REVIEW OF POLITICAL ECONOMY
https://doi.org/10.1080/09538259.2019.1687146

Putting Austerity to Bed: Technical Progress, Aggregate Demand and the Supermultiplier

Matteo Deleidi [a,b] and Mariana Mazzucato [b]

[a]Roma Tre University, Rome, Italy; [b]University College London, London, UK

ABSTRACT
The paper investigates the determinants of private investment and economic growth from a theoretical perspective. We start with a critical analysis of the crowding-out effect and we present a new version of the Sraffian Supermultiplier: a model that accounts for both the multiplier and accelerator effects. We focus on different types of fiscal policies: generic ones and 'mission-oriented' ones that set a new direction for the economy. We show that mission-oriented policies have the potential to generate the largest positive effect on investments and output growth as well as on innovation processes and labour productivity growth.

ARTICLE HISTORY
Received 20 May 2019
Accepted 8 October 2019

KEYWORDS
Mission-oriented innovation policy; Sraffian supermultiplier; austerity; labour productivity

JEL CODES
E22; E60; O25; O30

1. Introduction

After the 2007 financial crisis and the ensuing sovereign debt crisis across Europe, EU policy was steered by austerity measures, especially in the peripheral Eurozone countries (Italy, Greece, Spain, and Portugal). Austerity, defined mainly as a reduction in government spending to stimulate private investment through reductions in the interest rate, is based on the notion that the government is like a household, that during bad times it should tighten its belt. Post-crisis austerity policies were also accompanied by labour market policies focused on increasing competitiveness through a reduction in unit costs. While the assumption was that austerity policies, besides restoring economic growth and competitiveness, would also mitigate financial market speculation and decrease sovereign debt bond spreads, the reality soon became clear: growth did not return, financial markets remained vulnerable, spreads depend on the latest news, and labour market policies fuel inequality without resulting in higher investment.

Indeed, over the last two years, there has even been a change of heart in the International Monetary Fund (IMF), which has historically been one of the greatest proponents of austerity and wage cuts, or what some have called neoliberalism. In a paper called 'Neoliberalism: oversold?' (Ostry, Loungani, and Furceri 2016), the IMF questioned the foundations of austerity, showing how it has led to weak growth and rising inequality. Indeed, the chief economist of the IMF at the time, Olivier Blanchard, claimed that austerity had failed because the fiscal multiplier was higher than economists assumed (Blanchard and

CONTACT Matteo Deleidi m.deleidi@ucl.ac.uk, matteo.deleidi@uniroma3.it Department of Economics, Roma Tre University, Via Silvio D'Amico 77, 00148, Rome, Italy; Institute for Innovation and Public Purpose (IIPP), University College London, 11 Montague Street, London, WC1B 5BP, UK

Leigh 2013). Low interest rates have led many to argue that governments should be spending on areas like infrastructure to bring growth back, rather than continued spending cuts (IMF 2014).

But why has this eureka moment not led to a fundamental shift in policies? In this paper, we argue that while different economists, and the media, have questioned austerity, its theoretical pillars remain alive and well. If austerity is to be retired, we must debunk these pillars. We embark on this by focusing on the variables affecting the dynamics of business investment. While traditional austerity theory assumes that business investment is sensitive to the interest rate, in fact we show that the former is strongly affected by expectations of future growth opportunities, which in turn are positively related to expansionary fiscal policies. Furthermore, we argue that, rather than positing austerity versus generic public investment, it is essential to assess different types of fiscal policy, that is, tax incentives, government spending and government expenditure oriented toward promoting structural change, as in the case of mission-oriented innovation policies. The main novelty of the paper is to implant the class of government expenditure in innovation in the Sraffian supermultiplier model of growth and then show how these fiscal policies can produce the largest positive effect on output, expectations and private investment as well as on technical progress and labour productivity growth.

The paper is divided as follows. Section Two provides the theoretical basis for austerity following the *Neoclassical* and the *New-Keynesian* perspectives. Additionally, we propose a critique to these views on the ground of the *Classical-Keynesian* theory. Section Three presents an alternative positive view on the recipes needed for growth. This addresses the notion of a supermultiplier, looking at the effects of autonomous components of aggregate demand on private investment and GDP growth. Section Four complements this perspective by looking at the effect of different types of fiscal policies — such as innovation policies, and mission-oriented policies in particular — can have on business expectations, investment and labour productivity dynamics. Section Five concludes by discussing the implications of the results for future policies.

2. Fiscal Austerity and the Crowding-Out Effect: A Theoretical Inconsistency

In this section, we will analyse the effect of fiscal policies on the level of investment through the lenses of different theoretical perspectives: the standard neoclassical view, the New-Keynesian (henceforth, NK) perspective and the Classical-Keynesian (henceforth, CK) theory.

According to the neoclassical perspective, economic growth fostered by a cut in public expenditure through a reduction of the interest rate and in unit labour costs is referred to as expansionary austerity (henceforth, EA). EA is also described as a non-Keynesian effect of a fiscal adjustment (Giavazzi and Pagano 1990, 1996; Alesina et al. 2002). In fact, according to the EA narrative, the government spending multiplier would assume values equal to zero or even negative. To put it simply, a one-euro increase in public expenditure is supposed to be inconsequential or even recessive on total output. The EA measures are supposed to affect output through investment, consumption, and net exports. In this paper, we aim at discussing the determination of investment, disregarding the effects of fiscal policy on consumption patterns and external competitiveness.

According to EA supporters, an increase in public expenditure increases the interest rate and then crowds out private investment (Giavazzi and Pagano 1990; Alesina et al. 2002). Conversely, a reduction of public spending is assumed to stimulate business investment by means of a decrease in the interest rate, which is supposed to increase profitability and therefore the volume of capital goods employed in production. Additionally, by reducing (permanently) government spending rather than by increasing taxes, this is supposed to stimulate growth more rapidly. Indeed, a permanent government spending cut is supposed to improve agents' expectations, since it should lead to a stabilisation or even a reduction of the debt-to-GDP ratio, making a future default on government debt less likely. This would reduce the risk premium requested by economic agents, which, in turn, would decrease the long-term interest rate and increase the corresponding asset price. Subsequently, both the wealth effect generated by the rise in asset prices of government bonds and the corresponding fall in the interest rate should trigger an investment boom (Alesina and Ardagna 2010).

Following the EA perspective, the interest rate is a real phenomenon that equates investment with the full-employment savings both in the short and long-run. The flexibility of the interest rate combined with a downward investment demand curve allows to reach a full-employment equilibrium. In cases of unemployment of the factors of production, a full-employment equilibrium is achieved by means of a decrease of real interest rate and real wage, determined by the well-known market clearing mechanism.

Compared with the EA view, NK economists maintain a different short-run perspective concerning the role played by fiscal policy. According to the NK view, the government is supposed to intervene in the market in order to reduce frictions hampering the achievement of the natural full employment equilibrium. In this theory, sticky prices and wages (Romer 2000), imperfection and asymmetric information, market failures (Stiglitz 1989), a monetary policy constrained by a zero lower bound (Summers 2014), and the liquidity trap (Krugman 1998) are the main obstacles to equilibrium. These issues justify government intervention since these barriers are supposed to create a Keynesian problem of insufficient aggregate demand. Thus, the implementation of expansionary fiscal and monetary policies increases output and employment in the short-run.[1] However, when these frictions are solved, the neoclassical market-clearing mechanism, compatible with the EA perspective, leads to a natural full-employment equilibrium both in the capital and labour markets. In particular, being a downward-sloping investment and labour demand curve and being the path to reach a full-employment equilibrium unhindered by obstacles, a decrease in real interest rates and wages leads investment and labour demand to adapt to full-employment savings and labour supply respectively. Consequently, the role played by the aggregate demand and then by fiscal policies is thus relegated to a short-run analysis or to a study of the economic cycles, recessions, and depressions (Tobin 1975) by leaving the long-run output determination regulated by supply-side forces, as supposed by the neoclassical view (Woodford 2003).[2] Therefore,

[1]In the case of a negative natural interest rate under a zero lower bound condition or a liquidity trap situation, NK authors recognize that monetary policy is ineffective to stimulate aggregate demand.

