THE SUSTAINABILITY OF FISCAL POLICY: AN OLD ANSWER TO AN OLD QUESTION

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THE SUSTAINABILITY OF FISCAL POLICY: AN OLD ANSWER TO AN OLD QUESTION

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Introduction

The sustainability of fiscal policy, and the related problem of the stabilization of the ratio of the public debt to the GDP, are old questions. In the 1940s, Domar (1944) provided a pioneering contribution to the analysis of these issues. More recently, in the 1990s, Blanchard and others (1990) have offered what they call "new answers" to the problem of fiscal sustainability. The approach followed by Blanchard and his co-authors represents the current standard approach in the mainstream literature on the topic. This paper argues, however, that the old questions of fiscal sustainability and debt stabilization should be given an "old" answer, i.e. inspired by the original contributions of Domar. Domar argued that the problem of the public debt ratio to the GDP should be tackled by making the denominator grow more rapidly rather than by merely trying to reduce the numerator. A higher growth rate of the GDP can be obtained also through public spending.

For mainstream analyses of the dynamics of the debt ratio, to deal with the problem in the way suggested by Domar is difficult. Such analyses, in fact, are based on the hypothesis that all the variables considered are independent of one another; in particular, the economy's growth rate is taken as independent of public spending and its composition. The main object of the paper is to re-consider the conditions for debt stabilization by removing the hypothesis that the economy's growth rate is independent of public spending.

In the analysis of the problem of the public debt ratio to the GDP, Domar made the important point that the growth rate of the economy is not independent of public spending. He held that the economy's growth rate is an increasing function of "productive" public expenditures, which are those that contribute to the increase of the overall efficiency of production. Domar dealt with this aspect only at an intuitive level, without providing a more detailed analysis of the functional relationship between the growth rate and public spending. This paper develops the analysis of such functional relationship and its implications for the stabilization of the debt ratio.

The analysis of the relation between the growth rate and public spending is carried out by using a growth model that is a generalized version of the Domar model (Domar 1946; Palazzi and Sardoni 1987; Sardoni and Palazzi 2000). The model shows that the growth rate depends on the composition of public spending; more precisely it is decreasing in the share of public revenue devoted to current spending. This result is then used to look at the problem of the stabilization of the ratio of the public debt to the GDP.

The conclusion is that the stabilization of the ratio of the public debt to GDP does not necessarily require running a primary surplus, which instead is the fundamental mainstream conclusion when the interest rate on the debt is higher than the economy's growth rate. An adequate reduction of the share of the fiscal revenue devoted to current spending makes the economy's growth rate increase and become higher than the interest rate. In this situation, the debt ratio can be stable without the necessity to run a primary surplus.

Section 2 briefly expounds the generalized Domar growth model. Section 3 analyzes the condition for debt stabilization by using the growth model of section 2. Section 4 outlines Domar's original contribution to the analysis of the public debt. Section 5 concludes with some policy implications as well as some analytical and methodological qualifications.

The growth rate in a generalized Domar model

In the original Domar model, the equilibrium rate of growth of the economy is

$$g = s\sigma$$

s is the private propensity to save and σ is the potential social average investment productivity; it is

$$\sigma = \frac{\frac{dP}{dh}}{I} = \frac{P'}{I}$$

so that $P' = \sigma I$ ($dP/dh = P'$ is the increase in aggregate potential capacity associated with investment I; h is time.)

In Domar's original model the public sector is not considered, but it is easy to introduce it. Let us consider an economy in which the government's total revenue is tY, with t being the average tax rate. Public current spending, C_g, is a share $0 < a < 1$ of total revenue; capital spending is denoted by I_g. If $(C_g + I_g) > tY$, the government experiences a primary deficit.

In the present model and in the following analysis of debt stabilization, it is assumed that all public capital expenditures contribute to the increase in the aggregate potential capacity, while current expenditures do not.[1]. Moreover, for now, it is assumed that the ratio of the increase in P to investment is the public and the private sectors. Therefore $P' = \sigma\left(I_g + I_p\right)$, where I_p denotes private investment.

In order for the economy to be in equilibrium, it must be

$$Y' = \frac{dY}{dh} = \frac{dP}{dh} = P'$$

The increase in aggregate demand is

$$Y' = \left(1-s\right)\left(1-t\right)Y' + I'_p + atY' + I'_g$$

[1] This is a simplification, as there could be some investment expenditures that are "unproductive" and, conversely, current expenditures that contribute to the increase in capacity. Domar himself (see below, section 4) points out this aspect.

