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ORIGINAL ARTICLE

Flexicurity, education and optimal labour market policies

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Abstract
The paper provides a theoretical rationale for flexicurity policies, consisting of low employment protection, generous unemployment insurance and active labour market programmes. Education efforts give access to high productivity firms, more likely to survive and thus exposing less their workers to unemployment risk. Activation programmes support reallocation from risky and unproductive to safer and more productive firms, reducing unemployment. Low employment protection can provide incentives for self-insurance against unemployment risk through education, mitigating the moral hazard cost of unemployment insurance and activation programmes. The paper identifies conditions for flexicurity to be optimal and confronts theoretical predictions to the data.

JEL CLASSIFICATION
J64, J65, J68, J32, H30

1 | INTRODUCTION

Unemployment remains high in many developed countries. Flexicurity, based on low employment protection, generous unemployment benefits and active labour market policies, has been associated with encouraging signs of unemployment reduction in Denmark and the Netherlands. It is part of the European Union strategy for improving the functioning of labour markets (Bekker, 2018; European Commission, 2010) and consistent with policy recommendations (Blanchard et al., 2014; Bovenberg & Wilthagen, 2009). This paper provides a theoretical rationale for flexicurity based on education. I show that flexicurity can increase welfare, low employment protection encouraging self-insurance against unemployment risk and reducing the moral hazard cost of unemployment insurance and job search assistance.

Flexicurity is a frequent recommendation for curbing unemployment. Whether flexicurity is optimal or not, from an economic theory point of view, remains however little known: flexicurity may or may not be optimal. The main contribution of this paper is a theoretical rationale for flexicurity, including conditions for flexicurity to be optimal with a welfare utilitarian criteria.

With one exception, there are no complete theoretical analysis of flexicurity. There exists a large number of studies which consider a subset of the three policy instruments of flexicurity. For instance, unemployment insurance and employment protection have been considered by Pissarides (2001), Baumann and Staehler (2006), Blanchard and Tirole (2008), Algan and Cahuc (2009), Boeri et al. (2012) and many other authors. Most theoretical analyses of active labour market policies also consider unemployment insurance, including Fredriksson and Holmlund (2006) as well as Pavoni and Violante (2007). This brief overview does not do justice to the significant body of contributions investigating the three instruments involved in flexicurity. Yet, no study considers all three instruments together, except Brown et al. (2009). The complementarity of employment protection and unemployment benefit is however not investigated to a full extent in that study.

The present paper complements this literature. To capture interactions and complementarities of the labour market policies at the heart of flexicurity, one needs indeed to analyse all three instruments simultaneously. Andersen and Svarer (2007) remind for instance that low protection and generous unemployment benefits were already in place well before the rise in unemployment in Denmark, following the mid-1970's oil shock. Unemployment started to decrease only after implementation of active labour market policies.

This paper uses the model developed in Davoine and Keuschnigg (2010), which considers firing taxes (as employment protection), unemployment insurance and active labour market policies. In the model, low productivity firms may have to shut down and fire workers. To be hired by high productivity firms, which reduces exposure to unemployment risk, households need to educate, at a cost. Unemployment is due to negative productivity shocks and search frictions. Firing, job search and education are endogenous, following Blanchard and Tirole (2008) for firing decisions, Chetty (2008) for job search decisions and Heathcote et al. (2010) for education decisions.

The resulting model is an extension of Blanchard and Tirole (2008) to search frictions, sector reallocation and endogenous education, which lends itself well to the analysis of the policy instruments involved in flexicurity. Government offers unemployment benefits to the unemployed, financed by labour income taxes and, if any, firing taxes. Unemployed are enrolled in costly active labour market programmes, which help them retrain and find jobs. Each policy instrument comes with a trade-off. High unemployment insurance increases the welfare of the unemployed but reduces the incentive to search for a job. High firing taxes reduce the inflow into unemployment but also reduce the incentive to educate and join safer and productive firms. Large active labour market programmes speed up reallocation but are costly, both for the unemployed and for the state.

