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MAXIMIZING PRODUCTIVITY THROUGH FULL EMPLOYMENT: THE CASE OF EMPLOYMENT GUARANTEE SCHEMES

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If we have the welfare of the giraffes at heart, we must not overlook the sufferings of the shorter necks who are starved out, or the sweet leaves which fall to the ground and are trampled underfoot in the struggle, or the overfeeding of the long-necked ones, or the evil look of anxiety or struggling greediness which overcasts the mild faces of the herd.

JOHN MAYNARD KEYNES (1926), *The End of Laissez-Faire*

The natural price of labour is that price which is necessary to enable the labourers, one with another, to subsist and to perpetuate their race, without either increase of diminution. The power of the labourers to support himself, and the family which may be necessary to keep up the number of labourers, does not depend on the quantity of money which he may receive for wages, but on the quantity of food, necessaries, and conveniences become essential to him from habit, which the money will purchase.

DAVID RICARDO (1817), *On the Principles of Political Economy and Taxation*

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1 Introduction

Productivity is one of the major concerns of economics nowadays, and according to the majority of historians and experts of economic development it has been the greatest driver of mankind's progress and social evolution in the latest centuries. The shift from an extensive agricultural and self-sufficient economy - in which mere subsistence has been the greatest aim for millennia - to a full-fledged industrial and post-industrial society has been possible thanks to technological revolutions and innovations, which have dramatically increased the ability of workers to produce.

As a matter of fact, the rise of capitalism has generated an unprecedented quantum leap in the quantity and quality of the output that society is able to produce, and thus a major increase in the standard of living of a great share of the global population. Economic historians have linked the roots of capitalism to a major increase in the productivity of agriculture, which is the sector that has historically accounted for the majority of workers' real wage before the Industrial Revolution. It has been argued that such productivity gains have been obtained thanks to agricultural reforms, which provided the premises for the take-off of the modern industrial economy (Ricottilli, 1993). The reason behind this causal relationship is straightforward, and it is known since the works of Classical economists: any economy needs a given level of inputs in order to be able to reproduce the existing means of production and produce a surplus, and then distribute the latter back to a growing population, through market or non-market mechanisms. If this viability condition is violated, the living standards of the population will eventually decrease and massive inequality of income can arise between 'owners' of the means of production and 'workers'. It has been precisely the case in economies such as Great Britain in the 17-18th century, US and Japan in the 19th century, the Asian Tigers in the 20th century and perhaps China in the 21st century.

Before the productivity revolution in agriculture, and the subsequent development of capitalism, the global economy was trapped in what has been defined the *curse of decreasing returns*. Such an economic system is prone to the crises, which have been historically faced by the generation of excess labour. But the latter has allowed for the rise of capital accumulation and profits, namely the essential elements of a growing capitalist system.

After more than two centuries from the transition of modern societies to capitalism, their indisputable virtues cannot hide the new types of hurdles that threaten the evolution of mankind along this superior yet imperfect growth path. Massive inequality at the global level, the persistence of hunger and poverty rates in several developing countries, and the uneven development in the latter after the process of globalization are only some of the pressing issues that the system is still struggling to solve.

But hurdles are not limited to given geographical areas, nor explained simply by cultural or historical heterogeneity at the global level. The Great Depression in 1930s and the double-dip recession of 2007-2008 and 2010-2011 have shown that even advanced economies are prone to waves of progress and instability, expansion and recession. Most importantly, after a period of revolutionary innovation waves that cast its influence off until the 2000s, productivity and output growth are turning out to be persistently stagnant in mature economies. While a rising income inequality has threatened the inclusiveness of the economic system in the US and Europe, unemployment has skyrocketed - especially in the latter - with no apparent solution to

the recrudescence of the hurdle of effective demand, which post-WWII capitalism had seemed to overcome.

The simultaneous stagnation of output, employment and productivity which are characterizing mature economies has been explained in different ways according to various interpretations of the nature of capitalism across the academic community and policy makers. This paper focuses on the definition of a general measure of productivity, which captures the fact that human labour is the only true factor of production, as it directly and indirectly enters the process of production of all goods and services in the economy, including the 'capital' goods that the economy uses as intermediate inputs. Therefore, a global measure of the real cost that the economy faces in the process of production of a surplus must take into account workers' need for a socially fulfilling life, beyond the mere subsistence level. It will be argued that whilst the post-WWII growth in advanced economies and developing countries was triggered by unprecedented innovations in the technology level and productivity of consumption and investment goods, the persistence of unmet basic needs expressed by workers has not been addressed yet by policy makers in sufficient regard.

The existence of high unemployment and underinvestment in socially relevant 'wage goods' in modern market economies (e.g. efficient public housing, the availability of clean energy sources at affordable prices, functioning local transports and many others) highlights that there is room for significant improvements in *social productivity*. Therefore, this paper will discuss the possibility to increase the latter through a policy mix which is able to guarantee full employment to everyone who is willing and able to work and at the same time provide opportunities for research in technological advancements and productivity improvements in the aforementioned social sectors.

The following sections are structured as follows. Section 2 provides an analysis of the major determinants of the current stagnation: it reviews competing theories of stagnation and discusses data related to productivity and income inequality in mature economies. Section 3 investigates the process of innovation and assesses the impact of public investment on the capital development of the economy. Section 4 evaluates competing theories of the labour market and discusses fundamental features, policy experiences and issues of Employment Guarantee Schemes (EGS). Section 5 illustrates a multisectorial model of an economy in which a policy mix composed of public investment in R&D and EGS is implemented. Section 6 concludes.

2 The current stagnation and its determinants

After the Great Moderation in the 1990s and the Great Financial Crisis of 2008/09, OECD countries have experienced a persistent mix of low GDP growth and little or nil productivity growth, with no evident signs of confidence restored in businesses and consumers' assessment. Hence, the possibility that advanced economies have entered a stage of "stagnation" is at the heart of current economic debate and policymaking institutions. The notion of stagnation was reintroduced in modern debate through a contribution by Summers (2013) in a speech at the International Monetary Fund Economic Forum, who warned economists and policy makers about the emergence of a "secular stagnation". This concept which was pioneered by Hansen (1939), who argued that declining population growth, variations in the pace of

technological progress and the scarce discovery rate of new land explained the tendency towards stagnation in the 1930s US. Moving from Summers' contribution to the debate, economists have explored different underlying causes for the current stagnation and have discussed whether it is appropriate to define it as a "secular" one or not.

Consequently, three main theoretical approaches in the "mainstream" area of academic economics have analyzed the issue of stagnation (Teulings and Baldwin, 2014; Hein, 2016). A first approach to the problem has focused on factors that may have affected potential growth in OECD economies, with particular reference to a lower rate of knowledge leaps and major innovations in advanced economies (Gordon, 2012). Whilst the innovative ability of firms and workers is not thought of as decreasing, the sluggish rate of population growth and its rapid aging are seen as major hurdles to potential growth. Thus Gordon (2012) holds that no further US education revolutions that are able to boost productivity growth are expected in the future.

Another approach focuses on the possibility that actual growth rate of GDP is below potential growth due to the decrease in the natural (or real) interest rate associated with full employment (Summers, 2015, 2016; Blanchard et al., 2014). This phenomenon makes traditional inflation targeting policies harder as central banks face the zero lower bound for short-term nominal interest rates. Hence, expansionary monetary policies advocated by New Consensus Macroeconomics in the pre-crisis era turn out to be useless and potentially dangerous due to the potential increase in the risk of financial bubbles growth out of ultra-low interest rates Summers (2015). According to this second group of economists, ultra-low equilibrium interest rates are caused by a decline in the demand for loanable funds that caused a "savings glut" across advanced economies. Summers (2014) argues that such a decline happened due to the strong deleveraging caused by the 2007-08 financial crisis, the emergence of the digital economy which requires a lower capital stock and the rising wealth inequality and uneven income distribution. The latter cause was responsible of shifting a greater share of income to wealthy individuals and corporations characterized by a lower propensity to consume, thus increasing global savings according to Summers. In a similar fashion, Eggertsson and Mehrotra (2014) posit a New Keynesian model of secular stagnation with overlapping generations, where the lack of any equilibrating force is possible after a deleveraging shock, a decline in the growth rate of population, or a more unequal income distribution: all these forces are capable of generating a savings glut.

A third approach focuses on the aftermath of the Global Financial Crisis as it can be inferred from labour market hysteresis, which would have shifted advanced economies to a lower growth path. Accordingly, a greater relevance of structural unemployment may be explained by observing the participation rates of labour force across OECD countries, but this finding seems at odds with empirical evidence, that supports the conclusion in the US but not in European countries.

The three diagnoses above are also associated with different policy prescriptions for OECD economies. Economists who point at the drop in potential growth advocate supply-side policies in order to stimulate efficiency and thus increase the likelihood of new innovations. Teulings and Baldwin (2014) advocate measures such as infrastructural investments, the reduction in employment protection legislation, simplification of administrative procedures for start-ups and anti-monopoly policies. The OECD also supports a set of supply-side structural reforms aimed at boosting the growth of SMEs and entrepreneurship and augmenting the employability of the

labor force.

Authors who focus on the gap between actual and potential growth, instead, stress the importance of aggregate demand management policies in order to boost investments and reduce savings at the global level. Summers (2014) advocates a greater reliance on public investment, the adoption of expansionary fiscal policies in order to tackle the stagnation of aggregate demand, the stimulation of private consumption. On top of that, Teulings and Baldwin (2014) emphasize the need to increase the retirement age and further integrate global financial markets in order to channel excess savings from advanced to emerging economies.

Alternative explanations outside the mainstream area of economic thought have also tried to account for the persistent nature of stagnation after the Great Financial Crisis. Post-Keynesian economists largely agree with part of the analysis provided by Summers (2015) on the causes of the current stagnation, especially his concerns with rising income inequality, and some of the policy prescriptions, such as a bold infrastructural intervention financed through expansionary fiscal policies. However, according to Post-Keynesians, the logical premise upon which the theory of secular stagnation rests - namely the decline in the full employment level of the real interest rate - has questionable foundations. Post-Keynesians challenge the notion of a downward-sloping capital demand curve when the economy produces more than one good, as the "Cambridge controversy" on capital theory highlighted since the 1960s (Harcourt, 1969), and point at theoretical problems with the aggregate production function (Zambelli, 2004). Moreover, they reject the loanable funds theory and reverse the causality which underpins the description of the investment process provided by the former. Meade (1975) argues that in a monetary economy investment creates savings and not the other way around, due the working of a banking and financial system which is not constrained by the central bank's reserve requirement in the creation of bank deposits (McLeay et al., 2014). In Meade's words, in this economy "a dog called investment wags his tail called saving" (Meade, 1975, p. 62): firms establish the rate of investment of the economy and the global rate of saving adjusts to it through variations in the output growth, capacity utilization and functional income distribution.

Hence, Hein (2016) suggests to look at an alternative explanation for the persistence of stagnation in mature economies. A Post-Keynesian theory of stagnation is provided by Steindl (1952), who stresses the role of the market form in shaping the pattern of capital stock accumulation throughout mature economies. According to Steindl, competitive industries provide innovative firms with the opportunity of obtaining temporary positive profits, which tend to fade after the diffusion of innovation. However, marginal firms will have to exit the market with the reduction of output prices that are related to the increase in its quantity, so that only the market shares of more productive firms will grow. This process tends to move the market to concentration and oligopoly, which is thus posited by Steindl (1952) as the natural outcome in a capitalist economy. The fundamental feature of oligopolistic markets is then price rigidity: demand or technology shocks will not affect prices or exclude firms from the market, as firms earn positive extra-profits due to barriers to entry.

Hence, adverse demand shocks will determine lower capacity utilization due to downward price rigidities, and technological progress translates into higher profit margins (and higher profit shares): this chain of events links the microeconomic level to the macroeconomic one, and causes rising inequality across households due to the fall in the wage share caused by the persistence of the profit share. Moreover, in oligopolistic industries excess capacity is a strong
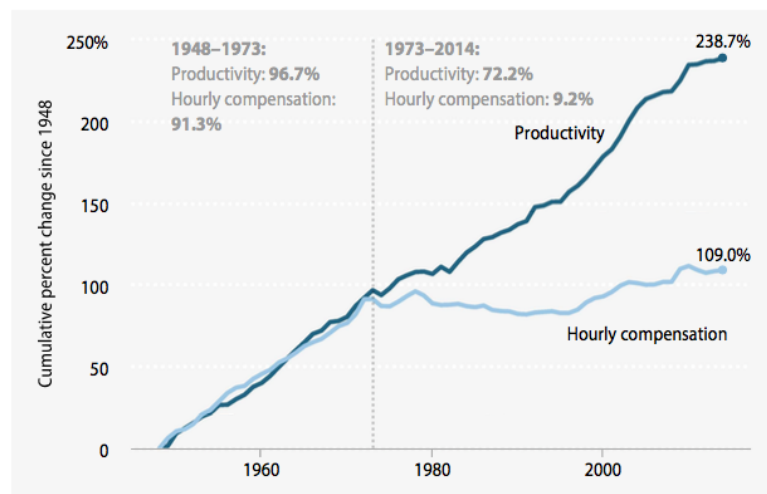
barrier to entry which brings depressive consequences and can cause the economy to shift on a permanently lower growth path.

Hein (2016) shows that in his previous publications, Steindl did not consider technical progress in his analysis in order to focus on the endogenous components of investments, whilst he acknowledged the importance of productivity-enhancing technological progress on the accumulation of capital only in later publications. As Section 3 investigates, technological waves have been in fact a major driving force of the unprecedented growth of post-war economies, causing the economy to experience quantum leaps when innovations arrive and periods of stagnation when waves exhaust.

2.1   An uneven income distribution

Despite the exceptional improvements in the quality and the quantity of technological capital stock, policy makers and economists have been struggling to explain the increasing gap between real wage growth and productivity growth that occurred in advanced economies (Bivens et al., 2014; Baker et al., 2007) in the recent years. As a matter of fact, Bivens et al. (2014) show that for decades in the post-World War II period, inflation-adjusted hourly compensation for American workers kept up with total productivity, thereby allowing the economy to produce sustained growth in living standards for workers. However, since 1973, hourly compensation of American workers rose only 8.7% in spite of a 72.2% growth of net productivity between 1973 and 2014. Moreover, roughly 15% of productivity growth between 1973 and 2014 generated higher hourly wages and benefits for workers. Rising equality over the entire post-1973 period explains over two-thirds of the wedge between productivity and real wages: productivity growth that did not trickle-down to workers' wages boosted incomes of the top of the pay scale (e.g. CEO pays) and those accruing to capital owners. Fleck et al. (2011) also find that growth in

Disconnect between productivity and a typical worker's compensation, 1948 -2014

250%
1948–1973:
Productivity: **96.7%**
Hourly compensation: **91.3%**

1973–2014:
Productivity: **72.2%**
Hourly compensation: **9.2%**

238.7%

Productivity

Cumulative percent change since 1948

200

150

100

50

0

109.0%

Hourly compensation

1960   1980   2000

Note: Data are for average hourly compensation of production/nonsupervisory workers in the private sector and net productivity of the total economy. "Net productivity" is the growth of output of goods and services minus depreciation per hour worked.

Figure 1: The wedge between productivity and a typical worker's compensation between 1948 and 2014. Source: Bivens et al. (2014)

real hourly compensation for U.S. workers has lagged behind labor productivity growth, by

analyzing more than 60 years of quarterly and annual data of labor productivity and sectoral hourly compensations. They show that productivity in the U.S. non-farm business sector grew an average of 2.2% from 1947 to 2010, whereas real hourly compensations (inclusive of benefits) grew at an average annual rate of 1.7%. The aforementioned trend points to the fact that while rising productivity in recent decades shown that US economy had the potential for a substantial growth in the living standards of the vast majority of workers, rising inequality put a wedge between potential and actual growth of real wages.

Recent studies show that this analysis can be generalized to encompass all developed economies (ILO, 2014). International Labour Organization's *Global Wage Report 2014/15* shows that labour productivity has continued to outstrip real wage growth in this group of countries, regardless of the usage of CPI or GDP deflator as measurement of price index (Figure 2). In this report, labour productivity is defined as GDP per worker, in order to capture how productively labour and other elements of the production process (e.g. changes in worktime, workers' know-how, the level of the capital stock) are implemented. The growing gap between wages
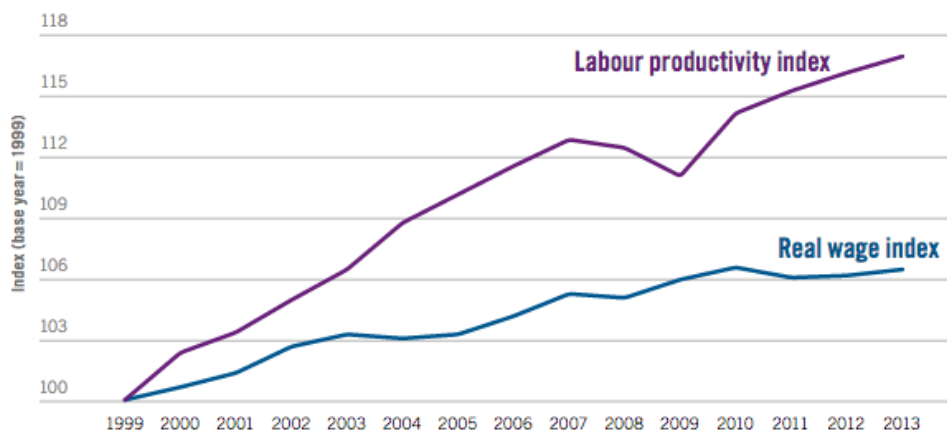
Figure 2: Trends in growth in average wages and labour productivity in developed economies (index), from 1999 to 2013. Source: ILO (2014)

and productivity has also determined a decline in the labour share of income in developed economies (Karabarbounis and Neiman, 2014; Guerriero, 2012). As ILO (2014) reports, the diminution of workers' income across developed economies may have strongly contributed to structurally weaken aggregate demand in the years before the 2007 crisis.

