldsymbol{J^*}} \begin{vmatrix} C_1\sigma & -\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda} \\ \frac{\mu}{1-\mu} & 1 \end{vmatrix}$$

$$= \frac{1}{\det \boldsymbol{J^*}} \left(C_1\sigma + \left(\frac{B\beta_p\lambda}{1 - B\beta_q(1-\gamma_0)\lambda} \right) \left(\frac{\mu}{1-\mu} \right) \right) \tag{29}$$

The variables whose signs change indicate which factors affect the results. It is clear that the effect of changes in profit income depends on (1) the income distribution-growth regime, which is affected by the tax system (2) the debt-growth regime, and (3) the type of monetary policy rule.

Using Cramer's rule, the effect of changes in the income distribution on inflation is obtained from the following relationship:

$$\frac{d\hat{p}^*}{d\pi^*} = \frac{1}{\det \boldsymbol{J^*}} \begin{vmatrix} 1 & C_1\sigma \\ \frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) & \frac{\mu}{1-\mu} \end{vmatrix}$$

$$= \frac{1}{\det \boldsymbol{J^*}} \left(\frac{\mu}{1-\mu} - C_1\sigma \left(\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) \right) \right) \tag{30}$$

Equation (30) shows that the impact of changes in the income distribution on the inflation rate depends on (1) the income distribution-growth regime and (2) the institutional configuration in the labor market (i.e., the degree of workers' bargaining power and employment security).

The impact of changes in government expenditures γ_1 on the economic growth rate is obtained from the following relationship:

$$\frac{dg^*}{d\gamma_1} = \frac{1}{\det \boldsymbol{J^*}} \begin{vmatrix} C_3 & -\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda} \\ 0 & 1 \end{vmatrix}$$

$$= \frac{1}{\det \boldsymbol{J^*}} C_3 > 0 \tag{31}$$

A rise in government expenditures always has a positive effect on the economic growth rate. This is true under any type of growth regime and monetary policy rule.

Similarly, the impact of changes in government expenditures on inflation are obtained from the following relationship:

$$\frac{d\hat{p}^*}{d\gamma_1} = \frac{1}{\det \boldsymbol{J^*}} \begin{vmatrix} 1 & C_3 \\ \frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) & 0 \end{vmatrix}$$

$$= \frac{-1}{\det \boldsymbol{J^*}} C_3 \left(\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) \right) \tag{32}$$

The degree of workers' bargaining power and employment security play an important role in this effect.

The effect of changes in the government debt stock λ on the economic growth rate is obtained from the following relationship:

$$\begin{aligned}\frac{dg^*}{d\lambda} &= \frac{1}{\det \boldsymbol{J}^*}\begin{vmatrix} C_2 & -\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda} \\ 0 & 1 \end{vmatrix} \\ &= \frac{1}{\det \boldsymbol{J}^*}C_2 \end{aligned} \tag{33}$$

Because C_2 includes (1) the effect of the debt-growth regime and (2) the type of monetary policy rule, these factors determine this effect.

Focusing on the impact of changes in the government debt stock on inflation, I obtain the following relationship:

$$\begin{aligned}\frac{d\hat{p}^*}{d\lambda} &= \frac{1}{\det \boldsymbol{J}^*}\begin{vmatrix} 1 & C_2 \\ \frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) & 0 \end{vmatrix} \\ &= \frac{-1}{\det \boldsymbol{J}^*}C_2\left(\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)\right) \end{aligned} \tag{34}$$

This result shows that the effect of a rise in government debt on inflation depends on (1) the debt-growth regime, (2) the type of monetary policy rule, and (3) the institutional configuration in the labor market.

I shift the focus onto the impact of changes in employment security γ_0 on growth and inflation. A rise in γ_0 means that employment security becomes less effective. Its impact on the economic growth rate is obtained from the following relationship:

$$\begin{aligned}\frac{dg^*}{d\gamma_0} &= \frac{1}{\det \boldsymbol{J}^*}\begin{vmatrix} C_4 & -\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda} \\ g^* & 1 \end{vmatrix} \\ &= \frac{1}{\det \boldsymbol{J}^*}\left(C_4 + g^*\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\right) \end{aligned} \tag{35}$$

The factors that determine the impact of a change in employment security on economic growth are (1) the debt-growth regime and (2) the type of monetary policy rule.

The impact of a rise in the value of γ_0 on inflation is calculated as follows:

$$\begin{aligned}\frac{d\hat{p}^*}{d\gamma_0} &= \frac{1}{\det \boldsymbol{J}^*}\begin{vmatrix} 1 & C_4 \\ \frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) & g^* \end{vmatrix} \\ &= \frac{1}{\det \boldsymbol{J}^*}\left(g^* - C_4\left(\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)\right)\right) \end{aligned} \tag{36}$$

Equation (36) reveals that (1) the debt-growth regime, (2) the type of monetary policy rule, and (3) the configuration in the labor market determine the impact of a change in employment security on inflation.

Last but not least, the bargaining power of workers μ also affects the economic growth rate as follows:

$$\begin{aligned}\frac{dg^*}{d\mu} &= \frac{1}{\det \boldsymbol{J}^*}\begin{vmatrix} 0 & -\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda} \\ \frac{1}{(1-\mu)^2} & 1 \end{vmatrix} \\ &= \frac{1}{\det \boldsymbol{J}^*}\left(\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\right)\left(\frac{1}{1-\mu}\right)^2 \end{aligned} \tag{37}$$

It is clear from equation (37) that (1) the debt-growth regime and (2) the type of monetary policy rule affect the consequences of a rise in workers' bargaining power on economic growth.

In addition, the impact of changes in the bargaining power of workers on inflation is obtained from the following relationship:

$$\begin{aligned}\frac{d\hat{p}^*}{d\mu} &= \frac{1}{\det \boldsymbol{J}^*}\begin{vmatrix} 1 & 0 \\ \frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0) & \frac{1}{(1-\mu)^2} \end{vmatrix} \\ &= \frac{1}{\det \boldsymbol{J}^*}\left(\frac{1}{1-\mu}\right)^2 \end{aligned} \tag{38}$$

This equation implies that an increase in workers' bargaining power always leads to a higher rate of inflation.

