ARTICLE SUBMISSION

Beyond Job Guarantee: the Employer of Last Resort Scheme as a tool to promote the Energy Transition

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ABSTRACT
The current health and economic crisis has revived the debate on fiscal policy as a major tool for stabilization and long-term goals. The massive surge in unemployment, due to the economic disruption of the lockdown measures, has increased the interest on policies that target employment directly instead of trying to achieve it via a general "demand push. One of the proposals currently under debate is the Job Guarantee. Under such a policy the government should act as an 'Employer of Last Resort", by offering a job to everyone that is able and want to work and cannot find a job in the private sector. The wage paid in these programs should become the minimum wage in the labour market. Over the years, this policy proposal has received a number of criticism, in particular on i) the impact on both the government budget and debt ii) the prevailing full-employment equilibrium wage rate once the program is implemented and iii) the implication on the external balances (current and trade account), especially when this policy is implemented in a small, open economy. It is our believe that such criticism can be properly addressed without "throwing the baby out with the bathwater", that is, rejecting the validity of the ELR as a tool to fight poverty, social exclusion and income inequality. As a matter of fact, we argue that a careful design of a scheme of direct employment and public provision by the state – tackling both low and high skilled workforce – can have permanent effects and promote the structural transformation of the economy, thus helping to overcome i), ii) and iii). Starting from this point we develop a Stock-Flow Consistent model to study the long run effect of the implementation of a job guarantee program inspired by the work of Godin (2013) and Sawyer and Passarella (2019).

KEYWORDS
Stock-Flow Consistent Models; Job Guarantee Plan; Structural Change; Energy Transition

JEL CLASSIFICATION
B52; J68; Q43

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1. Introduction

The current health and economic crisis has revived the debate on fiscal policy as a major tool for stabilization and for long-term goals. The massive surge in unemployment, due to the economic disruption of the lockdown measures, has increased the

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interest on policies that target employment directly instead of trying to achieve it via a general "demand push". At the same time, monetary authorities around the world, in the wake of this new normal, have renewed their provision of liquidity to support fiscal agencies, even to the point to permanently modify their mandate to pursue the employment target as in the case of the FED (Powell 2020) or to directly finance extra government spending as in the case of the Bank of England (Bank Of England 2020). As a matter of fact, the response of the European Union on both the fiscal and the monetary side has been partially (un)satisfactory, considering both the timing, the initial contradictory stance pursued by the ECB with respects sovereign rate differentials, and in the limited scope of some backstops. Consider, for instance, the SURE initiative, supporting EU Member states in the emergency provision of short-term work schemes. Although useful in preserving employment losses, a traditional cash-transfer approach appears to be inadequate given the structural dimension assumed by the current recession. One of the alternative proposals currently under debate is the Job Guarantee or Employer of last resort policy. Under such a policy the government should act as an 'Employer of Last Resort" (ELR), by offering a job to everyone that is able and want to work and cannot find a job in the private sector. The wage paid in these programs should become the minimum wage in the labour market. This job programs can be a substitute of unemployment subsidizes and would create an economic sector that increases during recessions and shrinks during the expansions. This proposal was developed by Minsky (1965; Minsky 1968; Minsky 1994), which saw it as a necessary counterpart of the Fed role as "Lender of last Resort" (LLR) in financial markets in order to "Stabilize an Unstable Economy", subject to cyclical fluctuations due to the decisions and expectations of the private sector, seldom driven by rational decisions (Minsky 2008). Over the years, this policy proposal has received a number of criticism, in particular on i) the impact on both the government budget and debt (Aspromourgos 2000; Sawyer 2003) ii) the prevailing full-employment equilibrium wage rate once the program is implemented (Seccareccia 2004) and iii) the implication on the external balances (current and trade account), especially when this policy is implemented in a small, open economy (Epstein 2019; Vernengo and Perez Caldentey 2020) . It is our believe that such criticism can be properly addressed without "throwing the baby out with the bathwater", that is, rejecting the validity of the ELR as a tool to fight poverty, social exclusion and income inequality. As a matter of fact, we argue that a careful design of a scheme of direct employment and public provision by the state – tackling both low and high skilled workforce, as put forward by (Colacchio and Forges Davanzati 2020) – can have permanent effects and promote the structural transformation of the economy, thus helping to overcome i), ii) and iii) criticism. Starting from this point we develop a Stock-Flow Consistent (SFC) model in order to study the long run effect of the implementation of a job guarantee program inspired by the work of Godin (2013) and Sawyer and Passarella (2019). The paper is divided as follows: Section 1 will illustrate the main principles of the ELR and its recent development in the context of the "Green New Deal" proposal, as well as its main criticisms. The accounting framework and the model equations will be introduced in Section 2, while Section 3 will describe the the different scenario performed. Section 4 will describe the results from the simulation as Section 5 will summarize our main findings.

2. The ELR and the Green New Deal

The problem of financing ambitious fiscal programs, in particular those aiming at shaping the long-run productive structure of an economy, has always been at the core of the economic theory. In the last years, within the non-mainstream academic community a body of literature known as "Modern Money Theory" (thereafter MMT) (Mosler 1997; Wray et al. 1998; Wray 2015; Mitchell et al. 2019, Cucignatto (2021)) has sort to revive some old-fashioned concepts revolved around the "State Theory of Money", from the name of the seminal work of Knapp (Knapp 1924), an early XXth century German economist. In short, its main argument is indeed that money is an institutional arrangement used to measure debt and credit relations rather than a medium of exchange. His view was endorsed by Keynes in his 1930 Treatise on Money (Keynes 1930), where he laid out that the State has accomplished the monopoly of the payment system when "(it) claimed the right not only to enforce the dictionary but also to write the dictionary", and this has been reached at least since "four thousand years". In so far as it could exercise this power, a Modern State would never technically incur in bankruptcy, as it would possess the ultimate weapon to redeem all the contracts, which is its unit of account established by law. From this consideration, a number of conclusions can be drawn: first, taxes do not play any role in financing government expenditure, as the latter comes forth as a result of a simple "Fiat" of the State; rather, their purpose is i) to create the demand for money by households and consequently to put them is search for means to obtain the latter to extinguish their fiscal obligations, and ii) to drawn excessive expenditure form the system, avoiding excessive inflation. In a typical Keynesian flavor, an MMT scholars would say: "Expenditure First". Second, if unemployment would persist over time, this should be read as a result of insufficient government expenditure in the system, as households would continue to search for money to pay for taxes but ultimately not being able to find it – again, following the Keynesian notion of involuntary unemployment. Third, if the treasury is to avoid a recession or the destruction of productive capacity (both in terms of physical and human capital), the solution is to counterbalance the decisions of the private sectors, escaping form the "paradox of thrift", guaranteeing a level of expenditure consistent with full employment – an approach to public finance which the Russia -born Keynesian economist Abba Lerner (1943; Lerner 1947) called as "functional". Fourth, precisely in order to employ all the capacity the State should act as an "Employer of Last Resort" (ELR), by offering a job paid with an amount that will become the minimum wage in the labour market, rather than seek to stimulate demand by offering subsidizes - that would well provoke the economy to fall ahead the target of full employment. This minimum wage would become the inflationary anchor of the economy, as private sector workers would take part in (drop out) a Buffer Stock Employment (BSE) during the downward (upward) phases of the cycle (Mitchell 1998). This "Job Guarantee" (JG) proposal was developed by Hyman Minsky (1965; Minsky 1968; Minsky 1994) , which saw it as a necessary counterpart of the Fed role as "Lender of last Resort" (LLR) in financial markets in order to "Stabilize an Unstable Economy" (Minsky 2008), subject to cyclical fluctuations due to the decisions and expectations of the private sector, seldom driven by rational decisions. Several MMT scholars – most of them reunited in the Levy Institute of Bard College, NY - owns to the works of Minsky, in particular for his analysis of the US financial system and for having documented how the US consolidated government (Treasury+Fed) was able to exercise an effective control of the latter, both directly (through LLR interventions) and indirectly (through strict regulative interventions).

For both its intellectual legacy, and its relevant body of literature, MMT has loomed in the progressive debate since the Great Financial Crisis of 2008, both in the US and in the EU – in the latter especially right after the sovereign debt crisis. In recent years, it has regained momentum both in academic and policy circles as it has been increasingly intertwining with the Green New Deal (GND), a set policy proposal to foster the transition away from carbon fossil fuels, increase energy efficiency and promote both environmental and social sustainability (Nersisyan and Wray 2021; Cucignatto 2021). In the version put forward by the Levy institute (Wray et al. 2018), a backbone of this strategy will be represented by an ambitious ELR scheme targeting labour force with below-average skills and labour-intensive vacancies. Given the properties of these jobs, they will be devoted only to a subset of the GND projects, such as care services, small construction and retrofitting interventions (Nersisyan and Wray 2019). Nonetheless, it is argued that for a net annual impact on the federal government's budget of roughly 400 USD billion per year over 10 years, there will be a boost to GDP of 560 USD billion annually and to employment of 19 million new workers (of which more than a fifth will be created in the private sector). These figures are grounded in the fact that these wages will constitute a direct addition to aggregate demand, as they will be immediately spent in consumption goods. However, the authors estimate that the inflation will increase only marginally in the steady state (0,09%), after a short-lived spike (0,74%) right after the implementation of the program. Finally, the ELR should affect both the quantity and the quality of the labour force, as the increased labor demand in the economy would force hidden or disguised unemployment to shrink, whilst workers employed in the scheme would improve their productivity by receiving training. In fact, Nersisyan and Wray (2019) argue that a JG represent both a cost (in terms of wages) and a source of resources (as it provides workforce for a vast array GND projects).

Since its early formulations the ELR has received a number of criticism in particular from both an orthodox and non-orthodox standpoint. The latter are of a particular interest, as they have been addressed by scholars with whom MMT researchers do share their intellectual roots. Post-Keynesian authors such as Moore (1988) and Lavoie (2013) basically endorse the process of money creation described by Wray (2004) and the fundamental role played by the government in shaping the monetary and income circuit (Keynes 1978), although they also point out that credit is not purely a creature of the state (Graziani 2003; Rochon et al. 2003). However, the JG proposal has met far less consensus among these scholars. Their critical assessments cover three areas: First, the sustainability of the program in terms of its impact on both the government budget and debt (Aspromourgos 2000; Sawyer 2003) as measured by the interest rate burden (the share of interest payments on total tax revenues). Second, the microeconomics assumptions behind the description of the behavior of the labour market once the JG is enacted. Mitchell (1998) and Mitchell et al. (2019) argue that the mechanism of the BSE establishes a Non Accelerating Inflation Buffer Employment Ratio (NAIBER), which differently from the mainstream Non Accelerating Inflation Rate of Unemployment (NAIRU) seeks to control inflation via quantity (rather than price) adjustments. Yet, Kriesler and Halevi (2016) and Levrero (2019) stress that the former may turn out higher than the latter, because of the increase in workers' bargaining power as they target a higher nominal wage. Seccareccia (2004) motivate this with the shape of the labour supply curve with respect the average real wage, which is seen as upward sloped with varying slope. This implies that the prevailing full-employment equilibrium real wage once the program is implemented could be very low and similar to the one prevailing in developing economies (Seccareccia 2004). Third, the implications

