Chapter Four

Fiscal Policy and Economic Growth in Mainstream

Introduction

In the previous chapter we have examined the role that fiscal policy, especially public debt, plays in the determination of the macro variables in an economy, including the national income. In this chapter we extend our discussion to the impact of fiscal policy on the rate of change in national income – i.e., rate of growth. This would give us an opportunity to engage with the growth literature and prepare ground for our own contribution in this area.

One of the first formal growth models is attributed to Ramsey (1928) when he addressed the question of how much a society should optimally save out of its production stream. He was trying to understand if individuals behave in a myopic manner by consuming (saving) too much (too little) and how does it impact on future generations. From this emerged the Ramsey-Keynes Rule which states that the optimal rate of investment (saving) is the ratio of current distance from the bliss point of society and the marginal utility of consumption. The Rule implies that optimal saving is reached where the marginal gain of speeding up is equal to the marginal cost of doing so.

Ramsey used the notion of a “bliss point” which was the highest level of utility that society could achieve. If society wanted to reach this level of utility or social welfare quickly then the initial generations would have to forgo large deductions in
their consumption so that these resources could be invested to accelerate growth. Even though Ramsey’s work predates that of Harrod-Domar, the sequence of growth writing uses the latter’s work as its beginnings.\(^1\) Harrod-Domar predicted that the growth rate of an economy was determined by the ratio of the savings rate and the capital-output ratio. For an equilibrium path to emerge, the natural rate of growth (population growth rate in efficiency units) needed to equate the warranted growth rate. So if any economy wanted to increase its growth rate, it had to do be either more thrifty (increase savings) or more efficient in its use of resources (reduce its capital output ratio). The role of the state in determining the growth rate was in deciding the level of autonomous expenditure that ensure a required amount of forced saving to take place in the economy. Empirical findings at that time suggested that technology was not malleable (inflexible in the short run) and so these models had assumed a fixed capital output ratio. The savings rate too was assumed to be fixed by behavioural features in the economy, and the natural rate of growth of population by individual reproductive choices.

However, there were two serious issues with the Harrod-Domar growth model:

(a) There was no way to ensure that equilibrium would be achieved,\(^2\) and (b) even if by some stroke of luck the equilibrium rate was reached it was inherently

\(^1\) For almost three decades, Ramsey’s work went unnoticed till issues of development planning became a serious concern for economists. When planners groped for the “right” rate of savings that the economy must undertake to maximise the rate of growth and also do justice to all generations, Ramsey’s pioneering work became popular.

\(^2\) By equilibrium we mean a situation where expectations are fulfilled and therefore warranted growth rate must equate the natural growth rate, the maximum growth the economy could achieve under full employment conditions.
unstable because the investors actual aggregate investment need not be equate the required amount to maintain equilibrium. The economy was doomed to spiralling depression or accelerating expansion by even a minor perturbation to the system. One interpretation that came out of these findings was that the capitalist economy would never attain stability since decentralised decision-making by individual agents would never be able to get the actual capital output ratio to equate the warranted, something that a centralised planner might find easier to achieve.

Almost a decade later, Solow and Swan (independently, in 1956) claimed to have found a way out of the instability problem by relaxing the assumption of fixed factor proportion. They used the flexibility of the neo-classical production function but continued with the fixed saving rate assumption to theoretically provide stability to the capitalist system. Solow and Swan's result for over 3 decades dominated the growth literature. The growth in per capita incomes, Solow demonstrated, was influenced by technology and not by changes in savings rate which would only have scale effects, unlike Harrod-Domar who assigned a central role to the saving's rate. This also meant that in the Solow model there is a complete negation of the fiscal role of government unless it influenced technological change. A critique of the Solow model is that it took away from the

3 Kaldor (1956) suggested that the capitalist economy was not as fragile as the Keynesian models expected it to be. The owners of capital would change the rate of saving in the economy by changing factor income shares. Even if technology was not malleable, the distributional changes would stabilise the economy by altering the saving rate. In this chapter we look at growth economics and how it has incorporated fiscal policy into its domain especially in its current phase of theoretical advancement. Growth economics has seen dramatic expansions after years of stagnation. We discuss this in detail in Chapter Five of this essay.
Harrod model the essence of the Keynesian dilemma – what happens when actual growth rate differs from the warranted growth rate. By operating in a neo-classical framework Solow wished away the demand problem that was at the core of the Harrod proposition.

The central message in the neoclassical models was that there is a steady state of rate growth to which an economy settles down and the only thing that can influence this rate of growth is technological change. How this technological change would take place remained a mystery and unexplained. Technology (and therefore growth) continued to be determined from outside the system. Since technology remained unexplained but came to occupy centre stage, (including in Arrow 1962) the search continued for a model where growth rate is determined by profit-seeking individuals or by social welfare maximising governments within a general equilibrium framework. The role of fiscal policy in such a setup was limited to having “level” effects and not trend effects.

This was in line with much of the neo-classical macroeconomic theorising which argued that fiscal expansionist policy was not effective in most situations and if it was, then in the wrong direction. However, there were others who argued that public investment (consumption) would impact on private production (utility) functions and so fiscal policy could have positive impacts on productivity and growth (Arrow & Kurz 1970) by “spill-over effects”.
Fiscal Policy & Endogenous Growth

From the mid-1980s, there was a new trend in growth writing which attempted to explain what determines technological change in rational societies (or profit making firms). These growth models attempted to endogenise technical change within the growth model. In essence, they seek to explain the impetus to growth using variables within the model rather than by exogenous factors. In contrast, the standard neo-classical model suggested that the equilibrium growth of per capita output is determined by the extent of labor augmenting technical change, which was exogenously given (Solow 1956). The endogenous growth models (unlike the Cambridge ones) used neo-classical tools but allowed for various relaxations in the production function.

A fundamental difference between traditional growth models and the new growth models is with regard to the characterisation of the production function. Traditional models have assumed constant returns to scale and decreasing factor productivity to reach equilibrium growth rates while some of the endogenous ones assume increasing returns to scale or non-decreasing factor productivity. In fact from this characterisation of the production function arises the possibility of a positive role that fiscal policy can have in maintaining or accelerating the equilibrium rate of growth. 4
In the traditional neo-classical growth model only exogenous technological change is able to change the growth rate. Increase in tax, and increased saving (investment) do not have an impact on equilibrium rate of growth but only have level effects. Economic policies therefore seem incapable of changing long-run growth rates. Steady state levels of growth are established in the presence of capital which exhibits decreasing marginal productivity.

