Sustainability: Macro-Accounting Approach to Deficits and Debt

Sustainability of debt has been viewed by some authors in a national income accounting framework wherein possible scenarios of macroeconomic adjustment are examined given that financing of the deficits is done either by way of money expansion or borrowing (or a combination of the two). While the debate on debt and growth has been part of the literature from the Ricardian times, concrete modeling exercises are of more recent origin and coincide with the evolution of growth models. One of the earliest and most celebrated models is that by Domar (1944) which provides a simple decision rule to check for sustainability of a fiscal policy based on borrowing.

We will briefly discuss this model. The economy is assumed to be in steady state so the national income grows at a steady state rate “g”. Therefore, current income is a product of the initial income \( Y_0 \), i.e., \( Y_t \) when time, \( t = 0 \) and the exponential of the growth rate.

\[ Y_t = Y_0 e^{gt} \]

The government is assumed to spend a fixed proportion “c” of the national income \( Y \) as public expenditure (current or revenue expenditure and no capital expenditures) and net government revenue is a fixed proportion “r” of the national income. Various outcomes emerge from assumptions regarding the expenditure and revenue options.
Deficit Financing through borrowing

If the expenditure is greater than the revenue receipts, i.e., \( c - \tau > 0 \), then the deficit is met entirely by borrowing from the public. Therefore any increase in debt “D” is the sum of past interest obligations and deficit in the current period.

2. \( \frac{dD}{dt} = \text{Current deficit} + \text{past Interest obligations} \)

3. \( \frac{dD}{dt} = (c-\tau)Y + rD \quad \text{where} \quad r = \text{fixed rate of interest} \)

Substituting 1 in 3 above we get an equation where “D” is a function of “t”.

4. \( \frac{dD}{dt} = (c-\tau)Y e^{rt} + rD \)

This transformation allows us to solve equation 4 as a differential equation to yield:

5. \( D = D_0e^{rt} + \frac{(c-\tau)}{(g-r)}Y_0[e^{rt} - e^{gt}] \)

Let us divide both sides of the equation by \( Y \) to get:

6. \( d = \frac{D}{Y} = D_0e^{r(t)}\frac{1}{Y_0} + [(c-\tau)/(g-r)][1 - e^{(r-g)t}] \)

The stability of debt financing is therefore dependent only on the relative values of the interest rate and the steady state growth rate (‘r’ and ‘g’). Debt sustainability (as a proportion of income) is reflected by the value of “d”.

Let us briefly discuss some of the findings of Domar (1944) which are of interest to us. The important question that we would like to ask here is whether a stable deficit income ratio can be achieved even when persisting deficits are in existence.
As it turns out, the results are critically dependent on the difference between the rate of interest in the economy and the rate of growth.

There are three scenarios which are possible:

a) \( r = g \)

b) \( r > g \)

c) \( r < g \)

**Option A:** This is the case when \( r = g \) but we cannot directly test this case since substituting the values makes the denominator in equation 6 go to zero and make it indeterminate. Therefore, we find the limit of the function \( r \to g \). When \( r \to g \) in equation 6:

\[
7. \quad \lim_{r \to g} d = \frac{D_0}{Y_0} + (c - \tau)t = d_0 + (c - \tau)t
\]

This suggests that as long as government does not persistently overspend, an initial deficit can be sustained to achieve steady state. The implication is that if \( c - \tau \equiv 0 \) then "d" will reach the steady state by attaining the value of the deficit in the initial period "d_0". However, if \( c - \tau > 0 \) then "d" would not reach a steady state and rise continuously.

This case is obviously not very interesting because all it is telling us (tautologically) is that if the rate of interest is equal to the rate of growth and the government is maintaining a balanced budget now, the deficit-income ratio will

---

1. By La Hospital’s rule: \( \lim_{x \to a} \frac{f(x)}{g(x)} = \lim_{x \to a} \frac{f'(x)}{g'(x)} \)
remain at the initial debt-income level. But what is of interest to us is the situation when government persistently incurs deficit which has two possible outcomes.

**Option B:** Let us now examine the case when interest rate exceeds growth rate: $r > g$.

Re-writing equation 6 we have:

$$d = D_0e^{(r-g)t/Y_0} + \left(\frac{c-r}{g-r}\right)[1 - e^{(r-g)t}]$$

In this option when $r > g$, and $c = \tau$ (balanced budget) then the second term on the right hand side disappears and the first term grows over time. This implies that "d" does not reach a steady state but grows over time even when there is a balanced budget in all periods "t > 0". When there is persistent over spending, the second term on the right hand side is positive and therefore leads to the explosive growth of "d". When the rate of growth is less than the rate of interest then, sustainability is not possible over long periods. This again is not a surprising result.

**Option C:** This brings us to the third case when the interest rate is less than the growth rate: $r < g$

In the third scenario where the growth rate exceeds the rate of interest, the possibility of a stable debt emerges. In order to find the long run value of "d" as $t \to \infty$, we find the limit of the function:

$$L_t \to \infty d = L_t \to \infty D_0e^{(r-g)t/Y_0} + \left(\frac{c-r}{g-r}\right)[1 - e^{(r-g)t}]$$
Note that the exponential function \( e^{(r-g)t} \) goes to zero as \( t \to \infty \) when \( r < g \), and the limit reduces to:

10. \( \lim_{t \to \infty} d = \frac{(c-r)}{(g-r)} \)

Since the denominator is positive, as long as the government maintains a constant proportion of overspending the deficit income ratio \( (c-r) \) will tend to a steady state. If the government, however, maintains a balanced budget, an initial deficit will disappear over a finite period of time \( (d \to 0) \). So, as far as a growth oriented policy intends to undertake debt financing the only sustainable path is to seek a scenario where \( g > r \), which can be achieved by appropriate monetary policies in a closed economy. This we will label as the Domar steady state debt condition and will be referred in Chapter Six of this essay as a pre-condition for a stable debt path.

