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ORIGINAL PAPER

The effect of government spending on the debt-to-GDP ratio in the medium term

Emanuel Reis Leão[1] · **Pedro Reis Leão**[2]

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Abstract

Using the dynamic model proposed by Leão and Leão (2024), this paper argues that, in an economy situated below full employment, an increase in government spending may reduce the debt-to-GDP ratio in the medium term. The reason is the following one. Through the so-called "paradox of investment", a fiscal stimulus triggers a multi-year process of mutually fed increases in the rate of utilization of productive capacity and in private investment. Specifically, a fiscal stimulus increases output and utilization, and this leads firms to raise investment. But this increase in investment generates less productive capacity than demand and, therefore, provokes a paradoxical and further rise in utilization. This in turn leads to even more investment, and so on—the result being a sustained path of output growth. This will in turn have an impact on public finances. After having deteriorated initially as a result of the fiscal stimulus, the budget balance and the path of public debt will start to improve, and this, coupled with the sustained output growth, may end up reducing the debt-to-GDP ratio in the medium term. The theoretical argument just presented is then used to elucidate the results of the US New Deal of the 1930 s, of the European fiscal consolidation of the early 2010 s, and of the US fiscal stimulus of 2009–2010.

Keywords Fiscal policy · US New Deal · US fiscal stimulus of 2009–2010 · European fiscal consolidation · Economic dynamics · Paradox of investment

JEL Classification E62 · E65

✉ Emanuel Reis Leão
emanuel.leao@iscte.pt

Pedro Reis Leão
pleao@iseg.ulisboa.pt

[1] Instituto Universitário de Lisboa (ISCTE-IUL) and Centro de Estudos Internacionais, Lisbon, Portugal

[2] Lisbon School of Economics and Management (ISEG) University of Lisbon and Research in Economics and Mathematics (REM), Rual Miguel Lupi 20, 1249 - 078 Lisbon, Portugal

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1 Introduction

After the Great Recession of 2008–2009, advanced countries faced the problem of the zero lower bound associated with monetary policy—the inability of zero Central Bank interest rates to raise demand to the level of full employment. In addition, quantitative easing failed to provide any significant stimulus. Despite this, governments were reluctant to use fiscal policy to expand demand, and thus permitted low output growth and high levels of unemployment for many years. The reason for that reluctance was the belief that large budget deficits would cause an increase in public debt to unsustainable high levels.

This paper challenges this belief. Using a static Keynesian model, Leão (2013) argued that, in an economy situated below full employment, an expansionary fiscal policy increases public debt by a smaller percentage than output in the short term, and therefore reduces the debt-to-GDP ratio. The present paper attempts to extend this result beyond the short term. Specifically, using a dynamic rather than a static Keynesian model this paper argues that, in an economy situated below full employment, an increase in government spending may reduce the debt-to-GDP ratio in the medium term (say, in 5 years). The reason is the following one.

We consider the dynamic Keynesian model proposed by Leão and Leão (2024). Besides the multiplier equation of the static Keynesian model, this dynamic model includes two other equations. One equation states that private investment is critically dependent upon the rate of utilization of productive capacity. The other additional equation indicates that net investment raises production capacity.

In this set-up, a fiscal stimulus produces the following chain of effects. The first is to increase output and therefore utilization. Afterwards, this increase in utilization leads firms to raise investment. In turn, this increase in investment has a dual effect on the economy: it increases both production capacity and, via the multiplier, aggregate demand. However, and as we shall see, production capacity will increase by less than demand. As a consequence, the increase in investment ends up provoking a further rise in utilization. (This is paradoxical because the increase in investment had been decided by firms to cope with the initial rise in utilization). And the process will repeat itself. The additional increase in utilization will lead to even more investment, which will cause yet another rise in utilization, and so on. The result of all this will be a sustained path of output growth.

In turn, the continuous growth in output will have an impact on public finances. After having deteriorated initially as a result of the fiscal stimulus, the budget balance and the path of public debt will start to improve. This will happen because of the decreasing government social transfers and the mounting tax revenues generated by the growing output. Finally, the improved path of public debt coupled with the growing output may end up reducing the debt-to-GDP ratio in the medium term.

There have been attempts on the Keynesian front to investigate the impact of fiscal policy on the debt-to-GDP ratio beyond the short run. These attempts have been based on the traditional neo-Kaleckian growth model (You and Dutt 1996; Dutt 2013; Palley 2013) and on a more recent version of this model including autonomous demand growth (Dutt 2020; Hein 2018; Ribeiro and Lima 2019; Obst et al.

2020). Like this paper, this research considers that investment is critically dependent upon the rate of utilization and, in turn, affects the rate of utilization. And this research also concludes that an increase in government spending has positive effects on investment and output growth, and thereby may reduce the debt-to-GDP ratio.

However, there are three important differences. First, the core structure of the models—the way they envisage the double-sided relationship between investment and utilization—is different. In particular, this paper's model—that proposed by Leão and Leão (2024)—is the only that takes the paradox of investment into account. Second, the above research analyzes the effect of fiscal policy on the debt-to-GDP ratio in a long-term steady state. By contrast, this paper analyzes the effect of fiscal policy on the evolution of the economy and on the debt-to-GDP ratio over a sequence of short periods—i.e., over the medium term. This is an important complement to long-term analysis. Indeed, as argued by Caserta and Chick (1997) and Trezzini (2021), the economy is subject to frequent changes in behavioral parameters, expectations, and other shocks (e.g., from the financial sector) that make long-term steady-state analysis often inapplicable to the real world. A third and final distinctive feature of this paper is that it confronts its model with three historical fiscal policy episodes: the US New Deal of the 1930 s, the European fiscal consolidation of the early 2010 s and the US fiscal stimulus of 2009–2010.