From above, we obtain the equilibrium rate of growth, *g*.

$$g = \left[s(1-t) + t(1-a) \right] \sigma \tag{1}$$

Given, *s* and *a*, the rate of growth is increasing in *t*, provided that the condition below is fulfilled,

$$a < (1-s) \tag{2}$$

a can be interpreted as the "public propensity to consume", so that condition (2) tells us that an increase in the tax rate is associated to a higher rate of growth if the public propensity to consume is lower than the private propensity to consume. In an equilibrium model, in which all savings must be invested, the existence of a public sector that levies taxes implies a reduction in private saving and, hence, a reduction in the equilibrium rate of investment and in the growth rate. However, if the public propensity to save *and to invest* is higher than the private, the negative effect of taxes is more than compensated for. The overall propensity to save of the economy is larger than *s*, the rate of investment is higher and, hence, the growth rate is higher.

From this it also follows that the growth rate is inversely related to *a*. The lower is the share of the public revenue devoted to current spending, the higher is the growth rate. From algebra, the economy's growth rate is maximum when $a = 0$, i.e. when all public expenditure is devoted to capital formation. This, however, does not mean that the achievement of such maximum growth rate is economically and/or socially feasible. A certain amount of current spending is obviously necessary for running the public sector itself, while other current expenditures are devoted to fundamental state functions like defense, justice, etc.[2] Therefore, here it is assumed that any reduction in current spending must leave its share of total revenue positive.

So far it has been assumed that public and private investment give the same contribution to the growth of potential capacity. More in general, it can be assumed that the productivity of public and private investment is different, so that the average investment productivity σ is a weighted average of the two different productivities:

$$\sigma = \frac{\sigma_p I_p + \sigma_g I_g}{I_p + I_g}$$

(σ_p is the private investment productivity and σ_g is the public investment productivity.)
It is clear that, if $\sigma_g > \sigma_p$, σ is increasing in I_g. Moreover, if we make the additional hypothesis that public investments positively affect the productivity of private investment, also σ_p is increasing in I_g. In conclusion, it is

[2] Moreover, the flow of capital expenditures is generally associated to a certain flow of current expenditures; for example, those current expenditures that are necessary for the maintenance of the infrastructures realized through investment expenditures (Sardoni and Palazzi 2000, pp. 158-63). This type of current expenditures, however, can be treated as if they were capital expenditures and embodied in what is defined as I_g in the present model.

$$\sigma = f\left(I_g\right)$$

$$\text{with } \frac{\delta\sigma}{\delta I_g} > 0$$

It follows that the economy's rate of growth can increase as a consequence of an increase in public investment, even though *a* remains unchanged.

For simplicity, in the following section, the investment productivity is always as taken and constant, i.e. independent of I_g. The analysis of cases of debt stabilization when σ varies with public capital expenditures is carried out in the Appendix.

The stabilization of the public debt in the generalized Domar model

Fiscal policy is defined as sustainable in so far as it does not lead to increasing ratios of the public debt to the GDP or, conversely, to an increasing tax burden. Central to the discussion of sustainability is the dynamic government budget constraint, which is

$$\frac{dB}{dh} = G - T + iB \tag{3}$$

where *B* denotes the public nominal debt, *G* is public expenditure, *T* taxes (net of transfers) and *i* is the nominal interest rate.[3] By writing the constraint in terms of ratios to GDP and considering the real interest rate, we obtain

$$\dot{b} = \frac{db}{dh} = (\gamma - \tau) + (r - g)b \tag{4}$$

where $b = \frac{B}{Y}, \gamma = \frac{G}{Y}, \tau = \frac{T}{Y}$, *r* is the real interest rate on the debt and *g* is the economy's growth rate.

If it is assumed that the interest rate *r* is larger than the growth rate *g*, the ratio of public debt to GDP does not vary from one period to the next ($\dot{b} = 0$) only if $(\tau - \gamma) > 0$, i.e. if the government runs a primary surplus. From (4) , it must be

$$(r - g)b = \tau - \gamma \tag{5}$$

Starting from a situation in which it is $\dot{b} > 0$, the ratio of public debt to GDP can be stabilized through fiscal policies that give rise to a primary surplus,[4] i.e. either by increasing the tax ratio and/or by reducing the expenditure ratio. If an increase of the ratio

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[3] The budget constraint in its general form is $\frac{dB}{dh} = G - T + iB + \frac{dM}{dh}$ (*M* is the supply of hard money). In other words, the government debt can be also financed by issuing money. Throughout this paper the possibility to "monetize" the debt is not considered $\left(\frac{dM}{dh} = 0\right)$.