This, however, still leaves the question that given ‘\( g \)’ and ‘\( r \)’ what will be the level of “\( c \)” and “\( \tau \)” that the government should choose (Rakshit 2000). It must be noted that the revenues of the government in this world come purely from taxation and is the difference between tax receipts and transfer payments. If an optimising exercise determines the efficient tax rate that a government should collect, then given “\( g \)” and “\( r \)”, it would fix the long term level of “\( c \)”. However, what Rakshit (2000) is silent on is the possibility of manipulating “\( r \)” by the monetary authority to provide options for different levels of “\( c \)”. 
In neo-classical theory with no rigidities and perfect markets this scenario is not feasible, i.e., the rate of interest differing from the rate of growth in the long run.\(^2\) However, Keynesian economics, both the Neo and Post-Keynesian variants recognize the possibility of structural rigidities and the rate of interest differing from the rate of growth. It is well accepted in post-Keynesian theory that monetary authorities either target interest rates or inflation rates. If we assume that it targets the interest rate, then the option of changing “c” as per necessity is clear. In a closed economy where the monetary authority in coordination with the fiscal authority determines the desired rate of growth such options could emerge where different rates of interest would be associated with different levels of government expenditures, given rate of growth and level of net government revenue.

**Sustainability and deficit composition**

This leads us to another set of contributions which examine the question of sustainability by decomposing deficits to seek alternate policy prescriptions. By disaggregating the components of fiscal deficit, these contributions examine the impacts when different assumptions are made regarding the size of the tax revenues vis-à-vis the GDP or when rate of growth. We discuss the result of these assumptions on long term sustainability of deficit ratios. Since some these contributions emanate from India they are particularly pertinent to the developing country context.

\(^2\) Marginal productivity of capital would equate the growth rate and interest rate in the economy in world with perfect markets and zero risk.
Rangarajan et al (1994) assume that (a) there is a constant real steady state growth occurring in the economy which is ensured by the state, and (b) there is no inflation, except in the monetary financing scenario. Deficit here is assumed to be alternatively financed by monetary expansion or borrowing. The second assumption in this basic model about stability of prices could be interpreted in two distinct ways: it is Keynesian in nature when the economy operates at less-than full capacity production levels and fiscal stimuli does not completely close the slack in the economy. This of course does not explain why with Keynesian unemployment, inflationary pressures emerge with monetary financing. This could be explained if one were to rely on supply-side economics and reduce inflation to a mere monetary phenomenon. Inflation under this framework occurs only because there is an increased supply of money in circulation. If this model operates not in the Keynesian but in a Monetary framework the standard critique of the Monetary school applies here -- inflation is not linked to any real variables. Inflation occurs irrespective of the state of the real economy and demand for credit and money (Kaldor 1958b, 1970).

The other significant silence of Rangarajan et al (1994) is on the mechanics of maintaining stable growth. There is no hint as to how the given real rate of growth is being determined and why the onus of maintaining the real rate of growth lies entirely with the state. In the Domar (1944) model too the rate of growth was not being determined within the model which is a limitation of these models. Additionally, Rangarajan et al (1994) impose on the state the responsibility of maintaining an optimal rate of growth. How this rate is being determined by the
state or the mechanism for maintaining it is also not discussed by the authors. Having made those observations it is nonetheless important to set out the model for understanding the macro-implications of monetary and fiscal policy in this framework. Let the simple inter-temporal budget constraint be represented as:

1. \[ G_t - T_t + iB_{t-1} + i^*RG_{t-1} = B_t - B_{t-1} + RG_t - RG_{t-1} \]

Equation (1) states that the sum of the primary deficit (G-T) and the interest burden of previously existing debt (to the RBI and non-RBI sources), i.e. \((iB_{t-1} + i^*RG_{t-1})\), must be paid for by new debt creation from RBI and non-RBI sources. Re-arranging the equation and taking both sides as a proportion of the national income

---

3. **Legends:**
   
   \[ G = \text{Government expenditures} = \text{Non-interest revenue expenditures} + \text{Capital Expenditures} \]
   \[ T = \text{Non-interest revenue receipts} + \text{Grants} \]
   \[ G-T = \text{Net Primary deficit} \]
   \[ B = \text{Gross domestic debt other than RBI} \]
   \[ RG = \text{Net Outstanding credit of RBI to Government} \]
   \[ NF = \text{Outstanding foreign debt} \]
   \[ L = \text{Outstanding loans & Advances of Centre to others} \]
   \[ i = \text{average interest rate on domestic debt} \]
   \[ i^* = \text{average interest rate on domestic debt held with RBI} \]
   \[ w = \text{average interest rate on foreign debt} \]
   \[ e = \text{average interest rate on L}_{t-1} \]
   \[ k = \text{Growth of nominal GDP} \]
   \[ n = \text{growth of real GDP} \]
   \[ p = \text{inflation rate} \]
   \[ j, h = \text{Proportion of loans to non-RBI credit} \]
   \[ t = \text{time} \]
   
   **Note:** \( k = n + p \)

---

4. In this case the authors choose to separate out the RBI and non-RBI debt.
allows us to separate the proportion of new non-RBI debt being created in the
market.

