
III ENEI
Encontro Nacional de
Economia Industrial e Inovação

Indústria e Desenvolvimento Econômico: desafios e perspectivas
18 a 20 de setembro de 2018
Uberlândia – Minas Gerais

Industrial unemployment, supply-side policies and the perverse interaction of flexibility and austerity

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Abstract

In this work we develop a set of policy experiments upon the well-known "Schumpeter meeting Keynes" agent-based model. The labour market is declined under two institutional industrial-relations variants, the "Fordist" and the "Competitive" set-ups meant to capture the historical transition from the Fordist toward the post "Thatcher-Reagan" period. Inside these two regimes we study the different effects of supply-side active labour market policies (ALMPs) vs. demand-management passive labour market ones (PLMPs). In particular, we analyse the effects of supply-side labour market policies aimed at i) promoting job search, and ii) providing training to unemployment people. Next, we compare the effects of those policies vs. unemployment benefits aimed at sustaining income and therefore aggregate demand. Our results show that (i) an appropriate level of skills is not enough when workers face adverse labour demand, (ii) supply-side policies are not able to reverse the perverse interaction between flexibility and austerity, and (iii) demand-management policies are better suited to mitigate inequality and to improve and sustain long-run growth.

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Resumo

Neste trabalho, desenvolvemos um conjunto de experimentos sobre políticas públicas utilizando o conhecido modelo baseado em agentes “Schumpeter meeting Keynes”. O mercado de trabalho é analisado sob duas variantes instituicionais de relações industriais, ”fordista” e ”competitiva”. Com isso se busca capturar a transição histórica do fordismo para o período pós-fordista. Dentro desses dois regimes, estudamos os diferentes efeitos das políticas públicas ativas versus passivas para o mercado de trabalho. Em particular, analisamos os efeitos de políticas para o lado da oferta que visam i) promover a procura de emprego e ii) capacitar os desempregados. Em seguida, comparamos os efeitos dessas políticas com a política tradicional de seguro-desemprego, que visa sustentar a renda e, portanto, a demanda agregada. Nossos resultados mostram que (i) um nível aprimorado de habilidades não é suficiente quando os trabalhadores enfrentam demanda de trabalho adversa, (ii) políticas do lado da oferta não são capazes de reverter a interação perversa entre flexibilidade e austeridade e (iii) políticas de gerenciamento de demanda são mais adequadas para mitigar a desigualdade e para melhorar e sustentar o crescimento de longo prazo.

Palavras-chave

Políticas públicas no mercado de trabalho, regimes de relações industriais, flexibilidade, austeridade, modelo baseado em agentes

Códigos JEL

C63, E02, E24

Área ABEIN

6.1

1 Introduction

In the wake of the most severe economic crisis after the Great Recession, a resurgent attention has been devoted to promote Active Labour Market Policies (ALMPs) as a measure apt to deal with structural industrial unemployment. The argument goes back to the late seventies: ALMPs, it has been suggested, are supposed by economists as a potential way to lubricate sclerotic labour markets reducing frictional unemployment (see from Baily and Tobin, 1977 all the way to OECD, 2013). ALMPs include (i) assistance in the job-search activity with the aim of enhancing the matching process in the labour market, and (ii) training programs with the aim of supporting the process of skills development of unemployed people.[1] Conversely, passive, demand-management labour market policies (PLMPs), usually including unemployment insurance and welfare benefits, are defined as "passive" because they do not require any activation mechanism in order to be granted to the beneficiaries.

Conditional on the different regimes of governance of labour relations, how the two sets of policy measures fare in terms of macroeconomic performance? In the following we shall address this question within an agent-based model (ABM) framework. More specifically, we develop a set of labour market and fiscal policy experiments upon the labour- and credit- augmented "Schumpeter meeting Keynes" model (K+S). In the proposed experiments, the labour market is declined under two broad institutional variants, the *Fordist* and the *Competitive* regimes (further details below).

Inside the two variants of labour market regimes we want to compare the different effects of ALMPs (supply-side) vs. PLMPs (demand-side) on macroeconomic dynamics. In particular we shall analyse the effects of active labour market policy experiments directed at promote job search and provide training to unemployed people under the two regimes. Next, we compare the effects of the ALMPs policies with the PLMPs ones, namely unemployment benefits aimed at sustaining aggregate demand. Finally, we test such labour market policies in different fiscal scenarios and in particular their interaction with austerity policies.

The contribution of this work is twofold. From the modelling perspective, we interact a decentralized labour market – declined under two institutional variants – with a credit market allowing for the coupling of real and financial dynamics. From the policy perspective, we study the interaction between labour market and fiscal policies. Our results reject the combination of flexible labour markets and austerity policies as a reasonable way-out from deep crises. First, they suggest that an appropriate level of skills is insufficient when workers face adverse labour market demand. Second, supply-side policies does not seem to be able to reverse the negative interaction between flexibility and austerity. Third, demand-management policies may be better suited to mitigate income inequality and to improve and sustain long-run growth.

The paper is organized as follows. Section 2 briefly discusses the empirical evidence and compares it to the prevailing policy discourse. Section 3 presents the model. The policy experiments on the labour market are discussed in Section 4. Section 5 performs the fiscal policy exercises. Section 6 concludes.

[1] There is a third type of ALMPs, namely public sectors job opportunities or alternatively, subsidized job opportunities in the private sectors. Nonetheless, the third type of policy schemes look less coherent with the definition of ALMPs provided by the OECD, whereby a key role is played by the stimulus for unemployed people to participate in some form of training and job search programs.

2 The empirical evidence and the policy discourse

Let us start with the empirical evidence on the effectiveness of ALMPs. The micro-econometric evidence is indeed rather controversial. A recent meta-research study by Card et al., 2015, extending the previous Card et al., 2010, from 97 to 207 research papers of which one fifth relies on randomized controlled experiments, concludes that the effects of ALMPs are very heterogeneous and vary according to (i) the time horizon of the program evaluation, indicating that the effects of the policies are higher after 2-3 years from the completion of the program, (ii) the pool of participants, where the effects are higher for long term unemployed workers and female, moreover (iii) they tend to be counter cyclical and more effective in recessionary periods. In general, the average effect of ALMPs on employment probability is rather weak, with an average effect of 2%, 5% and 10% for short, medium and long term programs, respectively. Finally, with reference to the type of ALMPs, while job-search assistance programs seem more cost-efficient, training programs result being more effective in increasing the employability opportunities, particularly when evaluated in the long term.

When moving from micro-econometric to macro-econometric, cross-country studies the picture looks more homogeneous, corroborating the positive effects of ALMPs in reducing unemployment and long term unemployment spells. However, most of these cross-country studies seem to suffer from endogeneity problems, as policies responses are not independent from the labour market conditions. Moreover, when looking at country-level case studies on activation policies conducted by the OECD, remarkable differences emerge in the degree of effectiveness according to (i) the amount of resources devoted to realize the policy interventions (share of the GDP), (ii) the way in which the schemes are implemented (e.g., how the agencies in charge are designed), (iii) the monitoring effort, (iv) the eligibility conditions, and (v) the activation regimes (Martin, 2015).

Still, what remains as open questions is (i) to which extent societies can rely on ALMPs during phases of severe downturns, and (ii) how labour markets characterized by structurally-weak labour demand (e.g., the Mediterranean countries) can benefit from policies aimed at reducing market mismatch or at encouraging labour participation and search intensity. Those issues are addressed by some empirical studies, as in Caroleo et al. (2001), which document how participation in training programs do not increase the employability opportunities of young workers but only the probability to participate in another training program – the "training trap". This phenomenon has been documented in Southern European regions where the lack of labour demand might hardly be solved by training programs. As it seems, the existing micro-econometric studies are not able to capture the macroeconomic effects of the policy schemes, nor they are able to disentangle the influence of the specific institutional features characterizing the labour market, which are indeed a key element when evaluating the fate of the policy schemes (Larsen, 2004).

Together with the spurring of ALMPs, there was a broader package of reforms advocated by the *OECD Jobs Study* (OECD, 1994) to render labour market more respondent to supply and demand conditions. Two types of flexibility were suggested, namely numerical, i.e., reducing firing restrictions for firms, and in wage terms, i.e., making the wage-adjustment process more in line with the labour market conditions. The ensuing policy recommendation was to reduce

worker bargaining power, unions coverage and institutional support like unemployment benefits and an effective minimum wage. We discuss the evidence on the (often negative) effects of such measures in Dosi et al. (2017c).

The "packaging" of ALMPs with reforms to increase the labour market flexibility has been frequent in the recent policy discourse, especially in Europe after the sovereign debt crises, (re) introduced by the axiomatic *expansionary austerity* hypothesis. This term has been coined by Alesina and Ardagna (2010) but the notion dates back at least to the intellectual supporters of the disastrous policies of Hoover, in the US, and Bruning, in Germany, during the 1930's. According to this view, fiscal adjustment on the spending side promotes permanent stabilization, has lower costs in terms of output loss, and stabilizes consumer expectations in terms of future tax hikes. Overall, expansionary austerity has turned out to be a huge hoax: evidence in a positive relationship between public debt reduction and GDP growth is basically non-existent. On the contrary, recent contributions emphasize the role of *private* debt in triggering historically-deep financial crises. Jordà et al. (2016) find evidence that public debt is not harmful per se in normal times, but also that a high level of public indebtedness might just reduce the fiscal ability to counteract financial crises, due to private debt overhang. Thus, debt level is relevant just *after* financial crises occur, therefore impinging "drag" on the *recovery* path, rather than triggering the recessions.

Notwithstanding the lack of any empirical support, the European policy stance (and recently even the Brazilian one) has embraced such a discourse with an ensembles of policy measures widening and deepening the Maastricht Treaty, namely the European Stability and Growth Pact (1997) and the subsequent Fiscal Compact (2012). The Mediterranean countries have been the hardest hit by such policy package. However, the policy experiment did not work well also for the European Union as a whole, with many indicators still below the pre-crisis period. On top of that, a diverging trend between Northern and Southern countries has dramatically emerged. We discuss the self-defeating impact of those policies in Dosi et al. (2016a). Accordingly, the the current work bring together those two strands of what we could call the "Berlin-Chicago Consensus", and analyse, first, the relative impact of ALMPs under different labour market regimes, and, second, the complementary effect of Fiscal Compact-type rules.