Finally, it is important to mention the results of three empirical studies about the effect of government expenditure on the debt-to-GDP ratio. First, applying the local projections approach to a dataset of 14 OECD countries for the 1981–2017 period, Ciaffi et al. (2024) concluded that increases (decreases) in government expenditure end up reducing (increasing) the public debt-to-GDP ratio. The same conclusion was arrived at by McCausland and Theodossiou (2016), who employed an annual data that span the period 1881–2011 for a panel of 11 OECD countries. Finally, Nikiforos (2021) made a detailed study of the evolution of the Greek economy after 2010. The study concluded that there was a vicious cycle of recession and austerity: each round of austerity measures led to a deeper recession, which increased the debt-to-GDP ratio and led to another round of austerity.

The article is organized as follows. In Sect. 2, we summarize the dynamic Keynesian model proposed by Leão and Leão (2024). Then, we use the model to analyze the effects of government spending on the debt-to-GDP ratio in the medium term (Sect. 3). Afterwards, in Sect. 4, we illustrate the theoretical argument with the case of the US New Deal of the 1930 s and the case of the European fiscal austerity of the early 2010 s. Subsequently, we use the model to interpret the results of the US fiscal stimulus of 2009–2010 (Sect. 5). Afterwards, in Sect. 6, we present some limitations of the argument developed in the paper. We end with a brief comparison between the dynamic Keynesian model used in this paper and the neo-Kaleckian growth model (Sect. 7).

2 The dynamic Keynesian model

The model proposed by Leão and Leão (2024) assumes a closed economy with government. It is centered on two ideas. The first is the dual effect of investment on the economy—it affects both demand/output and production capacity. Investment

affects demand and output through the multiplier (which acts within a single period, i.e., without lags):

$$Y = \{1/[1 - (c_{w.}(1 - \pi) + c_p.\pi).(1 - \tau)]\}.(I + C_p + G) \quad (1)$$

where Y is output, c_w and c_p are the marginal propensities to consume out of wages and out of profits, π is the profit share, τ is the overall tax rate, I is investment, C_p is the autonomous consumption of capitalists, and G is government expenditure (for simplicity, time subscripts "t" are omitted). Note that in an economy without government (hence $\tau = 0$) and with no saving out of wages ($c_w = 1$), the multiplier would be reduced to the more familiar $1/(s_p.\pi)$, s_p denoting the marginal propensity to save out of profits.[1]

On the other hand, investment increases the production capacity of the economy. The effect of investment on production capacity is equal to net investment times the potential productivity of capital. Productive capacity is given by:

$$Y_{FC} = a.K_{-1} + a.(I - \partial.K_{-1}) \quad (2)$$

where a is the potential productivity of capital, assumed to be constant, K_{-1} is the capital stock and $\partial.K_{-1}$ is capital depreciation (both of the previous period).

The second idea on which the model is based is that investment responds with a *lag* to deviations of the actual rate of capacity utilization from the desired rate—an investment function common in the heterodox literature (see for instance Lavoie 2022, 384; Skott 2012 presents empirical evidence). Gross investment relative to the capital stock is given by:

$$I/K = \partial + I_A/K + \gamma.(u_{-1} - u_n) \quad (3)$$

where I_A denotes autonomous investment, and u ($= Y/Y_{FC}$) and u_n represent the actual and the desired rates of capacity utilization.[2] Autonomous investment is the component of investment unrelated to the rate of utilization (Hicks 1950, 59): investment associated with innovations, housing investment associated with population growth, and investment which is only expected to pay for itself over a long period and is thus linked to the expected long–run growth of sales (e.g., a hydroelectric dam).

The desired rate of utilization, u_n, is the rate firms plan to have on average over time. It is well below 100% because firms want to have significant amounts of spare capacity in order to be able to meet peaks of demand and thereby avoid the risk of losing market share.[3]

[1] This is the multiplier in the Kaleckian version of the Keynesian system. In the basic Keynesian system, the corresponding multiplier is equal to 1/s, where s is the aggregate marginal propensity to consume.

[2] Some authors (for example, Trezzini 2021) argue that, rather than reacting to every divergence of past utilization from the desired level, investment may react only to an average of successive utilization rates differing from the planned level.

[3] From January 1967 to November 2024 the average of the total index of capacity utilization in the US was 80.05% (see https://fred.stlouisfed.org/series/TCU).

The dependence of investment on the actual rate of utilization, u, can be justified in two ways. First, if the actual rate of utilization is higher (lower) than the desired rate, businesses will undertake positive (negative) induced net investment to raise (reduce) their capital stock and thereby decrease (increase) utilization towards the desired rate. Second, because of fixed costs changes in utilization over the cycle are associated with amplified changes in total profits—and thus with firms' financial capacity to invest. As pointed out by Robinson (1962, 86), "an important part of investment is financed out of retained profits. Moreover, the amount that a company puts up of its own finance influences the amount it can borrow from outside"; this happens for several reasons, including Kalecki's (1937) "principle of increasing risk".

Finally, notice that according to Eq. (3) investment responds to actual utilization only after a lag. This happens for two reasons (Sherman 2010, 87). First, it takes time for businesses to know that changes in utilization are durable rather than transitory and to ponder whether to advance with new investments. Second, it may take time for businesses to obtain finance from banks or from bond issues and to acquire government permits for the construction of buildings. As will be seen, it is this lagged effect of utilization on investment in the dynamic Keynesian model that provides the link between the position of the economy in one period and the next one, and thereby makes it possible to trace the evolution of the economy along a sequence of several periods.

3 The effect of government spending on GDP and on the debt-to-GDP ratio in the medium term

An increase in government spending affects the economy beyond the short term because it triggers a multi-year process of mutually fed increases in the rate of utilization and in private investment. This happens because of the paradox of investment.

3.1 The paradox of investment

Leave autonomous investment aside for now, and suppose that for some reason in a certain period utilization rises above the desired rate. When this happens, after a lag firms raise investment above the amount of capital depreciation—Eq. (3) above—in an attempt to reduce utilization back towards the desired rate. If only a single firm acted in this way, its productive capacity would rise relative to its output. Therefore, its rate of utilization would fall back towards the desired level.

