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Aboa Centre for Economics

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ABSTRACT

The literature on growth theory is rich with models attempting to explain growth differences among countries. Several variables have been proposed many of which were found to be positively related to growth. However, a major problem with these models is that the factors explaining growth are endogenously determined by their environment so that a slow-growing or a poor country will find itself helpless because all the crucial variables it has ‘inherited’ are either deficient or inexistent. We propose policy-oriented model that empowers (poor or slow-growing) countries in the sense that they can use economic policies to achieve high growth and eliminate the gap of unused productive capacity of society. We demonstrate that such objectives are possible by manipulating some key control variables, namely the rate of interest and the net government spending.

JEL Classification: O11, O23, H2, H3

Keywords: growth, maximization, fiscal policy, interest rates, deficit, money

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1. Introduction

Economists have been preoccupied with the factors that determine economic growth at least since the publication of Adam Smith's (1776) *An inquiry into the nature and causes of the wealth of nations*. Several studies have attempted to explain why some countries grow faster than others and why some seem to even fall behind. The analysis in these studies is generally based on aggregate production functions and suggests that growth differences among countries can be attributed to differences in physical capital, human capital and productivity. While it is obvious that a highly skilled worker using a sophisticated machine can be several times more productive than a labourer working with rudimentary tools, it is far from clear why such differences in technological levels and labour characteristics exist in the first place and why they persist. Economic theory cannot praise itself for giving such superficial and tautological explanations to cross-country differences in growth.

Aware of these limitations, some economists decided to expand the list of their explanatory variables and included public infrastructure (Aschauer, 1990; Munnell, 1992; Easterly and Rebelo, 1993), nature of political systems and educational attainment (Barro and Lee, 1993), cultural factors (Dieckmann, 1996; Harrison, 1992), ethnic and linguistic differences (Easterly and Levine, 1997), and even religion (McCleary and Barro, 2006). A number of theoretical and empirical studies lend their support to this approach. Some have found high returns to public infrastructure (Sanchez-Robles, 1998; Kelly, 1997) while others have shown that educational levels and democracy play a major role (Barro, 1999; Barro, 2002). A common feature of these models, however, is the assumption that the additional factors are endogenously determined by their environment. For instance, a poor country (perhaps with unstable political system and so on) will admittedly spend less on public infrastructure and education and therefore could not immediately improve its weak institutions, which limits its prospects for economic growth. The implication, which is never explicit in these models, is that less developed countries are trapped in a vicious circle of endless poverty. These conclusions are not encouraging in terms of policy solutions to growth problems and in fact do not contribute much to the advancement of economic theory in its search for the mechanisms that can help improve economic performance.

Expanding the list further to incorporate yet more variables is clearly not the answer. In our opinion, what is needed is a policy-oriented approach; one which can promote growth, and maximize it if needed, by using tools and instruments that are readily available to the policy-maker. Many scholars agree that government policies are indeed very powerful tools that can shape the economic and social environment within which human activity is carried out. In his review of the literature on growth that followed the Second World War, Amartya Sen (1970: 9) remarked that although it was expected that growth theory would be 'practice-oriented' in order to solve the problems of both war-damaged and underdeveloped economies "its link with public policy is often very remote". Even though this remark is justified to some extent, we think that it applies mostly to developing countries and particularly to those that are lagging behind.

It is legitimate to ask why is the link between public policy and growth so remote in developing countries? Amsden (2007) sees a clear connection between the US policies and poor countries performance but one obvious answer is that international organizations, including NGOs, tend to present development as a complex, difficult-to-understand process; therefore implying, often explicitly, that any policy attempts to deal with the problems of underdevelopment will inevitably fail. The underlying argument is that the private sector, and not the government, is the driving force of the economy and consequently there is no need for government intervention, particularly when we know that interventions in the form of an expansionary fiscal policy, for instance, require the use of 'public funds', which are assumed to be limited (Toye, 2000). Following the advice of the so-called experts, policymakers in these countries feel powerless in the face of widespread poverty, cross their arms and hope for help from the 'West'.

However, we know from history that over the past three hundred years or so, advanced industrialized countries of Western Europe and North America have typically relied on heavy state intervention for their development (Dutt 1992; Thurow 1992). Several studies also demonstrate that recent success stories of the East Asian "miracle" economies have been based on the implementation of carefully designed trade and investment policies (Amsden, 1996; Amsden et al. 2003; Wade 2004). Of course, the same is true of Japan, and more recently Brazil, India, China and several other NICs (newly industrialized countries). In all these cases, the state planned, subsidized, and protected by tariffs or quotas, what it considered vital sectors of the economy. The state also built and maintained the public infrastructure and provided all the basic social services from health care to education.

In what follows, we develop a model in which government spending and taxing (fiscal policy) and interest rates (monetary policy) are key control variables that can be used to achieve the objective of higher economic growth. It is shown that these policies are useful both in fighting recessions in developed countries and in helping developing countries master their destiny and break out of poverty by implementing New-Deal type of industrialization programs.

