Review of Keynesian Economics, Vol. 1 No. 1, Spring 2013, pp. 79–104

Cambridge and neo-Kaleckian growth and distribution theory: comparison with an application to fiscal policy

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This paper compares Cambridge and neo-Kaleckian growth theory. Both are members of the post-Keynesian approach to growth and distribution, but the Cambridge model is a hybrid of Keynesian and classical features whereas the neo-Kaleckian model is Keynesian. The Cambridge approach assumes full capacity utilization, while the neo-Kaleckian approach assumes variable capacity utilization. The two theories rely on fundamentally different theories of income distribution. The Cambridge model has a class structure of saving that generates Pasinetti's (1962) theorem regarding irrelevance of worker saving for steady-state growth and distribution. That class structure can be included in the neo-Kaleckian model, generating a variant of the Pasinetti result whereby steady-state capacity utilization is independent of worker saving. Fiscal policy has similar growth effects in the two models, albeit via very different mechanisms. Both models suffer from lack of attention to the labor market.

Keywords: *Distribution, growth, Cambridge, neo-Kaleckian, ownership, fiscal policy*

JEL codes: *E12, E22, E25*

1 INTRODUCTION

This paper compares Cambridge and neo-Kaleckian distribution and growth theory, with a special focus on the comparative effects of fiscal policy. The Cambridge approach is identified with the models of Kaldor (1956) and Pasinetti (1962). The neo-Kaleckian approach is identified with Rowthorn (1982), Taylor (1983; 1991), Dutt (1984), and Lavoie (1995).

Both approaches are part of the post-Keynesian approach to growth. However, their substance is dramatically different, reflecting different theories of income distribution and different views about equilibrium capacity utilization. The Cambridge model is a mix of classical and Keynesian features. It is classical in that it assumes steady-state full capacity utilization, and growth effects of aggregate demand (AD) also work via the classical mechanism of variation in the profit share and profit rate. It is Keynesian in that the functional distribution of income is affected by AD. The neo-Kaleckian model is Keynesian in that it permits variable steady-state capacity utilization, enabling AD to also affect growth via the Keynesian mechanism of variation in the level of economic activity.

The paper illustrates these two perspectives with an application to fiscal policy. The paper also seeks to clarify the role of Pasinetti's (1962) version of the Cambridge model

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which incorporates a class-based structure of saving that renders worker saving behavior irrelevant for the determination of growth and distribution. A class-based structure of saving can also be incorporated into the neo-Kaleckian model, but now it is the rate of capacity utilization that is rendered independent of worker saving behavior.

2 THE CAMBRIDGE (UK) MODEL OF GROWTH AND INCOME DISTRIBUTION

This section presents the Cambridge (UK) model of growth and income distribution pioneered by Kaldor (1956) and Pasinetti (1962). A key analytic feature of this approach is the class-based structure of saving. A core economic assumption is that in the long run the economy settles at normal capacity utilization.

2.1 The basic model

The equations of the model are given by

$$u = Y/K = u^* \tag{2.1}$$

$$I/K = S/K = S_w/K + S_k/K \tag{2.2}$$

$$I/K = i = \alpha_0 + \alpha_1 \pi u^* \qquad \alpha_0 > 0, \alpha_1 > 0, 0 < \pi < 1 \tag{2.3}$$

$$S_w/K = s_w = \sigma_w \left[\omega u^* + [1 - z]\pi u^* \right] \qquad 0 < \sigma_w \leq 1, 0 < \omega < 1, 0 < z \leq 1 \tag{2.4}$$

$$S_k/K = s_k = \sigma_K [z \pi u^*] \qquad 0 < \sigma_w < \sigma_k \leq 1 \tag{2.5}$$

$$\pi + \omega = 1 \tag{2.6}$$

$$zi = s_k \tag{2.7}$$

$$g = i \tag{2.8}$$

where u = capacity utilization, Y = output, K = capital stock, u^* = normal capacity utilization, I = investment spending, S = aggregate saving, S_w = saving by worker households, S_k = saving by capitalist households, i = rate of capital accumulation, σ_w = worker household propensity to save, σ_k = capitalist household propensity to save, π = profit share, ω = wage share, z = share of the capital stock owned by the capitalist class, and g = rate of growth.

Equation (2.1) has the rate of capacity utilization equal to normal capacity utilization. Equation (2.2) is an investment–saving (*IS*) balance relation which ensures the goods market clears. Aggregate saving consists of saving by worker and capitalist households. Equation (2.3) determines the rate of capital accumulation which is a positive function of the profit rate, which in turn is a positive function of the profit share. Equation (2.4) determines the worker saving rate which is a positive function of the wage share and workers' ownership share of profits. Equation (2.5) determines capitalists' saving rate which is a positive function of their profit share. Equation (2.6) is the national income adding-up constraint requiring the profit and wage share to sum to unity. Equation (2.7) is the Pasinetti (1962) condition, which is explained below. Lastly, equation (2.8) has the rate of growth equal to the rate of capital accumulation.

There are two social classes in the model. Palley (2012a) discusses how the model can be extended to incorporate additional classes. The capitalist class is a 'pure' capitalist class in the sense of receiving only profit income and having no wage income. This issue is discussed further below. The assumption of normal capacity utilization reflects belief that, in the long run, firms are driven to the normal rate by a combination of microeconomic cost efficiency concerns and the forces of competition.

By appropriate substitution, the system of equations given by (2.1)–(2.8) can be reduced to a three-equation system given by:

$$\alpha_0 + \alpha_1 \pi u^* = \sigma_w \left\{ [1 - \pi] u^* + [1 - z] \pi u^* \right\} + \sigma_k [z \pi u^*] \tag{2.9}$$

$$z[\alpha_0 + \alpha_1 \pi u^*] = \sigma_k [z \pi u^*] \tag{2.10}$$

$$g = \alpha_0 + \alpha_1 \pi u^*. \tag{2.11}$$

Equation (2.9) is the *IS* schedule requiring investment–saving balance. Equation (2.10) is the Pasinetti condition, and equation (2.11) determines the growth rate.

The Pasinetti condition is not well understood and is easily mistaken for an *IS* condition. In fact, it is an ownership share equilibrium condition (Dutt 1990; Palley 2012a). To maintain their ownership share, capitalists must fund a portion of investment equal to their ownership share.

The model is illustrated in Figure 1. The *IS* schedule corresponds to equation (2.9) and yields combinations of capitalists' ownership share and the profit share consistent with goods market equilibrium. The *ZZ* schedule corresponds to equation (2.10) and determines the profit share consistent with a constant capitalist ownership share. The growth function corresponds to equation (2.11).

The slope of the *IS* schedule is given by $dz/d\pi|_{IS} = \{\alpha_1 + z[\sigma_w - \sigma_k]\}/[\sigma_k - \sigma_w]\pi < 0$.[1] The economic logic of the negatively-sloped *IS* schedule is that, as the profit share increases, capitalists' ownership share must fall to keep aggregate saving equal to investment. The *ZZ* schedule determines the profit share necessary to maintain capitalists' ownership share, and it is vertical because it is independent of z. The profit share (π) is the instantaneous endogenous variable and capitalists' ownership share (z) is a state variable.

The logic and dynamics of the model are as follows. In accordance with Kaldor's (1956) theory of income distribution, income distribution adjusts to ensure saving equals investment.[2] Assuming the goods market clears at every instant, the economy slides smoothly down the *IS* to the long-run equilibrium determined by the intersection of the *IS* and *ZZ* schedules. To the left of that intersection, capitalists' ownership share is declining because the profit share is not high enough to support enough saving by capitalists to maintain their existing ownership share. The reverse holds for points on the *IS* to the right of the intersection.

The *ZZ* schedule is often conflated with the *IS* schedule and the ownership share is often overlooked in macroeconomic analysis. However, it is a critically important

1. The denominator is positive. The numerator is assumed to be negative so that an increased profit share increases aggregate saving by more than it increases investment.
2. This is accomplished by a Marshallian price adjustment process whereby prices and the profit share are bid up or down to ensure goods market balance.

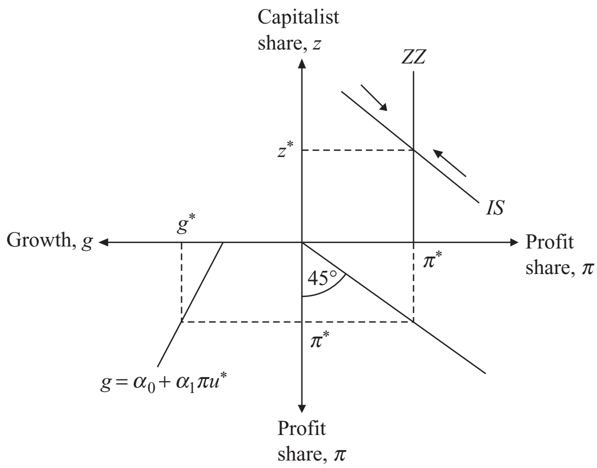

Figure 1 The Cambridge growth model

variable in the Cambridge model which emphasizes the class structure of saving. The level of saving depends on the class distribution of income, which in turn depends on the distribution of ownership.