But when most firms raise their investment above the amount of capital depreciation, besides increasing the productive capacity of the economy, they unconsciously provoke a macroeconomic effect: they increase aggregate demand and output. As a result, actual utilization does not necessarily fall back towards the desired rate. Instead, if the effect of the increase in investment on capacity happens to be smaller than the effect on aggregate demand, actual utilization

will move further above the desired rate. This will be paradoxical because the increase in investment had been decided by firms to cope with the rise in utilization. Therefore, it may be called the 'paradox of investment'.[4]

Now, the effect of the increase in investment on capacity is determined by the productivity of capital (Eq. (2) above) while the effect on aggregate demand and output is determined by the multiplier (Eq. (1) above). Therefore, the paradox of investment will occur if the productivity of capital is smaller than the multiplier. Is this the case in the real world? (i) Ponder first on the value of the multiplier. If we consider an overall tax rate of 0.4, the stylized facts $c_p = 0.4$, $c_w = 0.9$, and $\pi = 0.4$ mentioned by Lavoie (2022, 392 and 403), point to a multiplier in Eq. (1) of 1.72.[5] Ninety percent of this value—1.55—is associated with the initial change in investment expenditure plus the first and second rounds of consumption expenditure that follow it. Therefore, almost all of the effect of the multiplier occurs within a short period of time—probably one quarter, at most one semester. (ii) On the other hand, Lavoie (2022, 403) and Sherman (1991, 179) mention a productivity of capital of 1/3 per year (1/12 per quarter) as a stylized fact. (iii) Therefore, we can conclude that the productivity of capital, 1/12 per quarter, is smaller than the multiplier effect, 1.55 exerted over one quarter.

Now, recall that the fact that the productivity of capital is lower than the multiplier has the following implication: an increase in investment by firms to reduce utilization generates less productive capacity than demand—and therefore causes an increase in utilization. This paradox is in line with the fact that investment and utilization both rise along economic expansions and both fall in recessions (see Figs. 1 and 2). In fact, along economic expansions utilization rises and firms try to cope with that by raising investment. But rather than containing the rise in utilization, the increase in investment makes it rise even further (and so on). That is, along expansions $\uparrow u => \uparrow I => \uparrow u => \ldots$. Therefore, the two variables rise together. Similarly, in recessions, utilization falls and firms respond by reducing investment. But instead of curbing the decline in utilization, the reduction in investment makes it fall even further (and so on). That is, in recessions $\downarrow u => \downarrow I => \downarrow u => \ldots$. Hence, the two variables fall together.

Taking the paradox of investment into account, the remainder of this section will analyze the impact of fiscal policies on GDP and on the debt-to-GDP ratio in the medium term.

[4] This paradox can be extended to housing investment. In this case, the story may be told as follows. As the number of unsold houses—the "amount of spare capacity"—falls below the desired level, building firms increase construction above the replacement level in an attempt to raise the number of houses available for sale back to the desired rate. But this increases incomes (firstly in the construction sector) and therefore aggregate demand and output. If the value of the new houses built—the additional "capacity"—is lower than the increase in aggregate output, the average rate of capacity utilization across the economy will rise.

[5] Using a very different methodology, Blanchard and Leigh (2013) estimated for the European countries in 2010–2011 a multiplier of a similar value, around 1.6. This was much higher than the multiplier of 0.5 then assumed by the IMF.