2. The Model

The model developed here is, in many ways, an extension of the one proposed by Smithin (2003) in which aggregate demand and the distribution of income play a major role in economic growth. The distinguishing feature of our model is that it highlights the role of the public sector and more specifically the role of economic policies in stimulating growth. To focus the discussion on the role of 'national' economic policies, we leave aside the complication of the foreign sector. Therefore, in a closed economy, the expenditure-based breakdown of the (real) gross domestic product (GDP) Y_t is the sum of demand emanating from the private sector $D_p = C_t + I_t$ and the (net) demand from the public sector $(D_g = \mu Y_t - \tau Y_t)$:

$$Y_t = D_p + D_g = C_t + I_t + (\mu - \tau)Y_t \,, \tag{1}$$

where C_t is spending on goods and services by households and I_t is the aggregate spending by firms whereas μ is government spending (not only on goods and services, wages and so on, but also on public investment) as a share of GDP and τ is the share taken out in the form of various taxes. Assuming a standard Keynesian consumption function, C_t can be written as

$$C_t = X_t + cY_t \tag{2}$$

Where X_t stands for the autonomous spending and c is the marginal propensity to consume out of the current income. If we consider that profitability is the main concern for firms, we can expect their spending to be driven by the expected profitability, hence

$$I_t = e\Pi_t \tag{3}$$

where e is the share of profits Π_t allocated to investment and related expenditures. Substituting (3) and (2) into (1) we get

$$Y_t = X_t + cY_t + e\Pi_t + (\mu - \tau)Y_t = X_t + cY_t + e\Pi_t + \lambda Y_t \tag{4}$$

where we have denoted net public spending by $\lambda = \mu - \tau$, which is either an injection into the economy in the case of a deficit ($\lambda > 0$) or a withdrawal in the case of a surplus ($\lambda < 0$). If we assume that $(1 - c - \lambda) > 0$, divide through by initial GDP (Y_0) and let $\frac{X_t}{Y_0} = x_t$ and $\frac{\Pi t}{Y_0} = k_t$, equation (4) can be rearranged to become

$$y_t = \frac{Y_t - Y_0}{Y_0} = \frac{x_t + ek_t}{1 - c - \lambda} - 1 \tag{5}$$

where y_t is the rate of growth of real GDP during the time interval $[0, t]$, since by definition $Y_t = (1 + y_t)Y_0$. Since higher economic growth is, and thus far has always been, a policy objective for practically all governments, we claim that governments can indeed achieve this goal by using the standard policy tools namely the interest rate r (monetary policy) and the level of net public spending λ (fiscal policy). Hence, in this case the policymaker would be facing an optimal control problem which consists of maximizing economic growth by choosing the appropriate levels of interest rates and net public spending.

If we now let autonomous consumption be constant, that is, set $X_t = X$, so that $x_t = x = \frac{X}{Y_0}$, for all $t \geq 0$, the optimization problem is expressed as

$$V(t, k_0) = \max_{r,\lambda} \left\{ \frac{x + ek_t}{1 - c - \lambda} \right\} \tag{6}$$

Since the share of profits k_t is possibly time-dependent, the maximal value of $V(t,k_0)$ may depend, in addition to time t, also on the initial share of profits (k_0) so that the solution requires us to specify the dynamics of k_t. To this end, consider an income distribution similar to that which is suggested by Smithin (2003) where workers receive wages, capitalists receive profits and rentiers (money lenders) receive interest. In this framework, GDP can be decomposed as follows

$$Y_t = (1+r_t)(1+k_t)(1+w_t) = (1+r)(1+k_t)(\overline{w}_t L_t) \tag{7}$$

where r_t is rentiers' share, k_t is capitalists' share and w_t is workers' share. The latter can also be written in terms of an average wage level $\overline{w}_t$ received by all the workers in the economy L_t as $w_t = \overline{w}_t L_t - 1$. But then, labour productivity A_t equals

$$A_t = \frac{Y_t}{L_t} = (1+r_t)(1+k_t)\overline{w}_t \tag{8}$$

By Taylor expansion, we know that

$$A_t \approx \exp(r_t)\exp(k_t)\overline{w}_t \Rightarrow a_t = \ln A_t \approx r_t + k_t + \ln \overline{w}_t \tag{9}$$