Based on equations (29)-(38), I will examine macroeconomic performance. The results in this paper show that the rank order of the general equilibrium rates of output depends on the combination of debt-growth and the shape of the inflation frontier. The results below also show that the effects of changes in income distribution differ according to the income distribution-growth regime and the debt-growth regime as well as the type of monetary policy. These results form a sharp contrast from the results in Setterfield (2009a) and Rochon and Setterfield (2007).

3.2 Growth Regimes and Inflation Dynamics under Different Monetary Policy Rules

This section first analyzes the ordering of the growth and inflation rates under different post-Keynesian interest rate rules. Then, I present the effects of changes in the income distribution (π), government expenditures (γ_1), the debt ratio (λ), the working of employment security (γ_0), and workers' bargaining power (μ) on the steady state growth rate and inflation, in this order.

3.2.1 Debt-led Growth Dynamics with an Upward-Sloping Inflation Frontier

Figure 3 reveals that there is an unambiguous rank ordering of the steady state growth rates of output and inflation under the three different monetary policy rules. The growth frontier of a DLG regime is upward sloping, as is the inflation frontier in this case. If there exists a unique steady state in the first quadrant, then it is clear that at the steady state, the order of the economic growth rates is $g_P > g_S > g_K$, and the order of the inflation rates is $\hat{p}_P > \hat{p}_S > \hat{p}_K$.

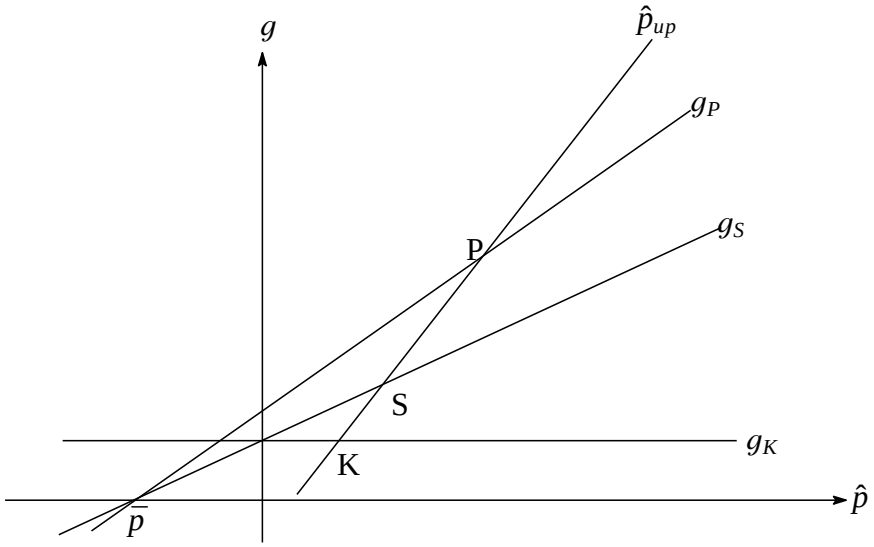

Figure 3: Growth and an Upward-Sloping Inflation Frontier under a DLG Regime

Note: g_K is the growth frontier under the Kansas City rule. g_P is the growth frontier under the Pasinetti rule. g_S is the growth frontier under the Smithin rule. $\hat{p}_{up}$ represents an upward-sloping inflation frontier. The coordinates K, P, and S denote the steady state of growth and inflation under the Kansas City, Pasinetti, and Smithin rules, respectively.

The effects of changes in the income distribution on the economic growth rate under each rule are obtained from equation (29). Given that the sign of C_1 is negative, it is clear that the effect of changes in the income distribution depends on (1) the income distribution-growth regime, which is determined by σ, (2) the debt-growth regime, which is determined by B, and (3) the type of monetary policy rule (β_q and β_p). Although growth under the Kansas City rule is independent of condition (2), conditions (1) and (2) are both effective under the Smithin and Pasinetti rules. The sign of B is positive under a DLG regime. Therefore, if σ is negative and the economy is a PLG regime, an increase in the profit share will increase the growth rate of output under all the monetary policy rules. However, if σ is positive and the economy is a WLG regime, an increase in the profit share will decrease the growth rate

of output under the Kansas City rule but will have an ambiguous effect under the Pasinetti and Smithin rules. This is because the sign of the first term in parentheses is negative, whereas that of the second term is positive.

From equation (30), the impact of changes in the income distribution on the inflation rate is as follows. As the sign of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is negative under an upward-sloping inflation frontier, the impact depends on the income distribution-growth regime that is stipulated by the sign of σ. If the sign of σ is negative and the economy is a PLG regime, an increase in the profit share causes inflation. However, if the economy is a WLG regime, the effect of an increase in the profit share on inflation is ambiguous. These results hold regardless of the type of monetary policy rule.

The impact of an increase in government expenditures on the steady state growth rates of output and inflation can be investigated using equations (31) and (32). The effect of an increase in government expenditures on the economic growth rate is unambiguously positive regardless of the type of monetary policy. Under an upward-sloping inflation frontier, the sign of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is negative. Therefore, an increase in government expenditures necessarily causes inflation.

The effect of an increase in the government debt ratio on the steady state growth rates of output and inflation can be investigated using equations (33) and (34). The effect of a rise in government debt on the economic growth rate depends on (1) the debt-growth regime and (2) the type of monetary policy rule. The effect of the government debt ratio on inflation depends on workers' bargaining power and the degree of employment security, in addition to (1) and (2). In a DLG regime under the Pasinetti and Smithin rules with an upward-sloping inflation frontier, the sign of C_2 is positive because $B > 0$ and $\beta_p = 1$, and that of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is negative. Therefore, an increase in government debt raises the growth rate of output, which accompanies the rise of inflation. However, under a DLG regime with the Kansas City rule and an upward-sloping inflation frontier, the value of C_2 is zero. Hence, the effect of changes in government debt on the growth rates of output and inflation is neutral under this rule.

The effect of changes in employment security on growth and inflation is determined by equations (35) and (36), respectively. First, the effect on the economic growth rate depends on (1) the debt-growth regime and (2) the type of monetary policy rule, and it is independent of workers' bargaining power. Under the Kansas City rule, both values in C_4 are zero because β_p is zero. Hence, the growth rate is independent of employment security under this rule. In a DLG regime under the Pasinetti and Smithin rules, the sign of C_4 is negative because $B > 0$ and $\beta_p = 1$, although

that of $\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}$ is positive. Therefore, when employment security becomes weaker (i.e., γ_0 becomes larger), its effect on economic growth is ambiguous.