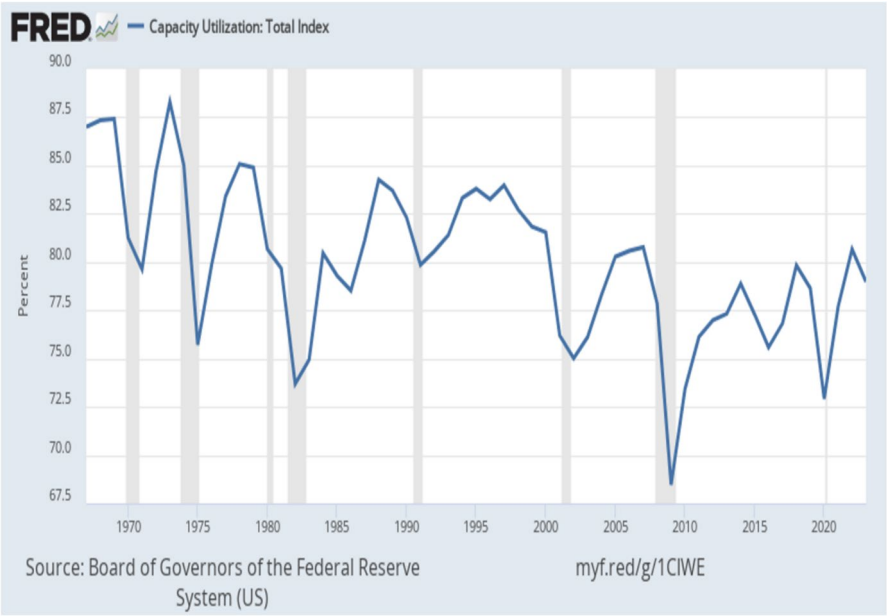

Fig. 1 Capacity utilization over US cycles, 1967–2024

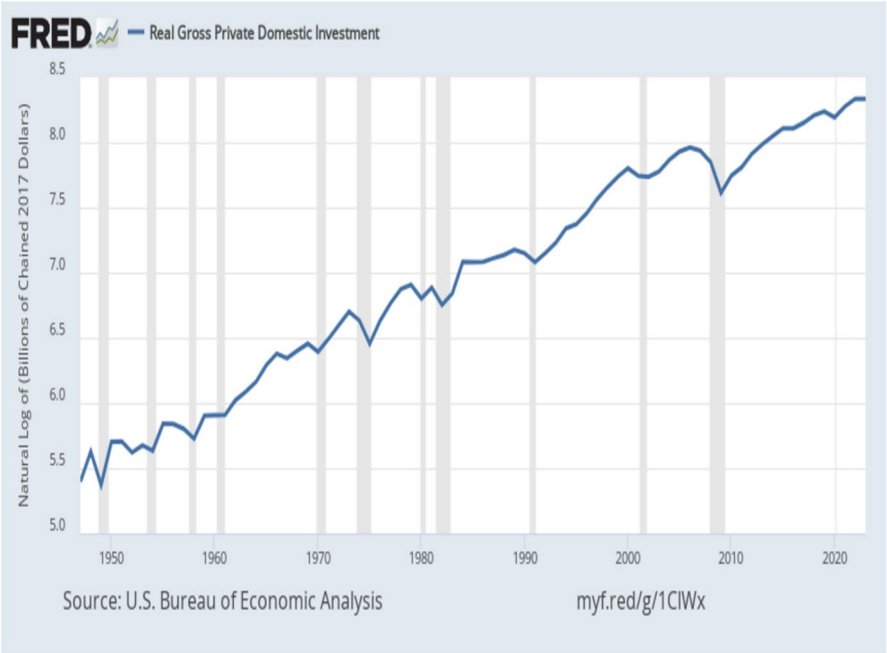

Fig. 2 Log of private investment in GDP over US cycles, 1947–2024

3.2 The effect of government spending on output

We start by analyzing the effect of an increase in government spending on GDP in the medium term. We do this by using a numerical example.[6] Leave autonomous investment aside, and assume that capacity utilization is at the desired rate. Investment is thus at the replacement level (Eq. (3) above). Assume further that the amount of capital depreciation is fixed at \$100 that the productivity of capital per quarter is 1/10, and that the multiplier is 1.5 (the full operation of which requires one quarter).[7]

Now, start in a period t when the economy is below full employment, and then suppose that the government raises expenditure. This will produce the following chain of effects. The first is an increase in output and thus in utilization above the desired rate. In response to this, in period $t+1$ entrepreneurs will raise investment above the amount of capital depreciation, say from \$100 to \$110, to increase production capacity and thereby drive utilization down to the desired rate. However, the increase in investment will lead to a bigger increase in demand, \$10 * 1.5, than in productive capacity, \$10*(1/10)—and, as a result, will cause a paradoxical increase in utilization further above the desired rate. Output will rise according to demand and profits will rise in an amplified way. To fix ideas:

$$\uparrow G_t \Rightarrow \uparrow u_t \text{ above } u_n \Rightarrow \uparrow I_{t+1} \text{ above depreciation} =$$
$$> \uparrow \text{demand}_{t+1} > \uparrow \text{capacity}_{t+1} \Rightarrow \Rightarrow \uparrow u_{t+1} \text{ further above } u_n$$

And this process—the paradox of investment—will repeat itself over several periods. Indeed, the mentioned rise in utilization in $t+1$ will lead to a new increase in investment in $t+2$. This will again have a bigger effect on demand than on capacity, and therefore will lead to a new rise in utilization in $t+2$. And so on. Along the way, profits will rise with utilization and reinforce the upward movement.

In sum, an increase in government spending affects output well beyond the short period. In fact, by raising output and utilization in the short period, an increase in government spending leads firms to raise investment in the following short period. And because this increase in investment has a bigger effect on demand than on capacity, utilization rises again in that following short period. And so on. The result is a self-sustained process of mutually fed expansions in output, utilization and private investment along several periods.

3.3 The effect on the debt-to-GDP ratio

The process described above has the following implication. After having deteriorated initially as a result of the increase in government spending, public finances will start

[6] This numerical example should not be interpreted too literally, as some bold assumptions are made and several relevant aspects are left aside.

[7] These last two values are roughly in line with the empirical evidence presented in the preceding subsection. Note also that, to keep the example simple, we are neglecting the fact that the capital accumulation that will ensue will imply increasing amounts of capital depreciation, and assume this fixed at \$100.

Table 1 The US economy in 1929–1937

Year	Real GNP	Consumption	Investment	Government purchases	Public debt (% GDP)
1929	203.6	139.6	40.4	22.0	14.8
1930	183.5	130.4	27.4	24.3	16.3
1931	169.5	126.1	16.8	25.4	22
1932	144.2	114.8	4.7	24.2	34
1933	141.5	112.8	5.3	23.3	38.6
1934	154.3	118.1	9.4	26.6	43.5
1935	169.5	125.5	18.0	27.0	42.4
1936	193.2	138.4	24.0	31.8	42.5
1937	203.2	143.1	29.9	30.8	39.6

Sources: Real GNP, consumption, investment, and government purchase are series F3, F48, and F66 from the US Department of Commerce (1975). Public debt as a percentage of GDP from the Congress Budget Office (2020)

to improve. Indeed, the sustained expansion in output—and corresponding decline in unemployment—triggered by the fiscal stimulus will generate increasing tax revenues and decreasing government social transfers. As a result of this, there will be a continuous improvement in the budget balance and in the path of public debt.

As long as the budget balance remains negative following the initial stimulus, public debt will still rise, but at decreasing rates. If, however, the continuous improvement in the budget balance eventually pushes this into positive territory, public debt will start falling. In any case, the decelerating or declining debt, coupled with the growing GDP, may lead to a continuous improvement in the debt-to-GDP ratio (compared with what would happen without the initial rise in government spending). In sum, in an economy situated below full employment, an increase in government expenditure may lead to a decline in the debt-to-GDP ratio in the medium term.

4 The effects of fiscal expansion and of fiscal retrenchment in the real world

Based on the argument developed in the preceding section, we now analyze the effects of two major historical episodes of fiscal policy—the US New Deal of 1933–1937 and the European fiscal consolidation of the early 2010s.

