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Pitfalls in the Theory of Growth: An Application to the Balance of Payments Constrained Growth Model

Abstract

Neo-classical growth theory, both old and new, represents growth as an exclusively supply driven phenomenon. Keynesian economics emphasizes the demand-side dimension to growth. In steady state demand and supply growth must be equal. Absent this, there will be growing excess capacity or excess demand. If supply growth does not respond one-for-one to changes in the rate of demand growth, this requires mechanisms for equilibrating the two. This paper presents a short treatment of the demand and supply growth problem, and uses the theory of balance of payments (BOP) constrained growth to illustrate the problem. The characteristics of the BOP model are dramatically changed by incorporating capacity growth considerations, which illustrates the pitfalls that can follow from failure to properly model supply - demand balance.

Keywords: growth, demand, supply, balance of payments constrained.

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I Introduction

Over the last decade, under the banner of new endogenous growth theory, there has been a revival of interest in the theory of economic growth. Though endogenizing steady state growth, the new theory persists with the claim that growth is a pure supply-side phenomenon. This is at odds with Keynesian economics which emphasizes the demand side dimension of the growth process. However, the Keynesian paradigm has itself fallen into the pitfall of failing to properly account for the supply side. In the long run there is a requirement that the rates of demand and capacity (potential output) growth be equal. Absent this, there will either be growing excess capacity or excess demand. If capacity growth is subject to different influences than those acting on the demand side, or if it does not respond one-for-one to changes in the rate of demand growth, this requires mechanisms that equilibrate the two.[1]

This paper presents a short treatment of the demand and supply growth problem, and then applies it to the theory of balance of payments (BOP) constrained growth (Thirlwall, 1979). In its simplest form, the BOP model is a pure demand constrained model of growth. A Verdoorn law equation can be added to describe the supply side, but this introduces problems of reconciling capacity growth with the BOP constrained rate of demand growth. Building on suggestions contained in Palley (1996), the paper suggests how this inconsistency can be reconciled.

II The problem of balancing demand and supply growth

Neo-classical growth theory (Solow, 1956) claims that steady state growth is determined by

[1]. Growth of capacity and potential output are the same. Neo-classical growth theorists tend to use the terminology of potential output. Post Keynesian theorists tend to refer to capacity. This terminological difference has likely contributed to misunderstanding between the two schools.

supply-side forces. Thus, in steady state the equilibrium growth rate is determined by

(1.a) $g^s = g(S)$

(1.b) $g = g^s$

where g = steady state growth rate, g^s = growth of capacity, S = vector of supply-side forces. In the Solow model the supply side forces are the rate of population growth and the rate of technological advance, both of which are taken to be exogenous. Equation (1.b) implicitly assumes a "dynamic" version of Say's law whereby the growth of capacity creates a matching growth of demand.

New endogenous growth theory retains this overarching framework, except that the steady state growth rate is now subject to influence by the choices of government and agents (Romer, 1993, 1994). Thus, equation (1.a) becomes

(1.a') $g^s = g(S, t)$

where t = choice variables subject to control by government and private sector agents. These choice variables include public R & D spending, the stock of public capital, public investment, the stock of human capital, and investment in human capital. The central implication is that the steady state growth rate is subject to endogenous variation despite an exogenously given vector of other supply-side forces, S.

This neo-classical perspective contrasts with a Keynesian perspective which emphasizes demand-side factors. In the Keynesian paradigm growth is given by

(2.a) $g^d = g(D)$

(2.b) $g = g^d$

where g^d = growth of demand, and D = vector of demand side forces which can be both

exogenous and endogenous. Equation (2.b) implicitly assumes that the growth of capacity adjusts to the growth of demand.

However, if there is a separate supply side (i.e. a production side of the economy), this requires the following condition to hold

(3) $g = g^s = g^d$

Absent the satisfaction of this condition, there will either be growing excess capacity or growing excess demand - neither of which are observed in modern capitalist economies. The imposition of this growth equilibrium condition in turn raises questions as to how equilibrium is achieved. In an endogenous growth framework, variation in the choices of individuals and governments could enable equilibration of demand and capacity growth, but this raises questions as to what are the market mechanisms and signals that give agents an incentive to change their choices.[2]

The implications of requiring steady state balance between demand and capacity growth are readily illustrated by the following Keynesian model presented in Palley (1997). The equations of the model are

(4.a) $g^s = g(S, g^d)$

(4.b) $g^d = g(D)$

[2]. The adoption of marginal productivity theory to explain income distribution introduces additional complications since it require that the steady state capital - labor ratio be constant, which then further restricts the set of possible equilibria. In a marginal productivity framework, a constant capital - labor ratio is needed to prevent capital deepening from driving the interest rate to zero.