2.2 The global productivity slump

Despite the evident wedge between growth rates of labor productivity and real wages, advanced economies are experiencing a global productivity slump in the recent years. A recent study by The Conference Board highlighted that labour productivity grew by an average annual rate of 1.5% in the Euro Area in the 1999-2006 period and by 0.6% in the 2007-2013 period. A similar slowdown affected the US: labor productivity grew by an average 2.4% in the 1999-2006 period and by 1.1% between 2017-2013. Japanese productivity growth hit an average 1.8% between 1999 and 2006, moving down to 1.0% between 2007 and 2013.

Worrying signs of a stagnant economic activity are also highlighted by the growth rate of total hours worked. In the Euro Area, total hours worked grew at an annual average rate of

0.9% between 1999 and 2006, whilst they moved down to an average -0.6% between 2007 and 2013. In the US, total hours worked hit an average annual rate of 0.6% between 1999 and 2006, moving down to -0.2% in the 2007-2013 period.

Different explanations have been employed in order to account for the puzzling slowdown in productivity and hours worked: a structural origin, a cyclical origin or the effect of a mismeasurement. A fully structural explanation can be understood by analyzing the paradigmatic model provided by Romer (1990). He posits a model that links the generation of knowledge and innovations to increases in labor productivity. A two-sector model is considered: the first one produces a final good throughout a Cobb-Douglas production function with standard capital and labour as factors of production. Labour enters the process according to a productivity index that embodies the knowledge stock of the economy, which is produced by the second sector. The latter builds upon the existing stock of applied knowledge to produce new knowledge, depending on the flow of investment generated in each period. There are two crucial assumptions by Romer (1990). First off, the economy is at full employment, thus the stock of investments is fully depending on the rate of savings accumulated in each period. Secondly, labor productivity is exogenously given. A fully structural explanation of a global productivity slowdown would thus point at a deterioration of labor quality (i.e. a reduction in rate of accumulation of knowledge), or a reduction of capital expenditure that may depend from several factors, including bureaucratic burdens and credit rationing by banks.

Some Post-Keynesian approaches to technical progress, instead, look at labor productivity as an endogenous variable. Verdoorn (1949) finds a simple econometric relationship between the growth rate of labor productivity and the growth rate of output, thereby showing that cyclical fluctuations in output may have an impact on output per head. Most importantly, autonomous sources of effective demand, and investment above all, can trigger a self-feeding process. In a very simple functional form we would have:

$$g_{(Y/L)} = \alpha + \beta g_Y$$

The relationship was further analyzed by the economist Nicholas Kaldor, who posited a *technical progress function*, with decreasing returns, that came to be known as *Kaldor-Verdoorn's law*. According to Kaldor's formulation, it is the growth of the degree of real capitalization that explains productivity growth (Targetti et al., 1992):

$$g_{(Y/L)} = F[g_{(K/L)}]$$

The simple intuition above implicitly posits a relationship between the growth rate of productivity and the profitability of investment in a given economy. Investment in each period can be seen as a function of the existing profit share of income, and Kaldor posited an adjusting price level which may enable the current profit share to coincide with the targeted one. The theory still falls short of explaining the causal drivers of productivity growth, namely the relationship between innovation, knowledge and productivity gains.

In order to account for the effective drivers of labour-saving innovations, recent studies in the Post-Keynesian strand have highlighted a relationship between wage pressures, effective demand and the growth rate of productivity (Storm et al., 2012; Naastepad, 2006). According to Storm et al. (2012), the growth of real wages has a twofold impact on labour productivity. First

off, a growth (decrease) of real wages increases (depresses) aggregate demand, thereby boosting (reducing) productivity growth through the Kaldor-Verdoorn effect (Mccombie et al., 2002). Secondly, a growth (reduction) of real wages accelerates (delays) the search for labour-saving technological progress, as it increases (reduces) firms' incentives to actively pursue labour-saving R&D, as studied by Hicks (1932); Kennedy (1964); Foley and Michl (1999); Funk (2002).

Storm et al. (2012) posit a simple linear relationship between labor productivity, output and real wages which captures most of the evidence highlighted by studies on the Kaldor-Verdoon effect and the cost-induced innovations:

$$g_{(Y/L)} = \beta_0 + \beta_1 g_Y + \beta_2 g_w$$

where g_w is the growth rate of real wages. Mccombie et al. (2002), reviewing 80 empirical studies, find a causal link from demand growth to productivity growth in the majority of them, while Marquetti (2004), using data for the US economy between 1869 and 1999, finds unidirectional Granger causality from the real wage to labour productivity. These pieces of evidence are consistent with the institutional setting of wage bargaining, which "drives" profit-seeking enterprises to enhance labour productivity when real wages grow, in order to ensure the reproduction of a positive economic surplus for capital owners.

Therefore, considering both the approaches outlined it can be argued that a productivity slowdown presents both *structural* and *cyclical* aspects, with the latter reinforcing the former. Studies such as Schmitt et al. (2012) stress that the constraints to real wages posed by post-1970s labour market policies in the US produced a deterioration in the quality of jobs. While the U.S. economy increased its potential of output creation due to increasing productivity (Bivens et al., 2014), the typical U.S. worker has also increased its *employability*. According to Schmitt et al. (2012), the median age of workers in the labor force in 2010 was 7 years older than in 1979 and the share of workers with at least a four-year college degree increased from 19.7% in 1979 to 34.3% in 2010. These findings suggest that deterioration of labour skills cannot be a structural driver of a current productivity slowdown, taking into account also the increasing mechanization of the economy and the development of ICT techonologies. According to the Kaldor-Verdoorn effect, stagnation of aggregate demand in the years of the Great Moderation and the 2007-2008 recession have provided a cyclical drag on productivity, as it is apparent by several case studies of low-productivity countries (Storm et al., 2012; Naastepad, 2006). At the same time, the loss of bargaining power on part of workers, aimed at restraining real wages in the U.S. and the Euro Area (Baker et al., 2007), provided less incentives for firms to seek for labor-saving innovations through R&D, thereby acting as a structural drag on productivity. The case of Netherlands, studied by Salverda et al. (2009), also finds that low productivity growth was responsible for the creation of low-wage flexible jobs in the service sector, thereby showing how real wage constraints may structurally redefine the average quality of employment.

Finally, another theory points at the possibility that the decline in the growth rate of productivity reflects *mismeasurement*, namely a decline in the effective capital stock due to lower utilization that is not captured by standard growth-accounting methods (Mokyr, 2014; Hatzius and Dawsey, 2015). The authors hypothesize that the phenomenon may be triggered by a decline in the effective capital stock due to a lower utilization of resources allowed by the diffusion of ICTs. According to recent empirical studies such as Syverson (2016), however, the theory

faces hurdles when confronted with the data. The author shows that the productivity slowdown occurred in several countries is unrelated to the countries' intensity of ICTs. Moreover, he finds that estimates of the surplus created by digital technologies cannot account for the missing output resulting from the productivity growth slowdown.

3   The Developmental State

3.1   Competing theories of innovation

The neoclassical growth model and the post-Keynesian one provide useful insights on two different aspects of technical progress, namely the production and accumulation of knowledge and the factors explaining the growth rate of productivity. Furthermore, Post-Keynesian literature has also analyzed the socio-political determinants of innovation and its relation with output growth and wage bargaining. However, in order to properly describe the process through which new ideas are turned into innovations - which may then contribute to increase the growth of productivity - further analysis is needed.

Schumpeter (1942) argues that capitalism is an inherently evolutionary system, the growth of which is best explained by analyzing the capability of generating new technologies that replace more costly or lower quality techniques of production and consumption goods. The process of *creative destruction* allows firms to introduce radical innovations in their production process, thereby acquiring competitive advantage that drives inefficient firms out of the market and their related technologies. The relevance of the creative destruction effect has been widely acknowledged by different theoretical strands of economic thought (Aghion and Howitt, 1990; Mazzucato, 2013b; Dosi et al., 2010).

The key driver behind the rise of innovation waves according to Schumpeter (1942) is entrepreneurship, which is mainly regarded as a function more than a specific individual, thus it can be embodied by a business leader, a corporate manager, or a group of people. Other important theories of entrepreneurship, as in Knight (1921) and Drucker (2011), emphasize that the distinctive feature of entrepreneurs is a risk-taking attitude. On top of that, they act in a context of *fundamental uncertainty*, and a sharp distinction is made by Knight (1921) between the two concepts. Whilst risk entails a known probabilistic distribution of outcomes and it is thus computable, uncertainty involves the impossibility to know the stochastic distribution of possible outcomes. According to Mazzucato (2013a), uncertainty is the existing condition of R&D efforts by firms, non-profit research organizations and public researchers. For instance, technological innovation from R&D projects in the pharmaceutical sectors may take up to 17 years to get finalized, with a probability of success approaching 0.01% and thus a significantly high amount of fixed costs (Mazzucato, 2013a; Nightingale, 2004).

Therefore, the Schumpeterian argument about the relationship between firm size and innovation is that reducing degrees of competition will be beneficial to innovation, as high-profit firms in concentrated markets can sustain higher R&D efforts due to inferior market uncertainty and a larger and more stable funding base. In Schumpeter's analysis, perfect competition with zero expected profit for firms achieves static efficiency but generates dynamic inefficiency. This argument was countered by Arrow (1962), who finds that competition positively induces innovation through a theoretical model. The Arrow-Schumpeter debate was further analyzed by

Delbono and Denicolò (1990), who show that the trade-off between static and dynamic efficiency arises due to overinvestment in R&D, when there is a strong competition over prices in the goods market. Furthermore, Aghion et al. (2002) step in the Arrow-Schumpeter debate and find that the relationship between competition and innovation behaves in opposite ways when considering low and high intensity of competition. For low levels of competitive pressure, the escape-competition effect dominates, whilst the Schumpeterian effect dominates at higher levels.

The debate, however, abstracts from any financial consideration, which turns out to be the crucial driver of investment for oligopolistic firms and market leaders in general. Myers and Majluf (1984) pioneered the Pecking Order Theory, which states that firms have a priority list of sources of fund, from which they choose in order to fund investments. According to Myers and Majluf (1984), firms regard retained earnings as the preferred source of funds for investment: therefore, in their model, wealthy firms are able to carry out a larger volume of investments. Whilst the theory has found mixed empirical support (Hubbard R. Glenn, 1995), the literature on the importance of financial constraints and capital market imperfections highlighted that financial factors can be an important driver in explaining investment differentials (Vogt, 1994; Fazzari et al., 1988).

The Neo-Schumpeterian school extends the discussion beyond the debate around the optimal market form, and focuses on the different incentives available to public and private agents. Mazzucato (2013a) implements the aforementioned distinction between risk and uncertainty in an original fashion. She appraises the role of the State (especially the US government) in the post-war era in promoting the General Purpose Technologies (GPTs) which allowed the rise of multinational players in different sectors (electronics, information technology, pharmaceuticals and many others).

Neo-Schumpeterians emphasize the limitations of the view of public investment as a necessity due to market failures. The thesis advanced by (Mazzucato, 2013a) is that in a world dominated by Knightian uncertainty, the State should act as the primary risk-loving entrepreneur and thus open new paths of research and innovation without any concern for short-term financial objectives. In fact, Ruttan (2006) shows that this is what the US government did in the post-war era. He discusses the development of several technology complexes ('mass production', aviation, space technologies, ICT, the Internet and nuclear energy) and shows that the government acted as first mover in their launch. Lazonick (2013) argues that the stark success of the US government in laying the foundations for aeronautical technologies, life sciences, nanotechnology and clean energy industries is not simply due to the fine-tuning of incentives. Rather, the government intervened in the early stage of development of these sectors, providing not only funding to pioneers of research, but also supervising the process of commercialization (Block and Keller, 2011; Abbate, 1999).

A similar trend is visible in pharmaceuticals. Mazzucato (2013a) shows that the percentage of innovative drugs, called New Molecular Entities (NMEs), out of the 1,072 drugs approved by the US Food and Drugs Administration between 1993 and 2004 was only 23%, whilst 67% were variations of existing drugs. It is interesting to note that 75% of the NMEs were developed through public research, namely in the National Institutes of Health's laboratories.

The role of venture capital and private equity in the development of an advanced network of industries is surely worth mentioning as it greatly contributed in the diffusion of groundbreaking

technologies and the creation of an investment-friendly environment (Hellmann and Puri, 2000). However, as Mazzucato (2013b) shows, profit incentives often leads venture capitalists to crave close exits instead of providing 'patient capital', thereby proving unable to sustain the full development of new markets from inception.

Hence, Block (2008) defines the US industrial policy as the intervention of a *Developmental State*, albeit of a 'hidden' kind due to business' leaders ambiguity on their support for such an intervention. Block and Keller (2011), accordingly, show that whilst major private players in several crucial industries as biotechnology demanded private intervention to foster the market's initial development, the State's role in these sectors has not been discussed in public debate in order to avoid criticism by more *laissez-faire* political groups.

Interestingly, Block and Keller (2011) shows that the most successful research programs emerged out of the activities related to the public military-industrial complex, due to a general convergence of the public opinion in support of defense-related studies. The nature of a 'hidden' developmental State emerges when analyzing the function of public agencies such as the Defense Advanced Reserach Projects Agency (DARPA). Despite the name clearly points at a military entity, the agency employed public funds devoted to military research in order to develop innovative technologies such as semiconductors, support to human-ICT interfaces and supervise the early stage of the Internet's development.

The same developmental lead by national governments is assessed by Mazzucato (2013a) in the field of green technologies and biotechnology today. For instance, the Brazilian Development Bank (BNDES) funded more than \$4.23 billion in clean technology projects in 2011 and China is developing a strategy to achieve the goal of installing 20 GWs of solar power each year until 2020, thereby tripling its solar capacity. In 2015, China outsmarted Germany as the global largest market for solar power, and it is still at the very beginning of its investment efforts. In the cases of Brazil and Japan, the 'patient capital' needed to foster the development of clean sectors was provided by State-funded investment (*development banks*), which are able to take more risk and provide long-term finance for more than ten years (Fried et al., 2014).

Assessing the patterns of State intervention in the 20th century, Mazzucato (2013a) highlights the benefits of public decentralized agencies such as DARPA, ARPA-E and SBIR (Small Business Innovation Research), which have been given a different focus each but a common set of features. First off, their activities enjoy higher degrees of autonomy compared to standard public administration offices. Secondly, they engage in 'blue-sky thinking' and act in partnership with private innovative start-ups and research groups. Finally, they actively engage in laying down the foundations for new markets created by new technologies.

3.2 A new wave of social innovation

The previous section discusses how major technological achievements of the last century can be traced back to investments and research efforts in the military field (Mazzucato, 2013a). The development of ICT, electronics, biotechonology and medical innovations spurred an unprecedented growth in productivity in the 1980s, which has now ground to a halt, in a puzzling fashion for economists and managers as it was discussed in Section 2.

Policy responses to the pressing issue of decreasing productivity greatly differed within OECD countries and between advanced and developing economies in the 1990s and the 2000s,

while the issue still remains unsettled. In Europe, Latin America and other emerging markets, the main policy response to the productivity slowdown has been the implementation of structural reforms, which include the reduction of workplace protection, reform of taxation systems, the increase in the incentives to hire and fire for employers. The rationale for these policies is reflected in the supply-side approach of the 1994 OECD *Jobs Study* (Casey, 2004), which attributes the productivity slowdown to bottlenecks and inefficiency in the production process of industrial countries due to lack of mobility of jobs and bureaucratic rigidities in Western countries.

Empirical evidence on the effectiveness of labour market reforms is mixed. Lora (1997) studies the impact of structural reforms in Latin America between 1985 and 1995, finding that per capita income in the region would have been 12% lower without reforms, whilst the reforms had not been able to restore pre-1990s growth rates. Salgado (2002) implements a panel analysis of 20 OECD countries and finds that the impact of structural reforms on productivity growth may be weak or negative in the short term, which may be attributed to adjustment costs and firms' difficult transition to a less regulated context. In the long run, instead, Salgado (2002) finds that product market reforms positively affect productivity growth. However, the same study finds that labor market reforms do not generate improvements in productivity growth. Moreover, Adascalitei and Pignatti (2015) and Adascalitei et al. (2015) show that the greater degree of labour market *flexibility* reduces the short-run rate of unemployment and generates a negative impact on employment rates. Building on existing empirical evidence, Dosi et al. (2016) build a Keynesian-Schumpeterian model that shows how reducing labour protection may increase fragility and volatility of the economic system, thereby triggering recessions.

A different policy response to the slowdown in productivity can arise out of the analysis of investment in infrastructure, services and general purpose technologies in OECD countries. For instance, productivity growth has been heterogeneous across different sectors in the late 20th Century. Whilst output grew at 3.6% in manufacturing and at 3.8% in services in OECD countries from 1960 to 1994, productivity in manufacturing had a 3.6% annual growth rate, in stark contrast to the 1.6% annual growth of services productivity (Rowthorn and Ramaswamy, 1999).