From this approximation, we write the natural logarithm of labour productivity, a_t, as

$$a_t = r + k_t + w \tag{10}$$

where $w = \ln \overline{w}$ is the natural logarithm of average real wages. In order to take into account the effects of public policy on wages, we further assume that

$$w = w_0 + (\sigma - \upsilon)w \tag{11}$$

where w_0 is the basic income reflecting the position and the bargaining power of labour in society, which is augmented by σw (e.g., in the form of unemployment benefits) but reduced by υw (in the form of premiums paid to the unemployment insurance funds and other deductions). Our wage relation, therefore, can be written as

$$w = \frac{w_0}{1-(\sigma-\upsilon)} \text{ or simply as } \quad w = \frac{w_0}{1-\alpha} \tag{12}$$

where $\alpha = \sigma - \upsilon$. Since $\sigma \in \mu$ and $\upsilon \in \tau$, we can expect α to be some positive function of λ, $\alpha = f(\lambda)$, meaning that when net government injections increase, we expect an increase in wages because of the higher unemployment benefits and other income-support payments made to workers and the lower deductions in the form of premiums paid out of income to the unemployment insurance fund. To simplify things, we assume that $f(\lambda) = \gamma\lambda$ for some $\gamma \in (0,1)$. Then the share of profits can be expressed as

$$k_t = a_t - r - \frac{w_0}{1-\gamma\lambda} \tag{13}$$

Now substitute (13) into (5) to get the rate of growth of real GDP as a function of net public spending (λ) and the real rate of interest (r)

$$y_t = \frac{x + e(a_t - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda} \tag{14}$$

In this context, the problem of growth becomes simply how to maximize y given the policy instruments available to the government. This can be considered as an optimal control problem where the state variable is y_t and the control variables are the rate of interest r and the size of the budget deficit λ which is manipulated through government injections μ and withdrawals τ of liquidity into/from the private sector. It is worth noticing that if labour productivity is constant, then both k_t and (consequently) y_t are time-independent and the control problem reduces to a static optimization. Therefore, if we let $a_t = a$ for all $t \geq 0$, then the optimization problem can be expressed as follows

$$\max_{r,\lambda} \left\{ \frac{x + e(a - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda} \right\} \quad \text{with constraints } r \geq r_{\min} \text{ and } \lambda < 1-c \tag{15}$$

3. Using Fiscal and Monetary Policies to Promote Growth

It is worth observing that the objective function corresponds now to the long run equilibrium GDP expressed as a multiple of initial GDP (see Appendix 2). The inequality-constrained maximization problem given in equation (15) can be solved by applying the standard Karush-Kuhn-Tucker (KKT) method. Here we provide the main steps of the procedure but the details are given in Appendix 1. First, the Lagrangian of the problem is

$$L(r,\lambda,\eta,\nu) = -\frac{x + e(a - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda} + \eta(r_{\min} - r) + \nu(\lambda - (1-c)) \tag{16}$$

The necessary conditions for an extremum point are obtained by taking the partial derivatives of the Lagrangian L with respect to r and λ and setting these derivatives equal to zero. Furthermore, the Lagrange multipliers η and ν must be non-negative and at an extremum point $\eta(r_{\min} - r) = 0$ and $\nu(\lambda - (1-c)) = 0$. Inspection of the first necessary condition $L_r = 0$ immediately shows that the only candidate for a maximizer is $r^* = r_{\min}$. Since the absolute value of the objective function in equation (15) approaches infinity as $\lambda \uparrow 1-c$, the maximization problem (15) is well posed only if $\lim_{\lambda \uparrow 1-c} \left\{ \frac{x + e(a - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda} \right\} = -\infty$ Otherwise the value of the objective can be made arbitrarily large by letting λ be sufficiently close to the boundary $1-c$. The desired boundary behaviour requires that the following condition be satisfied:

$$x < -e\left(a - r - \frac{w_0}{1-\gamma(1-c)} \right) \tag{17}$$

Given that condition (15) is satisfied, there exists $\lambda^* < 1-c$ such that the objective function in equation (15) achieves an extremal value when $\lambda = \lambda^*$. This extremum point can be found from the second necessary condition $L_\lambda = 0$ by observing that the zeroes and the sign of L_λ coincide with the zeroes and the sign of a second degree polynomial in λ given by

$$p(\lambda) = -[e(a-r)+x]\gamma^2\lambda^2 + 2\gamma\{[e(a-r)+x] - ew_0\}\lambda + \{ew_0(1+\gamma(1-c)) - [e(a-r)+x]\} \tag{18}$$

(this function is obtained by multiplying the expression of L_λ with $(1-\gamma\lambda)^2$, and rearranging the terms of the numerator of the ensuing expression). The graph of $p(\lambda)$ is a parabola opening downwards, if

$$e(a-r) + x > 0. \tag{19}$$

Only in this case is the extremum a maximum. If condition (19) is not satisfied, the extremum is a minimum and the maximization problem is not well posed. Given that conditions (17) and (19) are satisfied, the maximization problem (15) is well posed and the maximizing value of λ is given by the smaller of the two roots of equation $p(\lambda) = 0$. These are

$$\lambda_{1,2} = \frac{1}{\gamma}\left\{ 1 - \beta \mp \beta\sqrt{1 - \frac{1-\gamma(1-c)}{\beta}} \right\}, \tag{20}$$

where $\beta = \frac{w_0}{a - r - \frac{x}{e}}$. Moreover, when conditions (17) and (19) are satisfied, $\lambda_1 < 1 - c < \lambda_2$ and λ_1 is the maximizing value.