A close related empirical question is what are the labour market effects of credit availability and the impact of a credit crunch. Recent studies have linked the relation between the changing lending conditions and the flows in the labour market. In particular, since the paper by Bernanke (1983), the transmission channels between credit and the real economy dynamics have been put under the lens of the discipline. This attention has remarkably spurred after the burst of the recent financial crisis. Two main transmission channels have been emphasized. First, the one propagating via households indebtedness, which goes from housing prices burst, stressed household balance sheets, reduced consumption of non tradable goods and houses, with the ensuing employment losses largely affecting non-tradable, construction and manufacturing sectors in highly leveraged economies (Mian and Sufi, 2012; Charles et al., 2016). Second, the channel originating from firms indebtedness, going through the deteriorating effect of bad lending practices toward the balance sheets of firms, particularly small and medium ones, which once become financially constrained, incur in massive lay-offs (Chodorow-Reich, 2014).

To explain the slow recovery path registered in the Western economies, both in output and

employment, one shall evaluate not only the cyclical components attributable to the crises, as the debt overhang, but also the role played by the *structural* elements. In particular, factors like the slack in the productivity path, the declining labour force participation rate (Fernald et al., 2017), the reduced firms entry rate, and the slow down in capital accumulation (Siemer, 2014), which are pre-crisis phenomena that have emerged before the 2008 burst of the housing prices. Indeed, the two-way interaction between cyclical and long-term phenomena is one of the major challenges to the analysis of the macroeconomic dynamics. That, of course, involves the (possibly endemic) presence of hysteresis in the labour market, a documented finding during the Great Recession (Yagan, 2017; Jaimovich and Siu, 2012). However, the hysteresis effect plausibly extend to all macro phenomena involving some form of dynamic increasing returns or coordination externalities, as we discuss in Dosi et al. (2018).

3 The model

We build a general *disequilibrium*, stock-and-flow consistent, agent-based model, populated by heterogeneous workers, firms and banks which behave according to bounded-rational rules. More specifically, we extend the well-known "Schumpeter meeting Keynes" (K+S) model (Dosi et al., 2010, 2015, 2016b, 2017c), further adding endogenous processes affecting of workers' skills dynamics. This set up allows the in-depth analysis of the firm performances and the ensuing labour market conditions.

The three-sector economy in the model is composed of four populations of heterogeneous agents, L^S consumers/workers, F_t^1 capital-good firms, F_t^2 consumption-good firms, B banks, plus the Government and the Central Bank.[2] The basic structure of the model is depicted in Figure 1. Capital-good firms invest in R&D and produce heterogeneous machine-tools whose productivity stochastically evolves over time. Consumption-good firms combine machines bought from capital-good firms and labour in order to produce products for consumers. There is a banking sector represented by a fixed number of banks that take deposits and provide loans to firms to finance production and investment plans. Workers submit job applications to a (small) random subset of firms. Firms hire according to their individual adaptive demand expectations. The Government levies taxes on firms and banks profits, pays unemployment benefits, provide training for unemployed and imposes a minimum wage, according to the policy setting, absorbing excess profits and losses from the Central Bank and keeping a relatively stable debt in the long run.

In the following, we first summarize the functioning of the capital-good, consumption-good and banking sectors of our economy, and then present the labour market dynamics, detailing the skills accumulation and deterioration mechanisms and the policy experiments configuration. For details on the other parts of the model, which we did not change, please see Dosi et al. (2010), Dosi et al. (2015) and Dosi et al. (2017c).

[2]The subscript t stands for time, agent specific variables are denoted by a subscript ℓ in case of workers, i, for capital-good firms, j, for consumption-good firms, or k for banks.

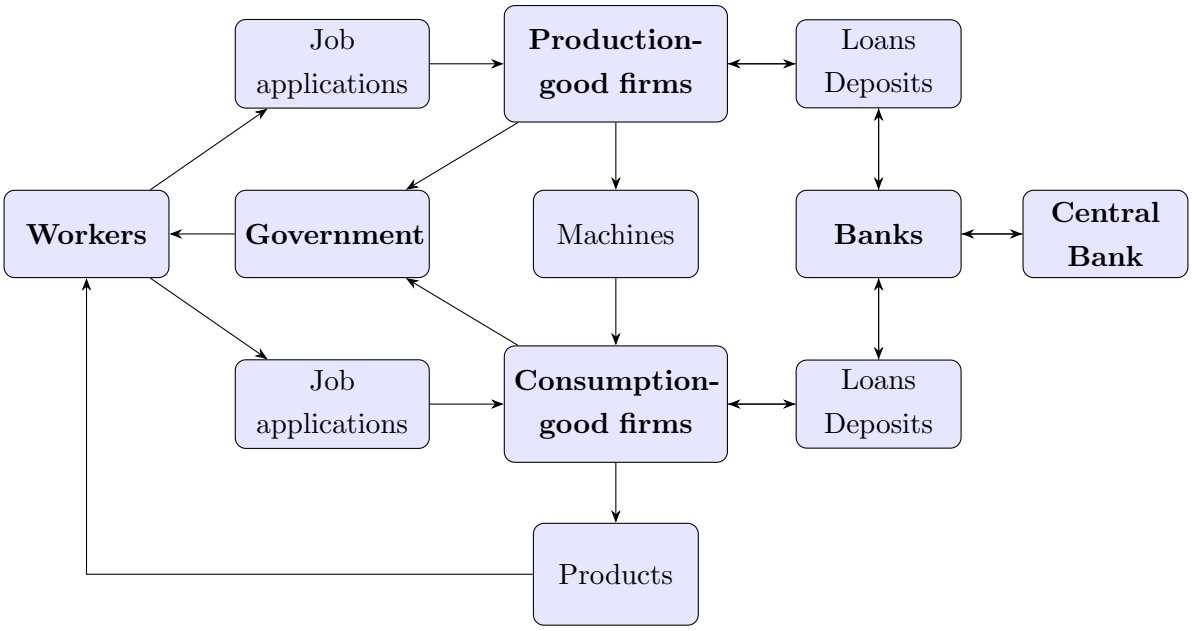


Figure 1: The model overall structure. Boxes in bold style represent the model's agents.

3.1 The capital- and consumption-good sectors

The two industrial sectors in the model follow the structure created by Dosi et al. (2010).The capital-good industry is the locus where innovation is endogenously generated in the model. Capital-good firms develop new machine-embodied techniques or imitate the ones of their competitors in order to produce and sell more productive and cheaper machinery. On demand, they supply machine-tools to consumption-good firms, producing with labour as the only input. Firms have access to bank loans to cover liquidity problems up to a limit. The capital-good market is characterized by imperfect information and Schumpeterian competition driven by technological innovation. Machine-tool firms signal the price and productivity of their machines to the current customers as well to a subset of potential new ones, and invest a fraction of past revenues in R&D aimed at searching for new machines or copy existing ones. Prices are set using a fixed mark-up over (labour) costs of production.

Consumption-good firms produce a quality-differentiated single good employing capital (composed by different "vintages" of machine-tools) and labour under constant returns to scale. Desired production is determined according to adaptive (myopic) demand expectations. Given the actual inventories, if the current capital stock is not sufficient to produce the desired output, firms order new machines to expand their installed capacity, paying in advance – drawing on their retained past profits or, up to some limit, on bank loans. Moreover, they replace old machines according to a payback-period rule. As new machines embed state-of-the-art technologies, the labour productivity of consumption-good firms increases over time according to the mix of vintages of machines in their capital stocks. Consumption-good firms choose in every period their capital-good supplier comparing the price and the productivity of the machines they are aware of. Firms then fix their prices applying a variable mark-up rule on their production costs, trying to balance profit margins and market shares. More specifically, firms increase their mark-up and price whenever their market share is expanding and vice versa. Imperfect information is also the

normal state of the consumption-good market so consumers do not instantaneously switch to the most competitive producer. Market shares evolve according to a (quasi) replicator dynamics: more competitive firms expand, while firms with relatively lower competitiveness levels shrink, or exit the market.

The process of entry-exit is entirely endogenous in both sectors. Firms leave the market whenever their market shares get close to zero or their net assets turn negative (bankruptcy). Conversely, the number of entrants stochastically depends on the number of incumbents and on the prevailing financial conditions. When the sectoral liquidity-to-debt ratio is shrinking new firms are more inclined to enter, and vice versa.

3.2 The banking sector and monetary policy

The structure of the credit market closely follows the one presented in Dosi et al. (2015). The B banks collect deposits from firms and evaluate the provision of loans on request. Firms in both sectors hold a fixed relationship with a (randomly chosen) single bank. The supply of credit is bounded by each bank's capital and Basilea-like regulatory capital adequacy constraints. The available credit allocation is allocated by each bank according to a pecking order where demanding clients are ranked by the liquidity-to-sales ratio. Credit rationed firms are not be able to accomplish their investment plans.

The Central Bank may fix the prime interest rate (r_t) using a mono or a dual mandate Taylor rule, according to the policy set up. All banks' deposits are hold by the central bank as compulsory reserves. There is an interest rate structure according to which there is corridor binding the interest rate fixed by the central bank with the interest rate on deposits r_D being the lower bound and the interest rate on loans (r_t^{deb}), the upper bound: $r_D \leq r_t^{res} \leq r_t \leq r_t^{deb}$. The interest rate on reserves (r_t^{res}) and loans are defined according to a mark-down and a mark-up rule, respectively, on the prime interest rate fixed. Central bank bail-outs the banking system when total net worth is negative.

3.3 The labour market and skills dynamics

The labour market in the model implements a fully-decentralized search and hiring process between workers and firms (more in Dosi et al., 2016b, 2017c). The aggregate supply of labour L^S is fixed and all workers are available to be hired in any period. When unemployed, workers submit a certain number of job applications to firms. Employed workers may apply or not for better positions, according to the institutional set up. Larger firms, in terms of market share, have a proportionally higher probability of receiving job applications, which are organized in separated, firm-specific application queues. The labour market is characterized by imperfect information as firms only observe workers skills and wage requests and workers are aware only of the wage offers they may receive.

Firms decide about their individual labour demand based on the received orders (capital-good sector), the expected demand (consumption-good sector), and the expected labour productivity levels. Considering the number and the productivity of the already employed workers, firms decide to (i) hire new workers, (ii) fire part of the existing ones, or (iii) keep the existing labour force. Each hiring firm defines a unique wage offer for the applicant workers, based on its internal

conditions and the received applications. Workers select the best offer they get from the firms to which they submitted applications, if any. If already employed, depending on the institutional regime, they quit the current job if a better wage offer is received. There is no second round of bargaining between workers and firms in the same period and, so, firms have no guarantee of fulfilling all the open positions – and no market clearing either. Moreover, there are no firing or hiring transaction costs.