According to studies by the think tank H3G (Third Generation Environmentalism), one of the major drags on services productivity in Europe is underinvestment in several crucial areas for economic growth in the continent. The European Commission forecasts the area will need a to invest up to 200 billion euros yearly in energy efficiency, new patterns of renewable energies and networks in order to create an Energy Union which is able to achieve EU climate objectives (Bergamaschi et al., 2015). A first policy response to this need is the European Fund for Strategic Investment (EFSI), commonly regarded as the investment device of the *Juncker Plan*. Therefore, Bergamaschi et al. (2015) advocate a strong investment effort that could be realized by the EFSI provided that *additionality* is entailed by projects that are proposed by Members States to the European agency. The concept of additionality is regarded by EFSI regulation as needed investment when market failures or suboptimal capital stock accumulation arise: it is therefore the approach to public investment which is criticized by Mazzucato (2013a). Bergamaschi et al. (2015) show that several sectors would require 'additional' investments in the aforementioned sense.

First off, building renovation and energy efficiency are regarded as crucial priority areas

where investment opportunities exist. Holmes et al. (2014) estimate that the EU could save up to 2 trillion euros through cost-effective energy savings which allow for a 80% reduction in gas imports. They suggest the creation of an investment platform for the renovation of public buidlings through refurbishing of schools, kindergartens, hospitals and universities and the renovation of low-income homes. As a matter of fact, 50 million people in EU are unable to bring power and heat to their dwellings, thereby highlighting the need for improving energy efficiency of social housing and low-income homes.

Furthermore, Bergamaschi et al. (2015) make the case for investments in offshore electricity infrastructure in the North Seas, estimating that the decarbonization of the EU's power sector would generate 300,000 high-skilled vacancies by 2030 and avoid the emission of 315 million tonnes of carbon dioxide emissions.

Another crucial investment opportunity lies in improving the innovation capacity of EU cities: the development of urban networks and smart cities would greatly enhance productivity of workers and businesses, as well as providing new opportunities for cultural development Bergamaschi et al. (2015). Moreover, climate change can bring about adverse effect on urban networks, as most cities find themselves at risk from systemic failures due to natural catastrophes.

The main problem highlighted by Bergamaschi et al. (2015) is that the existing projects related to these crucial investments often lack the financial support and long-term commitment that major infrastructural projects require. For instance, environmental projects needed by Germany according to the German Energy Agency would require at least 5 billion euros in yearly investments but existing support from the German national promotion bank KfW does not exceed 1.5 billion euros (Kopatz, 2013). Moreover, the general approach advocated by EU institutions strongly relies on the creation of investment platforms which are able to attract pension funds, investment funds, venture capitalists and private equity funds. As shown by Bottazzi et al. (2008) there is evidence that financial markets are not able to channel funds to the most promising and productive firms. Mazzucato and Wray (2015) argue that the increasing financialization of the economic system in the US and Europe has generated a set of incentives which is unfit for the provision of 'patient capital' needed for long-term commitment to infrastructural investment. They show that venture capitalists have greatly contributed in later stages of development of groundbreaking technologies, but they cannot provide initial funding to blue-sky research due to the search for 'impatience rewards' (early IPOs, stock repurchases, M&A deals aimed at downsizing employment, asset firesales).

Therefore, Mazzucato (2013b) and Mazzucato and Wray (2015) make a case for a *mission-oriented* finance which would be better able to deal with the capital development of nations. They argue that an ambitious policy stance is needed, where the public sector can: i) invest in high capital intensity and uncertain technologies, thereby creating *supply* of new innovations and ii) promote policies that create the *demand* for such innovation, inducing customers to modify their consumption patterns and switch their lifestyle towards more sustainable practices.

In this context, the creation of an Employment Guarantee Scheme as advocated by Minsky (1986) coupled with a public investment planning which coordinates a set of dedicated, decentralized public agencies can achieve the above stated goals in terms of supply and demand.

4 Employment Guarantee Schemes and the labor market

Building on the analysis of historical data and the discussion of the State's role in promoting innovation, the following section will outline both a theoretical and policy-related discussion of Employment Guarantee Schemes, preceded by a general review of the most relevant theories of the labour market in macroeconomics.

4.1 Competing theories of employment

The inability of modern economies to approach full employment in spite of unprecedented technological progress has been crucial in the economic debate since the very beginning of the 20th century. As a matter of fact, the Great Depression that began in 1929 in the United States provided a clear-cut example of how several hurdles to economic growth can prevent Say's Law to hold. The benchmark theory of the labor market at the time is best exemplified by Pigou (1933), who posits a short-run equilibrium relationship between labour supply and labour demand given by the following relations:

$$L_d = f(w) \quad f' < 0 \tag{1}$$

$$L_s = f(w) \quad f' > 0 \tag{2}$$

$$L_d = L_s \tag{3}$$

where L_d is the labour demand curve, w is the real wage and L_s is the labour supply curve. Therefore, according to Pigou (1933) the labour demand curve, obtained as a derivative of an aggregate production function with respect to labour input (the marginal productivity of labour), posits an inverse relationship between real wage and employment due to the law of diminishing returns. The labour supply function L_s is based on the intuition that workers choose between work (regarded as a 'bad') and leisure (regarded as a 'good') taking into account the real wage as a compensation mechanism for tolerating work. The interaction between the labour demand and supply function thus determines the real wage and the employment level in each period, with the (Walrasian) equilibrium level reflecting a full employment context. The latter is guaranteed by real wage adjustments via prices, according to which any shift in preference would result in a changing full employment level, provided that government intervention or any form of real wage constraint did not impede real wage adjustment. Therefore, Pigou (1933) provides a foundation for the neoclassical view of the labour market, according to which wages are to be conceived as the price of labour, and thus as market-determined.

The ability of real wage adjustments to attain full employment was notably criticized by John Maynard Keynes, whose fundamental objection lies in the in the assumption that no concern for effective demand issues is raised in the neoclassical framework as highlighted above (Galí, 2013). Therefore, employment is perceived in the neoclassical framework as an outcome of real wage determination, whereas in the Keynesian view the logic should be reversed. According to the latter, employment is a function of output that firms are willing to produce given the existing technology, and therefore the aggregate capacity utilization of firms is determined by

aggregate demand for goods and services. It is straightforward, then, that nominal wage cuts that are not followed by an expansion in aggregate demand will bear no impact on output, employment and the real wage, thereby failing to reduce involuntary unemployment.

Modern macroeconomics, however, also found several supply-side factors that are able to produce non-Walrasian outcomes in the labor market (Romer, 2011). First off, firms may be unwilling to reduce the nominal wages they pay for reasons explained by *efficiency-wage* theories (Akerlof and Yellen, 1986; Summers, 1988). Enterprises may value the benefits of higher wages on their labor forces as outweighing their financial costs due to a higher motivation of workers, the inability of firms to monitor workers' efforts and the possibility that higher wages can increase workers' capabilities. The second of these motives was notably analyzed by Shapiro and Stiglitz (1984). The authors show that if firms face imperfect monitoring of workers' activities, they can set wages at a premium with respect to market-clearing levels so that workers strictly prefer to exert effort than to shirk, given that the punishment for shirking is being fired. Therefore, Shapiro and Stiglitz (1984) see unemployment as a means to discipline workers, as the relevance of punishment for workers will be an increasing function of the unemployment level. Another reason for the persistence of unemployment explored by modern macroeconomics is the phenomenon of *hysteresis*, which turns short-term fluctuations in employment levels into a permanent increase in labour slack (Blanchard and Summers, 1986). Under a set of institutional arrangements, among which there is the protection of existing contracts, workers that become unemployed end up losing bargaining power in wage-setting. The relevance of the phenomenon has been considered by the author especially for the European context. Among the possible sources of hysteresis there are also the progressive deterioration of skills of unemployed workers, so that firms are forced to insist on a restricted pool of workers when they are in need to hire, and the adjustment of unemployed workers to a lower standard of living. Other mainstream macroeconomic theories known as *search and matching models* also explore issues of workers' heterogeneity as a driver of frictional unemployment issues (Mortensen and Pissarides, 1994).

Hence, the existence of non-Walrasian outcomes has been analyzed with respect to several potential drivers, which tend to drive real wages away from theoretical market-clearing levels. Given this point of reference, it may be also of interest to look at the theories accounting for the function of unemployment in a capitalist economy.

4.2 The function of unemployment

Classical economists held the view that real wages cannot be determined within market transactions, but they are administered through institutional mechanisms. In this respect, the idea is that real wages represent the real cost of production and a positive surplus can be determined by the production process only after that the share of output needed by workers has been determined. An analytical foundation for the out-of-market determination of wages can be found in Sraffa (1960), who provides a mathematical foundation of the surplus approach pioneered by David Ricardo (Ricardo, 1973).

From a broad perspective, unemployment is a form of inefficiency in a modern capitalistic economy. The existence of unemployment means that an important share of the labour force is idle, with zero productivity and the risk of progressively deteriorating their skills and human capital. Furthermore, unemployment determines a suboptimal use of firms' capacity utilization,

thereby resulting in a loss of output and, ultimately, profits.

However, economic theory has found several explanations for the importance of unemployment as a distinctive feature of actual economies, besides the 'disciplining' argument explored by Shapiro and Stiglitz (1984) which was already discussed. The former engineer and econometrician Alban W. Phillips introduced a key concept in the debate on labour markets, namely the existence of a trade-off between the growth in nominal wages and the growth rate of unemployment (Phillips, 1958) that is today known as the *Phillips curve*. The study, further analyzed by Lipsey (1960), finds a statistically significant inverse relationship between the growth of nominal wages and the rate of unemployment between 1862 and 1957, thereby laying the foundations for the idea that the existence of unemployment is instrumental to the stabilization of the growth of wages. Further steps in economic research, such as Samuelson and Solow (1960), went further in seeing the relationship proposed by Phillips as a trade-off between unemployment and inflation. They also found a significant shift in the Phillips curve between the pre-war and the post-war period, thereby stressing the need to control employment growth in order to curb excessive inflation. Friedman (1968) debated the Phillips curve by stressing the importance of inflation expectations, whereas Samuelson and Solow (1960) link the growth of unemployment to actual inflation. Accordingly, the tightening of labour markets due to the growth in demand brings workers to supply more labour because they do not notice the difference between a rise in money wages and a rise in real wages (Mitchell and Muysken, 2008). However, due to asymmetric information, businesses are instead able to internalize the impact of inflation expectations. When workers realize their mistake they withdraw the excessive effort, thereby triggering a contraction of output and employment levels to their *natural* levels. Therefore, Friedman argues there is no long-run trade-off between inflation and unemployment, but that the long-run equilibrium unemployment is the '*level that would be ground out by the Walrasian system of general equilibrium equations, provided there is embedded in them the actual structural characteristics of the labor and commodity markets, including market imperfections, stochastic variability in demand and supplies, the cost of gathering information about job vacancies and labor availabilities, the costs of mobility, and so on.*' (Friedman, 1968). Hence, in the Fredmanian framework any economy has a set of structural features that lead the labor market to set a maximum threshold to labour absorption, regardless of demand-side issues. The notion of NAIRU (*Non-Accelerating Inflation Rate of Unemployment*), which was established by Layard et al. (1991) and derives from the analysis contained in (Friedman, 1968), is a standard tool employed in policy analysis at the majority of institutional levels, including the European Commission. The empirical soundness of the root of this concept, namely Phillips (1958), is disputed by Gilbert (1976). Furthermore, authors as Bhaduri (2002) show that formulation of out-of-equilibrium dynamics postulated by Friedman is theoretically problematic as well.

Another tradition looks at the relationship between the growth of wages (and prices) and unemployment essentially as the outcome of a social bargaining process. One of the first appraisals of the phenomenon was given by Marx (1976)[1], with the following logic: firms need a 'reserve army' of unemployed workers for times of overproduction, in order to quickly and cheaply respond to fluctuations in demand and capacity utilization. Therefore, unemployment plays for firms the same role that Keynes (1936a) attributed to liquidity preference for con-

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[1]The original manuscript, which was not published, was written in 1847.

sumers in a world characterized by fundamental uncertainty: it provides a pool of workers from which firms can hire and be sure that their wage offer will be accepted. Marx (1976) also conceived the process of wage formation as an inverse function of the unemployment rate, thereby coming to the same conclusion advocated by Phillips (1958), though with a totally different explanation for the phenomenon. Other scholars as Kalecki (1943) also mention the function of unemployment as a device to retain political control of the production process by business leaders, which may lead corporate groups to advocate the need for neutral fiscal policy in order to avoid the unemployment rate to decrease.

4.3 The idea of Employment Guarantee Scheme

Regardless of the theoretical framework underpinning the concept of unemployment and its relationship to inflation, the relevance of the link between fiscal policies, the tightness of the labour market and price dynamics is thus well established in the literature and it is clear in policy making at any institutional level. The pervasiveness of the NAIRU approach led many governments in the 1980s to reconsider the large scale reached by social welfare systems (Atkinson, 1999) provided the scientific basis for the famous 1994 OECD *Jobs Study*, that implemented a 'full employability' policy stance in order to reduce the structural non-demand hurdles to the persistence of high unemployment in OECD economies (Casey, 2004).

The supply-side policies advocated by the NAIRU approach consider the maintenance of a low and stable inflation rate as main priority, in order to anchor inflation expectations and prevent wage-price spirals that would dramatically increase the cost of living and jeopardize investment. The policy tool chosen by this approach to stabilize the inflation rate is the use of unemployment as a buffer stock in order to curb excessive demand (Mitchell and Muysken, 2008).

Therefore, the appropriate kind of fiscal policy which is consistent with the goal of stabilizing inflation is neutral or restrictive, according to theoretical approaches which establish a direct link between public spending and inflation (Sargent and Wallace, 1983; Buchanan, 1958). According to a Quantity Theory of Money interpretation of the price level, government expenditure is mainly directed to subsidies, wages for services in the public administration, unemployment doles and other non-manufacturing uses, thereby leading to an increase in the money supply without an increase in transactions (i.e. the velocity of money) and thus producing inflation. If the government runs a deficit, according to the model developed by (Sargent and Wallace, 1984), fiscal deficits cause inflation because the government needs seignorage revenues to prevent default.

Building on the notion of buffer stocks as a crucial device to stabilize the general price level, a radically different approach to fiscal policy and the welfare state has been developed by scholars in the Post-Keynesian tradition. The American economist Hyman Minsky, whose *Financial Instability Hypothesis* has been extensively mentioned in the financial press and acknowledged by the Federal Reserve Chairman Janet Yellen (Yellen et al., 2009), pioneered the concept of the State as *employer of the last resort*. The basic case for such a program can be retrieved in Keynes (1936a), who argues that public capital expenditures should be devoted to guarantee a stable growth of investment over the business cycle in order to achieve full employment.

Another important foundation to this idea was provided by Lerner (1943), who developed a

theory of *functional finance* according to which budgetary outcomes should be assessed solely in terms of their contribution to the employment level, and monetary policies should mainly be concerned with the maintenance of policy short-term rates of interest. Whilst the second proposition is widely accepted among scholars and in the world of central banking (McLeay et al., 2014; Bindseil, 2014; Woodford, 2011), the former represents a challenge to the orthodox fiscal policy discourse and it will be further discussed in the following section.

4.4   Financial and real constraints

Neoclassical microeconomics focuses on the study of budget constraints, which then generate the problem of allocation of a limited stock of wealth among alternative uses. In a similar fashion, public finance studies generally revolve on the government's dynamic budget constraint, which can be defined as follows in a continuous time setting:

$$\dot{b}(t) = \alpha(t) - \beta(t) + [r - g]b(t) - \dot{m}(t)$$

where $b(t)$ is the ratio between stock of public debt in a time unit t and GDP, $\alpha(t)$ is the ratio between the stock of government expenditures in t and GDP, $\beta(t)$ represent the ratio of the stock of tax revenues over GDP, r is the real interest rate at time t, g is the growth rate of GDP and $m(t)$ is the ratio of the stock of central bank's net money creation in purchase of government debt (generally defined as *monetization*) to GDP. Therefore, the above is an accounting identity linking variations of government debt in a unit of time to the excess of government spending over taxation, the interest payments on outstanding government debt, the growth rate of GDP and changes in central bank's purchases of government debt. The problem which this accounting identity is geared to solve is the stabilization of the ratio of public debt to GDP, which is considered as a necessary condition for the stability of an economy in several theoretical frameworks, including New Keynesian scholars (Romer, 2011; Blanchard et al., 1991). Mainstream scholars read the identity as a causal and binding constraint, arguing that high debt-to-GDP ratios will lead financial markets to lose confidence in the government's ability to pay principal and interest on its debt. Furthermore, $m(t)$ and its rate of change is often neglected in the budget constraint due to the common institutional arrangement of central bank independence in OECD countries. Two further assumptions are made within the mainstream view of government debt (Sardoni, 2009): the real interest rate is higher than the growth rate of GDP ($r > g$), and the economy's growth rate is exogenously given, thus it does not depend on public or private demand.