The new parameter β introduced in equation (20) can be interpreted as the share of the basic wage in firms' profits. Therefore, it cannot take on very large values since this would effectively mean that workers are paid more than their contribution to total productivity. Clearly, this is not feasible nor can it be sustainable in the long run if it ever happened. Intuitively then, and for all practical purposes, we would expect this parameter to lie strictly between the values of zero and unity. If β is low, it would indicate that labour's basic earnings are quite low compared to the earnings of other groups and, therefore, that income distribution is biased toward the capitalists and the rentiers. Similarly, high values of β would indicate that workers reap a larger share of productivity. Income distribution in either case would have different implications for economic growth. This is reminiscent of the debate over whether growth is wage-led or profit led, which is beyond the scope of this paper (see Setterfield, 2003). In any case, the parameter β can be considered an indicator of income distribution since it largely reflects the bargaining position of labour in society.

The importance of this income-distribution variable in our model is that it has direct implications for the values of λ^*, that is, the optimal fiscal policy that maximizes growth. Hence, for reasonable parameter values of β, λ_1 is likely to be positive (and very close to zero if it is negative) – that is to say, the 'normal' fiscal policy that is consistent with growth and expansion of the economy is for the government to be running budget deficits. The above discussion can be succinctly summarized by noting that the larger the value of β is, the smaller the value of λ_1 will be; in particular, if

$$\beta > \frac{1}{1 + \gamma(1 - c)}, \text{ then } \lambda_1 < 0 \tag{21}$$

Our condition (17) can be also expressed in terms of β in the following manner:

$$\beta > 1 - \gamma(1 - c). \tag{22}$$

Combining (21) and (22), we get that

$$1 - \gamma(1 - c) < \beta < \frac{1}{1 + \gamma(1 - c)} \tag{23}$$

Which allows us to conclude that the maximization problem (15) has a unique solution $(r^*, \lambda^*) = (r_{\min}, \lambda_1)$ such that $0 < \lambda^* < 1 - c$. This simply means that fiscal policy must remain expansionary if we are to maximize growth. As can be seen in Figure 1, the growth rate of real GDP can be maximized if the government maintains $0 < \lambda^* < 1 - c$, that is to say, if it constantly runs a budget deficit; the size of which is determined by the value of the parameter β as explained above. Fiscal policy turns out to be a very powerful instrument for any growth and development strategy.

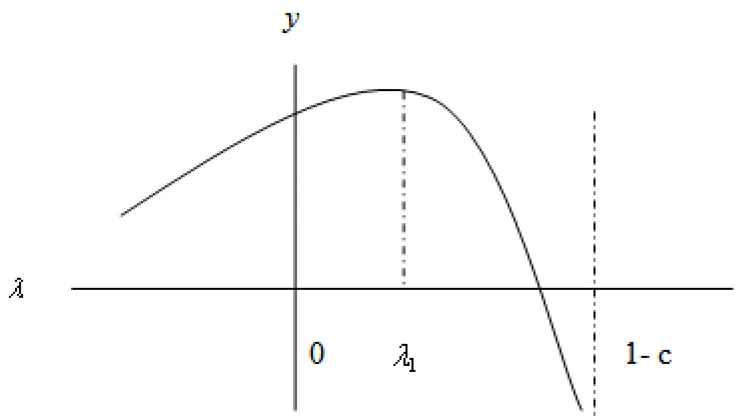

Figure 1: The Optimizing Role of Fiscal Policy

In addition to this well-defined solution, there are two other cases, which are extremes and irrelevant but which we mention here for the sake of completeness (see Figure 2). The first one is when $\beta \leq 1 - \gamma(1-c)$. Here the maximization problem (15) is undefined and must be rejected as can be seen in panel (a) of Figure 2 below.