4.1 The effects of the new deal policies of 1933–6

Table 1 and Fig. 3 display the evolution of some key macroeconomic variables in the USA from 1929 to 1937. Between 1929 and 1933, output had fallen by 25% and public debt had jumped from 14.8 to 38.6% of GDP. Afterwards, the New Deal policies led to

an increase in government expenditure of 6.5 billion dollars between 1933 and 1936. But this only accounted for around 10% of the increase in output over the period—which was equal to 62.2 billion dollars. By contrast, nearly half of the increase in output was associated with an expansion in consumption of 30.3 billion dollars. Yet, this expansion in consumption was too big relative to the increase in government spending for it to be accounted by the Keynesian multiplier. The explanation for a significant part of the increase in consumption must therefore lie elsewhere.

Nearly 40% of the increase in output that occurred between 1933 and 1937 was linked to a jump in private invest of 24.6 billion dollars (from a figure of only 5.3 billion in 1933). There is no data about the rate of utilization of production capacity before World War 2. But the big increase in GNP between 1933 and 1937—of 43%—was surely associated with a big increase in utilization and profits. And this explains the enormous expansion in private investment that took place. In turn, this expansion in private investment caused, through the multiplier, the part of the increase in consumption—mentioned above—that cannot be accounted by the rise in government expenditure.

In sum, the increase in government expenditure associated with the New Deal led to (i) an increase in consumption and output through the multiplier, and to (ii) mutually fed rises in utilization, private investment, consumption, and output.

Finally, the economic recovery triggered by the New Deal explains why this was not followed by increases in the budget deficit and in public debt as percentages of

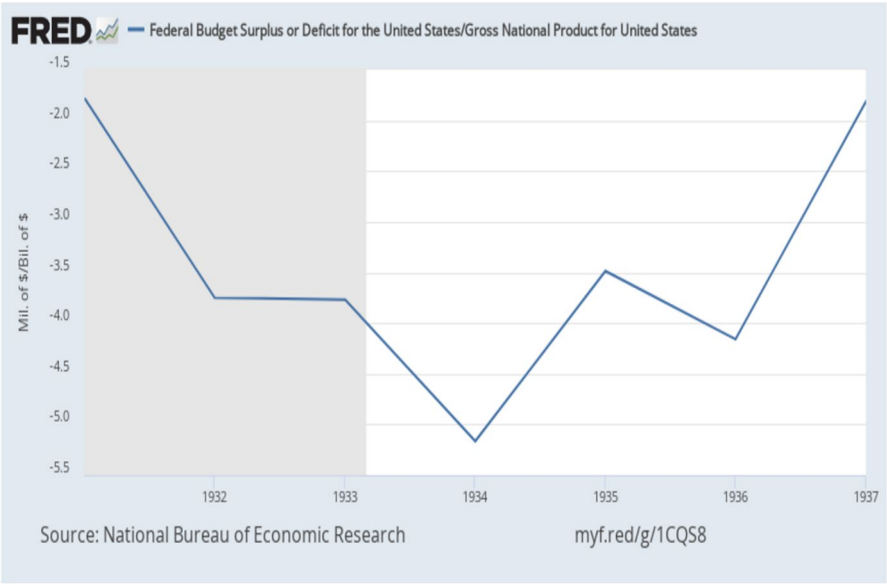

Fig. 3 US Budget Deficit, 1931–1937

Table 2 Debt-to-GDP ratios in Southern Eurozone countries between 2010 and 2015

	2010	2015
Portugal	100.2%	131.2%
Spain	60.5%	103.3%
Italy	119.2%	135.3%
Greece*	147.5%	176.7%

*Despite a 50% "haircut" on its debt in March 2012

Source: Trading Economics

GDP. First, the increase in tax revenues generated by the recovery of 1933–1937 explains why, after an initial increase in 1934, the budget deficit declined to under 2% of GNP in 1937 (Fig. 3).[8] And this, coupled with the big increase in output, accounted for the fact that, after an initial increase in 1934, the debt-to-GDP ratio fell between 1934 and 1937 (Table 1).

4.2 The effects of the European fiscal consolidation of the early 2010s

The above argument made in reverse makes possible a dynamic analysis of the effects of the fiscal consolidation undertaken in Europe in the early 2010 s. At the time, the analysis of the fiscal austerity was typically restricted to its multiplier effect on consumption and output in the short period. But in the real world that short-period effect had an impact on the next short period, and so on. Specifically, the initial decline in consumption, output, and utilization in the short period, resulting from the multiplier effect of austerity, led to a reduction in private investment in the next short period. Therefore, it was followed by a new decline in consumption, output and utilization. And so on. That is to say, austerity depressed the paths of consumption, output, utilization, and investment along a whole sequence of short periods. For example, investment between 2010 and 2013 fell around 20% in Italy and Spain, 30% in Portugal, and 45% in Greece (Ameco Database 2021).

An important empirical study assessed the effects of the European austerity on output beyond the short term (Fatás and Summers 2018). It found that the negative effect of the European austerity on output in the short term spread out over several years. Specifically, the authors estimated that, for each 1% reduction in GDP in 2011 caused by the fiscal consolidation of that year, 4 years later—in 2015—GDP was around 1.2% lower than it would otherwise have been.

In addition, the debt-to-GDP ratios in Southern European countries increased markedly between 2010 and 2015 (see Table 2). According to Fatás and Summers (2018), these increases were higher than they would have been without austerity. The reason was that austerity impacted on GDP at a horizon much longer than predicted by the traditional analyses of fiscal multipliers.

[8] Tax revenues increased by 100% between 1933 and 1937 (Koo 2009, 114).

5 The dynamic effects of the expansionary US fiscal policy of 2009–2010

We now analyze the dynamic effects of the US fiscal stimulus of 2009–2010, first on output and afterwards on the debt-to-GDP ratio.