As regards conflation of the *IS* and *ZZ* schedules, that likely occurs for two reasons. First, the *ZZ* resembles an *IS* relation. Second, for simplicity, it is often assumed that workers have a propensity to save of zero ($\sigma_w = 0$) so that capitalists' ownership share is unity ($z = 1$). In that very special case, the *IS* and *ZZ* schedules are identical.

A major feature of the model is that the steady-state profit share and growth rate are both independent of worker saving behavior. This is the famous Pasinetti (1962) theorem, whereby only capitalists' saving behavior affects growth and the functional distribution of income. In terms of Figure 1, the steady-state profit share and growth rate are determined by the *ZZ* schedule, which is independent of workers' saving behavior and dependent only on capitalists' saving behavior.

An increase in capitalists' propensity to save (σ_k) shifts both the *IS* and *ZZ* schedules left, so that the profit share and growth fall, while capitalists' ownership share increases.[3] The lesson is that capitalists can save their way to a higher profit share, but they cannot save their way to a higher profit share or faster growth. Trying to do so is counterproductive. The fact that growth falls as a result of increased capitalist saving appears to be a conventional Keynesian result. However, capacity utilization is constant and lower growth is due to a lower profit share caused by increased saving.

Increases in workers' propensity to save shift the *IS* left but leave the *ZZ* unchanged. The steady-state profit share and growth are unchanged, but capitalists' ownership share falls while that of workers' increases. Like capitalists, workers also cannot save their way to faster growth, but at least their saving has no negative effect on steady-state growth. However, worker saving does increase their ownership share so that workers can save their way to greater ownership and an improved class distribution of income.

3. The decline in capitalists' ownership share follows from the fact the *ZZ* shifts further left than the *IS*. The relative shifts are $d\pi/d\sigma_k|_{IS} = z\pi u^*/[\alpha_1 u^* + \sigma_w z u^* - \sigma_k z u^*] < 0$ and $d\pi/d\sigma_k|_{ZZ} = z\pi u^*/[\alpha_1 u^* - \sigma_k z u^*] < 0$.

2.2 Robustness of the Pasinetti theorem

There is a long line of research on the robustness of Pasinetti's theorem regarding the irrelevance of worker saving for growth. One issue is whether the existence of government debt undermines the theorem and the conclusion is that it does not (Pasinetti 1989; Dalziel 1991). This is easy to show for the case of bond-financed budget deficits by amending the Pasinetti equation and adding the following conditions:

$$z[i + d] = \sigma_k[z\pi u^* + zrb] \tag{2.12}$$

$$d = D/K \tag{2.13}$$

$$D/B = I/K \tag{2.14}$$

$$b = B/K \tag{2.15}$$

$$r = \rho - c \tag{2.16}$$

$$\rho = \pi u^* \tag{2.17}$$

where D = budget deficit, d = budget deficit relative to the capital stock, B = government debt, r = real interest rate on bonds, p = profit rate, and c = exogenous risk premium on capital relative to bonds. Equation (2.12) is the amended Pasinetti condition whereby capitalists receive a portion of bond interest payments and must also save enough to maintain their ownership share of the bond stock by financing their share of the budget deficit. Equations (2.13), (2.15), and (2.17) are definitions. Equation (2.14) is the steady-state condition requiring that the bond stock grow at the same rate as the capital stock. Equation (2.16) determines the real interest rate on bonds via a profit rate arbitrage condition.

By appropriate substitution and algebraic manipulation the Pasinetti condition with government debt can be expressed as

$$g[1 + b] = \sigma_k\{[\pi u^*[1 + b] - cb\}. \tag{2.18}$$

This condition is independent of workers' propensity to save, so that the Pasinetti theorem continues to hold. Inspection of equation (2.12) provides the key to this result, which is that capitalists hold identical shares of the capital and bond stocks. As long as that is true, the ownership share (z) cancels out, removing the channel whereby worker saving can affect the profit share and growth. A key condition for the Pasinetti theorem is that capitalists hold different asset classes in identical proportions. This is confirmed by Palley (1997) who shows that the Pasinetti theorem breaks down in a multiple asset model with money, if workers have a relatively larger demand for money owing to risk aversion.

In this connection, it can also be seen from inspection of equation (2.12) that the Pasinetti theorem will fail if the interest rate is a function of ownership shares. In the above specification, the bond interest rate is determined by a profit rate arbitrage condition. An alternative would be a portfolio model of interest rate determination of the type developed by Tobin (1982). In that case, if agents have differential asset demands, changes in saving behavior would affect the pattern of asset demands and the interest rate, causing the Pasinetti theorem to fail.

Inside debt is another cause for the theorem to fail (Palley 1996). If workers borrow from capitalists, they make debt service payments that transfer income to capitalists, thereby shifting the *ZZ* schedule left. An increased propensity to borrow by workers therefore lowers the profit share and growth.

A final reason for the Pasinetti theorem to fail is if capitalists also receive wage income and are not 'pure' capitalists (Palley 2012a). This is easily illustrated by amending the capitalist saving function to include wage income as follows:

$$s_k = \sigma_K[\gamma\omega u^* + z\pi u^*] \quad 0 < \gamma \leq 1 \tag{2.19}$$

where γ = capitalists' share of the wage bill. Substituting equation (2.19) in equation (2.7) then yields a new ownership equilibrium condition given by:

$$zi = \sigma_k[\gamma\omega u^* + z\pi u^*]. \tag{2.20}$$

Once again, capitalists' ownership share does not cancel out, so that worker saving can affect the profit share and growth by altering capitalists' ownership share. Finally, though all these instances undo the Pasinetti theorem, they do not undo the Cambridge model of growth and distribution which remains a logically valid perspective.

2.3 Fiscal policy in the Cambridge model

The issue of fiscal policy and government debt is of enormous importance in the current economic environment and the Cambridge model has its own perspective on this issue. This section explores the steady-state implications of alternative fiscal experiments using the Cambridge model.

A first experiment is to consider the impact of a lump-sum tax redistribution from capitalists to workers. In this case, the *IS* and *ZZ* schedules are given by

$$\alpha_0 + \alpha_1\pi u^* = \sigma_w\{[1-\pi]u^* + [1-z]\pi u^* + t\} + \sigma_k[z\pi u^* - t] \tag{2.21}$$

$$z[\alpha_0 + \alpha_1\pi u^*] = \sigma_k[z\pi u^* - t] \tag{2.22}$$

where $t = T/K$ = lump-sum redistribution per unit of capital. The first thing to note is that the lump-sum tax undoes the Pasinetti theorem. The reason is that the lump sum tax on capitalists makes it as if capitalists are no longer pure capitalists and have another source of income, albeit negative. Rearranging equation (2.22) and solving for z yields

$$z = -\sigma_k t/\{\alpha_0 + [\alpha_1 - \sigma_k]\pi u^*\}. \tag{2.23}$$

Differentiating with respect to π then yields the slope of the *ZZ* schedule which is as follows:

$$dz/d\pi|_{ZZ} = \sigma_k t[\alpha_1 - \sigma_k]u^*/\{\alpha_0 + [\alpha_1 - \sigma_k]\pi u^*\}^2 < 0^4$$

4. The Keynesian stability condition is $\alpha_1 < z[\sigma_k - \sigma_w]$. Since $\sigma_k > z[\sigma_k - \sigma_w]$, it follows that $\sigma_k > \alpha_1$.

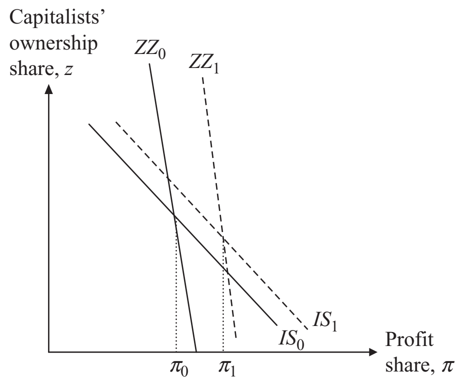

Figure 2 The effect of an increased lump-sum redistribution from capitalists to workers

The *ZZ* schedule is therefore negatively sloped. The logic is that the lump-sum tax on capitalists is based on the total capital stock (*T*/*K*). As capitalists' ownership share falls, that increases the burden of the tax on them. Consequently, they need a higher profit share to support their share investment.[5]

The effect of an increase in *t* is illustrated in Figure 2. The *ZZ* schedule shifts to the right as capitalists require a higher profit share to finance their existing ownership share. The *IS* schedule also shifts right, because the redistribution increases *AD*, which drives up the profit share, given the existing distribution of ownership. The net result is the profit share increases but capitalists' ownership share decreases.[6] Growth also increases. The lump-sum tax redistribution from capitalists to workers is expansionary, which drives up the profit share and growth. Capitalists' ownership share falls because workers are able to save more.