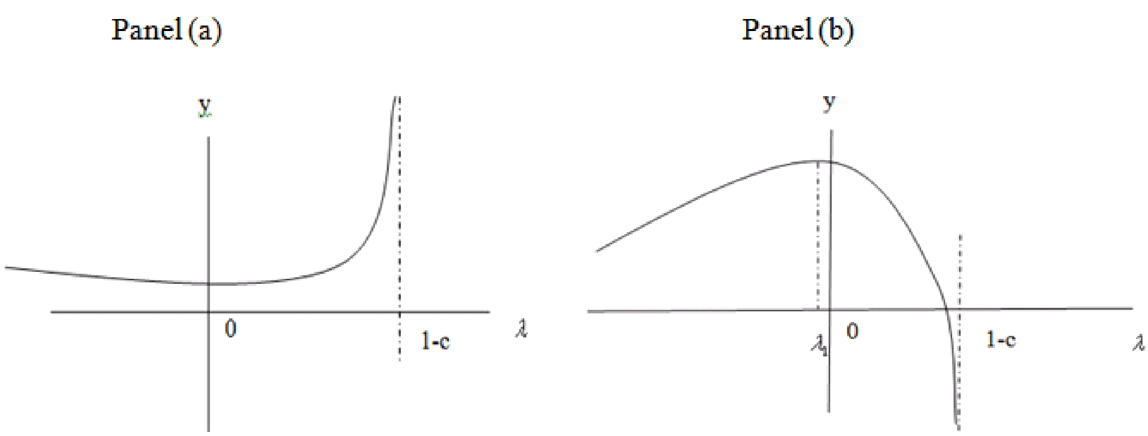

Figure 2: The Extreme Cases

The second unlikely event (panel b) is when $\beta > \dfrac{1}{1+\gamma(1-c)}$. Here, there is a unique solution and $\lambda^* < 0$, which means that the government would be running a budget surplus (see Figure 2).

However, as we mentioned above, for practically relevant parameter values, this last case is unlikely to occur since it would mean that the basic wage is exceeding high, which is not feasible. Therefore, we conclude that this case must also be ruled out and that the unique solution that prevails is $0 < \lambda^* < 1 - c$ which means that fiscal policy must be expansionary; with the public sector running budgets deficits.

4. Policy Recommendations

If we now focus on the interior solution, the policy implications of our results are quite clear: economic growth – and development in general- can be maximized if the government follows a two-pronged active interventionist strategy based on the following principles:

a. Through its central bank, the government exogenously sets the interest rate at its lowest level $(r_{\min})$ (which can be zero), thus reflecting Keynes's recommendation that "we . . . retain control of our domestic rate of interest, and keep it *as low as suits our own purposes. . .*" (Quoted in Smithin and Wolf, 1993: p. 370).
b. Adopting a deficit-spending policy which means that total government expenditures must exceed what is taken out in the form of taxes and other contributions from the private sector.

These conclusions are often regarded as practical by the pragmatic policymaker and by most Keynesian-inspired economists as the 2008-9 crisis has demonstrated. Indeed, as the crisis worsened, most governments responded by slashing interest rates in an effort to encourage the injection of liquidity into the system and promote private spending but since business expectations remained low, it became necessary for governments to increase their net spending; therefore leading to huge budget deficits. As it has been shown elsewhere, deficits in the public sector stimulate the economy and are necessary for growth and expansion because, from an accounting perspective, they are equivalent to surpluses in the private sector (see, among others, Godley and Lavoie 2007). This is easily demonstrated by noticing that equation (1) above can be re-arranged to read

$$Y_t - C_t - I_t = (S_t - I_t) = (\mu - \tau)Y_t \tag{24}$$

Where the right-hand side $(S_t - I_t)$ represents the *net* private saving, which if we want it to be positive, i.e., if we want to have a surplus in the private sector, we must necessarily have a deficit on the left-hand side, i.e., in the public sector. The relevance of this accounting principal is supported by empirical evidence as can be seen in Figure 3 below where we have plotted the net lending/borrowing by the consolidated government sector in Canada (the public sector) as well as the net lending/borrowing by the private sector (represented by households and non-financial corporations), both as a percentage of GDP for the period from 1961 to 2008 (using quarterly data). Figure 3 clearly shows that whenever the public sector is running a deficit, the private sector as a whole will be running a surplus, and vice versa. Even in terms of size, the large public deficits of the mid-1970s to the late 1990s were translated into large surpluses (net accumulation) in the private sector. Therefore, the public budget really does reflect—almost like a mirror—the private sector's net accumulation of savings. The empirical evidence presented here (also verified for other countries, see, Leclaire, 2008) should make those economists who advocate balanced budgets or surpluses think more seriously about the implications of their statements for the well-being of the economy.