on the external balances (current and trade account), especially when this policy is implemented in a small, open economy (Epstein 2019; Vernengo and Perez Caldentey 2020; Prates 2020). Apart from the key international reserve currencies (the US Dollar, the Euro and the Yen), virtually all the countries face this constraint, with different degrees (Kaltenbrunner 2018; Kaltenbrunner and Painceira 2015). On top of that, emerging economies are technological dependent on imported intermediate inputs, as their productive matrix present several "holes" in some critical sectors (Prebisch 1949; Ocampo et al. 2009; Cimoli 1988). This means that in order to either repay previous debt commitments or import items manufactured abroad a small country should obtain foreign currency first, in a sense mirroring the process through which money is legally enforced to the public by a sovereign state. Notice, however, that this reasoning does not rely on the twin deficit hypotheses (Barro et al. 1991), as the causality does not run from the government to the external balance but rather in the opposite direction as contended by the Non-orthodox (and in particular Structuralist) standpoint (Ocampo et al. 2009) - or alternatively, from the external to the private sector with the government deficit (surplus) adjusting endogenously[1]. As for the GND version of the ELR, to the best of our knowledge far less issues have been raised, perhaps because this JG program would be just one out of a bunch of measure within this policy - standing out as a significant shift with respect the more radical positions of Mitchell (1998) on the ELR as a substitute for social expenditure. Nevertheless, there are a few observations that can be identified: firstly, as Nersisyan and Wray (2019) acknowledge that the program tackle the workforce with below-the-average skills, it is not clear though how they would be able to perform activities that may be radically different from the ones of the previous jobs - even with proper training and especially when these relates to innovative GND-related projects. It could be just a matter of timing: a JG worker may be forced out from the program before actually accomplishing any kind of task, simply because the economy enters an upswing phase and the BSE needs to shrink. For this reason, it is hard to imagine an enhancement of productivity of the labour force similar to education (Colacchio and Forges Davanzati 2020) . If anything, by eliminating long-term unemployment, the declining trend in labour productivity observed in many developed economies may be offset, although a reversal achieved only via training for short-term employment is hardly plausible. Secondly, the GND would require to drastically reduce the importance of "brown" sectors by cutting both government and household expenditure in non-renewable energy. However, subtracting them from the estimated costs of the various renewable energy and energy efficiency proposals as in Nersisyan and Wray (2021) may be misleading; albeit fossil fuels do represent an invoice for some agents in the economy (and definitely a cost for the environment), they are also a source of income at the very least for utility and utility-linked sectors. Even assuming small multiplier effects of current expenditure on non-renewables on the economy - due for instance to the monopolistic features of these industries - the negative consequences from the reduction of a component of aggregate demand would still affect a subset of households and firms. The net balance may still be positive in a "greener" steady state as the new energy sectors would display higher multipliers and with a close to zero carbon footprint. However, the analysis of the traverse from one equilibrium to another should not be dismissed. Finally, the proponents of the GND

[1]Mitchell et al. (2019) offer *Prima facie* to this problem the adoption of a floating exchange rate regime, which would absorb the shocks from the rest of the world through a simple price adjustment and maintain in check the trade balance. However, Epstein (2019) and Vernengo and Perez Caldentey (2020) criticize this mechanism as a pure flexible exchange arrangements, if left unchecked, attract speculative capital flows which bet against the value of the local currency and triggers destabilizing dynamics

does not seem to be aware of the "rebounding" effect (Sorrell et al. 2007; Vivanco et al. 2016), that is the increase in energy consumption following the improvement in energy efficiency. It may be interpreted either as a change in the micro behaviour and more specifically in the increase in the propensity to consume energy resulting from the improvement of fuels efficiency - echoing Lucas (1976) critique - or as a macro adjustment stimulated by cost-saving technical changes in energy production which feed back positively on output and energy demand - in accordance with a long-lasting tradition dating back Jevons (1865) and Malthus (1872) . This is a challenge for any environmental-oriented policy, but it also represent a serious issue for an ELR scheme due to the fact that by its very characteristics the JG wage bill would induce almost a one-by-one increase in aggregate consumption. To sum up, the Levy version of the GND strategy while offering a very intriguing plan to reshape the economy towards a more sustainable pattern, fails to properly take into account some of the structural modifications that this strategy brings about in an economy with complex interactions.

3. The Model

In order to tackle some of the questions emerged in the previous section, we will develop a multi-sector Stock-Flow Consistent (SFC) model. SFCs are dynamic, medium-scale Keynesian macro-econometric models based on a rigorous accounting framework, which integrates the flows and stocks of a financially sophisticated economy (Carnevali et al. 2019; Godley and Lavoie 2012; Nikiforos and Zezza 2017; Caverzasi and Godin 2013). There are three reasons upon which we opted for this methodology.

First, the intellectual roots of this approach lie in the national account – based macroeconomic models, built in Cambridge in the sixties by Richard Stone, whose work was successively taken up by Godley one decade later in the framework used by the Cambridge Economic Policy Group (Fetherston 1976, 1977), that himself helped to develop. In the early '90s Godley he started his collaboration with the Levy Institute, as he published a number of seminal contribution analyzing the imbalances of US trade through the lens sectorial balance approach (Godley 1999). Since then, both this approach and in general the SFC methodology have become a fundamental component of the Institute's research. Furthermore, proponents of the MMT have been adopting SFC models to illustrate some of its core principles (Ehnts 2014, 2016; Hannsgen 2020) and viceversa, critics have resort to this framework to underline its weaknesses (Carnevali and Deleidi 2020).

Second, it ensure the model consistency, which Nikiforos and Zezza (2017) and Zezza and Zezza (2019) have identified in four principles: (i) the flow consistency, i.e. that every flow must come from somewhere and goes somewhere else – for example, in an open economy model, exports of one country are the imports of another one; (ii) the stock consistency, i.e. that every asset owned by an agent (sector) is the liability of another one in the system: (iii) The stock-flow consistency, i.e. that every flow implies the change in one or more stocks; (iv) the quadruple entry, i.e. that every transaction is recorded four times in the accounting matrix, for instance twice as a flow of expenditure and twice as a change of asset or increase of liabilities. As we have seen in Section 2, the need for a rigorous accounting framework for the analysis of the GND is justified directly by Nersisyan and Wray (2019) as they argue that the estimates of the JG should avoid double-counting since the stock of BSE represent both a financial commitment for the state and a direct addition of real resources for the economy. Moreover, it helps to shed light on some weak spots of this strategy, such

as the costs of phasing out entire "brown" sectors and the rebounding effect.

Finally, SFC models have risen in recent year as the main tool to assess the interactions between the environment and the economy from a Postkeynesian perspective. Ecological SFC contributions are inspired by the flow of funds approach of Georgescu-Roegen (1979; Georgescu-Roegen 1971) to physical materials transformation (and destruction/tendency towards greater entropy) linked with the economic activity, in order to answer an array of research questions - such as whether or not decoupling growth from debt accumulation may be achieved (Jackson and Victor 2015), which policy may be contemporaneously deliver output and employment growth, a more equal income distribution and environmental sustainability (Naqvi 2015), if environmental-friendly interventions by the Central Bank reduce financial instability (Dafermos et al. 2018) and which are the impact of green financial investment on cross border flows (Carnevali et al. 2020) - or to integrate it with other methodologies - such as the Input-Output analysis (Berg et al. 2015), the Supermultiplier approach (Deleidi et al. 2019) and the evolutionary/Agent-Based techniques (Monasterolo et al. 2019).

For the sake of our analysis we started from two SFC contributions, namely the ones of Godin (2013; Godin 2014) and Sawyer and Passarella (2019) . Godin (2013) modeled a multi-sector economy whereby the BSE was tasked to reduce government's and households' energy demand. He then focused on the impact of the green JG and compared these results with a standard Keynesian demand spur. Sawyer and Passarella (2019) instead built a a complete SFC dynamic model to study and compare the effects of a variety of monetary and fiscal policies, including both LLR and ELR measures. Our model expand these two previous works both in terms of its agents, stocks and flows, in order to fit with our research purposes [2]. In fact, it is made up of 7 sectors, as shown in both the balance sheet 1 and transaction flow 2: a productive sector, composed by the consumption, investment and energy firms, banks, government, central bank, households and a foreign sector. The main features with respect to the benchmark Godin (2013; Godin 2014) model are: a) the presence of a more complex financial transmission mechanism, with banks able to manage the interest rate that they charge on loans; b) a foreign sector by which we can detect balance of payments problems of such a policy; c) an explicit distinction between the government and the central bank. At variance with Sawyer and Passarella (2019) we encompassed an utility (capital goods) sector whose output is not entirely destined to consumption but enters in the production function of both the consumption goods and the capital good (energy) sector. Lastly, the possibility for the Central Bank to carry out Outright Monetary Transactions (OTMs) or Quantitative Easing (QE) policies has been explicitly included in the baseline. We indeed believe that these measures constitute a structural element of modern economies and in particular financial markets. Nowadays, they constitute a new normal for monetary authorities, as they have been in place for over a decade - although with different degrees of intensity, timing and instruments. In the next subsections, we will break down the model in each of its components and behavioural equations.

[2]The points of departure from each of these works in terms of policy scenario will be discussed more in depth in Section [3][Feature of the experiments]

Table 1. Balance Sheet Matrix

	Households	Firms e	Firms c	Firms k	Financial Sector	Government	Central bank	Foreign Sector	sum
cheque deposits	$+m1h$				$-m1h$				0
Saving deposits	$+m2h$				$-m2h$				0
Bills	$+bh$				$+bb$	$-bs$	$+bcb$		0
Loans	$-lh$	$-lf_e$	$-lf_c$	$-lf_k$	$+ls$				0
Securities	$+eh$	$-eh_e$	$-eh_c$	$-eh_k$					0
Capital		$+k_e$	$+k_c$	$+k_k$					K
Cash	$+hh$						$-hh$		0
Advances					$-ad$		$+ad$		0
Reserves					$+hbd$		$-hbd$		0
Foreign Reserves					$+hf$			$-hf$	0
Balance	$-V$	NWe	NWc	NWk	NWb	NWg	$NWcb$	NWf	0

[a] Source: own elaboration.