[2]A recent stream of literature in macroeconomics, by rehabilitating the concept of 'Secular Stagnation' (Summers 2014), affirms that protracted and prolonged falls in output can influence also the potential output (Fatás and Summers 2018). In particular, cyclical conditions – for instance, a fall of aggregate demand – lead to permanent effects on both aggregate supply and potential output by means of a mechanism that is typically termed 'hysteresis' (Yellen 2016).

the idea of expansionary policy measures relevant in the short, but not the long-run, allows NK economists to reconcile with the pure neoclassical view.[3]

We seek to challenge both views, by discussing the theoretical underpinning of the crowding-out effect: the notion of an equilibrium (or natural) interest rate and the existence of a downward-sloping investment demand curve incorporated in the aggregate demand schedule (Romer 2000).[4] These theoretical pillars have allowed the incorporation of the pure standard neoclassical view into the long-run NK view, thus relegating to a short-run analysis the novel argument of the Keynesian revolution (Garegnani 1979): the idea that investment creates an equal volume of savings through changes in the output level (Keynes 1936).

Both in the NK and EA perspectives, a decreasing investment demand curve can be justified by means of the neoclassical concept of marginal productivity of capital and therefore grounded on the direct substitution mechanism between the factors of production, namely labour and capital. According to neoclassical theory, a fall in the interest rate should lead firms to shift toward capital-intensive methods of production. The preservation of this mechanism would ensure the return to the neoclassical theory in which the interest rate is seen as an instrument capable of generating an investment level compatible with full employment, by limiting the principle of effective demand to a short-run analysis or to the study of economic cycles. In fact, in the long-run, when prices are flexible and objective elements prevail over psychological and subjective factors, the interest rate is considered a sufficient instrument to restore full employment and to allow investment to adjust to savings (Garegnani 2015).

As a consequence, if we want to extend the role played by aggregate demand in determining output in the long-run, we have to criticise the substitution mechanism on which the long-run NK models are based. In particular, we have to untie the link between interest rates on the one hand and the level of investment and the process of accumulation on the other. In this regard, the 'Capital Controversy' provides the theoretical background to refute the existence of a decreasing marginal productivity of capital, a demand for investment elastic with respect to the interest rate, and a natural interest rate that equates investment to full-employment savings. According to Sraffa (1960) and Garegnani (1970), when we assume several production techniques and heterogeneous capital goods, the re-switching of techniques and the reverse capital deepening undermine the neoclassical assumption based on the substitution mechanism between labour and capital. To be clear,

[3]The NK perspective seems endorsed by a prominent institute like the IMF, which has recently criticized the EA narrative. Episodes of fiscal consolidation have led to a fall in output, an increase in the unemployment rate and an increase of the debt-to-GDP ratio (Guajardo, Leigh, and Pecatori 2011; Ostry, Loungani, and Furceri 2016). According to IMF, expansionary fiscal policies are effective in fostering GDP, investment and employment growth (Leigh et al. 2010; Guajardo, Leigh, and Pecatori 2011). In a recent empirical study, Blanchard and Leigh (2013) show that the fiscal multiplier assumes a positive value equal to 1.5 suggesting that a fiscal consolidation generates a Keynesian effect, thus causing an economic recession rather than an expansion. Yet, despite IMF economists support the positive Keynesian effects of an expansionary fiscal stimulus in the short-run, they maintain that fiscal consolidation is beneficial in the long-run, as this lowers public debt and subsequently reduces the interest rate and distortionary taxes (Leigh et al. 2010).

[4]In this paper, we criticise the expansive austerity measures by discussing the direct relationship between interest rate and investment. However, additional mechanisms supporting the expansive austerity measures should also consider the role of consumption in light of the well-known 'Ricardian Equivalence'. For an in-depth theoretical and empirical review of the inconsistency and weakness of the EA measures, see among others Auerbach and Gorodnichenko (2012), Boyer (2012), Jordà and Taylor (2016), Botta (2018) and Fatás and Summers (2018). Additionally, for a discussion of the 'Ricardian Equivalence' and its underlying assumptions, see among others Romer (2007), Ciccone (2013) and Hayo and Neumeier (2017). Additionally, for a monetary critique to these views, namely a discussion on the idea of an endogenous rate of interest, see among others Moore (1988), Rochon (2001) and Lavoie (2014).

different interest rates allow producers to use the same method of production and therefore the same factor intensity. Subsequently, we cannot sketch a downward-sloping investment demand schedule summarising a general negative relationship between the interest rate and the level of investment since no automatic mechanism ensures that firms adopt a more capital-intensive production technique when the interest rate decreases. Therefore, the crowding-out mechanism is unfeasible, given the non-existence of a downward-sloping investment demand curve and an equilibrium interest rate.

3. The Sraffian Supermultiplier

The 'Capital Controversy' represents the cornerstone through which the CK approach has extended the principle of effective demand to a long-run analysis. In particular, the CK framework, by refusing the traditional theory of the distribution, a downward investment demand schedule, and the neoclassical substitution mechanism, affirms that the investment is independent of savings both in the short and long-run. On the contrary, investment determines savings through changes in the output level. The CK is

> essentially based on the recognition of the elasticity with which output responds, in the long no less than in the short period, to changes in aggregate demand. Such elasticity, which is at the core of Keynes's contribution, in the short period is related to the varying utilization of installed capacity, while in the long period is further increased by the possibility of creating new resources, or destroying the existing ones, at different possible speeds. (Trezzini and Palumbo 2016, p. 504)

Within the CK approach, some authors have developed the Sraffian Supermultiplier model (henceforth, SSM) to describe the long-run relationship between the level of demand and the level of output. This model, initially proposed by Serrano (1995) and Bortis (1997) and then developed by Cesaratto, Serrano, and Stirati (2003) and Freitas and Serrano (2015), shows the existing positive relationship between the autonomous components of aggregate demand and the level of output, combined with a function in which investment is endogenously determined by the level of demand.[5] We develop a new SSM model which considers the role played by monetary policy, different social classes and fiscal policies.

Initially, we need to classify the components of aggregate demand, distinguishing between (i) autonomous and induced, and (ii) capacity- or non-capacity creating. Table 1 shows this classification where government spending, net export, total consumption, and business expenditures are non-capacity-creating, and only gross investment is able to create productive capacity. We consider public expenditure, exports, autonomous consumption, and autonomous business expenditures as autonomous variables, that is, independent of the current level of income (Cesaratto, Serrano, and Stirati 2003).[6] Moreover, business expenditure has both exogenous and endogenous components, positively influenced by a specific type of public expenditure.

[5]A recent lively debate on the role played by autonomous components has been developed by Allain (2015), Lavoie (2016), Hein (2018) and Palley (2019), among others. The notion of the supermultiplier and the role played by the autonomous components of aggregate demand in affecting the economic growth was also shared and acknowledged by contributions carried out by Kaldor (1940, 1970, 1975, 1989). Kaldor and his followers focused on the role of export and the external demand (Kaldor 1970) and Thirlwall (1979).

[6]For an in-depth review of the concept of autonomous expenditures, see the recent special issue published in Metroeconomica entitled 'Autonomous Demand, Capital Utilization and Economic Growth'. Particularly, see among others, Dutt (2019), Fiebiger and Lavoie (2019), Palley (2019) and Serrano, Freitas, and Bhering (2019).

Table 1. Components of aggregate demand.

	Capacity Creating	Non–Capacity Creating
Exogenous		Government expenditures, Export, Autonomous consumption, Autonomous business expenditure, Autonomous taxes and Autonomous transfers
Endogenous	Gross Investment	Induced consumption, Induced import, Induced business expenditure

Let us consider an open economy with a government sector and two social classes (workers and capitalists). The current level of output (Y) is equal to aggregate demand, which is the sum of consumption (C), business expenditure (BE), gross investment (I_{i}), public expenditure (G), and net export ($E - M$). This is represented in equation 1:

$$Y = C + \mathrm{BE} + I_{\mathrm{i}} + G + E - M \tag{1}$$

The consumption function is developed and implemented starting from equations presented by Pariboni (2016). Equations 2 and 3 represent respectively the total consumption of workers (C_{w}) and of capitalists (C), which include an autonomous and an induced component. The former is independent of current income and is financed in the credit market via an endogenous money creation process. The latter is an induced component dependent on the disposable income of workers (Y_{Dw}) and capitalists (Y_{D}).