(4.c) $g = g^s = g^d$

The model is Keynesian in that demand growth influences the rate of capacity growth, and the rate of demand growth is influenced by choice of D. Thus, government policy can influence the rate of demand growth, and in so doing it can influence the rate of potential output growth. Yet despite this, the set of growth equilibria may be very limited, and there may even be only a single equilibrium point. This is illustrated in figure 1 in which the rate of capacity growth is a strictly concave function of the rate of demand growth. In this dynamized income - expenditure model there is only one equilibrium point. Figure 2 illustrates an alternative representation in which capacity growth is a quasi-concave function of demand growth, and there are three equilibria.[3] Though increased in number, the set of equilibria is still very restricted. It is also very different from static Keynesian models of the equilibrium "level" of income which are marked by a continuum of equilibria. In these static models (e.g. the income - expenditure model) policy makers can continuously vary the equilibrium level of income by changing the level of demand. In the above dynamic model they can only cause jumps between equilibria, and even this requires that the capacity growth function be shaped in a particular way. These differences illustrate the critical importance of properly accounting for demand and capacity growth, as well as the pitfalls of failing to do so.

Finally, in connection with the above distinction between static and dynamic Keynesian models, the work of Cornwall (1972) provides a possible intermediate position. Cornwall recognizes the importance of the distinction between growth of supply and growth of demand, and also recognizes that the two must be equal in equilibrium. He then postulates that there may

[3]. Which of the three are stable depends on the details of the dynamic adjustment mechanism (see Palley, 1997).

be a range of demand growth where the two correspond. This is illustrated in figure 3 in which growth of capacity and demand correspond over the region g_A - g_B.

III An illustration: the balance of payments constrained growth model

The balance-of-payments (BOP) constrained growth model introduced by Thirlwall (1979) has become a work-horse of post Keynesian growth theory. The BOP growth model is intended to show how country growth rates are ultimately constrained by the rate of growth of demand, thereby making for a Keynesian theory of growth. In this regard, the growth of exogenous demand provided by exports is especially important. The logic is that the current account provides an ultimate constraint on growth because countries cannot continuously increase their foreign debt to GDP ratios. Consequently, if domestic income and import demand are growing in excess of export demand, at some stage the rising foreign debt to GDP ratio implied by a growing current account deficit will force a slowdown that restores current account balance.

However, the BOP model embodies an internal inconsistency owing to its failure to consistently incorporate the supply side of the economy. In the long run, not only is growth constrained by the requirement of dynamic current account balance, but there is also a requirement that the rate of growth of output equal the rate of growth of capacity. This leads to potential for inconsistency between the dual requirements of capacity balance and current account balance. This problem can be seen from the following simple statement of the BOP growth model given by

(5.a) $x = a_0 g^*$

(5.b) $m = b_0 g^d$

(5.c) $x = m$

(5.d) $a = c_0 + c_1 g^d$

(5.e) $g^s = a + n$

where x = rate of export growth g^* = rate of foreign income growth
m = rate of import growth g^d = rate of domestic income growth
a = rate of labor productivity growth
g^s = rate of potential output growth n = rate of labor force growth

Equation (5.a) is the export demand growth equation. Equation (5.b) is the import demand equation. Equation (5.c) is the balance of payments constraint which requires equality between the long run rates of import and export growth to prevent a growing current account deficit or surplus. Equation (5.d) is the Verdoorn law equation which endogenizes productivity growth by linking it to domestic output growth. Lastly, equation (5.e) determines the rate of capacity growth.

Solutions for the equilibrium rates of actual output growth and capacity growth are given by

(6.a) $g^d = a_0 g^* / b_0$

(6.b) $g^s = c_0 + c_1 a_0 g^* / b_0 + n$

The model is over-determined, and it is only by chance that the BOP constrained rate of output growth will equal capacity growth. The necessary condition is

(7) $g^* = [c_0 + n]/[a_0/b_0 - c_1]$

If this condition is not satisfied there will be growing imbalance between actual and capacity output. If $g^* > [c_0+n]/[a_0/b_0 - c_1]$ there will be growing excess demand. If $g^* < [c_0+n]/[a_0/b_0 - c_1]$ there will be growing excess capacity.