Table 2. Transaction Flow Matrix

	Households	Firms e	Firms c	Firms k	Financial Sector	Government	Central bank	Foreign Sector	sum
Consumption	$-c$		$+y_c$			$-c_{g,c}$			0
Energy Consumption	$-c_e$	$+y_e$	$-c_c$	$-c_k$		$+c_{g,e}$			0
Govt. Expenditures		$+c_{g,e}$	$+c_{g,c}$	$+c_{g,k}$		$-gov$			0
Investment		$-id_e$	$-id_c$	$+y_k$		$-c_{g,k}$			0
Firms' Profit	$+fdf$	$-fdf_e$	$-fdf_c$	$-fdf_k$					0
Taxes	$-tax$					$+tax$			0
Banks Profits	$+fb$				$-fb$				0
CB Profits						$+fcb$	$-fcb$		0
Exports			$+x$					$-x$	0
Imports			$-m$					$+m$	0
Int. on cheque deposits	$+rm_{-1} * m1h_{-1}$				$-rm_{-1} * m1h_{-1}$				0
Int. on Saving deposits	$+rm_{-1} * m2h_{-1}$				$-rm_{-1} * m2h_{-1}$				0
Int. on Bills	$+rb_{-1} * bh_{-1}$				$+rb_{-1} * bb_{-1}$	$-rb_{-1} * bs_{-1}$	$+rb_{-1} * bcb_{-1}$		0
Int. on Loans	$-rl_{h,-1} * lh-1$	$-rl_{e,-1} * lf_{e,-1}$	$-rl_{c,-1} * lf_{c,-1}$	$-rl_{k,-1} * lf_{k,-1}$	$+rl_{x,-1} * ls_{x,-1}$				0
Int. on Securities	$+re_{x,-1} * eh_{x,-1}$	$-re_{e,-1} * eh_{e,-1}$	$-re_{c,-1} * eh_{c,-1}$	$-re_{k,-1} * eh_{k,-1}$					0
Int. on Advances					$-ra_{-1} * ad_{-1}$		$+ra_{-1} * ad_{-1}$		0
Int. on Reserves					$+rh_{-1} * hbd_{-1}$		$-rh_{-1} * hbd_{-1}$		0
Change in cheque deposits	$-\Delta m1h$				$+\Delta m1h$				0
Change in Saving deposits	$-\Delta m2h$				$+\Delta m2h$				0
Change in Bills	$-\Delta bh$				$-\Delta bb$	$+\Delta bs$	$-\Delta bcb$		0
Change in Loans	$+\Delta lh$	$+\Delta lf_e$	$+\Delta lf_c$	$+\Delta lf_k$	$-\Delta ls$				0
Change in Securities	$-\Delta eh$	$+\Delta eh_e$	$+\Delta eh_c$	$+\Delta eh_k$					0
Change in Cash	$-\Delta hh$						$+\Delta hh$		0
Change in Advances					$+\Delta ad$		$-\Delta ad$		0
Change in Reserves					$-\Delta hbd$		$+\Delta hbd$		0
Change in Foreign Reserves					$-\Delta hf$			$+\Delta hf$	0

[a] Source: own elaboration.

3.1. *Non-financial firms*

Total Output (1) is composed by the sum of the output in the three productive sectors , namely consumption/widget (sector c), investment (sector k) and energy (sector e). The demand for sector c (2) depends upon households' consumption demand, plus the (endogenous) government expenditure on this sector. Notice that it is assumed that this is the only sector that imports (exports). The k sector receives the invoices of investment goods from the other two sector, plus the endogenous sectorial government expenditure (3). The e sector accommodates the demand of sector k, c, households and government (4). The first two consume energy based on the energy productivity (5), while for households' consumption is a fraction of total consumption (6). The microeconomic behavior of each industry with respect capital accumulation is quite straightforward: firms aim at a certain target capital stock based on their previous real demand (8). Depreciation allowances are a percentage of firms' capital stock and they are assumed to match amortization funds (9 and 10). Hence, investment demand covers both depreciation and the deviation of current capital stock from its target, while capital grows over time in accordance with 12. Profits are obtained as residual from firms receipts minus amortization funds, wages and interest on loans (14). The latter are demanded to cover that portion of investment not funded by internal funds (amortization+retained profits, 7) and/or the issuance of corporate securities offered to the public (18).

$$y = \ y_c + \ y_k + \ y_e \tag{1}$$

$$y_c = \ c + \ c_{g,c} + \ tb \tag{2}$$

$$y_k = \sum_{x=1}^{n} \ id_x + \ c_{g,k}, \forall x \in \{c, k, e\} \tag{3}$$

$$y_e = \ c_c + \ c_k + \ c_{g,e} + \ c_e \tag{4}$$

$$c_x = \frac{y_x}{pre}, \forall x \in \{c, k\} \tag{5}$$

$$c_e = \sigma_3 * (\ c_{-1}) \tag{6}$$

$$fdf = \sum_{x=1}^{n} \ fdf_x, \forall x \in \{c, k, e\} \tag{7}$$

$$kt_x = \kappa_x * \ y_x * \frac{ep}{p}, \forall x \in \{c, k, e\} \tag{8}$$

$$da_x = \delta * \ k_{x,-1}, \forall x \in \{c, k, e\} \tag{9}$$

$$af_x = \ da_x, \forall x \in \{c, k, e\} \tag{10}$$

$$id_x = \gamma_x * (\ kt_x - \ k_{x,-1}) + \ da_x, \forall x \in \{c, k, e\} \tag{11}$$

$$k_x = \ k_{x,-1} + \ id_x - \ da_x, \forall x \in \{c, k, e\} \tag{12}$$

$$ff_x = \ y_x - \ rl_{x,-1} * \ lf_{x,-1} - \ af_x - \ wb_x - \ c_x, \forall x \in \{c, k\} \tag{13}$$

$$ff_e = \ y_e - \ rl_e{-}1 * \ lf_e{-}1 - \ af_e - \ wb_e \tag{14}$$

$$fdf_x = \ (1 - theta_x) * \ ff_x, \forall x \in \{c, k, e\} \tag{15}$$

$$fuf_x = \ theta_x * \ ff_x, \forall x \in \{c, k, e\} \tag{16}$$

$$lf_x = \ lf_{x,-1} + \ id_x - \ af_x - \ fuf_x - \ (esr_x - esr_{x,-1}) * \ pe_x, \forall x \in \{c, k, e\} \tag{17}$$

$$esr_x = \ esr_{x,-1} + \ chi * \frac{id_{x,-1}}{pe_{x,-1}}, \forall x \in \{c, k, e\} \tag{18}$$

3.2. *Households*

Households' disposable income is made of wages both paid in the private and in the JG sector, plus distributed profits from firms and banks plus interest payments on deposit and transfers from the government (19). To these we should subtract the interest

payments on mortagages, taxes and public tariffs. Aggregate consumption depends upon real disposable income and wealth minus energy consumption (20). Notice that we decided to specify the propensity to consume from each asset hold in order to more realistically capture the decision to spend. Moreover, we endogenize the propensity to consume out of income by assuming that it behaves according to the policy and unemployment rate (22). Net wealth (23) is defined according to the Haig-Simmons standard (including capital gains on shares, 25), while gross wealth includes mortgages (24). The private wage bill goes entirely to disposable income (21), as the aggregate wage share includes also public jobs (26). Finally, mortgages' demand is a fraction of disposable income, weighted by their exogenous repayment rate (27).

$$\begin{aligned} yd = \ & wb + \ rm_{-1} * \ m2h_{-1} + \ rb_{-1} * \ bh_{-1} - \\ & (rep_{-1} + rlh_{-1}) * \ lh\_1 + \ fdf + \ fb + \ tr - \ tax + \ wbg - cgov \end{aligned} \tag{19}$$

$$c = \alpha_1 * \ yd * \frac{ep}{p} + \alpha_2 * \ hh_{-1} + \alpha_3 * \ m1h_{-1} + \alpha_4 * \ m2h_{-1} + \alpha_5 * \ bh_{-1} + \alpha_6 * \ eh_{-1} - c_e \tag{20}$$

$$wb = \sum_{x=1}^{n} \ wb_x, \forall x \in \{c, k, e\} \tag{21}$$

$$\alpha_1 = \alpha_{10} - \alpha_{11} * \ {r_{-1}}^{\star} - \alpha_{12} * un_{-1} \tag{22}$$

$$nvh = \ nvh_{-1} + \ yd + \ cg - \ c \tag{23}$$

$$vh = \ nvh + \ lh \tag{24}$$

$$cg = \sum_{x=1}^{n} \ esr_{x,-1} * \ (pe_x - pe_{x,-1}), \forall x \in \{c, k, e\} \tag{25}$$

$$\Omega = \frac{(wb + wbg)}{y} \tag{26}$$

$$lh = \ lh_{-1} * \ (1 - rep) + \phi * \ yd \tag{27}$$

3.3. *Commercial banks*

Banks accommodate the demand for credit, both from firms and households (29), as they accept cheque and saving deposits (30-31) from the latter. In addition, their balance sheets include bills, central bank's reserves (based on deposits' demand) and advances (33). Banks' profits are entirely redistributed to households (32). Notice that notional demand for bills should be distinguished from the actual one. If the former is strictly positive (34), then it is stored in form of treasury bills and extra reserves (35), otherwise banks will demand advances from the Central Bank (36).

$$lf = lf_c + lf_e + lf_k \tag{28}$$

$$ls = lf + lh \tag{29}$$

$$m1s = m1h \tag{30}$$

$$m2s = m2h \tag{31}$$

$$fb = \sum_{x=1}^{n} rl_{x,-1} * lf_{x,-1} + (rlh_{-1} + rep_{-1}) * lh_{-1} + rb_{-1} * bb_{-1} - rm_{-1} * m2s_{-1} - ra_{-1} * ad_{-1} + rh_{-1} * (hbd_{-1} + hbd_{-1}^{\star}), \forall x \in \{c, k, e\} \tag{32}$$

$$bb_{not} = m1s + m2s - ls - hbd \tag{33}$$

$$if(bb_{not} > 0)\ bb = bb_{not} * \beta\ else\ bb = 0 \tag{34}$$

$$if(bb_{not} > 0)\ hbd^{\star} = bb_{not} * (1 - \beta)\ else\ hbd^{\star} = 0 \tag{35}$$

$$if(bb_{not} > 0)\ ad = 0\ else\ ad = -bb_{not} \tag{36}$$

3.4. *Government*

Taxes are levied in accordance with different tax rates on labour, capital and property income (37). Government expenditure on the productive sectors (including energy, 39) is completely induced and *pro-cyclical* (based on the demand for each sector 40-41-42). Transfers are instead constituted by both an autonomous and induced, *counter-ciclical* component (based on the unemployment rate, 38). Beside these items, government deficit (43) includes interest payments on bills minus taxes and central bank profits. The latter is financed by new issuance of government bills (44).

$$tax = \tau_0 + \tau_1 * wb + \tau_2 * (rm_{-1} * m2h_{-1} + rb_{-1} * bh_{-1} + fdf + fb) + \tau_3 * vh_{-1} \quad (37)$$

$$tr = \tau_4 + \tau_5 * un_{-1} \quad (38)$$

$$gov = c_{g,c} + c_{g,k} + c_{g,e} \quad (39)$$

$$c_{g,k} = \sigma_1 * (y_{k,-1}) \quad (40)$$

$$c_{g,c} = \sigma_0 * (y_{c,-1}) \quad (41)$$

$$c_{g,e} = \sigma_2 * (y_{e,-1}) \quad (42)$$

$$def = gov + tr + rb_{-1} * bs_{-1} - tax - fcb + wbg - cgov \quad (43)$$

$$bs = bs_{-1} + def \quad (44)$$

3.5. *Portfolio decisions*

Households demand assets in accordance with Tobinesque principles, represented in the usual matrix form (50). Their portfolio comprise shares - which are supplied on demand by firms and are expressed in real terms (45-46-47-48-49) - government bills and cheque deposits. Notice that alongside the financial yields, disposable income is included as determinant to represent the transaction motive for money demand. Cash is demanded by households based on their expected consumption expenditures (51), while saving deposits act as a buffer (52).