$$C_{\mathrm{w}} = C_{\mathrm{aw}}(i; X_{\mathrm{w}}) + c_{\mathrm{w}} Y_{\mathrm{Dw}} \tag{2}$$

$$C_{\Pi} = C_{a\Pi}(i; X_{\Pi}) + c_{\Pi} Y_{D\Pi} \tag{3}$$

C_{aw} and $C_{\mathrm{a}\Pi}$ represent autonomous consumption that are negatively influenced by the interest rate (i) — set exogenously by the central bank (Moore 1988; Rochon 2001; Lavoie 2014) — and by the lending policy instruments of banks (X_{w} and X). In particular, a fall in interest rates reduces borrowing costs to finance the purchase of autonomous consumption and it can be seen by borrowers as an increase in their purchasing power, or as a decrease in the price of consumption goods. Moreover, autonomous consumptions are also negatively affected by a range of bank lending policy instruments that can influence the level of the effective demand for loans. In equations 2 and 3, such policy instruments are represented by variable X. This variable varies between 0 and 1 and it is a proxy for the assessment by banks of borrowers' creditworthiness (Fontana and Setterfield 2010) or, rather, it measures the ability of the banking system to provide loans to different categories of borrowers.[7] X and X_{w} are respectively the assessment of capitalists' and workers' creditworthiness. c_{w} and c are respectively the marginal propensity to consume of workers and capitalists, and we assume that $c_{\mathrm{w}} > c$ (Kaldor 1955). We derive the total consumption function (4) by combing equation 2 and 3 and by substituting total transfers (TR), total taxes (T) and wage and profit shares to disposable incomes (Y_{Dw} and $Y_{\mathrm{D}\Pi}$).

$$\begin{aligned} C = {} & C_{\mathrm{a}}(i; X_w; X_{\Pi}) + c_{\mathrm{w}}(\mathrm{TR}_{\mathrm{aw}} - T_{\mathrm{aw}}) + c_{\Pi}(\mathrm{TR}_{\mathrm{a}\Pi} - T_{\mathrm{a}\Pi}) \\ & + [c_{\mathrm{w}}\omega(1 - t_{\mathrm{w}} - t_{\mathrm{rw}}) + c_{\Pi}(1 - \omega)(1 - t_{\Pi} - t_{\mathrm{r}\Pi})]Y \end{aligned} \tag{4}$$

[7]When X is equal to 0, the banking system does not credit-constrain borrowers. Conversely, the closer X is to one, the more the banking system tends to constrain borrowers. The trustworthiness of borrowers can be measured in terms of, for example, banks' collateral request.

TR_{aw} and TR_a are the government autonomous transfers to wage- and profit-earners. T_{aw} and T_a are the autonomous taxes to workers and capitalists. ω is the wage share and $1 - \omega$ is the profit share. t_w and t are respectively the workers' and capitalists' tax rates. t_{rw} and t_r represent the workers' and capitalists' transfers coefficients.[8]

$$I_i = v(d + g_e)Y \tag{5}$$

The gross investment function is represented in equation 5. In the SSM, gross investment (I_i) is fully induced and is positively affected by the normal capital-output ratio (v)[9] that represents cost minimising technical conditions of production and by the replacement coefficient or also termed the rate of depreciation of capital (d). Furthermore, the actual level of effective demand and the expected rate of growth of the normal level of effective demand (g_e) have a positive influence on the level of investment. In other words, firms increase their capital stock by increasing the level of their investment in order to satisfy a greater demand for goods and services and when technical innovations occur (Garegnani 2015).

Furthermore, the investment function (equation 5) does not imply that the actual degree of capacity utilisation (u) is equal to the normal desired by entrepreneurs (u_n), but a continuous process of adjustment toward the latter is operational. u_n can be defined as the normal degree of capacity utilisation that minimises the costs of production (Kurz 1986; Girardi and Pariboni 2018).[10] In the short run, the equilibrium between saving and investment is realised through a flexible degree of capacity utilisation. In the long run, a gradual adjustment of the capital stock is determined by changes in long-term expectations (g_e) and by a flexible accelerator mechanism. Such changes occur by means of reconsiderations by entrepreneurs about the expected growth of the effective demand (g_e) in light of the current rate of growth of output (g_y), with the former moving toward the latter. However, as firms know that demand fluctuates, entrepreneurs do not consider any changes in demand as a stable and permanent change. Further, they adjust their capital stock by increasing (when $g_y > g_e$) and decreasing (when $g_y < g_e$) investment gradually over time rather than in one single period through a flexible accelerator process.[11]

$$G = G_1 + G_2 \tag{6}$$

Equation 6 represents government spending, which is composed of two types of public expenditure. The former is based on the purchase of goods and services which are directly fruited (G_1) and the latter is oriented to promoting structural change, namely stimulating technical progress by means of industrial policies (G_2). For instance, among the latter, we can include mission-oriented investment, which has led to major technological advances,

[8]Both total taxes and the total transfers depend both on an autonomous component and on an endogenous component related to wage and profit shares.

[9]Following Girardi and Pariboni (2016), we assume that actual degree of capacity utilisation is equal to the ratio between the actual level of output and the normal level of output. Hence, the normal degree of capacity utilisation is equal to one. Subsequently $v = K/y^n$, where K is the actual capital stock and y^n is the normal level of output desired by entrepreneurs.

[10]We define the degree of capacity utilisation as the ratio between actual and normal output. It follows that normal utilisation is equal to 1.

[11]Since some fluctuations of demand could not be considered permanent, entrepreneurs do not immediately undertake a full adjustment of productive capacity to effective demand; rather, such adjustments occur by a flexible accelerator process. Notwithstanding, a flexible degree of capacity utilisation allows firms to meet all expected peaks of demand with the current installed capacity (Ciccone 1986).

such as the DARPA (Department of Defense) investment on ARPANET which became in the modern-day internet, the ARPA-E (Department of Energy) investments in renewable energy, or the National Institutes of Health investments in the biotechnology sector (Block and Keller 2009; Mazzucato 2013, 2018). This kind of public expenditure is based on a specific and forward-looking industrial policy, oriented to finding solutions for technical problems (Pivetti 1992), leading to new technological opportunities and directions for technical change (Mazzucato 2013).

$$\mathrm{BE} = \mathrm{BE_a} + \gamma G_2 \tag{7}$$

Equation 7 shows the business expenditure (BE). In BE, we can include managerial expenses, for example, unproductive consumption, and R&D. However, we split BE into exogenous and endogenous components. Particularly, we consider as autonomous $\mathrm{BE_a}$ the above-mentioned unproductive consumption, such as the purchase of a company car, executive jet, marketing expenditure, etc., and a share of R&D due to an intrinsic capitalist competition. However, firms' R&D is composed of an endogenous component driven by public expenditure oriented to promote innovation. In other words, specific types of public spending, for example, military expenditure, are able to induce and positively influence R&D of private firms (Mazzucato 2013, 2016, 2018; Cantner and Vannuccini 2018) by generating spin-offs through which research and innovation are developed and diffused to other sectors (Pivetti 1992; Crespi and Guarascio 2018). In each of the above cases, state intervention created a new landscape (rather than simply fixing market failures), which raised the expectations of business, resulting in an increase in private expenditure (Mazzucato 2016, 2018). From an analytical standpoint, we introduce in equation 7 γ — a reaction coefficient greater than zero — that shows how an increase of G_2 leads to an endogenous rise of firms' BE.[12] In particular, the size of γ depends on the capacity of industrial policy to capture and involve more sectors in the economy. For instance, an industrial policy focused on one specific sector will show a lower γ compared to a policy that involves several sectors across the economy, as in the case of mission-oriented spending (Mazzucato 2018).

Finally, equations 8 and 9 represent export and import. For what concerns equation 8, export is positively influenced by foreign demand (Y_{frn}) and by a depreciation of the exchange rate (ε), which decreases national prices compared with foreign prices. In this regard, the central bank can entail considerable changes of the exchange rate by varying the interest rate (i) (Arestis and Sawyer 2004). In particular, a decrease of the domestic interest rate makes domestic deposits less attractive compared to those denominated in foreign currencies. This leads to an outflow of capital and a depreciation of the domestic currency. The lower value of the national currency allows national goods to be less expensive than foreign goods, thus increasing exports (E_{ela}) (Mishkin 1995).[13]

$$E = E_{\mathrm{A}}(Y_{\mathrm{f}}) + E_{\mathrm{ela}}[\varepsilon(i)] \tag{8}$$

At the same time, the depreciation of the exchange rate reduces imports (M_{ela}) since

[12]Such theoretical relationship is confirmed by a recent empirical paper which examines the impact of public R&D on private one on a panel of twenty-six countries (Moretti, Steinwender, and Van Reenen 2016) and for the US economy (Deleidi and Mazzucato 2019).