In contrast, the new endogenous models clearly have a role for public policy by impacting on human capital accumulation which creates a positive production externality (Lucas 1988) or through an increase in the aggregate stock of knowledge (Romer 1990). These externalities provide incentives to both private (profit-motivated agents) and public expenditures to enhance productivity. So public expenditures, which improve investment, skill and technology will have positive impacts on growth.

Arrow & Kurz (1970) were among the first to introduce public capital in the neo-classical growth model wherein public investment had a positive impact (spillover) on private capital and thereby on the production function. However, the determination of public investment is exogenous in this model. Later growth models incorporating fiscal policy have distinguished between two kinds of public

4. The production function \( y = f(k) \) with, \( f' > 0, f'' < 0 \) is a standard assumption in addition to the Inada conditions which are \( f'(0) = \infty \) and \( f''(\infty) = 0 \). The endogenous models allow for \( f'' > 0 \), making constant or increasing returns possible.

5. Modigliani (1961) did introduce government spending into an aggregate production function but he assumed full employment and government spending had no externality, instead bid away goods from the private domain.
spending – stock expenditures and flow expenditures. Arrow & Kurz’s model falls into the first category. Romer (1986), who triggered a whole new genre of growth models, drew upon Arrow’s (1962) learning-by-doing model wherein the externalities of technological knowledge led to perpetual growth in the economy. The limitation of Arrow (1962) was, however, the lack of explanation about technology development from within the model making it an exogenously determined factor. The trigger of technology development is not internally determined by Arrow’s model.

There are, however, other models which use accumulation of human capital to ensure constant returns even if physical capital tends to show decreasing returns (Rebelo 1991). The choice between investing in physical capital and human capital is determined by individual agents in order to maximise returns to private capital and there are no externality effects. The role of public capital in the production process is not important. Romer (1986), on the other hand, endogenises technological development by incorporating increasing return to scale. A unit investment in technology feeds back on increased production by more than one unit setting up a virtuous cycle of technological development and productivity growth. However, this leads to further complications and makes perfect competition incompatible with long run growth. Received theory acknowledges that the perfect competition pricing rule of marginal cost being equal to price is not tenable since the average cost is higher than the marginal cost under increasing
returns to scale in the long run. Firms when they are unable to receive positive profits leave the industry making it imperfectly competitive.⁶

**Economic Growth and Balanced Budgets**

The growth models that explicitly incorporate the government often operate under specific budgetary regimes. In this section we discuss Barro (1990) who introduced public expenditure on services in the private production function and we briefly illustrate his model. The balanced budget budgetary rule operates in this model. In this presentation the representative individual is assumed to have an inter-temporal utility function as below.⁷

1. \[ U = \int \ e^{-\rho t} \ u(c) \ dt \] is where \( \rho > 0 \) is the constant rate of time preference, ‘c’ consumption per person.

The utility function is assumed to have constant elasticity of substitution

2. \[ u(c) = (c^{1-\sigma} - 1)/(1-\sigma) \] where \(-\sigma = \text{elasticity of marginal utility with respect to consumption, and is } > 0.\]

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⁶ Increasing returns to scale characterises a decreasing cost industry where price (and marginal cost) is below average cost of production. This means that at any output, if price fixation followed the perfectly competitive profit-maximising rule (Price = Marginal Cost) then firms incur losses since average cost is greater than price. This leads to the exit of some firms till the industry becomes imperfectly competitive and rents accrue to firms over and above the marginal cost of production.
Every individual faces a representative production function where ‘k’ is capital per efficiency unit, and ‘y’ is per capita output.

3. \( y = f(k) \) where \( f' > 0, f'' < 0 \).

The individual is constrained by his production function. Under given conditions the growth (\( \gamma \)) of consumption of the individual is given by

4. \( \gamma = \frac{\delta c/\delta t}{c} = (1/\sigma). f' - \rho \)

However, if an Ak-type of production model is introduced with ‘A’ being the marginal productivity of capital and \( A > 0 \), such that

5. \( y = Ak \),

6. Then \( \gamma = \frac{\delta c/\delta t}{c} = (1/\sigma). (A - \rho) \).

Being a steady state model with bounded utility, consumption (c), capital per efficiency unit (k) and per capita output (y) grow at the same rate ‘\( \gamma \)’. However, in order to bring in the government, Barro (1990) then introduces public spending on services in the production function:

7. \( y = Ak^{1-a} g^a \).

The only regime under which the government operates is the balanced budget – expenditure is equal to revenues earned by the government and this is a fixed proportion ‘\( \tau \)’ of the per capita output which is in the nature of a lump sum tax.

8. So, \( g = \tau y = \tau Ak^{1-a} g^a \).

After manipulating the above equations, we get,

9. \( \gamma = \frac{\delta c/\delta t}{c} = (1/\sigma). [(1-\alpha)A^{1/(1-\alpha)} - \tau].(1-\tau).g^{\alpha/(1-\alpha)} - \rho \).

It can be inferred from the model that as long as the government per capita expenditures and tax rate is held constant, the growth of consumption, capital and
output are at the steady state ‘y’ irrespective of its starting point. The maximum
growth in this model is attained when \( \tau = \alpha \), i.e., tax rate is equal to elasticity of
output with respect to government spending on services. This is a classic result,
which since Barro (1990) has been fairly widely used.

Two things need to be noted here: Barro is working under a balanced budget
formulation and public expenditure that he considers here is not investment but a
flow of services. Since Barro uses a balanced budget model, there is very little that
we can infer for economies which do not have a balanced budget or are trying to
move between fiscal regimes some of which are not of the balanced budget variety.
We now turn our attention to some of the literature that looks beyond the
implications of balanced budget with government spending influencing the rate of
growth.

Growth without Balanced Budget

In some countries where there is a move towards monetary union, for example in
Europe, there are pre-conditions which are laid out as far as fiscal policy is
concerned, e.g., 60% upper limit on debt-GDP ratio and 3% on deficit-GDP ratio
under the Maastricht Treaty. There have been some interesting contributions in this
area. Pérez (2002), for example, examines the impacts on growth and welfare when
an economy has to transit from a high debt/deficit structure to a lower one in order
to conform to the monetary union rules. On the lines of Arrow & Kurz (1970), he
examines the impact of public expenditure routed through both the production
function (output) as well as the utility function (welfare). In the production
function, public expenditure increases both capital and labour productivity while there is a positive externality from public spending in the household utility function. The choice of instrument in changing debt levels (changes in tax rate or public spending) could have differential impact on growth and welfare. An attempt to reduce debt to attain a target debt-GDP ratio by raising taxes leads to a higher balanced growth path (higher growth rate) but a lower welfare in comparison to the initial steady state. But if the attempt to reduce debt is done by cutting public spending it reduces both growth and welfare.