A second experiment is a reverse Robin Hood lump-sum redistribution from workers to capitalists. In this case the *ZZ* schedule is positively sloped. The reason is the effective transfer to capitalists increases as their ownership share falls, necessitating a lower profit share to maintain their saving at a level consistent with their investment share. An increase in the reverse Robin Hood tax shifts both the *IS* and *ZZ* schedules left. The profit share and growth fall, while capitalists' ownership share increases.

A third experiment is balanced-budget government expenditure financed by a lump-sum tax on capitalists. In this case, the *IS*, *ZZ*, and budget restraint equations are given by:

$$\alpha_0 + \alpha_1 \pi u^* + e = \sigma_w \left\{ [1-\pi]u^* + [1-z]\pi u^* \right\} + \sigma_k [z\pi u^* - t] + t \tag{2.24}$$

$$z[\alpha_0 + \alpha_1 \pi u^*] = \sigma_k [z\pi u^* - t] \tag{2.25}$$

$$G/K = e = t \tag{2.26}$$

5. Stability of the model now requires that the *ZZ* be steeper in absolute value than the *IS*.
6. Rearranging the *IS* schedule in terms of π yields $\pi = \{\sigma_w[u^* + t] - \sigma_k t\}/\{\alpha_1 + z[\sigma_w - \sigma_k]\}u^*$ and the partial derivative with respect to t is $d\pi/dt|_{IS} = [\sigma_w - \sigma_k]t/\{\alpha_1 + z[\sigma_w - \sigma_k]\}u^* > 0$. Rearranging the *ZZ* in terms of π yields $\pi = -[\sigma_k t + z\alpha_0]/[\alpha_1 - \sigma_k z]u^*$ and the partial derivative with respect to t is $d\pi/dt|_{ZZ} = -\sigma_k/[\alpha_1 - \sigma_k z]u^* > 0$. Algebraic manipulation then shows $d\pi/dt|_{IS} > d\pi/dt|_{ZZ}$.

where G = government spending, and e = government spending relative to the capital stock. This experiment produces identical directional shifts of the *IS* and *ZZ* schedules to those shown in Figure 2. However, the shift of the *IS* will be larger because there is no leakage from workers saving as part of the lump-sum redistribution. The profit share and growth increase, but the effect on capitalists' ownership share is unclear. However, as the *IS* shift is larger, the fall in capitalists' ownership share is smaller and it may even increase.

A fourth experiment is balanced-budget government expenditure financed by a lump-sum tax on workers. In this case the equations of the model are given by

$$\alpha_0 + \alpha_1 \pi u^* + e = \sigma_w \left\{ [1 - \pi]u^* + [1 - z]\pi u^* - t \right\} + \sigma_k z \pi u^* + t \tag{2.27}$$

$$[\alpha_0 + \alpha_1 \pi u^*] = \sigma_k \pi u^* \tag{2.28}$$

$$G/K = e = t. \tag{2.29}$$

Now, the *ZZ* schedule is again vertical and the Pasinetti theorem holds. The *ZZ* schedule is unaffected by the fiscal action, but the *IS* still shifts right because of the balanced budget-multiplier effect on *AD*. The profit share and growth are unaffected, but capitalists' ownership share rises because of the tax on workers. Capitalists should therefore support government spending financed by workers.

A fifth experiment is government expenditure financed by a tax on business profits. In this case the equations of the model are given by

$$\alpha_0 + \alpha_1[\pi u^* - t] + e = \sigma_w \left\{ [1 - \pi]u^* + [1 - z][\pi u^* - t] \right\} + \sigma_k z[\pi u^* - t] + t \tag{2.30}$$

$$\left\{ \alpha_0 + \alpha_1[\pi u^* - t] \right\} = \sigma_k[\pi u^* - t] \tag{2.31}$$

$$e = t. \tag{2.32}$$

With taxes paid by corporations, both worker and capitalist households bear the burden. The Pasinetti theorem also holds. The effect of a profits tax on corporations is illustrated in Figure 3. The *IS* schedule shifts right.[7] The *ZZ* also shifts right since $\sigma_k > \alpha_1$. The profit share therefore rises but the change in capitalists' ownership share is ambiguous. The growth function also shifts right so that the impact on the rate of accumulation and growth is also ambiguous. If investment is relatively insensitive to the profit rate (that is, α_1 is small), the shift in the *IS* will be large and the shift of the growth function small, so that growth and capitalists' ownership share could both rise.

A sixth experiment is balanced-budget public investment financed by a lump-sum tax on household profit income. Introducing public investment requires introducing public capital and describing how it impacts economic activity. Government is assumed to pick a public-to-private capital stock ratio. Moreover, following Aschauer (1989) and Munnell (1990), public capital is assumed to have a positive effect on private sector

7. Saving is more sensitive to income than investment, so that the net effect on *AD* is $-\alpha_1 + \sigma_w[1 - z] + \sigma_k z > 0$.

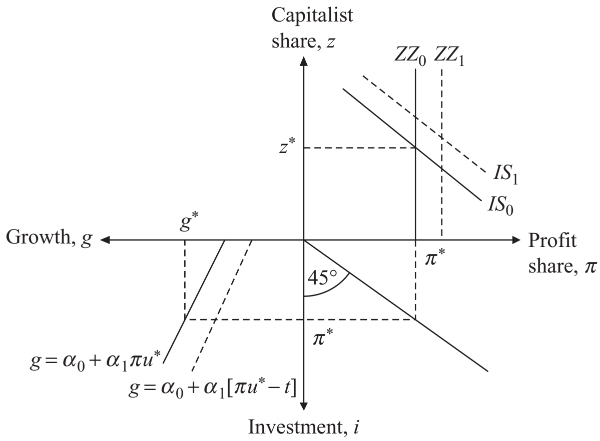

Figure 3 A corporate profit tax in the Cambridge growth model

productivity and therefore increases private sector investment. Steady state implies the following relations between public capital, private capital, and private investment:

$$K_G/K_P = \varphi \tag{2.33}$$

$$I_G/K_G = I_P/K_P = g \tag{2.34}$$

$$I_G/K_P = \varphi g \tag{2.35}$$

where K_G = government capital, K_P = private capital, I_G = government investment, and I_P = private investment. The new growth function, *IS* and *ZZ* schedules, and government budget restraint are given by:

$$g = \alpha_0 + \alpha_1 \pi u^* + \alpha_2 \varphi \tag{2.36}$$

$$[1+\varphi]g = \sigma_w\{[1-\pi]u^* + [1-z][\pi u^* - t]\} + \sigma_k z[\pi u^* - t] + t \tag{2.37}$$

$$\alpha_0 + \alpha_1 \pi u^* + \alpha_2 \varphi = \sigma_k[\pi u^* - t] \tag{2.38}$$

$$\varphi g = t. \tag{2.39}$$

In terms of Figure 3, the *IS* schedule shifts right because private saving decreases. The *ZZ* schedule also shifts right as capitalists need a higher profit share to offset taxes and to finance the increase in private investment spending triggered by government capital.[8] Lastly, the growth function in the southwest quadrant shifts left because of the positive

8. Once again, capitalists' ownership share will increase if the horizontal shift of the *IS* is larger than that of the *ZZ*. It will fall if the opposite holds.

public capital effect. Growth therefore accelerates for two reasons: a higher profit share and the positive effect of public capital on private investment.