The effect of employment security on inflation depends on (1) the debt-growth regime, (2) the type of monetary policy rule, and (3) workers' bargaining power and the degree of employment security. Under the Kansas City rule, C_4 is equal to zero because $\beta_p = 0$ and $d\hat{p}^*/\gamma_0 > 0$ is always true. However, the Smithin and Pasinetti rules under a DLG regime give a negative value for C_4, and the upward-sloping inflation frontier also gives a negative value for $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$. Therefore, the sign of equation (36) is not determined uniquely.

Finally, the impact of changes in the institutional configuration of the labor market on growth and inflation can be shown using equations (37) and (38), respectively. The impact of an increase in the workers' bargaining position (μ) on the economic growth rate depends on (1) the debt-growth regime and (2) the type of monetary policy rule. In a DLG regime under the Pasinetti and Smithin rules with an upward-sloping inflation frontier, the sign of equation (37) is positive because $B > 0$ and β_p is unity. Therefore, an increase in workers' bargaining power leads to economic growth under the Pasinetti and Smithin rules, whereas it is neutral under the Kansas City rule because $\beta_p = 0$. The effect of an increase in workers' bargaining power on inflation is always positive regardless of the type of monetary policy rule and the debt-growth regime.

3.2.2 Debt-led Growth Dynamics with a Downward Sloping Inflation Frontier

Figure 4 shows the basic configuration of the steady state growth and inflation rates in a DLG regime with a downward-sloping inflation frontier. There is an unambiguous rank ordering of the steady state growth rates of output and inflation under the different monetary policy rules in this case too. When there exists a unique steady state in the first quadrant, then it is clear that the order of the economic growth rates is $g_P > g_S > g_K$, and the order of the inflation rates is $\hat{p}_K > \hat{p}_S > \hat{p}_P$. Although the order of the growth rates is the same as in the previous case, the order of inflation rates differs because of changes in the institutional configuration of the labor market.

The impact of changes in the income distribution π, government expenditures γ_1, the government debt ratio λ, employment security γ_0, and workers' bargaining power μ on growth and inflation can be examined in a similar manner to the previous section.

From (29), the impact of changes in the income distribution on the economic growth rate under each rule can be summarized as follows. The impact of an increase

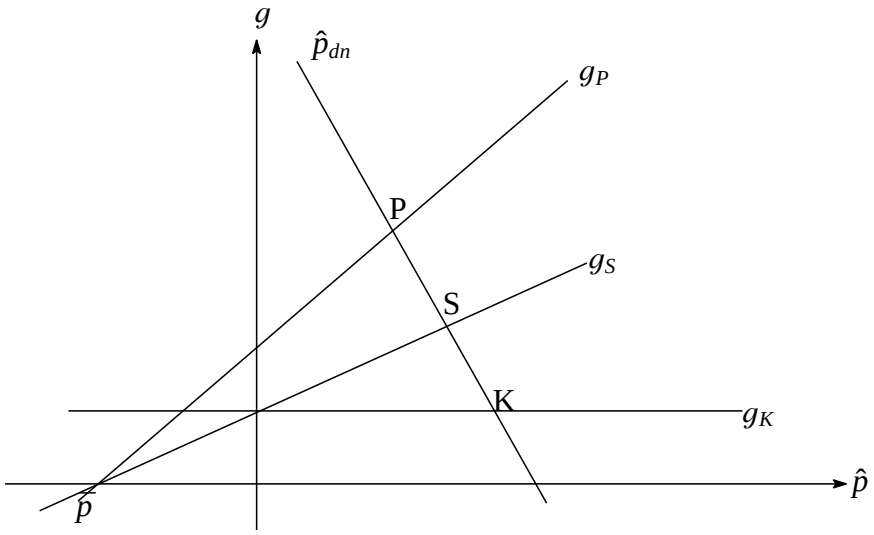

Figure 4: Growth and a Downward-Sloping Inflation Frontier under a DLG Regime

Note: The notations are the same as in Figure 3. $\hat{p}_{dn}$ represents a downward-sloping inflation frontier.

in the profit share on the output growth rate in the steady state has a similar effect as in a DLG regime with an upward-sloping inflation frontier, and the mechanism is the same. If the economy is a PLG regime, economic growth is stimulated by a rise in the profit share under all monetary policy rules. However, in case of a WLG regime, the impact of a rise in the profit share on economic growth is ambiguous under the Pasinetti and Smithin rules but is negative under the Kansas City rule.

In contrast, the effect of an increase in the profit share on inflation differs from the case of an upward-sloping inflation frontier. In the case of a downward-sloping frontier, the sign of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is positive. In this case, the income distribution-growth regime σ also plays an important role in inflation, but the consequences are different. If the sign of σ is positive and the economy is a WLG regime, an increase in the profit share causes inflation. However, if $\sigma < 0$ and the economy is a PLG regime, the effect of an increase in the profit share on inflation is ambiguous. These results hold regardless of the monetary policy rule.

As I showed above, an increase in government expenditures has an unambiguously positive effect on the economic growth rate regardless of the type of monetary policy rule. However, the effect of government expenditures on the steady state inflation rate differs from the case of a DLG regime with an upward-sloping inflation frontier because the sign of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is positive. Therefore, an increase in government expenditures has a deflationary effect regardless of the monetary pol-

icy rule.

The impact of an increase in the government debt ratio on the steady state growth rates of output and inflation can be investigated using equations (33) and (34). The results are the same as in a DLG regime with an upward-sloping inflation frontier. Under the Pasinetti and Smithin rules, an increase in government debt raises the growth rate of output, but government debt has a neutral effect under the Kansas City rule.

Equation (34) shows that the effect of an increase in government debt on the inflation rate depends on (1) the debt-growth regime, (2) the type of monetary policy, and (3) the strength of bargaining power and the degree of employment security. Under a DLG regime with the Pasinetti and Smithin rules, $C_2 > 0$. In the case where $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is positive, a rise in public debt leads to a fall in the inflation rate. This result holds under the Pasinetti and Smithin rules, but this effect is neutral under the Kansas City rule.

The effect of changes in employment security on growth and inflation is given by equations (35) and (36), respectively. As the effect on economic growth is independent of the bargaining power of workers, the results are the same as in the case of a DLG regime with an upward-sloping inflation frontier. That is, the effect is neutral under the Kansas City rule, but it is ambiguous under the Pasinetti and Smithin rules.