IV A suggestion for reconciling the inconsistency in the BOP model

The theoretical good sense of the BOP model and its ability to make empirical sense of many countries' growth experience (McCombie, 1997; Bairam and Dempster, 1991) suggest that the

model is a worthwhile one. That said, reconciling the inconsistency between the current account and the capacity balance constraints is an important matter.

A possible means of reconciliation is suggested by Palley (1996) who shows how steady state excess supply conditions can impact the steady state rate of growth. This allows for growth without full employment. Such a suggestion can be incorporated into the BOP growth model by having the income elasticity of import demand coefficient be a negative function of the state rate of excess capacity, E, where the rate of excess capacity is defined as the level of output divided by the level of capacity. A rationale for this is that imports are driven by bottlenecks. As the rate of excess capacity and unemployment decrease, bottlenecks become more prevalent and the share of increments in income spent on imports increases. Thirlwall and White (1974) and Thirlwall and Hughes (1979) provide some empirical evidence for this hypothesis and show that the elasticity of import demand is increasing in conditions of excess demand.

In steady state equilibrium the rate of excess capacity is constant, indicating that demand and capacity are growing at the same rate. Given this, the model becomes

(5.a') $x = a_0 g^*$

(5.b') $m = b_0(E) g^d$

(5.c') $x = m$

(5.d') $a = c_0 + c_1 g^d$

(5.e') $g^s = a + n$

(5.f') $g^d = g^s$

where E = level of normal output/level of capacity.[4] The changes from the earlier specification

[4]. The rate of change of excess capacity is given by $dE/E = g^d - g^s$. Thus, $dE/E = 0$ when $g^d = g^s$. In the background of the current model is a multi-sector model with stochastic demand

concern the specification of (5.b) and the addition of a capacity balance condition given by (5.f').

The workings of the model can be understood as follows. The existence of a balance of payments constraint requires that export growth equal import growth in steady state. This imposes the condition[5]

(8) $g^d = a_0 g^* / b_0(E)$

Side-by-side, the requirement that demand growth equal capacity growth imposes the condition[6]

(9) $g^d = g^s = [c_0 + n]/[1 - c_1]$

The potential inconsistency is illustrated in figure 4. The ray from the origin shows the rates of demand growth consistent with foreign income growth, while the horizontal line determines the rate of demand growth consistent with capacity growth (as determined by Verdoorn's law). Given the exogenously given rate of foreign income growth, demand is constrained to grow at $g^{d\wedge}$. However, this is below the rate of demand growth consistent with capacity growth, and as a result there is a growing rate of excess capacity.

The adjustment to steady state equilibrium is as follows. The increase in the rate of excess capacity pulls down the elasticity of import demand (i.e. reduces b_0), thereby relaxing the external constraint on growth. This in turn allows for faster aggregate demand growth, and such an adjustment process will then continue until the balance of payments constrained growth rate

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distribution such as is described in Tobin (1972). In such an economy, random shifts of demand mean that some sectors have excess capacity and others are at full capacity (bottleneck sectors). If the trend rate of aggregate demand growth exceeds the trend rate of aggregate supply growth, there will be a steady increase in the proportion of sectors subject to bottlenecks. The reverse holds if the rate of supply growth exceeds the rate of demand growth.

[5]. This condition is derived using equation (5.a'), (5.b'), and (5.c').

[6]. This condition is derived using equation (5.d'), (5.e'), and (5.f').

has been raised to a level consistent with the underlying capacity growth process. In terms of figure 4, the increase in the rate of excess capacity causes the ray from the origin (the BOP growth constraint) to gradually rotate upward, and this continues until the balance of payments constrained growth rate equals the capacity balance growth rate. From equations (8) and (9), this is satisfied when

(10) $a_0 g^* / b_0(E) = [c_0 + n]/[1 - c_1]$

The implicit function theorem then implies that the equilibrium rate of excess capacity associated with steady state is

(11) $E = b_0^{-1}(a_0 g^* [1 - c_1]/[c_0 + n])$

Interestingly, when the capacity growth - demand growth problematic is resolved in this fashion, the steady state growth rate again becomes uniquely determined on the supply side by Verdoorn's law (equations (5.d) and (5.e)). Demand growth, operating though the BOP constraint (equation (5.a)), only impacts the steady state rate excess capacity.