The final experiment is bond-financed deficit spending on government. Introducing public debt requires specifying the steady-state relation between the debt and capital stock which is given by

$$D/B = I/K = g \tag{2.40}$$

$$b = B/K \tag{2.41}$$

where B = public debt, and D = budget deficit. Using equations (2.39) and (2.40) implies a steady state bond stock of

$$b = d/g. \tag{2.42}$$

The *IS* and *ZZ* schedules, interest rate, and budget restraint are given by

$$\alpha_0 + \alpha_1 \pi u^* + e = \sigma_w \{[1-\pi]u^* + [1-z][\pi u^* + rb]\} + \sigma_k z[\pi u^* + rb] - rb \tag{2.43}$$

$$z[\alpha_0 + \alpha_1 \pi u^*] + zd = \sigma_k z[\pi u^* + rb] \tag{2.44}$$

$$r = \rho - c = \pi u^* - c \tag{2.45}$$

$$d = e + rb > 0 \tag{2.46}$$

$$g = \alpha_0 + \alpha_1 \pi u^*. \tag{2.47}$$

Equation (2.43) is the *IS* condition and households' saving is now augmented by saving out of bond interest payments, while interest payments on the debt render taxes negative. Equation (2.44) is the Cambridge ownership equilibrium condition which now requires capitalists to finance their share of the budget deficit. Equation (2.45) determines the real interest rate in terms of an arbitrage relation with the profit rate, and capital earns a risk premium of c. Equation (2.46) is the actual deficit, which is a positive function of government spending, the real interest rate, and the public debt. Equation (2.47) is the growth function.

From equation (2.44) it can be seen that the Pasinetti theorem holds so that the steady-state profit share and growth rate are independent of workers' saving behavior. As discussed earlier, the reason is that capitalists own identical shares of the capital stock and public debt.

Using equations (2.42)–(2.47), the steady-state public debt and constant ownership condition can be expressed as

$$b = e/[g - r] = e/\{[\alpha_0 + c + \pi u^*[\alpha_1 - 1]\} \tag{2.48}$$

$$[\alpha_0 + \alpha_1 \pi u^*] + e + [\pi u^* - c]b = \sigma_k \{\pi u^* + [\pi u^* - c]b\}. \tag{2.49}$$

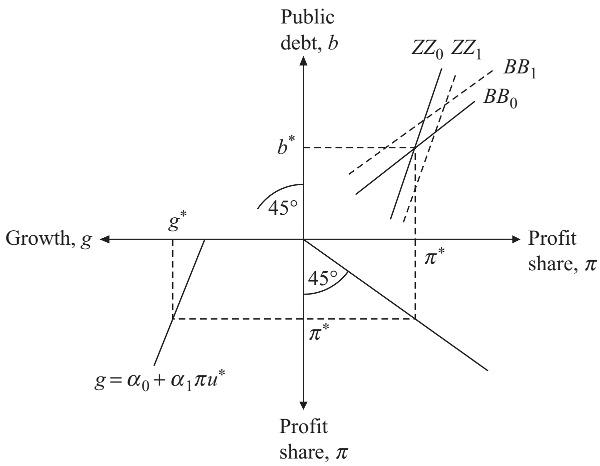

Figure 4 The effect of increased bond-financed spending in the Cambridge growth model with a steady-state budget deficit

There are now two state variables: the debt–capital ratio and capitalists' ownership share. The determination of steady-state equilibrium is illustrated in Figure 4. The *BB* schedule represents the steady-state debt–capital condition given by equation (2.47), while the *ZZ* schedule represents the Cambridge constant ownership share condition given by equation (2.48). The *BB* schedule is unambiguously positively-sloped in [π, b] space, but the slope of the *ZZ* schedule is theoretically ambiguous.[9] A positively-sloped *BB* schedule implies that the steady-state debt–capital rises with the profit share and interest rate. A higher profit share (π) increases the interest rate (r) more than growth (g), generating a higher steady-state debt (b) for a given level of spending (e). A positively-sloped *ZZ* schedule implies that a higher steady-state debt requires a higher profit share for capitalists to have sufficient income to finance their share of the increased deficit. The intersection of the *BB* and *ZZ* schedules determines the steady-state profit share (π) and debt stock (b).

Figure 4 is drawn with both the *ZZ* and *BB* schedules having positive slopes, and the *ZZ* being steeper. It also shows the effect of an increase in government spending (e). The *BB* shifts up as increased spending raises the steady-state debt. The *ZZ* shifts right as more spending increases b, necessitating a higher profit share for capitalists to finance their share of the increased steady-state budget deficit. The debt–capital ratio, profit share, and growth all increase. The logic is as follows. Government spending (e) adds to demand, and it also increases debt which generates interest income for households. *AD* therefore increases, which raises the profit share and growth. Table 1 summarizes the effects of the above fiscal policy experiments.

9. The slope of the *BB* schedule is $db/d\pi|_{BB} = -eu^*[\alpha_1 - 1]/\{[\alpha_0 + c + \pi u^*[\alpha_1 - 1]\}^2 > 0$ since $\alpha_1 < 1$ according to the Keynesian stability condition. A higher profit share (π) raises the growth rate (g) and the interest rate (r) so that the debt–capital ratio rises. The slope of the *ZZ* is $db/d\pi|_{ZZ} = \{\sigma_k - \alpha_1 - [1 - \sigma_k]b\}u^*/[\pi u^* - c][1 - \sigma_k] \gtrless 0$ if $\sigma_k - \alpha_1 - [1 - \sigma_k]b \gtrless 0$. It is therefore positively-sloped if $b < [\sigma_k - \alpha_1]/[1 - \sigma_k]$ and negatively-sloped otherwise.

Table 1 Comparative statics with regard to fiscal policy in the Cambridge model

	Profit share	Capitalists' ownership	Growth
Lump-sum 'Robin Hood' transfer from capitalists to workers	+	−	+
Lump-sum 'reverse Robin Hood' transfer from workers	−	+	−
Balanced-budget spending financed by lump-sum tax on capitalists	+	?/−	+
Balanced-budget spending financed by lump-sum tax on workers	0	+	0
Balanced-budget spending financed by a tax on business profits	+	?	?
Public investment financed by a tax on household profit income	+	?/+	+
Bond-financed government spending	+	?	+

Figure 4 shows the comparative static outcomes. That raises the question of the stability of bond-financed government spending. There are two state variables, the debt stock (b) and capitalists' ownership share (z). These state variables are governed by the following equations of motion:

$$\Delta b = D/B - I/K = e/b - c - \alpha_0 + \pi u^*[1 - \alpha_1] \tag{2.50}$$

$$\begin{aligned} \Delta z &= Z\big(\sigma_k[\pi u^* + rb] - [\alpha_0 + \alpha_1 \pi u^*] - d\big) \quad Z(0) = 0, Z' > 0 \\ &= Z\big(\sigma_k[\pi u^* + [\pi u^* - c]b] - [\alpha_0 + \alpha_1 \pi u^*] - e - [\pi u^* - c]b\big) \end{aligned} \tag{2.51}$$

$$\pi = \pi(z, e, \sigma_k, \alpha_0, \alpha_1) \quad \pi_z < 0, \pi_e > 0, \pi_{\sigma k} < 0, \pi_{\alpha 0} > 0, \pi_{\alpha 1} > 0 \tag{2.52}$$

where Δ = rate of change. The profit share, described by Equation (2.51), is an instantaneous variable determined by the *IS* relation and it affects the adjustment process. According to Cambridge distribution theory, the profit share increases with demand pressure, which explains the signing of partial derivatives. Stability requires that both the debt–capital ratio and capitalists' ownership share be constant in steady-state. Depending on the slopes of the *BB* and *ZZ* schedules in Figure 4, the model economy may be stable or unstable.[10] Simple phase-plane analysis using Figure 4 shows the model is stable if the *ZZ* is negatively-sloped and the *BB* positively-sloped; stable if the *ZZ* is positively-sloped and steeper than the *BB*; and unstable if the *ZZ* is positively-sloped and flatter than the *BB*.[11]

10. The logic of instability is that increased *AD* can increase the profit share, raising interest payments and the debt and contributing to yet further increased demand.
11. From equation (2.50) it can be seen that a high profit rate increases b because it raises the interest rate. Points to the right of the *BB* are therefore associated with increasing b, and points to the left are associated with falling b. From equation (2.51) it can be seen that a high profit rate is associated with capitalist saving in excess of investment and demand shortage which lowers π. Points to the left of the *ZZ* are therefore associated with rising π, and points to the right are associated with falling π.

3 THE NEO-KALECKIAN MODEL

This section explores the neo-Kaleckian model which constitutes an alternative post-Keynesian approach to growth and distribution. The Cambridge model assumes full capacity utilization and emphasizes the role of profit dynamics in determining growth: the neo-Kaleckian model assumes variable capacity utilization and emphasizes the role of capacity utilization dynamics in determining growth.

3.1 The basic model

The model is described by the following six equations:

$$I/K = S/K \tag{3.1}$$

$$I/K = i = \alpha_0 + \alpha_1 \pi u + \alpha_2 u \tag{3.2}$$

$$S/K = \sigma_w[1 - \pi]u + \sigma_k \pi u \quad 0 < \sigma_w < \sigma_k < 1 \tag{3.3}$$

$$g = i \tag{3.4}$$

$$m = m(\psi) \quad m_\psi > 0 \tag{3.5}$$

$$\pi = m/[1 + m] = \pi(m) \quad \pi_m > 0 \tag{3.6}$$

where m = mark-up of firms over normal costs, and ψ = firms' mark-up pricing power. Equation (3.1) is the *IS* equilibrium condition. Equation (3.2) determines the rate of capital accumulation. Equation (3.3) is the saving rate function. Equation (3.4) has the rate of growth equal to the rate of capital accumulation. Equation (3.5) determines firms' mark-up, and equation (3.6) determines the profit share as a positive function of the mark-up.