In addition to the debt-growth regime and the type of monetary policy rule, the degree of workers' bargaining power and employment security also affect the relationship between employment security and the inflation rate. It is clear that $d\hat{p}^*/\gamma_0 > 0$ under the Kansas City rule. Although a DLG regime under the Smithin and Pasinetti rules gives a negative value for C_4, the downward-sloping inflation frontier gives a positive value for $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$. Therefore, the sign of equation (36) is necessarily positive. Thus, more dysfunctional employment security in the labor market will lead to inflation in these cases.

As I showed above, the effect of an increase in the workers' bargaining position (μ) on the economic growth rate depends on (1) the debt-growth regime and (2) the type of monetary policy rule. In a DLG regime under the Pasinetti and Smithin rules, the same results as in previous section are obtained. That is, an increase in workers' bargaining power leads to more economic growth under the Pasinetti and Smithin rules, whereas it is neutral under the Kansas City rule. The impact of an increase in workers' bargaining power on inflation is always positive regardless of the type of monetary policy and the debt-growth regime.

3.2.3 Debt-burdened Growth Dynamics with an Upward-Sloping Inflation Frontier

Figure 5 depicts the macroeconomic performance of inflation and growth under a DBG regime with an upward-sloping inflation frontier. When the inflation frontier and the growth frontiers of the Pasinetti and Smithin rules intersect at the left side of $\bar{p}$, the order of the growth rates is $g_K > g_S > g_P$, and the order of the inflation rates is $\hat{p}_K > \hat{p}_S > \hat{p}_P$.

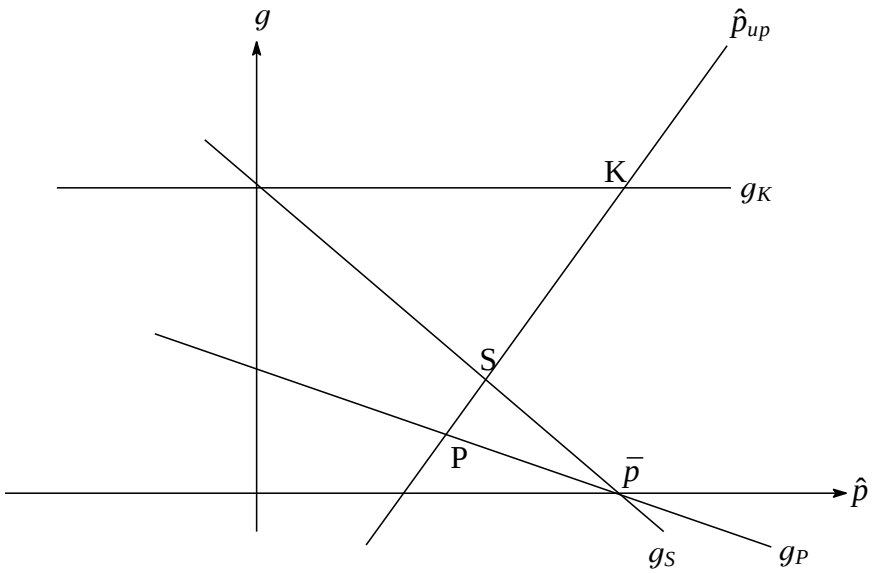

Figure 5: Growth and an Upward-Sloping Inflation Frontier under a DBG Regime

Note: The notation is the same as in the previous cases.

I start by examining the impact of an increase in the profit share under different monetary policy rules. In a DBG regime, the sign of B is negative. β_p is zero under the Kansas City rule. Taking these conditions into consideration, I obtain the following results. If σ is positive and the economy is a WLG regime, an increase in the profit share will decrease the growth rate of output under all the rules. By contrast, if σ is negative and the economy is a PLG regime, the effect of an increase in the profit share on the output growth rate is ambiguous under the Pasinetti and Smithin rules, but it is always positive under the Kansas City rule.

Equation (29) shows that the impact of a rise in the profit share on inflation depends on the income distribution-growth regime in addition to the bargaining position and employment security. When the inflation frontier is upward sloping, the sign of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is negative. Therefore, if σ is negative and the economy is a PLG regime, the effect of an increase in the profit share on inflation is unambigu-

ously positive. By contrast, if σ is positive and the economy is a WLG regime, its effect on inflation is ambiguous.

The effect of a rise in government expenditures on the economic growth rate is always positive according to equation (31). Its effect on the inflation rate is also always positive according to equation (32) in the case of an upward-sloping inflation frontier.

Equation (33) shows the factors that affect the relationship between government debt and the economic growth rate. These factors are (1) the debt-growth regime and (2) the type of monetary policy rule. Under a DBG regime with the Pasinetti and Smithin rules, the sign of C_2 is negative, whereas it is zero in case of the Kansas City rule. Therefore, it follows that a rise in government debt will restrain economic growth under a DBG regime with the Pasinetti and Smithin rules. Under the Kansas City rule, the impact on growth is neutral. I next consider the effect of government debt on the inflation rate. The sign of equation (34) is always negative under the Pasinetti and Smithin rules with an upward-sloping inflation frontier, whereas it is always zero under the Kansas City rule. Therefore, a rise in the government debt ratio will cause deflation under the Pasinetti and Smithin rules, but it will not affect inflation under the Kansas City rule.

The effect of changes in employment security on growth and inflation is measured by equations (35) and (36). The results can be obtained for a given debt-growth regime and type of monetary policy rule. First, the impact is always zero under the Kansas City rule. Under the Pasinetti and Smithin rules, the sign of C_4 is positive, whereas that of B is negative. Thus, although the first term in equation (35) is positive, the second term is negative. As a result, under these two rules the effect on growth is still ambiguous. The impact on the inflation rate is always positive under the Kansas City rule. A DBG regime under the Smithin and Pasinetti rules gives a positive value for C_4. On the other hand, the upward-sloping inflation frontier gives a negative value for $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$. Therefore, the sign of equation (36) is necessarily positive. Thus, the fluidization of the labor market will lead to inflation in the DBG case with an upward-sloping inflation frontier, but it is not necessarily so in the DLG case with an upward-sloping inflation frontier.