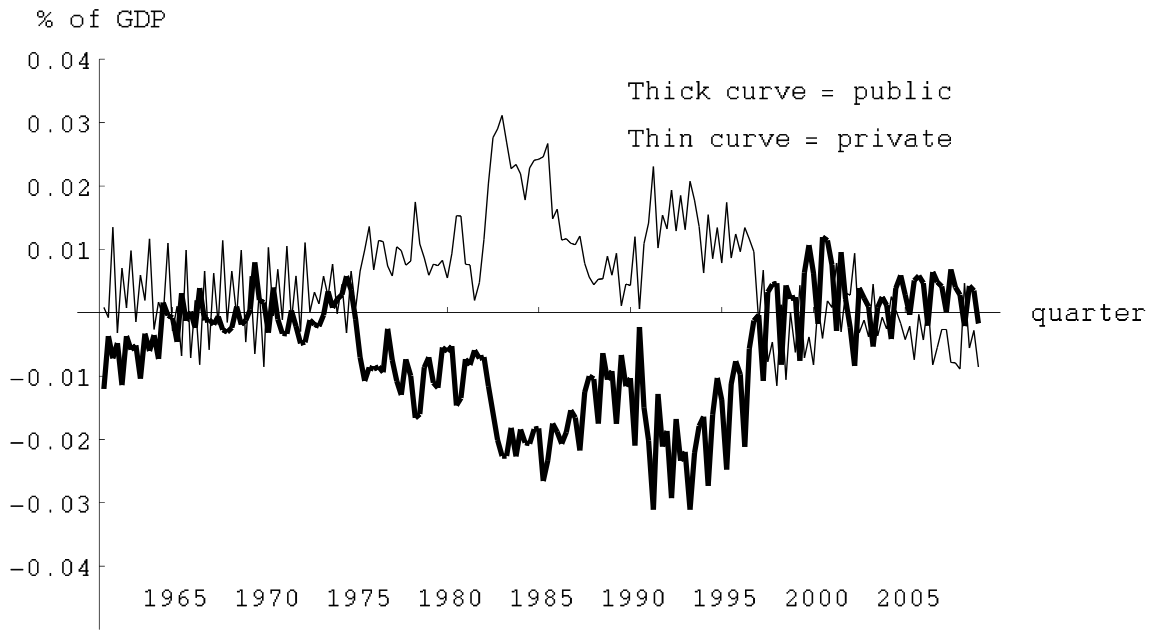

Figure 3: Public Sector versus Private Sector Net Balances, Canada 1961-2008

Source: Statistics Canada, CANSIM series nos. V31751, V31786, V33360, V498086

Furthermore, if we recognize that total private saving (S_t) is composed of both households' saving (S_h) and firms' saving or their profits (S_f), equation (24) can be re-written as

$$S_f = (I_t - S_h) + (\mu - \tau)Y_t \qquad (25)$$

Equation (25) clearly indicates that, in the absence of the foreign sector, firms' profits are positively affected by investment and government spending (usually referred to as injections). It is also clear that households' savings and taxes (leakages) lower business profits. In other words, long-run firms' profits can be sustained by low or negative households' savings (indebtedness) and/or by a public budget deficit (for more details on this, see, among others, Bougrine 2004). Given the centrality of profits in the capitalist system and given that households' indebtedness cannot be relied upon for a long time to sustain firms' profitability; the only viable policy for improving private sector's wealth is the public deficit. In addition to this, of course, interest rates must be kept at a minimum as indicated by the maximization solution given above. These policies have proved to be quite effective in dealing with the current crisis (2009) as governments around the world incurred large budget deficits in order to finance what has become known as a 'stimulus package', which typically consisted of a wide variety of public programs, subsidies or outright acquisitions of some private enterprises that were on the verge of bankruptcy.

The relevance of these policies cannot be over-emphasized in the case of many developing countries which seem to be in a constant need of stimuli packages because of the chronic poverty and high unemployment they have been facing for decades. Indeed, to build the much needed infrastructure, provide the essential public services (e.g., health, education) and establish social programs of insurance and welfare similar to what is found in developed countries, it would require massive injections and large public budget deficits. These countries are truly in need of a New-Deal program to build the material base for development whereby the state must take the responsibility of building the public infrastructure (roads, schools, hospitals) and providing universal health care and education as well as a social safety net to protect the most vulnerable people in society. These are the essential elements of any growth strategy and experience has demonstrated that there can be no take-off in their absence.

Why are these countries in such a dire situation? Why is there a serious lack of all the basic ingredients of growth and development? Historians obviously have a lot to say about this (see, for instance, Rodney 1973) but a popular answer is that the lack of development is justified by the lack of money. This is indeed the case but economists differ on what are the sources of money. Mainstream economists tend to argue that the financing of the programs mentioned above can only be done through taxation[1]. Toye (2000: 36), for instance, attributes the existence of the welfare state and its social programs in developed countries to their success in "establishing the institutions necessary for the direct taxation of the majority of adult population during the first half of the twentieth century." Referring to the situation in developing countries, he notes that "The absence of direct personal taxation on the revenue side of the budget is matched by the absence, on the expenditure side, of much spending on social security, education and health services." The conclusion, then, is that since there are limits of the use of increased taxation to raise additional government revenue and since borrowing and money creation have their own problems (crowding out and inflation), the future for these countries in terms of growth and development is bleak indeed.