[13]In order to increase net exports by means of an exchange rate devaluation, the Marshall-Lerner condition has to be satisfied: the sum of export and import price elasticities has to be greater than 1.

foreign goods become more expensive compared to national goods. Moreover, following equation 9, if there is an increase in national output (Y), imports increase since the marginal propensity to import (m) assumes a value greater than zero.

$$M = mY + \varepsilon M_{\mathrm{ela}}[\varepsilon(i)] \tag{9}$$

Although, on the one hand, the exchange rate can be considered an instrument able to help the domestic net export ($E - M$), on the other hand, the expansionary effect of an exchange rate devaluation could be partially offset by an expansionary monetary policy carried out in foreign countries. Additionally, the technological advantages driven by innovation processes, enriching the productive matrix of a country, become factors that determine the growth of exports and the fall of import penetration (Cesaratto, Serrano, and Stirati 2003; Simonazzi, Ginzburg, and Nocella 2013).[14]

Equation 1, along with equations 4–9, together allow us to obtain the output supermultiplier. Equation 10 shows that the level of output is determined by an autonomous component of aggregate demand (numerator of equation 10) and by the supermultiplier (denominator of equation 10).[15]

$$Y = \frac{C_{\mathrm{a}}(i;X_{\mathrm{w}};X_{\Pi}) + c_{\mathrm{w}}(\mathrm{TR}_{\mathrm{aw}} - T_{\mathrm{aw}}) + c_{\Pi}(\mathrm{TR}_{\mathrm{a}\Pi} - T_{\mathrm{a}\Pi}) + \mathrm{BE}_{\mathrm{a}} + G_1 + (1+\gamma)G_2 + E_{\mathrm{A}}(Y_{\mathrm{f}}) + E_{\mathrm{ela}}[\varepsilon(i)] - \varepsilon M_{\mathrm{ela}}[\varepsilon(i)]}{1 - [c_{\mathrm{w}}\omega(1 - t_{\mathrm{w}} - t_{\mathrm{rw}}) + c_{\Pi}(1-\omega)(1 - t_{\Pi} - t_{\mathrm{r}\Pi})] - v(d + g_{\mathrm{e}}) + m} \tag{10}$$

The numerator of equation 10 is characterised by autonomous components of aggregate demand that, for sake of simplicity, we call Z in equation 11

$$\begin{aligned} Z = {} & C_{\mathrm{a}}(i;X_{\mathrm{w}};X_{\Pi}) + c_{\mathrm{w}}(\mathrm{TR}_{\mathrm{aw}} - T_{\mathrm{aw}}) + c_{\Pi}(\mathrm{TR}_{\mathrm{a}\Pi} - T_{\mathrm{a}\Pi}) + \mathrm{BE}_{a} \\ & + G_1 + (1+\gamma)G_2 + E_{\mathrm{A}}(Y_{\mathrm{f}}) + E_{\mathrm{ela}}[\varepsilon(i)] - \varepsilon M_{\mathrm{ela}}[\varepsilon(i)] \end{aligned} \tag{11}$$

Moreover, in equation 12, we can denominate the marginal propensity to save as s

$$s = 1 - [c_{\mathrm{w}}\omega(1 - t_{\mathrm{w}} - t_{\mathrm{rw}}) + c_{\Pi}(1-\omega)(1 - t_{\Pi} - t_{\mathrm{r}\Pi})] + m \tag{12}$$

Subsequently, we can substitute equations 11 and 12 in equation 10 and the output supermultiplier can be represented as shown in equation 13

$$Y = \frac{Z}{s - v(d + g_{\mathrm{e}})} \tag{13}$$

As shown in equation 13, a rise in the autonomous components of aggregate demand, as well as a rise in the marginal propensity to spend, leads to an increase in total output. However, whereas the output trend growth rate is driven by the trend growth rate of the autonomous components (Z), a change in marginal propensity to consume causes a permanent level effect (Freitas and Serrano 2015). For instance, a single increase in the marginal propensity to spend (a decrease in s in equation13), for example determined by an increase in wages, generates a higher rate of growth of output only in the period immediately after the change of distribution. Notwithstanding, when the supermultiplier effect vanishes, the economy resumes growing at the autonomous components rate (g_{z}).

[14]Yet, despite we have assumed that the exchange rate can affect the trade balance, the ability of the exchange rate to stimulate export and output growth has been questioned by several economists (see among others, Alejandro 1963; Krugman and Taylor 1978; Frenkel and Taylor 2006; Dvoskin, Feldman, and Ianni 2019).

[15]In order to have an economically significant solution, the denominator of equation 10 has to be positive.

Additionally, the output level represented by equation 13 is not necessarily associated with a normal degree of the capacity utilisation (u_n). However, u_n has to be regarded as a centre of gravitation toward which the actual degree of capacity utilisation (u) is presumed to be attracted. This attraction occurs through a continuous tendency of productive capacity to adjust to the trend of effective demand by means of slow, gradual changes in investment behaviour (Cesaratto, Serrano, and Stirati 2003). Such changes occur by means of reconsiderations by entrepreneurs about the expected trend rate of growth of the effective demand (g_e), based on the current rate of growth (g_y). The behaviour through time of long-term expectations about the growth of effective demand can be represented by equation 14:

$$\dot{g}_e = x(g_y - g_e) \tag{14}$$

where x is a reaction coefficient. If x is equal to 1, equation 14 shows a rigid accelerator process. However, since some fluctuations of demand could not be considered by firms as permanent, a gradual adjustment driven by a flexible accelerator is operative. Hence, x assumes positive values less than 1 ($0 < x < 1$). The gradual process of the revision of the expectations (in equation 14) allows a tendency to the alignment of the actual output growth rate, the expected growth rate, and the rate of growth of capacity. Any discrepancy between g_e and g_y also denotes a difference between the rate of growth of capacity and the output growth rate. To clarify this issue, it can be useful to start our analysis by simply assuming a fully adjusted position in which normal capacity utilisation (u_n) is realised. If a divergence between the actual and the expected rate of growth occurs, this leads to a symmetrical deviation of the level of output to the level of normal output, and thus a symmetrical discrepancy between u and u_n. The process described by equation 14 allows the required adjustment in the capacity by means of changes in investment (Pariboni 2015, 50). Such a process ceases in the fully adjusted position where $u = u_n$ and $g_y = g_z = g_e$[16]

Analysing dynamically equation 13, we can represent the rate of growth of output in equation 15

$$g_y = g_z + \frac{v(\dot{g}_e)}{s - v(d + g_e)} \tag{15}$$

where g_z is the current rate of growth of the autonomous components of aggregate demand and $\dot{g}_e$ represents the change over time of the expected growth rate of demand. When investment function (5) is analysed dynamically, the rate of growth of investment (g_I) can be summarised in equation 16

$$g_I = g_y + \frac{\dot{g}_e}{d + g_e} \tag{16}$$

meaning that the rate of growth of investment depends on the growth rate of current output and the dynamic of expected demand.

[16]For an in-depth review on the notion of a fully adjusted position, see among others Serrano (1995), Cesaratto, Serrano, and Stirati (2003), Cesaratto (2015), and Freitas and Serrano (2015). Additionally, for a review of the static and local dynamic stability conditions of the SSM, see Freitas and Serrano (2015) and Lavoie (2016). Furthermore, for the stability condition of this specific model based on the investment function as in equation (5), see Pariboni (2015, Appendix A, pp. 87–89, equations A9–A11). Specifically, to have the local stability of the model, the marginal propensity to spend has to be less than one. In our model, $v * (x + d + g_z) + c_w * \omega * (1 - t_w - t_{rw}) + c * (1 - \omega) * (1 - t - t_r) < 1$.

Moreover, by starting from equation 5 and defining rate of growth of capital as $g_k = (I/K) - d$, we can write g_k as follows in equation 17:

$$g_k = u\,(d + g_e) - d \tag{17}$$

Equation 17 shows that for a given g_e, the accumulation depends on the realised degree of capacity utilisation and firms will accumulate faster when u is higher. Specifically, when $g_k = g_e$, u is equal to 1 and $u = u_n = 1$ (see also footnote 9); when $g_k < g_e$, $u < u_n$ and then $u < 1$; finally, when $g_k > g_e$, $u > u_n$ and therefore $u > 1$.

In light of this model, we can understand that the rate of output growth and investment is strictly related to the rate of growth of autonomous components of aggregate demand passing through a multiplier and an accelerator effect. Therefore, stimulating aggregate demand becomes necessary in terms of output and investment growth, not only during a period of economic slowdown or only in the short-run, but in the long-run when the possibility of creating new resources and new productive capacity increases and it becomes particularly relevant (Trezzini and Palumbo 2016). Fiscal austerity measures negatively affect macroeconomic performances and, simultaneously, expansionary fiscal policies generate positive effects on output throughout the business cycle. Furthermore, if expansionary policies are sufficiently persistent to change entrepreneurs' current expectations of growth (g_e), gross investment also has to increase in order to satisfy a greater expected demand for goods and services.