The effects of a change in workers' bargaining power on growth and inflation are summarized as follows. The debt-growth regime and the type of monetary policy rule play an important role for the determination of economic growth. In case of a DBG regime ($B < 0$) under the Pasinetti and Smithin rules ($\beta_p = 1$), a rise in workers' bargaining power will decrease the rate of output growth. If the monetary authority takes the Kansas City rule ($\beta_p = 0$), this impact becomes neutral. Equation

(38) indicates that the effect on inflation is always positive.

3.2.4 Debt-burdened Growth Dynamics with a Downward-Sloping Inflation Frontier

I finally consider the properties of a DBG regime with a downward-sloping inflation frontier in Figure 6. When the inflation and growth frontiers under the Pasinetti and Smithin rules intersect at the left side of $\bar{p}$, the order of steady state economic growth rates changes to $g_K > g_S > g_P$, and the order of steady state inflation rates is $\hat{p}_P > \hat{p}_S > \hat{p}_K$. Although the order of the growth rates is the same as in the case of a DBG regime with an upward-sloping inflation frontier, the order of the inflation rates differs due to the shape of inflation frontier.

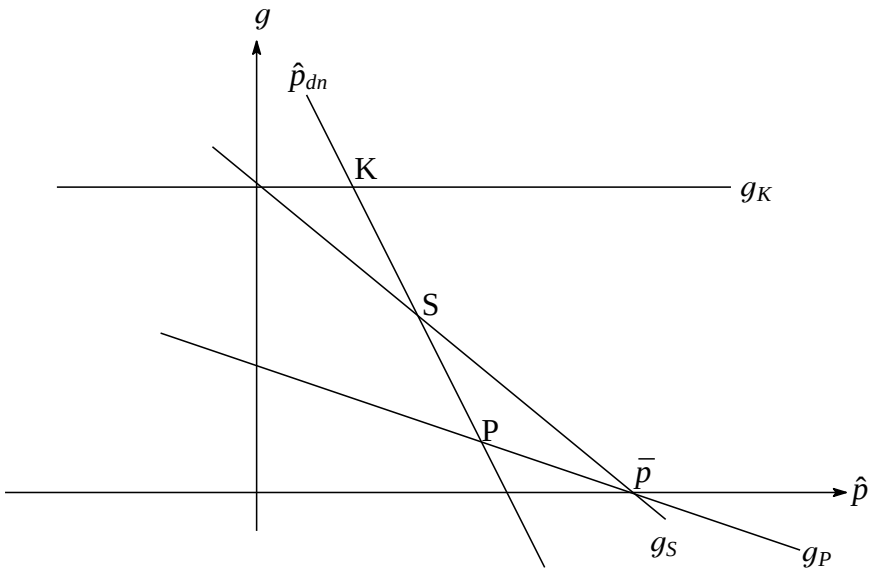

Figure 6: Growth and a Downward-Sloping Inflation Frontier under a DBG Regime

Note: The notation is the same as in the previous cases.

I first examine the effect of an increase in the profit share on economic growth and inflation in a DBG regime with a downward-sloping inflation frontier. Equation (29) shows that the impact on economic growth rate can be explained similarly to that of a DBG regime with an upward-sloping inflation frontier. If σ is positive and the economy is a WLG regime, an increase in the profit share will decrease the growth rate of output under all rules. By contrast, if σ is negative and the economy is a PLG regime, the effect of an increase in the profit share on the output growth rate is ambiguous under the Pasinetti and Smithin rules, whereas it is always positive under the Kansas City rule.

Equation (30) shows that the effect of an increase in the profit share on inflation depends on the income distribution-growth regime in addition to the workers' bargaining position and employment security. When the inflation frontier is downward sloping, the sign of $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$ is positive. Therefore, if σ is positive and the economy is a WLG regime, the effect of an increase in the profit share on inflation is unambiguously positive. In contrast, if σ is negative and the economy is a PLG regime, its effect on inflation is ambiguous.

From equation (31), government expenditures always have a positive impact on economic growth. Equation (32) indicates that the effect of government expenditures on inflation is always negative in the case of a downward-sloping inflation frontier.

Equation (33) indicates the effect of government debt on the economic growth rate. Under a DBG regime with the Pasinetti and Smithin rules, the sign of C_2 is negative, whereas it is zero in case of the Kansas City rule. The same results as in a DBG regime with an upward-sloping inflation frontier are obtained. A rise in government debt will restrain economic growth under a DBG regime with the Pasinetti and Smithin rules, but it has a neutral effect under the Kansas City rule. Its impact on the inflation rate makes a sharp contrast to the case of a DLG regime with an upward-sloping inflation frontier. The sign of equation (34) is always positive in case of a DBG regime with a downward-sloping inflation frontier, except under the Kansas City rule. Therefore, a rise in the government debt ratio will cause inflation under the Pasinetti and Smithin rules, although it does not change inflation under the Kansas City rule.

The effect of changes in employment security on growth is the same as in the previous DBG regime. Although this impact on growth is always zero under the Kansas City rule, it is ambiguous under the Pasinetti and Smithin rules. Given (36), the impact of a change in employment security on the inflation rate can be determined. Under the Kansas City rule, this effect is always positive. However, a DBG regime with the Smithin and Pasinetti rules gives a positive value for C_4. On the other hand, the downward-sloping inflation frontier gives a positive value for $\frac{\mu}{1-\mu}\pi'(g^*) + (1-\gamma_0)$. Therefore, the sign of equation (36) remains ambiguous. Thus, the fluidization of the labor market may or may not lead to inflation in the DBG case with a downward-sloping inflation frontier, whereas it necessarily does so in the DLG case with a downward-sloping inflation frontier.

Lastly, the effects of a change in workers' bargaining power on growth and inflation are the same as in a DBG regime with an upward-sloping inflation frontier. This is because this effect is related to the debt-growth regime and the type of monetary policy rule, not the conditions in the labor market. In sum, when the economy is a

DBG regime ($B < 0$) under the Pasinetti and Smithin rules ($\beta_p = 1$), a rise in workers' bargaining power will lower the rate of output growth. If the monetary authority takes the Kansas City rule ($\beta_p = 0$), this impact becomes neutral. Moreover, the impact on inflation is always positive, which follows from equation (38).

4 Summary of the Results and Implications for the Policy Regime

This section summarizes the results obtained in the previous section and gives some implications for the argument for the policy regime. Here, I do not discuss all the results of the comparative statics, leaving them to Tables 1 and 2, but I remark on four important implications for the policy regime.