Hence, *sustainability* could be defined as the government's capacity to extinguish its obligations, and it will crucially depend upon the government's ability to sell bonds to private investors and to raise taxes. In order to keep interest rates low, the government should reduce or stabilize the debt-to-GDP ratio. Given the above set of assumptions, the only possible way for governments to achieve its goals is to run primary surpluses, by increasing tax rates or reducing public spending. Moreover, the *Fiscal Theory of the Price Level* argues that the value of outstanding public debt equals the present value of the future stream of taxation, thereby reinforcing the importance of a government's commitment to maintain at least a balanced budget in the long run (Sims, 1994). However, relaxing the above set of assumptions can provide different results as shown by Sardoni (2009). First off, if budget deficits can be funded

by the central bank's purchases of the government debt, they do not affect the stock of public debt: this possibility is ruled out as policy measure because the creation of additional money would generate inflation in the long-run (Carlin and Soskice, 2006), but the recent experience of unconventional monetary policies aimed at expanding the monetary base in EU, USA and Japan have shown little support of this claim (Borio and Disyatat, 2010). Furthermore, when the economy's growth rate g exceeds the real interest rate, the debt-to-GDP ratio could be stabilized (or even reduced) through primary deficits. The mainstream view, however, argues that empirical evidence has shown that most OECD countries have experienced higher interest rates on the public debt than the growth rate since the 1990s (Carlin and Soskice, 2006) and that the growth rate of the economy is generally exogenous, independent from the growth of public expenditures. This conclusion reflects the view of the public debt as essentially equal to private debt, and therefore $r > g$ can be thought of as a No-Ponzi Game condition which is necessary to support the conclusion: the government cannot borrow indefinitely as it needs to end up repaying its debt in the long run due to its intertemporal budget constraint.

It can be argued that the above line of reasoning seems to conflate the notion of sustainability with the notion of *solvency*, which are equivalent when related to private agents but can differ when related to governments. As a matter of fact, the ability of any agent to repay its obligations is constrained by the ability to fund its position in assets through an adequate issuance of liabilities (Minsky, 1976). However, Cochrane (2005) and Sims (2013) show the basic difference between a government and a private agent (firm or consumer). Government liabilities are an asset for any private agent: banks need high-powered money in order to settle payments among themselves, whilst consumers and businesses need it ultimately to redeem tax liabilities imposed by the governments, and more generally to pay for goods and services within their nation (even when mediated by bank accounts).

Therefore, as long as a government can assume a 'short' position in a liability which it is able to create, solvency is never an issue and the debt-to-GDP ratio is irrelevant for the ability to pay interest on outstanding debt (Sims, 1994). Whilst the latter is a purely *nominal* debt in the aforementioned case, different institutional arrangements may create a *real* debt for the government, where funding is constrained by the present and future streams of tax revenues and the willingness of private lenders to purchase government bonds. A real debt arises when governments borrow in foreign currency, undertake exchange rate pegs or enter the Euro Area, where any monetization of government's debt by the central bank is forbidden, thereby making the euro a foreign currency for EU governments for all practical purposes and eliminating a lender of the last resort for governments at a European level (Sims, 2012).

Hence, solvency is determined by the kind of institutional setting which ties monetary policy to fiscal policy, with central bank independence playing a minor role in its determination. As a matter of fact, independence is a characteristic feature of the majority of OECD countries and it comes down to the lack of direct debt monetization by the central bank on the primary market. However, central bank purchases on the secondary market are always possible and the presence of an explicit guarantee by the central bank puts a downward pressure on interest rates, thereby ensuring solvency for national governments.

Neo-Chartalist economists take this line of reasoning even further and argue that government debt and tax revenues are not required for the government's funding, with the former being instrumental to the targeting of a policy short-term interest rate by the central bank (Kelton,

2011; Wray et al., 1998; Mosler, 1997). Neo-Chartalists analyze the relationship between the Treasury and the central bank by pointing out that in order for the central bank to fully commit to its short-term interest rate target, the central bank must adjust the level of reserves in the banking system so as to achieve the policy rate. Government spending represents an injection of reserves in the private banking system, whereas taxes drain reserves: therefore, from a pure accounting perspective, deficit spending represents a net injection of reserves for the banking system. Therefore, the central bank needs to act in a defensive fashion in case of a public deficit in order to maintain the announced policy rate, and thus it will need to resort to different policy tools to drain reserves. Bond sales is one of these tools, and Bell (2000) shows how these operations can be *ex ante* coordinated between the Tresury and the central bank or they can be arranged due to excess reserves in the banking system. In any case, the sale of bonds for governments which issue the currency in which their spending is denominated is an internal accounting operation instead of a funding one, whereas governments that are simply users of the currency (as in the Eurozone) are constrained by bond sales and tax revenues (Lavoie, 2013).

Therefore, according to Neo-Chartalists, sustainability issues should be separated from solvency considerations. The latter entail the existence of *financial constraints*, which depend upon institutional relationship between fiscal and monetary policy at the national level. On the contrary, sustainability entails the presence of *real constraints* in the spending capacity of the government, which is limited by the existing unemployed labor force and the amount of unused or underutilized real resources in the economy (Wray et al., 1998). Public deficits will be sustainable as long as they are able to raise the productive capacity of the economy in the neo-Chartalist view, whilst they will be inflationary if spending power outstrips the ability of firms to adjust their capacity utilization levels to the increase in demand. Hence, they make a strong case for the implementation of Keynesian policies in times of underutilization of labour and real resources, and propose other a-cyclical measures in order to stabilize the business cycle, the main one being the implementation of Employment Guarantee Schemes.

4.5 Fiscal policy and EGS

Neo-Chartalists are not alone in their advocacy of fiscal policy as a stabilizing tool for the economy, especially in the aftermath of the 2007-08 financial crisis (Stiglitz, 2016; Buiter, 2014; DeLong and Summers, 2012; Galí, 2014). Economists of different theoretical strands, most frequently of New Keynesian and Post-Keynesian orientation, actively support an expansion of government investments in infrastructure, a decrease in tax rates for the income classes with a higher propensity to consume and other expansionary measures which are considered to be paving the way out of the present stagnation of the global economy, whether it is 'secular' or not.

However, Keynesian policies in the second half of the 20th century have been judged as a short-run solution by monetarist economists due to the emergence of bottlenecks and inflationary pressures in the long-run. Furthermore, the NAIRU approach rejects any possibility for increased public spending to absorb the whole labor force due to hysteresis (Blanchard and Summers, 1986), failure of coordination and political economy issues (Alesina and Tabellini, 1990).

Drawing on the analogy between the Lender of the Last Resort function by the central bank, which is crucial to solve liquidity crises, Minsky (1986) pioneered the concept of Employer of the Last Resort as a kind of targeted fiscal policy aimed at giving unemployed workers the opportunity to return to private sector employment through a transition job in the public sector. In Minsky's own words, the Employer of the Last Resort would provide '*an infinitely elastic demand for labor at a floor or minimum wage that does not depend upon long- and short-run profit expectations of business*' (Minsky, 1986).

As previously discussed in Section 3, the business cycle reflects shifts in firms' expectations which generate euphoric or depressed stages of investment, that ultimately lead to expansion or recession and changes in the level of output and employment. According to Minsky (1976), this fundamental instability of capitalist economies is magnified by the financial system due to the entity of leverage and the increasing interdependence of agents' balance sheet. The impact of credit cycles on employment and output was also acknowledged and assessed by economists of different tradition (Kiyotaki et al., 1997; Bernanke et al., 1999; Adrian and Shin, 2010), but Minsky's originality lies in his *Financial Instability Hypothesis*, which argues that any agent in the economy behaves as a bank, due to the need to fund asset positions through a sustainable amount of liabilities. Moreover, Minsky (1976) explains that the pro-cyclical nature of private sector expectations drives leverage ratios through expanding or contracting stages according to the corresponding stage of the business cycle: positive expectations tend to inflate the leverage ratios of firms and banks, but the former are systematically missed when the economy moves from the boom to the bust.

The role of fiscal policy is not neutral in Minsky's analysis of instability. Keynesian demand management policies have generally aimed at creating positive expectations for private investors but failed to achieve both full employment and an equitable distribution of income (Minsky, 1976), which are regarded by Keynes (1936b) as fundamental goals of economic policy. Minsky (1986) argues that this unsatisfactory outcome arises when demand policies are not properly targeted in order to offer job opportunities to medium- and low-income unemployed workers. Neo-Chartalist economists who further developed the ELR concept argue that the New Deal era agencies such as Works Progress Administration provided the first targeted direct job creation policy in history. Hence, they propose a modern adaptation of these schemes in public utility tasks such as infrastructure maintenance, public housing, environmental services (Tcherneva, 2014).

ELR proponents also point out that a targeted employment guarantee scheme is also able to counter the inflationary pressure which may arise from increases in demand induced by public expenditure (Wray et al., 1998; Tcherneva, 2014). The explanation they provide is that both private and public investments triggered by aggregate demand management require firms and the State to compete for a limited pool of already working employees, because a core of long-term unemployed workers will not be searched for and hired due to hysteresis effects. Thus, a government-induced increase in demand may exceed the productive capacity of the economy due to a NAIRU effect, generated by the mismatch between firms' requested profiles and the different skills and the experience possessed by the unemployed. This outcome can be seen as a form of *illiquidity* of workers, which do not possess the required human capital or the experience due to long-term unemployment, or whose skills are insufficiently demanded by the market.

Thus, scarcity of available workers will lead to higher bids for wages when the employment

rate increases, ultimately leading to inflation and to the government's retrenchment from expansionary policies in order to curb the price increases (Tcherneva, 2014). In order to prevent inflationary pressures coming from increases in demand, ELR programs aim at providing a job opportunity to all unemployed workers that are willing and able to work at a fixed wage, which should be lower than the average wage paid in the private sector (Wray et al., 1998), but with a number of entitled workers that varies according to the business cycle. By enlarging the pool of employable workers, the program aims at aligning the growth of demand with the growth in output, as disposable income and demand for goods and services increase in the economy. Hence, Neo-Chartalists argue that the program would reduce the chances of demand-pull inflation arising for fiscal policy.

The goal of ELR is thus to increase the liquidity of workers, providing working experience and skills to unemployed people, thereby joining an increased employability with the payment of an income and an increased productivity. The measure of its success as a program is to be assessed through the velocity of return of unemployed workers to the private sector, and in the Argentinian experiment of *Plan Jefes* (further analyzed in this section), a policy inspired by ELR, the speed of re-hiring was such that roughly 750,000 beneficiaries of the program were able to return to formal labor markets in the 4 years of its implementation.

ELR is thus able to establish an effective minimum wage for the economy by directly creating job opportunities for the unemployed. Unliked standard minimum wage proposals, it fixes a minimum wage for the pool of ELR workers only at a discount with respect to the average private sector wage, thereby avoiding any displacement effect which may arise with standard proposals. At the same time, this employment guarantee scheme provides existing private sector workers with an 'outside option' in the bargaining process with firms, and provides the latter with a much more socially viable alternative than simply turning excess workers into unemployed in negative stages of the business cycle. Furthermore, the introduction of ELR preserves welfare payments for those who are permanently or temporarily unable to work, but it can eliminate existing unemployment compensations as it provides several superior features (Wray et al., 1998, p. 127): universal coverage for the unemployed, elimination of unproductive public expenditures and equalization of the minimum wage for all ELR workers.

The size of the ELR pool of workers, as previously mentioned, is 'market determined', i.e. the quantity of participants in the program depends on the number of layoffs that firms decide to operate according to the status of effective demand. It will effectively operate as a buffer stock, with an exogenous pricing of the minimum wage which sets a floor to the ladder of wages. In Section 5 a disaggregated model of the economy is explored, and it is shown that the whole price system is entirely determined by what Sraffa (1960) defines as the *basic system*, namely the one which directly and indirectly enters all production processes. Since labour is fundamentally a basic input in this sense, stabilizing its 'price' (i.e. nominal wages) creates a tendency of general stabilization of all prices in the economy from the demand side (Mitchell and Muysken, 2008).

ELR proponents admit that other cost-push sources of inflation can still arise, for instance due to the shortage of raw inputs from inside or outside the national economy, or due to the growth of the whole wage structure (Wray et al., 1998, p. 132). The second possibility is deemed unlikely by ELR proponents, however, for several reasons. First off, the entity of the ELR wage discount with respect to private sector wages depends on the global demand for labour by the

private sector. Therefore, a wage-price spiral would be conceivable if private sector demand exceeded the available labour supply: however, demand increases due to ELR are lower and slower than those arising from 'pump-priming' Keynesian spending in the form of industrial public investment or a strong credit expansion aimed at funding industrial investments from the private sector, due to the presence of a fixed wage for ELR workers. Moreover, Bayoumi et al. (2014) shows that even the Phillips curve is flat in the present economy, proving that inflation seems not relevant for the dynamics of the labour market at the moment. In addition, as it will be formally discussed in the next section, ELR workers are geared to produce a wider range of public services 'in kind', thereby decreasing inflationary pressure arising out of this newly-produced output as tariffs are institutionally fixed (if they exist at all).

On top of ELR wages being unlikely to drive inflationary spirals by themselves, several New Keynesian and Post-Keynesian economists have shown that the sensitivity of inflation to output fluctuations is weaker than a quantity theory of money would conceive (Lee, 1999). Blinder et al. (1998) uses a peculiar survey approach in order to assess whether the most common New Keynesian theories of price stickiness are effectively implemented by business leader and pricing offices. Their research involves 200 structured interviews with American executives and a questionnaire which comprises information about the company and questions on the executives' assessment of the various price stickiness theories. According to the findings in Blinder et al. (1998), roughly 72% of enterprises perform price changes not more than 4 times per year. The main reasons explained by executives include: fear of antagonizing customers (21%), fear of being displaced by competitors (14%), costly price adjustments (14%), invariance of costs over pricing cycles (14%). Other interesting findings include the fact that the vast majority of firms does not account for inflation when setting prices, and that coordination failure, cost-based pricing, non-price competition and implicit contracts were the only strongly supported theories of price stickiness among the interviewed participants.

A similar approach is implemented by Alvarez et al. (2006), who join original evidence from underlying consumer and producer price indexes and information from surveys of firms and find that there is a significant degree of inflation persistence in the Euro Area as well. Alvarez et al. (2006) find that Eurozone firms change prices once a year on average (thus less frequently than in the US). Higher degree of price flexibility emerges for energy and unprocessed food for consumer prices, whilst greater price stickiness characterizes services. For producer prices, prices are stickier for capital goods and more flexible for energy and food. Mark-up pricing is the most common strategy employed by firms, with a stronger price sensitivity to cost increases rather than decreases and a higher sensitivity to a fall in demand than to a rise (Alvarez et al., 2006, p. 14).

Therefore, given these pieces of evidence and the fact that ELR workers should generally be involved mostly in services, energy-saving tasks and social entrepreneurship (Tcherneva, 2014), a strong inflationary outcome of the European and American economies seems unlikely. However, the issue requires structural analysis and future research should properly address it in a theoretical framework.

Given the above discussion on the role of the public debt, optimal design of ELR programs requires an institutional framework that allows the government to meet the solvency constraint. Therefore, the prohibition of monetization of the government debt by the central bank, the issuance of government denominated in foreign currencies and exchange rate pegs severely limit

the ability of ELR programs to absorb the excess of labor force at any stage of the business cycle Wray et al. (1998). However, as it was previously argued, sustainability of the public debt is constrained by the ability of the government to keep the growth rate of the economy above the real interest rate. According to this specific definition, sustainability entails the stabilization of the debt-to-GDP ratio, thereby preventing it to increase indefinitely. Such an outcome would not pose any financial constraint for a government that is able to issue its currency. However, it implies a general inefficiency of government spending and a redistribution of income towards *rentiers*, therefore fostering income inequality and enforcing a decreasing standard of living for non-rentier classes (Sardoni, 2009).

Given that sustainability crucially depends upon the growth rate of the economy, the impact of public spending on the growth rate is key in order to understand whether an expansion of government debt will improve or worsen the economy's efficiency. In a seminal growth model, Domar (1944) shows that productive government expenditure performs a stabilizing function on the debt-to-GDP ratio, thereby relieving the 'burden of debt' for taxpayers. Therefore, it is crucial to ensure that Employment Guarantee Schemes such as ELR gears workers to perform productive tasks, by creating jobs through targeted investments in public purpose infrastructure.

4.6   Funding of Employment Guarantee Schemes

Despite their scarce diffusion in OECD countries, Employment Guarantee Schemes of different kinds have been tested especially in developing countries (Devereux and Solomon, 2006; Antono-poulos, 2008). In countries such as Argentina, India, South Africa, Sri Lanka and Bangladesh, the programs have employed a labour-based approach to infrastructure building, in order to tackle both a persistent structural unemployment problem and the presence of unsatisfied basic social needs due to severe economic downturns, droughts, local conflicts, informal labour markets. Lacking a shared standard of optimal policy design for these programmes, countries have adapted the basic idea of funding jobs for the poorest among the unemployed to the different national context. For instance, Argentina's *Plan Jefes* followed the footsteps of the previous *Trabajar* program that was active from 1997 to 2002, but with an additional focus on tackling the sharp reduction in the standard of living of the majority of the population after the country defaulted in 2001 Tcherneva and Wray (2005). In South Africa, instead, the focus of Expanded Public Works Programme (EPWP) is centered on the structural duality in labour markets due to regional and racial issues (Devereux and Solomon, 2006).