If there were no limits to public debt, then raising tax rates on labour has a positive effect on growth assuming that government spending is productive. However, when learning by doing drives growth, raising taxes on labour only serves to reduce the incentives to work, with a negative effect on the growth rate. A reduction in government spending has negative effects on growth if public spending is productive, but has negligible effects if public spending only affects utility, in both cases regardless of the presence of a debt limit.

Another set of models that works with different budgetary regimes rather than only a balanced budget constraint is Greiner & Semmler (2000) and Greiner, Semmeler & Gong (1997). Within the framework of an endogenous growth model, they allow for productive government borrowing and public deficit. The different budgetary regimes are variations of the golden rule and budgetary deficits are permitted as long as they augment public capital. In line with Arrow and Kurz (1970), these models use public capital in the production function rather than the flow of public
services (as in Barro 1990, Barro & Sala-i-Martin 1992). However, unlike Perez (2002), they look at only one source of economic growth – productive government expenditure, and neglect production externalities or positive impacts that might arise from human capital and knowledge.

Geiner & Semmler (2000) find that if the endogenously determined ratio of public debt to private capital is constant and when larger proportions of interest payments are financed by public debt, then an increase in public investment financed by a budget deficit will have a positive impact on growth. Also, sustained per capita growth can only happen if the government owns assets and is a lender once the interest payments exceeded a certain threshold level. A soft budgetary constraint will not necessarily lead to higher growth rates in the long run. We present below the Geiner & Semmler (2000) model briefly.

The standard model (in the Ramsey tradition and similar to the Barro model earlier) is set out once again:

10. \[ \text{Maximise } U = \int_0^\infty e^{-t} u(C(t)) \, dt \]

Subject to the constraint

11. \[ C(t) + I(t) = [w(t) + r(t).S(t)](1-\tau) + Trp(t) \]

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8. The Geiner & Semmler (2000) model has been extended by Ghosh & Mourmouras (2004) to examine the welfare impacts of public expenditure under different budgetary rules – (a) when government has to maintain a dynamic (present value) balanced budget, and (b) when the government is allowed to borrow for public investment. They conclude that optimal fiscal policy differs in the two budgetary regimes. Under regime (a) there is a tendency to over-invest in public capital. Under regime (b) growth rate and welfare along the balanced growth path is reduced when there is a less strict budgetary stance.
This implies that consumption $C(t)$ and investment $I(t)$ equate the disposable incomes of the individual. The right hand side of equation 11 represents disposable income which is the sum of lump sum transfers from the government, $T_{rp}(t)$, and earnings from wage labour, $w(t)$ and capital earnings $r(t).S(t)$ minus the tax payment $(1-\tau)$. The sum of wages and interest earnings on assets (savings) is the aggregate income in the economy. The objective is to maximize the sum of present discounted utilities of the infinitely lived individual given the budget constraint as stated above in equation 11. The discount rate $\rho$ is assumed to be constant and depreciation of physical capital is also assumed to be zero. Like Barro (1990), a constant elasticity marginal utility function is assumed. 9

12. $u(c) = (C(t)^{1-\sigma}-1)/(1-\sigma)$, where $-\sigma = $ elasticity of marginal utility with respect to consumption, as described before

$\sigma$ could also be interpreted as the inverse of the instantaneous inter-temporal elasticity of substitution of consumption. $\sigma$ is normally assumed to be constant and empirical estimates place it in the range $1 \leq \sigma$ (Blanchard & Fisher 1989). It could also be used to find impacts of interest rate change on consumption over time.

The solution to the above objective function can be approached by using a current value Hamiltonian (the time argument is removed for convenience):

13. \[ H(.) = u(C) + \gamma((w + r.S)(1-\tau) + Tr_{p} - C - I) \]

The first order conditions are

14. \[ \gamma = C^{\alpha} \]

15. \[ \delta \gamma = \gamma(\rho - (1-\tau)r) \]

16. \[ I = (w + r.S)(1-\tau) + Tr_{p} - C \]

The second order (sufficiency) condition is

17. \[ \lim_{t \to \infty} e^{r \gamma(t)}(S(t)) = 0 \]

18. i.e., \[ \lim_{t \to \infty} e^{r \gamma(t)}(K(t) + D(t)) = 0 \]

where \( D = \text{debt} \)

Let us assume that there is an aggregate production function of the form:

19. \[ f(K,G) = K^{1-\alpha}G^{\alpha} \]

where \( K \) is per capita capital and \( G \) stock owned by the government is in the nature of a pure public good.

The government’s budget constraint is given by

20. \[ dD + T = r.D + C_{p} + Tr_{p} + G \]

The government revenue is on the left hand side and expenditure on the right hand side \( T = \text{Tax revenue of the government} = \tau.(w + r.S); \ rD = \text{interest obligations on debt}; \)

\( G = \text{government capital expenditure}; \ Tr_{p} = \text{Transfers}; \ C_{p} = \text{Government Consumption Expenditures} \)
The underlying fiscal rule is that there is a No-Ponzi game\textsuperscript{10} which in this context implies:

21. \[ \lim_{t \to \infty} D(t)e^{-f(t)}dt = 0 \]

Let us define the budgetary constraint as:

22. \[ \varphi_2r.D + C_p + Tr_p + \varphi_3G = \varphi_1T \]

The different budgetary regimes normally used are the following:

a) Regime A -- Golden Rule of Public Finance (GRPF): This rule states that public consumption expenditures must not be financed by borrowing. It, however, allows the option of borrowing for public investment.

Then equation 22 reduces to

23. \[ r.D + C_p + Tr_p + G = \varphi_1T \quad \text{where } \varphi_1 < 1, \text{ and } \varphi_2 = \varphi_3 = 1 \]

b) Regime B -- If we relax the GRPF and allows some amount of the interest burden to be financed by borrowing we arrive at the second kind of budgetary regime.