[4] Or fiscal policies that generate a larger primary surplus if it initially $0 < (\tau - \gamma) < (r - g)b$.

of fiscal revenue to GDP is excluded, the primary surplus can be realized only through a reduction in the ratio of public spending to GDP, γ.

Once the hypothesis that the economy's growth rate depends on the share of public revenue devoted to current public expenditure is introduced, the conclusion above that the debt ratio can be stabilized only by running a primary surplus does not necessarily follow any longer. The fact that the growth rate depends on the value taken by *a* suggests that it could be possible to stabilize the ratio of the public debt to the GDP through measures that do not necessarily require changes in the right-hand side of (5). $\dot{b}$ can be reduced, or brought to zero, through variations of the left-hand side of (5). In other words, the stabilization of the debt ratio can be obtained through an increase in *g* such as to make it larger than *r*.

Since, from the model of section 2, it is

$$Y = \frac{I_g + I_p}{s(1-t) + t(1-a)} = \frac{I_g + I_p}{T - at}$$
$$\text{with } T = s(1-t) + t > 0$$

And

$$g = \left[s(1-t) + t(1-a)\right]\sigma = (T - at)\sigma$$

(5) can be written as

$$\left[r - (T - at)\sigma\right]\frac{B(T-at)}{I_g + I_p} = t - \left[at + \frac{I_g(T-at)}{I_g + I_p}\right] \tag{6}$$

Let us consider a case in which the ratio of the public debt to GDP is stabilized by leaving the primary budget unchanged. Suppose that it is $\dot{b} = D > 0$, i.e. the debt ratio is increasing. The problem to solve is the determination of the changes in I_g and *a* that yield a change in $(r-g)b$ equal to $-D$ while $(\tau - \gamma)$ is left unchanged. Formally,

$$\begin{aligned} &\frac{d}{da}\left[t - \frac{I_g(T-at)}{I_g + I_p}\right]da + \frac{d}{dI_g}\left[t - \frac{I_g(T-at)}{I_g + I_p}\right]dI_g = 0 \\ &\frac{d}{da}\left[r - (T-at)\sigma\right]\frac{B(T-at)}{I_g + I_p}da + \frac{d}{dI_g}\left[r - (T-at)\sigma\right]\frac{B(T-at)}{I_g + I_p}dI_g = -D \end{aligned} \tag{7}$$

The general solutions of (7) are:

$$dI_g = \frac{D\left(I_g + I_p\right)^2}{B(T-at)^2\sigma} = \frac{D}{B\sigma}Y^2 > 0 \tag{8}$$

And

$$da = -\frac{(T - at)dI_g}{t\left(I_g + I_p\right)} = -\frac{1}{Y}\frac{dI_g}{t} < 0 \qquad (9)$$

dI_g is always positive, increasing in D and decreasing in B[5]. On the other hand, for any $dI_g > 0$ it is $da < 0$.

The fact that the fiscal budget must be left unchanged necessarily implies that the decrease in the share of total fiscal revenue devoted to current spending (necessary to raise the growth rate) must be accompanied by an increase in capital expenditure. The larger is the required reduction in the debt ratio, the larger is the required increase in g, the larger is the required decrease in the share of current expenditures (a) and, hence, the larger the required increase in capital expenditures. On the other hand the larger is B, the larger is the impact that the change in the growth rate has on the left-hand side of (6), so that a smaller increase in capital expenditures is required.

However, not every decrease in a is economically acceptable and compatible with the hypotheses of the model. The decrease in a must be such as to ensure that $a + da > 0$. In fact, it has been assumed that there must always be a positive amount of current expenditures. Moreover, if $a + da$ were allowed to be negative, this would amount to allow an increase in the tax rate t, which instead is kept constant throughout in the model.