4. Fiscal Policies, Technical Progress and the Supermultiplier

Following the SSM model and the line of reasoning developed by Mazzucato (2013, 2016, 2018), in next subsections we analyse how different types of fiscal policies can influence level of output, the expectation of growth and the investment level. In addition, we show how specific government spending can stimulate innovation and how the latter affects both autonomous and induced components of aggregate demand. Additionally, in light of the Kaldor-Verdoorn law and following the recent contribution of Nah and Lavoie (2019), we will show the effect of alternative types of fiscal policies on labour productivity growth.

4.1. Fiscal Policies and Expectations of Growth

In order to detect the relationship between fiscal policies and the expectations of growth of aggregate demand (g_e), we assume that the government exogenously decides to pursue an expansionary fiscal policy by changing the rate of growth of the fiscal autonomous components. We assume that the state — alternatively and permanently — changes of the same magnitude the rate of growth of one of the above-mentioned fiscal autonomous components.

This permanent change generates both different level effects and simultaneously modifies the trend growth rate. Subsequently, this modification alters the expectations of aggregate demand growth (g_e) and therefore affects the value assumed by the supermultiplier (see equation 10 and 13). Furthermore, alternative types of fiscal policy produce different output levels, depending on the values assumed by the supermultiplier. These generate different output growth rates (g_y) during the phase of transition towards a new fully-adjusted position or, in other terms, in the traverse between one steady state and the other one. Thus, alternative fiscal policies will induce different expected growth rates of aggregate demand, impacting in various ways on investment.[17]

In order to explain this influence on expectations, we focus on G_1 and G_2 and later we introduce the effect of a change in the rate of growth of autonomous transfers and taxes. An increase in the rate of growth of G_1 and G_2 raises the trend growth rate of the economy and generates two different level effects on output. Starting from equation 10, we can represent different effects of alternative public expenditure through the following relationship (18):

$$\Delta G_1 \frac{1}{s - v(d + g_e)} = \Delta Y_{G1} < \Delta Y_{G2} = \frac{1 + \gamma}{s - v(d + g_e)} \Delta G_2 \tag{18}$$

In relationship (18), we can show such inequality only in the period immediately after the increase of the growth rate of G_1 and G_2. In particular, during the transition toward a new fully adjusted position, a larger supermultiplier generates a greater output growth rate, whether the public spending is targeted towards G_2 rather than G_1.[18] Although in a fully adjusted position the output growth rate and the expected effective demand growth rate are equal to growth of exogenous components of the aggregate demand ($g_y = g_e = g_z$), during the adjustment process toward a normal equilibrium position, the expected rate of growth of the effective demand (g_e) diverges from the trend growth rate of autonomous components (g_z). In particular, changes in g_e are influenced by the realised output growth rate (g_y), which, in our example, depends on the effect of different types of public spending on output growth (see equation 14).

When autonomous transfers and taxes are considered, the level effects generated by alternative types of fiscal policy are summarised in the inequality (19):

$$\frac{1 + \gamma}{s - v(d + g_e)} > \frac{1}{s - v(d + g_e)} > \frac{c_w}{s - v(d + g_e)} > \frac{c_\Pi}{s - v(d + g_e)} \tag{19}$$

The supermultiplier related to G_2 assumes the largest value since $\gamma > 0$. By contrast, the supermultiplier related to autonomous capitalists' transfers and taxes is the lowest value since $c < c_w < 1$.

As a consequence, during the process of adjustment toward a new equilibrium position, alternative fiscal policies generate various growth rates of output, through the different values that the supermultiplier can assume (see inequality 19). Therefore, we can summarise these effects on output growth (g_y) with the following inequality (20):[19]

$$g_{y\Delta G_2} > g_{y\Delta G_1} > (g_{y\Delta TR_{aw}} = g_{y\Delta T_{aw}}) > (g_{y\Delta TR_{a\Pi}} = g_{y\Delta T_{a\Pi}}) \tag{20}$$

[17]In a fully adjusted position, capacity follows the trend of effective demand, $g_e = g_z$ and the degree of capacity utilisation is equal to the planned utilisation rate ($u = u_n$). (Cesaratto, Serrano, and Stirati 2003, 44).

[18]In a fully adjusted position where $g_e = g_z$, the trend growth rate generated by alternative government spending will be the same:

$$\Delta G_1 \frac{1}{s - v(d + g_z)} = \Delta Y_{G1} = \Delta Y_{G2} = \frac{1 + \gamma}{s - v(d + g_z)} \Delta G_2.$$

Only a further change in the growth rate of autonomous components can generate the inequality shown in (18).

[19]Here a twofold issue has to be highlighted. First, compared to the remaining variables presented in inequality (20), exogenous taxes have to decrease in order to generate a positive effect on output (see equation 10); second, for the sake of simplicity, we do not consider any affects in the change of the tax rate and of transfers coefficient.

The subscript presented in each component represents the implementation of alternative fiscal policies by the government. Only during the transition toward a new fully adjusted position does an increase in the rate of growth of G_2 generate the greatest effect in terms of output growth compared with the remaining variables controlled by the government.

Moreover, following equation 14, a continuous process of confirmation of expectations takes place. That makes firms reconsider the expected rate of growth of the effective demand (g_e) based on the realised rate of growth of the output (g_y). Notably, if a divergence between the actual and the expected rate of growth occurs, this leads to a symmetrical deviation of the level of output to the level of normal output and thus a symmetrical discrepancy between u and u_n. Therefore, the higher is the effect generated by a fiscal policy on the output, the larger will be the discrepancy between u and u_n and between g_y and g_e.

Thus, combining the process summarised in equation 14 with the several effects of alternative fiscal policies (see inequality 20), we can represent the expectation revision in the following system of equations 21:

$$\begin{aligned}
g_{e\Delta\dot{G}_2} &= x(g_{y\Delta G_2} - g_e)\\
g_{e\Delta\dot{G}_1} &= x(g_{y\Delta G_1} - g_e)\\
g_{e\Delta\dot{T}\mathrm{R}_{aw}} &= x(g_{y\Delta \mathrm{TR}_{aw}} - g_e)\\
g_{e\Delta\dot{T}_{aw}} &= x(g_{y\Delta T_{aw}} - g_e)\\
g_{e\Delta\dot{T}\mathrm{R}_{a\Pi}} &= x(g_{y\Delta \mathrm{TR}_{a\Pi}} - g_e)\\
g_{e\Delta\dot{T}_{a\Pi}} &= x(g_{y\Delta T_{a\Pi}} - g_e)
\end{aligned} \tag{21}$$

Furthermore, starting from relationships presented in (20) and (21), we can also represent changes in the expectations of growth corresponding to alternative fiscal policies through the following inequalities (22):

$$g_{e\Delta\dot{G}_2} > g_{e\Delta\dot{G}_1} > (g_{e\Delta\dot{\mathrm{T}}\mathrm{R}_{aw}} = g_{e\Delta\dot{T}_{aw}}) > (g_{e\Delta\dot{\mathrm{T}}\mathrm{R}_{a\Pi}} = g_{e\Delta\dot{T}_{a\Pi}}) \tag{22}$$

Subsequently, following equation 16, we can show that alternative fiscal policies, having different impacts in terms of output and expectations, affect the growth of investment in a different way. Starting from relationships presented in (16), (20) and (22), we can represent the rate of growth of investment through the following inequality (23):

$$g_{IG_2} > g_{IG_1} > (g_{ITR_{aw}} = g_{IT_{aw}}) > (g_{ITR_{a\Pi}} = g_{IT_{a\Pi}}) \tag{23}$$

As shown, government spending, targeted towards strategic sectors (G_2), generates the greatest effects in terms of output and expectations and then investment growth. On the contrary, the rate of growth of autonomous capitalists' transfers and taxes shows the lowest effect in terms of output, expectations, and thus investment growth.

4.2. A Demand-Led Technical Progress

In this section, we analyse how the process of innovation generated by targeted government expenditure can take place and materialises in the economic system. To do this, we will assess both the feasible effects on the components of aggregate demand as well as the influence on labour productivity dynamics by using the lens of the Kaldor-Verdoorn law. In particular, we will evaluate the effect of innovation produced by a narrow class of government expenditure, namely those targeted at the development and diffusion of technical transformation, as in the case of mission-oriented innovation policies (G_2). These expenditures — which have historically led to major technological advances (Pivetti 1992; Mazzucato 2018) — are oriented to transforming the production systems by generating an innovation cascade and therefore an endogenous productivity growth (Tavani and Zamparelli 2018).