24. \[ \varphi_2r.D + C_p + Tr_p + \varphi_3G = \varphi_1T \]

25. \[ \varphi_2r.D + C_p + Tr_p = \varphi_1T \quad \text{where } \varphi_1 < 1, \ 0 < \varphi_2 < 1 \text{ and } \varphi_3 = 0 \]

c) Regime C -- The third regime is a further relaxation of the constraint where the tax revenue finances only the consumption and transfer payments while

\textsuperscript{10} We have discussed elsewhere in this essay the notion of Ponzi games which implies a situation where one borrows to meet even the interest obligations.
the borrowings of the government are used not only for public investment
but also for paying the interest burden.

26 \[ \varphi_2 rD + C_p + Tr_p + \varphi_3 G = \varphi_1 T \]

27 \[ C_p + Tr_p = \varphi_1 T \quad \text{where} \quad \varphi_0 < 1, \text{and} \varphi_2 = \varphi_3 = 0 \]

A deficit financed increase in public investment has a feedback through two
channels: an increase in public debt raises interest payments takes away a portion
of the tax revenues which could have been invested in the public sector. This
leakage is a drag on growth in the two regimes where interest payments have to be
financed by taxes which leads to internal crowding-out of public investment.
Interest payments also enter the economy wide resource constraint has a negative
feedback on private investment in all the three regimes and is called external
crowding out. It is however, possible to have a positive impact on growth under
Regime A (GRPF) under special circumstances.

In this model it has been demonstrated that a deficit financed increase in public
investment can lead to negative growth in economies which have a large
proportion of government consumption expenditures including interest payments.
A less strict budgetary regime may or may not lead to higher rates of growth.
Interestingly, given the Non-Ponzi restriction, the third regime can only have a
feasible steady state if at the initial point there is negative debt which makes this
regime less realistic.
Fixed and Variable deficits

In the next section we examine the effects of public debt on growth in an Over Lapping Generation (OLG) model in the presence of a fixed independent budget deficit ratio (Brauninger 2002).11 The government has three instruments at its disposal -- the government expenditure ratio, the budget deficit ratio and the tax rate. For reasons of convenience the model assumes that the first control variable, government expenditure ratio is exogenously given, may be, by political compulsions. Then the government has a choice of either fixing the deficit ratio or the tax rate. Once one of the above variables (deficit ratio and tax rate) is exogenously fixed, the other becomes automatically endogenously determined in the model.

There is a critical level of deficit which determines whether the economy stays on a steady state growth path or not. As long as the deficit ratio stays below a critical level, there are two possible steady states where capital, output, and public debt grow at the same constant rate. There is, however, an inverse relationship between the deficit ratio and the growth rate contrary to some of the models discussed above. If the deficit ratio exceeds the critical level, then there is no steady state and capital growth declines continuously with capital being driven down to zero in finite time. Instead if tax rates were fixed then there is no steady state except in one instance. If future consumption elasticity is very high and primary deficit is extremely small there could be two steady states one of which would be stable. So

11 Such a situation could arise if a country joined a monetary union.
if we were looking for a feasible stable steady state growth rate then a fixed deficit ratio would be preferable to a fixed tax ratio.

Brauninger (2002) uses an OLG model with individual consumption-saving decisions interacting with a macro-economic budget constraint of the government. Similarly, there are a large number of identical firms \((i)\) manufacturing a single product \((Y_i)\) with labour \((L_i)\) and capital \((K_i)\) inputs. A standard Cobb Douglas production function under constant returns to scale and perfect competition is used:

28. \[ Y_i = AK_i^\alpha (EL_i)^\beta, \] with \(A > 0, \alpha > 0, \beta > 0, \alpha + \beta = 1\), and \(E\) is an exogenous labour augmenting factor depicting technological growth.

The objective function of the firm is to maximize profits -- the difference between output and cost of production.

29. \[ \pi_i = Y_i - rK_i - wL_i, \] where \(\pi_i\) = profits, \(r\) = interest rate and \(w\) = wage rate

The profit maximizing condition is that the marginal product of each factor equals its factor price.

30. Capital: \[ \delta Y_i / \delta K_i = \alpha Y_i / K_i = r \]

31. Labour: \[ \delta Y_i / \delta L_i = \beta Y_i / L_i = w \]

Summing up across all firms yields the aggregate production function

32. \[ Y = AK^\alpha (EL)^\beta \]
Labour efficiency input $E$ represents accumulated knowledge which comes from learning by doing and is an endogenous variable which is the ratio of capital to labor ($E = K/L$).

The advantage of this assumption is that the aggregate production function reduces to

$$Y = A.K$$

The marginal product of the factors in the aggregate production function is:

34. Capital: $\frac{\delta Y}{\delta K} = \alpha \frac{Y}{K} = \alpha A = r$

35. Labour: $\frac{\delta Y}{\delta L} = \beta \frac{Y}{L} = w$

The aggregate output from the demand side has three components: private consumption ($C_p$), investment and government expenditures:

36. $Y = C_p + I + G$

The model assumes that a fixed proportion $g_c$ of the aggregate production is devoted to government purchases. However, $G$ does not influence inter-temporal consumption decisions of the individual consumers and therefore when we setup the utility functions, $G$ will not be a part of it.

37. $G = g_c Y$

The government also borrows a fixed proportion $b$ of the national income $B = bY$. The budget deficit $B$ adds to the existing public debt to give the next period's debt.

38. $D_{t+1} = D_t + B_t$, where $D =$ Public debt in time period ‘t’.
$D_{t+1} = D_t + bY_t$

Since the interest rate is 'r', the interest obligations in any period equals $rD$

The debt is held by the public, and therefore the disposable income is $Y + rD$

The government levies tax on disposable income at a fixed rate 'r'.

$T = \tau(Y + rD)$

The revenues of the government constitute its borrowings and tax collections and its outgoings are government expenditure and interest obligations. So the budget constraint is:

$B + T = G + rD$

$bY + \tau(Y + rD) = g_cY + rD$

As discussed above the government takes the consumption and the deficit rate as being externally fixed. Interest rates are given so the government is committed to meeting the debt obligations. The only item that therefore needs to be determined in the model is the tax rate. Having set up the macro-model, the focus is back on the individual who is assumed to live for two periods. In the first period he works and earns. In the second period he is no longer in the work force and therefore lives off his savings which consists of government bonds and private equity. At the end of his life he completely exhausts his savings so there is no gift to the next generation.

$\Sigma c_i = c_{1i} + c_{2i}$

where $c_i = \text{consumption in period 1 and 2}$.