The main contribution of the paper is a theoretical, normative rationale for flexicurity. From a modelling standpoint, the paper makes small additions to the model from Davoine and Keuschnigg (2010) for robustness analyses involving sanctions and broader job search options. From a normative standpoint, the main contributions are analytical results which identify when flexicurity is an optimal policy combination, and when it is not. As will be made clear, education behaviour plays a key role. From an empirical standpoint, the paper provides a modest contribution, confronting theoretical predictions to the data.

The paper shows analytically that flexicurity—low firing taxes, high unemployment benefits and large active labour market programmes—is optimal under conditions related to education, job search behaviour and views on inequality. In particular, unemployment insurance and firing taxes are substitutes, while unemployment insurance and active labour market programmes are complements, if education decisions are responsive, activation measures are cost-effective relative to unemployment benefits and aversion for low-end inequality is large. Intuitively, low firing taxes reduce employment protection in risky, low-productivity but free access firms while they increase education efforts to join safer and high-productivity firms. A marginal decrease of employment protection thus allows for a marginal increase of unemployment benefits, as more households join safer firms, which also reduces inequality. Further, cost-effective activation measures reduce aggregate expenditures generated by unemployment benefits, by putting more unemployed people back to work. Flexicurity in this case encourages self-insurance against unemployment risk through education and reduces the net financial burden of public policy, mitigating the moral hazard cost of public unemployment insurance and active labour market programmes.

Absent moral hazard and education decisions, Blanchard and Tirole (2008) show that the optimal level of employment protection via firing taxes is high, as it reduces inflows into unemployment and internalizes a firing externality, the fact that firms ignore unemployment insurance costs in their firing decisions. Flexicurity is never optimal, in that case. With moral hazard and education decisions, I show that flexicurity can be optimal, the self-insurance effect becoming more important than the firing externality.

The paper finds that flexicurity is optimal in some cases, but not always. Analyses in other papers related to flexicurity have also reached case-dependent conclusions. Algan and Cahuc (2009) for instance find that high unemployment insurance and low employment protection is more likely to hold in countries with high civic attitudes, where households are less likely to cheat on unemployment benefits. Using political economy arguments, Boeri et al. (2012) show that this policy combination, high unemployment insurance and low employment protection, is more likely to take place when the education rate is high. Both of these outcomes use different arguments but are consistent with my analysis, as I will discuss later in more detail.

The next section presents the model. Section 3 contains analytical results. An empirical confrontation is provided in Section 4, extensions in Section 5, a discussion of results in Section 6 and a conclusion in Section 7.

2 | MODEL

Policy instruments which are part of flexicurity impact both firm and household decisions. There is indeed evidence that employment protection influences firing decisions by firms (see for instance Boeri & Jimeno, 2005) while unemployment benefits and active labour market policy impact the effort and the success of job search (see respectively, Krueger & Meyer, 2002; Card et al., 2010).

The model is taken from Davoine and Keuschnigg (2010). It builds on Blanchard and Tirole (2008), a one-sector theory with firing decisions, employment protection and unemployment benefits. To capture moral hazard and search frictions, job search decisions are introduced following Chetty (2008). A second sector is added to capture reallocation flows between sectors, which active labour market policies aim to facilitate. Endogenous sector choice will correspond to education decisions, which are modelled as in Heathcote et al. (2010). For comparison purposes, the model stays close to its literature sources and makes the same modelling choices without debating them.

Endogenous firm and household decisions as well as three flexicurity policy instruments create analytical complexity. To maintain tractability, gain insights and obtain analytical results, I strive for model simplicity. Extensions are discussed in Sections 5 and 7.

2.1 | Jobs and firms

There are two types of jobs: jobs for low-skilled workers requiring no education, and jobs for high-skilled workers requiring education. For notational convenience, I collect the first type of jobs into a low-skill sector (with index 1) and the second kind of jobs into a high-skill sector (with index 2).