$$esr = \sum_{x=1}^{n} esr_x, \forall x \in \{c, k, e\} \tag{45}$$

$$ehr = \sum_{x=1}^{n} ehr_x, \forall x \in \{c, k, e\} \tag{46}$$

$$ehr_x = \ esr_x, \forall x \in \{c, k, e\} \tag{47}$$

$$eh = \sum_{x=1}^{n} eh_x, \forall x \in \{c, k, e\} \tag{48}$$

$$eh_x = \ ehr_x * \ pe_x, \forall x \in \{c, k, e\} \tag{49}$$

$$\begin{bmatrix} bh \\ m1h \\ pe_c * ehr_c \\ pe_k * ehr_k \\ pe_e * ehr_e \end{bmatrix} = \begin{bmatrix} \lambda_{10} \\ \lambda_{20} \\ \lambda_{30} \\ \lambda_{40} \\ \lambda_{50} \end{bmatrix} * vh_{(-1)} + \begin{bmatrix} \lambda_{11} & \lambda_{12} & \lambda_{14} & \lambda_{15} & \lambda_{16} \\ \lambda_{21} & \lambda_{22} & \lambda_{24} & \lambda_{25} & \lambda_{26} \\ \lambda_{31} & \lambda_{32} & \lambda_{34} & \lambda_{35} & \lambda_{36} \\ \lambda_{41} & \lambda_{42} & \lambda_{44} & \lambda_{45} & \lambda_{46} \\ \lambda_{51} & \lambda_{52} & \lambda_{54} & \lambda_{55} & \lambda_{56} \end{bmatrix} * \begin{bmatrix} \mathrm{rb}_{(-1)} \\ \mathrm{rm}_{(-1)} \\ \mathrm{re}_{c,(-1)} \\ \mathrm{re}_{k,(-1)} \\ \mathrm{re}_{e,(-1)} \end{bmatrix} * vh_{(-1)} + \begin{bmatrix} \lambda_{13} \\ \lambda_{23} \\ \lambda_{33} \\ \lambda_{43} \\ \lambda_{53} \end{bmatrix} * \mathrm{yd}_{(-1)} \tag{50}$$

$$hh = \lambda_c * \ c * \frac{ep}{p} \tag{51}$$

$$m2h = \ vh - \ hh - \ m1h - \ bh - \ eh \tag{52}$$

3.6. *Central bank*

The Central Bank commits to purchase all the bills left unsubscribed, in accordance with its function as LLR (53). Cash matches the bills purchased by the monetary authority plus advances minus reserves (both standard and extra, 3.7-58-59). Advances (55) are supplied on demand by the Central Bank, whilst reserves depend on the legal requirements imposed to banks' deposits (57). Central Bank profits are entirely transferred to government (56).

$$bcb = \ bs - \ bh - \ bb \tag{53}$$

$$hs = \ bcb + \ as - \ (hbs + hbs^{\star}) + \ hf \tag{54}$$

$$as = \ ad \tag{55}$$

$$fcb = \ rb_{-1} * \ bcb_{-1} + \ ra_{-1} * \ as_{-1} - \ rh_{-1} * \ (hbs_{-1} + hbs_{-1}{}^{\star}) \tag{56}$$

$$hbd = \rho 1 * \ m1s_{-1} + \rho 2 * \ m2s_{-1} \tag{57}$$

$$hbs = \ hbd \tag{58}$$

$$hbs^{\star} = \ hbd^{\star} \tag{59}$$

3.7. *Quantitative easing*

When the monetary authority conducts OTM with the private sector, it targets a certain share of the existing stock of bills issued (60). We assumed that this share depends on an exogenous target minus the policy rate (61), as it increases when the economy reaches the zero lower bound. For the sake of simplicity we also assumed that the Central Bank purchases bills directly from the households, hence both equation (53-) for cash and bills demand need to be replaced with (--).

$$bcb = \ bs_{-1} * \ vareps \tag{60}$$

$$vareps = \ vareps_0 - \ vareps_1 * \ r^{\star} \tag{61}$$

$$hh = \ hh + \ bh - \ (bs - bb - bcb) \tag{62}$$

$$hs = \ hh \tag{63}$$

$$bh = \ bs - \ bb - \ bcb \tag{64}$$

3.8. *Interest rates*

The yields in the financial sector behaves in accordance with the policy rate set by the Central Bank plus an exogenous mark-up (66-67-68-69-70-71). The only endogenous mark-up is the one on bills (72), which adjusts to the share of bills purchased by the private sector (73). Yields on corporate securities depend on the ratio between dividends and shares held by the public (65).

$$re_x = \frac{fdf_x}{eh_{x,-1}} \ , \forall x \in \{c, k, e\} \tag{65}$$

$$rb = \ r^\star + \ mub \tag{66}$$

$$rl_x = r^\star + mul_x, \forall x \in \{c, k, e\} \tag{67}$$

$$rlh = \ r^\star + \ mulh \tag{68}$$

$$rm = \ r^\star + \ mum \tag{69}$$

$$ra = \ r^\star + \ mua \tag{70}$$

$$rh = \ r^\star + \ muh \tag{71}$$

$$mub = \ mub_0 - \ mub_1 * \ (bpr - \ bpr_{-1}) \tag{72}$$

$$bpr = \frac{(bh + \ bb)}{bs} \tag{73}$$

3.9. *Labour market*

Labour demand for each sector is simply defined as the ratio between the demand and the labour productivity minus tariffs (75). The workforce grows at an exogenous growth rate but it endogenously adjusts to labour demand in the private sector (76). Nominal wages (78-79-80) in each sector depends upon both real wages and the adjustment of the actual to the non-inflationary rate of unemployment, which is set to zero.

$$wb_x = w * nd_x, \forall x \in \{c, k, e\} \tag{74}$$

$$nd_x = \frac{(y_x - cgov)}{prf_x}, \forall x \in \{c, k, e\} \tag{75}$$

$$ns = ns_{-1} * (1 + gl) + nu * (nd_{-1} - ns_{-1}) \tag{76}$$

$$un = 1 - (\frac{nd}{ns}) \tag{77}$$

$$w_e = (1 - \omega_1 * (un_{-1} - nun)) * ep * \frac{w_{e,-1}}{p_{-1}} \tag{78}$$

$$w_c = (1 - \omega_2 * (un_{-1} - nun)) * ep * \frac{w_{c,-1}}{p_{-1}} \tag{79}$$

$$w_k = (1 - \omega_3 * (un_{-1} - nun)) * ep * \frac{w_{k,-1}}{p_{-1}} \tag{80}$$

$$w = \frac{(w_c + w_e + w_k)}{3} \tag{81}$$

$$prf = \frac{(prf_c + prf_e + prf_k)}{3} \tag{82}$$

3.10. *Prices and expectations*

Prices in the private sector are determined as a simple mark up over unit labour costs (83). The general level of prices (85) includes the costs of public goods and their production costs, given by the labour force in the JG sector (84, more on this in Section 4). Inflation expectations are assumed to be adaptive (87-87).

$$pf = (\frac{w}{prf}) * \ (1 + \ mup) \tag{83}$$

$$pg = \frac{cgov}{(prg * \ ng)} \tag{84}$$

$$p = \ pf * \ (1 - \ (\frac{cgov_{-1}}{y_{-1}})) + \ pg * \ (\frac{cgov_{-1}}{y_{-1}}) \tag{85}$$

$$\pi = (\frac{p}{p_{-1}}) - 1 \tag{86}$$

$$epi = epi_{-1} + \psi_1 + \psi_2 * (\pi_{-1} - epi_{-1}) \tag{87}$$

$$ep = \ p_{-1} * \ (1 + \ epi) \tag{88}$$

3.11. *Foreign sector and Redundant equation*

As mentioned early, exports (imports) appear only in the widget sector (89-89). They are defined in logarithmic form as a function of the nominal exchange rate, foreign (sector c) output and local prices. Foreign output grows at an exogenous growth rate, (91). The exchange rate is fixed and any commercial surplus (deficit) is matched by inflows (outflows) of foreign reserves (92-93). The model is closed by the redundant equation (94) that matches the demand and supply for cash by households.

$$ex = \xi_0 + \xi_1 * \ log(xr_{-1}) + \xi_2 \ * log(y_{f,-1}) + \xi_3 * \ log(p_{-1}) \tag{89}$$

$$im = \mu_0 + \mu_1 * log(xr_{-1}) + \mu_2 \ * log(y_{c,-1}) + \mu_3 * \ log(p_{-1}) \tag{90}$$

$$y_f = \ y_{f,-1} * \ (1 + g_f) \tag{91}$$

$$hf = \ hf_{-1} + \ tb \tag{92}$$

$$tb = ex - im \tag{93}$$

$$hh = hs \tag{94}$$

4. Features of the experiments

The shock to the model are performed by either adding or replacing some of the baseline equations outlined in the previous section. In this sense, several modifications to Godin (2013) and Sawyer and Passarella (2019) were introduced such as:

i. *a Job guarantee with an exogenous wage rate and complete absorption of unemployees*: this is a closer depiction of the scheme proposed by Minsky (1994) . As a matter of fact , in Sawyer and Passarella (2019) the BSE was constrained to a fraction of the unemployed workforce, as wages adjusted endogenously. In our simulation We assume instead that 1) ELR wages are a fraction of wages in the private sector; 2) ELR program target all unemployees. As observed above, the latter point is at variance with Nersisyan and Wray (2019), since both skilled and unskilled labour is targeted to cover all type of tasks of the GND - as proposed also by Colacchio and Forges Davanzati (2020).

ii. *a JG that improves the energy productivity alongside the reduction in energy demand*: Godin (2013) was mainly concerned with government and households expenditure in the energy sector (c_e and c_g). But in order to constrain energy consumption and prevent rebounding effect endogenously caused by growth in total output and to stimulate the other productive sectors to expand their output is necessary to intervene also on the energy productivity pre. Moreover, an increase in energy efficiency would be the main objective of GND-related public guaranteed jobs, as noted earlier. Yet, we discarded the possibility that an ELR scheme improves labour productivity prf, provided that the impact that may have such a scheme on an heterogeneous workforce is not clear.

iii. *the reduction in the parameters of energy consumption are driven by how many public resources are committed*: Godin (2013) simply assumed that parameters in c_e and c_g (σ_3 and σ_2) were reduced in accordance of the size of the JG. We assumed instead that this effort depends on how many monetary resources are committed. This also to provide a comparison with the scenario with a simple boost in government expenditure;

iv. *a scenario with government expenditure is introduced in order to provide a comparison either with the normal JG and with the green JG*: in both these cases, the reduction in critical parameters is driven by the size of this expenditure, which equals the (hypothetical) dimension of a JG wage bill. That is, is as if the government was to introduce transfers to all unemployees equals to the JG salary. This again to make the JG more closed as argued by Minsky (1994) ;

v. *endogenous government expenditure in the productive sectors is redistributed away from sector e and injected into sector k (scenario 6)*: A possible way out to a recessionary results obtained in case of the reduction of a dependent component of output (as in case of the expenditure in energy consumption of households

and government) is to compensate for the fall in the endogenous component of government expenditure that shrinks as a consequence of the reduction in the expenditure in sector e. By doing so, the redistribution of output away from the energy sector and towards the other components of output (consumption, widgets and investment) may took place without output losses.

Once the model[3] has been run through 100 periods to obtain a baseline (**Scenario 1**), the following scenarios are then performed:

- **Scenario 2**: Minsky-like JG;
- **Scenario 3**: Government transfers to unemployees;
- **Scenario 4**: Green JG (as Scenario 2 with Godin-like modified with endogenous energy productivity);
- **Scenario 5**: Government transfers to unemployees (as Scenario 3) with reduction in energy consumption similar to Scenario 4 ;
- **Scenario 6**: as Scenario 4 but with redistribution of government expenditure.