What we are dealing with here is a specific technological development whose effects go beyond the traditional Keynesian treatment of the topic. Indeed, while in the Kaldor-Verdoorn law a stable relationship between the rate of growth of output and labour productivity growth is found, we are also interested here in the operation of very specific class of public expenditure, namely government spending G_2 oriented to directly promoting structural change.[20] The specific way in which these expenditures translate into technical progress is not determinable a priori and therefore a description of the feasible effects of innovation on the component of demand is needed.

Technical progress directly produced by G_2 affects output by varying the value of the supermultiplier as well as the exogenous components of demand, such as consumption and export. When we look at the effects on the supermultiplier, innovation produces persistent effects on gross investment by changing the capital-output ratio (v) and the depreciation rate (d) as new technologies are principally embodied in new capital goods. Consequently, a change in marginal propensity to invest (see equation 5) influences the supermultiplier and then the level of output. In particular, technical progress increases the obsolescence of installed capital goods and thus grows the depreciation rate (d) and then accelerates the process of investment and of replacement of old machineries (Garegnani 2015). In addition, technical progress could influence the capital-output ratio, or rather, the adopted techniques of production.[21] Based on which technical progress is introduced in the economy, the capital-output ratio (v) could increase, decrease, or even remain constant. In particular, if the technical progress is capital-using, a larger v positively influences both the investment level. On the contrary, a capital-saving technical progress reduces v and investment. Finally, if the innovation is Harrod-neutral, v remains constant, as well as the investment (Cesaratto, Serrano, and Stirati 2003).

Nevertheless, the innovation might also engender a positive effect on the autonomous components of aggregate demand, as with consumptions and exports. Product innovation,

[20] For an in-depth review on the Kaldor-Verdoorn law, see among others McCombie, Pugno, and Soro (2002), Jeon and Vernengo (2008), McCombie and Spreafico (2015), Deleidi, Paternesi Meloni, and Stirati (2018) and Antenucci, Deleidi, and Paternesi Meloni (2019).

[21] If the new production technique, which has been discovered by the process of innovation, is dominant for all distribution combinations compared to the old techniques, then the new technique will be adopted. That occurs since it allows firms to generate a greater rate of profit for every possible wage rate. Conversely, if the new technique is dominant, but not for all distribution combinations, it will only be adopted under certain distributive arrangements. Especially for a given profit rate, the chosen technique will have to be so to maximize the wage rate. In that case, either the new or an old production technique could be adopted.

by continuously creating new consumption needs, increases the obsolescence of old commodities.[22] This could positively stimulate the autonomous consumption financed out of the credit market through an endogenous money-creation process (Pariboni 2016). However, although innovation might stimulate borrowers' demand for loans, an increase in the interest rate, and a rise in the value of collateral requested by commercial banks, as well as a sudden institutional restrictive regulatory policy, could limit the positive effect of an innovative wave.

Concerning countries' external relations, technical change generates technological advantages in terms of productive capacity that represent one of the main factors that stimulate the export growth of a country. Enriching the productive matrix through technical specialisation in capital and consumption goods, countries are able to satisfy a wide external demand and simultaneously reduce import penetration. As in the case of autonomous consumption, monetary policy could influence the net export growth rate through its control over the exchange rate by setting alternative interest rates. In particular, a depreciation of the exchange rate accelerates the net export growth, while its appreciation slows it down. Moreover, due to its easy diffusion in foreign countries, innovation has to be continuous to generate positive technological advantages, and then a positive effect on the net export growth rate.

Therefore, a continuous technical progress is able to increase the output trend growth rate by affecting the growth rate of autonomous demand. In addition to this, an innovation also determines level effects by changing the value of the supermultiplier, by means of modifications of the propensity to invest, that is, by changing the output-capital ratio and the replacement coefficient.

We have described up until now the many dimensions in which innovation can affect aggregate demand. However, drawing from Post-Keynesian literature, a more stylised representation of the technical development can be provided by making use of Kaldorian insights. Specifically, following Kaldor (1967) and its recent reappraisal (McCombie 2002, p. 104), the classical Verdoorn law — which postulates a positive relationship between the rate of growth of output and the labour productivity dynamics — can be augmented by considering the rate of growth of the capital stock (g_k). Conceptually, g_k is included to capture the contribution of the technical progress embodied in new capital goods: the faster is the capital accumulation, the higher is the rate of technical progress (Nah and Lavoie 2019).[23] We can represent this relationship as follows in equation 24:

$$g_p = a + \eta\, g_y + \gamma g_k \tag{24}$$

Where g_p represents the rate of growth of the labour productivity, a is the exogenous technical progress, g_y is the rate of growth of output and g_k the growth rate of the capital stock. Following equations 17, 20, 22 and 23, during the traverse between one steady state and the other one determined by an increase in the rate of growth of public expenditure,

[22]The technical progress could lead to changes in the marginal propensity to consume by means of changes in the distributive shares. Such modifications could occur in both directions, leaving the change of the marginal propensity to consume undetermined. However, if the marginal propensity to consume decreases due to an increase in profit share, the stylised fact of the constancy of average propensity to consume in advanced countries (Cesaratto, Serrano, and Stirati 2003) could be explained by an increase in autonomous consumptions financed through the credit market.

[23]For an in-depth discussion of the use of the rate of growth of the capital stock and the investment-output ratio, see among others Kaldor (1967), McCombie (2002) and Deleidi, Paternesi Meloni, and Stirati (2018).

the average rate of growth of g_y and g_k is higher when fiscal expansion is targeted towards those classes of public expenditures associated with a larger multiplier (see inequality 19).[24] As a consequence, following equation 24, G_2 — among which mission-oriented innovation policies can be included — produces the highest average rate of growth of output, expectations, capital stock and then labour productivity g_p.

5. Concluding Remarks

The present paper critically analyses the theoretical underpinnings of austerity measures which were implemented after the 2007 financial crisis in order to stimulate investment and foster GDP growth. First, we analyse the theoretical assumptions on which these austerity measures are based. Second, we propose an alternative framework which we believe to stand on stronger grounds — both theoretically and empirically.

We argue that both New-Keynesians and the supporters of Expansive Austerity are wrongly assuming that an increase in public spending generates negative effects on investments and output. By evoking the well-known crowding-out mechanism, they claim that raising public spending leads to an automatic increase in the rate of interest that in turn decreases the volume of private investment. We discuss how this crowding-out reasoning is based on a major problematic assumption: the existence of a downward-sloping investment demand curve. We propose a critique based on the CK approach and on the concepts of re-switching of techniques and reverse capital deepening, which disprove the supposed negative relationship between interest rates and investment.

As a consequence of such critiques, we propose a new version of the Sraffian Supermultiplier model to explain the determinants of investment and output. In this alternative model, the growth rate of output depends on the growth rate of the autonomous components of the aggregate demand. Private investments, in this framework, are fully induced by and depend on the level of effective demand and technical progress. Consequently, aggregate demand matters for output determination both in the short and the long-run, and expansionary fiscal policies increase output both in the short and the long-run without crowding out private investments. In fact, in the long-run, when productive capacity can change, a higher level of output, driven by expansionary fiscal policies, determines a higher level of investments.

Then, focusing on what types of fiscal policies are more efficient in terms of output and investment growth, we demonstrate that a permanent change in taxes and transfers generate the lowest influence on output and thus on investments.

On the contrary, a permanent change in the rate of growth of public expenditures — targeted towards strategic sectors and focused on the promotion of innovation and mission-oriented policies — generates the largest effect in terms of output, investment and labour productivity growth. In particular, such public policies — by directly stimulating private business expenditure in R&D — engender the largest supermultiplier, which in turn produces the highest expectations (by business) of opportunities for growth and thus the largest effect on private investment. Moreover, such public policies — by stimulating

[24] See Nah and Lavoie (2019) for a discussion of the growth and level effects during the traverse from one to another steady state as well as the effect of the average rate of growth of output on labour productivity. As already discussed in footnote 18, the trend growth rate generated by alternative government spending shocks of the same magnitude will be the same.

key areas that promote innovation — facilitate the diffusion of technical progress in the economic system. When that occurs, innovation generates additional effects on the components of aggregate demand — that is, on consumption, investment and net-exports. Finally, by making use of the insights developed by Kaldor and Verdoorn, we show that this targeted class of public expenditures produces the largest effect on technical progress and then on labour productivity growth.