5.1 The effect on the path of output

The stimulus package of 2009–2010 of the Obama Administration translated into a rise in US government spending between the first and the third quarters of 2009, followed by stabilization at a high level until the third quarter of 2010. Afterwards, the expiration of the stimulus package led to a decline in total government spending. All this is shown in Fig. 4.

According to a static Keynesian model, this behavior of government spending should have led to rises in output from mid- 2009 to mid- 2010, followed by declines in output afterwards. Thus, the US Congress Budget Office estimated the effect of the Obama stimulus on GDP shown in Fig. 5. And, based on this, Krugman (2011) argued that "the US federal government has been practicing destructive fiscal austerity since the middle of 2010."

Yet, instead of falling, output kept on rising after 2010: average annual growth in 2011–2015 was equal to 2.5% (IMF 2021). How was this possible in view of the ´destructive austerity'? The dynamic Keynesian model presented in this paper suggests the following answer. The Obama stimulus led to a revival of the economic

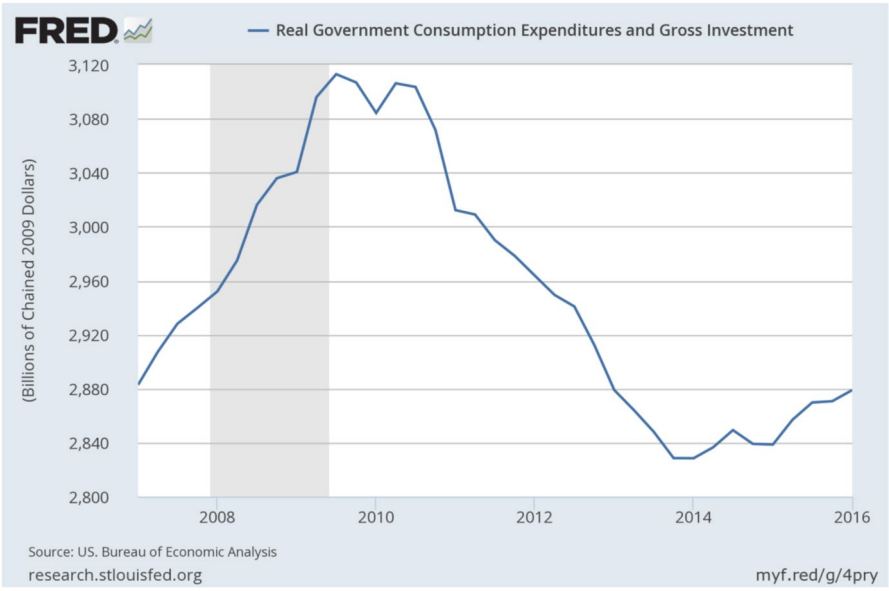

Fig. 4 US Government spending, 2007–2015

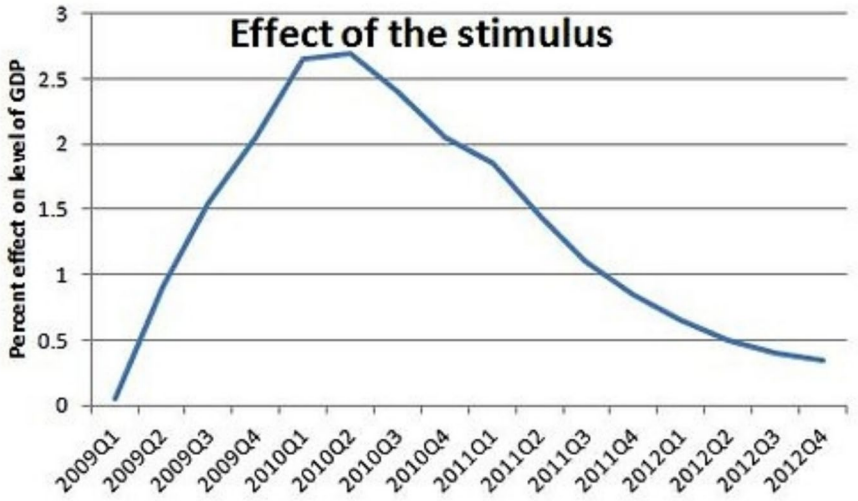

Fig. 5 The effect on GDP of the Obama stimulus as estimated by the US Congress Budget Office

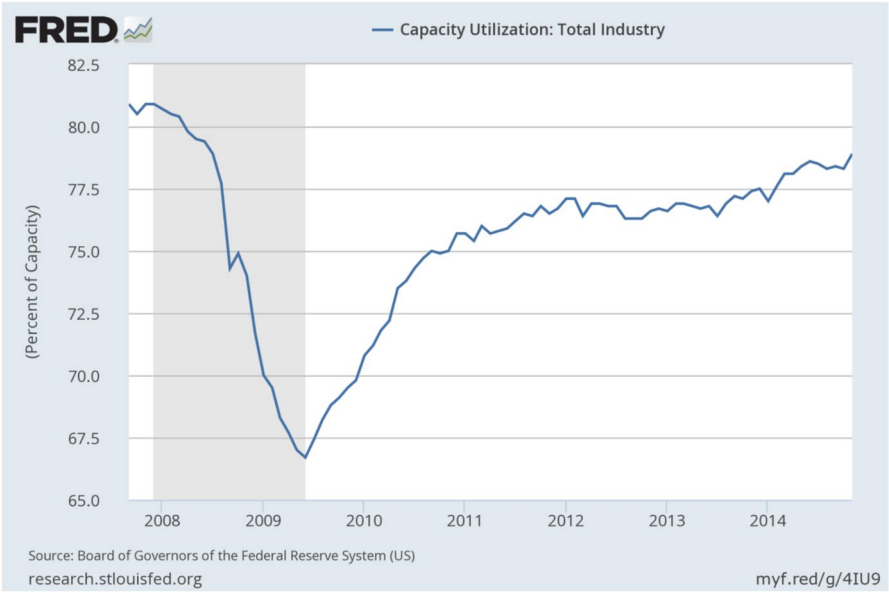

Fig. 6 US capacity utilization, 2007–2014

activity after the middle of 2009. This in turn led to rises in utilization and profits, which afterward produced a revival of private investment in the beginning of 2010 (Figs. 6 and 7). As a result, a dynamic interplay between rising utilization and profits

and increasing investment followed—and this brought about a continuous expansion of output. (Without the reversal of the increase in government spending, the same would have happened but at a faster pace).