2. \( \frac{B_t - B_{t-1}}{Y_t} = \frac{G_t - T_t + iB_{t-1} + i^*RG_{t-1} - (RG_t - RG_{t-1})}{Y_t} \)

As discussed earlier, Rangarajan et al (1994) assume that there is steady state
growth (k) in the economy

3. \( Y_t = (1+k)Y_{t-1} \)

Therefore, using equation 3 in 2 gives us:

4. \( \frac{B_t}{Y_t} - \frac{B_{t-1}}{Y_{t-1}} = B_t/Y_t - (1+k)B_{t-1}/Y_t \)

5. \( B_t/Y_t = (B_t - B_{t-1})/Y_t - k(B_{t-1}/Y_t) + B_{t-1}/Y_{t-1} \)

Substituting 2 in 5 above gives us,

6. \( B_t/Y_t = \frac{G_t - T_t + iB_{t-1} + i^*RG_{t-1} - (RG_t - RG_{t-1})}{Y_t} - k(B_{t-1}/Y_t) + B_{t-1}/Y_{t-1} \)

7. \( B_t/Y_t = \frac{G_t - T_t + i^*RG_{t-1} - (RG_t - RG_{t-1})}{Y_t} + (i - k)(B_{t-1}/Y_t) + B_{t-1}/Y_{t-1} \)

8. \( B_t/Y_t = \frac{G_t - T_t}{Y_t} - \frac{[RG_t - RG_{t-1}]/Y_t + [i^*/(1+k)].RG_{t-1} + [(1+i)/(1+k)].(B_{t-1}/Y_{t-1})}{Y_t} \)

**Open Economy Case**

Till this point we have been looking at a closed economy and it is possible to
extend this analysis to an open economy. In addition to domestic borrowing, the
state is able to borrow internationally and therefore also has international debt
obligations. One could also incorporate the loans and advances the central
government gives to other sub-national governments or public utilities. The general
budget constraint after these alterations then adds up to:
9. \[ G_t - T_t + [iB_{t+1} + i*RG_{t+1} + wNF_{t+1}] + [L_t - L_{t-1} - e.L_{t-1}] = B_t - B_{t-1} + RG_t - RG_{t-1} + [NF_t - NF_{t-1}] \]

Equation 9 states that the sum of increase in net primary deficit, the interest payments on domestic and foreign debt, and the lending in excess of interest earnings must be financed by an increase in domestic debt, money creation and/or foreign borrowings. The new foreign debt obligation is the difference between the current and the existing outstanding foreign debt and interest obligation on it:

10. \[ F_t = NF_t - NF_{t-1} - wNF_{t-1} \]

Rangarajan et al (1994) further assume that the loans and advances of the state are a fixed proportion of non-RBI debt

11. \[ L_t - L_{t-1} = h.(B_t - B_{t-1}), \text{ and} \]

12. \[ L_{t-1} = h.B_{t-1} \]

When the assumptions made in the above equations 10 to 12 are placed in the equation 9 we get:\n
16. \[ B_t = (1/(1-h)).\left\{G_t-\left(T_t - (RG_t - RG_{t-1}) \cdot F_t\right) + \left[(1 + i - e.h)/(1-h)\right]B_{t-1} + \left[i*/(1-h)\right]RG_{t-1}\right\} \]

The items as a proportion of current income yield:\n
\[ \text{\underline{5. The intermediate equations are as follows:}} \]

13. \[ G_t - T_t + [iB_{t+1} + i*RG_{t+1}] + h.[B_t - B_{t-1}] - e.h.B_{t-1} = [B_t - B_{t-1}] + [RG_t - RG_{t-1}] + F_t \]

14. \[ (1-h).[B_t - B_{t-1}] = G_t - T_t + [iB_{t+1} + i*RG_{t+1}] - e.h.B_{t-1} - [RG_t - RG_{t-1}] \cdot F_t \]

15. \[ [B_t - B_{t-1}] = (1/(1-h)).\left\{G_t - \left(T_t - (RG_t - RG_{t-1}) \cdot F_t + (i - e.h)B_{t-1} + i*RG_{t-1}\right)\right\} \]

\[ \text{\underline{6. The intermediate equation is:}} \]
18. \[ B_t/Y_t = \left[1/(1-h)\right]\left[G_t - T_t\right]/Y_t - \left[1/(1-h)\right](RG_t - RG_{t-1})/Y_t + \left[1/(1-h)\right]F_t/Y_t + \left\{1 + (1 - e.h)/(1-h)\right\}B_{t-1}/Y_{t-1} + \left\[i^*/(1-h)(1+k)\right\]RG_{t-1}/Y_{t-1} \]

The above equation represents the gross non-RBI debt (as a proportion of GDP) created in the current period in an economy with foreign borrowing. Having set up this general constraint applicable to all economies, we now examine the implications under different financing scenarios. Note that if domestic lending and foreign loans are nil, it implies that \(h = 0\) and \(F_t = 0\) then equation 18 above reduces to the case of a closed economy as in equation 8.