V Other possible ways of reconciling the inconsistency in the BOP model

Adjustment of the elasticity of import demand represents one possible demand side mechanism for ensuring consistency between the balance of payments constraint and the rate of growth of supply. A second possible mechanism of adjustment is through the impact of the rate of excess capacity on productivity growth (Palley, 1996). Here the argument is that productivity growth is negatively related to the rate of excess capacity. The reason is that higher excess capacity reduces investment spending, and investment spending is the mechanism for generating productivity growth. In the event that the supply growth exceeds demand growth, excess capacity will rise over time, thereby reducing productivity growth and supply growth. In terms of

figure 4, equilibrium is now be brought about by having the g^s function shift down. This mechanism is fully consistent with the income elasticity of import demand mechanism, and the two could both be operative.

In addition to these mechanisms, there also exist pure supply side mechanisms for ensuring consistency. However, here it is necessary to distinguish between medium run mechanisms and long run mechanisms. The former can ensure consistency between the balance of payments and the rate of output growth for prolonged periods of time, but they cannot sustain an ultimate steady state. The latter can.

These supply-side mechanisms can be seen by respecifying equation (5.e), which describes the rate of output growth, as follows

(5.e") $g^s = a + h + s + p$

where a = rate of productivity growth
h = rate of growth of hours worked
s = rate of growth of labor force participation
p = rate of population growth

According to (5.e"), growth of labor input can come through longer hours, greater labor force participation, and a growing population. In the event that a country is growth constrained by its balance of payments, the rate of growth of supply can adjust down to a consistent level. This can be done through falling hours, falling participation rates, or falling population growth. However, falling hours and participation rates represent medium term adjustment mechanisms because these variables are ultimately bounded. Both are bounded from below by zero, while hours are bounded from above by 24, and participation rates are bounded from above by 100.

Hours and participation rate adjustment must ultimately exhaust themselves, and at this stage the only sustainable long run adjustment mechanism is the rate of population growth. One

possibility is that family reproduction rates may ultimately fall in response to persistent excess supply growth that generates rising unemployment (as happened in industrialized countries during the Great Depression), thereby reducing population growth and capacity growth. Such an adjustment mechanism would support a steady state equilibrium. A second possibility is that immigration flows may decline in response to rising excess capacity, and this would also reduce population and supply growth. Conversely immigration flow could increase in response to persistent growing excess demand.

VI Conclusion

Growth models have tended to assume away the problem of reconciling demand and supply growth. Neo-classical models assume away the demand side, while Keynesian models tend to assume away the supply side. This paper presented a short general treatment of the demand and supply growth problematic, and illustrated this problematic with an application to the BOP constrained growth model. The paper then suggested a resolution of the problem that has the steady state growth rate being uniquely determined by supply-side factors, but demand constraints impact the degree of excess capacity along the growth path. The fact that the BOP model is dramatically changed by incorporating capacity growth considerations is illustrative of the pitfalls that can result from failure to properly model this issue.

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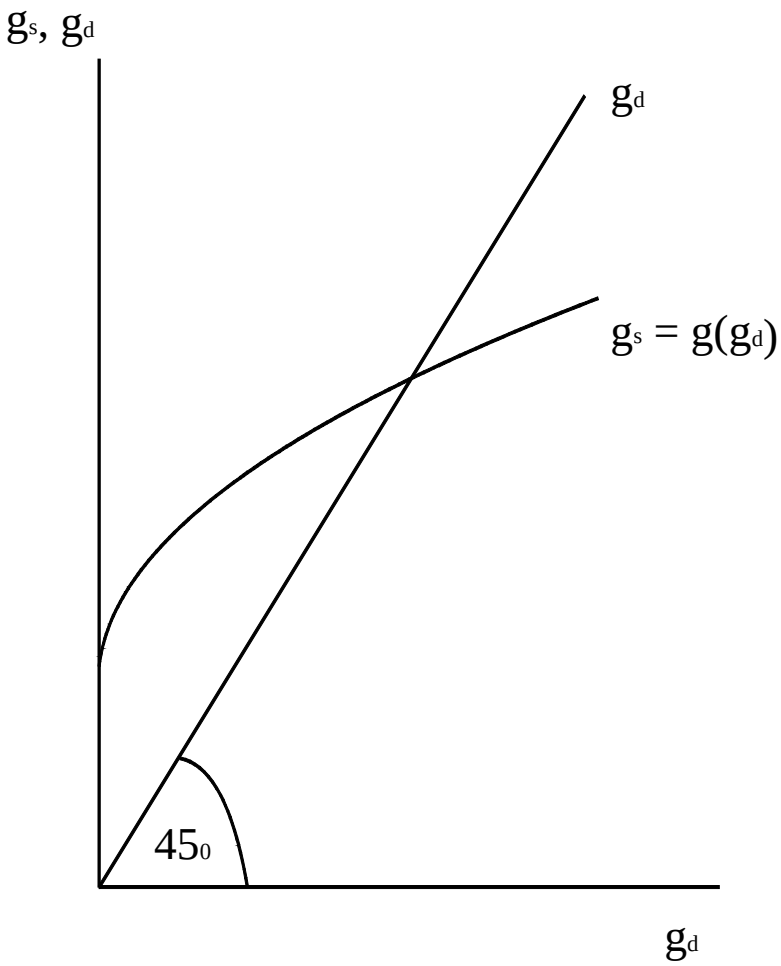