In spite of national differences, the common idea behind EGS is to provide the non-employable with an opportunity to rebuild a basic level of skills and work habit *while* working, instead of providing education and training without ensuring a paid job to all entitled workers Mitchell and Muysken (2008). However, it is appropriate to assess the different choices available to a government when deciding about the breadth, funding schemes, envisaged production tasks and administrative practices of the program, drawing from past experiences of EGS across countries.

Proponents of the Employer of the Last Resort scheme posit a universal job guarantee for all unemployed workers, which should be funded at the national level and managed at the regional level (even at a more micro level, if any) (Tcherneva, 2014). This scheme allows

to achieve two simultaneous goals: government funding can ensure a complete coverage of the program through deficit spending (whose solvency and sustainability conditions has been analyzed in Section 4.4) and local management ensures that the projects satisfy the needs of local communities (Mastromatteo and Esposito, 2015). First off, local infrastructural tasks are rapidly scalable if needed to adjust fluctuations of unemployment without problem to the public sector projects. On top of that, these projects are more directly linked to social needs such as primary schools, public housing, caregiving for the disabled and the elderly, energy saving, renovation of the artistic and cultural heritage, environmental protection. ELR programs do not necessarily entail the rise of a Leviathan-like Big Government. Tcherneva (2012) also envisages the possibility of an ELR scheme with the active participation of non-profit organizations and social entrepreneurship projects funded by government. She proposes the allocation of grants to non-profits that are already operating and managing tasks that the private sector or the State have failed to accomplish, but that lack adequate funding. Projects might be evaluated on the grounds of their effectiveness according to socially relevant criteria established by public agencies participated by local communities at the local level.

Neo-Chartalist and Post-Keynesian economists who support the ELR scheme argue that in order to effectively adapt to shifts in the number of entitled workers and ensure global coverage, the government should be able to run deficits (Bhaduri, 2005; Wray et al., 1998; Mosler, 1997). Provided that ELR works are able to generate additional output and spur additional investment through increased capacity utilization, the initial excess of government spending over taxation can be geared to increase GDP and tax revenues, thereby preventing the debt-to-GDP ratio to explode. One-off increases in the debt-to-GDP ratio, however, are not to be considered pathological phenomena in the spirit of Lerner (1943): as long as the government is solvent (i.e. without institutional arrangements which make funding conditional on private investors' willingness to lend), the unemployment rate should be considered as the unique benchmark of fiscal policy according to ELR theorists (Wray et al., 1998).

Moreover, the existing simulations with regards to the fiscal cost of ELR programs have shown that the program can be rather inexpensive for the government's budget. Majewski and Nell (2000) and Fullwiler (2007) implement a Fair econometric model to estimate the cost of an ELR program, Papadimitriou (2008) provides simulations for 3 countries (US, Australia and the UK) whereas Godin (2013) employs a Stock-Flow Consistent approach. These studies establish a range of cost which varies between 1.5% and 3% of GDP, also showing that the program would be at least self-financing as it would bring a higher benefit to the national income. On top of that, ELR wages do not represent additional social costs as they bring unemployed people with zero productivity to partake in the production process of real resources, so that the standard of living of the former is no longer supported by other employed workers (Lal et al., 2010). Figure 3 reviews the funding features of some of the most relevant EGS around the world:

Generally, existing EGS such as South Africa's NREGA plan or the former Argentinian *Jefes* have been designed so as to be funded out of taxation and, in the case of Argentina, through international loans by the World Bank (Tcherneva and Wray, 2005). These choices avoid political panic about uncontrolled deficits (both public and external ones), which happen to be particularly strong in developing countries that have often relied on international aid. However, limited ex ante funding implies that the coverage of these programs is not universally guaranteed: it is limited to a finite amount of vacancies which are allocated across the national territory accord-

	Total no. of PWP jobs/annum	Total no. of person years/annum	Total labour force	Jobs as % of labour force	Person years % of labour force
South Africa: EPWP I (2006/7)	200,000	70,000	16,000,000	1.3%	0.44%
Indonesia: PK (1998/99)	1,481,481	181,818	92,000,000	1.6%	0.20%
India: NREGA (2006/7)	21,200,000	4,109,091	427,000,000	5.0%	0.96%
India: NREGA (2008/9 estimate)				15%	3
Ireland: CEP (1990s)	41,000	n/a	1,400,000	2.9%	n/a
Ethiopia: PSNP (2006/7)	1,500,000	n/a	31,000,000	4.8%	n/a
Senegal: AGETIP (2004)	21,000	n/a	4,500,000	0.5%	n/a
Usa: New Deal programmes (1933-1940 average	n/a	n/a	53,000,000	3.4-8.9%	n/a
Jefes: Argentina (2003)	2,210,000	n/a	17,000,000	13.0%	n/a

Figure 3: Indicative Financing Estimates and Impacts of EG programs. Source: Lal et al. (2010).

ing to different criteria, e.g. with respect to the poorest regions, the poorest households in the whole territory and many others (Devereux and Solomon, 2006). Furthermore, despite being often endowed with targeting features aimed at specific population groups, quantity-limited EGS have posed problems in terms of corruption, due to the competition among interested unemployed workers for a scarce pool of vacancies Lal et al. (2010). This issue has emerged in the context of developing countries, yet it can be still relevant in OECD countries where criminal organizations may attempt to control the hiring process through blackmail and corruption. Instead, fighting criminal economy and informal labour markets by preventing unemployed workers from seeking income out of criminal activities should be one of the most important goals of EG plans, and their role in reducing crime and poverty would be particularly relevant even in several areas of Europe (e.g. Southern Italy). Therefore, universality of opportunities should be preserved while fine-tuning the program so as to guarantee an appropriate targeting at the lowest level of the income distribution ladder. This need reinforces the case for an appropriate funding level of EGS, which can be ensured by deficit spending as ELR proponents advocate or international funding agreements with developmental institutions.

4.7   Policy experiences of EGS

An appropriate management of EGS should take into account both general principles and local necessities, in order to properly distribute incentives among all the participants in the programs and stakeholders. As for the former, Lal et al. (2010) provide an extensive set of best practices that governments should adopt in planning direct job creation schemes. First off, they argue that programmes should integrate groups of EGS workers with technical departments made of regular high-skilled workers, researchers and executives that support the definition of EGS workers' tasks. This will prevent the administration of EGS from becoming a separate infrastructural office and reinforce the work habit of newly entitled workers. Secondly, EGS must ensure the production of good quality assets that align with the productivity standards established by administrative staff. At the same time, governments should design ongoing capacity building for the technical staff and allow the participation of NGOs, civil society

groups and social enterprises in the definition and the realization of the tasks within the EGS scope. Finally, governments should be sensitive to gender, class or social group issues in different areas of interested nations - an issue which is also explored by Antonopoulos (2008).

It is worth discussing two of the major policy experiences of Employment Guarantee Schemes in order to take stock of their areas of success and failures. The *Plan Jefes y Jefas de Hogar* was introduced in Argentina after the recession that hit the country after the 2001 default, which was triggered by the collapse of the currency board that the Menem government had implemented in order to curb inflationary pressures (Tcherneva and Wray, 2005). Even after the abandonment of the currency board, CPI hit 40%, PPI hit 125%, the peso depreciated by 200% and unemployment skyrocketed (Kaboub, 2007). The introduction of Jefes in 2002 was inspired by the ELR model, but its scope was not universal, in that it limited entitlements to enter the program to the heads of troubled households in the country (i.e. those who include minors, handicapped persons or pregnant women). The *Jefes* program paid a monthly wage of 150 pesos for at least 4 hours of work per day, which entails community services, maintenance tasks or simple training programs. The links between local communities and ELR projects have proved strong, as 87% of *Jefes* participants were involved in community projects such as agricultural cooperatives, cleaning services, environmental support and improving sewer systems. Moreover, ELR workers could also be included in great infrastructural projects. Tcherneva and Wray (2005) report that after four months from the beginning of the program in 2002, the poverty rate among participating households had plunged 25%, with a 18% reduction in individual poverty as well. The financing scheme entailed a 80% maximum funding from the government to the *Jefes* projects, as NGOs and enterprises which proposed and executed these project had to contribute with their own funds first. As it is reported in Figure 4, the global cost of *Jefes* hit 1% of Argentinian GDP in 2005, the total number of beneficiaries reached 1.8 million and conservative estimates reported by Tcherneva and Wray (2005) compute a 2.57 multiplier effect on GDP. Therefore, the program was more than self-financing and it contributed to the reduction in poverty rates in a moment of critical downturn for the country.

Tcherneva and Wray (2005) also provide a detailed analysis of the program's successes and failures. Whilst the limitation to heads of households weakened the program's impact on unemployment rates, Tcherneva and Wray (2005) argue that the program was well targeted in that it addressed households with unmet basic needs, absorbed beneficiaries with low education and low income and it also dramatically increased women's participation in the labour force, as 64% of *Jefes* workers were women. The program was also successful in ensuring a high reinsertion rate of *Jefes* labourers in the formal private sector: over 76,000 workers managed to re-enter the private sector from *Jefes* as of September 2003 (Tcherneva and Wray, 2005, p. 10). Moreover, in the four years of activity of the program, the wage earned by participants (150 pesos) provided a floor to the whole structure of salaries in the country, thereby confirming a basic claim of ELR proponents about the ability of ELR wage to ensure an effective minimum wage in the implementing nation. However, there were several areas of improvement according to ELR proponents such as Tcherneva and Wray (2005). They argue that the access to the program should have been universally open to anyone willing and able to work, that the proposed wage was below the minimum poverty line and provided insufficient training and education to participant workers. ELR proponents' suggestions could not be further implemented due to the interruption of the program in 2006, yet it was well received by international institutions such

as UNDP due to its positive contribution in terms of work participation and poverty reduction.
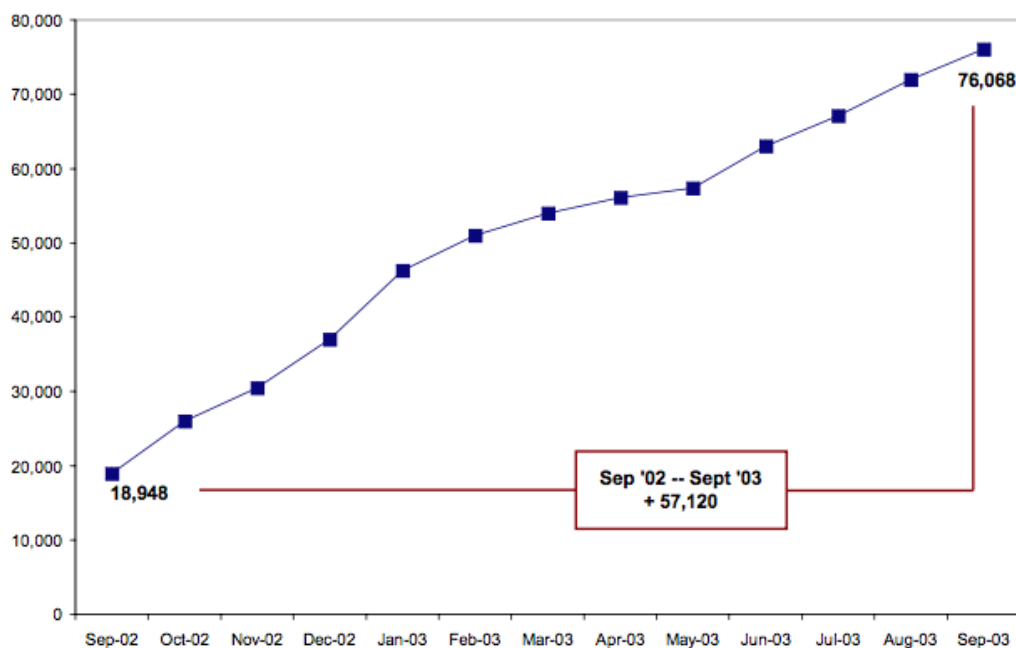
Figure 4: Insertion rate of *Jefes* beneficiaries into the labor market from September 2002 to September 2003. Source: Tcherneva and Wray (2005).

India also experienced the introduction of an EGS, the *National Rural Employment Act* (NREGA), in 2005. The program ensures 100 days per year of rural public employment to a member of every household in the country. Drèze (2004) computes that the program's cost approaches 1.3% of Indian GDP, and assesses that if the program is successful in boosting aggregate demand and private employment, the scope of NREGA can be downsized alongside with the economy's expansion. The program focuses on labour-intensive tasks in nine areas of interventions which include environmental conservation, watershed development, regeneration of land, fighting deforestation and soil erosion. The institutional framework that underpins NREGA is original in that it makes the government legally accountable for providing work, in a rights based approach which relies on article 23 of the Universal Declaration of Human Rights. Moreover, the focus on maximization of the labour intensity has led Indian policymakers to establish a 60:40 ratio of labour to materials in every NREGA project, even though technical and material resources need to be brought from other sectors in order to avoid a deterioration of the quality of assets produced by NREGA workers (Lal et al., 2010). Moreover, Antonopoulos (2008) emphasizes the strong gender impact of the program: at least one third of NREGA participants must be women, who also have the right to locally available employment, thereby easing the burden of unpaid care work by women due to male migration. The program also envisages spaces for children care and provides maternity leave time.

Another interesting experiment has been undertaken by France. A decree by the French government in December 2005 established the *Contrat de transition professionelle* (Professional Transition Contract), which addresses workers who have been laid off from companies of less than 300 employees. CTP workers will be guaranteed a salary which is equal to the one paid by their previous employment through a contract with a government agency. Besides the guarantee of income to the unemployed who are actively searching for new stable jobs, the

program provides targeted coaching, skill-building and job training, in order to facilitate the transition to new sectors of employment (Kaboub, 2007). The issue is particularly pressing in OECD countries, as structural and technological changes are increasing the obsolescence rates of many sectors as well as the birth of new occupations.

CTP funding is guaranteed by unemployment insurance and payments coming from companies who enjoy services provided by CTP workers, with a residual contribution by the French government. A 2005 estimate of the global cost of the program - if all the unemployed entered immediately - hit roughly 70 billion euros yearly, which equals approximately 4% of French GDP. Kaboub (2007) notes that despite the CTP's cost impact in terms of GDP is higher than other EGS experiences such as Argentina and India, it is still less expensive than the current 4.2% of GDP spent on unemployment doles. Original proponents of the measure in France and technical reports of public administration offices claim that the entitlement to CTP should be generalized to all workers who are willing and able to work, but the French government has not yet taken steps in this direction (Kaboub, 2007).

4.8   Matching EGS and a National Investment Board

Most of the policy prescriptions on Employment Guarantee Schemes that were outlined by international institutions such as UNDP and ILO, and several of the existing experience of public works programs focused on developing countries, which are often in need of massive infrastructural and public services improvements (Lal et al., 2010). However, one of the first experiments of direct job creation in the 20th century was the US New Deal, which occurred in a cultural and political context in which the Keynesian emphasis on full employment was felt as a priority by most of the governments in mature economies (Tcherneva, 2014). Moreover, after the Second World War, a role for public intervention in the construction of a social protection net - the so-called Welfare State - was envisaged by influential studies such as Beveridge (1944), who defines 'full employment' as a condition in which available vacancies equal or exceed the total number of job seekers. A survey of the most relevant policy discussions in the postwar history on EGS in industrial economies is provided by Kaboub (2007), who shows that various US policy makers, economists and executives in the aftermath of WWII considered full employment as a viable and necessary feature for the stability of an economic system.

Pierson (1980), a former executive at the US Department of Labor and co-author of the Employment Act of 1946, proposes the implementation of an Economic Performance Insurance (EPI), which sees the government standing ready to act in a countercyclical fashion to hire all unemployed workers in downturns and gradually stepping out when aggregate demand starts growing again. Even though the EPI is thought of a last resort measure, Pierson (1980) stresses the importance of reducing business cycle fluctuations in order to prevent the public guaranteed sector to absorb growing levels of labour force. Hence, he advocates the maintenance of high levels of consumer demand by having the government target the full-employment level of consumer spending and the insurance of positive future expectations through government intervention in infrastructures.

Wernette (1945) elaborates a Full Employment Standard (FES) which encompasses a re-definition of the relationship between fiscal and monetary policy in order to obtain an institutional framework which is geared to eliminate unemployment. He advocates the creation of

a Federal Stabilization Board which should be responsible of managing the creation of high-powered money needed to finance budget deficits and repay the Federal debt of US government. In a sense, Wernette (1945) calls for the establishment of a *monetary rule* consistent with full employment levels, so that the essential features of a market economy can co-exist with the guarantee of a job for all unemployed workers. In Wernette's assessment, FES would be responsible for the fiscal-monetary coordination which is needed to ensure that public institutions are able to effectively sustain employment, and such a program would not be inflationary for two reasons. First off, according to Wernette, advanced economies where population grows at a high rate and potential GDP per capita is sufficiently high are able to deliver a sufficient amount of production without creating inflation even in the presence of an expanding money supply. It is interesting to note that according to the secular stagnation theory - that is the main object of discussion of Section 2 - modern economies experience a high potential GDP per capita level but a slow or decline rate of population growth, which would partially undermine Wernette's point. Whilst the rate of population growth is generally considered as an exogenous variable in most 'orthodox' or 'heterodox' growth models, the assumption of endogenous fertility in some economic models links the level and the growth rate of labour supply with macro-economic policies, especially the quality and quantity of public health outlays (Fanti and Gori, 2014). Secondly, Wernette argues that inflationary pressures can be faced by curbing aggregate demand through increasing taxation, which decreases disposable income and thus prevents spending power to outstrip the productive capacity of the economy. Similarly to Lerner (1943), Wernette posits that taxation is not needed by the government for funding purposes: its role would be to fine-tune aggregate demand in order to keep it in line with institutional targets of inflation and employment.