Debt Financing Scenario:

In order to derive the difference equation for debt financing (from equation 20) all the terms involving net RBI credit in equation 18 are given by:

20. \[ \left\{(1 + i^*)/(1-h)(1+k)\right\}RG_{t-1}/Y_{t-1} - \left[1/(1-h)\right]RG_t/Y_t \]

In order to examine the situation wherein the government relies less on the RBI for credit, Rangarajan et al (1994) assume that the central bank places a ceiling on the amount of credit that it will create, therefore:

21. \[ RG_t/Y_t = RG_{t-1}/Y_{t-1} \]

Equation 20 then reduces to:

22. \[ \left\{(1 + i^*)/(1-h)(1+k)\right\}RG_{t-1}/Y_{t-1} - \left[1/(1-h)\right]RG_t/Y_t \]

17. \[ B_t/Y_t = \left[1/(1-h)\right]\left[G_t - T_t\right]/Y_t - \left[1/(1-h)\right](RG_t - RG_{t-1})/Y_t - \left[1/(1-h)\right]F_t/Y_t + \left\{1 + (1 - e.h)/(1-h)\right\}B_{t-1}/Y_{t-1} + \left\[i^*/(1-h)(1+k)\right\]RG_{t-1}/Y_{t-1} \]

7. The intermediate step is:

19. \[ i^*/(1-h)(1+k)RG_{t-1}/Y_{t-1} - \left[1/(1-h)\right]RG_t/Y_t + \left[1/(1-h)(1+k)\right](RG_{t-1})/Y_{t-1} \]
Substituting these terms back in the general equation 18 we get an expression for non-RBI debt as a function of the net primary deficit, net foreign obligations and previous RBI and non-RBI debt:

23. \[ \frac{B_t}{Y_t} = \left[ \frac{1}{1-h} \right] \frac{[G_t - T_t]}{Y_t} - \left[ \frac{1}{1-h} \right] \frac{F_t}{Y_t} + \left[ \frac{(1 - h)(1-h)}{(1+k)} \right] B_{t-1}/Y_{t-1} - \left[ \frac{(k - i^*)}{(1-h)(1+k)} \right] R_G_{t-1}/Y_{t-1} \]

**Monetary Financing Scenario:**

Let us now examine the case when the entire additional debt burden is financed by money expansion. In the general equation developed in 18 above, the terms containing the non-RBI debt of the previous period can be re-written as:

26. \[ (B_{t-1}/Y_{t-1}) - \left[ \frac{k}{(1+k)} \right] (B_{t-1}/Y_{t-1}) + \left[ \frac{(i - e.h)}{(1-h)(1+k)} \right] (B_{t-1}/Y_{t-1}) \]

Substituting this back in the general equation 18 we have:

27. \[ \frac{B_t}{Y_t} = \left[ \frac{1}{1-h} \right] \frac{[G_t - T_t]}{Y_t} - \left[ \frac{1}{1-h} \right] \frac{(R_G_t - R_G_{t+1})}{Y_t} - \left[ \frac{1}{1-h} \right] \frac{F_t}{Y_t} + \left[ \frac{i^*/(1-h)(1+k)}{Y_{t-1}} \right] (B_{t-1}/Y_{t-1}) + \left[ \frac{(k - i^*)}{(1-h)(1+k)} \right] (B_{t-1}/Y_{t-1}) \]

To separate out the impact of pure monetary financing of deficit it is assumed that the level of debt financing is kept constant, that is:

28. \[ \frac{B_t}{Y_t} = B_{t-1}/Y_{t-1} \]

---

8. The intermediate steps are:

24. \[ \left[ \frac{1+ (i - e.h)/(1-h)}{(1+k)} \right] B_{t-1}/Y_{t-1} = \left[ \frac{1}{1-h} \right] \frac{(B_{t-1}/Y_{t-1}) + (i - e.h)/(1-h)(1+k)}{(B_{t-1}/Y_{t-1})} \]

25. \[ = \left[ \frac{1+ (i - e.h)/(1-h)}{(1+k)} \right] (B_{t-1}/Y_{t-1}) + \left[ \frac{(i - e.h)/(1-h)(1+k)}{Y_{t-1}} \right] (B_{t-1}/Y_{t-1}) \]
With these changes the original equation 18 reduces to:

29. \[
\frac{1}{1-h} \frac{G_t - T_t}{Y_t} - \frac{1}{1-h} \frac{(R_G - R_{G_t})}{Y_t} - \frac{1}{1-h} \frac{F_t}{Y_t}
\]

\[
+ \frac{i^*}{1-h} \frac{RG_{t-1}}{Y_{t-1}} + \left[ \left( \frac{i - e(h)}{(1-h)(1+k)} \right) - \frac{k}{1+k} \right] \frac{B_{t-1}}{Y_{t-1}} = 0
\]

30. \[
\frac{(R_G - R_{G_t})}{Y_t} = \left[ \frac{(G_t - T_t)}{Y_t} - \frac{F_t}{Y_t} \right] + \frac{i^*}{1-h} \frac{RG_{t-1}}{Y_{t-1}} + \left[ \frac{h(k-e) - (k-i)}{1+k} \right] \frac{B_{t-1}}{Y_{t-1}}
\]

The above equation indicates the additional credit creation in the market as a function of the net primary deficit, current net foreign outstanding debt and the previous domestic RBI and non-RBI debt. Solving the difference equation shows that the co-efficient term associated with debt in the previous period must be less than one for debt to converge. This implies that the stability (or Sustainability condition) is:

31. \[
\left\{ \frac{1 + (i - e(h))}{(1-h)} \right\} (1+k) < 1
\]

In other words

32. \[
[e(h) + (1-h)k] > i
\]

Rangarajan et al (1994) suggest one possible way of manipulating a sustainable debt regime is to either increase ‘e’ the net lending rate in the economy and/or increase the rate of growth in the economy while keeping the interest rate unchanged. The other possible way would be to reduce the rate of interest ‘i’ (borrowing cost in the economy). This, however, they feel would not be viable due to financial market constraints. Working in a pre-Keynesian framework, they argue that a decline in interest rate would lead to a decline in Household saving.
especially in an inflationary environment. If we assume that we are in a closed economy (as we did in equation 8), i.e., $h = 0$,

Then the condition for stability (equation 31), reduces to

$$k > i,$$

The implication is that the rate of growth must be greater than the average interest rate on domestic debt and this is exactly what Domar (1944) had anticipated as we have discussed above.