All the experiments have been introduced as shocks to the baseline model at time 60. The new equations of the model can be found at the end of the paper, as well as the parameters used in the simulation. As we did not meant to empirically validate our exercise, the exogenous values are either taken from the literature or adopting reasonable *rule of thumbs*. Nevertheless, we conducted some sensitivity analysis, whose results can be consulted in the appendix.

5. Results

The results from the simulation for selected variables (Aggregate and Sector e Output, Aggregate Consumption, Energy Consumption from both Households and Government, Aggregate and Sector e Investment, Unemployment, Employment, Prices, Nominal wages, wage share, trade balance, output growth, deficit/GDP and debt/GDP ratio) are presented in this section as the ratio with respect to their baseline. Since our model does not comprise a physical stock-flow matrix as in Georgescu-Roegen (1979), Berg et al. (2015) and Dafermos et al. (2018), Sector e output and its related variables will be used as proxies to measure energy efficiency. Reducing energy consumption does come with a cost for the economy, as it can be observed from figure 1. The difference with the "standard" (Scenario 2 and 3) and the "green" measures (Scenario 4 and 5) is that, in spite of the stimulus, total output tends to be lower than the baseline as a result of the endogenous reduction in the parameters of households and government energy consumption. This does not take place in Scenario 6, as total government spending has been redistributed instead of reduced, thereby maintaining a certain target expenditure on GDP. This is consistent with Godley and Cripps (1983), Carnevali et al. (2019) and in general the tradition of demand-led models. As expected, in figure 2 only the "true" green policies (Scenario 4, 5 and 6) manage to reduce at the same time sector e demand, government and households consumption. Although these last two variables are driven towards zero, output in sector e tends to converge to a lower yet positive steady state due to the reduction in energy costs and the subsequent (partial) rebound of the economy. This side-effect of the energy efficiency policies can be appreciated by the dynamic of aggregate consumption which

[3]the .R code to generate the simulations can be downloaded from the following repository: `https://github.com/Giutoya/JG_GND`

is boosted in all but one Scenarios (Scenario 4). Similar observations apply to both aggregate and sector e investment in figure 3. Looking at the behaviour of the labour market in all the experiments, the effect of the ELR scheme clearly emerges in contrast with a cash transfer approach. The unemployment (employment) rate in Scenario 4, 2 and 6 falls (increases) as the BSE is enacted. Although Scenario 3 display a similar tendency, its slope tends to diverge with respect the JG ones. Scenario 5 deserves a particular interest; as the government grants transfers to unemployed workforce, the employment (unemployment) rate immediately rises (shrinks) . However, this reverses in the subsequent periods as the energy-saving policies are progressively put in place, causing workers in sector e to be dismissed and aggregate unemployment to rise above (fall below) the baseline. Eventually, workers are reabsorbed into the private sector given to the rebound in the widget sector and the recovery in capital goods' firms. Given the assumptions we made for the labour market, the average nominal wage in the private sector do tend to steadily increase with the exception of the one in Scenario 5, driving the (long-run) rise in prices of the private goods (figure 4). The reader may point out that this inflationary (albeit mild) outcome contrasts with Minsky (1994), Mosler (1997) and Mitchell (1998) on the JG as the path to price stability. There are two explanations for this puzzle: first, although we postulate that wages in the JG act as a numeraire for the labour market, workers' nominal wages are a function of the unemployment rate as in Kriesler and Halevi (2016) and Levrero (2019) . Hence, cost-induced inflation may arise well before the supply constraints that triggers the demand-induced one. Second, ours is not a business cycle exercise, as we are simply interested in studying the properties - both during the traverse and at its steady state - of the model once a shock is performed. Therefore, depending on the nature of the latter, the new values for flows and stocks may permanently deviate from the original ones. Thus, one should not be surprised of the exhilarationist results in both the "brown" Scenarios (2 and 3), as involuntary employment is progressively eliminated either via the ELR or cash transfers. Nor one should be surprised by the stagnant trend in Scenario 5, due to the employment's losses in the private sector during the adjustment phase. The focus should go instead to Scenario 4 and 6, since it is not clear at first which tendency should prevail - the positive one caused by the BSE or the negative one caused by the unemployment in sector e. Given the premises of the model, our experiment denote that a JG scheme has a positive impact on the price levels of private goods in these two scenarios, whilst their slopes are not as steep as that of the Minsky-like Scenario. The increase in the wage share under all the alternative scenarios hints that government outlays are channeled almost entirely to consumption, as noted by Nersisyan and Wray (2019) . Moreover, they also denote a profit squeeze situation in 4, 5 and 6 as mark-ups are held constant, assigning to our simulation strong wage-led properties (Bhaduri and Marglin 1990). Output tends to grow in all the brown scenarios, as shown in Figure 5, while the sustainable ones present a decoupling condition with respect the growth rate of the labour force, which is pressured by a tight labour market. As expected, the trade balance deteriorates in all the exhilaration Scenarios, with the exception of Scenario 6, whereas in all the other cases either improves when total output is lower in the steady state. Finally, both the deficit and the debt to GDP ratio tend to be higher, although the former exhibits a logarithmic increase as the latter stabilizes at an higher steady state in 4, 5 and 6. Consequently, the interest rate burden (the share of interest payment over tax revenues) grows in all the scenarios with respect the baseline, although at different rates. Table 3 wraps-up the results for the main variables.

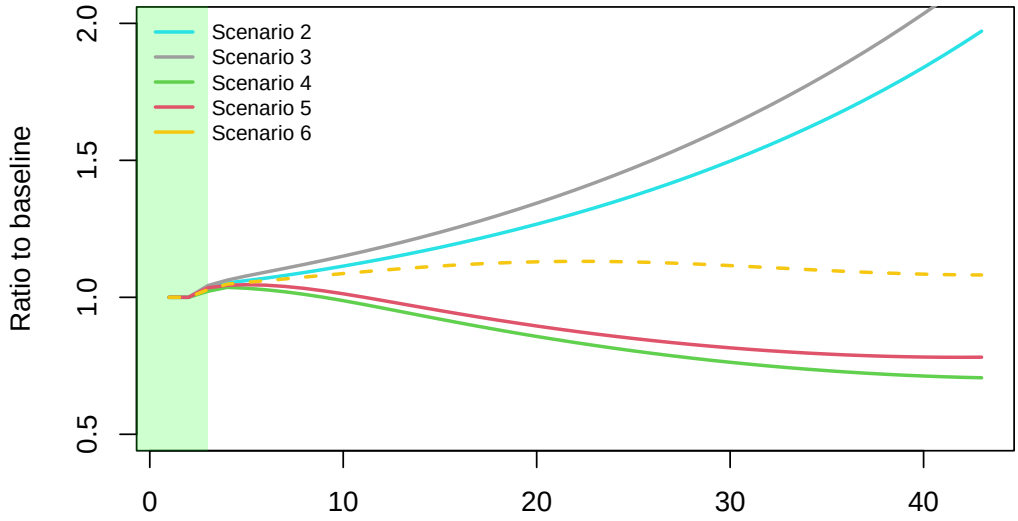

Figure 1. Output under alternative scenarios. Source: Own elaboration.

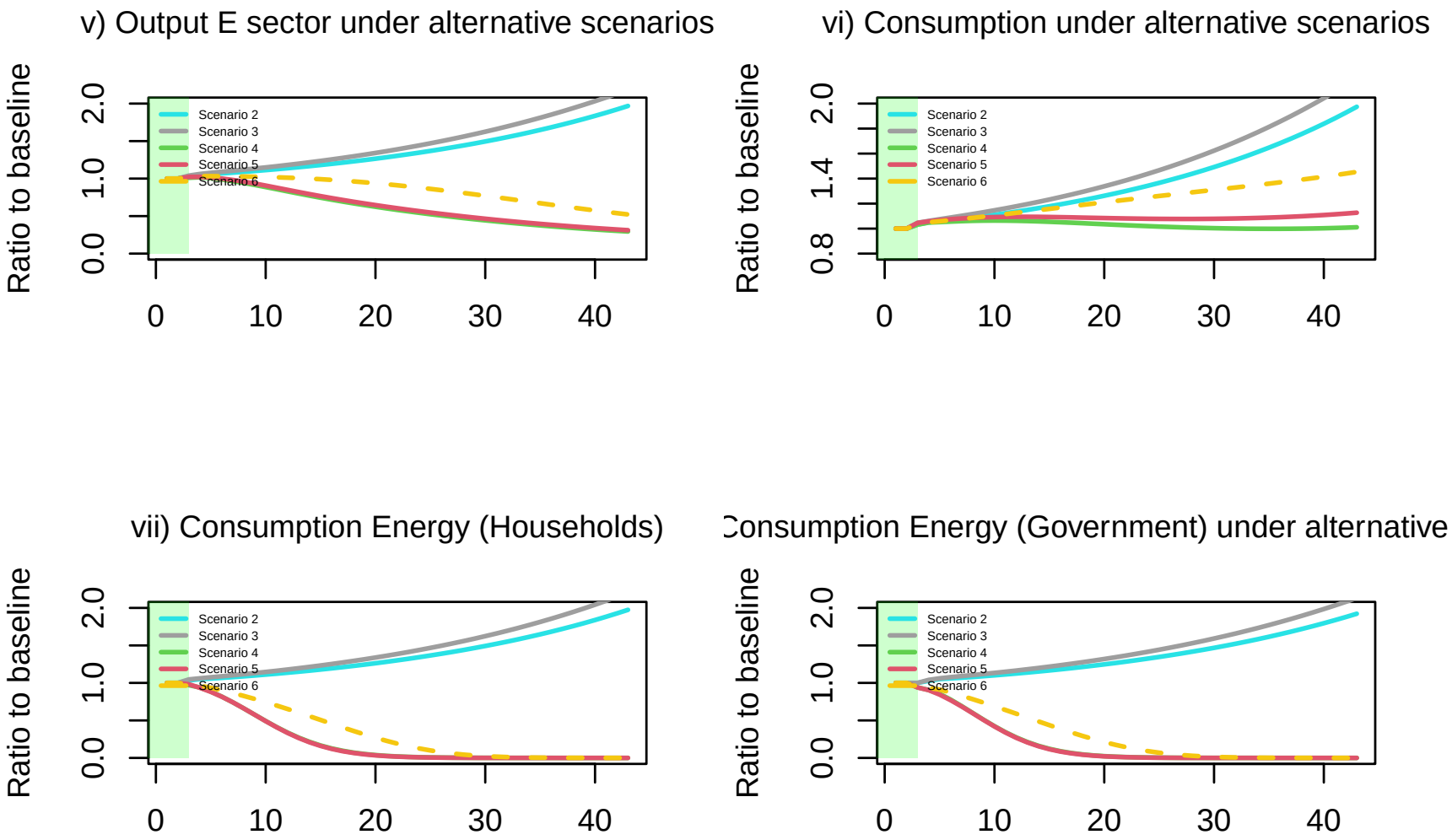

Figure 2. Selected Indicators. Source: Own elaboration.