Our findings suggest that governments should carry out expansive fiscal policies, since they generate positive effects on output and on investments throughout the business cycle. However, differently from what the IMF (2014) has affirmed in a recent paper entitled 'Is It Time for an Infrastructure Push? The Macroeconomic Effects of Public Investment', we believe that fiscal policies targeted towards the financing of mission-oriented policies are the most efficient in terms of output, investment and productivity growth, as they generate the largest supermultiplier and the highest expectations of future growth opportunities — the key driver of private investment.

Acknowledgements

We warmly thank all the participants of the EAEPE Conference, held at Corvinus University of Budapest in October 2017, for feedback received on a preliminary draft of this article. The authors would also like to thank two anonymous referees and the following people for fruitful discussion: Riccardo Pariboni, Santiago Gahn, Enrico Sergio Levrero, Luigi Salvati, Antonella Stirati, Francesca Tosi and Attilio Trezzini. All errors remain our own.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Funding

We would like to thank the European Union Horizon 2020 (DOLFINS Nr. 640772 and ISIGrowth Nr. 649186) and Innovate UK grants for financing the study.

ORCID

Matteo Deleidi http://orcid.org/0000-0001-6371-5255

References

Alejandro, C. F. D. 1963. 'A Note on the Impact of Devaluation and the Redistributive Effect.' *Journal of Political Economy* 71 (6): 577–580.

Alesina, A., and S. Ardagna. 2010. 'Large Changes in Fiscal Policy: Taxes Versus Spending.' *Tax Policy and the Economy* 24 (1): 35–68.

Alesina, A., S. Ardagna, R. Perotti, and F. Schiantarelli. 2002. 'Fiscal Policy, Profits, and Investment.' *American Economic Review* 92 (3): 571–589.

Allain, O. 2015. 'Tackling the Instability of Growth: A Kaleckian-Harrodian Model with an Autonomous Expenditure Component.' *Cambridge Journal of Economics* 39 (5): 1351–1371.

Antenucci, F., M. Deleidi, and W. Paternesi Meloni. 2019. 'Demand and Supply-side Drivers of Labour Productivity Growth: An Empirical Assessment for G7 Countries.' Associazione Studi e Ricerche Interdisciplinari sul Lavoro ASTRIL Working Papers 0042.

Arestis, P., and M. Sawyer. 2004. ‘Monetary Policy When Money is Endogenous: Going Beyond the “New Consensus”.’ In *Central Banking in the Modern World*, edited by M. Lavoie, and M. Seccareccia. Cheltenham: Edward Elgar.

Auerbach, A. J., and Y. Gorodnichenko. 2012. ‘Measuring the Output Responses to Fiscal Policy.’ *American Economic Journal: Economic Policy* 4 (2): 1–27.

Blanchard, O. J., and D. Leigh. 2013. ‘Growth Forecast Errors and Fiscal Multipliers.’ *American Economic Review* 103 (3): 117–120.

Block, F., and M. R. Keller. 2009. ‘Where do Innovations Come From? Transformations in the US Economy, 1970–2006.’ *Socio-Economic Review* 7 (3): 459–483.

Bortis, H. 1997. *Institutions, Behaviour and Economic Theory: A Contribution to Classical-Keynesian Political Economy*. Cambridge: Cambridge University Press.

Botta, A. 2018. ‘The Short-and Long-run Inconsistency of the Expansionary Austerity Theory: A Post-Keynesian/Evolutionist Critique.’ *Journal of Evolutionary Economics*, 1–35.

Boyer, R. 2012. ‘The Four Fallacies of Contemporary Austerity Policies: The Lost Keynesian Legacy.’ *Cambridge Journal of Economics* 36 (1): 283–312.

Cantner, U., and S. Vannuccini. 2018. ‘Elements of a Schumpeterian Catalytic Research and Innovation Policy.’ *Industrial and Corporate Change* 27 (5): 833–850.

Cesaratto, S. 2015. ‘Neo-Kaleckian and Sraffian Controversies on the Theory of Accumulation.’ *Review of Political Economy* 27 (2): 154–182.

Cesaratto, S., F. Serrano, and A. Stirati. 2003. ‘Technical Change, Effective Demand and Employment.’ *Review of Political Economy* 15 (1): 33–52.

Ciccone, R. 1986. ‘Accumulation and Capacity Utilization: Some Critical Considerations on Joan Robinson’s Theory of Distribution.’ *Political Economy* 2 (1): 17–36.

Ciccone, R. 2013. ‘Public Debt and Aggregate Demand: Some Unconventional Analytics.’ In *Sraffa and the Reconstruction of Economic Theory: Volume Two: Aggregate Demand, Policy Analysis and Growth*, edited by E. Levrero, A. Palumbo, and A. Stirati. London: Springer, Palgrave Macmillan.

Crespi, F., and D. Guarascio. 2018. ‘The Demand-Pull Effect of Public Procurement on Innovation and Industrial Renewal.’ *Industrial and Corporate Change* 28 (4): 793–815.

Deleidi, M., and M. Mazzucato. 2019. ‘Mission-oriented Innovation Policies: A Theoretical and Empirical Assessment for the US Economy.’ *Department of Economics-University Roma Tre*, WP No. 0248.

Deleidi, M., W. Paternesi Meloni, and A. Stirati. 2018. ‘Structural Change, Labour Productivity and the Kaldor-Verdoorn Law: Evidence from European Countries.’ *Department of Economics-University Roma Tre*, WP No. 0239.

Dutt, A. K. 2019. ‘Some Observations on Models of Growth and Distribution with Autonomous Demand Growth.’ *Metroeconomica* 70 (2): 288–301.

Dvoskin, A., G. D. Feldman, and G. Ianni. 2019. ‘New-structuralist Exchange-rate Policy and the Pattern of Specialization in Latin American Countries.’ *Metroeconomica*.

Fatás, A., and L. H. Summers. 2018. ‘The Permanent Effects of Fiscal Consolidations.’ *Journal of International Economics* 112: 238–250.

Fiebiger, B., and M. Lavoie. 2019. ‘Trend and Business Cycles with External Markets: Non-Capacity Generating Semi-Autonomous Expenditures and Effective Demand.’ *Metroeconomica* 70 (2): 247–262.

Fontana, G., and M. Setterfield, eds. 2010. *Macroeconomic Theory and Macroeconomic Pedagogy*. Basingstoke: Palgrave Macmillan.

Freitas, F., and F. Serrano. 2015. ‘Growth Rate and Level Effects, the Stability of the Adjustment of Capacity to Demand and the Sraffian Supermultiplier.’ *Review of Political Economy* 27 (3): 258–281.

Frenkel, R., and L. Taylor. 2006. ‘Real Exchange Rate, Monetary Policy and Employment.’ DESA Working Paper No. 19.

Garegnani, P. 1970. ‘Heterogeneous Capital, the Production Function and the Theory of Distribution.’ *Review of Economic Studies* 37 (3): 407–436.