5.2 The effect of the fiscal stimulus on the debt-to-GDP ratio

We now analyze the implications of this paper's argument on the debate about the effects of a fiscal stimulus on the debt-to-GDP ratio, the indicator most used to assess the sustainability of public finances.

It is possible to argue that expansionary fiscal policy tends to reduce the debt-to-GDP ratio in the short term (Leão 2013). (i) Through the multiplier an increase in government spending raises output—the denominator of the ratio. (ii) On the other hand, the higher GDP brings about larger tax revenues and lower government social transfers. Therefore, the rise in government spending translates only partially into an increase in debt—the numerator of the mentioned ratio. (iii) Since it raises both the numerator and the denominator, a rise in government expenditure has a priori an uncertain effect on the debt-to-GDP ratio. (iv) However, if we do the arithmetic using estimates of the relevant parameters (the multiplier, the tax rate, and the impact of a higher output on social transfers), we conclude that a rise in government spending raises public debt by a smaller percentage than GDP—and therefore leads to a lower debt-to-GDP ratio.

However, in a static Keynesian framework, this is only a short-term result. The reason is that when the fiscal stimulus is withdrawn output falls back to its initial

Fig. 7 US private investment, 2007–2014

level—but the larger debt remains. Thus, after a brief decline, the debt-to-GDP ratio rises above its level before the stimulus.[9]

By contrast, in the dynamic Keynesian model of this paper if the stimulus is withdrawn only after it has started a virtuous spiral of rising utilization, profits, and private investment, output will grow continuously. In turn, the growing output will generate mounting tax revenues and decreasing government social transfers—and thus lead to a continuous improvement in the budget balance and in the path of public debt. Finally, the decelerating (or declining) debt coupled with the growing GDP will lead to a continuous deceleration (or reduction) in the debt-to-GDP ratio.

The evolution of the US public finances after 2010 illustrates this point. The economic expansion that followed the Obama stimulus led to a big decline in the budget deficit, from almost 10% in 2009 to a little over 2% of GDP in 2015. This combination of dwindling budget deficits and rising nominal GDP led in turn to a halt in the increase of the debt-to-GDP ratio after 2012 (data from the IMF 2021).

The contrast with the evolution of the Eurozone is worth noting. After the beginning of austerity in 2011, Eurozone's output remained roughly stagnant for several years: GDP in 2015 was only 1.3% higher than in 2011 (the US GDP was 9.7% higher). And because the stagnant output prevented an automatic growth in tax revenues and an automatic reduction in government social transfers, the budget deficit declined by only 2.2% of GDP between 2011 and 2015—despite all the austerity. Over the same period the US budget deficit fell by 6.1% of GDP (Data from the Ameco Database 2021).

6 Qualifications

The argument developed in this paper should be somehow qualified. First and foremost, it does not apply to all economic contexts. In fact, it was based on the assumption of a closed economy. But in small economies where imports constitute a very big share of domestic spending our argument will hardly hold, for two reasons. On the one hand, a fiscal stimulus will generate a big increase in imports and a big decline in the trade balance. This in turn may lead to problems in the balance of payments that will force the government to reverse course (as happened, for example, in many Latin American countries in the 1970 s and 1980 s). On the other hand, in economies with a very big propensity to import the Keynesian multiplier is very low—and conceivably lower than the productivity of capital. If this is the case, the paradox of invest, and thus, our argument about the medium-term effects of fiscal policy will not hold.

By contrast, the argument can still be applied to big economies where imports from the rest of the world constitute only a small share of domestic expenditure

[9] The result will be the same if the stimulus is not withdrawn and government spending stays constant at the higher level. In fact, while in this case output will stay constant rather than fall back to its initial level, the budget deficit will remain. Therefore, public debt will keep on growing period after period, and so will the debt-to-GDP ratio.

(namely, the USA, the European Union as a whole, and China). Even so, its applicability to such economies depends critically on the effect of the rate of capacity utilization—and of profits—on investment. As pointed out in Sect. 2, there are theoretical reasons and empirical evidence for this. However, the estimates of the exact magnitude of the effect of utilization on investment are uncertain (Skott 2012). As a result, our argument does not provide a guide for the size of the stimulus that should be implemented in an economy situated below full employment. It can only serve two other purposes. On the one hand, it can help us understand retrospectively the effects a particular past fiscal stimulus had on the path of output, the budget deficit, and public debt over several years. On the other hand, the argument can make policymakers aware that, rather than be restricted to the short term, the effects of a fiscal stimulus can play out over several years—and that this has two implications. The first is that a withdrawal of the stimulus after a couple of years will not necessarily lead to a decline in output. The second implication is that the (medium-term) effects of a fiscal stimulus on the budget deficit and public debt (as a percentage of GDP) are more favorable than suggested by the traditional Keynesian analysis.

Thirdly, we assumed that the marginal propensity to consume and thus the multiplier are constant over time. But they are not: they are higher during the upswings than during the downturns of the economy. For instance, for the period 1960–2011 in the US Trezzini (2011, 583) calculated an elasticity of consumption with respect to net disposable income equal to 1.73 on average during economic expansions, and always lower than 0.4 during recessions. These facts make the upward and downward movements of the economy brought about by fiscal policy respectively stronger and weaker than suggested in this paper.