Figure 1 Equilibrium growth with a strictly concave capacity growt

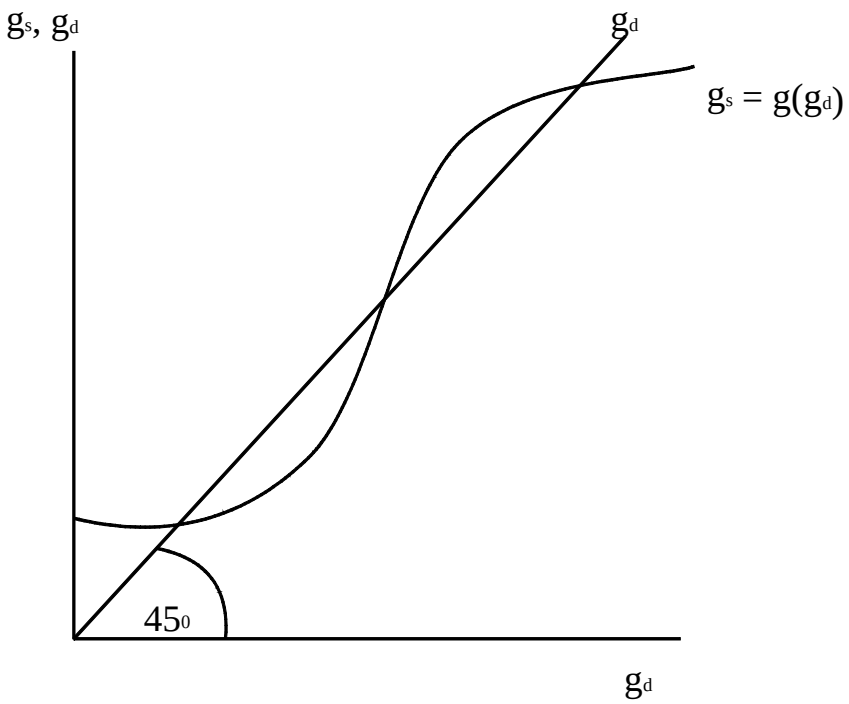

Figure 2 Equilibrium growth with a quasi-concave capacity growth function.