In a later contribution Mohanty (1997) augments this structural model by endogenising price and interest rate variables. The basic set up of the model is the same as Rangarajan et al (1994), but there are some additional components which allows the author to endogenise price and interest rate in order to link them to the policy variables. In variation to equation 12 above it is assumed that:

$$L_{t-1} = j \cdot B_{t-1}$$  

where $j \neq h$ (as in Rangarajan et al)

9. In hindsight, this does not seem to hold true in the Indian economy. In the last few years there has been a concerted move to reduce the rate of interest in the economy by the RBI but this has not reduced the mobilisation of resources. In fact, in the years preceding this decline in interest rate, though ex-ante saving seem to have increased in a high interest rate structure, credit off-take had fallen in the economy due to depressed industrial conditions. The revival in industrial growth has been due to a fall in interest rate and there does not seem to have been a decline in the level of savings.

10. Rangarajan et al (1994) had assumed that price is externally determined and fixed (except when there is monetary financing).

11. The original equation used by Mohanty’s (1997) is: $L_{t-1} = h \cdot B_{t-1}$. Also we have used ‘$j$’ instead of ‘$g$’, in difference to Mohanty’s (1997) notation.
In contrast to the earlier model, Mohanty (1997) separates the growth into its real and nominal component. For example, growth

\[ k = [(1 + n)(1 + \pi)] - 1, \]  
where \( n \) = real rate of growth and \( \pi \) = inflation rate

The external debt is assumed to be a constant proportion of GDP, such that

\[ \frac{[NF_t - NF_{t-1}]}{Y} = f \]

Therefore, once again debt is the sum of obligations to the RBI (ad hoc Treasury bills), non-RBI domestic sources and external debt.

\[ D_t = B_t + RG_t + NF_t \]

However, distinctively, Mohanty (1997) proceeds to look at total debt rather than the differential impact of RBI and non-RBI debt.

\[ \frac{D_t}{Y_t} = [(1 - h + i - e,j)/(1-h)(1+k)] D_{t-1}/Y_{t-1} + \frac{[G_t - T_t]/Y_t}{Y_{t-1}} + [(i^* - i + h + e,j)/(1-h)(1+k)] RG_{t-1}/Y_{t-1} + \frac{[(w - i + e,j)/(1-h)(1+k)]NF_t}{Y_{t-1}} - h/(1-h) RG_t/Y_t - hf/(1-h) \]

The sustainability of debt once again is determined by the size of the coefficient associated with the existing debt ratio. As in the earlier case the debt is convergent if:

\[ (1 - h + i - e,j)/(1-h)(1+k) > i \]

Mohanty (1997) argues that if net lending goes to zero in the long run and ‘j’ converges to ‘h’, then we have the familiar requirement that

\[ k > i \]  
exactly as in equation 33.
Here too it is assumed that the level of RBI credit through RBI ad hoc Treasury Bills will stay constant as a proportion of income (as in equation 21 above). The assumption was in anticipation of the move to stop issue of ad hoc T-Bills to the government at that time. A part of the ad hoc T-Bills (as special securities) was meant to be serviced at an interest rate \( (i^*) \) while the remaining were meant to be converted to stocks or given as Ways & Means advances from RBI to be serviced at a special rate \( (i^{**}) \). All this information can be collated into equation 38 above to give us:

\[
\frac{D_t}{Y_t} = \frac{(1 - h + i - e.j)}{(1-h)(1+k)} \frac{D_{t-1}}{Y_{t-1}} + \frac{1}{(1-h)} \left[ G_t - T_t \right] / Y_t \\
+ \frac{[(i^{**} - i + e.j)/(1-h)(1+k)]}{(1-h)(1+k)} \frac{R_t}{Y_{t-1}} - \frac{[(i^* - i)/(1-h)(1+k)]}{(1-h)(1+k)} \frac{R_{t-1}}{Y_{t-1}} \\
+ \frac{[[(w - i + e.j)/(1-h)(1+k)]}{(1-h)(1+k)} \frac{NF_{t-1}}{Y_{t-1}} - hf/(1-h)
\]

This will be the general equation for extrapolating the debt ratio in the long run. In addition to examining the debt dynamics, there has been an attempt to compute the debt burden too. Both Rangarajan (1994) et al and Mohanty (1997) define debt burden as the ratio of interest dues to the revenue receipts of the government.

\[
\text{IB} = \frac{rD_{t-1}}{R}
\]

where \( \text{IB} = \text{Interest Burden, } R = \text{Revenue Receipts} \)

\[
\text{IB} = [i.B_{t-1} + i^*RG_{t-1} + i^{**}(RG-RG_{t-1})+wNF_{t-1}] / R
\]

**Fiscal deficit, Debt, Inflation and Money**

Following up on the monetary financing scheme, Rangarajan et al (1994) suggest that inflation in the current period is a function of increase in RBI credit to government and inflation in the past period.\(^{12}\) They go on to suggest that active or

\(^{12}\) We already know from equation 30 above that:

\[
(RG_t - RG_{t-1})/Y_t = \left[ (G_t - T_t)/Y_t - F_t/Y_t \right] + [i^*/(1+k)]\frac{R_t}{Y_{t-1}} + \left[ (h(k-e) - (k-i))/(1+k) \right] \frac{B_{t-1}}{Y_{t-1}}
\]
pure monetary financing of deficits/debts would lead to a vicious circle wherein deficits and inflation chase each other. Mohanty (1997) has a more elaborate model in this context. He sub-divides monetised debt into three sub-components: Outstanding ad hocs, RBI's holding of government securities, and other 91-day T-bills. The first component is endogenously generated in the model, but kept constant after a particular year (1997-98), the latter component is assumed to move along with other domestic debt as a fixed proportion.\textsuperscript{13}