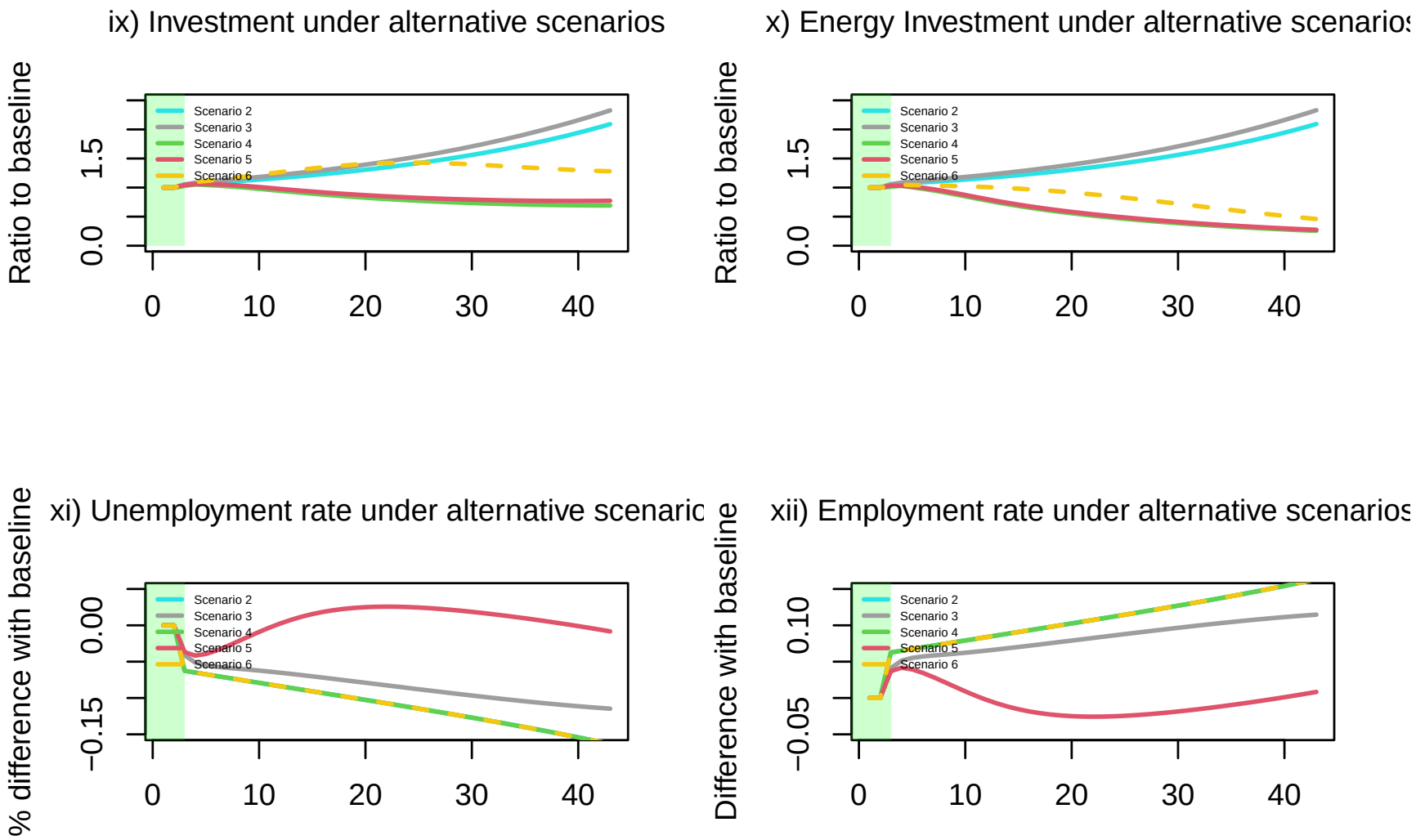

Figure 3. Selected Indicators. Source: Own elaboration.

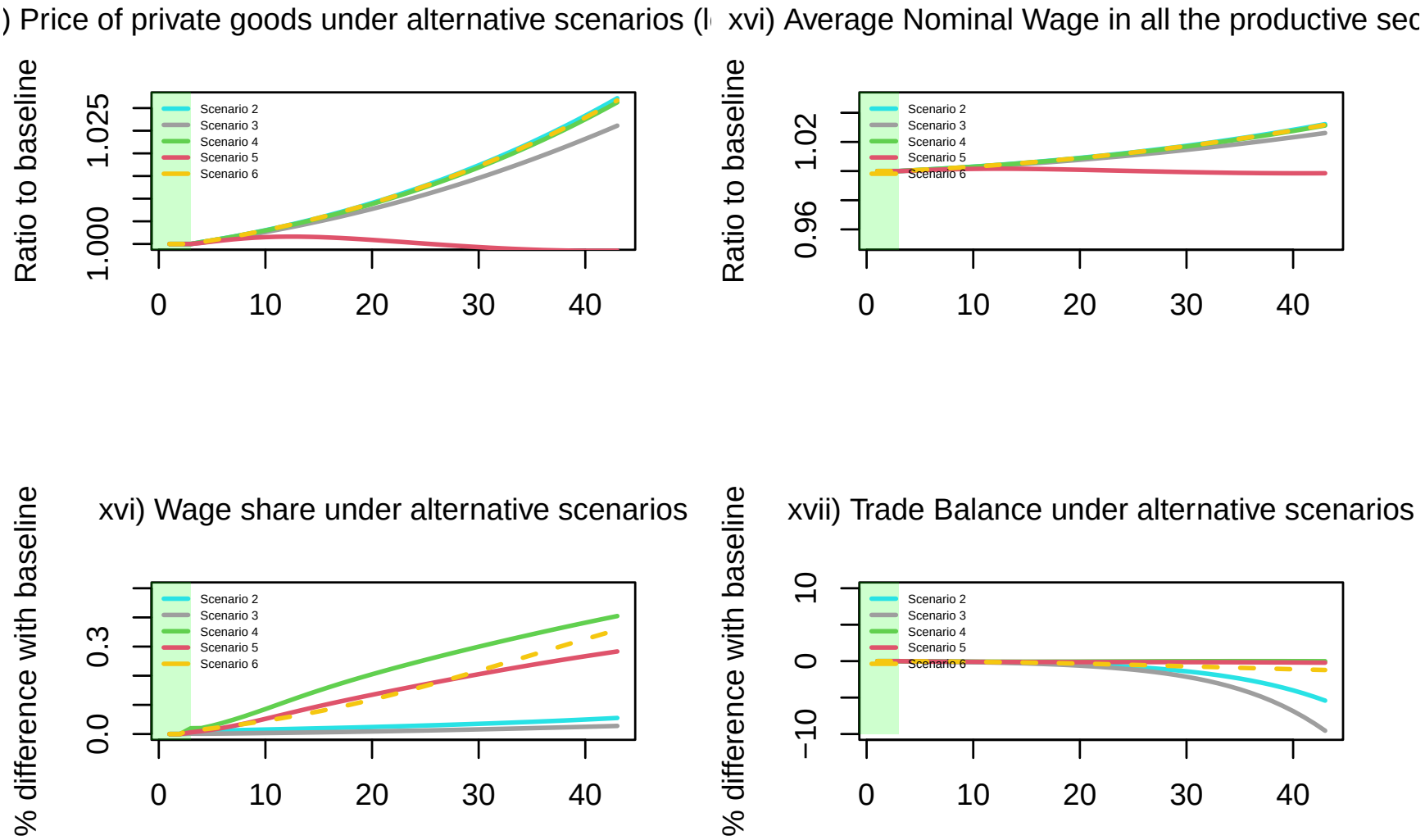

Figure 4. Selected Indicators. Source: Own elaboration.

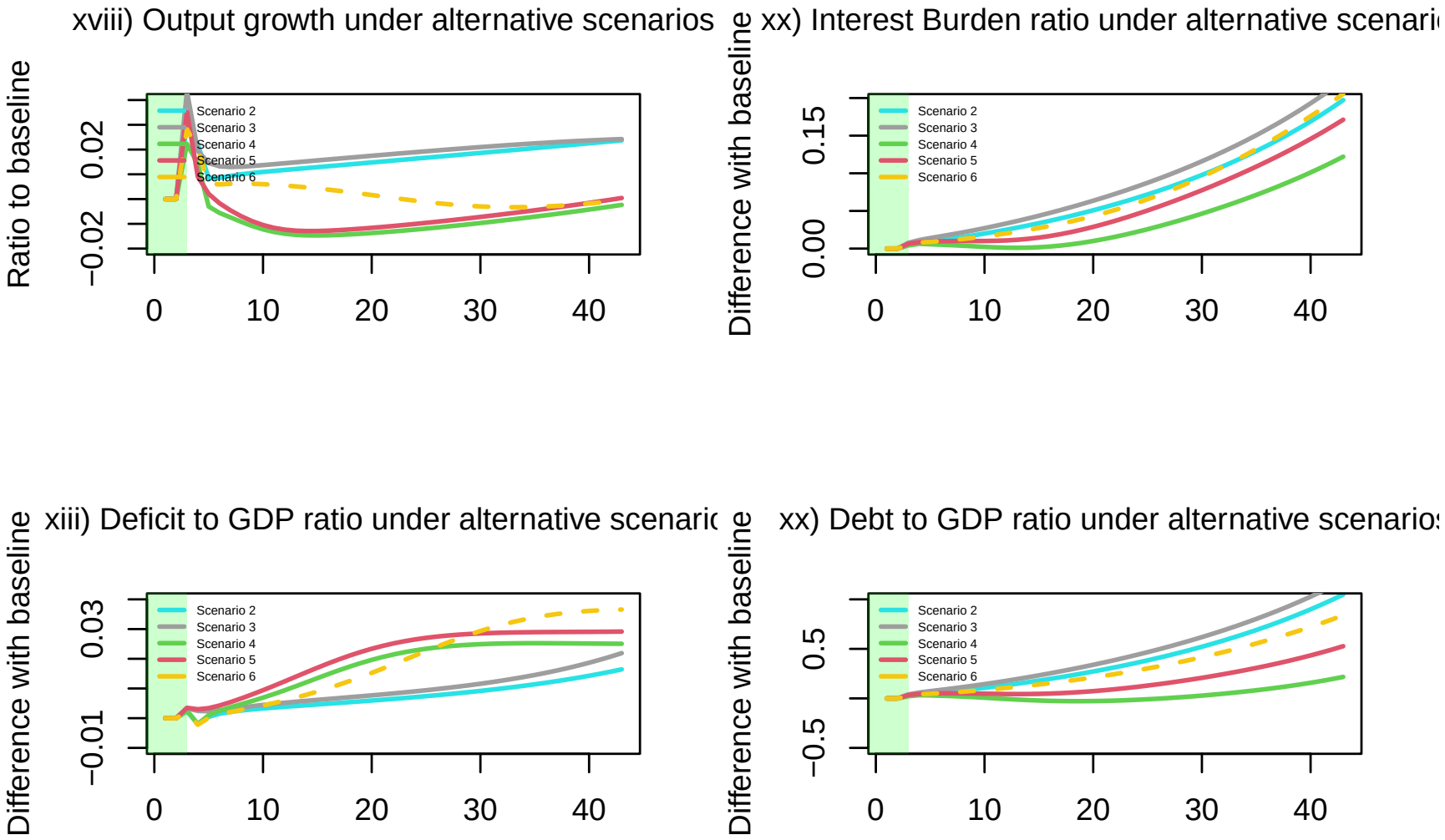

Figure 5. Selected Indicators. Source: Own elaboration.