As it was already discussed in previous sections, ELR proponents since Minsky (1986) rely on similar arguments in order to support their full employment proposal, with innovative approaches to policy implementation. Moreover, experiences from developing countries that were reviewed in Section 4.7 may help in preventing issues related to bad incentives design, corruption and mismanagement of public funds related to the availability of vacancies and many others. The design of an appropriate institutional framework of Employment Guarantee Schemes for advanced economies faces numerous challenges, and requires a careful analysis of the features of existing labour force.

For instance, a 2014 paper published by the World Economic Forum's *Global Agenda Council on Employment* reports that several firms at the global level were found to experience difficulties in filling available vacancies by recent surveys, due to the mismatch between required and existing skills in the labour force (WEF, 2014). It is often argued that this stylized fact reflects an inappropriate level of knowledge in the labour force, which should be tackled by increasing learning opportunities at work and working opportunities in schools. However, WEF (2014) shows that only 6% of firms who responded to a 2013 survey by Manpower enhance their benefits in order to attract applicants, and only 5% of them increase their starting salaries in order to search for skilled labour to fill available vacancies. Therefore, unattractive working conditions for skilled graduates and qualified workers seems to be one of the major hurdles in correctly matching workers' know-how and the needs of enterprises (WEF, 2014, p. 11).

This phenomenon increases the issue of qualification mismatch: roughly 21% of workers in advanced economies are found to possess higher qualifications than what is needed for their

jobs, whereas 13% of them turns out to be underqualified. (WEF, 2014, p. 11). In addition, overqualified workers increased by 5% in Europe, with 1.5% of this shift happening after the Great Financial Crisis: as a result, 40% of overqualified labourers found a job in areas which are unrelated to their background. Figure 5 reports the incidence of over- and underqualification in OECD countries:
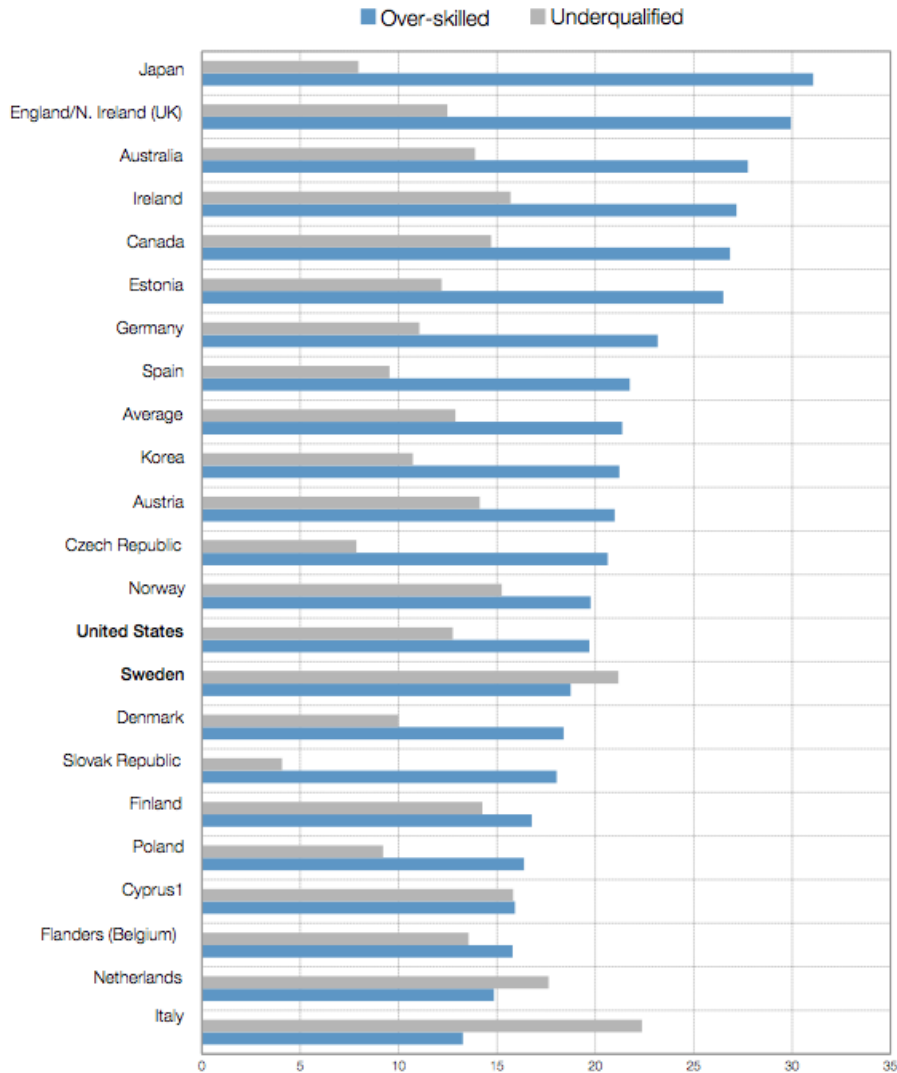
Figure 5: Incidence of over- and under-qualification of the labour force in a selection of OECD countries. Source: WEF (2014).

WEF (2014) reports that the *Survey of Adult Skills* shows how the mismatch in skills also affects the workplace. When a sample of workers were asked to evaluate the relevance of their skills in relation to their job tasks, 33% of employees said they are overskilled with respect to their duties, whereas 13% said they were underskilled - regardless of their qualification. The Survey thus pointed at a direct relation between overskilling (and overqualification) and a relevant underuse of human capital and skills like numeracy, literacy, ICT and problem solving in the workplace.

Hence, labour markets appear strongly segmented in OECD countries, but with both low-skilled and high-skilled workers finding themselves out of context in the workplace, and also facing a serious risk of growing hysteresis with the persistence of stagnation. EU Commission (2013) shows that young people with higher education face higher difficulties in finding jobs

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that meet their qualification level, whereas a growing share of young people is composed of those who are not involved in employment nor education or training (commonly known as NEETs): this share was over 16% in countries such as Italy, Greece, Ireland and many others. In relation to this phenomenon, the European Foundation for the Improvement Working and Living Conditions also estimates that the cost of unemployment and inactivity of youngsters hit 1.21% of European GDP, namely a 153 billion euros yearly loss (EFILWC, 2012). Instead, re-integrating only 10% of these young people is expected to generate an annual gain of 15 billion euros for the whole EU.

Thus, it is appropriate to take account of these facts about the composition of the labour force in OECD economies while planning a policy mix which is able to address the pressing issues of unemployment, stagnation and decreasing productivity simultaneously. As it was discussed in previous subsections, Employment Guarantee Schemes can provide a solid social protection to unemployed workers - especially long-term ones - and also contribute to revamping aggregate demand without generating excessive inflationary pressures. In order to establish a viable EGS in Italy, Mastromatteo and Esposito (2015) advocate the creation of a State agency whose mandate is akin to that of a central bank in maintaining price stability, but which focuses on the maintenance of unemployment. This State Employment Bank (SEB) would thus have to coordinate with the central bank in ensuring appropriate funding for the ELR program envisaged by Mastromatteo and Esposito (2015). The authority should assume a long position in terms of local projects developed by participants in the program and have the wage bill of ELR workers as liability, plus operating costs related to overhead officers. The SEB's task would be to define the EG wage and closely supervise the projects: key performance indicators, quality analysis of the management and consumer protection should be included in the set of instruments available to SEB officers in the evaluation of the projects, as suggested by Devereux and Solomon (2006).

In addition, Mastromatteo and Esposito (2015) argue that in order to guarantee full accountability, social and local empowerment should be fostered. Hence, their ELR plan includes the operations of a second control group composed of local stakeholders who should monitor the quantity and quality of social services provided by ELR workers. Mastromatteo and Esposito (2015) propose to set up local committees made by local citizens, experts appointed by SEB and representatives of ELR workers (one third each). The committee should thus be in the position to control the efficiency and the quality of public expenditures in ELR projects, with a balanced representative of ELR workers who perform the tasks entailed by the same projects.

On top of that, it can be argued that a complete policy mix for tackling the multiple issues of high unemployment, low output growth and stagnant productivity growth should also promote innovations that are able to increase the level of real surplus that the economy is able to produce. Besides the absorption of surplus labour through guaranteed employment, the issue of decreasing or slowly increasing productivity can be approached by resorting to anti-stagnation policies in the sense of Steindl (1952), which include the pro-active role of the State in promoting innovative investments and supporting blue-sky thinking as explained by Mazzucato (2013a). The two policy prescriptions are often thought of as separate paths that governments should follow in order to achieve different goals: the need to expand employment is generally perceived as different from the need to improve the productive capacity of the economy. Moreover, the separation is reinforced by the fact that high-technology investments need researchers, skilled

manufacturing workers, engineers and other categories of skilled workers, whilst ELR programs are targeted for the lowest levels of the income distribution ladder and the unskilled workers.

However, a way to integrate the two policy prescriptions is to think in terms of a 'socialization of investment' in the words of Keynes (1936a). This notion implies a pro-active policy by the government aimed at intervening in the process of capital accumulation by addressing unsatisfied social needs that market (and/or the State) could not target or could target only partially. Lunghini (1995) provides a general definition of the kind of social goods and services that workers demand but cannot find in sufficient quantity of quality among the existing supply of goods. According to Lunghini, these goods are not necessarily wares characterized by market prices, but rather a set of public needs produced by *concrete labour*, i.e. the one which is geared for the production of *use values*. Lunghini (1998) also expands his analysis in order to consider the possible sectors geared to produce social use values. His list of proposals include: the protection of the cultural heritage, environmental services, the recovery of dismantled industrial areas and the fight against hydro-geological instability, care services for the elderly, poor families and addicted and, last but not least, education services.

In general, investment opportunities for social wage goods are given by all the physical goods and services that can compose a socially determined minimum real wage, i.e. a socially viable standard of living ensured to all the workers who participate in the social provisioning process. In this context, 'socialization of investment' represents a turning point in both public and private approaches to investment in the 20th century. Minsky (1986, 1976) argues that post-war fiscal policy in the US has mostly been involved in aggregate demand management aimed at stimulating private investments and thus guarantee high profitability to enterprises. However, this model of development, according to Minsky, has been based on the mass production of private consumption goods, thereby leaving aside the issue of public consumption, namely the set of conditions that enable workers to have a socially fulfilling life as well as maintaining and improving their skills, work habit and creativity. As it was discussed in Section 3, innovation in advanced countries has mostly been triggered by initial public investments in risky and uncertain technologies which have ultimately laid the foundations for the ICT revolution of the 1980s (Mazzucato, 2013a).

The slowdown in productivity - the main theories related to it have been explored in Section 2 - may thus be associated with the need for a new broad set of innovation opportunities to be found by private and public agents. The 'stagnation policy' described by (Hein, 2016), as well as the diagnosis of 'secular stagnation' provided by Summers (2016), picture a rising increase in income inequality, in which the disregard for improvements in the provision of socially relevant goods for the whole community of workers across advanced countries can be reflected. The insufficient provision of these essential services was defined by Lunghini (1998) as a form of "mistaken rationalization" of costs: the decreases in workers' bargaining power, wage shares and rates of employment described by Bivens et al. (2014) have decreased production costs for a single enterprise but increased social production costs, '*thereby enriching individuals and impoverishing society*' (Lunghini, 1998, p. 7).

The pivotal role of Developmental States (Block and Keller, 2011) and the implementation of Employment Guarantee Schemes can thus increase social productivity by lowering the cost of reproduction of the labour force and increasing the quality of life. The two policies could thus be integrated by a common planning approach of governments. First off, the public sector

could focus on targeting investment opportunities in socially relevant areas, create decentralized agencies of researchers, managers and officers geared to deliver R&D efforts in order to achieve innovations, in the style of DARPA, SBIR and other innovative agencies described by Mazzucato (2013a). Secondly, governments could set up Employment Guarantee Schemes such as ELR and channel workers *in the same areas where investment opportunities have been found.* Therefore, ELR workers would not only be able to perform important tasks that are not provided by the market, related to caregiving, recycling and environmental services: their jobs would be directly linked with sectors in which productivity-enhancing innovations are being achieved, thereby contributing to the expansion in output and the standard of living of the population in a much more complete way.

Socially relevant sectors of intervention include public housing, public health care, transports and the leisure industry. Public housing could be taken as example of an interesting area from the perspective of a National Investment Board which includes Employment Guarantee workers in its labour force. For instance, Economist (2015) directly links a host of recent studies on the scarcity of houses in big cities and capitals to the sagging productivity growth experienced by OECD countries. For instance, studies on British cities reported in the article show that affordable and diffused housing would mean a productivity increase worth 12 billion pounds yearly to the UK. Whilst many observers point at an excessive regulation preventing houses being built in worker-attractive cities such as London, investment opportunities for the socialized investment policy mix that is being advocated include disused and derelict lands which could be efficiently recovered. Godin (2013) also describes a version of ELR program centered on the creation of Green Jobs, that deal mostly with the construction and renovation of green buildings. Several benefits accruing from green buildings are mentioned in the paper: savings of energy and water in dwellings and private buildings, declining mortality, improving learning by students in schools and ultimately increases in productivity. For instance, Kats (2006) calculates that each feet of Green School built can generate net financial benefits for up to \$71, and bring about substantial reduction in energy costs.

The absorption of slack in the labour market provided by ELR schemes, together with the provision of fundamental goods and services to the economy would thus meet the need for increasing productivity and innovations and the need for an expansion in aggregate demand. The aforementioned policy mix, based upon the socialization of investment envisaged by Keynes (1936a), can make Employment Guarantee Schemes a structural and not merely a counter-cyclical policy measure.

5   A model of Employment Guarantee Scheme

The following section provides an analytical description of the implementation of the policy mix discussed in Section 4. The analysis is carried out by resorting to a meso multisectorial model and a macro model which closely follows the approach outlined in Ricottilli (1993).

5.1   A multisectorial model of the economy

The economy is modeled as a system of i sectors that produces v commodities through a technology which comprises the production of wage goods as a necessary condition of workers'

subsistence. The investigation will be limited to the analysis of intermediate inputs rather than to fixed capital, lasting more than the current production period, following the approach outlined in Sraffa (1960): the economy produces commodities by means of commodities. The economy thus produces $v - s$ final goods and s intermediate goods, which are composed by n capital goods and $s - n$ 'wage' goods. The latter include essential services demanded by workers such as local transports, social housing, urban planning and public health care. Assuming the technology of the economy (which is on the frontier of production possibilities)[2] as described by a $n \; x \; n$ matrix, where n is the number of capital goods that are produced, we have:

$$A = A[a_{ij}] \; \geq 0$$

The above matrix represents the real capital cost of production for each of the n capital goods. Augmenting the matrix with the necessary real labour cost of production for the n capital goods and the $s - n$ wage goods socially needed for the viable life and reproduction of the labour force yields a full-fledged technology matrix $\bar{A}$, made of column vectors $(a_v; c_v l_i \tau_w)$, where the real wage w_R is expressed as a vector in terms of a bundle of commodities $c = (c_k)$ with $k = n + 1, n + 2, \cdots, s$ and a distributional value τ_w which measures the units of such commodities to be included in the real wage at any given point in time. This bundle of goods and services entering the real wage is composed of products and services demanded by workers. The economy must provide them with these goods in order to satisfy the socially determined needs they express in order to take part in the production process and conduct a socially fulfilling life. Recalling the discussion outlined in Section 4 about social needs which could provide the impulse for targeted public investment, the elements of vector c should at least include local transports, public housing, urban planning, public health care and the leisure industry. Classical economists used to describe this socially determined consumption level as the subsistence wage (Chiodi, 1992). A modern version of this method could consider what Sen (1981) defines as *entitlement* and *capability* approach: a composite commodity which corresponds to the socially determined minimum standard of living. An EGS would thus aim at setting the fixed wage for workers entitled for entering the program at this level.

This formulation is able to capture both the technological conditions needed for the reproduction of the system and the general viability of the system in terms of labour (Chiodi, 1992).

The structural scheme is completed by denoting by $X = (X_j)$ the output column vector of v elements, and by $Y = (Y_j)$ the final output vector of v elements. Furthermore, a distinction should be made between the goods and services that directly or indirectly enter the production process - *basic goods* in the sense of Sraffa (1960) - and those that do not enter directly or indirectly the production of all goods and services, defined as *non-basic goods*. In a nutshell, non-basic goods are to be considered as surplus goods (e.g. luxury goods).

An economy which is merely able to reproduce its existing means of production is not capable of experiencing growth. Therefore, a positive growth rate of this v-sector economy is ensured at any point in time only if the total output of goods produced is enough to allow for the recovery of the used-up goods needed to reproduce the existing means of production and

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[2]In this case, there are no concerns with the choice of technique, a problem analyzed by Sraffians Sraffa (1960).

to satisfy the need of surplus goods required by investment and the final 'consumption' goods:

$$\bar{A}X(t+1)(1+g) + \bar{A}_b X_{nb}(1+g) = X(t) \tag{4}$$

$$A_{nb}X_{nb}(t)(1+g) + Y_{nb} = X_{nb}(t) \tag{5}$$

where $\bar{A}$ is a square, indecomposable matrix of dimension $s\ x\ s$. $\bar{A}_b$ is a rectangular matrix of inputs entering the production of commodities which do not enter either directly or indirectly into the production of all other commodities but are produced by industries whose output enters the production of all commodities, with a $s\ x\ (v-s)$ dimension. $\bar{A}_{nb}$ is a square matrix of inputs entering the production of commodities which do not enter either directly or indirectly into the production of all other commodities but that are produced by these industries, with a $(v-s)x(v-s)$ dimension. X_{nb} is an output column vector of commodities which do not enter either directly or indirectly into the production of other commodities, with a dimension $(v-s)$ and $X(t)$ is a vector of dimension s.