44. \( B_t - B_{t-1} = (BM_t - BM_{t-1}) + (BNM_t - BNM_{t-1}) \)

Now it is assumed that the monetary debt is a fraction of the total domestic debt (excluding ad hocs)\textsuperscript{14}, i.e.,

45. \( BM_t - BM_{t-1} = \gamma (B_t - B_{t-1}) \)

Then the outstanding RBI credit to the Centre (RBCG) is given by:

46. \( RBCG_t = RBCG_{t-1} + \gamma (B_t - B_{t-1}) + (RG_t - RG_{t-1}) \)

Reserve money (RM) in the system is a function of the RBI credit to the centre and ‘others’ as well as the level of economic activity (GDP).

\[ \text{Let } MFR = RG_t - RG_{t-1}/Y_t, \text{ then } \]
\[ \pi_t = f(MFR_{t-1}, \pi_{t-1}), \text{ where } \pi = \text{inflation rate} \]

\textsuperscript{13} Let, \( BM = \text{Monetary debt excluding ad hocs} \)
\( BNM = \text{Non-monetary debt} \)

\textsuperscript{14} Mohanty (1997) arrives at the value of ‘\( \gamma \)’ by taking the average ratio of change in net RBI credit to centre to change in domestic debt for the years 1991-92, 1992-93 and 1995-96. The years 1993-94 and 1994-95 are excluded as ‘\( \gamma \)’ took negative values due to exceptional increase in net foreign assets of the RBI.
47. \[ RM_t = RBCG_{t-1} + \gamma(B_t-B_{t-1}) + \theta Y_t, \] where \( RG_t-RG_{t-1} = 0 \) by assumption.

The supply of money then is assumed to be a product of the reserve money (RM) in any period and the long run money multiplier \( 'm^{*}$.\(^{15} \) The demand for money is assumed to be determined by the level of economic activity (real income) alone\(^{16} \) and the money markets clear at all times.\(^{17} \) Price then is stated to be a function of the money supply, real income and past prices which on differentiation gives us the measure of inflation in the economy. The author then goes on to estimate the inflationary expectations (\( \pi^e \)) in the Indian economy following the Fisher equation for estimating nominal interest rates in developing countries and Edwards and Khan (1985) estimation procedure for real interest rates.\(^{18} \)

**Inflation, Deficits and the Mode of Financing**

Rao (2000 & 2003) within the monetary framework attempts to build a model linking fiscal deficit, interest rates and inflation. He assumes that the fiscal deficit

\[^{15}\] Let, the Money Multiplier be \( \ M_3 = m^{*}.RM \)
\[^{16}\] Let, \( \ln \left( \frac{M^{d}}{P} \right) = \ln \alpha_0 + \alpha_1 \ln y \)

This of course is different from the Keynesian set up where money acts not only as a means of transaction but also as an asset. Demand for money is the sum of the transaction and precautionary demand as well as the speculative demand for money.

\[^{17}\] This makes it easy to determine prices based on the level of money supply, real income and previous price levels. Differentiating this function gives us a relationship between current inflation, change in money supply, rate of growth in real income and past inflation.

\[^{18}\] \( i_t = \pi_t^e + \pi_t^e \) where \( i = \) nominal interest rate and \( r = \) real interest rate
\( r_t = \rho - \lambda \cdot \text{EMS} + u_t \) where, \( r = \) long run real interest rate, \( u = \) error term
\( \text{EMS}_t = \ln m_t - \ln m_t^d \) \( \text{EMS} = \) Excess money supply,

\( m_t \) & \( m_t^d \) = supply and demand for real money balances
is related to the level of growth, the inflation rate and the interest rate in the
economy. He finds that while inflation is desirable for growth up to a point, it
could choke off growth after a certain limit. Rao (2003) models an economy which
defines a threshold rate of inflation for sustainable growth and determines the
optimal level of monetary expansion. Growth of GDP is assumed to be related to
the growth of real money supply and the real rate of interest in prior periods.19

Further, inflation in the current period is assumed to be related to the level of
growth in money supply and the level of growth.20 With the above specifications
he is able to arrive at an optimal level of fiscal deficit21 which maximises growth.22

In addition to the issue of fiscal deficit and growth, Rao (2000) also makes the
point that not only does the size of the fiscal deficit matters but also its mode of
financing. To what extent a deficit will be financed by central bank would depend
on the relative bargaining power of the monetary and fiscal authority. Therefore,
for any given level of deficit there would exist optimal levels of monetisation and

\[ g = \alpha_1 + \alpha_2(\mu - \pi), + \alpha_3(i - \pi), + \alpha_4 (i - \pi), \]

\[ \pi_i = \mu_i - \eta g_i \quad \text{where } \eta = \text{income elasticity of money demand} \]

\[ f = \mu + e^{-\beta i} \quad \text{where } f = \text{fiscal deficit ratio}, \]

\[ \beta = \text{(semi-)} \text{ elasticity of money demand with respect to} \]

\[ \text{interest rate where income elasticity is assumed as unity} \]

22. One must add here that he does not make the case for excessive fiscal expansion but only
suggests that fiscal consolidation should be done in stages. If fiscal reduction is done abruptly, it
could lead to long run recession (Rao 2003:818).
borrowings because there might be multiple levels of monetisation for any given level of debt.\textsuperscript{23}

This is in variance to the Sargent & Wallace (1981) thesis which states that if deficits are financed by inflation tax today and the government manages to keep prices low today, it will be unable to stem inflation in the subsequent periods. So monetary financing of deficit is merely a way of choosing when the inflation is desired. However, inflation over long periods might be sticky downwards to the extent that even though it is triggered initially by deficits, the reduction of deficits later may not necessarily lead to lowering of inflation due to other factors. It is quite feasible (at least theoretically) that an economy could be stuck at a high interest rate even though it could alternatively have been at a lower level with the same level of debt if there is excess borrowing to finance debt.\textsuperscript{24}

A unique solution

\textsuperscript{23} While in a closed economy, the deficit has an impact on the inflation rate, in an open economy the impact could also spill over onto the current account and result in twin deficits.