However, from our perspective there is no reason for such pessimism. In fact, we argue here that a sovereign (national) government, with its own central bank, faces no budget constraints and

[1] Toye (2000: 35) maintains that "the objective of taxation is, fundamentally, to increase government revenue" and that "the ability to tax the domestic population is not just another method of financing government expenditure, one among a variety of others. The non-taxation options for financing are secondary and derivative. Their exploitation requires that the government maintain a sound system of domestic taxation. This is the economic sense in which there is a primacy and a centrality about taxation in the entire armoury of instruments of government finance."

that it can pay for any expenditure—whether it is related to building a new hospital, a school, or a highway, or to the hiring of teachers, nurses, engineers, or street sweepers—simply by creating new money. But what is money and how is it created? In modern capitalist economies, money is created by banks *in the form of credit* whenever banks agree to give loans to investors. Investors will transfer these credits as wages to their employees and as payments to the suppliers of raw materials and equipment and the providers of other services related to production. These credits do not necessarily take the form of bills or coins and more often than not, they are simple scriptures on the books of the banks (or more accurately, digital symbols on the hard discs of their computers). In the private sector, investors (or entrepreneurs) engage in this sort of activity because they are motivated by profits. Their earnings are used to pay back the banks. Investors in the public sector—and the government in particular—do not necessarily seek profits, because the benefits from their investments will be enjoyed by the whole population. Their investment expenditures, however, are also financed via bank credit advances. In most cases, the bank that advances these credits to the government has traditionally been the *central bank*.[2]

As several studies of the practice of modern banking have shown (see, among others, Lavoie and Seccareccia, 2006), the government pays its employees and contractors by crediting their bank accounts (at commercial banks) and debiting its own account at the central bank. In this way, the government becomes a debtor to its own bank. Depending on the banking system, the government can carry out this operation by sending cheques to those it must pay, who will then deposit the cheques in their bank accounts; when the banks receive the cheques, they credit their customers' accounts. In a more developed banking system, the government can directly credit its employees or suppliers' bank accounts by electronically "depositing" the amounts due. Whichever method is used, it is important to note that when deposits are made, the balance sheets of commercial banks are increased by an equal amount on the liabilities side (due to the increase in deposits) and the assets side (since banks now have a claim on the government). Banks' claims on the government in this form are called "reserves." Banks can claim these reserves through the central bank, which keeps accounts for both the government and commercial banks. In a setting where the central bank is the banking arm of the government, the central bank executes the operation simply by *crediting* commercial banks' accounts (that is, by adding to their reserves and therefore increasing the amount of liquidity in the system) and *debiting* the government's account by an equal amount. Government spending results in a net injection of liquidity (money) into the private sector; the government is now running a *deficit*, but the private sector has a *surplus*. As we mentioned above, government spending increases the private sector's incomes and, therefore, the accumulated deficits (the "public debt") add to the private sector's wealth.

[2] However, in the early 1990s, legislation was enacted in the European Monetary Union that prevented the central bank from granting credit to governments in this manner. This forced governments of countries that became members of the EMU to rely on taxation and to resort to commercial banks—and even sell securities—to finance their expenditures.

What about taxes? We all know that when we pay taxes, our accounts (at commercial banks) are *debited* and the government's account at the central bank is *credited*. In the process, the balance sheet of commercial banks will have been reduced on both sides by the same amount, since deposits went down and (consequently) banks lost reserves (meaning that their claims on the government decreased). The central bank shows this by debiting commercial banks' accounts and crediting the government's account. This operation is the same whether we pay taxes (fines and penalties, or contributions to the social security system) or purchase government bonds. One can say that the accumulated credits in the government's account at the central bank will now be tallied against the government's debts, which will be reduced or eliminated; however, this has nothing to do with the *financing* of public spending, since the latter has already been paid for. If the government collects more taxes (fines and contributions) than it spends, its account at the central bank will have a *surplus*, but the private sector as a whole will be in *deficit*. This is why deficits in the public budget increase liquidity (money) in the private sector and public budget surpluses reduce it (see Wray, 1998; Bell, 2001; Bougrine and Seccareccia, 2002).

In orthodox thinking, there are serious objections to financing government expenditures in the way we describe here because of the fears of inflation associated with the government creating too much money. But the astute observer will have noticed that there is no such possibility for an excess supply of money since all the money that is created has been demanded. When workers seek jobs, they are demanding money. When contractors are hired to build a needed school, a hospital or a bridge, they are demanding money for compensation. Therefore the supply of money is always equal to the demand for money. The supply of money cannot exceed the demand for it and inflation is not a monetary phenomenon. In fact, when the government permits unemployment to exist by refusing to hire workers and neglects the infrastructure by not building the needed schools, roads, and so on, it is voluntarily choosing to suppress the demand for money and keep it arbitrarily low. Understanding money is essential because it effectively liberates the government from being subject to an imaginary budget constraint and allows it to actively intervene to fill the gap of under-utilised capacity of society as a whole, i.e., to strive to achieve full employment and high economic growth and development.

5. Conclusion

The mechanics of growth and development are deliberately shrouded in mystery. Policymakers in poor countries are often duped into thinking that rapid development and caching up with 'the West' is pure utopia. International organizations present development as a complex, difficult-to-understand process; therefore implying, often explicitly, that any policy attempts to deal with the problems of underdevelopment will inevitably fail. Our analysis shows clearly that these are misleading statements. We demonstrate that it is feasible to kick-start the economy and move it toward its highest levels of growth by using fiscal and monetary tools in an optimizing manner. In this setting, net government spending is found to be a major source of profits for private firms. For this reason, we conclude that government involvement is an essential element for preserving and improving the capitalist system.