3.4 Policy experiments

In the foregoing we describe the policy experiments we undertake in order to study the different effects of ALMPs vs. PLMPs. The two supply-side policy schemes we implement in the K+S model are: (**ALMP 1**) support in the worker job-search activity with the aim of reducing mismatches in the labour market, and (**ALMP 2**) training program targeting the improvement of the skills of unemployed people.[3]

3.4.1 ALMP 1: reducing mismatches and enhancing job search

To understand the effect of the support in the job search activity, we study the model results when different degrees of imperfect information is applied to the workers job application process. In particular, we are interested in the impact additional information has upon the matching process between firms and workers in terms of open positions vacancy and hiring rates.

In the model, the search and matching process occurs in some steps. First, each firm (expectedly) gets a fraction of the candidate workers in its application queue $\{\ell^s_{j,t}\}$, proportional to firm market share $f_{j,t}$:

$$\mathrm{E}(L^s_{j,t}) = (\omega(1-U_{t-1}) + \omega_{un}U_{t-1})\, L^S f_{j,t-1}, \tag{1}$$

where L^S is the (fixed) total labour supply, U_t is the unemployment rate and $\omega, \omega_{un} \in \mathbb{R}^+$ are parameters defining the number of job application queues each seeker joins, employed or unemployed, respectively and in average. Considering the set of workers in $\{\ell^s_{j,t}\}$, each firm select the subset of desired workers $\{\ell^d_{j,t}\}$ to make a job (wage) offer:

$$\{\ell^d_{j,t}\} = \{\ell_{j,t} \in \{\ell^s_{j,t}\} : w^r_{\ell,t} < w^o_{j,t}\}, \quad \{\ell^d_{j,t}\} \subseteq \{\ell^s_{j,t}\}. \tag{2}$$

Firms target workers that would accept the wage offer $w^o_{j,t}$, considering the wage $w^r_{\ell,t}$ requested by workers, if any. Each firm hires workers up to its total demand $L^d_{j,t}$ is fulfilled, or up to all workers in its queue, whichever is lower. So, the number of workers $L_{j,t}$ the firm may count on, based on the existing workforce $L_{j,t-1}$, is bounded by:

$$0 \leq L_{j,t} \leq L^d_{j,t} \leq L^s_{j,t}, \qquad L^z_{j,t} = L_{j,t-1} + \#\{\ell^z_{j,t}\}, \quad z = d, s. \tag{3}$$

Therefore, a significant number of candidates in the job application queue $L^s_{j,t}$ is critical for firms achieving the desired number of workers $L^d_{j,t}$ in the matching process. In the same direction, as firms have heterogeneous wage offers $w^o_{j,t}$, workers "maximize" their chance of getting a higher wage if participating in as many application queues as possible. As the intensity of the search

[3]We do not explore ALMPs based on subsidized employment considering that, more than active policies, they are also incentive schemes to firms.

process is embodied by the parameters ω and ω_{un}, they in effect control the level of information available to the labour market participants. By varying those two parameters, in the following we shall study the impact of increased job searching upon the functioning of the labour market. A higher intensity of the search activity increases the degree of information firms and workers have and should improve the effectiveness of their decisions in the market, and in principle foster the efficiency of the matching process.

3.4.2 ALMP 2: Government-sponsored training

We extended the K+S model to account for the process of workers' skills accumulation and deterioration. Such a process is driven by the worker-specific job tenures, assuming a learning-by-doing process when employed, a gradual deterioration of skills while unemployed, assuming firms keep introducing new techniques all the time, and the possible upgrade of the skills of unemployed workers participating in Government sponsored (re) qualification training. The skill level $s_{\ell,t} > 0$ of each worker ℓ evolves over time as a multiplicative process:

$$s_{\ell,t} = \begin{cases} (1+\tau_T)s_{\ell,t-1} & \text{if employed in } t-1 \\ (1+\tau_G)s_{\ell,t-1} & \text{if unemployed but under training in } t-1 \\ \dfrac{1}{1+\tau_U}s_{\ell,t-1} & \text{if unemployed and not under training in } t-1, \end{cases} \tag{4}$$

where $\tau_T \geq 0$ is a parameter governing the learning rate while the worker is employed, $\tau_G \geq 0$ is the learning rate of unemployed workers under training and $\tau_U \geq 0$, the corresponding parameter accounting for the skills deterioration when a worker is unemployed. As a consequence, when worker ℓ is employed or being trained her abilities improve over time, as she becomes more experienced in her task or acquire new skills. Conversely, unemployed workers lose skills. In particular, when a worker is hired, she may immediately acquire the minimum level of skills already present in the firm (the existing worker with the lowest skills), if above her present level. Also, workers have a fixed working life. After a fixed number of periods $T_r \in \mathbb{N}^*$ in the labour market, workers retire and are replaced by younger ones,[4] whose skills are set to the current minimum level of employed workers.

Workers' skills define their individual (potential) productivity $A_{\ell,t}$:

$$A_{\ell,t} = \frac{s_{\ell,t}}{\bar{s}_t} A_i^\tau, \qquad \bar{s}_t = \frac{1}{L^S}\sum_\ell s_{\ell,t}, \tag{5}$$

where $\bar{s}_t$ is the average worker skills level, A_i^τ is the average-worker productivity of the machinery vintage the worker operates, and L^S, the (fixed) total labour supply. The ratio $s_{\ell,t}/\bar{s}_t$, or the worker normalized productivity, represents her ability to produce more (if $s_{\ell,t} > \bar{s}_t$) or less (otherwise) when using a certain machine technology, in relation to the planned vintage productivity.[5]

[4] In the start of the simulation, initial workers ages are randomly draw in the integer range $[1, T_r]$ and all start from the same skills level.

[5] Note that, in this specification, the firm-level effective productivity $A_{j,t}$ is a truly emergent property, resulting, simultaneously, from the technical innovation dynamics (the introduction of new vintages A_i^τ), the worker skills evolution and the effective demand, which guides firms when deciding the capital stock dynamics and the employed machine mix (see (Dosi et al., 2010) for details).

The influence of the workers' skills upon production reflects a learning by tenure/doing mechanism well established in the literature at least since the seminal contribution of Arrow (1962). On the empirical side, for the links between job tenure, capability accumulation and firm productivity, see Zhou et al. (2011) and Lucidi and Kleinknecht (2009), among others.

Under ALMP 2, Government supplies training to a set of unemployed workers. A given fraction $0 \leq \Gamma \leq 1$ of unemployed workers, randomly selected, participate in (re) qualification activities. In case of participation, the usual process of skills deterioration (at the $1/(1+\tau_U)$ rate) is replaced by an accumulation one, driven by the $(1+\tau_G)$ rate as defined by Equation 4b. Therefore, if $\tau_G = 0$, the Government training program simply prevents the process of skills deterioration, while whenever $\tau_G > 0$, it improves the skills level.

The unit cost of the Government-sponsored training program is equal to a fraction Γ_{cost} of the current average wage in the economy $\bar{w}_t$. So, the public expenditure devoted to the training activity is defined as:

$$G_t^{train} = (L^S - L_{t-1}^D)\Gamma \bar{w}_{t-1}\Gamma_{cost}. \tag{6}$$

3.4.3 Demand-management policies

The Government taxes firms and banks profits at a fixed rate $tr \geq 0$ and collects revenues as defined by:

$$Tax_t = \left(\Pi_t^1 + \Pi_t^2 + \Pi_t^b\right) tr, \tag{7}$$

being Π_t^1, Π_t^2 and Π_t^b the aggregate total profits of the capital-good, the consumer-good and the banking sectors, respectively.

The Government targets paying a benefit w_t^{un} to unemployed workers which is a fraction of the current average wage $\bar{w}_t$:

$$w_t^{un} = \psi_T \bar{w}_{t-1} \tag{8}$$

where $0 \leq \psi_T \leq 1$ is a parameter representing the target benefit level, which can be reduced according to the applicable fiscal rules (see below). Considering the training cost G_t^{train} as above, the total public expenditure is:

$$G_t = (L^S - L_t^D)w_t^{un} + G_t^{train}. \tag{9}$$

Therefore, the public (operational) deficit can be defined as:

$$Def_t = G_t - Tax_t, \tag{10}$$

Accordingly, the stock of public debt is updated:

$$Deb_t = Deb_{t-1} + Def_t - \Pi_t^{cb} - G_t^{bail}, \tag{11}$$

where Π_t^{cb} is the operational result (profits) of the Central Bank and G_t^{bail} is the cost of rescuing (bail-out) the banking sector during financial crises, if any.

3.5 Timeline of events

In each simulation time step, which can be taken to roughly represent a quarter, behavioural rules are applied according to the following timeline:

1. Policy variables (prime rate and unemployment benefits) are fixed;
2. Total credit supply by banks to firms is determined;
3. Workers (employed, unemployed or under training) update their skills;
4. Machines ordered in the previous period (if any) are delivered;
5. Capital-good firms perform R&D and signal their machines to consumption-good firms;
6. Consumption-good firms decide on how much to produce, invest and hire/fire;
7. Firms allocate cash-flows and (if needed) borrow from banks to operate and invest;
8. Firms pay wages and government pays unemployment subsidies and provides training;
9. Firms send/receive machine-tool orders for the next period (if applicable);
10. Job-seeker workers send applications to firms;
11. Wages are set (indexation or bargaining) and job vacancies are partly or totally filled;
12. Consumption-good market opens and the market shares are driven by competitiveness;
13. Firms and banks compute their profits, pay wages and taxes and repay debt;
14. Exit takes place, too-small or bankrupt firms are eschewed from the market;
15. Prospective entrants decide to enter according to the markets conditions;
16. Aggregate variables are computed and the cycle restarts.

3.6 Alternative institutional regimes

The model is configured under two alternative base configurations to represent different institutional regimes which we call *Fordist* and *Competitive*.[6] The policy regimes are telegraphically sketched in Table 1.

	Fordist (baseline)	Competitive
Wage sensitivity to unemployment	low (rigid)	high (flexible)
Workers search activity	unemployed only	unemployed and employed
Labour firing restrictions	under losses only	none
Workers hiring priority	higher skills	lower payback
Workers firing priority	lower skills	higher payback
Unemployment benefits	yes	yes (reduced)
Minimum wage indexation	full	partial
Firms credit limits	low	high
Banks capital requirements	high	low

Table 1: Main characteristics of tested policy regimes.