The utility function of the representative individual is similar to the constant returns to scale Cobb Douglas production function:
\[ U = c_1^\gamma c_2^\delta \quad \text{where } \gamma > 0, \delta > 0, \text{ and } \gamma + \delta = 1 \]

So,
\[ \log U = \gamma \log c_1 + \delta \log c_2 \]

The individual's budget across his lifetime includes his earnings in the first period and his consumption across two periods of his entire income. He does not consume his entire income in the first period some of which he saves and therefore earns interest on his assets. In the first period the individual's budget is:

\[ (1 - \tau)w = c_1 + s \]

In the second period the budget constraint is:

\[ c_2 = [1 + r(1-\tau)].s \]

The inter-temporal budget then turns out to be the sum of consumptions in the two periods:

\[ c_1 + [c_2/(1 + r(1-\tau))] = w.(1 - \tau). \]

Using the Lagrange multiplier method, the utility optimization conditions for the first period decisions are:

\[ c_1 = (1 - \tau)\gamma w. \]

\[ s = (1 - \tau)w - c_1 = (1 - \tau)\delta w \quad \text{where } \delta = 1 - \gamma \]

The individual conditions can be summed for the economy to yield aggregate savings:

\[ S = s.L \]

\[ = (1 - \tau)\delta w.L \]

\[ = (1 - \tau)\delta (\beta Y/L).L \quad \text{since } w = \beta.(Y/L) \]

\[ S = (1 - \tau)\delta \beta Y \]
These savings are used to finance the budget deficit and investment which adds to the debt and private capital in the economy.

53 Then, \( S = D_{t+1} + K_{t+1} \) where \( D_{t+1} = \) Additional debt, \( K_{t+1} = \) Additional capital

54 \( D_{t+1} + K_{t+1} = (1 - \tau) \beta \delta Y \)

The above equations describe the entire system and the variables in the system are: \( r, w, \tau, D_{t+1}, K_{t+1} \) and \( Y \).

The growth in public debt is given by the ratio:

55 \( D_{t+1}/D = (D + B)/D \)

\[ = 1 + bY/D = 1 + bAK/D \]

56 \( D_{t+1}/D = 1 + bA/d, \) where \( d = \) debt-capital ratio

From above we know that the government’s budget constraint is:

57 \( bY + \tau(Y + rD) = g_cY + r.D \)

Therefore,

58 \( \tau = [(g_c - b)Y + rD]/[Y + rD] \)

59 \( \tau = [(g_c - b)AK + \alpha AD]/[AK + \alpha AD] \)

\[ = [(g_c - b)K + \alpha D]/[K + \alpha D] \]

If one divides both the numerator and the denominator by ‘\( K \)’, then

60 \( \tau = [(g_c - b) + \alpha d]/[1 + \alpha d] \)

After re-arranging terms it can be written as:

61 \( (1 - \tau) = (1 + b - g_c)/(1 + \alpha d) \)

Putting the above relation into the modified government budget constraint gives us

62 \( D_{t+1} + K_{t+1} = (1 - \tau) \beta \delta Y \)

63 \( D_{t+1} + K_{t+1} = \beta \delta Y(1 + b - g_c)/(1 + \alpha d) \)

64 \( \beta \delta AK(1 + b - g_c)/(1 + \alpha d) \)
Since $D_{t+1} = D + b.Y$, and

$D_{t+1} + K_{t+1} = \beta \delta A K(1 + b - g_c)/(1 + \alpha d)$

$\Rightarrow D_t + b.Y_t + K_{t+1} = \beta \delta A K(1 + b - g_c)/(1 + \alpha d)$

Dividing through out by $K$ we get:

$D/K + b.Y/K + K_{t+1}/K = \beta \delta A K(1 + b - g_c)/K(1 + \alpha d)$

$d + b.A + K_{t+1}/K = \beta \delta A (1 + b - g_c)/(1 + \alpha d) - d - b.A$

$K_{t+1}/K = \beta \delta A (1 + b - g_c)/(1 + \alpha d) - b.A - d$

And from above, $D_{t+1}/D = 1 + b.A/d$

It is obvious from the above that growth of both public debt and capital are inversely dependent on ‘d’. Since all other elements in these equations are given, the growth rates are constant as long as ‘d’ is constant. Also under steady state, both these must grow at the same rate, i.e,

$D_{t+1}/D = 1 + b.A/d = K_{t+1}/K = [\beta \delta (1 + b - g_c)/(1 + \alpha d) - b]A - d$

$1 + b.A/d = [\beta \delta (1 + b - g_c)/(1 + \alpha d) - b].A - d$

The solution to the above equation for a given level of $b < b'$ (the critical deficit ratio), yields two values of the debt capital ratio. If deficit ratio exceeds the critical value then there is no steady state growth. There is, however, a further limitation. Of the two steady states, only one is stable -- the lower debt-capital ratio ($d_{min}$). This implies that if there is a high initial value of ‘d’ the economy will not have a stable steady state growth rate.
Ewijk & Klundert (1993) have also investigated whether it is better to have steady level of deficit or allow it to vary. They derive a general result that a constant budget deficit is less favourable vis-à-vis productivity growth as compared to a variable budget deficit. In contrast to some of these findings Peretto (2001) points us to two robust empirical observations – taxes and scale of economic activity have no effect on long run growth rates. He argues that earlier theoretical models of endogenous growth found a positive impact of public expenditure on growth rates through a scale effect because the aggregate market size expanded by changing labor supply, consumption and other variables. But these models suffered from mis-specification. When corrected for size of the economy, scale of economic activity should have no impact on long run growth. These observations provide support to some of the policy implications that derive from the Solow model. Fiscal policy has level effects but not trend effects.

Peretto (2001) differs from the neo-classical model in that he acknowledges growth is endogenous and is driven by productivity increases at the firm level. So whatever affects technology at the firm level affects growth. He further goes on to add that the proportion of labour force employed in Research and Development (R&D) at the level of the economy is not necessarily what determines the rate of growth as in some other formulations like Grossman & Helpman (1991). The investment rate used in this model is R&D employment per firm. Productivity of each firm (and therefore the rate of growth) is dependent on each firm’s own innovations. Long run growth therefore can be impacted by fiscal policy through the technology route at the firm level. So any policy that biases a firm’s allocation
for more R&D will in effect increase long run growth. A reduction in tax rate on household capital income would boost allocation for savings and thereby increase investment and possibly R&D by firms. This is the only way fiscal policy has an impact on savings behaviour, capital accumulation and growth rates in the long run.