Comparison with the Cambridge model reveals several features. First, and most important, is that capacity utilization is variable. Second, the investment equation now includes an additional stand-alone channel whereby capacity utilization affects the rate of accumulation. These two features render the neo-Kaleckian model fundamentally Keynesian. Thus, variations in *AD* affect capacity utilization, which in turn impacts growth. The Cambridge model has no equivalent Keynesian channel because capacity utilization is fixed.

Third, the aggregate saving function distinguishes between saving out of profit and wage income but it lacks a class structure. The propensity to save out of wage income is assumed to be less than that out of profits, reflecting a behavioral approach whereby households treat income streams differently. The absence of a class structure to saving also means there is no mention of ownership shares. Unlike the Cambridge model, the distribution of ownership has not been viewed as central to the neo-Kaleckian model.

That said, the neo-Kaleckian model can be given a special class interpretation if workers have a propensity to consume of unity and capitalists receive no wage income. In this event, the aggregate saving function is

$$S/K = \sigma_k \pi u \quad 0 < \sigma_k < 1. \tag{3.7}$$

Because workers do not save, capitalists own the entire capital stock and receive all profits. Ownership is therefore accounted for in equation (3.7).

Fourth, the profit share is determined by firms' mark-up, reflecting a fundamentally different theory of income distribution. The mark-up is positively affected by firms' power, which can be interpreted either as monopoly power in the product market or bargaining power in the labor market.[12] In the current model, the mark-up is independent of capacity utilization, which greatly simplifies the analysis while subtracting little. Moreover, in practice there is empirical uncertainty about any relationship. On one hand, higher capacity utilization might be associated with a lower mark-up if increased capacity utilization correlates with increased worker bargaining power. Alternatively, it might be associated with a higher mark-up if it correlates with tighter goods markets and increased pricing power. Using a game-theoretic model, Rotemberg and Saloner (1986) argue mark-ups are counter-cyclical as firms try to win market share in booms.

As is well known, the neo-Kaleckian model is characterized by three regimes: profit-led, wage-led, and conflictive (see Bhaduri and Marglin 1990; Taylor 1991; Stockhammer 2011). These different regimes capture the range of possible effects of an exogenous increase in the profit share on capacity utilization and growth. An economy is profit-led if an increase in the profit share increases capacity utilization and growth; it is wage-led if it decreases capacity utilization and growth; and it is conflictive if capacity utilization decreases but growth increases. The character of the economy is determined by the combination of the responsiveness of capacity utilization and investment spending to changes in the profit share, as shown in Table 2.

The nature of the economic regime is related to the slope of the *IS* schedule in $[u, \pi]$ space. The *IS* schedule is given by

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u = \sigma_w [1 - \pi] u + \sigma_k \pi u. \tag{3.8}$$

Differentiating totally with respect to π and u and re-arranging yields:

$$d\pi/du|_{IS} = \left\{\sigma_w[1-\pi] + \sigma_k \pi - \alpha_1 \pi - \alpha_2\right\}/[\alpha_1 u + \sigma_w u - \sigma_k u].$$

The numerator is assumed to be positive, reflecting the Keynesian expenditure multiplier stability condition requiring saving to be more responsive than investment to income. The denominator's sign is ambiguous and depends on the relative responsiveness of investment and saving to changes in the profit share. If the investment response is stronger, it is positive. If the saving response is stronger it is negative. The slope of the *IS* may therefore be positive or negative.

In a profit-led regime the denominator is positive, reflecting the strong response of investment to the profit share, making the *IS* positively-sloped. In wage-led and conflictive regimes the denominator is negative, making the *IS* negatively-sloped.

12. The relationship between the mark-up and profit share is easily illustrated with a linear production function and a price rule whereby firms set prices as a mark-up over average labor costs, as follows:

$$y = aN \quad a > 0 \tag{1}$$

$$p = [1 + m]w/a \tag{2}$$

where y = real output, N = employment, p = price level, and w = nominal wage. In this case, the wage share is given by wN/py. Substituting for p and y yields $\omega = 1/[1 + m]$ and $\pi = m/[1 + m]$.

Table 2 Conditions describing profit-led, wage-led, and conflictive regimes

	Capacity utilization	Investment rate
Profit-led	$u_m > 0$	$\alpha_2 u_m + \alpha_1[\pi u_m + u\pi_m] > 0$
Wage-led	$u_m < 0$	$\alpha_2 u_m + \alpha_1[\pi u_m + u\pi_m] < 0$
Conflictive	$u_m < 0$	$\alpha_2 u_m + \alpha_1[\pi u_m + u\pi_m] > 0$

The difference between the wage-led and conflictive regimes in the response of investment to the profit share is stronger in the latter. Consequently, an increase in the profit share increases investment in the conflictive regime despite lowering capacity utilization.

The reduced model is given by the following three equations:

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u = \sigma_w [1 - \pi] u + \sigma_k \pi u \tag{3.9}$$

$$\pi = \pi\big(m(\psi)\big) \quad \pi_m > 0, m_\psi > 0 \tag{3.10}$$

$$g = \alpha_0 + \alpha_1 \pi u + \alpha_2 u. \tag{3.11}$$

The model is illustrated in Figure 5 for the case of a wage-led regime. The *IS* and profit share function (denoted ΠΠ) jointly determine the profit share and rate of capacity utilization. Those variables in turn determine the rate of growth.

3.2 Fiscal policy in the neo-Kaleckian model

The model can be used to analyse the same balanced-budget experiments examined earlier. A lump-sum tax on profit income that is transferred to wage income results in a new *IS* given by

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u = \sigma_w \big\{[1 - \pi] u + t\big\} + \sigma_k [\pi u - t]. \tag{3.12}$$

In terms of Figure 5, the tax shifts the *IS* right, raising capacity utilization and growth. The *IS* shifts because *AD* increases owing to the higher propensity to consume out of wage income. The reverse holds for redistribution from wages to profits.

Balanced-budget government spending financed by a lump-sum tax on households' profit income results in another new *IS* and a budget restraint given by

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u + e = \sigma_w [1 - \pi] u + \sigma_k [\pi u - t] + t \tag{3.13}$$

$$e = t. \tag{3.14}$$

In terms of Figure 5, the *IS* again shifts right, raising capacity utilization and growth. This time the *IS* shifts because *AD* increases as government spends all the tax revenue whereas households would have saved some.

A third experiment is balanced-budget government spending financed by a lump-sum tax on firms' profits. In this case, the *IS* function, growth function, and budget restraint are given by:

$$\alpha_0 + \alpha_1 [\pi u - t] + \alpha_2 u + e = \sigma_w [1 - \pi] u + \sigma_k [\pi u - t] + t \tag{3.15}$$

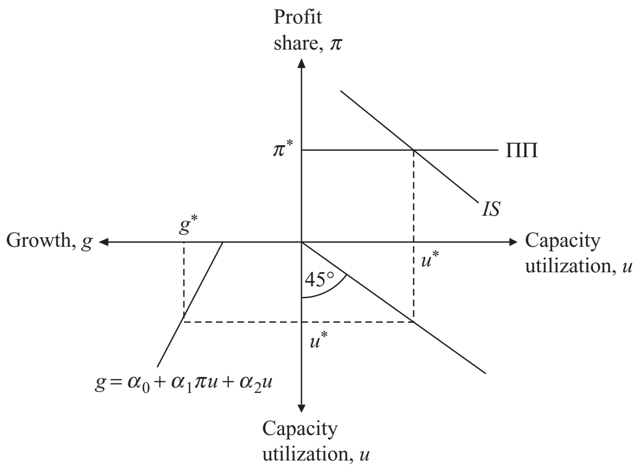

Figure 5 The neo-Kaleckian growth model with behavioral saving

$$g = \alpha_0 + \alpha_1[\pi u - t] + \alpha_2 u \tag{3.16}$$

$$e = t. \tag{3.17}$$

The direction of shift of the *IS* is ambiguous. On the positive side, increased government spending and reduced saving shift the *IS* right, but now there is a negative effect from the decline in investment spending caused by the profit tax. If the latter dominates, the *IS* may shift left. Even if the *IS* shifts right and capacity utilization increases, growth can decline. This is because the tax on corporate profits shifts the accumulation function in the southwest quadrant to the right so that the negative-profit tax effect on investment may dominate the positive-capacity utilization effect. Balanced-budget spending financed via taxes levied directly on corporate profits is therefore less likely to be expansionary.