\textsuperscript{24} The demand for real money balances is given by:

\begin{equation}
\frac{M}{P} = A.y^\alpha e^{\beta i}, \quad \text{where: } \alpha = \text{income elasticity of real money demand, } \beta = \text{interest rate (semi) elasticity of money demand.}
\end{equation}

Fiscal Deficit is the sum of debt servicing and current primary deficit.

\begin{equation}
\text{FD} = (i+\varepsilon).D + x.P.y,
\end{equation}

\begin{equation}
(i+\varepsilon) = \text{average nominal interest, } D = \text{Debt, } x = \text{Ratio of primary deficit to nominal income}
\end{equation}

This fiscal deficit could be financed by either monetary expansion or by additional borrowing.

\begin{equation}
\text{FD} = M' + D', \quad \text{where } M' = \text{Increase in money supply, } D' = \text{Increase in debt}
\end{equation}

\begin{equation}
\text{Let, } f = \frac{\text{FD}}{P}y = (M'/M).(M/Py) + (D'/D).(D/Py)
\end{equation}

\begin{equation}
\text{Then, } f = \mu[A.y^\alpha e^{\beta i}]/y + d.(D'/D), \quad \text{where } \mu = M'/M, d = D/Py
\end{equation}

\begin{equation}
\text{And } f = (i+\varepsilon).d + x
\end{equation}

If we put equation 56 into 61 we get
will result with steady interest and inflation rates if an optimal mix of debt and monetary financing is followed. Contrarywise, a situation of hyper-inflation might result (with no steady state) in the absence of debt financing of deficit. There could alternatively be sub-optimal mixes of debt and money financing which might result in multiple steady state solutions – if the debt financing is more than the optimal level then there would be a high interest solution and vice-versa.

Some other studies argue the case of reverse causation where there could be inflation-induced deficits too (Aghelvi & Khan 1978, Jadhav & Singh 1990). Government expenditure (rather than government receipts) is said to adjust quicker to inflation. This implies that any unanticipated change in price level will increase

\[ \mu A \gamma^{a-1} e^{\delta} = (i + \varepsilon - \delta) d + x, \quad \text{where} \quad \delta = D'/D \]

The logarithm form of equation 56 is differentiated under steady state assumptions (when \( i = 0 \)) to yield

\[ \mu = \pi + \alpha g, \quad \text{where} \quad \pi = \text{inflation rate,} \quad g = \text{real growth rate} \]

Equation 63 is then introduced into equation 62 to give an expression for inflation:

\[ \pi = \{ [(i + \varepsilon - \delta) d + x] A \gamma^{a-1} e^{\delta} \} - \alpha g \]

Inflation here is a function of interest rate for given levels of monetised deficit. In order to estimate the interest rate \( 'i' \), the Edwards-Khan (1985) model is invoked which states that nominal interest in a semi-open economy is the weighted average of the closed economy Fisher equation and the uncovered interest rate party equation for the open economy.

\[ i = (1-\Omega)(r + \pi) + \Omega (i_r + e^d), \quad \text{where} \quad r = \text{domestic real interest rate,} \]
\[ i_r = \text{foreign interest rate,} \]
\[ e^d = \text{expected rate of depreciation,} \]
\[ \Omega = \text{index of financial openness} \]

This can be re-arranged to keep inflation as the dependent variable:

\[ \pi = \left[ i / (1-\Omega) \right] + \left( \Omega / (1-\Omega) \right)(i_r + e^d) - r, \]

Subsequently, an optimisation involving equation 66 (as the constraint) and equation 64 as the objective function provides the desired result, ceteris paribus.
the deficit which in turn will further increase inflation. So while there is deficit-induced inflation there is also inflation-induced deficit.

Debt financing and Inflation

Another issue that occasionally figures in the debt debate is the manner of issue of debt and its implications for inflation control in the economy. It has been argued that the government is better off selling securities to agents other than central bank because this would reduce the inflationary impact of debt on the economy, especially in developing countries like India (RBI 1985). This line of reasoning is implied in Rangarajan et al (1994) and Mohanty (1997) discussed earlier. The argument in its simplest version runs as follows: When government supplies debt to the central bank, there is a build up of reserve money in the system. The money multiplier acts in a way to augment the money supply in the system as a multiple of the initial increase in the reserve money in the system. Since money demand must equate money supply in the system, given real income, interest rate and increase in supply of money, the nominal income must rise in order to accommodate an increase in money demand. The only way nominal income will rise given real incomes is by an upward movement of prices. Thus emerges the inflationary character of selling bonds to the central bank. This of course implicitly assumes that there is always existent in the system a set of borrowers who would be willing to take loans from the banks once their liquidity has gone up irrespective of the real state of the economy.