First, it is important to understand that the dynamics of economic growth and inflation are not unique but rather can vary. These dynamics of macroeconomic performance result from the complex relationships between the growth regime, policies, and institutions. As I showed in the previous section, some of (1) the income distribution-growth regime affected by the tax system (σ), (2) the debt-growth regime (B), (3) the type of monetary policy rule (β_p and β_q), and (4) the configuration in the labor market (i.e., the degree of workers' bargaining power and employment security: μ, $\pi'(\cdot)$, and γ_0) play an important role in economic performance when a shock occurs in the economy.

For instance, the effect of a change in the income distribution on economic growth depends on the income distribution-growth regime, the monetary policy rule, and the debt-growth regime. If the monetary policy is the Kansas City rule, the income distribution growth regime alone determines the impact of a shock to the income distribution share on the economic growth rate. In other words, under this rule, the growth rate is determined only by the income distribution-growth regime, regardless of the debt-growth regime. However, even if the income distribution-growth regime is WLG, an increase in the wage share may not induce a higher growth rate under a DLG regime with the Smithin or Pasinetti rule. On the contrary, if the income distribution growth regime is WLG, an increase in the wage share certainly induces a higher growth rate under a DBG regime with the Smithin or Pasinetti rule. Therefore, macroeconomic performance does not result just from institutions or the growth regime. Rather, growth regimes, policies, and the role of institutions altogether generate macroeconomic performance.

A second implication relates to the relationship between the type of monetary policy rule and the rank ordering of the growth and inflation rates. It is clear that the

(1) DLG regime with upward-sloping inflation frontier			
The order of	Kansas City	Smithin	Pasinetti
growth rate	Low	Middle	High
inflation rate	Low	Middle	High
A rise in			
π (WLG: $\sigma > 0$)	$g:-,\ \hat{p}:\pm$	$g:\pm,\ \hat{p}:\pm$	$g:\pm,\ \hat{p}:\pm$
π (PLG: $\sigma < 0$)	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$
γ_1	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$
λ	$g:0,\ \hat{p}:0$	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$
γ_0	$g:0,\ \hat{p}:+$	$g:\pm,\ \hat{p}:\pm$	$g:\pm,\ \hat{p}:\pm$
μ	$g:0,\ \hat{p}:+$	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$

(2) DLG regime with downward-sloping inflation frontier			
The order of	Kansas City	Smithin	Pasinetti
growth rate	Low	Middle	High
inflation rate	High	Middle	Low
A rise in			
π (WLG: $\sigma > 0$)	$g:-,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$
π (PLG: $\sigma < 0$)	$g:+,\ \hat{p}:\pm$	$g:+,\ \hat{p}:\pm$	$g:+,\ \hat{p}:\pm$
γ_1	$g:+,\ \hat{p}:-$	$g:+,\ \hat{p}:-$	$g:+,\ \hat{p}:-$
λ	$g:0,\ \hat{p}:0$	$g:+,\ \hat{p}:-$	$g:+,\ \hat{p}:-$
γ_0	$g:0,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$
μ	$g:0,\ \hat{p}:+$	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$

Table 1: Comparative Statics on DLG Regimes in the cases of upward- and downward-sloping inflation

(3) DBG regime with upward-sloping inflation frontier			
The order of	Kansas City	Smithin	Pasinetti
growth rate	High	Middle	Low
inflation rate	High	Middle	Low
A rise in			
π (WLG: $\sigma > 0$)	$g:-,\ \hat{p}:\pm$	$g:-,\ \hat{p}:\pm$	$g:-,\ \hat{p}:\pm$
π (PLG: $\sigma < 0$)	$g:+,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$
γ_1	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$	$g:+,\ \hat{p}:+$
λ	$g:0,\ \hat{p}:0$	$g:-,\ \hat{p}:-$	$g:-,\ \hat{p}:-$
γ_0	$g:0,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$	$g:\pm,\ \hat{p}:+$
μ	$g:0,\ \hat{p}:+$	$g:-,\ \hat{p}:+$	$g:-,\ \hat{p}:+$

(4) DBG regime with downward-sloping inflation frontier			
The order of	Kansas City	Smithin	Pasinetti
growth rate	High	Middle	Low
inflation rate	Low	Middle	High
A rise in			
π (WLG: $\sigma > 0$)	$g:-,\ \hat{p}:+$	$g:-,\ \hat{p}:+$	$g:-,\ \hat{p}:+$
π (PLG: $\sigma < 0$)	$g:+,\ \hat{p}:\pm$	$g:\pm,\ \hat{p}:\pm$	$g:\pm,\ \hat{p}:\pm$
γ_1	$g:+,\ \hat{p}:-$	$g:+,\ \hat{p}:-$	$g:+,\ \hat{p}:-$
λ	$g:0,\ \hat{p}:0$	$g:-,\ \hat{p}:+$	$g:-,\ \hat{p}:+$
γ_0	$g:0,\ \hat{p}:+$	$g:\pm,\ \hat{p}:\pm$	$g:\pm,\ \hat{p}:\pm$
μ	$g:0,\ \hat{p}:+$	$g:-,\ \hat{p}:+$	$g:-,\ \hat{p}:+$

Table 2: Comparative Statics on DBG Regimes in the cases of upward- and downward-sloping inflation

ordering of the economic growth rates differs between the DLG and DBG regimes, especially depending on the type of monetary policy rule. Under a DLG regime, the Pasinetti rule always leads to the highest growth rate, whereas under a DBG regime, the Kansas City rule always leads to the highest growth rate. The Smithin rule has a modest impact on economic growth and inflation regardless of the debt-growth regime.

This result hinges on the positive effect of the interest rate on the demand formation pattern. Under a DLG regime, a rise in the interest rate or debt stimulates effective demand through the increase in capitalist rentiers' consumption. The Pasinetti and Smithin rules stipulate that the interest rate increases one-for-one with the inflation rate. Therefore, economic growth moves positively with a rise in inflation and interest rates. In the Pasinetti rule, the positive effect on the interest rate from the growth-productivity effect also stimulates the effective demand, meaning that the growth rate is higher than under the Smithin rule. In contrast, there is no financial impact on growth if monetary policy takes the Kansas City rule. Therefore, the economic growth rate is the lowest under the Kansas City rule if the economy is a DLG regime.