Therefore, the additional constraint that $a + da > 0$ has to be introduced. Such a constraint essentially is a limit to the variation in I_g that can be expressed in different ways. It is interesting to express the constraint in terms of D, that is to say as a limit to the size of the reduction of the growth of the debt ratio. In order that $a + da > 0$, it must be

$$D < \frac{aBt\left(T - at\right)\sigma}{I_g + I_p} = \frac{1}{Y}aBt\sigma \qquad (10)$$

The rationale of this constraint is simple. As dI_g is increasing in D, the larger is the latter, the larger must be the increase in capital expenditures and, hence, the larger the reduction in the ratio of current spending to the total revenue, which positively affects the growth rate. But this ratio cannot decrease freely as it must remain positive. The constraint on D, therefore, amounts to a constraint on the reduction of current spending, which is the same as a constraint on the increase in capital spending. At the same time, as dI_g is decreasing in B, the larger is the latter the smaller is the increase in capital expenditures and, hence, the larger can D be.

From this a general conclusion follows: governments largely indebted can more easily adjust the dynamics of their debt through changes in the composition of their expenditures rather than through running primary surpluses that require a generalized reduction in spending and/or increases in taxation. This, however, is true only if the initial share of total revenue devoted to current spending (a) is sufficiently large. As D is increasing also in a, the larger is the latter the less stringent is the constraint on D. Intuitively, if a is initially very small, it might be impossible to reduce it to the extent required to raise the growth rate above the interest rate to obtain $b\left(r - g\right) = -D$. Thus, for governments that have already a small share of their revenue devoted to current spending,

[5] Or in b.

it could be impossible to realize a large debt ratio reduction by leaving their primary budget ratio to GDP unchanged, even though they are largely indebted.

In conclusion, there exist situations in which it is impossible to stabilize a fast increasing debt ratio (a large *D*) through policies that do not affect the primary budget. In such cases, either the stabilization of the debt ratio is only partial, i.e. the rate of growth of the ratio of the public debt to GDP is reduced but not brought to zero,[6] or the stabilization must be realized by also making the fiscal budget vary. However, as it will be shown presently, the choice to stabilize the debt ratio also through variations of the ratio of the fiscal budget to GDP does not necessarily ensure that the constraint on *D* is less restrictive.

In order to show this, let us now consider the case in which the debt stabilization is realized through both an increase in (τ - γ) and a decrease in ($r - g$). The problem to solve, therefore is

$$\begin{aligned} &\frac{d}{da}\left[t-\frac{I_g(T-at)}{I_g+I_p}\right]da+\frac{d}{dI_g}\left[t-\frac{I_g(T-at)}{I_g+I_p}\right]dI_g = mD \\ &\frac{d}{da}\left[r-(T-at)\sigma\right]\frac{B(T-at)}{I_g+I_p}da+\frac{d}{dI_g}\left[r-(T-at)\sigma\right]\frac{B(T-at)}{I_g+I_p}dI_g = -nD \end{aligned} \tag{11}$$

with $0 \le m \le 1$ and $n = 1 - m$.

The general solutions for (11) are:

$$dI_g = \frac{\left(I_g+I_p\right)^2 D\left\{nI_p+Bm\left[r-2\left(T-at\right)\sigma\right]\right\}}{BI_p(T-at)^2\sigma} = \frac{D}{B\sigma}\frac{\left[nI_p+Bm\left(r-2g\right)\right]}{I_p}Y^2 \tag{12}$$

and

$$da = -\frac{\left(I_g+I_p\right)Dm}{I_p t}-\frac{(T-at)dI_g}{\left(I_g+I_p\right)t} = -\frac{1}{Y}\frac{dI_g}{t}-\frac{\left(I_g+I_p\right)Dm}{I_p t} \tag{13}$$

If it is imposed that $a + da > 0$, it must be

$$D < \frac{aBtI_p\left(T-at\right)\sigma}{\left(I_g+I_p\right)\left\{nI_p+mB\left[r-\left(T-at\right)\sigma\right]\right\}} = \frac{aBtI_p\sigma}{nI_p+mB\left[r-\left(T-at\right)\sigma\right]}\frac{1}{Y} \tag{14}$$

If the new constraint on *D* must be less stringent than the one when the debt ratio adjustment is realized by leaving the primary budget ratio unvaried, the ratio of (14) to (10) must be larger than 1. It is easily seen that this condition is fulfilled for any

[6] *D* in (7) is reduced, so that (10) is fulfilled.