Under the *Fordist regime*, wages are insensitive to the labour market conditions and indexed on a convex combination between economy-wide and firm-level productivity growth. There is a sort of covenant between firms and workers concerning long-term employment: firms fire only

[6]The two regimes roughly capture two alternative *wage-labour nexus* in the language of the *Regulation Theory* (see, within a vast literature, Boyer and Saillard, 2005 and Amable, 2003).

when their profits become negative, while workers are loyal to employers and do not seek for alternative jobs. When hiring and firing, firms aim to keep the more skilled workers. Labour market institutions contemplate a minimum wage fully indexed to the aggregate economy productivity and unemployment benefits are financed by taxes on profits. Conversely, in the *Competitive regime*, flexible wages respond to unemployment in a decentralized labour market dynamics, and are set by means of an asymmetric bargaining process where firms have the last say. Employed workers search for better paid jobs with some positive probability and firms freely adjust (fire) their excess workforce according to their planned production. The hiring and firing of workers by firms are based on a trade-off between skills and wages, using a simple payback-like comparison rule. The Competitive regime is also characterized by different labour institutions: minimum wage is only partially indexed to productivity and unemployment benefits – and the associated taxes on profits – are relatively lower.

In order to embed the growing importance of the banking sector in the economy, we also differentiate the two regimes in terms of the parameters governing prudential limits in the supply of credit. From a more regulated (Fordist) to a more liberal (Competitive) institutional context, the first change (parameter Λ) increases the credit limit to firms indebtedness, while the second (parameter τ^b) reduces the minimum bank capital adequacy rate. Both changes effectively ease the credit provisions by banks to firms despite the inherent increasing in the financial fragility of these agents.

The simulation exercises in Section 6 are built so that there is a regime transition at a certain moment ($t = 100$, indicated by the vertical dotted line in the time series plots), capturing a set of labour-market structural reforms. This institutional shock is aimed at spurring flexibility on the relations among agents in the labour market and implies that the social compromise embodied in the Fordist regime is replace by the Competitive one. Additionally, the shocks also incorporate a component of financial deregulation in the credit market.

3.7 Sensitivity analysis

We performed a global sensitivity analysis (SA) to explore the effects of alternative model parametrizations, to assure the robustness of our results regarding the frequent criticism of ABMs on the issue of the importance of the model structural properties vs. "lucky" parameter configurations.[7] The SA exercise is performed in the period $t \in [200, 400]$ for a set of metrics relevant to the current discussion, namely the unemployment ($\bar{U}$), vacancy ($\bar{V}$) and hiring ($\bar{L}_{entry}$) average rates and the workers skills average level ($\bar{s}$).[8]

Out of the 79 parameters and initial conditions in the K+S model version employed, as a first step we reduce the relevant parametric dimensionality, by means of an Morris elementary effects screening procedure (EE). This is important because it allows discarding from the in-depth analysis the parameters and initial conditions (the "factors") which do not significantly affect the selected model metrics, if any.[9] The EE analysis indicates that $\bar{U}$ is the metric

[7] For technical details on the global sensitivity analysis methodology applied here, see Dosi et al. (2017e).

[8] Other relevant metrics, like the macro aggregates growth rates, the hysteresis losses, the inequality measures, and the industrial performance indicators were already evaluated in previous papers based on the labour-augmented K+S model and will not be replicated here. The general results from these past analyses indicate a relatively small dependence of the qualitative model results on the chosen parametrization, in most cases.

[9] Briefly, EE proposes both a specific design of experiments, to efficiently sample the parametric space under a

sensitive to the larger number of factors (19) while $\bar{s}$ is the least sensitive, as no factor presented a statistically relevant effect on it. $\bar{L}_{entry}$ and $\bar{V}$ are in an intermediate situation with 15 and 8 influential factors, respectively.[10] In total, 24 unique *relevant* factors were identified after discarding duplicates.

In order to better understand the effect of each of the 24 relevant factors over the selected metrics, directly or in interaction, in the second step we perform a Sobol variance decomposition (SVD).[11] Because of the relatively high computational cost to produce the SVD using the original model, a simplified version of it – a meta-model – is estimated using the Kriging method and employed for the SA.[12] The meta-model is estimated by numerical maximum likelihood using a set of observations sampled from the original model using a high-efficiency, nearly-orthogonal Latin hypercube design of experiments (Cioppa and Lucas, 2007).

Interestingly, the SVD results indicated a common and small subset of just five *important* factors for the chosen metrics, except $\bar{s}$ as discussed before, mostly in direct effect and not in interaction (linear effects). Curiously, all important factors come from the technological dynamics part of the model, in particular for the entrant firms. These factors, in order of importance, (i) define the maximum technical advantage of an entrant ($x_5 : +$), (ii) control the shape of the technological opportunity space for entrant firms ($\beta_2 : -$, $\alpha_2 : +$), (iii) set the upper shape of the same space for the incumbent firms ($\beta_1 : -$), and (iv) the notional upper limit of the technological search space ($\bar{x}_1 : +$). The signals in parenthesis indicate positive or negative effects on the affected metrics.

The impacts of all the tested factors in the SVD are quite mild. Just two factors, x_5 and β_2, account for more than 80% of the estimated meta-model effects on the metrics $\bar{U}$, $\bar{L}_{entry}$ and $\bar{V}$ ($\bar{s}$ is not significantly affected by any factor). Figure 2 presents an exploration of the Kriging meta-model response surface for the two critical factors on the two most sensitive metrics. The almost flat surfaces clearly indicate the (almost) linear interaction nature of the system response surface for the identified critical factors. Figure 2(a) renders the surface for the average unemployment rate $\bar{U}$ and show how unemployment (and aggregate growth, not shown) in the long-run is dependent on the entry of technologically advanced firms in the market, in a classical "creative destruction" Schumpeterian sense. Indeed, this metric is very sensitive to changes in the two factors, in an addictive way. The presented surface corresponds to a Competitive regime configuration but results are essentially the same under all the tested set ups (as well for the other metrics). Figure 2(b) presents the response surface for the average hiring rate $\bar{L}_{entry}$.

multi-path, one-factor-at-a-time strategy, and some absolute importance statistics, to evaluate direct and indirect (nonlinear/non-additive) effects of parameters on the model results as well their statistical significance (Morris, 1991, Saltelli et al., 2008).

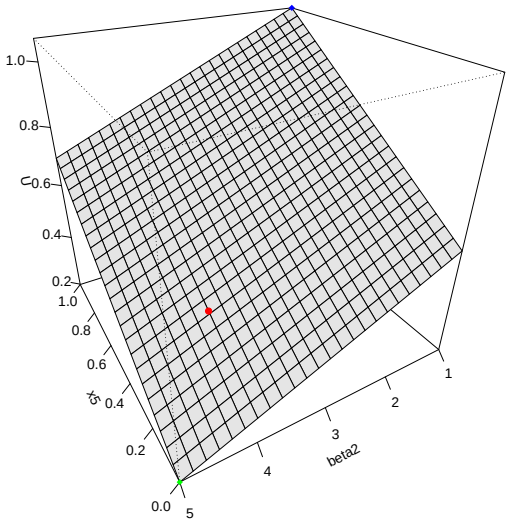
[10] The selection criteria includes the top 80% EE contributors at 5% significance.

[11] SVD is a variance-based, global SA method consisting in the decomposition of the variance of the chosen model metric into fractions according to the variances of the factors selected for analysis, better dealing with nonlinearities and non-additive interactions than EE or traditional local SA methods. It allows to precisely disentangle both direct and interaction quantitative effects of the factors on the chosen metrics over the entire parametric space (Sobol, 1993, Saltelli et al., 2008).

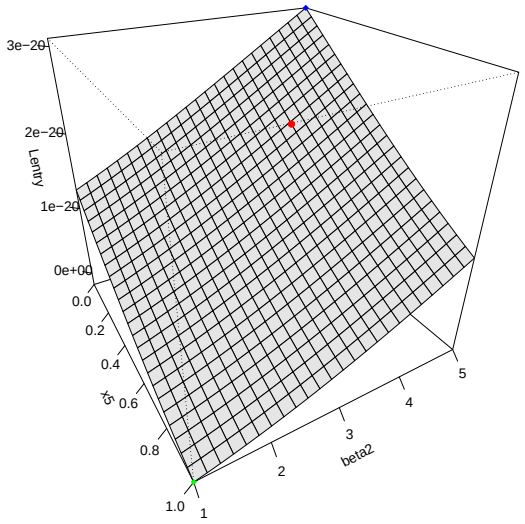
[12] In summary, the Kriging meta-model "mimics" our original model using a simpler, mathematically-tractable approximation, fitted over a sample of the original model response surface. Kriging is a spatial interpolation method that under fairly general assumptions provides the best linear unbiased predictors for the response of complex, non-linear computer simulation models (Rasmussen and Williams, 2006, Salle and Yildizoglu, 2014).

Figure 2: Global sensitivity analysis: response surfaces.
Surfaces modelled using the fitted Kriging meta-model. Red dot: calibration settings | Markers: maximum (blue) and minimum (green) predicted values.

(a) Average unemployment rate ($\bar{U}$)



(b) Average hiring rate ($\bar{L}_{entry}$)



Notice the highly stretched z-axis scale due to auto-scaling. Indeed, the "inclined" surface is mostly horizontal, as this metric varies very little even for the full excursion of the interacting factors. The average vacancy rate $\bar{V}$ (not shown) has the same shape and even lower sensitivity. Finally, none of the remaining 77 factors in the model, including the ones associated to policy or the labour and banking markets were quantitatively relevant for the long-term dynamics of the chosen metrics.

3.8 Empirical validation

The K+S model is able to generate endogenous growth and business cycles, emergent crises, and to reproduce a rich set of macro (relative volatility, co-movements, etc.) and micro (firm size distributions, firm productivity dynamics, etc.) stylized facts (see Dosi et al., 2010, 2013, 2015, 2017a), as shown in the top panel of Table 2. In addition, the labour-enhanced version of the model (Dosi et al., 2016b, 2017b), which explicitly accounts for decentralized firm-worker interactions, robustly replicate most of the labour market empirical regularities (cf. the bottom panel of Table 2).

Table 3 presents the correlation structure with respect to GDP of three key financial variables in both regimes: (i) total firm debt is pro cyclical and leading in Fordist and counter cyclical and lagging in Competitive, (ii) liquidity-to-sales ratio is perfectly counter cyclical in the two regimes, and (iii) bankruptcy rate is pro cyclical and slightly leading in Fordist and counter cyclical and lagging in Competitive.