In a DBG regime, a rise in the interest rate and debt discourage effective demand especially through the debt burden on the government expenditures decision. The interest rate changes in accordance with inflation rates under the Pasinetti and Smithin rules, by which the effective demand is restrained. Moreover, changes in growth-productivity also affect the interest rate under the Pasinetti rule. This change in interest rates also negatively affects the economic growth rate. By these effects, the economic growth rates under the Smithin and Pasinetti rules are lower than under the Kansas City rule in which there is no impact on growth from the financial side. Therefore, the economic growth rate is the highest under the Kansas City rule.

This result implies that the choice of monetary policy rule should be made given the type of economic growth regime. Similar policies may generate different macroeconomic outcomes, as shown above. In this sense, the policy regime is not independent of the economic growth regime. For instance, if the economic growth regime is DLG with a downward-sloping inflation frontier, a monetary policy sticking to the Kansas City rule will bring the worst economic performance (i.e., the lowest growth rate and the highest inflation rate) of all the policy options. On the contrary, when the economic growth regime is DBG with a downward-sloping inflation frontier, monetary policy should be based on the Kansas City rule, since it will bring the best economic performance (i.e., the highest growth rate and the lowest inflation rate) of all the policy options.

A third implication is that the choice of policy rule is also important for the stability of economic growth. However, a policy choice that contributes to stabilization may not be compatible with high economic growth. When the economic growth regime is DLG, the Pasinetti rule will bring the highest economic growth rate. However, if workers' bargaining power becomes stronger (i.e., μ and $\pi'(g^*)$ are large), the inflation frontier may become flatter than the growth frontier. In this case, the Pasinetti rule may not prevent explosive dynamics, even though it brings the highest economic growth rate of all the policy choices. Therefore, if the political goal is to stabilize the economy in a DLG regime, the monetary authority should choose the Kansas City rule at the cost of high economic growth. Thus, there is a trade-off between high growth and economic stability depending on the economic growth regime. In this sense too, there is no optimal monetary policy rule, and the effectiveness of the policy depends on the economic growth regime.

The fourth implication, which may be a corollary of the third, is that the goals of high economic growth, stability, and distributional equality across different classes may not be reconciled. Different interest rules have different distributional impacts for the social classes. Although the Pasinetti rule gives rentiers a role in the economy, the Smithin and Kansas City rules attempt to eliminate them with a low interest rate. Therefore, the political choice of the interest rule affects the income distribution for the hegemonic classes. For example, Bresser-Pereira (2012) indicates that there was a shift in the hegemonic political coalition from workers to rentier capitalists living on interest, rents, and dividends in the era of the neoliberal regime. Suppose that an economy has such a hegemonic constellation. If the monetary authority aims for stable and high economic growth under a DBG regime with downward-sloping inflation, it should choose the Kansas City rule. However, this rule does not give the capitalist-rentiers a high interest income. Thus, a trade-off between stable and high economic growth and the interests of the different classes occurs under this debt-growth regime and policy rule. On the contrary, in the same situation, if capitalist-rentiers insist on more financial income as a hegemonic class, the Pasinetti rule will be necessary. However, this will bring the lowest economic growth rate and may also lead to dynamic instability. Hence, there may be a trilemma among low growth, instability, and income distribution to the hegemonic classes (capitalist-rentiers in the case of the neoliberal era).

The implications in this paper question the desirability of what the argument for a policy regime suggests. If the policy regime is defined as an equilibrium in which policies are similar across different parties, as Przeworski (2000) presents, one policy regime may not always be favorable for macroeconomic performance.

It is not desirable to pursue or stick to the same policy, since a type of economic policy may be effective under one economic growth regime but not under a different regime. Consequently, macroeconomic policy should be chosen given the type of growth regime and the inflation dynamics.

5 Conclusion

In this paper, I extended a post-Keynesian growth model to obtain implications for the policy regime. This paper is novel in that it examines the dynamic properties of inflation and economic growth, introduces an institutional setting that includes wage bargaining, employment security, and the tax system, and thus generates several varieties of income distribution- and debt-growth regimes.

In this setting, this paper reconsidered the arguments in favor of a policy regime as well as its relationship with the growth regime. To put it simply, according to Adam Przeworski, a policy regime is a situation in which similar policies are implemented regardless of the governing party (Przeworski (2000); Przeworski (2010)). In order to examine first whether such a political constellation has a favorable effect on macroeconomic performance and second its relationship with the economic growth regime, this paper investigated macroeconomic policy based on different types of monetary policy rules as well as fiscal policy. This paper particularly compares three types of post-Keynesian interest rate policy rules, the Smithin, Pasinetti, and Kansas City rules. This paper approached this issue using a theoretical model, so a positive analysis on this issue remains as future work.[12]

Through the macroeconomic analysis, as Tables 1 and 2 show, there are several combinations of growth and inflation frontiers. In each case, the effects of the monetary policy rule and fiscal policy on growth and inflation differ. Which of these cases is more relevant for growth and inflation in an economy depends on the historical circumstances and hence on some combination of income distribution-growth, debt-growth, the type of monetary policy rule that the central bank chooses, and workers' bargaining power and employment adjustments.

Four implications for the policy regime are presented in this paper. First, macroeconomic performance originates from the economic growth regime, policy, and the role of institutions; second, the policy regime is not independent of the economic

[12] A variety of literature on capitalism, such as Soskice (2007) and Amable and Azizi (2009), argues the patterns of economic policy. The former argues that non-liberal economies have less accommodating macroeconomic policies than liberal market economies, whereas the latter does not support this result.

growth regime; third, there is a trade-off between high economic growth and dynamic stability; and fourth, there is a possible trilemma among low growth, instability, and the distribution of income to hegemonic coalitions.

These results, showing various economic growth regimes and types of macroeconomic policies, question the desirability of all parties always pursuing the same policy in an economy. As Tables 1 and 2 show, a policy may work effectively under one economic growth regime but not under another. In this sense, there is no one best optimal policy for growth. The policymaker should choose an economic policy from the various options based on the economic growth regime. In other words, the effectiveness of a policy regime depends on its compatibility with the economic growth regime. If a similar policy is always pursed regardless of the economic growth regime, it may not be favorable for economic performance under certain circumstances. Only if a policy that is compatible with the economic regime is pursued does it has a favorable effect on economic performance. For example, setting a zero nominal interest rate (the Kansas City rule) may be the best for sustaining economic growth under the DBG regime, but it is not so under the DLG regime. In contrast, the Pasinetti rule brings the highest growth rate in the DLG regime. Nonetheless, this rule cannot exclude the possibility of dynamic instability. Hence, the effectiveness of the policy regime is not independent of the economic growth regime, or, to put it differently, the policy regime and the growth regime are interdependent.