$$B < \frac{I_p}{r-(T-at)\sigma} \qquad (15)$$

Thus, given a reduction target D of the debt ratio that cannot be realized by leaving the primary budget ratio unchanged, it can be possible to achieve the target by implementing a mixed policy, i.e. variations of the fiscal budget ratio and of its composition. However, this alternative policy is feasible only if B is sufficiently small to fulfill (15). In fact, if (15) is not fulfilled, the constraint on D is less stringent when the primary budget ratio is left unchanged, so that the reduction of the rate of increase of the debt ratio that can be realized is larger if the fiscal budget ratio is left unchanged.[7]

In conclusion, the analysis above yields results that are different from the standard conclusions. In the present analysis, the hypothesis that the economy's growth rate is dependent on the composition of the public expenditure is made. Under this hypothesis, it is possible to show that, starting from a situation in which the interest rate is higher than the growth rate, appropriate changes in the composition of the public expenditure, namely a reduction in the share of the fiscal revenue devoted to current spending, determine an increase in the growth rate, which becomes higher than the interest rate. As a consequence of this, the stabilization of the ratio of the public debt to the GDP does not require to run a primary fiscal surplus. When $r < g$, there is no need to have $\tau > \gamma$ in order that (5) is fulfilled. The possibility to implement such a kind of policy is greater when the government is largely indebted and devotes a large share of its revenue to current spending.

As the debt stabilization is essentially realized by varying the differential between r and g, the same results could be obtained by implementing a monetary policy that lowers the interest rate while the growth rate is left unchanged. The choice to concentrate on changes in the growth rate derives from the model above being inspired by Domar's approach, which underlines the importance of considering the effects of public spending on the economy's growth rate. In the next section, we briefly look at Domar's original contributions.

Domar's contribution to the problem of debt sustainability

The determination of the growth rate in the way followed in section 2 above is derived from Domar's growth model. Also the idea that the problem of debt can be approached by concentrating on the growth of GDP rather than on the public budget derives from Domar's analysis of the "burden" of public debt.

Domar's objective was to contrast the opinion that deficit spending leads to an ever-growing public debt, the servicing of which inevitably leads to an increasing tax burden on the economy. For Domar, while all underline the obvious fact that continuous

[7] It is interesting to notice that the same condition (15) above applies even if the stabilization is realized only through changes in the fiscal budget ratio, i.e. when $m = 1$ and $n = 0$. In this case too, as it can be easily verified, the constraint on D is less stringent upon the fulfillment of (15).

borrowing results in an ever-increasing debt, many tend to overlook that deficit spending affects income.[8]

In order to study the analytical relations between deficit spending, debt and income, Domar considers four different cases.[9] In the first case, it is assumed that income remains constant while, in each period, the government borrows a percentage α of income. It is clear that in this case the ratio of debt to income will grow indefinitely. But "there is something inherently odd about an economy with a continuous stream of investment expenditures and a stationary national income" (Domar 1944, p. 804). Such a case could occur because investment does not have any positive effect on productivity and the number of working hours remains unchanged.[10] The second case is analogous to the first. Now income grows over time but at a constant *absolute* rate ($Y = a + bt$). Since the government keeps on borrowing α% of the income, also in this case the ratio of debt to income will grow with no limit (1944, p. 806). The reasons why such a case could occur are the same as in the first case.

The third case is the most important. Domar now assumes that income grows at a "constant percentage rate" ($Y = ae^{gt}$). In this case the public deficit grows at the same rate as income. Also the growth rate of debt will approach the growth rate of income and, therefore, the ratio of debt to income will tend to a constant value (1944, p. 809). More precisely, it will approach the value $\frac{\alpha}{g}$.

It follows that the larger is the rate of growth of income, the lower is the ratio of debt to income.[11] Thus, the problem of the debt ratio lies in the ability to make income grow rather than in attempting to reduce it without taking account of the effects of such reduction on income.[12]

A certain growth rate of income can be achieved if aggregate demand grows at that rate and, *at the same* time, a sufficient amount of the expenditures is directed toward "increasing the efficiency of production, so as to allow the required volume of monetary expenditures to take place without a rise in prices." (1944, p. 820). The government can contribute to increasing the economy's growth rate by converting part of the private income that it absorbs through taxation into productive expenditures.

For simplicity, such expenditures can be thought of as public investment, opposed to current expenditures seen as unproductive. But Domar is careful to point out that the distinction between investment and current expenditure may be misleading: "As a matter of fact, the term 'investment expenditures' may be misleading, because it is too closely

[8] "… that deficit financing may have some effect on income (…) has received a different treatment. Opponents of deficit financing often disregard it completely, or imply, without any proof, that income will not rise as fast as the debt." (1944, p. 801).