Table 3. Wrap-up of the results (long-run)

	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Output	+	+	−	−	+
Output e	+	+	−	−	−
Investment	+	+	−	−	+
Wages	+	+	+	−	+
Unemployment	−	−	−	0	−
Deficit/GDP ratio	+	+	+	+	+
Debt/GDP Ratio	+	+	+	+	+
Trade Balance	−	−	0	0	−
Output Growth	+	+	0	0	0

[a] Source: own elaboration.

6. Conclusions

In this article we investigated the the policy package known as "Green New Deal", and in particular its proposal to tackle the problem of involuntary unemployment, namely the Employment of Last Resort scheme inspired by Minsky (1965; Minsky 1968; Minsky 1994) and MMT scholars (Mosler 1997; Wray et al. 1998; Wray 2015; Mitchell et al. 2019). After a brief outline of their core ideas, we highlighted some of the weaknesses in their analysis, with respect to both the standard and the green JG. Since an ambitious plan that aims at improving energy efficiency requires a rigorous estimation of all its components to avoid double counting, as acknowledged also by its proponents Nersisyan and Wray (2021) , we adopted the SFC methodology to implement the scenario analysis of the transition towards a carbon-neutral economy. SFC models have become increasingly popular in the heterodox community and have been crossing paths with both ecological economics to incorporate environment issues and the MMT-related research to test some of its assertions. In particular, for our model we drawn upon Godin (2013) and Sawyer and Passarella (2019) as we proposed a multi-sectorial stylized economy with a detailed description of both the financial sector and the monetary policy transmission mechanism. We then propose five combinations of policies designed to either reduce energy demand and/or reduce (alleviate) unemployment. The best policy mix to achieve full employment and environmental sustainability appears to be the one in Scenario 6 (Green JG+Public Expenditure in Capital Formation) as it raises aggregate output, investment and wages while reducing unemployment and total energy consumption without compromising too much the external balance. In turn, neither the pure "brown" (Scenario 2 and 3) nor the pure "green" (Scenario 4 and 5) policies manage to hit the two targets foreseen by the GND, as for the former the rebouding effect is not taken into account whilst for the latter the ELR penalizes too much the energy sector and the entire economy. In short, the green JG can't do the "job" alone, but it requires a expenditure in the productive sectors. The real advantage of the JG over cash transfers is that it prevents job losses when energy transition is undertaken. Finally, some observations are in order: first, the ELR scheme simulated in our exercise departs from the traditional BSE mechanism, since i) endogenous fluctuations are not inspected and ii) the scope of the tasks performed in this scheme goes beyond even the JG put forward by Nersisyan and Wray (2021) . In fact, the uncertainties about the short-term lenght of the program that we pointed out earlier are removed as the program takes on the bulk of the energy efficiency efforts instead of working on secondary projects. Can we still compare it one to one to Minsky (1965) original idea? Certainly not, as it resembles Colacchio and Forges Davanzati

(2020) proposal for the State as Innovator of First Resort when it comes to green the productive structure. Second, as reminded by Kalecki (1943), Epstein (2019) and Vernengo and Perez Caldentey (2020) while there are no real problem with financing the debt for a sovereign country, there are limits to how much a government can push up, politically speaking, public debt and in particular the interest rate burden. For a small open economy which needs to attract foreign capital, higher interest rate are a necessity even though they imply a redistribution towards financial rentiers. In other words, the deficit may not be an issue, but only for these wealthier individuals whereas other social groups may bear this higher burden via reduction in social expenditure, higher taxes and so on. Third, for the same reasons aforementioned, moving towards a carbon-neutral footprint may trigger even stronger resistance from the industries affected negatively by green policies. Any progressive, environmental-friendly coalition should not disregard that energy transition may turn out as a positive-sum game for the economy, as hinted by our model, but it is certainly a zero-sum gain politically speaking.

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References

Aspromourgos, T.
2000. Is an employer-of-last-resort policy sustainable? a review article. *Review of Political Economy*, 12(2):141–155.

Bank Of England, B.
2020. HM Treasury and Bank of England announce temporary extension to Ways and Means facility.

Barro, R. J., X. Sala-i Martin, O. J. Blanchard, and R. E. Hall
1991. Convergence across states and regions. *Brookings papers on economic activity*, Pp. 107–182.

Berg, M., B. Hartley, and O. Richters
2015. A stock-flow consistent input–output model with applications to energy price shocks, interest rates, and heat emissions. *New journal of physics*, 17(1):015011.

Bhaduri, A. and S. Marglin
1990. Unemployment and the real wage: the economic basis for contesting political ideologies. *Cambridge journal of Economics*, 14(4):375–393.

Carnevali, E. and M. Deleidi
2020. The trade-off between inflation and unemployment in an mmt world: An open economy perspective.

Carnevali, E., M. Deleidi, R. Pariboni, and M. V. Passarella
2019. Stock-flow consistent dynamic models: Features, limitations and developments. In *Frontiers of Heterodox Macroeconomics*, Pp. 223–276. Springer.

Carnevali, E., M. Deleidi, R. Pariboni, and M. Veronese Passarella
2020. Cross-border financial flows and global warming in a two-area ecological sfc model. *Socio-Economic Planning Sciences, forthcoming*.

Caverzasi, E. and A. Godin
2013. Stock-flow consistent modeling through the ages. *Levy Economics Institute of Bard College Working Paper*, (745).

Cimoli, M.
1988. Technological gaps and institutional asymmetries in a north-south model with a continuum of goods. *Metroeconomica*, 39(3):245–274.

Colacchio, G. and G. Forges Davanzati
2020. Modern money theory: A critical assessment and a proposal for the state as innovator of first resort. *Review of Political Economy*, 32(1):77–98.

Cucignatto, G.
2021. *Un'analisi input-output del Job Guarantee e della Strategia nazionale per l'idrogeno nell'economia italiana*. PhD thesis, Roma Tre University.

Dafermos, Y., M. Nikolaidi, and G. Galanis
2018. Climate change, financial stability and monetary policy. *Ecological Economics*, 152:219–234.

Deleidi, M., R. Pariboni, and M. V. Passarella
2019. Supermultiplier, innovation and the ecosystem: a stock-flow dynamic model. *Institute for Innovation and Public Purpose, UCL, Working Paper*, (2019-01).

Ehnts, D. H.
2014. A simple macroeconomic model of a currency union with endogenous money and saving-investment imbalances. *International Journal of Pluralism and Economics Education*, 5(3):279–297.

Ehnts, D. H.
2016. *Modern monetary theory and European macroeconomics*. Taylor & Francis.

Epstein, G. A.
2019. *What's Wrong with Modern Money Theory?: A Policy Critique*. Springer.

Fetherston, M. J.
1976. Technical Manual on the CEPG Model · CPES Online Archive. Technical report.

Fetherston, M. J.
1977. Technical Manual on the CEPG Model 2nd Edition · CPES Online Archive. Technical report.
Georgescu-Roegen, N.
1971. *The entropy law and the economic process*. Harvard university press.
Georgescu-Roegen, N.
1979. Energy analysis and economic valuation. *Southern Economic Journal*, Pp. 1023–1058.
Godin, A.
2013. Green jobs for full employment, a stock flow consistent analysis. In *Employment Guarantee Schemes*, Pp. 7–46. Springer.
Godin, A.
2014. Job guarantee: a structuralist perspective. *Revue de la regulation. Capitalisme, institutions, pouvoirs*, (16).
Godley, W.
1999. Seven unsustainable processes, special report. Technical report.
Godley, W. and F. Cripps
1983. *Macroeconomics, Fontana*. Oxford.
Godley, W. and M. Lavoie
2012. *Monetary Economics: An Integrated Approach to Credit, Money, Income, Production and Wealth*, 2 edition. Palgrave Macmillan UK.
Graziani, A.
2003. *The monetary theory of production*. Cambridge University Press.
Hannsgen, G.
2020. Mmt in equations and diagrams: An expositional framework. In *Eastern Economic Association meeting, February*.
Jackson, T. and P. A. Victor
2015. Does credit create a 'growth imperative'? a quasi-stationary economy with interest-bearing debt. *Ecological Economics*, 120:32–48.
Jevons, W. S.
1865. *The coal question: An inquiry concerning the progress of the nation, and the probable exhaustion of the coal-mines*. Macmillan.
Kalecki, M.
1943. Political aspects of full employment. *Political quarterly*, 14(4):322–331.
Kaltenbrunner, A.
2018. Financialised internationalisation and structural hierarchies: a mixed-method study of exchange rate determination in emerging economies. *Cambridge Journal of Economics*, 42(5):1315–1341.
Kaltenbrunner, A. and J. P. Painceira
2015. Developing countries' changing nature of financial integration and new forms of external vulnerability: the brazilian experience. *Cambridge Journal of Economics*, 39(5):1281–1306.
Keynes, J. M.
1930. *Treatise on money: Pure theory of money Vol. I*. Macmillan, London.
Keynes, J. M.
1978. *The Collected Writings of John Maynard Keynes*, volume 6 of *The Collected Writings of John Maynard Keynes*. Royal Economic Society.
Knapp, G. F.
1924. *The State Theory of Money*. McMaster University Archive for the History of Economic Thought.
Kriesler, P. and J. Halevi
2016. Political aspects of "buffer stock" employment. In *Post-Keynesian Essays from Down Under Volume II: Essays on Policy and Applied Economics*, Pp. 100–109. Springer.
Lavoie, M.
2013. The monetary and fiscal nexus of neo-chartalism: a friendly critique. *Journal of*

Economic Issues, 47(1):1–32.

Lerner, A. P.
1943. Functional finance and the federal debt. *Social research*, Pp. 38–51.

Lerner, A. P.
1947. Money as a creature of the state. *The American Economic Review*, 37(2):312–317.

Levrero, E. S.
2019. On the criticisms of and obstacles to the employer of last resort policy proposal. *International Journal of Political Economy*, 48(1):41–59.

Lucas, R.
1976. Macro-economic policy evaluation: a critique. *Journal of Monetary Economics (Supplementary Series)*, 1(2):19–46.

Malthus, T. R.
1872. *An Essay on the Principle of Population.*.

Minsky, H.
1965. The role of employment policy. hyman p minsky archive paper no. 270.

Minsky, H. P.
1968. Effects of shifts of aggregate demand upon income distribution. *American Journal of Agricultural Economics*, 50(2):328–339.

Minsky, H. P.
1994. Full employment and economic growth as objectives of economic policy: Some thoughts on the limits of capitalism.

Minsky, H. P.
2008. *Stabilizing an unstable economy*, volume 1. McGraw-Hill New York.

Mitchell, W., L. Wray, and M. Watts
2019. *Macroeconomics*. Macmillan Education UK.

Mitchell, W. F.
1998. The buffer stock employment model and the nairu: The path to full employment. *Journal of Economic Issues*, 32(2):547–555.

Monasterolo, I., A. Roventini, and T. J. Foxon
2019. Uncertainty of climate policies and implications for economics and finance: An evolutionary economics approach. *Ecological Economics*, 163:177–182.

Moore, B. J.
1988. The endogenous money supply. *Journal of Post Keynesian Economics*, 10(3):372–385.

Mosler, W.
1997. Full employment and price stability. *Journal of Post Keynesian Economics*, 20(2):167–182.

Naqvi, S. A. A.
2015. Modeling Growth, Distribution, and the Environment in a Stock-Flow Consistent Framework. Ecological Economic Papers 2, WU Vienna University of Economics and Business.