Microeconomic Stylized Facts	Aggregate-level Stylized Facts
Skewed firm size distributions	Endogenous self-sustained growth with persistent fluctuations
Fat-tailed firm growth rates distributions	Fat-tailed GDP growth rate distribution
Heterogeneous productivity across firms	Endogenous volatility of GDP, consumption and investment
Persistent productivity differentials	Cross-correlation of macro variables
Lumpy investment rates of firms	Pro-cyclical aggregate R&D investment and net entry of firms in the market
Heterogeneous skills distribution	Persistent and counter-cyclical unemployment
Fat-tailed unemployment time distribution	Endogenous volatility of productivity, unemployment, vacancy, separation and hiring rates
Fat-tailed wage growth rates distributions	Unemployment and inequality correlation
	Pro-cyclical workers skills accumulation
	Beveridge curve
	Okun curve
	Wage curve
	Matching function

Table 2: Stylized facts matched by the K+S model at different aggregation levels.

4 ALMPs experiments results

ALMP 1: search activity and mismatches

We shall start by presenting the effects of different degrees of search activity and the corresponding impact on the matching process between supply and demand. In the model, there are two parameters for setting the search intensity/information level in the labour market, namely ω and ω_{un}, which set the mean number of job applications sent by employed and unemployed workers to firms on each period, respectively. By changing the number of applications we try to mimic the effect of policies aimed at improving the job-search intensity and, thus, we analyse the consequences upon the hiring rate and ultimately on the labour demand. Table 4 reports the tested configurations for both institutional regimes.[13]

Figure 3 presents a performance comparison exercise in terms of (a) hiring rates (hired workers over total labour supply) and of (b) vacancy rates (unfilled positions over total labour supply) among the three search degrees for both regimes. With reference to the Fordist case, the search intensity *does* not significantly affect nor the number of hired workers neither the number of unfilled positions. Conversely, when moving to the Competitive set up, the higher intensity of search leads toward mildly higher hiring and vacancy rates, signalling that although the matching improves, this occurs at the cost of higher turbulence in the labour market. Notably,

[13]The intensity labels (low, medium, high) are just references for the chosen parameter values, admittedly extreme to allow for the exploration of scenarios closer to the complete information case. Of course, the submission of 50 or 100 job applications in a single period (quarter) would represent a very high level of search activity when compared to the empirical averages.

Fordist	$t-4$	$t-3$	$t-2$	$t-1$	0	$t+1$	$t+2$	$t+3$	$t+4$
Total firm debt	0.17	0.22	0.18	0.09	−0.03	−0.11	−0.11	−0.05	0.02
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(−)	(−)
Liquidity-to-sales ratio	0.05	−0.10	−0.31	−0.50	−0.59	−0.52	−0.34	−0.12	0.07
	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.02)	(0.03)	(0.03)	(0.02)
Bankruptcy rate	−0.03	0.05	0.14	0.20	0.18	0.07	−0.06	−0.16	−0.17
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
Competitive	$t-4$	$t-3$	$t-2$	$t-1$	0	$t+1$	$t+2$	$t+3$	$t+4$
Total firm debt	0.04	0.03	0.00	−0.05	−0.09	−0.11	−0.10	−0.07	−0.03
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Liquidity-to-sales ratio	0.10	−0.04	−0.23	−0.42	−0.54	−0.53	−0.39	−0.20	−0.01
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.04)
Bankruptcy rate	0.11	0.12	0.09	0.03	−0.05	−0.10	−0.13	−0.11	−0.08
	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)

Table 3: Correlation structure with respect to GDP on selected variables. All results significant at 1% level. MC standard errors in parentheses. Total firm debt series is Baxter-King bandpass-filtered (6,32,12).

	Search activity		
(ω, ω_{un})	Low	Medium	High
Fordist	$(2, 5)$	$(50, 50)$	$(100, 100)$
Competitive	$(2, 5)$	$(50, 50)$	$(100, 100)$

Table 4: Configuration of parameters (ω, ω_{un}) for different levels of worker job-search activity.

as shown by Figure 3(c), in the Competitive case the average worker skills level *decreases* under the high search scenario, due to the shorter tenure (time in the job) periods.

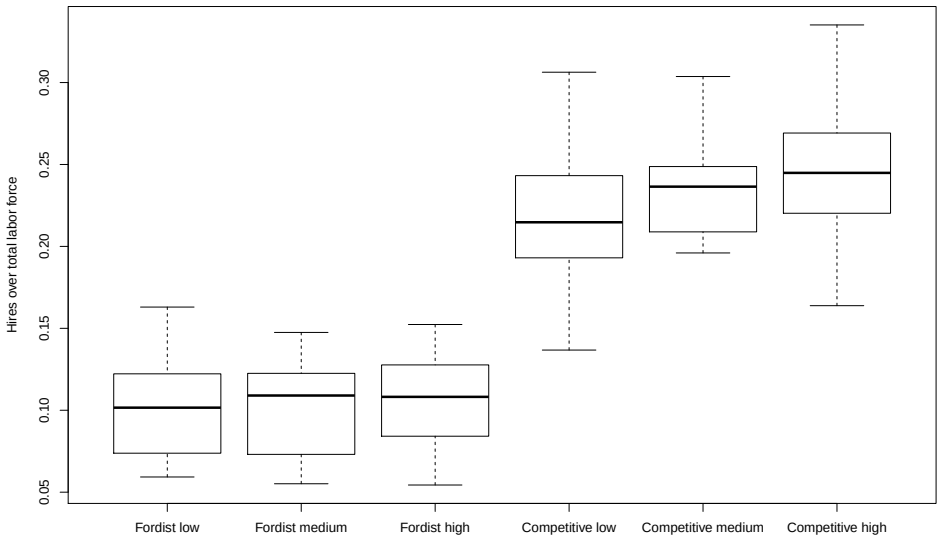
On top of that, the key metrics related to the long-run dynamics of the model, like GDP and productivity growth, unemployment, and inequality are *not* affected by the increased of search activity in both regimes, as evidenced in Table 5.[14] In fact, the only statistically relevant impact of the increased information level was a mild reduction in the (already low) unemployment level in the Fordist regime.

From this first battery of results it clearly emerges that job-search-enhancing ALMPs aimed at fostering efficiency in the labour market are not effective under a more rigid industrial relations regime like the Fordist. Instead, in terms of increasing the matching process measured in terms of hiring rate, those policies look more relevant in the more flexible Competitive institutional set up. Nonetheless, this improvement comes at the cost of additional turbulence, as signalled by the increased unfilled vacancies. Additionally, these initial experiments show this kind of policy are ineffective to boost the long-run macro dynamics.

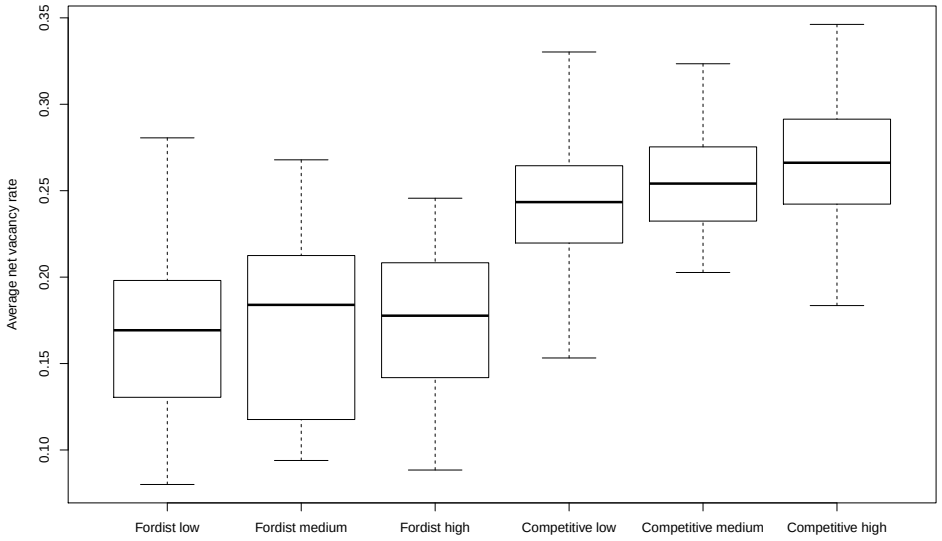
[14]This table, as well the similar ones below, compares the average results from different model configuration scenarios on several macroeconomic variables as the ratio (division) between the respective variable for each of the variants with respect to the same variable for the chosen baseline case. Also a two-means t-test is performed in each case to evaluate if the difference between the variant and the baseline is statistically significant and at which p-value level.

Figure 3: Performance comparison between regimes and different degrees of job search. Statistics for 50 MC runs in period $[200, 400]$. Bar: median | box: 2nd-3rd quartile | whiskers: max-min | dots: outliers.

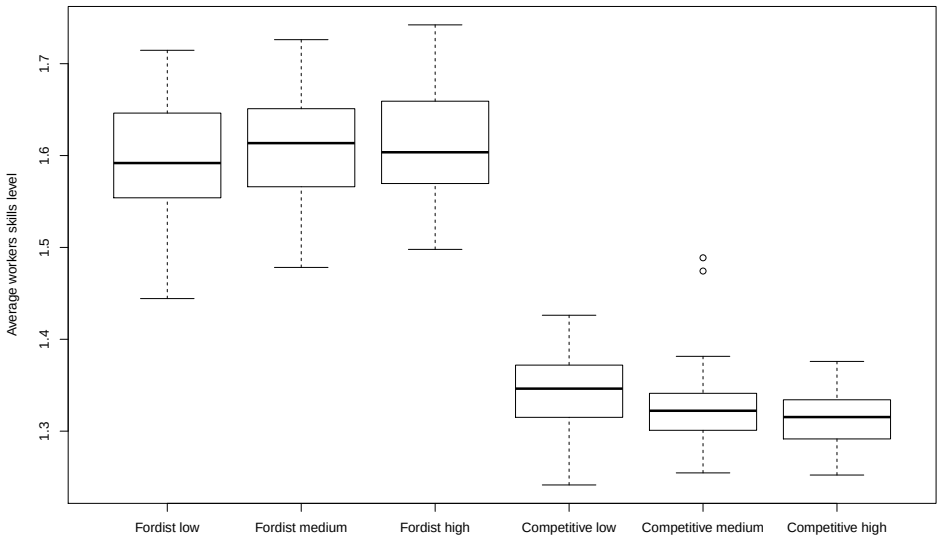
(a) Hiring rate



(b) Vacancy rate



(c) Workers average skills



Fordist	Low	Medium		High	
	Baseline	Ratio	p-value	Ratio	p-value
GDP growth	0.02	0.94	0.28	0.99	0.83
Productivity growth	0.02	0.95	0.33	1.00	0.91
Unemployment	0.02	0.62	0.01	0.59	0.01
Income concentration	0.05	1.20	0.05	1.09	0.18
Competitive	Low	Medium		High	
	Baseline	Ratio	p-value	Ratio	p-value
GDP growth	0.01	0.96	0.71	0.95	0.72
Productivity growth	0.01	0.95	0.69	0.97	0.77
Unemployment	0.20	1.01	0.87	1.03	0.35
Income concentration	0.18	1.01	0.77	0.99	0.67

Table 5: Performance comparison among three alternative scenarios in two regimes. Averages for 50 MC runs in period $[200, 400]$. p-value for a two-means t test, H_0: no difference between scenarios.