[9] In all four cases, the interest rate on the debt and the price level are taken as given and constant.

[10] Alternatively, productivity grows but the number of working hours diminishes.

[11] See the mathematical appendix to Domar's article (1944, pp. 823-25). The fourth case is a "war model", in which the percentage of income borrowed differs between peace times and war times. For brevity, this case is not considered here.

[12] "Now, some economic and political circles are burning with a desire to reduce the debt burden (…). They recognize no other method of achieving their goal but by reducing the absolute size of the debt; that the government must stop borrowing is of course taken for granted. They should beware, however, lest the policies they advocate exert such a depressing effect on the national income as to result in an actually heavier debt burden, even though they succeed in paying off a part of the debt." (Domar 1944, pp. 815-6).

associated with steel and concrete. If healthier people are more productive, expenditures on public health satisfy these requirements. The same holds true for expenditures on education, research, flood control, resource development and so on." (1944, p. 820).
The analysis carried out in sections 2 and 3 is in the spirit of Domar's approach. However, whereas Domar deals with the relation between the growth rate and public spending only at an intuitive level, the present model is based on an explicit functional relationship between the growth rate and the composition of public spending.

Concluding Remarks

The main object of this paper is to present an approach to the problem of the sustainability of fiscal policy and debt stabilization that is different from the mainstream approach. The paper argues that it is unsatisfactory to deal with the ratio of the public debt to GDP by considering the growth rate of the economy as independent of the composition of public spending. A larger share of public spending devoted to "productive expenditures" can positively affect the growth rate and, hence, the ratio of public debt to GDP. The present model is built in such a way to emphasize this aspect. Other functional relations–like, e.g., private investment or the tax rate–are dealt with in a very simple way, but the model could be developed by introducing more specific equations for such variables.

The present work draws its inspiration from two contributions by Domar in the 1940s. The analytical relationship between the composition of public spending and the economy's growth rate is derived from a generalization of Domar's growth model. The idea that the problem of the public debt must be dealt with by considering the effects on the GDP of different types of public expenditure comes from Domar's contribution on the burden of the public debt. In this sense, the paper offers an "old answer" to the old question of fiscal sustainability.

In the approach suggested here, public spending and borrowing have an impact on the economy as a whole. The government can run deficits and borrow from the private sector in order to bring the economy to a higher growth rate. Mainstream analyses of fiscal sustainability do not concern themselves with the problem of the effects of government spending and borrowing on the economy's output. In fact, in these models, the economy's growth rate is totally independent of the level and composition of the public expenditure as well as the public debt.[13]

The mainstream approach to fiscal sustainability amounts to not offering any real explanation of why the government borrows resources from private agents, unless it is (at least implicitly) accepted the idea that governments draw resources from the private sector only to the benefit of their bureaucratic apparatuses and/or their constituencies, without any concern for the general welfare. The exclusive concern for the stabilization of the debt ratio through the realization of primary surpluses follows from this sort of approach. Differently, this paper suggests that the problem of debt stabilization should not focus exclusively on the realization of primary surpluses but rather on the effects that

[13] Even the obvious multiplier effects of public spending on the GDP are often ignored, for example by assuming that any reduction in the level of public expenditure implies a proportional reduction in its ratio to the GDP.

different types of public expenditure have on the economy's overall productivity and growth rate.

The approach to the problem of the public debt suggested here does not imply that there should not be any concern for the state's debt and, in particular, for its possible tendency to explode. However, the concern for a continuously growing ratio of the public debt to GDP does not derive from the unlikely possibility of a default of the state, but rather from the fact that a growing debt ratio indicates that the government is not using resources in an "efficient" manner. The government is spending resources in such a way that the GDP does not grow sufficiently to keep the debt ratio stable.

In this perspective, policies aimed at reducing the debt ratio should be centered on the attempt to increase productive expenditures rather than being concentrated on measures aimed at eliminating deficits through reducing expenditure and ignoring the long-period negative effects of such reductions. The EMU and its fiscal discipline is an evident exemplification of this wrong approach to the problem of public debt. In fact, several economists have been suggesting that the EMU adopt some version of the UK "golden rule", which deals with government deficits by distinguishing between current and capital expenditures.