Solving the above quantity system requires an equilibrium condition, which can be designated in a simple way by assuming a common profit rate r across the production sectors. In real terms, the wage rate is defined as the product between the distributional variable τ_w and the wage goods vector $c = (c_k)$, such that $w_R = \tau_w c$.

$$p\bar{A}(1+r) = p \tag{6}$$

$$p\bar{A}_b(1+r) + p_{nb}\bar{A}_{nb}(1+r) = p_{nb} \tag{7}$$

It is straightforward to notice that the price system of the whole economy explained by (6)-(7) is independently determined by the basic system, provided that the real wage rate is part of it. Therefore, while the structure of the non-basic price vector is dependent on the structure non-basic sector, the general price vector p is fully determined by the basic sector. Logically, the basic system plays the major role in determining production prices as it entails goods and services that directly or indirectly enter all production processes: therefore changes in these prices will reflect in price variations across all productive sectors of the economy.

Another crucial finding of the above system is that whilst the equilibrium growth of the economy has to coincide with the growth rate of the non-basic system ($g = g_{nb}$), the maximum growth rate for the system is fully determined by the basic system. Following a Classical approach, the maximum growth rate is reached when the growth of final consumption goods is set to zero, i.e. $Y_{nb} = 0$, which also implies $X_{nb} = 0$. This means that the surplus rate, namely what the system is capable of producing over and above the real cost of production, is independently set by the basic system alone. The solution of the system given by (4) and (5) can be found through the following steps. First off, the non-basic output vector as a function of final output can be determined:

$$X_{nb}(t) = [I - (1+g)A_{nb}]^{-1}Y_{nb}(t) \tag{8}$$

As shown by (4), the basic output vector is a function of the non-basic one, thereby yielding:

$$X(t) = [I - (1+g)\bar{A}]^{-1}\bar{A}_b[I - (1+g)A_{nb}]^{-1}Y_{nb}(t) \tag{9}$$

In order to solve the price system given by (6) and (7), a further assumption is needed as the system includes $v + 1$ unknowns in v equations. Different options have been implemented in the literature to reduce the number of unknowns so as to make the system determinate, the most common being the definition of one of the v commodities as the numeraire of the system (Pasinetti et al., 1993; Kurz and Salvadori, 1997). Taking a simple example with $v = 3$ with 2 capital goods and 1 wage good, the price vector becomes $p = (p_1, p_2, p_3)$ and thus the set of equations for (6) could be represented as:

$$(p_1 a_{11} + p_2 a_{21} + \tau_w l_1 c_3 p_3)(1 + r) = p_1 \tag{10}$$

$$(p_1 a_{12} + p_2 a_{22} + \tau_w l_2 c_3 p_3)(1 + r) = p_2 \tag{11}$$

$$(p_1 a_{13} + p_2 a_{23} + \tau_w l_3 c_3 p_3)(1 + r) = p_3 \tag{12}$$

As wages paid to workers are included in the matrix $\bar{A}$, that represents the technology through which the economy carries out its production processes, it possible to choose any of v goods as numeraire. In this specification, distribution is represented by the parameter τ_w, thus it is not affected by the choice of any specific numeraire. For instance, normalizing $p_1^* = 1$, the other prices of the system become $p_2^* = \frac{p_2}{p_1}, p_3^* = \frac{p_3}{p_1}$. Considering this assumption, (6) can be rewritten in terms of the Perron-Frobenius eigenvalue $\lambda = \frac{1}{1+r}$ so that (6) becomes:

$$p\bar{A} = \lambda p \tag{13}$$

The Perron-Frobenius Theorem ensures that a solution for r exists (Kurz and Salvadori, 1997) and it is equal to the maximum real eigenvalue of the matrix $\bar{A}$ as long as the distributional value τ_w is given. The profit rate resulting from the Perron-Frobenius eigenvalue is a function of τ_w such that $r = f(\tau_w)$. Plugging λ in (6) we have:

$$p(\bar{A} - \lambda I) = 0 \tag{14}$$

It is straightforward to note that (14) is a homogeneous equation which holds for the value of λ^* that satisfies

$$\det[\bar{A} - \lambda^* I] = 0 \tag{15}$$

A simple example of computation of λ^* with 2 capital goods and 1 wage good is provided in the Appendix. The profit rate r, derived through the computation of λ^*, corresponds by definition to the maximum growth rate of the economy, and it is equal to

$$r = \frac{1 - \lambda^*}{\lambda^*} \tag{16}$$

This means that the realized growth rate of the economy will equal the maximum level $g_{\max} = r$ only if all profits are reinvested by firms. However, the profit rate associated with the Perron-Frobenius eigenvalue λ^* expresses the maximum level of surplus that the economy can achieve, thereby representing a global measure of productivity which accounts for the real labour cost associated with the production process. The profit rate r is also associated to a left eigenvector of relative prices p^* with respect to the numeraire that was previously chosen (p_1 in the $v = 3$ example). Given the normalization of all prices in terms of p_1, finding the money wage rate

paid to workers requires to multiply the real wage rate - weighted by the relative price of the wage good (p_3^*) - by the price p_1 that was chosen as a numeraire. This computation yields:

$$w_m = p_1(\tau_w p_3^* c_3) \tag{17}$$

Hence, the computation of the equilibrium profit rate r in this specification allows to compute a general and socially relevant measure of the productivity of the economic system as a whole. As a matter of fact, the profit rate is associated with the maximum surplus that the economy is able to generate over and above its real cost of production, which comprises both labour and intermediate inputs. The real cost of labour is the minimum level of real wages which ensures the function of an orderly economy, and it is possible to ensure that labour receives this socially determined level of wages through Employment Guarantee Schemes.

5.2   Public investment and productivity

The above analysis entails an augmented technology matrix, where labour and capital inputs are given. However, firms undertake R&D efforts in order to develop kinds of innovation that are able to alter the real cost of production in terms of labour and capital inputs within the matrix $\bar{A}$. Innovation is a complex process involving a self-organizing search of information, with the arrival of ideas being the result of a stochastic process (Ricottilli, 2015). Therefore, labour and capital input coefficients are subject to modifications from one time period to the following one when research and development is introduced in the analysis. The outcomes of R&D efforts are uncertain as explored in Section 2, and as a first approximation it is assumed that the outcomes of R&D activities carried out by the private sector and the public sector workers both follow a cumulative probability distribution which depends on the investment in labour undertaken by private firms and the State. Considering the matrix $\bar{A}$ as a complete description of the technology through which production is enacted - a technology matrix which also takes account of the real cost of labour - technical change will induce changes in the coefficients of $\bar{A}$. As a result of R&D efforts, new technologies or incremental innovations related to existing ones can lead to changes both in the capital coefficients per unit of output and/or in the labour coefficients. The specification introduced by Ricottilli (1993) allows to assess the net effect of technical change in the production coefficients by evaluating the variations in the Perron-Frobenius eigenvalue of $\bar{A}$. Accordingly, given (16), changes in the Perron-Frobenius eigenvalue λ^* will translate into changes in the equilibrium profit rate r. Elaborating on (16), we have:

$$\Delta r \equiv \frac{dr}{dt} = -\frac{1}{(\lambda^*)^2}\frac{d\lambda^*}{dt} \tag{18}$$

R&D efforts by private and public researchers will thus induce changes in the equilibrium rate of profit of the economy and, consequently, increase the maximum rate of the growth, i.e. the global measure of productivity. Using the notion of global productivity derived in (16), it is possible to model average changes in the global productivity of the system as a result of

uncertain outcomes of R&D efforts by the private sector and the State:

$$\overline{\Delta r_p} = \int_0^Z \Delta r_p d_{\Delta r_p} \phi(\Delta r_p, L_{IP}) \tag{19}$$

$$\overline{\Delta r_s} = \int_0^Z \Delta r_s d_{\Delta r_s} \psi(\Delta r_s, L_{IS}) \tag{20}$$

where (19) is related to the R&D efforts of the private sector and (20) is related to public R&D. Δr is a random variable, $\phi(\Delta r_p, L_{IP})$ and $\psi(\Delta r_s, L_{IS})$ are cumulative distributions of Δr which depend on the input of labour in the private sector (L_{IP}) and the State (L_{IS}) respectively. Z is the upper distribution bound and both the cumulative distributions of Δr are assumed to be decreasing in L_{IP} and L_{IS} respectively.

This specification allows to grasp the process of innovation as an uncertain one, as the average change in the equilibrium profit rate arises out of a stochastic distribution of R&D outcomes. Introducing R&D and thus innovation brings technical change into the system, which may manifest in the reduction of labour inputs and/or capital inputs per unit of output and thereby affects also the maximum growth rate of the economy. The real labour cost for the production of these capital goods decreases, thereby increasing the surplus rate enjoyed by the economy and appropriable by profits.

5.3 Macroeconomic impact of public investment

The process of innovation in the public sector can also be related to macroeconomic outcomes, and it can be shown that the latter are significantly affected by a proactive investment policy by the government. The approach that will be presented here relies on the fundamental notion of effective demand as a major hurdle for economic growth (Ricottilli, 1993). As a matter of fact, structural change is not only triggered by shifts in productivity and distribution: the growth rate of capital accumulation, led by investment, shapes the former aspects and it is shaped by them both in the short-run and the long-run. As discussed in Section 3.1, in real world economies full employment of resources is not ensured by the growth of supply. This is due to the inability of the level of effective demand to absorb all the produced supply of goods and services (Keynes, 1936b). Therefore, the level of capacity utilization of plants and the employment level of labour will depend upon the level of investment in each period of time, and underemployment equilibria can be possible outcomes of the system. In this context, it is throughout assumed that firms' investment behavior follows an augmented version of an investment function pioneered by Kalecki (1971). Accordingly, the growth rate of investment depends first and foremost on an autonomous component capturing what John Maynard Keynes defined as 'animal spirits'. This component represents the impact of entrepreneurs' agency and depends upon general expectations on economic activity. Section 5.1 explores the definition of a general measure of productivity, given by the equilibrium profit rate generated by the Perron-Frobenius eigenvalue of the technology matrix $\bar{A}$, and finds the impact of private and public R&D activities on changes in the equilibrium average profit rate. The expectations on the changes in the expected profit rate due to the increases in productivity (allowed by innovation) can be reasonably thought of an important driver of general expectations on economic activity. Therefore, this component can be modeled as a function of the average increase in the equilibrium profit rate

triggered by public and private R&D efforts, which can be expressed as follows:

$$\overline{\Delta r} = \overline{\Delta r_p} + \overline{\Delta r_s} \tag{21}$$

Furthermore, the growth rate of investment depends on the realized rate of profit (r) and the capacity utilization rate of the economy (u), which is defined as the ratio between the current output Y and the full-employment output Y_{fe}. The growth rate of investment thus can be specified as follows:

$$g_i = \gamma \overline{\Delta r} + \gamma_r r + \gamma_u u \tag{22}$$

Moreover, by definition we have that the actual (realized) profit rate is $r = (\pi u)/v$, where π is the profit share of total output and v is the ratio of the ratio between the current capital stock and the full-employment output, which is an increasing function of level of the equilibrium profit rate $\bar{r}$ found in (16)[3]. The output-capital ratio can be thought of as a measure of the efficiency of capital in the production process. Thus, it is expected to decrease in the presence of each innovation, whose impact in terms of productivity of the whole economy is given by $\bar{r}$. The profit share π can also be expressed in terms of the real wage rate as previously defined:

$$\pi = 1 - w_R L \tag{23}$$

In equilibrium, the growth of investment must equal the growth rate of savings and, in turn, it should equal the growth rate of the economy g. We define the growth of savings as a simple function of current profits times the propensity to save of entrepreneurs, under the assumption that workers do not save as in Kalecki (1971):

$$g_s = s_P r \tag{24}$$

The model thus closes by setting $g_s = g_i$ so that we have:

$$s_p \pi \frac{u}{v(\bar{r})} = \gamma \overline{\Delta r} + \gamma_r \pi \frac{u}{v(\bar{r})} + \gamma_u u \tag{25}$$

Manipluating (25), it is straightforward to see that the realized capacity utilization rate is:

$$u^* = \frac{\gamma \overline{\Delta r}}{(s_p - \gamma_r)\frac{\pi}{v(\bar{r})} - \gamma_u} \tag{26}$$

Hence, the equilibrium capacity utilization rate depends crucially on the outcome of public and private R&D efforts weighted by the sensitivity of investment growth to the level of research and the multiplier $\frac{1}{(s_p-\gamma_r)\frac{\pi}{v(\bar{r})}-\gamma_u}$, which is a version of the Keynes-Kahn multiplier (Kahn, 1931). The solution is stable and positive provided that the Keynesian stability condition is verified, in order to prevent the growth of investment from exploding. Namely, the saving rate out of profits weighted by the ratio between the profit share π and the output-capital ratio v must be greater than the sum of the sensitivity of investment to the profit rate (weighted by the same

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[3]The equilibrium profit rate associated with the Perron-Frobenius eigenvalue λ^* is redefined as $\bar{r}$ throughout this section in order to avoid confusion with the actual (realized) profit rate r.

ratio) and the sensitivity of investment to the capacity utilization rate:

$$s_p \frac{\pi}{v(\overline{r})} > \gamma_r \frac{\pi}{v(\overline{r})} + \gamma_u \tag{27}$$

Given the relationship between the capacity utilization rate and the profit rate, the corresponding equilibrium solution for the realized profit rate is:

$$r^* = \frac{\pi^*}{v(\overline{r})} \frac{\gamma \overline{\Delta r}}{(s_p - \gamma_r)\frac{\pi^*}{v(\overline{r})} - \gamma_u} \tag{28}$$

Furthermore, since in equilibrium it must be $g = g_s$, the realized growth rate of the economy is equal to:

$$g^* = s_p \frac{\pi^*}{v(\overline{r})} \frac{\gamma \overline{\Delta r}}{(s_p - \gamma_r)\frac{\pi^*}{v(\overline{r})} - \gamma_u} \tag{29}$$

where (27) must hold for (26), (28) and (29). In order to assess how exogenous components affect the capacity utilization rate and the growth rate of the economy, the two equilibrium solutions are differenced with respect to the saving rate out of profits and the equilibrium profit share π^*.

$$\frac{\partial u^*}{\partial \pi^*} = -\gamma \overline{\Delta r}(s_p - \gamma_r)\frac{1}{v} \frac{1}{\left((s_p - \gamma_r)\frac{\pi}{v(\overline{r})} - \gamma_u\right)^2} < 0 \tag{30}$$

$$\frac{\partial u^*}{\partial s_p} = -\gamma \overline{\Delta r} s_p \frac{\pi^*}{v} \frac{1}{\left((s_p - \gamma_r)\frac{\pi}{v(\overline{r})} - \gamma_u\right)^2} < 0 \tag{31}$$

$$\frac{\partial g^*}{\partial \pi^*} = s_p \frac{\gamma \overline{\Delta r}}{v} \frac{-\gamma_u}{(s_p - \gamma_r)\frac{\pi^*}{v(\overline{r})} - \gamma_u} < 0 \tag{32}$$

$$\frac{\partial g^*}{\partial s_p} = \pi^* \frac{\gamma \overline{\Delta r}}{v} \frac{-\gamma_r \frac{\pi^*}{v} - \gamma_u}{(s_p - \gamma_r)\frac{\pi^*}{v(\overline{r})} - \gamma_u} < 0 \tag{33}$$

Thus, the model predicts that both the Keynesian 'paradox of thrift' (i.e. a higher saving rate can decrease the growth rate of the economy) and the Kaleckian 'paradox of costs' (i.e. a higher equilibrium profit share can decrease the growth rate) as it pictures a wage-led economy (Bhaduri and Marglin, 1990). These findings suggest that greater capacity utilization rates induce higher investment at a given profit rate, due to the higher propensity to consume of workers with respect to capitalists. In this specific case, the profit share must fall if capacity utilization increases for a given profit rate: a redistribution in favor of wages happens. The findings seem consistent with an economy in which the State increases demand of goods and services and productivity through public investment in R&D and hires residual unemployed workers. In addition, innovations that raise the average (expected) profit rate $\overline{r}$ related to the Perron-Frobenius eigenvalue λ^* are also growth-enhancing, as it can be logically inferred from the meaning of the output-capital ratio v. Finally, the expected impact of innovations, through changes in the average (expected) profit rate on the equilibrium growth rate of the economy can be now computed, provided that (27) holds:

$$\frac{\partial g^*}{\partial \gamma \overline{\Delta r}} = s_p \frac{\pi^*}{v(\overline{r})} \frac{\gamma}{(s_p - \gamma_r)\frac{\pi^*}{v(\overline{r})} - \gamma_u} > 0 \tag{34}$$

Therefore, the sum of private and public R&D efforts produces positive effects on the rate of growth of the economy, with the capital-output ratio $v(\bar{r})$ playing the role of accelerator for each innovation.