ALMP 2: the effects of qualification training

In this section we shall present the simulation results of the ALMP 2 experiment. The four scenarios under analysis are summarized in Table 6. They are configured in order to compare three different situations: (i) the change of the institutional set up from Fordist to Competitive, (ii) the provision of active vs. passive labour market policies in the Competitive regime, (iii) the combination of the two situations. The experiment is meant to understand whether flexible labour markets – properly "oiled" by the policy scheme – might have the same efficiency and equity outcomes of a more rigid market. Additionally, we investigate to which extent the adopted policy scheme could "lubricate" labour market matching or sustain aggregate demand. In the foregoing, we compare the aggregate empirical regularities of the alternative configurations on micro and macroeconomic terms and on the efficiency and equity performance of the system.

	Unemployment benefits	Qualification training
Fordist	✔	✖
Competitive 1	✔	✖
Competitive 2	✖	✔
Competitive 3	✔	✔

Table 6: The tested ALMPs and PLMPs configuration scenarios.

We start analysing the *movement* of some regularities in the matching process. Table 7 presents the slopes for the fitted Beveridge, matching function and Okun curves.[15]

The Beveridge curve captures the degree of frictional mismatch in the labour market by connecting the vacancy to the unemployment rate. From the data, a clear *outward shift* emerge in the curves from the Fordist toward the Competitive regimes, independently from the policy mix. This shift depicts a change in the efficiency of the matching process. This "malfunctioning"

[15]The linear fittings are performed by ordinary least-squares regression. The average R^2 was 0.22, indicating a reasonably good fitting to a linear model.

behaviour, namely a *positive* correlation between vacancy and unemployment rates, has been documented in the recent years and associated with an increasing mismatch between labour demand and labour supply.[16] The reasons for the increase are not only the cyclical components of the business cycle, but also the structural changes in long-term unemployment. The latter includes changes in the composition of labour supply and the potential twisting effects of the policies schemes. In fact, of particular relevance for our analysis is the effect exerted by the reduction in aggregate demand upon the labour market efficiency, via an increase in the long-term unemployment rate. This mechanism appears to be relevant in the model.

	Fordist	Competitive		
		Un.ben.	Train.	Un.ben.&train.
Beveridge curve	-0.043	0.360	0.061	0.205
	(0.054)	(0.044)	(0.028)	(0.046)
Matching function	0.279	0.557	0.397	0.571
	(0.014)	(0.042)	(0.035)	(0.037)
Okun curve	-0.202	-0.219	-0.192	-0.197
	(0.020)	(0.018)	(0.019)	(0.014)

Table 7: Fitted coefficient (slope) of a OLS regression for selected curves. Averages for 50 MC runs in period $[200, 400]$. MC standard errors in parentheses.

An evidence on the effects of the reduced aggregate demand upon the labour market matching efficiency can be inferred from the matching function curve. It presents the relationship between the probability of finding a job and the vacancy/unemployment ratio. In line with the empirical evidence, the two variables are positively correlated in the four scenarios. However, the training only policy is the *least* effective alternative in a Competitive regime to improve the matching (or increase the curve slope), as presented in Table 7. This policy is significantly worse with respect to the two alternatives which include unemployment benefits.

Finally, when analysing the Okun curve slope, the negative correlation between unemployment and GDP growth, Table 7 shows a close behaviour in the all set ups, independently from the adopted policy schemes. Again, these results hint at the increasing detrimental effects of unemployment on output growth.

A further step in understanding the effects of the combination of a regime change and the alternative policy schemes is to analyse the macroeconomic variables. Figure 4(a) presents the dynamics of the actual and the full-utilization GDP. Two of the configurations are set at time $t = 0$ under the Fordist regime without training (the lines 'Fordist' and 'Competitive + Unemployment Benefits') and the other two, under Fordist with training (the lines 'Competitive + Training' and 'Competitive + Unemployment Benefits + Training'). At $t = 100$ we introduce the exogenous policy regime change to the three Competitive variants. The trajectories of the GDP (the averages of 50 Monte Carlo simulation runs) show a long-run divergence be-

[16] See Bova et al. (2017) who document how 10 out of 12 of the OECD countries under examination experienced an outward shift of the Beveridge Curve during the recent crisis.

tween the set-ups.[17] Clearly, the worst performer is the training-only Competitive scenario (no unemployment benefits), wherein only the supply side policy is undertaken.

A careful look at the skills dynamics presented in 4(b) clarifies the effects of the qualification training program. Under the schemes sponsoring it, the average skills dynamics improves sensibly. Considering the similar unemployment levels among the Competitive varieties (see below), the training program is effectively protecting the unemployed workers skills from deterioration. Yet, they cannot compensate the increased average unemployment level and so do not recover the Fordist skilling level. In fact, as skills accumulate under worker job tenure (see Equation 4) and being the Competitive set ups characterized by a lower average tenure with respect to the Fordist, the bias in favour of the latter is significant.

The detrimental effects of wage and numerical flexibility introduced by the regime change are also documented in Table 8, which shows the significant differences among the scenarios for the vacancy and the unemployment rates, among other results discussed below. Finally, note that the unemployment rate is even higher under the training-only scenario, while it is mitigated to some extent by the provision of unemployment benefits, confirming their Keynesian nature.

	Fordist	Competitive					
		Un.ben.		Train.		Un.ben.&train.	
	Baseline	Ratio	p-value	Ratio	p-value	Ratio	p-value
GDP growth	0.02	0.79	0.00	0.73	0.00	0.88	0.06
Volatility of GDP growth	0.11	0.99	0.91	1.22	0.00	0.89	0.01
Recovery from GDP crises	9.30	1.91	0.00	2.18	0.00	2.16	0.00
Losses from GDP crises	0.98	4.85	0.00	7.37	0.00	4.43	0.00
Capacity utilization	0.79	1.03	0.00	1.02	0.10	1.03	0.01
Productivity growth	0.02	0.81	0.01	0.76	0.00	0.90	0.08
Unemployment	0.02	13.39	0.00	16.02	0.00	13.32	0.00
Vacancy	0.17	1.41	0.00	1.32	0.00	1.36	0.00
Workers skills	1.60	0.84	0.00	0.88	0.00	0.91	0.00
Wages dispersion	0.10	1.65	0.00	1.81	0.00	1.82	0.00
Income distribution	0.05	3.81	0.00	5.64	0.00	3.96	0.00
Mark-ups	0.22	1.00	0.35	1.02	0.00	1.01	0.00
Loans	0.57	15.20	0.31	1.87	0.01	1.50	0.01
Financial fragility	0.00	2.63	0.00	2.79	0.00	1.85	0.03

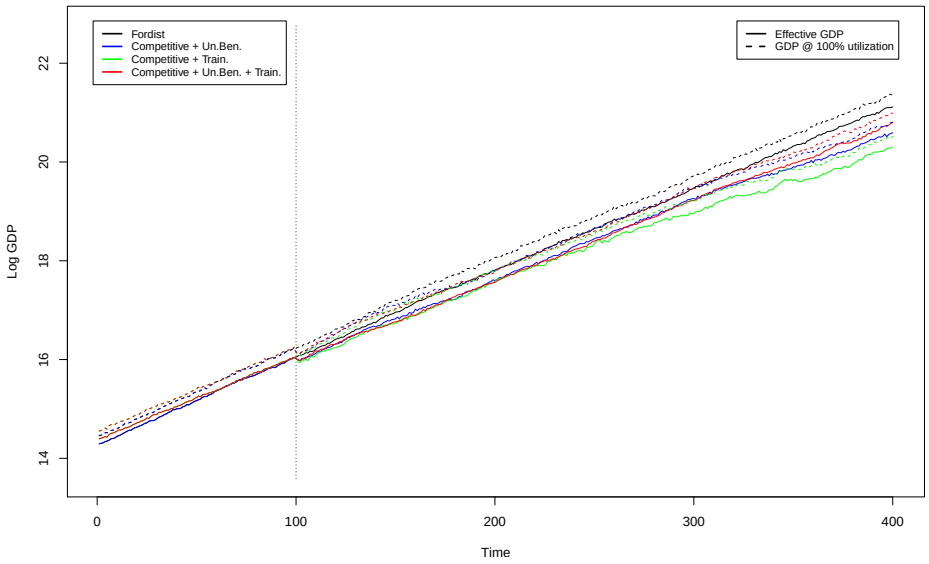
Table 8: Performance comparison among four alternative scenarios, selected time series. Averages for 50 MC runs in period $(200, 400)$. p-value for a two-means t test, H_0: no difference between scenarios.

Moving from efficiency toward equity variables, Figure 4 and Table 8 also present some metrics on income inequality. From the latter, it is quite evident that in absence of unemployment benefits ALMPs are not able to mitigate the negative effects of labour market flexibility. In fact, the profit share is mildly higher in the Competitive variants. Nonetheless, a much striking difference emerge in the income concentration measure (the Gini coefficient) which include income of both employed and unemployed workers. Figure 4(c) shows how deeply the Gini index is affected

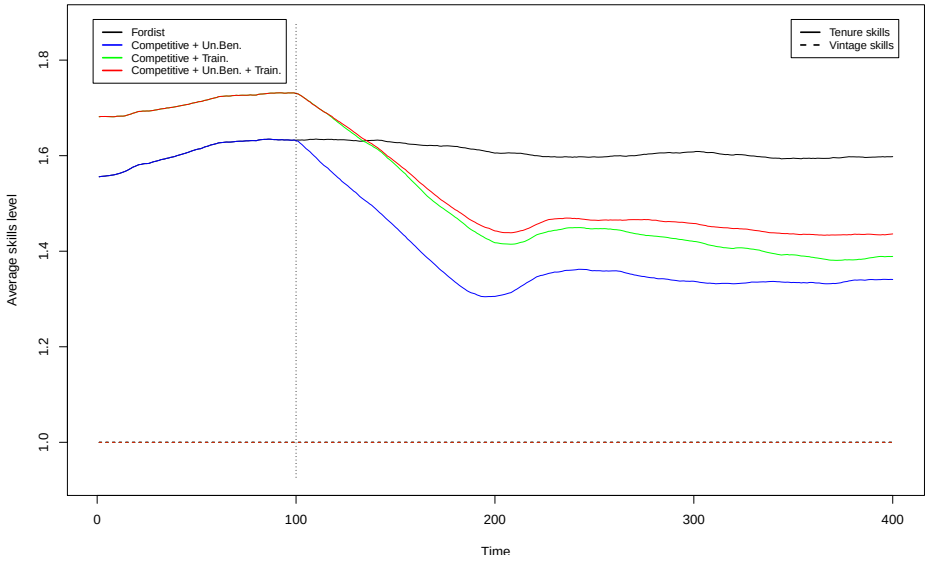
[17] Those are interesting examples of super-hysteresis. For a definition of the concept and a discussion about it, see Dosi et al. (2017d).