25. Empirical studies have found this theory controversial – there is evidence of both confirmation and rejection of this hypothesis (Heller 1980).
Contrarywise, if the government were to supply debt directly to the market agents or to banks, this would not lead to a creation of additional reserve money and therefore money supply through the money-multiplier effect would be unaffected implying that there would be no inflationary impact. However, given the structural features of economies like India where the parameters of monetary policy are institutionally determined and not the outcome of a market-clearing process, inflationary pressures may not build up in the manner as suggested by received theory (Patnaik 1986). The reasons for this are the following:

a) Once debt is issued, the government cannot control how and who holds the debt.

b) The identity of the debt holder is of little consequence as far as liquidity creation is concerned and therefore inflationary potential determination on the basis of who holds the debt can be misleading. However, what is important is the profile of debt creation

c) Efforts to supply debt to market agents as an attractive financial asset could be counter-productive as far as inflation control is concerned. This may alter the distribution of wealth in a manner that negates the need for inflation control in the first place.

The models discussed above while not negating fiscal policy do however provide primacy to monetary policy (including the reverse causation models), especially when they talk of "monetary targeting". This is of course in conformity with the
recent developments in the literature and the so-called “new consensus” in macroeconomics, which has moved away from targeting monetary aggregates to focusing on interest rates and inflation rate as the key policy instruments. This is possibly a response to the increasing financial openness that economies have experienced in the last two decades.

**Monetary Targetting and Endogenous Money**

So isn’t monetary targetting a kind of convergence towards the concept of “endogenous money”? Not quite, according to Arestis & Sawyer (2003), the “new consensus” approach continues to treat money as a residual (in the monetary tradition) while Keynesian “endogenous money” theory treats money and credit as determinant factors of real variables, like income and employment. The stock of money (or money supply) is dependent on the level of money demand in the economy and a mere expansion of money supply is not seen as a factor triggering inflation (Clarida et al 1999, Fontana & Palacio-Vera 2002).

Between the monetarists and the fiscalists lies a zone of “new consensus” macroeconomics which is a modified version of the IS-LM model, which was the workhorse of policy analysis (Meyer 2001). The Hicksian version of the IS-LM curve had two equations and three variables and therefore could only be solved if either prices or output were assumed to stay constant. The expanded version of this model allows for stickiness of prices in the short run but flexibility in the long run with the help of the expectation augmented Philips curve. So in the short run there is a trade-off between inflation and output but in the long run the tradeoff is not
operative as the economy settles at the Non-Accelerating Inflation Rate of Unemployment (NAIRU). The money market equilibrium (LM curve) is upgraded from being an instrument to being a policy rule. It ensures that central banks instead of focusing on keeping money supply constant actually targets interest rates and inflation. This is more inline with the post-Keynesian position where, as we have discussed elsewhere, the LM curve is presumed to be horizontal in the long run and therefore the money supply is flexible but interest rates are exogenously determined and therefore does not emerge from the model.26

Having examined public policy interventions and their impact on macro variables it is now necessary to look at the impact of public policy on growth. In the following chapter we begin by examining the role of fiscal policy in growth models. The Harrod-Domar models which triggered the development of growth theory articulated a Keynesian perspective that given a capital output ratio in an economy, it was the saving rate that determined the rate of growth. This continues to be a powerful policy idea but what tickled the interest of later writers was the problem of instability that the model has instability problem in a market economy

26 The essence of the model is summarized in three equations:

\[ Y_g = ao + a_1 E_r(Y_{g+1}) - a_2[R_r E_r(p_{t+1})] + s \]
\[ p_t = b_1 Y^g + b_2 p_{t+1} + b_3 E_r(p_{t+1}) + s_2 \]
\[ R_t = RR^* + E_r(p_{t+1}) + c_1 Y^g_{t+1} + c_2 (p_{t+1} - p^T) + c_2 R_{t+1} \]

Such that,
\[ Y_g = \text{Output gap} \]
\[ R = \text{Nominal interest rate} \]
\[ p = \text{inflation rate} \]
\[ p^T = \text{target inflation rate} \]
\[ RR^* = \text{equilibrium rate of interest when } Y_g = 0 \]
\[ E_r = \text{Expectations at time 't'} \]
which was not being guided by the hand of an omniscient social planner. The contributions that followed, came both from the neo-classicals as well as the post-Keynesians both of whom concentrated on showing how a market economy was not inherently unstable. The Solow-Swan response relied on the flexibility of the capital output ratio while the post-Keynesians relied on manoeuvrability of the savings rate to ensure that the economy would not enter a perpetual downward (or upward spiral) as anticipated by Harrod-Domar.

The next question that came up was whether the neo-classical model or the distribution model was the more reliable one to analyse economic growth. While part of the Cambridge-Cambridge debate of the 1930s and 40s evolved around the capital controversy, it also spilled over to a discussion on the validity of the Pasinetti process (which was a more fully developed distribution model of Kaldor). The Kaldor-Pasinetti results resurrected the central role that savings played in determining the rate of growth. However, they concluded that in a heterogeneous society it was not the average savings rate but only the saving rate of the capitalists or profit earners that mattered in growth rate determination. We will examine these in more detail later in the essay. In contrast to this, the neo-classical model argued that the only thing that affects the rate of growth is technological change and the rate of population growth. Given technology, an increase in population would negatively affect the per capita income growth. Ceteris paribus, only technological change would increase the rate of growth of per capita incomes. It was robust in its conclusion that any change in policy which worked through the saving rate would not affect the growth rate but only have level effects.
The next big push to the growth literature was in the mid-1980s, when new or endogenous growth theories began to examine the notion of technological determination. Interestingly, while neo-classical theory saw little role for fiscal intervention, endogenous growth theory was amenable to fiscal interventions and therefore opened up newer avenues of government participation. In the following chapter we begin our discussion on growth theories with a particular focus on endogenous growth models which incorporate fiscal policy.