Nersisyan, Y. and L. R. Wray
2019. How to pay for the green new deal.

Nersisyan, Y. and L. R. Wray
2021. Can we afford the green new deal? *Journal of Post Keynesian Economics*, 44(1):68–88.

Nikiforos, M. and G. Zezza
2017. Stock-flow consistent macroeconomic models: a survey. *Journal of Economic Surveys*, 31(5):1204–1239.

Ocampo, J. A., C. Rada, and L. Taylor
2009. *Growth and Policy in Developing Countries: A Structuralist Approach*. Columbia University Press. Pages: 200 Pages.

Powell, J. H.
2020. Speech by Chair Powell on new economic challenges and the Fed's monetary policy review.

Prates, D.

2020. Beyond modern money theory: a post-keynesian approach to the currency hierarchy, monetary sovereignty, and policy space. *Review of Keynesian Economics*, 8(4):494–511.

Prebisch, R.

1949. *El desarrollo económico de la América Latina y algunos de sus principales problemas.* CEPAL. Journal Abbreviation: El desarrollo económico de la América Latina y algunos de sus principales problemas Last Modified: 2020-11-14T23:30-03:00.

Rochon, L.-P., M. Vernengo, L.-P. Rochon, and M. Vernengo

2003. State money and the real world: or chartalism and its discontents. *Journal of Post Keynesian Economics*, 26(1):57–67.

Sawyer, M.

2003. Employer of last resort: could it deliver full employment and price stability? *Journal of Economic Issues*, 37(4):881–907.

Sawyer, M. and M. V. Passarella

2019. Policy experiments in a minsky sfc model.

Seccareccia, M.

2004. What type of full employment? a critical evaluation of" government as the employer of last resort" policy proposal. *Investigacion Economica*, Pp. 15–43.

Sorrell, S. et al.

2007. The rebound effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency.

Vernengo, M. and E. Perez Caldentey

2020. Modern money theory (mmt) in the tropics: functional finance in developing countries. *Challenge*, 63(6):332–348.

Vivanco, D. F., R. Kemp, and E. van der Voet

2016. How to deal with the rebound effect? a policy-oriented approach. *Energy Policy*, 94:114–125.

Wray, L. R.

2004. *Credit and state theories of money: the contributions of A. Mitchell Innes.* Edward Elgar Publishing.

Wray, L. R.

2015. *Modern money theory: A primer on macroeconomics for sovereign monetary systems.* Springer.

Wray, L. R., F. Dantas, S. Fullwiler, P. R. Tcherneva, and S. A. Kelton

2018. Public service employment: A path to full employment.

Wray, L. R. et al.

1998. *Understanding modern money.* Edward Elgar Publishing.

Zezza, G. and F. Zezza

2019. On the Design of Empirical Stock-Flow-Consistent Models. Technical Report wp_919, Levy Economics Institute. Publication Title: Economics Working Paper Archive.

Appendix 1 – Parameters and initial values

Table 4.: Parameters and initial values

Variables and parameters of the economy	Symbols	Baseline
Energy productivity	pre	2
Dependent component of consumption spending on energy	σ_3	0.055
capital-output ratio of the sector x	κ_x	0.8
Depreciation rate	δ	0.1
Reaction speed of adjustment of capital to its target value sector c	γ_x	0.15
Mark-up: loans' interest rate sector x	mul_x	0.02
Profit retention rate sector x	$theta_x$	0.25
Target percentage of investment to be funded by share issues	chi	0.1
Mark-up: saving deposits' return rate	mum	0.25
Coefficient of bills' return rate	mub_0	0.25
Coefficient of bills' return rate	mub_1	0.25
Repayment rate on mortgages	rep	0.01
Mark-up: interest rate on mortgages	$mulh$	0.02
Autonomous component of propensity to consume	$\alpha_1 0$	0.75
Propensity to consume out of wealth: cash	α_2	0.15
Propensity to consume out of wealth: cheque deposits	α_3	0.1
Propensity to consume out of wealth: saving deposits	α_4	0.05
Propensity to consume out of wealth: bills	α_5	0.01
Propensity to consume out of wealth: shares and other firms' securities	α_6	0.01
Sensitivity of propensity to consume to interest rate	α_{11}	2
Sensitivity of propensity to consume to unemployment rate	α_{12}	0.05
Policy rate	$r_\star$	0.0145
Mortgages to disposable income ratio	ϕ	0.03
Mark-up: CB advances' return rate	mua	0.005
Mark-up: reserves' return rate	muh	0
Share of notional bills held as bills by banks	β	0.5
Autonomous component of tax revenue (shock)	τ_0	0
Tax rate on labour income	τ_1	0.2
Tax rate on capital income	τ_2	0.2
Tax revenue rate on wealth	τ_3	1/200
Other transfers	τ_4	2
Unemployment benefits (relative to unemployment rate)	τ_5	5
Dependent component of government spending	σ_1	0.1
Autonomous component of government spending	σ_0	0.1
Dependent component of government spending on energy	σ_2	0.1
Parameter in portfolio equation of bills	λ_{10}	0.1
Parameter in portfolio equation of bills	λ_{11}	0.2
Parameter in portfolio equation of bills	λ_{12}	-0.1
Parameter in portfolio equation of bills	λ_{13}	-0.1
Parameter in portfolio equation of bills	λ_{14}	0
Parameter in portfolio equation of bills	λ_{15}	0
Parameter in portfolio equation of bills	λ_{16}	0
Parameter in portfolio equation of cheque deposits	λ_{20}	0.4

Continued on next page

Table 4 – continued from previous page

Variables and parameters of the economy	Symbols	Baseline
Parameter in portfolio equation of cheque deposits	λ_{21}	-0.1
Parameter in portfolio equation of cheque deposits	λ_{22}	-0.1
Parameter in portfolio equation of cheque deposits	λ_{23}	0.2
Parameter in portfolio equation of cheque deposits	λ_{24}	0
Parameter in portfolio equation of cheque deposits	λ_{25}	0
Parameter in portfolio equation of cheque deposits	λ_{26}	0
Parameter in portfolio equation of c firms' securities	λ_{30}	0.033333333
Parameter in portfolio equation of c firms' securities	λ_{31}	0
Parameter in portfolio equation of c firms' securities	λ_{32}	0
Parameter in portfolio equation of c firms' securities	λ_{33}	0
Parameter in portfolio equation of c firms' securities	λ_{34}	0
Parameter in portfolio equation of c firms' securities	λ_{35}	0
Parameter in portfolio equation of c firms' securities	λ_{36}	0
Parameter in portfolio equation of k firms' securities	λ_{40}	0.033333333
Parameter in portfolio equation of k firms' securities	λ_{41}	0
Parameter in portfolio equation of k firms' securities	λ_{42}	0
Parameter in portfolio equation of k firms' securities	λ_{43}	0
Parameter in portfolio equation of k firms' securities	λ_{44}	0
Parameter in portfolio equation of k firms' securities	λ_{45}	0
Parameter in portfolio equation of k firms' securities	λ_{46}	0
Parameter in portfolio equation of e firms' securities	λ_{50}	0.033333333
Parameter in portfolio equation of e firms' securities	λ_{51}	0
Parameter in portfolio equation of e firms' securities	λ_{52}	0
Parameter in portfolio equation of e firms' securities	λ_{53}	0
Parameter in portfolio equation of e firms' securities	λ_{54}	0
Parameter in portfolio equation of e firms' securities	λ_{55}	0
Parameter in portfolio equation of e firms' securities	λ_{56}	0
Cash to consumption ratio	λ_c	0.18
Reserves to cheque deposits parameter	$\rho 1$	0.025
Reserves to saving deposits parameter	$\rho 2$	0.005
Autonomous component of target share of bills held by CB	$vareps_0$	1
Sensitivity of target share of bills to interest rate	$vareps_1$	0.1
Labour Productivity in sector e	prf_e	2
Labour Productivity in sector c	prf_c	0.5
Labour Productivity in sector k	prf_k	0.5
Structural rate of growth of labour force	gl	0.03
Speed of adjustment of labour supply to labour demand	nu	0.2
PC coefficient: speed of adjustment of un to nun sector e	ω_1	0.01
PC coefficient: speed of adjustment of un to nun sector c	ω_2	0.005
PC coefficient: speed of adjustment of un to nun sector k	ω_3	0.005
Mark-up over labour cost	mup	0.163
Labour productivity in government sector	prg	0.75
Coefficient of price expectations function	ψ_1	0
Coefficient of price expectations function	ψ_2	0.01
Parameter in export equation	ξ_0	-3.1
Parameter in export equation	ξ_1	0.01
Parameter in export equation	ξ_2	0.01

Continued on next page

Table 4 – continued from previous page

Variables and parameters of the economy	Symbols	Baseline
Parameter in export equation	ξ_3	0.01
Parameter in import equation	μ_0	-3.1
Parameter in import equation	μ_1	0.01
Parameter in import equation	μ_2	0.01
Parameter in import equation	μ_3	0.01
Foreign income growth	g_f	0.03
Government wage rate to private sector wage rate	ρ_g	0.3
Speed of adjustment of JG size to market conditions	γ_g	1
Parameter in the loss function of energy consumption	ζ	0.01

Appendix 2 – Equations of the Scenarios

Scenario 2

This is the scenario in which a simple Employment Guarantee scheme is implemented. Closely resembling Minsky (1965; Minsky 1968; Minsky 1994), the wage paid in this program is set below the current prevailing wage in the private sector, while workers that does not find a job in the private industry are hired in the JG workforce. Part of the scheme is assumed to be financed by tariffs levied on households.

$$nn = \ ns - \ nd \tag{95}$$

$$wg = \rho_g * w \tag{96}$$

$$ng = \ ng_{-1} + \gamma_g * \ (nn - ng_{-1}) \ , \gamma_g = 1 \tag{97}$$

$$wbg = \ wg * \ ng \tag{98}$$

$$cgov = \ min(alpha_g * \ c, \ wbg) \tag{99}$$

Scenario 3

Under this scenario, unemployment benefits are distributed to all workers that do not find a job in the private sector.

$$\tau_4 = nn * \ wg \tag{100}$$

$$\tau_5 = 0 \tag{101}$$

Scenario 4

In addition to the equation in Scenario 2, this experiment introduces the loss function for both households and governemnt energy expenditure and the gain function for energy productivity in the private sector. The intuition behind this choiche is that the Employment Guarantee scheme target energy efficiency, as it reduces the need of energy by both the private and the public sector.

$$\sigma_2 = \ (1 - wbg * \zeta) * \sigma_2 \tag{102}$$

$$\sigma_3 = \ (1 - wbg * \zeta) * \sigma_3 \tag{103}$$

$$pre = \ (1 + wbg * \zeta) * pre \tag{104}$$

Scenario 5

$$\sigma_2 = \ (1 - \tau_4 * \zeta) * \sigma_2 \tag{105}$$

$$\sigma_3 = \ (1 - \tau_4 * \zeta) * \sigma_3 \tag{106}$$

$$pre = \ (1 + \tau_4 * \zeta) * pre \tag{107}$$

Scenario 6

In this scenario, government expenditure in the k sector depends also upon the endogenous shift of expenditure from the e sector.

$$c_g k = \sigma_1 * (y_{k,-1}) + (0.1 - \sigma_2) * (y_{e,-1}) \tag{108}$$