Figure 4: Macroeconomic dynamics in alternative policy regimes. Lines represent 50 MC runs averages.

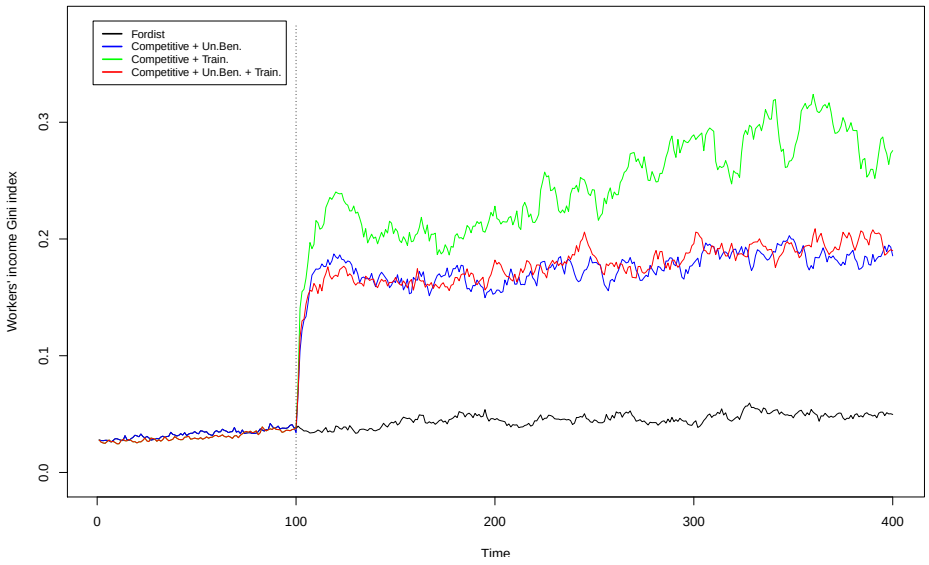
(a) Actual and full capacity GDP



(b) Average worker skills



(c) Income concentration



by the regime change and presenting a positive trend (worsening distribution) when the supply-side-only policy is performed. Finally, when looking at inequality among employed workers (the real wages dispersion), a quite similar pattern is verified. Those results confirm that not even the combination of supply and demand labour market policies (ALMPs and PLMPs, respectively) is able to mitigate the negative labour market effects emerging from the Competitive regime change.

Let us now address the potential for hysteresis in more flexible labour markets. Figure 5 presents the scenarios performance in terms of (a) the GDP growth, (b) the GDP average losses incurred during deep crises, and (c) the average number of periods required for the GDP to recover the pre-crisis trend level. Under the Competitive variants, even *with* both ALMPs and PLMPs, the average GDP growth rate is lower. The supply-side-only scheme exhibits a much worse performance letting rather evident its poor performance vs. the traditional Keynesian demand-side policies. Looking at the losses of the GDP due to deep crisis (more that 3% GDP reduction) and the duration of the crises, a similar picture emerges. Losses are substantially higher under the training-only Competitive variant and recovery periods are longer. The relative performance of the policy scenarios is also presented in Table 8, including other relevant metrics. Overall, although the order is not always the same, the training-only scheme usually exhibits the worst results.

The bottom-line of this second battery of experiments is that demand-side policies like unemployment benefits are better suited to foster economic growth, reduce unemployment, and mitigate inequalities. At the same time, supply side policies aimed at raising skills of unemployed workers are not *enough* to counterbalance adverse labour markets, despite still positive to attenuate the overall worker skills deterioration.

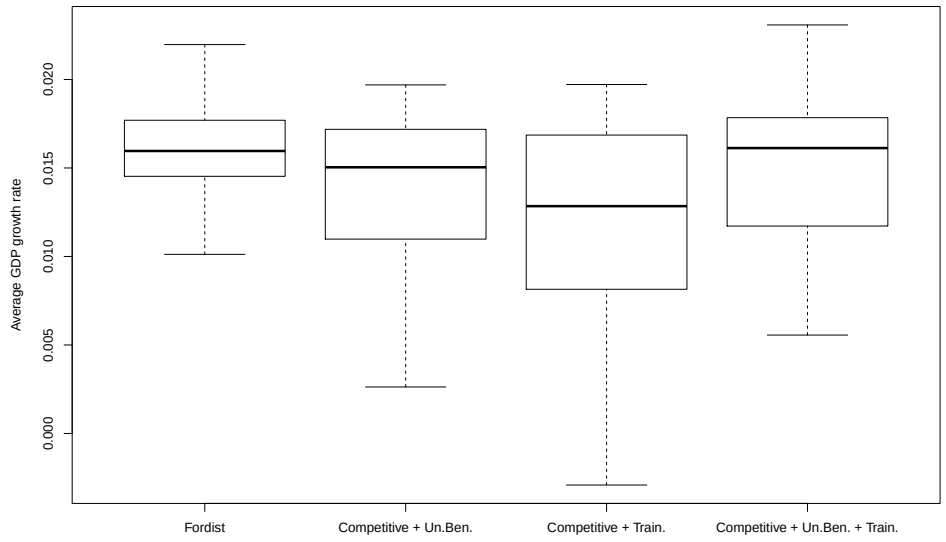
The litmus test to evaluate the effect of the policy schemes is to understand whether there is a positive effect for those who take part to the policy-sponsored programs. In particular, with reference to (re) qualification training initiatives, the policy maker is usually interested in evaluating the impact of the program at least upon (i) the wage level, (ii) the wage growth, and (iii) the unemployment duration. Therefore, we asses the effectiveness of training-based ALMPs comparing those three metrics among the policy scenarios.

Figure 6(a) presents the worker-level wage distributions for the alternative regimes. If the training scheme would have helped trained workers in getting a higher wage compared to untrained ones, we should have observed a wage distribution shifted toward the right. However, the distributions of the three Competitive scenarios are almost overlapping, with a small but positive impact of training.[18] Similarly, Figure 6(b) shows wage growth processes which give evidence that the availability of qualification training has no relevant influence in this respect (completely overlapping distributions). The most striking result is the distribution of the unemployment duration, presented in Figure 6(b). The training-only scenario (the green curve and dots) presents the most right-skewed distribution, hinting at the fact that the training scheme is *not able* to reduce the duration of unemployment spells. Indeed, here the model replicates the "training trap" phenomena mentioned in Section 2. This latter evidence also reinforces the

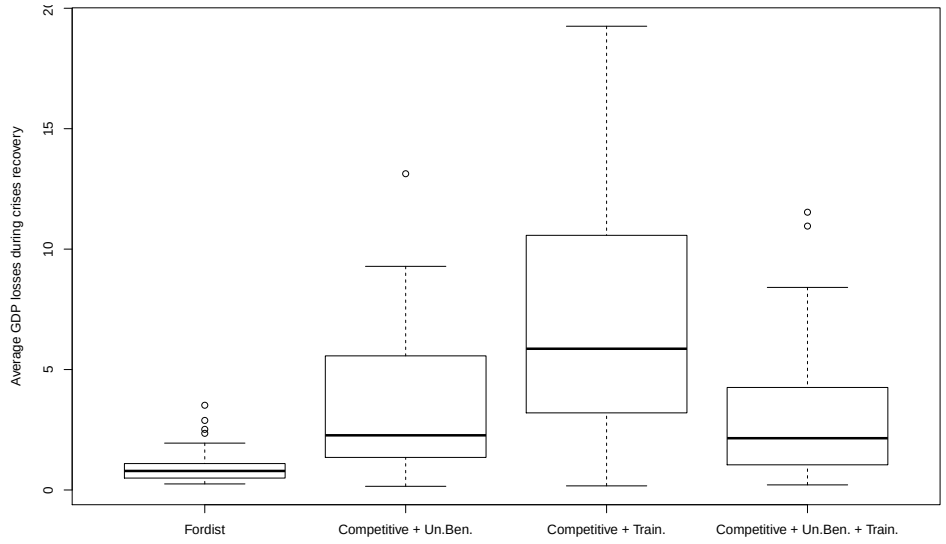
[18]The Fordist regime is not a good benchmark in the case of wage and its growth distributions because of the institutional characteristics defining the firm wage-setting behaviour (see Section 3.6).

Figure 5: Performance comparison between policy scenarios. Statistics for 50 MC runs in period $[200, 400]$. Bar: median | box: 2nd-3rd quartile | whiskers: max-min | dots: outliers.

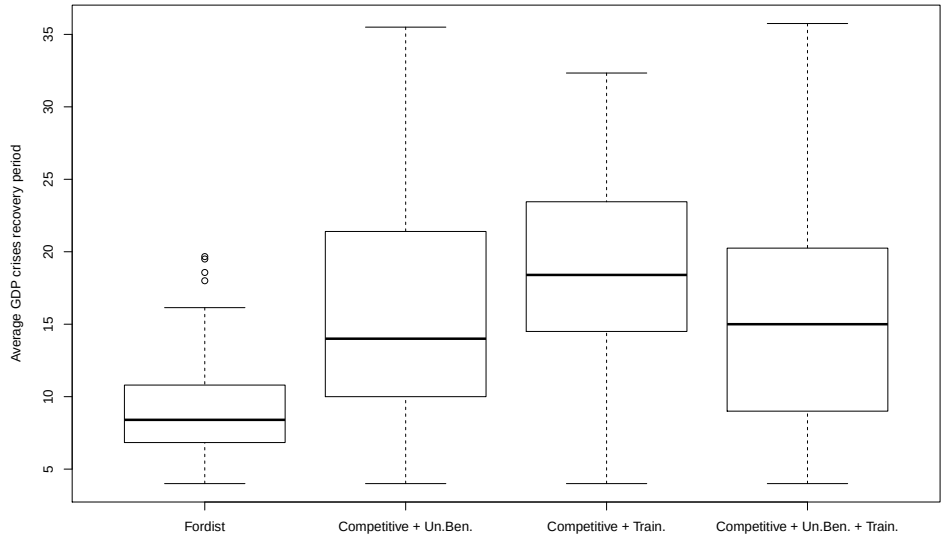
(a) GDP growth



(b) Losses from GDP crises



(c) Recovery from GDP crises



detrimental effects of the reduced aggregate demand due to the regime change and the absence of unemployment benefits on the labour market.