In such a model, whenever, the government imposes a tax on labour and/or consumption, two things happen. Taxes reduce the disposable income of the consumers which reduces consumption and aggregate demand. This also leads to a reduction in the number of firms since demand has reduced. Similarly, higher taxes when used for public consumption leads to larger employment by the government. The number of people available for employment in the private sector declines leading to a closure of some firms. An increase in tax accompanied by an increase in the size of the government has a neutral effect on growth. This is much like the Ricardian Equivalence theorem where fiscal policy does not impact on long term growth. However, the mechanism of operation is very different. This is in difference to much of the recent literature on endogenous growth that we have reviewed here.

In OLG models that we have looked at here, the debt tax neutrality would emerge as long as rational, fully informed individuals care for their future generations (Barro 1974). These models employ a dynamic altruism mechanism whereby the present generation’s utility is negatively affected if it anticipates that there will be a rise in tax rates in future (because of current over-spending by the government) and
reduces current consumption in order to compensate for future reduction in
disposable income. These models, however, fail to explain why different countries
have varying levels of public expenditure and debt but similar rates of growth.

Losada (2003) uses a joy-of-giving altruism (like Yaari 1965), where parents build
up human capital in their children as a form of bequest by hiring teachers.\footnote{Human capital has been measured in many ways including quality of schools attended, (Glomm and Ravikumar 1992) or parental educational level and the time that they spend with their children, etc., (Eckstein and Zilcha 1994). Macroeconomic studies have used aggregate data of literacy rates, number of graduates, spending on R&D as proxy measures too.} Like in
many other models, public expenditure is assumed to be financed by borrowing
and tax on labour income. He finds that there is a unique level of debt and tax for
every given level of public expenditure which maximises growth. If revenue is
fixed, a compositional change in the revenue instruments could have both positive
and negative growth impacts. For example, if taxes are reduced but compensated
for by an increase in debt it leads to greater disposable income in the current
period. Increase in debt leads to withdrawal of money from the private capital
market, reducing physical capital formation, factor prices and incomes. But, the
increased disposable income could lead to parents spending more on building up
children's human capital.

It is therefore quite conceivable that an increase in debt could have a net positive
effect on growth not because the government spends wisely the money that it
generates as public revenue but because of forward looking individuals who invest
in human capital and over-compensate for the decline in private capital. Debt in
such cases is not neutral unlike Barro (1974). However, this model assumes a situation of credit constraint on the part of financial institutions that need not be a true representation of a paper-money economy. If there is flexible supply of credit then there should be no constraint on private capital formation.

**Congestion of Public Goods**

Again, the models of endogenous growth which have public expenditure assume a first best world where there is no congestion or over use of public goods. But most public goods in the real world get congested and therefore require a second-best analysis. We present here a model by Piras (2004) who has studied public expenditure by decomposing public spending into consumption and investment. Individuals are assumed to have an instantaneous utility function which has a component of both private consumption (c) and public consumption services (cₕ) similar to equation 45 as in Brauninger (2002).

\[ U(c, cₕ) = \log c + \beta \log cₕ, \] where \( \beta \geq 0, \) ‘\( \beta \)’ measures the relative importance of public to private consumption.

Public consumption expenditure (Gₑ) ensures provision of public services to the citizens and when there is no congestion then it increases proportionately with the GDP otherwise it increases at a lesser rate than the GDP. This is represented by the public services function where \( \delta \) represents the degree of congestion. When \( \delta = 0 \) the level of public consumption expenditure is fixed and not linked to the level of GDP indicating a high level of congestion. On the other hand when \( \delta = 1 \) the level
of public consumption expenditure is directly proportional to the level of GDP indicating no congestion.

\[ c_g = G_c \delta [G_c/Y]^{1 - \delta} = G_c Y^{\delta - 1} \quad \text{where } 0 \leq \delta \leq 1 \]

The households earn an income from ownership of capital which yields them returns but their disposable income reduces to the extent that they have to pay a (distortionary) tax on their income.

Household disposable income = (1-\(\tau\)).rk

Therefore, the households budget constraint is given by

\[ c + d_k = (1-\tau).rk, \quad \text{where, } d_k = \text{net investment or saving} \]

The representative firm too needs public production services (\(G_1\)) to maintain production.

\[ Y = A k [G_1/k]^\alpha \quad \text{where } \alpha = \text{elasticity of output with respect to } G_1, \text{ and } A > 0, \text{ is a scale parameter, and } K = \text{Aggregate capital.}^{13} \]

Congestion occurs if for a given amount of \(G_1\), the level of aggregate capital keeps increasing. In order for congestion not to occur, the ratio \(G_1/K\) must remain constant. The government finances its public expenditures on consumption and production services through the taxes that it raises and always balances its budget.

\[ (1-\tau).y = (1-\tau).rk = G = G_c + G_1 = g_c G + (1-g_1)G, \quad \text{where } \tau, \text{ and } g_1 \text{ are given.} \]

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13 Aggregate capital \(K = N.k\) where \(N = \text{Total number of identical firms in the economy. For reasons of convenience, Piras (2004) has normalized } N, \text{ so that } K = k.\)
The representative household once again aims at maximizing its instantaneous utility function:

\[ U = \int e^{\rho t} [\log c + \beta \log e^{g}] dt \]

where \( \rho > 0 \) is the discount rate,

which is maximized given that households have a disposable income from capital earnings spent either for consumption or savings.

The standard first order conditions for steady state growth in consumption are:

\[ y = (\delta c/ \delta t)/c = (1-\tau)r - \rho. \]

And the transversality condition

\[ \lim_{t \to \infty} e^{\rho t} \lambda_k = 0 \]

where \( \lambda \) = shadow price of capital.

For firms, profits are maximised when

\[ r = A[G_t/K]^\alpha \]

The second best optimality conditions yield\(^{14}\):

\[ g_t = \frac{(1-\tau)(1-\delta)}{1-\alpha(1-\delta)} \]

There is a negative relationship between \( g_t \) and \( \tau \), which could be interpreted in the following way. When spending on production services is increased, it has a positive impact on private production and profit. However, since this increase in spending has not been achieved by an increase in total outlay but a shift from consumption spending to production services the total tax revenue remains constant. The increased production thereby implies that the tax rate must decline in order for the budget to remain balanced (otherwise the existing tax rate would yield a surplus).