Garegnani, P. 1979. 'Notes on Consumption, Investment and Effective Demand: II.' *Cambridge Journal of Economics* 3 (1): 63–82.
Garegnani, P. 2015. 'The Problem of Effective Demand in Italian Economic Development: On the Factors That Determine the Volume of Investment.' *Review of Political Economy* 27 (2): 111–133.
Giavazzi, F., and M. Pagano. 1990. 'Can Severe Fiscal Contractions be Expansionary? Tales of two Small European Countries.' *NBER Macroeconomics Annual* 5: 75–111.
Giavazzi, F., and M. Pagano. 1996. 'Non-Keynesian Effects of Fiscal Policy Changes: International Evidence and the Swedish Experience.' *Swedish Economic Policy Review* 3: 67–103.
Girardi, D., and R. Pariboni. 2016. 'Long-run Effective Demand in the US Economy: An Empirical Test of the Sraffian Supermultiplier Model.' *Review of Political Economy* 28 (4): 523–544.
Girardi, D., and Pariboni, R. 2018. 'Normal Utilization as the Adjusting Variable in Neo-Kaleckian Growth Models: A Critique.' *Metroeconomica*.
Guajardo, J., D. Leigh, and A. Pecatori. 2011. 'Expansionary Austerity: New International Evidence.' IMF WP No 11/158.
Hayo, B., and F. Neumeier. 2017. 'The (In)Validity of the Ricardian Equivalence Theorem–Findings From a Representative German Population Survey.' *Journal of Macroeconomics* 51: 162–174.
Hein, E. 2018. 'Autonomous Government Expenditure Growth, Deficits, Debt, and Distribution in a neo-Kaleckian Growth Model.' *Journal of Post Keynesian Economics* 41 (2): 316–338.
International Monetary Fund. 2014. 'Is It Time for an Infrastructure Push? The Macroeconomic Effects of Public Investment.' In *World Economic Outlook: Legacies, Clouds, Uncertainties*. Washington, DC: International Monetary Fund.
Jeon, Y., and M. Vernengo. 2008. 'Puzzles, Paradoxes, and Regularities: Cyclical and Structural Productivity in the United States (1950–2005).' *Review of Radical Political Economics* 40 (3): 237–243.
Jordà, Ò, and A. M. Taylor. 2016. 'The Time for Austerity: Estimating the Average Treatment Effect of Fiscal Policy.' *Economic Journal* 126 (590): 219–255.
Kaldor, N. 1940. 'A Model of the Trade Cycle.' *Economic Journal* 50 (197): 78–92.
Kaldor, N. 1955. 'Alternative Theories of Distribution.' *Review of Economic Studies* 23 (2): 83–100.
Kaldor, N. 1967. *Strategic Factors in Economic Development*. New York: Cornell University.
Kaldor, N. 1970. 'The Case for Regional Policies.' *Scottish Journal of Political Economy* 17 (3): 337–348.
Kaldor, N. 1975. 'Economic Growth and the Verdoorn Law–A Comment on Mr Rowthorn's Article.' *Economic Journal* 85 (340): 891–896.
Kaldor, N. 1989. 'Further Essays on Economic Theory and Policy.' In *Collected Economic Essays*. Vol. 9, edited by F. Targetti, and A. Thirlwall. London: Duckworth.
Keynes, J. M. 1936. *The General Theory of Employment, Interest and Money*. London: Macmillan.
Krugman, P. R. 1998. 'It's Baaack: Japan's Slump and the Return of the Liquidity Trap.' *Brookings Papers on Economic Activity* 1998 (2): 137–205.
Krugman, P., and L. Taylor. 1978. 'Contractionary Effects of Devaluation.' *Journal of International Economics* 8: 445–456.
Kurz, H. D. 1986. 'Normal Positions and Capital Utilization.' *Political Economy* 2(1): 37–54.
Lavoie, M. 2014. *Post-Keynesian Economics: New Foundations*. Cheltenham, UK: Edward Elgar Publishing.
Lavoie, M. 2016. 'Convergence Towards the Normal Rate of Capacity Utilization in Neo-Kaleckian Models: The Role of Non-Capacity Creating Autonomous Expenditures.' *Metroeconomica* 67 (1): 172–201.
Leigh, D., P. Devries, C. Freedman, J. Guajardo, D. Laxton, and A. Pescatori. 2010. 'Will it Hurt? Macroeconomic Effects of Fiscal Consolidation.' *World Economic Outlook*, Chapter 3, 93–124.
Mazzucato, M. 2013. *The Entrepreneurial State: Debunking the Public Vs. Private Myth in Risk and Innovation*. London: Anthem Press.
Mazzucato, M. 2016. 'From Market Fixing to Market-Creating: A New Framework for Innovation Policy.' *Industry and Innovation* 23 (2): 140–156.
Mazzucato, M. 2018. 'Mission-oriented Innovation Policies: Challenges and Opportunities.' *Industrial and Corporate Change* 27 (5): 803–815.

McCombie, J. 2002. 'Increasing Returns and the Verdoorn Law From a Kaldorian Perspective.' In *Productivity Growth and Economic Performance: Essays on Verdoorn's law*, edited by J. McCombie, M. Pugno, and B. Soro, 64–114. Basingstoke: Palgrave Macmillan.
McCombie, J., M. Pugno, and B. Soro. 2002. *Productivity Growth and Economic Performance: Essays on Verdoorn's law*. Basingstoke: Palgrave Macmillan.
McCombie, J. S., and M. R. Spreafico. 2015. 'Kaldor's 'Technical Progress Function' and Verdoorn's law Revisited.' *Cambridge Journal of Economics* 40 (4): 1117–1136.
Mishkin, F. S. 1995. 'Symposium on the Monetary Transmission Mechanism.' *Journal of Economic Perspectives* 9 (4): 3–10.
Moore, B. J. 1988. *Horizontalists and Verticalists: The Macroeconomics of Credit Money*. Cambridge: Cambridge University Press.
Moretti, E., C. Steinwender, and J. Van Reenen. 2016. '*The Intellectual Spoils of War? Defense R&D, Productivity and Spillovers*.' Technical report, Working Paper, London School of Economics.
Nah, W. J., and M. Lavoie. 2019. 'Convergence in a neo-Kaleckian Model with Endogenous Technical Progress and Autonomous Demand Growth.' *Review of Keynesian Economics* 7 (3): 275–291.
Ostry, J. D., P. Loungani, and D. Furceri. 2016. *Neoliberalism Oversold?* Washington, DC: International Monetary Fund.
Palley, T. 2019. 'The Economics of the Super-Multiplier: A Comprehensive Treatment with Labor Markets.' *Metroeconomica* 70 (2): 325–340.
Pariboni, R. 2015. 'Autonomous Demand and Capital Accumulation: Three Essays on Heterodox Growth Theory.' Doctoral dissertation, Department of Economics and Statistics, Università degli Studi di Siena.
Pariboni, R. 2016. 'Household Consumer Debt, Endogenous Money and Growth: A Supermultiplier-Based Analysis.' *PSL Quarterly Review* 69 (278): 211–233.
Pivetti, M. 1992. 'Military Spending as a Burden on Growth: An 'Underconsumptionist' Critique.' *Cambridge Journal of Economics* 16 (4): 373–384.
Rochon, L. P. 2001. 'Horizontalism: Setting the Record Straight.' In *Credit, Interest Rates and the Open Economy: Essays on Horizontalism*, edited by L. P. Rochon, and M. Vernengo. Cheltenham, UK: Edward Elgar Publishing.
Romer, D. 2000. 'Keynesian Macroeconomics Without the LM Curve.' *Journal of Economic Perspectives* 14 (2): 149–170.
Romer, D. 2007. *Advanced Macroeconomics*. 4th ed. New York: McGraw-Hill Companies.
Serrano, F. 1995. 'Long Period Effective Demand and the Sraffian Supermultiplier.' *Contributions to Political Economy* 14 (1): 67–90.
Serrano, F., F. Freitas, and G. Bhering. 2019. 'The Trouble with Harrod: The Fundamental Instability of the Warranted Rate in the Light of the Sraffian Supermultiplier.' *Metroeconomica* 70 (2): 263–287.
Simonazzi, A., A. Ginzburg, and G. Nocella. 2013. 'Economic Relations Between Germany and Southern Europe.' *Cambridge Journal of Economics* 37 (3): 653–675.
Sraffa, P. 1960. *Production of Commodities by Means of Commodities: Prelude to a Critique of Economic Theory*. Cambridge: CUP Archive.
Stiglitz, J. E. 1989. 'Markets, Market Failures, and Development.' *American Economic Review* 79 (2): 197–203.
Summers, L. H. 2014. 'US Economic Prospects: Secular Stagnation, Hysteresis, and the Zero Lower Bound.' *Business Economics* 49 (2): 65–73.
Tavani, D., and L. Zamparelli. 2018. 'Growth, Income Distribution, and the "Entrepreneurial State".' *Journal of Evolutionary Economics*, 1–25.
Thirlwall, A. P. 1979. 'The Balance of Payments Constraint as an Explanation of the International Growth Rate Differences.' *PSL Quarterly Review* 32 (128): 45–53.
Tobin, J. 1975. 'Keynesian Models of Recession and Depression.' *American Economic Review* 65 (2): 195–202.
Trezzini, A., and A. Palumbo. 2016. 'The Theory of Output in the Modern Classical Approach: Main Principles and Controversial Issues.' *Review of Keynesian Economics* 4 (4): 503–522.

Woodford, M. 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton: Princeton University Press.

Yellen, J. 2016. '*Macroeconomic Research After the Crisis*.' In *Speech at 'The Elusive "Great" Recovery: Causes and Implications for Future Business Cycle Dynamics.'* 60th annual economic conference sponsored by the Federal Reserve Bank of Boston. Boston, Massachusetts. http://www.federalreserve.gov/newsevents/speech/yellen20161014a.pdf.