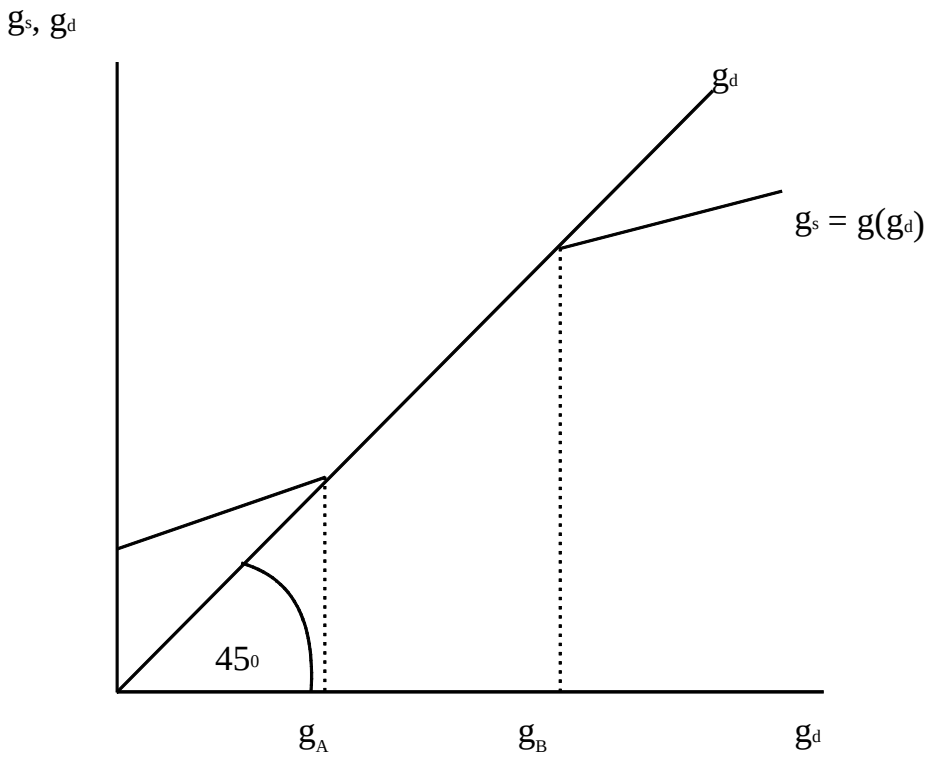

Figure 3 The Cornwall (1972) model with a region of correspondence between capacity and demand growth.

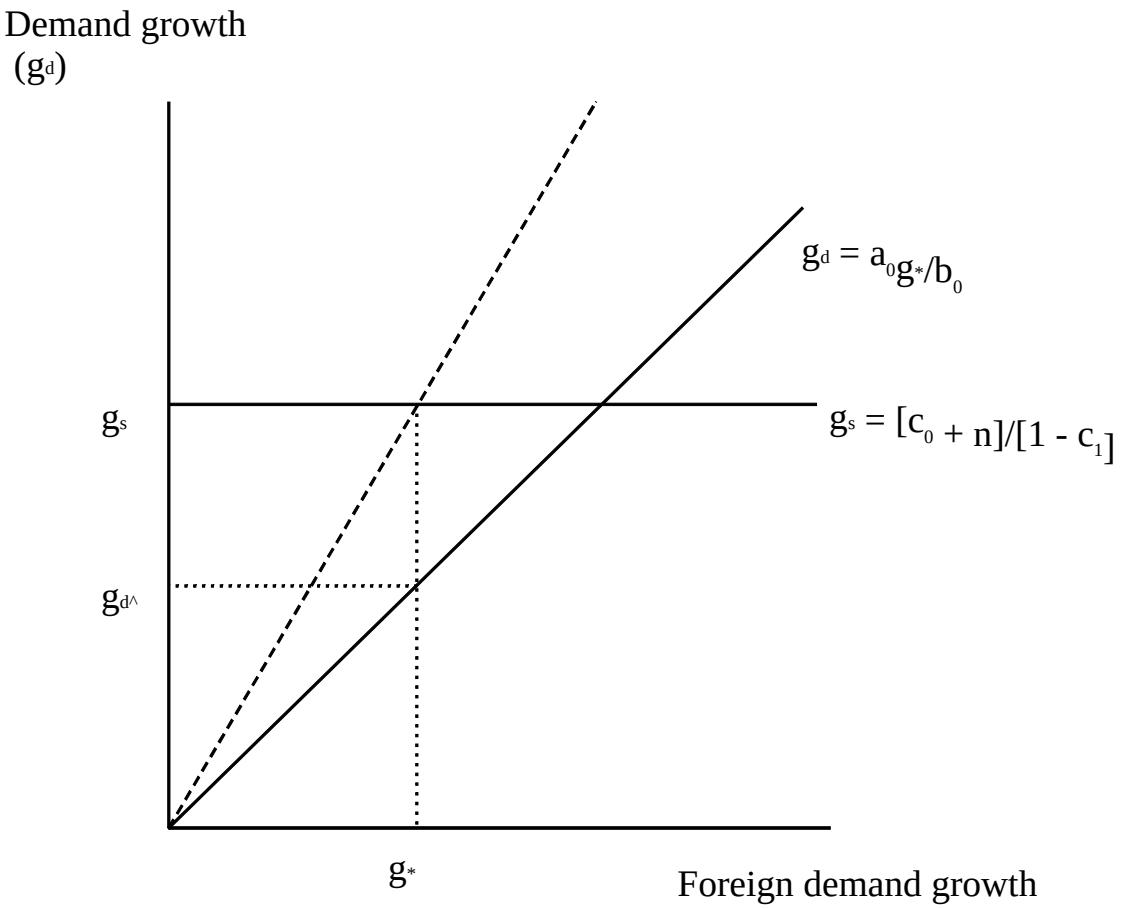

Figure 4 Inconsistency between the BOP constrained growth rate, $g_{d^\wedge}$, and the capacity balance growth rate, g_s.