The above policy experiment raises an important microeconomic issue regarding corporations, capital markets, and shareholders. The neoclassical perspective is that managers are fully identified with shareholders, as if they were one and the same. Taxing profits at the household level is therefore akin to taxing profits at the corporate level, and all profit taxes discourage investment. The neo-classical belief is that managers act as if they were shareholders, so that taxing shareholders is equivalent to directly taxing firms. Post-Keynesians dispute this claim and treat the decision loci as separate. Taxing profit income at the firm and household level therefore has differential impacts.[13]

A fourth experiment is balanced-budget public investment financed by a lump-sum tax on household profit income. Recalling the earlier discussion about public and

13. Neo-classicals make the same claim regarding stock markets and their impact on investment. It is this claim that is behind the controversy over q theory of investment (Crotty 1990; Palley 2001). Post-Keynesians argue for a separation between managers and shareholders, so that managers have different expectations and views about the true worth of companies and the incremental value of additional investments. Consequently, stock markets signal shareholder understandings which may be radically different from the understanding of managers, and stocks may therefore have little connection to managers' decisions to invest.

private capital in the classical model, the equations for the neo-Kaleckian model with public capital are:

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u + \alpha_3 \varphi + \varphi g = \sigma_w[1-\pi]u + \sigma_k[\pi u - t] + t \tag{3.18}$$

$$g = \alpha_0 + \alpha_1 \pi u + \alpha_2 u + \alpha_3 \varphi \tag{3.19}$$

$$\varphi g = t. \tag{3.20}$$

In terms of Figure 5, the *IS* schedule shifts right because of reduced saving, increased private investment ($\alpha_3\varphi$), and public investment (φg), while the growth function shifts left. Capacity utilization and growth therefore both increase.

A final experiment is government expenditure financed by bond issues, but limited by the requirement that the bond stock grow at the steady-state rate of capital accumulation.[14] The *IS* schedule and steady-state debt condition are given by

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u + e = \sigma_w[1-\pi]u + \sigma_k[\pi u + rb] - rb \tag{3.21}$$

$$b = e/[g-r] = e/\{\alpha_0 + \pi u[\alpha_1 - 1] + \alpha_2 u + c\}. \tag{3.22}$$

The *IS* is augmented to include government spending; interest payments on the debt that add to household capital income and increase saving; and interest payments that are a government transfer and reduce government saving. From equation (3.22), the requirement of non-negative debt imposes the condition $g > r$.

The model is represented in $[u, b]$ space in Figure 7. The *IS* schedule now incorporates the exogenously-given profit share. The *BB* schedule corresponds to the steady-state debt condition. Unlike the Cambridge model, because ownership shares are absent, there is only one state variable whose motion is governed by[15]

$$\begin{aligned} \Delta b &= e/b + r - g \\ &= e/b + [\pi u - c] - \alpha_0 - \alpha_1 \pi u - \alpha_2 u. \end{aligned} \tag{3.23}$$

Setting equation (3.23) equal to zero yields the *BB* schedule. Totally differentiating with respect to b and u and rearranging yields the slope of the *BB* schedule:

$$db/du|_{BB} = -e[\alpha_1\pi + \alpha_2 - \pi]/\{\alpha_1 \pi u + \alpha_2 u + c - \pi u\}^2 > 0 \text{ if } \pi - \alpha_1\pi - \alpha_2 > 0^{16}$$

The Keynesian stability condition ensures this condition holds, making the *BB* positively-sloped. Inspection of equation (3.21) shows the *IS* must be positively-sloped if the Keynesian stability condition holds. Increases in b reduce saving, necessitating an

14. You and Dutt (1996) conduct a similar analysis but they assume an exogenously fixed interest rate on government debt. The current analysis also provides a simple accessible and tractable graphical analysis that brings out the economic logic of results.
15. The debt–capital ratio is given by $b = B/K$. Taking the natural log logarithms and differentiating yields $\Delta b = d/b - g = e/b + r - g$. The *BB* schedule is obtained by setting $\Delta b = 0$ and solving for b. The stability condition is $d[\Delta b]/db < 0$.
16. The debt–capital ratio is restricted to be positive ($b > 0$). That implies the denominator in equation (3.22) is negative, which suggests $[\alpha_1\pi + \alpha_2 - \pi] > 0$ and $db/du|_{BB} < 0$.

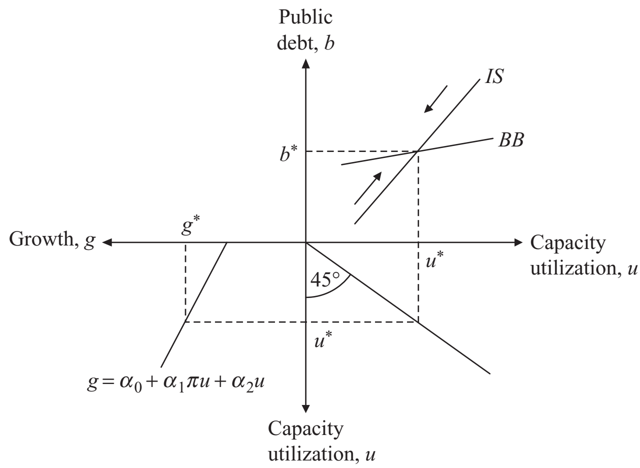

Figure 6 The neo-Kaleckian growth model with public debt

increase in capacity utilization to restore the saving–investment balance. The economic logic is that an increase in the debt ratio (b) increases interest payments to households, which increases household disposable income, *AD*, and capacity utilization.[17]

Figure 6 shows a positively-sloped *IS* schedule that is steeper than the *BB* schedule. The positive slope of the *BB* reflects the fact that increased-capacity utilization raises the interest rate by more than it raises growth and capital accumulation, thereby increasing the debt–capital ratio. The instantaneous variable is capacity utilization (u) and the state variable is the bond stock (b). Steady-state equilibrium is determined by the intersection of the *IS* and *BB* schedules. If the goods market is always in equilibrium, adjustment to steady state takes place along the *IS* schedule. Simple phase-plane analysis shows that the economy is stable if the *IS* is steeper than the *BB* schedule, as drawn in Figure 6.[18]

An increase in government spending (e) shifts the *IS* schedule right and the *BB* schedule up. Capacity utilization, the steady-state public debt ratio, and growth, all increase. The debt ratio can actually fall as a result of increased government spending if the impact of spending on accumulation and growth is strong. Table 3 summarizes the comparative statics regarding the effects of the above fiscal policy experiments in the neo-Kaleckian model with rule-of-thumb saving.

Finally, it is worth noting that, in the current model, higher interest rates are expansionary since they increase interest payments to households, and they can also cause debt instability. The current specification has the economy determining the bond interest rate via the endogenously-determined profit rate. This highlights the importance of the interest rate determination mechanism for the growth effects of government debt, and the impact of alternative mechanisms is an important issue for future consideration.

17. The slope of the *IS* is obtained by totally differentiating equation (3.21) with respect to b and u and rearranging to yield: $db/du|_{IS} = \{\sigma_w[1 - \pi] + \sigma_k\pi - \pi b[1 - \sigma_k] - \alpha_1\pi - \alpha_2\}/[\pi u - c][1 - \sigma_k]$. The denominator is positive, as is the numerator, if the Keynesian stability condition holds.

18. High rates of capacity utilization raise the interest rate more than the growth rate, contributing to rising debt–capital ratio. Points to the right of the *BB* schedule are therefore associated with rising b, while points to the left are associated with falling b.

Table 3 Comparative statics with regard to fiscal policy in the neo-Kaleckian model with rule-of-thumb saving

	Utilization rate	Growth
Lump sum tax redistribution from profit to wage income	+	+
Balanced-budget spending financed by lump sum tax on profits	+	+
Balanced-budget spending financed by lump sum tax on business profit	?	–/?
Balanced-budget spending financed by a tax on household profit income	+	+
Bond-financed government spending	+	+

4 ADDING A CLASS STRUCTURE OF SAVING TO THE NEO-KALECKIAN MODEL

The neo-Kaleckian model is usually analysed with rule-of-thumb saving or with a class structure in which workers have no saving. However, as shown by Dutt (1990) and Palley (2012a), the model can be amended to include a more general Cambridge class structure of saving. In this case the equations of the model are given by:

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u = \sigma_w \left\{ [1-\pi]u + [1-z]\pi u \right\} + \sigma_k [z\pi u] \tag{4.1}$$

$$\pi = \pi\big(m(\psi)\big) \qquad \pi_m > 0, m_\psi > 0 \tag{4.2}$$

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u = \sigma_k \pi u \tag{4.3}$$

$$g = \alpha_0 + \alpha_1 \pi u + \alpha_2 u. \tag{4.4}$$

Equation (4.1) is the *IS* schedule with a class structure to saving. Equation (4.2) is the profit share function. Equation (4.3) is the Pasinetti constant-ownership share condition, while equation (4.4) is the growth function.