Fourth and finally, underneath the short- to medium-term movements of economic activity may lie a long-run process of output growth associated with proportional rises in productive capacity and aggregate demand (of the type super-multiplier models attempt to explain through the idea of a rising trend in autonomous investment expenditures (Hicks 1950) and/or in non-capacity creating expenditures (Girardi and Pariboni 2016)). If this is true, the upward and downward movements brought about by specific fiscal policy packages should be seen as mere positive or negative additions to a long-run upward trend of the economy.

7 Comparison between the dynamic Keynesian model and the neo-Kaleckian growth model

In order to clarify the nature of the dynamic Keynesian model used in this paper, it is important to compare its structure with that of the widely used neo-Kaleckian growth model. In a closed economy without government and no saving out of wages, the neo-Kaleckian growth model consists of three equations (see for instance Lavoie 2016, 176–8):

$$I = S \tag{4}$$

$$g^s = S/K = s_p.\pi.u.a - C_p/K \tag{5}$$

$$g^i = I/K = \gamma + \gamma_u.(u\text{-}u_n) \tag{6}$$

Equation (4) defines the equilibrium in the goods market. Equation (5) is the "saving function" where the variables and parameters have the meaning already explained in this paper. Autonomous consumption of capitalists, C_p, was absent from the traditional neo-Kaleckian model; this was used by You and Dutt (1996), Dutt (2013) and Palley (2013) to analyze the long-term effects of fiscal policy. A more recent version of the neo-Kaleckian model has included autonomous non-capacity creating expenditures, including consumption of capitalists and/or other expenditures, growing at an exogenous rate; Dutt (2020) used this version to analyze the long-term effects of an increase in the growth rate of government spending.

We can now make a first comparison between the neo-Kaleckian growth model and our dynamic Keynesian model. Equations (4) and (5) above would be equivalent to Eq. (1) of the multiplier of the dynamic Keynesian model, if this had also assumed an economy without government and no saving out of wages. That is to say, Eqs. (4) and (5) can be reduced to:[10]

$$Y = [1/(s_p.\pi)].(I + C_p) \tag{7}$$

Equation (6) above is the investment function, where γ represents entrepreneurs' expectations about the trend growth of sales. It corresponds to Eq. (3) of the dynamic Keynesian model, with three differences: actual utilization appears without a lag, the constant term does not include the rate of capital depreciation, and besides, it includes a slightly different notion of autonomous investment.

In sum, (i) the neo-Kaleckian model can be reduced to Eqs. (6) and (7), and (ii) these are similar to Eqs. (1) and (3) of our dynamic Keynesian model. This means that the neo-Kaleckian model does not include an equation corresponding to Eq. (2) of our model—an equation according to which investment increases the productive capacity of the economy. Therefore, there is one important difference between the two models. In both models an increase in investment by firms to cope with a rise in utilization (caused by say a fiscal stimulus) leads to a further rise in utilization. However, in the neo-Kaleckian model utilization rises simply because that increase in investment boosts demand and output (Eq. 7). By contrast, in the dynamic Keynesian model utilization rises because the effect of that increase in investment on demand and output exceeds its effect on productive capacity.

[10] Indeed, the profit rate P/K is equal to $(P/Y).(Y/Y_{FC}).(Y_{FC}/K)$; that is $P/K=\pi$.u.a. This being so, Eq. (5) can be re-written as $S/K=s_p.P/K - C_p/K$. In turn, under $S=I$ and considering that $P=\pi.Y$, this equation is equivalent to $I/K=s_p.\pi.Y/K - C_p/K$, therefore to $I=s_p.\pi.Y - C_p$ and finally to $Y=[1/(s_p.\pi)].(I+C_p)$.

8 Conclusion

The traditional analysis of the effects of fiscal policy on GDP and on the debt-to-GDP ratio relies on short-term multipliers. By contrast, this paper used a dynamic model under which an active fiscal policy triggers a multi-year process of mutually-fed changes in the rate of utilization and in private investment: $\Delta G => \Delta u => \Delta I => \Delta u => \ldots$. As a result, the paper concluded that an active fiscal policy affects the paths of GDP and of the debt-to-GDP ratio well beyond the short term.

However, it should be noted that the effects produced by fiscal policy pointed out in the paper do not occur in all economic contexts. In particular, in small economies where imports constitute a very big share of domestic expenditure our argument will hardly hold. First, in these economies a fiscal stimulus may lead to problems in the balance of payments and thus be unsustainable. Second, in such economies the multiplier is very low – and possibly lower than the productivity of capital. If this is the case, the paradox of investment and thus the mentioned medium-term effects of fiscal policy will not hold.

By contrast, the argument is still applicable to big economies where imports from the rest of the world constitute only a small share of domestic expenditure (namely, the USA, the European Union as a whole, and China). For example, the argument is in line, and contributes to explain, the results of three major fiscal policy episodes. First, the argument contributes to explain the strong recovery of the US economy generated by the New Deal, and why this did not lead to increases in the budget deficit and in public debt (as percentages of GDP). Secondly, the argument helps to understand why the European fiscal consolidation of the early 2010 s had negative effects on GDP that extended over several subsequent years. And thirdly, the argument helps to make sense of the fact that the US economy continued to grow after 2010 despite the withdrawal of the Obama fiscal stimulus.

Finally, it is important to say that the applicability of the argument to economic policy should not be overstated. In fact, because the estimates of the magnitude of the effect of utilization on investment are uncertain, the argument does not provide a guide for the size of the stimulus that should be implemented in an economy situated below full employment. Instead, it can only make policymakers aware that, rather than be restricted to the short term, the effects of a fiscal stimulus can play out over several years—and that this has two implications. The first is that a withdrawal of the stimulus after a couple of years will not necessarily lead to a decline in output. And the second implication is that the (medium-term) effects of a fiscal stimulus on the budget deficit and public debt (as a percentage of GDP) are more favorable than suggested by the traditional Keynesian analysis.

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Data availability Source data for Figs. 1, 2, 3, and 4 are provided with the paper.

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