\(^{14}\) Optimal values for \( g_t = g_t \) and \( \tau = \tau \); under second best conditions.
Barro's (1990) result ($\tau=\alpha$) emerges here if we assume that public spending on consumption services does not influence the individual’s utility function, i.e. when $\beta=0$. If the entire government expenditure is channeled towards investment expenditures and $g_i = 1$, and this leads to Barro's result.\textsuperscript{15} When $\beta>0$, the tax rate is expected to be greater than the elasticity of output with respect to government production services. An important policy implication here is that countries where the share of public production services is low in comparison to the consumption services, the output, income and therefore welfare is likely to be lower.

\textbf{Public Policy and Leisure-Labour Choice}

Another issue which the literature has examined is the soft labour supply constraint, i.e., labour supply is endogenous. Turnovsky (1998a,b) examines fiscal policy impacts on the growth rate through the work-leisure choice of individuals. Standard models of endogenous growth treat labour supply as inelastic. Distortionary taxes on wage income and consumption behave like lump sum taxes but capital tax has a negative impact on growth in a closed economy with elastic labour supply (similar to Peretto 2001). But when the assumption of a closed

\textsuperscript{15} There are two differences between the Barro (1990) and Piras (2004) results. One, Barro was operating under first best conditions while Piras has extended the model to second best conditions. The other difference arises from the character of government spending being considered here. Barro was considering only public services which enter the production function while Piras attempts to examine composition of government services into consumption and production services and thereby finds the Barro result as a special case.
economy is relaxed and the economy is assumed to be open, even the capital tax acts like a lump sum tax and therefore ceases to have any impact on growth.

The labour-leisure trade-off adjusts to any change in the capital tax or government expenditure. A tax on capital leads to an increase in work-effort and fall in leisure time. Similarly an increase in government expenditure financed by non-distortionary tax has an opposite effect – increase in leisure. These two impacts are contrary to what happens in a closed economy. So can fiscal policy have any impact on growth? The answer is yes, but only through a tax on foreign interest income in an open economy.

The assumption of a small open economy provides the option of accessing a global capital market where it takes the real rate of interest as given. Domestic capital market equates its post-tax return to the world rate of return and thereby fixes the equilibrium output-capital ratio. An increase in labour supply or government expenditure increases the equilibrium output-capital ratio. Government expenditures increase the return to capital and by the equilibrium condition leads to a fall in labour demand (supply). On the other hand, an increase in capital tax reduces the post-tax return and increases the demand and supply of labour. Turnovsky's results are in line with policy implications of the neo-classical model which predicted that fiscal policy has little impact on the growth rate. This is in line with some of the empirical models of the endogenous genre which suggests that changes in tax rates do not impact on long run growth (Barro 1991a).
However, there are others who suggest that while aggregate public investment may not empirically show up as being significant in determining growth, there are different components of infrastructure that have an impact, e.g., electricity generating capacity, road and rail lines, and telephone lines (Calderón and Servén 2002), transportation and communications sectors (Easterly and Rebelo 1993) public investment in education, transport and communications (Milbourne, Otto, and Voss 2003). Disaggregated government spending also seems to indicate positive impacts on growth, for example, educational expenditures (Barro and Sala-i-Martin 1995) and public investment (Aschauer 1989). We now turn our attention to some of these empirical studies and examine their findings.

**Empirical Models**

It is widely accepted that when levels of government expenditures are low an increase in government spending is likely to have a positive effect on the level and rate of growth as the productive effects of public goods are likely to exceed the social cost of raising funds (Barro 1990 and Slemrod 1995). This consensus breaks down when it comes to increasing transfer payments and matching taxes which are believed to have a negative effect on growth. There exists a large empirical literature which has studied the impact of public expenditure on growth. We will distinguish between two kinds of studies: (a) models which study both the ‘rich’ and ‘poor’ economies simultaneously, and (b) which look at these categories separately to assess impact of government expenditures. A further categorisation can be made between models that treat government expenditure only as flow
expenditures as opposed to those that include a component of stock changes in public assets.

Barro (1991a, b) belongs to the first category. Using panel data for 98 countries in the 1960–85 period, he finds that the level of government consumption as a share of GDP has a negative effect on the growth of GDP per capita. This is found to be a fairly robust result even when the model is controlled for investment, etc. Some earlier studies similarly had found that government consumption as a share of GDP has a negative impact on the growth rate of GDP per capita. When the sample however is restricted to the poorest half of the countries the negative relationship is no longer significant. When transfers, educational expenditure and government investment are separately tested none of these seem to have an impact on growth (Landau 1983). Another study examines panel data from 47 countries for the period 1950-77 and finds that there is no effect of the government consumption expenditures ratio on the average GDP growth rate (Kormendi & Meguire 1985). Therefore, when we have different kinds of countries in the same sample, the impact of government expenditure on growth rates is indeterminate.

Some theoretical models, however, argue that a clear relation between government expenditures and growth shows up only when the proportion of government expenditures exceeds a critical value, as discussed above. Therefore, the choice of countries then gets limited to those where the level of government expenditure is high, which seems to happen only in the rich countries in confirmation of the
empirically popular Wagner’s Law (Easterly and Rebelo 1993). However, these tests are controversial and much of the regression analysis has problems ranging from selection bias, simultaneity problems, heteroscedasticity to multi-collinearity. In order to tackle these econometric issues, Fölster & Henrekson (1999) use panel data which allows mitigation of the simultaneity problem and use a weighted least squares regression to correct for heteroscedasticity. In order to address the selection bias, in addition to the 23 OECD countries, five additional countries are selected whose PPP per capita incomes are close to the OECD countries and seem to form a cluster. A robust negative relationship is found between (large) public expenditure and growth in these rich countries. Fölster & Henrekson (1999), however, do not extend their analysis to developing countries.

A Vector Auto-Regression (VAR) analysis of US data for the period 1983-2002 shows that when two fiscal indicators (e.g. deficit and tax spending) are incorporated in the regression analysis, and deficit reduction occurs due to increase in taxes, there is a contractionary effect while if the same reduction in deficit is obtained by reducing spending then there is an expansionary effect (Fu, Taylor & Yücel 2003). 17 Similarly, if there is an increase in deficit financed by a tax cut then there is an expansionary effect while a spending increase is contractionary. If only one of the indicators is changed (e.g. only deficit level), an increase in deficit.