However, it is necessary to conclude with some qualifications. First of all, it is important to stress that the paper develops the analysis of fiscal policy and public debt in the context of a long-period equilibrium model. The long-period nature of the model implies that no attention is paid to the fiscal budget in the short period and the possibility to run budget deficits for stabilization purposes. The concern for the debt stabilization in the long period does not exclude that primary deficits can, or must, be run in the short period. The short-period implication of the present model, however, is that, if it is necessary to realize primary deficits, it is preferable to do so by increasing capital rather than current public expenditures, as the former have also a positive impact on the economy's growth.

Secondly, as the present analysis is carried out by using an equilibrium model, the results obtained should be regarded as strictly belonging to the domain of comparative dynamics. Given two economies that differ only for the ratio of public current expenditure to the tax revenue, the economy with the smaller ratio grows at a higher rate and can stabilize the ratio of the public debt to the GDP without necessarily running primary surpluses. The present equilibrium model does not permit any rigorous analysis of dynamic changes in an economy that varies the composition of its public expenditure over time. In the present context, considerations of this nature can be made only at an intuitive, casual level.

Finally, it should also be stressed the need for further developments to eliminate some of the simplifications and assumptions made in the present model. In particular, our model is based on the assumption that a clear-cut distinction between capital and current expenditures can be made as well as on the idea that no current expenditure has positive effects on the economy's productivity. These clearly are very simplistic assumptions. Domar himself underlines that productive public expenditures are not necessarily to be identified with capital expenditures. Some classes of current expenditures have a positive impact on the economy's productivity while some sorts of unproductive expenditures can be too easily disguised as capital expenditures. Thus, further developments and, above all, attempts to look at the problems of fiscal and debt sustainability in actual situations

should be based on further refinements concerning the classification of the government expenditures and their impact on the economy as a whole.

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Appendix

In section 3, the analysis has been carried out under the hypothesis that the public and private investment productivities are equal. Now this hypothesis is lifted and it is assumed that σ is an increasing function of I_g. For simplicity, we assume that σ is linearly increasing in I_g, i.e. that it is

$$\begin{aligned} &\sigma = kI_g \\ &k > 0 \end{aligned} \qquad (16)$$

Under this new hypothesis, the problem to solve in its general form is

$$\begin{aligned} &\frac{d}{da}\left[t - \frac{I_g(T-at)}{I_g + I_p}\right]da + \frac{d}{dI_g}\left[t - \frac{I_g(T-at)}{I_g + I_p}\right]dI_g = mD \\ &\frac{d}{da}\left[r - (T-at)kI_g\right]\frac{B(T-at)}{I_g + I_p}da + \frac{d}{dI_g}\left[r - (T-at)kI_g\right]\frac{B(T-at)}{I_g + I_p}dI_g = -nD \end{aligned} \qquad (17)$$

with $0 \le m \le 1$ and $n = 1 - m$.

The solutions for dI_g and da are:

$$dI_g = \frac{(I_g + I_p)^2 D\left\{I_p n + Bm\left[r - 2I_g k(T-at)\right]\right\}}{BkI_p(2I_g + I_p)(T-at)^2} = \frac{D\left[I_p n + Bm(r-2g)\right]}{BkI_p(2I_g + I_p)}Y^2 \qquad (18)$$

And

$$da = -\frac{Dm\left(I_g + I_p\right)^2 - I_p(T-at)dI_g}{I_p\left(I_g + I_p\right)t} = -\frac{dI_g}{Yt} - \frac{Dm\left(I_g + I_p\right)}{I_p t} \qquad (19)$$

In order that $a + da$ is positive, the following constraint on D must be added:

$$D < \frac{aBI_p(2I_g + I_p)kt(T-at)}{(I_g + I_p)\left\{mBr + I_p\left[n + mBk(T-at)\right]\right\}} = \frac{aBI_p(2I_g + I_p)kt}{\left\{mBr + I_p\left[n + mBk(T-at)\right]\right\}}\frac{1}{Y} \qquad (20)$$

The change of the hypothesis about σ does not affect the left-hand side of (6), but only its left-hand side. More precisely, what changes is the effect of a change in I_g. dI_g is still positive, increasing in D and decreasing in B, but now it has to increase less to realize the stabilization of the debt ratio because it also directly affects the productivity of investment. Consequently, da must decrease less. It can be easily verified that dI_g in (18) is smaller than dI_g in (12). In other words, when σ is increasing in I_g, the effect of a change in the composition of public spending in favor of capital expenditures is more powerful.