Figure 7 provides a graphical representation of the model. The mark-up function is incorporated into the *IS* schedule. The *IS* is negatively-sloped because a lower capitalist ownership share reduces saving and increases *AD*, which increases capacity utilization. The *ZZ* schedule represents the Pasinetti constant ownership share condition given by equation (4.3). Assuming the good market clears along the steady-state adjustment path, the economy slides down the *IS* to the point of intersection with the *ZZ* schedule.

In the Cambridge model, the profit rate and growth are independent of worker saving behavior and are only affected by capitalist saving behavior. In the neo-Kaleckian model with a class structure to saving, the rate of capacity utilization and growth are independent of worker saving behavior and only affected by capitalist behavior. The Pasinetti theorem continues to hold, but now it concerns steady-state capacity utilization rather than the steady-state profit rate. As discussed earlier there are conditions in the classical model where the Pasinetti theorem does not hold. Those same conditions will cause the Pasinetti theorem not to hold in the neo-Kaleckian model.

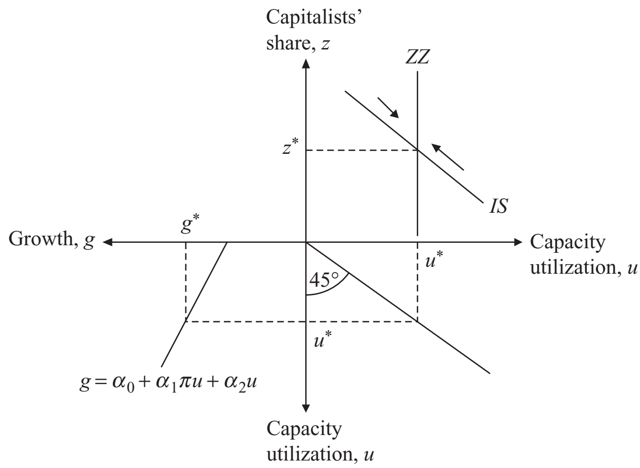

Figure 7 The neo-Kaleckian growth model with a class structure to saving

Once again, the model can be used to explore fiscal policy experiments. A lump-sum tax redistribution from capitalist to worker households changes the *IS* and *ZZ* equations as follows:

$$\alpha_0 + \alpha_1\pi u + \alpha_2 u = \sigma_w\{[1-\pi]u + [1-z]\pi u + t\} + \sigma_k[z\pi u - t] \tag{4.5}$$

$$z[\alpha_0 + \alpha_1\pi u + \alpha_2 u] = \sigma_k[z\pi u - t]. \tag{4.6}$$

As earlier, the lump sum tax on capitalists renders the *ZZ* schedule negatively-sloped. The logic is as before. The tax is constructed in terms of the total capital stock (*T*/*K*) so that the tax burden on capitalists increases as their ownership share falls. That necessitates a higher utilization rate and profit rate to finance their share of investment and maintain their ownership share. A higher tax shifts both the *IS* and *ZZ* schedules right, so that capacity utilization, the profit rate, and growth, all rise.[19] However, capitalists' ownership share falls as the transfer from capitalists to workers enables the latter to increase their saving.[20]

A lump-sum reverse Robin Hood transfer from workers to capitalists renders the *ZZ* schedule positively-sloped, and an increase in the reverse Robin Hood tax shifts both schedules to the left. Capacity utilization and growth fall, while capitalists' ownership share increases.

19. Note, as discussed earlier in connection with analysis of the Cambridge model, the lump-sum transfer means that the *ZZ* schedule is no longer vertical and independent of z. It is as if capitalists are no longer pure capitalists because they have another source of income, albeit negative, from the lump-sum tax.
20. Capitalists' ownership share declines if the horizontal shift of the *ZZ* is larger than the horizontal shift of the *IS*. The horizontal shift of the *ZZ* is $du/dt|_{ZZ} = \sigma_k/[\sigma_k\pi - \alpha_1\pi - \alpha_2]$. The horizontal shift of the *IS* is $du/dt|_{IS} = [\sigma_w - \sigma_k]/[\alpha_1\pi + \alpha_2 - \sigma_w\{[1-\pi] + [1-z]\pi\} - \sigma_k z\pi]$. The numerator for the *ZZ* is larger and the denominator smaller. Ergo, the shift of the *ZZ* is larger and capitalists' ownership share falls.

A third experiment is a lump-sum tax on capitalist households to pay for government spending. In this case, the *IS*, *ZZ*, and budget restraint equations are as follows:

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u + e = \sigma_w \left\{ [1-\pi]u + [1-z]\pi u \right\} + \sigma_k [z\pi u - t] + t \tag{4.7}$$

$$z[\alpha_0 + \alpha_1 \pi u + \alpha_2 u] = \sigma_k [z\pi u - t] \tag{4.8}$$

$$e = t. \tag{4.9}$$

The *ZZ* schedule is again negatively-sloped. Both the *IS* and *ZZ* schedules shift right, increasing steady-state capacity utilization and growth. The economic logic behind the increase in capacity utilization is the balanced-budget multiplier theorem. Capitalists' ownership share falls.[21] The increase in the profit rate reflects the Kaleckian dictum that capitalists earn what they spend, with the profit tax to finance government spending being a form of forced spending.

A fourth experiment is a balanced-budget lump-sum tax on worker households to pay for government spending. In this case, the *IS*, *ZZ*, and budget restraint equations are as follows:

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u + e = \sigma_w \left\{ [1-\pi]u + [1-z]\pi u - t \right\} + \sigma_k z\pi u + t \tag{4.10}$$

$$\alpha_0 + \alpha_1 \pi u + \alpha_2 u = \sigma_k \pi u \tag{4.11}$$

$$e = t. \tag{4.12}$$

The *IS* schedule shifts right but the *ZZ* is unchanged. Steady-state capacity utilization and growth are therefore unchanged, and capitalists' ownership share increases. Again, the logic of increased capacity utilization is the balanced-budget multiplier theorem.

A fifth experiment is a balanced-budget lump-sum tax on corporate profits to pay for government spending. The *IS*, *ZZ*, and budget restraint equations are as follows:

$$\alpha_0 + \alpha_1 [\pi u - t] + \alpha_2 u + e = \sigma_w \left\{ [1-\pi]u + [1-z][\pi u - t] \right\} + \sigma_k z[\pi u - t] + t \tag{4.13}$$

$$\alpha_0 + \alpha_1 [\pi u - t] + \alpha_2 u = \sigma_k [\pi u - t] \tag{4.14}$$

$$e = t. \tag{4.15}$$

As earlier, the direction of shift of the *IS* schedule shifts is ambiguous. On the positive side, there is the effect of government spending and reduced saving. On the negative side, there is the drain of taxes and the negative effect of taxes on investment spending.

21. Capitalists' ownership share declines because the horizontal shift of the *ZZ* is larger than that of the *IS*. The horizontal shift of the *ZZ* is $du/dt|_{ZZ} = \sigma_k/[\sigma_k\pi - \alpha_1\pi - \alpha_2] > 0$. The horizontal shift of the *IS* is $du/dt|_{IS} = -\sigma_k/[\alpha_1\pi + \alpha_2 - \sigma_w\{[1-\pi] + [1-z]\pi\} - \sigma_k z\pi] > 0$.

The shift of the *IS* is given by $du/dt|_{IS} = \{\alpha_1 - \sigma_w[1-z] - \sigma_k z\}/[\alpha_1\pi + \alpha_2 - \sigma_w\{[1-\pi] + [1-z]\pi\} - \sigma_k z\pi]$. The denominator is negative but the sign of the numerator is theoretically ambiguous. In wage-led regimes α_1 is small so that the *IS* likely shifts right. In profit-led and conflictive regimes it may shift left. The *ZZ* schedule shifts right as the tax on capitalists is akin to reduced saving, so a higher utilization rate is needed to finance their investment share.[22]

A sixth experiment is public investment financed by a lump-sum tax on household dividend income. Recalling the earlier specification between public and private capital described by equations (2.12)–(2.15), the new growth function, *IS* and *ZZ* schedules, and government budget restraint, are given by:

$$g = \alpha_0 + \alpha_1\pi u + \alpha_2 u + \alpha_3\varphi \tag{4.16}$$

$$[1+\varphi]g = \sigma_w\big\{[1-\pi]u + [1-z][\pi u - t]\big\} + \sigma_k z[\pi u - t] + t \tag{4.17}$$

$$\alpha_0 + \alpha_1\pi u + \alpha_2 u + \alpha_3\varphi = \sigma_k[\pi u - t] \tag{4.18}$$

$$\varphi g = t. \tag{4.19}$$

In terms of Figure 7, the *IS* and *ZZ* schedules both shift right, while the growth function shifts left. Capacity utilization and growth therefore increase, but the effect on capitalists' ownership share is ambiguous. With public investment having a stronger effect on *AD* because of its additional impact on private investment, that increases the rightward shift of the *IS* which increases the likelihood that capitalists' ownership share increases.