Finally, in order to evaluate the transmission mechanisms from the labour market to the credit market, let us present some comparisons in terms of the financial performance of the economy. Figure 7 shows (a) the total loans provided by banks and (b) the financial fragility of banks for the alternative scenarios. Considering the increased prudential limits and the reduced capital requirements applicable to banks after the policy regime transition at $t = 100$ (see Section 3.6), a rise in both macro variables should be expected. More surprisingly, the total supply of loans and in particular the financial fragility are affected differently by the variants in the Competitive regime. The level and the volatility of the stock of debt kept by firms increase as the labour market policies are changed, as presented in Figure 7(a). Remarkably, the adoption of training-only policies are particularly negative for the stability of the financial system, as indicated by Figure 7(b). The message here seems clear: when moving to a more flexible labour market regime, the combination of PLMPs and ALMPs is critical to mitigate the potentially augmented systemic risk of the banking system.

5 Conclusions

In this work, we interact a decentralized labour market, declined under two institutional variants, allowing the understanding of the macroeconomic effects of supply-side employment-support industrial policies.

Our results debunk the discourse supporting the combination of flexible labour markets and austerity policies as potentially virtuous way-out from deep crisis, like the current one, both in the short and the long run. Firstly, an appropriate level of skills is not enough when workers face adverse labour demand. Secondly, supply-side policies alone are not able to reverse the perverse interaction between flexibility and austerity. Lastly, demand-management policies are better suited to mitigate inequality and to improve and sustain long-run growth.

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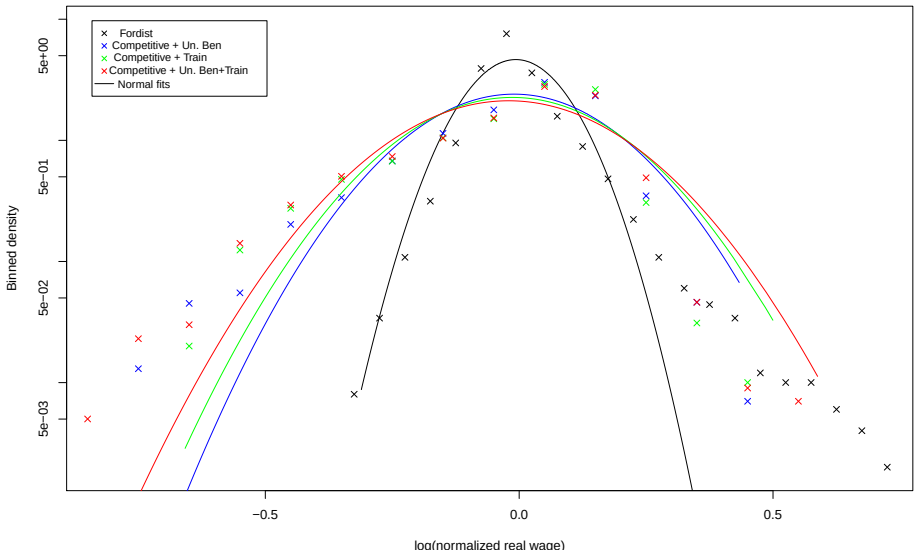
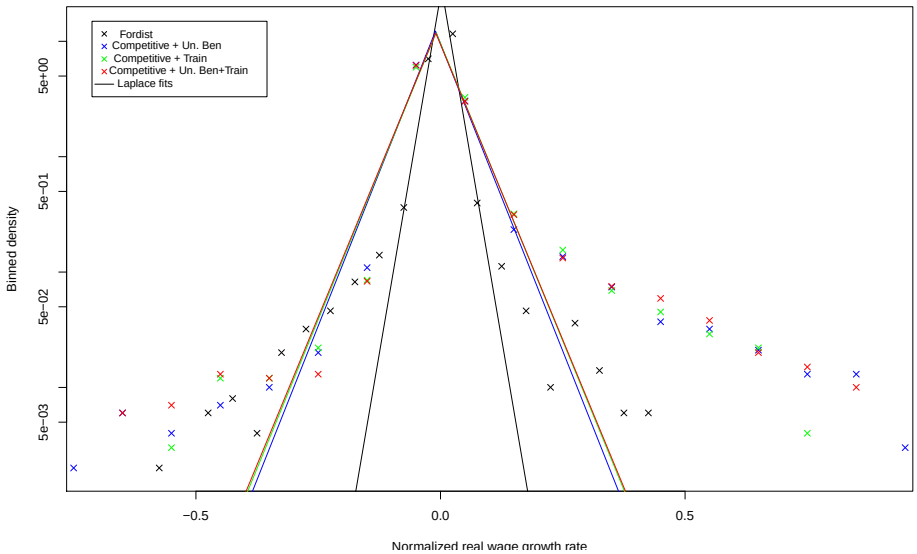
Figure 6: Worker-level analysis. Data pooled from 10 simulation runs in period $[200, 400]$.

(a) Log-normalized real wages distribution



(b) Log-normalized real wage growth distribution



(c) Unemployment time distribution

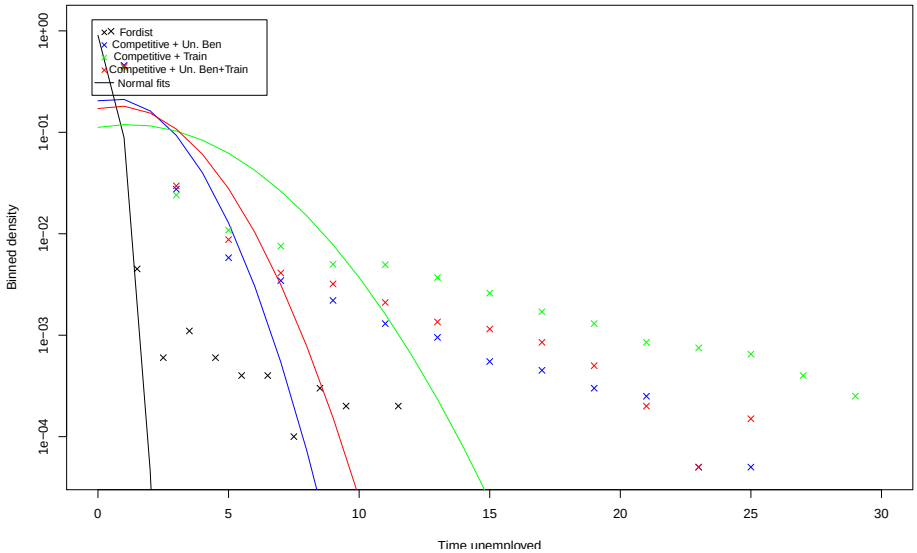
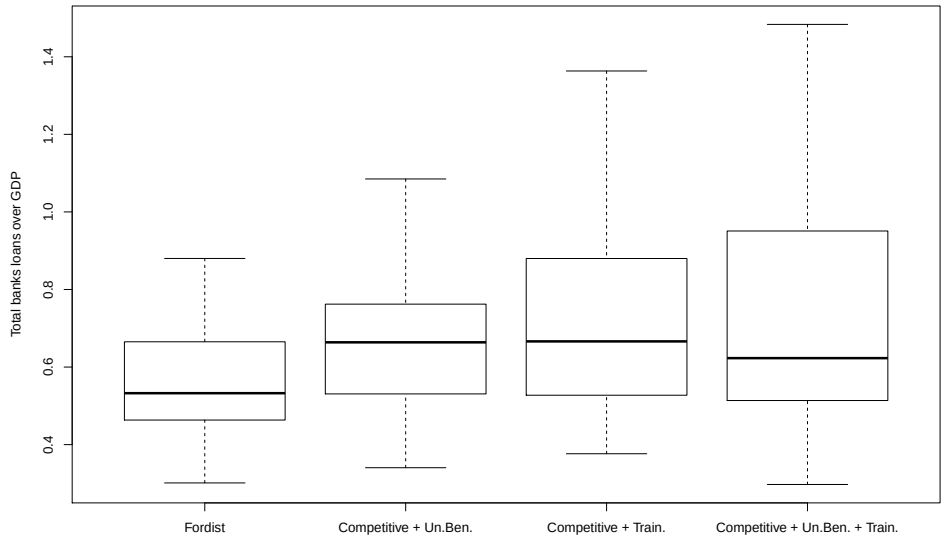
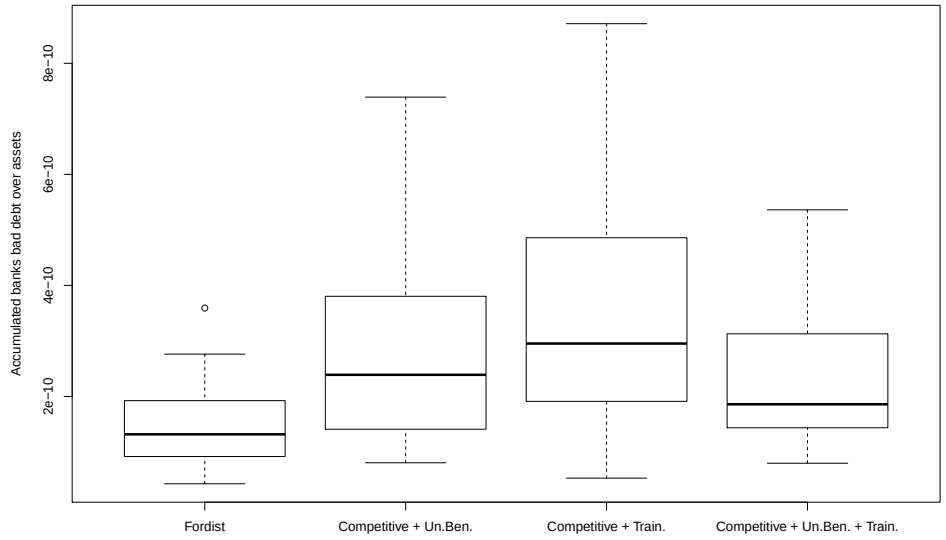


Figure 7: Performance comparison between policy regimes. Statistics for 50 MC runs in period $[200, 400]$. Bar: median | box: 2nd-3rd quartile | whiskers: max-min | dots: outliers.

(a) Loans



(b) Financial fragility



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