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APPENDIX 1

Here we give the details for solving maximization problem (15) by applying Karush-Kuhn-Tucker (KKT) theory. We first recast problem (15) to standard form, i.e. to a minimization problem with inequality constraints of the type $g(x) \le 0$, using the fact that maximization of $f(x)$ is equivalent to minimization of $(-f(x))$. Hence we consider the equivalent minimization problem

$$\min_{r,\lambda}\left\{-\frac{x+e(a-r-\frac{w_0}{1-\gamma\lambda})}{1-c-\lambda}\right\} \text{ with constraints } r_{\min}-r\le 0 \text{ and } \lambda+c-1\le 0. \tag{26}$$

The Lagrangian of problem (26) is given in equation (16). From this Lagrangian we obtain the KKT necessary conditions for an extremum point:

$$L_r = \frac{e}{1-c-\lambda}-\eta = 0 \tag{27a}$$

$$L_\lambda = \frac{1}{(1-c-\lambda)^2}\left[\frac{e\gamma w_0(1-c-\lambda)}{(1-\gamma\lambda)^2}-e(a-r-\frac{w_0}{1-\gamma\lambda})-x\right]+\nu = 0 \tag{27b}$$

$$\eta(r_{\min}-r)=0 \tag{27c}$$

$$\nu(\lambda-(1-c))=0 \tag{27d}$$

$$\eta \ge 0, \nu \ge 0 \tag{27e}$$

A pair (r,λ) can be an extremum point only if conditions (27a)-(27e) are satisfied in that point. It follows from (27a) that $\eta = \frac{e}{1-c-\lambda} > 0$, and hence by (27c), $r = r_{\min}$. When condition (17) is imposed, the objective of problem (26) approaches positive infinity as $\lambda \uparrow 1-c$ and thus the boundary point $\lambda = 1-c$ cannot be a minimizer, i.e. minimum is achieved at some interior point $\lambda < 1-c$. Hence by (27d), $\nu = 0$. Minimizing value of λ must satisfy (27b) with $\nu = 0$, which is equivalent to

$$\left[\frac{e\gamma w_0(1-c-\lambda)}{(1-\gamma\lambda)^2}-e(a-r-\frac{w_0}{1-\gamma\lambda})-x\right] = \frac{e\gamma w_0(1-c-\lambda)-[e(a-r)-x](1-\gamma\lambda)^2+ew_0(1-\gamma\lambda)}{(1-\gamma\lambda)^2} = 0$$

since $\lambda < 1-c < 1 < 1/\gamma$. The numerator in the previous equation is function $p(\lambda)$ introduced in equation (18). When condition (19) is satisfied, equation $p(\lambda) = 0$ has two roots $\lambda_1 < 1-c < \lambda_2$ given by equation (20) (this follows from the well-known formula for roots of second degree polynomials). Moreover, the sign of $p(\lambda)$ is negative before λ_1 and after λ_2, and positive in the interval (λ_1, λ_2). Since the signs of $p(\lambda)$ and L_λ coincide, we see that λ_1 is a minimum point (and λ_2 is a maximum point). In summary, pair $(r_{\min}, \lambda_1)$ minimizes the objective function of problem (26) and consequently it also maximizes the objective of the original equivalent maximization problem (15).

APPENDIX 2

The objective function of problem (15) is the long-run equilibrium level of GDP expressed as a multiple of initial GDP. This can be seen by considering the dynamics of GDP in a small time interval Δt:

$Y_{t+\Delta t} = x\Delta t + c\Delta t Y_t + e\Delta t \Pi_t + \lambda \Delta t Y_t$ with initial condition $Y_0 = z$.

Subtracting Y_t from both sides and dividing by Δt yields (recall that $\Pi_t = k_t Y_0$)

$$\frac{Y_{t+\Delta t} - Y_t}{\Delta t} = x + (c + \lambda - 1)Y_t + e(a - r - \frac{w_0}{1-\gamma\lambda})z$$

Letting now $\Delta t \to 0$ we obtain a non-homogeneous first order linear differential equation for the infinitesimal growth rate

$$\dot{Y} = x + (c + \lambda - 1)Y_t + e(a - r - \frac{w_0}{1-\gamma\lambda})z$$

This differential equation is readily solvable and has the solution

$$Y_t = z\left[1 - \frac{x + e(a - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda}\right]\exp\left\{-(1-c-\lambda)t\right\} + \frac{x + e(a - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda}z$$

for $\lambda < 1-c$. We see now that when $t \to \infty$, then Y_t approaches the long-run equilibrium level

$$\frac{x + e(a - r - \frac{w_0}{1-\gamma\lambda})}{1-c-\lambda}z.$$

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