A seventh and final experiment is bond-financed government spending. The equations of the steady state are given by

$$\alpha_0 + \alpha_1\pi u + \alpha_2 u + e = \sigma_w\big\{[1-\pi]u + [1-z][\pi u + rb]\big\} + \sigma_k z[\pi u + rb] - rb \tag{4.20}$$

$$z[\alpha_0 + \alpha_1\pi u + \alpha_2 u + d] = \sigma_k z[\pi u + rb] \tag{4.21}$$

$$r = \rho - c = \pi u - c \tag{4.22}$$

$$d = e + rb \tag{4.23}$$

$$b = e/[g-r] = e/\{[\alpha_0 + \alpha_2 u + c + \pi u][\alpha_1 - 1]\} \tag{4.24}$$

$$g = \alpha_0 + \alpha_1\pi u + \alpha_2 u. \tag{4.25}$$

Figure 8 provides a representation of the model with bond-financed government spending. There are now two state variables, the bond ratio (b) and capitalists' ownership share (z). The *ZZ* schedule represents bond–capacity utilization combinations consistent with a constant capitalist ownership and satisfying equation (4.21). The *BB* schedule represents bond–capacity utilization combinations consistent with a constant

22. The horizontal shift of the *ZZ* is $du/dt|_{ZZ} = -[\sigma_k - \alpha_1]/[\alpha_1\pi + \alpha_2 - \sigma_k\pi] > 0$.

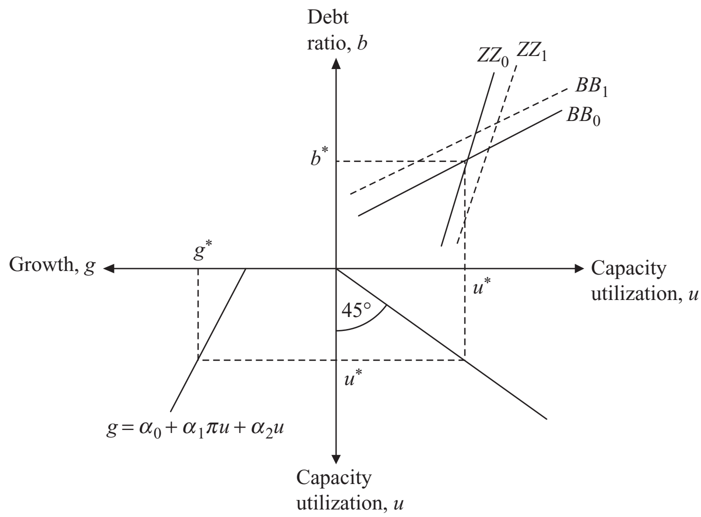

Figure 8 The neo-Kaleckian growth model with a class structure to saving and government debt

bond–capital ratio and satisfying equation (4.24). The slope of the *BB* schedule is positive and the same as in the neo-Kaleckian model with rule-of-thumb saving. Inspection of equation (4.21) shows the *ZZ* schedule must also be positively-sloped. An increase in b increases the left-hand side by more than the right-hand side, necessitating an increase in capacity utilization to restore balance.

In Figure 8, both the *ZZ* and *BB* are positively-sloped and the *ZZ* is steeper than the *BB*. The intersection of the *ZZ* and *BB* schedules determine the steady-state capacity utilization and debt ratio, and the steady-state capacity utilization ratio then determines the rate of growth. An increase in government spending (e) shifts the *ZZ* schedule right and the *BB* schedule up. The debt–capital ratio, capacity utilization, and growth, all increase. The logic of these positive outcomes is government spending and payments of debt interest add to *AD*, which raises capacity utilization and growth. Table 4 summarizes the outcomes of the various fiscal policy experiments.

Finally, as in the Cambridge model, there is the question of stability, which requires the state variables adjust to a steady-state position. This adjustment process is governed as follows:

$$\Delta z = Z\Big(\sigma_k\big\{\pi u + [\pi u - c]b]\big\} - \alpha_0 - \alpha_1\pi u - \alpha_2 u\Big) \quad Z(0) = 0, Z' > 0 \tag{4.26}$$

$$\Delta b = \big\{e + [\pi u - c]b\big\}/b - \alpha_0 - \alpha_1\pi u - \alpha_2 u \tag{4.27}$$

$$u = u(z, b, e, \sigma_k, \sigma_w, \alpha_0, \alpha_1, \alpha_2) \tag{4.28}$$

where Δz = rate of change of capitalists' ownership share, and Δb = rate of change of debt–capital ratio. The state variables are z and b. The instantaneously determined

Table 4 Comparative statics with regard to fiscal policy in the neo-Kaleckian model with a class structure to saving

	Utilization rate	Capitalists' ownership	Growth
Lump sum 'Robin Hood' transfer from capitalists to workers	+	−	+
Lump sum 'reverse Robin Hood' transfer from workers	−	+	−
Balanced-budget spending financed by lump sum tax on capitalists	+	−	+
Balanced-budget spending financed by lump sum tax on workers	0	+	0
Balanced-budget spending financed by a tax on business profits	?	?	?
Public investment financed by a tax on household dividend income	+	?/+	+
Bond-financed government spending	+	+	+

endogenous variable is u, which contrasts with the Cambridge model in which it is π. Once again, simple phase-plane analysis using Figure 8 shows the model is stable if the *ZZ* is positively-sloped and steeper than the *BB*, and it is saddle-path stable if the *ZZ* is positively-sloped and flatter than the *BB*.[23]

5 CONCLUSION

This paper has compared the Cambridge growth model with the neo-Kaleckian growth model. Both models are members of the post-Keynesian approach to growth and distribution, but the Cambridge model has some classical features whereas the neo-Kaleckian model is strictly Keynesian.

The Cambridge model assumes full capacity utilization, while the neo-Kaleckian model assumes variable capacity utilization. The two models also use fundamentally different theories of income distribution. The Cambridge approach has income distribution determined by the pressure of *AD* at full capacity utilization, with increased demand pressure increasing the profit share. This is consistent with conventional Marshallian market analysis in which increased demand drives up prices. The neo-Kaleckian model has income distribution determined by firms' mark-up pricing behavior, with higher mark-ups shifting distribution in favor of profits. The mark-up is interpreted in terms of firms' power, but it is unclear whether that power refers to monopoly power in goods markets or bargaining power in labor markets.

The Cambridge model has a class-based structure of saving which is central to its analysis. That class-saving structure is the foundation of Pasinetti's (1962) theorem regarding the irrelevance of worker-saving behavior for steady-state growth and distribution. That same class-saving structure can be included in the neo-Kaleckian model. In that case, it

23. The phase-plane dynamics are as follows. Points to the right of the *BB* correspond to high capacity utilization and high interest rates that generate increasing b. Points to the left of the *BB* generate falling b. Points to the right of the *ZZ* correspond to high u that generates high capitalist saving and excess supply that generates falling u. Points to the left of the *ZZ* correspond to low u that generates low capitalist saving and excess demand that generates increasing u.

generates a variant of the Pasinetti result whereby it is the steady-state rate of capacity utilization that is independent of worker-saving behavior.

Fiscal policy has very similar growth and distribution effects in the two models, albeit via very different mechanisms. The fact that the two perspectives agree reinforces claims about the positive growth effects of expansionary and progressive redistributive fiscal policy.

Both models suffer from lack of attention to the labor market. The Cambridge model claims to be a class-based model of income distribution, but class is restricted to working through the class structure of saving and there is no labor market conflict between capital and labor over income distribution (Palley 2005). The neo-Kaleckian model also lacks a labor market and essentially relies on capacity utilization as a proxy for labor market conditions. That proxy relationship is theoretically unwarranted. Moreover, there is no reason why the labor market will be in equilibrium, with labor supply growth equal to employment growth, when the goods market clears at a given capacity utilization rate. Adding a labor market to both the Cambridge and neo-Kaleckian models is therefore an important area of research. Such research is already underway (see Dutt 2006; Palley 2012b).

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