16. Contrast this to Brauninger (2002) who finds that no steady state growth would exist if the budget deficit exceeded a certain critical value.

17 The three fiscal indicators that Fu, Taylor & Yücel (2003) talk about are -- budget deficit, tax revenue and government spending. A proxy for growth used in this paper is increase in non-farm employment.
always turns out to be expansionary. However, an increase in government spending, no matter how it is financed leads to reduction in growth rate.

Another set of empirical studies has concentrated on the compositional effect in fiscal policy adjustments, also known in the literature as consolidation – reduction in deficits and debt. Alesina & Perotti (1995), who looked at cross country evidence on fiscal adjustments in developed countries, is regarded as a referral point. The choice in fiscal consolidation is between cutting expenditures or increasing taxes. They find that a reduction in public expenditures is more likely to be successful in bringing about a permanent fiscal change than a tax increase which is found to have only a temporary fiscal impact. The successful cases of fiscal consolidation have involved decreases in consumption expenditures (wage bill of the government) and transfers.

In a follow-up study they found that in countries where successful consolidation had taken place, it coincided with periods when there was an expansion of the economy with higher output, reduced unemployment and better performance on the external sector (Alesina & Perotti 1997). Interestingly they suggest that these expansions were triggered by an increase in private investment and not consumption. However, they do concede that if a permanent reduction in the wage bill is perceived by the people as reduction in future taxes due to a fall in deficit, the present discounted tax would fall creating a positive wealth effect and a higher current consumption by individuals. Further, during a period of adjustment, the bargaining power of labour might decline and cause a lower wage which would
lead to a decline in public consumption expenditure (wage bill) easing the process of consolidation (Alesina & Ardagna 1998). On the other hand, consolidation periods could see a rise in debt ratios since a current decline in aggregate demand could reduce growth but not reduce debt proportionately in the short run. Heylen and Everaert (2000) have examined consolidation periods and reject the hypothesis that government wage cuts leads to a permanent decline in the debt ratio.

Töglhofer & Zagler (2004) find that compositional effects do not seem to be important in periods of consolidation. While reduction in the wage expenditures have the strongest influence on debt reduction, increase in revenue is also effective as a means of reducing the debt ratio. Importantly, they find that tax cuts could have debt enhancing implications. As far as policy implications are concerned they find that it is better to avoid increasing those expenditures on categories that lead to an increase in debt. If debt reduction is managed with reduction in some categories, then future public finance management should rely on those categories to do fiscal adjustment.

This, however, leaves us with important policy issues specially in the context of the developing world. Should wage reduction be a target of fiscal consolidation? A large part of the literature we have reviewed here seems to suggest that. But we are also aware that these policy recommendations will be more suitable for countries with very low levels of unemployment. In fact, as we have discussed elsewhere, the Kaleckian schema of demand management envisages exactly the opposite solution -- aggregate demand expansion through an increase in workers
wages when there is excess capacity in the system. Similarly, the Keynes-Robinson solution to under-consumption is to expand autonomous expenditure. We are also aware that wages in the private sector are pegged to those in the public sector so a structural adjustment programme essentially tries to alter the overall distribution of produce as pointed out by Alesina & Ardagna (1998). In so doing it could lead to impoverishment of a large body of the employed and unemployed workforce seriously affecting social welfare.

Conclusion

In the chapter we have examined the role of fiscal policy in theoretical and empirical growth models. In the traditional neo-classical models, fiscal policy was found to be incapable of altering the rate of growth but with the emergence of new growth theories, fiscal policy came to occupy centre stage not only in macro policy but in determining growth dynamics too. We took a brief detour here of growth theory from Ramsey (1928) to the early growth models of Harrod (1939) and Solow (1956). We picked up the strings of the endogenous growth models from Arrow (1962) and Romer (1986). Arrow & Kurz (1970) brought in the role of the government which opened up the way for later contributions to explicitly incorporate public consumption and investment expenditures.

In their effort to explain technological change, which was till then exogenously determined, economists examined the externality effects of R & D, human capital, public infrastructure spillovers (among other things). These allowed the
production function to overcome the limitation of decreasing returns. Barro (1990) introduced public expenditure on services under a balanced budget regime. Perez (2002), Greiner & Semmler (2000), Greiner, Semmler & Gong (1997) expanded this attempt to see if steady state growth would continue if the assumption for a balanced budget was violated. Brauninger (2002) on the other hand examined whether it is desirable to have a fixed or variable level of deficit. He finds that a flexible tax rate along with a fixed level of deficit arrives at a steady state rate of growth as long as this level of deficit is below a maximum critical level above which there is no steady state. Ewjik & Klundert (1993) have similar findings. Losada (2003) finds that even with a fixed level of debt and tax revenue, mere change in the revenue instruments could have dissimilar effects on growth. If a reduced tax leads to forward looking individuals to increase investment in human capital then this could have a positive impact on growth. However, most of these models assume that all factors of production are fully employed and any expansion of the government sector takes place only at the expense of the private sector. We have elsewhere in this essay discussed the limitations of such analysis especially in developing countries.

Piras (2004) questions the basis of first best solutions when according to him the real world is characterised by congestions in the use of public services. Like Losada (2003) he finds that a change in public expenditure from production services to consumption services can reduce growth. An increase in expenditure on production services could lead to an increase in production, output and incomes.  

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This would increase tax collection and lead to budgetary surplus requiring a fall in tax rates to balance the budget.

Turning to the empirics of aggregate public investment and growth, some authors have found that when individual components of infrastructure are examined they seem to have an impact, e.g., electricity generating capacity, road and rail lines, and telephone lines (Calderón and Servén 2003), transportation and communications sectors (Easterly and Rebelo 1993) public investment in education, transport and communications (Milbourne, Otto, and Voss 2003). Disaggregated government spending also seems to indicate positive impacts on growth, for example, educational expenditures (Barro and Sala-i-Martin 1995) and public investment (Aschauer 1989). We had occasion to discuss some of the voluminous international evidence on growth, public expenditures and deficit. One thing is certain, the dispute on fiscal policy and debt is far from resolved and continues to evade consensus. We now turn to another set of growth models largely neglected by mainstream growth writing but with a fairly distinguished contribution to the literature. These are the distribution growth models that lie outside the realm of neo-classical economics – namely the Cambridge growth models. In the following chapter we build up the Cambridge model from its early stages and then introduce fiscal policy into the model to examine the robustness of the equilibrium and stability results.