5.4   Stabilizing the debt ratio through productive spending

In Section 4.5 the importance of maintaining sustainability of the public debt is stressed, in order to prevent the debt-to-GDP ratio from rising indefinitely and thus from causing a continuous redistribution of income from workers and businesses to rentiers. Section 5 assesses the impact of innovative public investment on the equilibrium growth rate, the realized profit rate and the capacity utilization rate, establishing a direct link between 'productive' public expenditures and economic growth. The theoretical literature on the optimal size of government intervention is vast, and it embraces both macroeconomics and political economy. The debate on the relationship between government expenditure and growth has been dominated by three main theoretical perspectives that can be loosely classified as the Neoclassical, the Ricardian and the Keynesian one (Rangarajan and Srivastava, 2005). The Neoclassical view holds that fiscal deficits are detrimental to growth, whilst the Keynesian paradigm envisages a positive short-run effect of public investment on the rate of capital accumulation and output growth. Instead, the Ricardian framework stresses the irrelevance of the financing structure of public expenditures: in this view, debt implies future taxes whose present values is equal to the current value of debt, thereby leading consumers and businesses to ignore any wealth effect, provided they are rational (Seater, 1993).

Several empirical studies have concluded that public expenditure on growth directly and indirectly increases the growth rate of the economy. Devarajan et al. (1996) use a dynamic optimization framework in order to show that productive public expenditure can be increased until an optimal level is reached. Aschauer (1989) and Munnell et al. (1990) conclude that public capital stock has a strong impact on private sector productivity. However, later studies have criticized these approaches as they implement production functions in testing the relationship between public expenditure and growth. These later studies find little evidence of public investment impact on productivity (Sturm and De Haan, 1995; Tatom, 1991).

Arrow and Kurz (1970) posit a model in which consumers gain utility both from private and public capital stocks: this intuition was further analyzed by the endogenous growth literature, which related public investment with the long-term growth rate of the economy (Barro and Sala-i Martin, 1990). Successive papers such as Barro (1991) distinguish between consumption and investment public expenditures, with empirical findings suggesting that non-productive outlays can have a negative impact on the long-run growth rate of real GDP. Studies such as Glomm and Ravikumar (1997) distinguish between public expenditures that directly enter as inputs in the private production function (i.e. infrastructure investments) and those that affect technology, such as education and training programs. However, they conclude that the distinction does not help in factoring in expenditures that can bring about a one-time impact in the long-run, for instance health care expenditures.

Turning to more empirical literature on the relationship between public expenditure and the growth of investment, Carranza et al. (2014) analyze the relationship between fiscal consolidation and public investment in six Latin American countries. They find that linear cuts in

current expenditures are not appropriate for fiscal consolidation, and point at the case of Peru where the fiscal position of the government was improved through measures that favored public investment in infrastructure while imposing limits to current consumption expenditures only. Moreover, Gupta et al. (2014) investigate the impact of public investment on private capital stock and growth, finding that the quality and the composition of public expenditures have a statistically significant effect in explaining the heterogeneity of economic growth in a panel of low-income countries.

A significant point of debate among the three views of public debt is represented by the possibility that public expenditure, whether it is aimed at consumption or investment, may displace private investment due to the 'crowding out' effect. Neoclassical, New Classical and several New Keynesian economists explain this phenomenon through a loanable funds theory of money: the increase in borrowing by the public sector takes a greater share of the available stock of high-powered money, thereby increasing interest rates and thus undermining the sustainability of public debt (Buiter, 1998). Whilst the monetary channel of 'crowding out' has been disputed by academic and institutional research (McLeay et al., 2014; Wray et al., 1998; Moore, 1989, 1991), it can be argued that public initiative may displace private entrepreneurial activity by insisting on sectors which can be covered as efficiently or more efficiently by private firms. This would cause the net effect of public investment on growth to be negative. Another strand of literature, instead, supports a 'crowding in' hypothesis which would operate through productivity-enhancing public investments (Bose et al., 2007; Ortiz and Cummins, 2013; Cavallo and Daude, 2011; Khan and Kumar, 1997). Some of the effects captured by empirical research belonging to this strand, however, differ with respect to the quality and the composition of public expenditure and the nature of the economy that was examined (i.e. whether these studies focus on advanced or developing countries).

Therefore, the government's dynamic budget constraint can be reassessed. The implementation of a policy mix which comprises innovative public research as part of a social investment pattern can improve the infrastructural endowment of the economy and the provision of essential 'wage goods' while at the same time providing job opportunities for the unemployed within an Employment Guarantee Scheme. The dynamic budget constraint can be restated by considering that the growth rate of the economy is not exogenously given as in the mainstream hypothesis explored in Section 4. Following the model outlined in Section 5.3, (29) shows that the equilibrium growth rate of the economy crucially depends on the average change in the expected profit rate of the economy triggered by public and private investments. Therefore, the equilibrium growth rate can be thought of a function of the maximum growth rate of the economy. Thus, the equilibrium growth rate is a function of public investment in the form of investment in R&D efforts in 'social innovation' sectors ($g^* = g(\alpha)$), where α is defined as the ratio of public expenditures on GDP as in Section 4.4. Plugging (29) into the dynamic budget constraint yields (omitting time indexes) as in Sardoni (2009):

$$\dot{b} = \alpha - \beta + [i - g^*]b - \dot{m} \tag{35}$$

This specification suggests that the stabilization of the debt-to-GDP ratio can occur even without a systematic balanced budget or a primary surplus, provided that the growth rate of the economy exceeds the interest rate paid on public debt (i.e. it must be $g^* > i$). Monetization

of debt by the central bank is also another funding option that would not increase the debt-to-GDP ratio, but it will not be considered in the following analysis. It is not an available option in countries where the central bank is prohibited from purchasing government bonds in the primary market, or that have pegged their currencies to foreign ones. If the stability condition holds, then the debt-to-GDP ratio converges to a stable ratio:

$$b^* = \frac{\alpha - \beta}{g^* - i} \tag{36}$$

Therefore, even in the presence of a primary public deficit, choosing a composition of government spending that relies mostly on productive uses can significantly affect the path towards debt stabilization with greater social and economic viability with respect to austerity policies that entail a balanced budget or primary surpluses. In the same fashion, Pasinetti (1997) argues that debt stabilization through public investment in productivity-enhancing sectors allows the government to achieve multiple goals besides the need to maintain a constant debt-to-GDP ratio: namely, decreasing unemployment and improving income distribution through targeted public works programs.

The proposed policy mix that joins a National Investment Board with an Employment Guarantee Scheme may contribute in two ways to a debt stabilization policy. First off, public investments in 'wage good' sectors have a positive impact on the maximum growth rate of the economy as discussed in Section 5.2. They increase the productivity of the system as a whole by lowering the real cost of labour, allowing for a greater surplus to be produced. Hence, they directly increase the growth rate of the economy g^* in the same way as private investments as shown by (29). Secondly, the increased capacity utilization that results from an increase in consumption - triggered by the expansion of employment - has a positive influence on the growth rate of the economy. On top of that, the introduction of EGS can bring about the elimination of several welfare measures than would be integrated in the benefit package related to EG wages: for instance, it would eliminate unemployment doles, which are an important component of 'unproductive' government expenditures.

Arguably, a failure of the stability condition $g^* > i$ to hold undermines the possibility to stabilize debt-to-GDP through deficit spending. This may occur due to the failure of public and private investment to deliver successful innovations, or the inability of consumption and investment growth to exceed the growth of interest rates paid by the government. In this case, the institutional setting of economic institutions can make a difference in trying to cope with an excess of interest rates over the growth rate without imposing an additional social burden through increased taxation. As a matter of fact, modern central banks operate on the basis of an interest rate target: money aggregates are thus able to fluctuate endogenously and depend upon the level of economic activity and the growth of the price level, whilst the central bank exogenously sets interest rates (McLeay et al., 2014). Operationally, central banks set the short-term interest rate on central bank reserves and influences the whole term structure of interest rates through the transmission mechanism. Most importantly, the latter allows the central bank to control the yields of short-term government bonds. Therefore, cooperation between the central bank and the Treasury can always set the interest rate paid on government bonds lower than the growth rate of the economy through exogenous pricing. This is why Mosler (1997) and other ELR proponents advocate a permanent 0% policy rate by the central bank,

while simultaneously providing full employment through EGS: it allows income distribution to favor workers over rentiers at all times.

However, countries who adopt foreign currencies or peg their exchange rates to foreign currencies do not enjoy a similar policy space. Interest rate setting by the central bank cannot be fully exogenous in this second case, as the government should usually accumulate a foreign currency reserve in order to be able to maintain the peg (Sims, 2001). Hence, besides other adverse effects, such as the need to deflate wages and restrain imports in case of adverse economic developments, foreign currency pegs erode the degrees of freedom of central banks in such a way that discretionary fiscal policy is no longer an option for the pegging government.

Exchange rate pegs (or dollarization in extreme cases) are regarded as a potentially disruptive option by several studies (Wray et al., 1998; Sims, 2001; Cochrane, 2003). ELR proponents advocate floating exchange rates even for developing countries, in order to allow a full utilization of domestic resources without the need to implement excess capacity and labor displacement to keep wages low. However, for countries that decide to keep their exchange rates fixed to other currencies for political or commercial reasons, the case for a productive implementation of EGS and infrastructure-enhancing public investment becomes even more compelling. Being the interest rate on public debt not fully under the control of these countries' central bank, it becomes mandatory to ensure a positive growth rate by maximizing productivity if the government does not want to rely on primary surpluses to keep the debt-to-GDP ratio stable. International cooperation may then help the country to fund the program via international loans as in the case of Argentina's *Jefes* (Lal et al., 2010).

6 Conclusions

The paper has analyzed some of the most relevant causes underpinning the sluggish growth of productivity, output and employment in recent decades across advanced and developing countries. Whilst several differences exist among different theoretical views about the fundamental causes, convergence of orthodox and heterodox diagnoses has increased over major issues such as income inequality and the need for investment in infrastructure and crucial assets for the productivity of the system as a whole. The contributions of Summers (2014, 2013, 2015, 2016) and Steindl (1952) both address the issue of secular tendencies to stagnation which can be countered mainly by pro-active, expansionary fiscal policies with a focus on public investment.

Policy makers have focused on maximizing 'full employability' of the workforce since the 1994 OECD *Jobs Study*, which laid the foundation for the prevalence of structural reforms in OECD and non-OECD governments' agenda. The shift of policy making concerns from direct job creation efforts to the provision of an optimal background for private enterprises has produced mixed results in terms of tackling persistent failures of labour markets such as hysteresis. As discussed by Mitchell and Muysken (2008), this policy prevailed in the context of a general retrenchment of the State from a balancing role in the relations between firms and businesses, and in general from any active role in job creation.

The turning point in European and US policymaking was marked by the failure of traditional Keynesian policies in the 1970s: the decade was characterized by stagflation, i.e. the simultaneous persistence of unemployment and inflation, which had both supply-side and demand-side

causes but was mainly interpreted as generated by the latter.

Besides the evaluation of the 'full employability' framework, the role of the State with respect to growth and productivity has been reassessed through the analysis of the impact of the 'Entrepreneurial State' in the 20th century provided by Mazzucato (2013a). Studies in the Neo-Schumpeterian tradition stress the importance of creating a national system of innovation, where public agencies undertake the most uncertain, early stage research projects and coordinate the transition of early prototypes into the market. Innovation is seen as a collective process, where positive feedback loops exist between private and public agents, workers and managers, researchers and businesses.

Moreover, the paper analyzes the fundamental features of Employment Guarantee Schemes and compares theoretical models of implementation - such as the Employer of the Last Resort - with policy experiences from different countries in the recent decades. Building on both theory and practical experience, a multisectorial model of the economy in the framework elaborated by Ricottilli (1993) is provided, with particular emphasis on the role of innovations in the sectors related to 'wage goods', which are demanded by workers but previously provided in an insufficient quality or quantity by the private sector and the State. The model in Section 5 finds that public investment in R&D, when focused on socially relevant sectors related to 'absolute needs', have a positive impact on the maximum rate of surplus that the economy can achieve. The latter is also considered as the global measure of productivity of the system, which includes both real costs of capital and labour inputs.

In addition, this measure of productivity is implemented in a macroeconomic analysis based on a model of investment function pioneered by Kalecki (1971). Several conclusions can be drawn from the analysis of Section 5. First off, the impact of public investment in research on short-run equilibrium values of the realized profit rate, capacity utilization rate and growth rate of the economy is found to be positive. Secondly, both the Keynesian 'paradox of thrift' - i.e. a negative impact of the increase in the rate of savings on the equilibrium growth rate of the economy - and the Kaleckian 'paradox of costs' - the negative impact of an increasing profit share on the equilibrium growth rate - are found to hold. This finding is consistent with the notion of a 'wage-led' economy, a condition that empirically holds for many European countries and which is favored by the implementation of Employment Guarantee Schemes.

Finally, Section 5 provides an analysis of the fiscal impact of EGS and analyzes the conditions by which a stabilization of the debt-to-GDP ratio is possible through targeted budget deficits aimed at increasing productivity. The policy mix that this paper proposes, which is composed of public investments in R&D related to socially necessary goods and services and ELR programs focused in the same areas, is an example of productivity-enhancing program based on public deficits. The possibility to stabilize the debt-to-GDP ratio is clearly visible when it is assumed in the equation of the government's budget constraint that the growth rate of the economy is not exogenous, but it is a positive function of productive public investment directed to 'social innovation' sectors.

Hence, this paper concludes that full employment is an achievable goal in modern economies, and that it positively contributes to their productivity when it is closely related to public investment targeting absolute social needs. The analysis of long-run positions of such an economy is left for future research, as well as an analytical foundation for the pricing mechanism described by ELR proponents. Moreover, extensions of this research should include a careful analysis of

the political economy effects of Employment Guarantee Schemes, which also contributes to the aforementioned long-run analysis.

There is room for an evolution of capitalism into a system which is able to use all of the material and intellectual resources provided by human labour. At the same time, the system can provide the opportunity for a decent and fulfilling life to all of the participants in the provisioning process. Groping towards a more inclusive, equal and innovative economy in which individuals are free to pursue their own projects and endeavors, but where they are also free from the chains of poverty and need, is precisely the aim of the present research and hopefully of its future continuation.

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Appendix: Derivation of the Perron-Frobenius eigenvalue

In the example outlined in Section 5.1, an economy which produces 2 capital goods and 1 wage good is considered. In this case, the matrix $\bar{A}$ can be designed as follows:

$$\bar{A} = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ \tau_w l_1 c_3 & \tau_w l_2 c_3 & \tau_w l_3 c_3 \end{pmatrix}$$

Therefore, finding the eigenvalues of $\bar{A}$ associated with $p\bar{A} = \lambda p$ requires to check whether $\det[\bar{A} - \lambda^* I] = 0$ holds for some values of λ^*. This determinant is given by

$$\det[\bar{A} - \lambda I] = \begin{vmatrix} a_{11} - \lambda & a_{12} & a_{13} \\ a_{21} & a_{22} - \lambda & a_{23} \\ \tau_w l_1 c_3 & \tau_w l_2 c_3 & \tau_w l_3 c_3 - \lambda \end{vmatrix}$$

In order for the determinant to be equal to zero, it must thus be

$$(a_{11} - \lambda)(a_{22} - \lambda)(a_{23} - \lambda) + a_{12}a_{23}\tau_w l_1 c_3 + a_{13}a_{21}\tau_w l_2 c_3 -$$
$$-(a_{22} - \lambda)a_{13}\tau_w l_1 c_3 - a_{21}a_{12}(\tau_w l_3 c_3 - \lambda) - (a_{11} - \lambda)\tau_w l_2 c_3 a_{23} = 0$$

Manipulating the above condition we have:

$$\lambda^3 - \eta_1\lambda^2 - \eta_2\lambda - k = 0$$

where the following substitutions have been implemented in order to save notation space:

$$k_1 = a_{12}a_{23}\tau_w l_1 c_3$$
$$k_2 = a_{13}a_{21}\tau_w l_2 c_3$$
$$k_3 = -a_{22}a_{13}\tau_w l_1 c_3$$
$$k_4 = a_{21}a_{12}\tau_w l_3 c_3$$
$$k_5 = a_{11}\tau_w l_2 c_3 a_{23}$$
$$k = k_1 + k_2 + k_3 + k_4 + k_5$$
$$\eta_1 = -(a_{23} + a_{11} + a_{22})$$
$$\eta_2 = -(a_{13}\tau_w l_1 c_3 - a_{11}a_{23} - a_{22}a_{23} - a_{11}a_{22} - a_{21}a_{12} - \tau_w l_2 c_3 a_{23})$$

Therefore, the characteristic polynomial of $\bar{A}$ allows for up to 3 real distinct eigenvalues to be found. On top of that, the Perron-Frobenius Theorem ensures that real square matrices with positive elements (such as $\bar{A}$) have a unique maximum real eigenvalue, whose corresponding eigenvectors are the only ones associated with the maximum real eigenvalue. In the case of the system outlined in Section 5.1, the right eigenvector which is associated with the Perron-Frobenius eigenvalue is the price vector p, whose elements must be all positive by definition.

Hence, the largest real eigenvalue λ^* that can be computed out of the characteristic polynomial of $\bar{A}$ will yield the equilibrium profit rate r which is also equal to the maximum growth rate of the economy $g_{\max}$.