Appendix

Dynamic Stability Condition

Proof of Proposition 1. The dynamic economy consists of the following two equations:

$$\hat{p}_t = \frac{\mu}{1-\mu}(\pi - \pi(g_{t-1})) - (1-\gamma_0)g_{t-1} \tag{39}$$

$$g_t = \frac{1}{1 - B\beta_q(1-\gamma_0)\lambda}\left(A + B\beta_p\lambda\hat{p}_t\right) \tag{40}$$

By substituting equation (39) into equation (40), the dynamics of this system are obtained as follows:

$$\begin{aligned} g_t = \frac{A}{1 - B\beta_q(1-\gamma_0)\lambda} &+ \frac{B\beta_p\lambda}{1 - B\beta_q(1-\gamma_0)\lambda}\left(\frac{\mu}{1-\mu}\right)\pi \\ &- \frac{B\beta_p\lambda}{1 - B\beta_q(1-\gamma_0)\lambda}\left(\frac{\mu}{1-\mu}\pi(g_{t-1}) + (1-\gamma_0)g_{t-1}\right) \end{aligned} \tag{41}$$

When the growth rate is constant, the inflation rate is also constant in equation (39). Thus, I will investigate the stability condition for equation (41). Let equation (41) be rewritten as $g_t = G(g_{t-1})$. By using a Taylor series expansion, the function $G(\cdot)$ evaluated at the steady state is expressed as $g_t = G(g^*) + G'(g^*)(g_{t-1} - g^*)$. The necessary and sufficient condition for the local stability of this difference equation is $|G'(g^*)| < 1$. By differentiating equation (41) with respect to g_{t-1} and evaluating at the steady state value, I obtain the stability conditions as follows:

$$\left|\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\left(-\frac{\mu}{1-\mu}\pi'(g^*)-(1-\gamma_0)\right)\right|$$
$$=\left|\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\right|\left|-\frac{\mu}{1-\mu}\pi'(g^*)-(1-\gamma_0)\right|<1$$

Hence, the necessary and sufficient condition for the local stability of equation (41) is

$$\left|\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\right|<\left|-\frac{\mu}{1-\mu}\pi'(g^*)-(1-\gamma_0)\right|^{-1} \tag{42}$$

The absolute value of the growth frontier's slope is $\left|\frac{B\beta_p\lambda}{1-B\beta_q(1-\gamma_0)\lambda}\right|$, and that of the inflation frontier's slope is $\left|-\frac{\mu}{1-\mu}\pi'(g^*)-(1-\gamma_0)\right|^{-1}$. Therefore, as long as the absolute value of the growth frontier's slope is smaller than that of the inflation frontier's slope, local stability is assured. The magnitude of the debt-growth regime, types of monetary policy rule, workers' bargaining power, and the degree of employment security all affect the local stability condition.

□

Proof of Corollary 1. Under the Kansas City rule that stipulates $\beta_q = \beta_p = 0$, the nominal interest rate is set to zero, $i = 0$. It follows immediately that $G'(g^*) = 0$ in equation (41) and the local stability condition $|G'(g^*)| < 1$ are both always satisfied. □

The Shapes and Positions of Growth Frontiers under Different Monetary Policy Rules

The growth frontiers under the different interest rate rules are as follows:

Kansas City rule $\quad g_K = A$

Smithin rule $\quad g_S = A + B\lambda\hat{p}$

Pasinetti rule $\quad g_P = \frac{1}{1-B(1-\gamma_0)\lambda}(A + B\lambda\hat{p})$

This subsection investigates the relationship between the slopes, intercepts, and intersections of these equations. First, it is trivial that the intersection of the Smithin rule and the Kansas City rule is the same position. Therefore, comparing of the intercept of the Smithin rule to that of the Pasinetti rule shows that:

$$\frac{A}{1-B(1-\gamma_0)\lambda} - A = \frac{A}{1-B(1-\gamma_0)\lambda} B(1-\gamma_0)\lambda \gtreqless 0 \tag{43}$$

Thus, the positions of these frontiers depend on the debt-growth regime. In case of DLG (i.e.,$B > 0$), the intercept of the Pasinetti rule is higher than that of the Smithin rule. In case of DBG (i.e.,$B < 0$), the intercept of the Smithin rule is higher than that of the Pasinetti rule.

Second, it is also trivial that the Kansas City rule does not have a slope. Comparing the slope of the Smithin rule and that of the Pasinetti rule gives that:

$$\frac{B\lambda}{1-B(1-\gamma_0)\lambda} - B\lambda = \frac{(B\lambda)^2}{1-B(1-\gamma_0)\lambda}(1-\gamma_0) > 0 \tag{44}$$

That is, the value of the slope of the growth frontier under the Pasinetti rule is always greater than that under the Smithin rule. The growth frontier of the Pasinetti rule is steeper in the case of a DLG regime, but the slope of the Smithin rule is steeper in the case of a DBG regime,

Finally, the intersection of these frontiers is as follows. The growth frontier of the Smithin rule intersects that of the Kansas City rule at the vertical axis. Considering the intersection of the Smithin rule and the Pasinetti rule, it is clear that these two growth frontiers intersect at the following point.

$$\begin{aligned} &\frac{1}{1-B(1-\gamma_0)\lambda}(A + B\lambda\hat{p}) = A + B\lambda\hat{p} \\ &\bar{p} = -\frac{A}{B\lambda} \gtreqless 0 \end{aligned} \tag{45}$$

This result shows that if the economy is a DLG regime (i.e.,$B > 0$), the frontiers intersect at a negative value of $\hat{p}$. It also shows that under a DBG regime (i.e.,$B < 0$), the frontiers intersect at a positive value of $\hat{p}$. In these cases, the growth rate at the intersection is equal to zero. Using these conditions, the relationship between the growth frontiers of each rule can be depicted as in Figure 3-6.

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