All firms employ exactly one worker and produce the same composite good, which I take as numeraire. Production is Ricardian, with inelastic labour supply normalized to unity. Because there are no savings and because the analysis in Section 3 will compare steady-state outcomes (comparative statics) with a utilitarian welfare criteria, a static environment is sufficient.

Uncertainty in the economic environment forces some firms to close down. In reality, there are a number of reasons for jobs' and firms' closure, such as obsolete products, unproductive workers-job matches, ageing production processes. In this static, single composite good model where firms have only one worker, I capture uncertainty with productivity shocks following Blanchard and Tirole (2008). There are four phases in the life of a firm. First, an investor decides to create a firm. Second, the firm hires one worker at an agreed wage. Assuming free entry for investors, expected profits are driven down to zero. As we shall see below, this results in equal wages within each sector, w_1 or w_2. Third, the firm learns about its productivity: it draws a productivity shock $x \in [0, \infty)$ from a given distribution with density $g_i(x)$, which depends on sector $i \in \{1, 2\}$. The productivity draw reflects the firm performance relative to the market as well as the quality of the match between the worker and the job: the productivity draw will be low for firms producing goods with quality worse than competitors or for ill-matched workers and jobs, for instance. Because workers in sector 2 are educated the worker-job match is more productive,[1] so the distribution g_2 stochastically dominates[2] the distribution g_1 and wages satisfy $w_2 > w_1$. Four, the firm decides to operate or close down. If its productivity x is high, it can survive and expects a profit $x - w_i$. If it is too low, it will make no profit. The firm has to pay a tax t_s if it decides to downsize, close down and fire the worker.[3]

In that sequence, the wage is set before the realization of the productivity shock, which is mostly consistent with reality. On the one hand, the quality of the match between worker and job can indeed not be fully assessed during recruitment, yet the wage is already defined at that stage. On the other hand, firms are not immune to subsequent negative competition shocks, making their products obsolete.

As will be shown below, high firing taxes reduce firing. The tax thus can be used as employment protection (EP). Note that there are other forms of employment protection in reality, such as notice periods, firing rules and severance payments. These other forms are ignored, to follow Blanchard and Tirole (2008), to identify optimal policy in the absence of waste and for clarity.[4]

Firm owners are risk-neutral and operate a portfolio of firms.[5] Owners start with several firms and pay firing taxes for these firms which need to close down with the profit they make from surviving firms.

2.2 | Labour market

The labour market is imperfect, due to relocation costs, skill mismatch, search and other frictions. Unproductive firms fire their workers, who become unemployed. During unemployment, workers engage in home production[6] h, retrain to acquire missing skills and search for a job. If the retraining and search are successful, they leave unemployment. Otherwise, they remain unemployed. Unemployment is thus due to negative productivity shocks (job destruction) as well as search and retraining frictions.

Two assumptions simplify the analysis. First, I consider the limit case where the support of the distribution of productivity shocks g_2 in the high-skill sector has only one value, x_2^a. Second, workers who lose their job search for new employment in the other sector. The first assumption removes uncertainty in the high-skill sector: as all firms survive, there is no unemployment risk in that sector. The assumption that the low-skill sector is risky, and the high-skill sector safe, is in line with evidence of a negative link between education and unemployment risk (e.g., Dengler et al., 2021; Nickell, 1979; Nunez & Livanos, 2010) and a positive link between workers education and firms survival rates (Mendes et al., 2010). Educated workers lose their job less frequently, and, when fired, take less time to find a new job. There is evidence that the first effect, a lower separation rate, is more important than the second effect, shorter unemployment spells (e.g., Cairo & Cajner, 2018; Mincer, 1991). Figure 1 illustrates for instance the negative link between education and unemployment risk for a selection of four European countries in 2005 and for the average over 15 European countries.[7] The second assumption is consistent with Schumpeterian creative destruction flows (Aghion & Howitt, 1994; Schumpeter, 1942) and active labour market policies in developed countries.[8]

As Chetty (2008), I borrow from Hopenhayn and Nicolini (1997) the modelling of search effort decisions, based on a reduced-form specification. Let $e \in [0,1]$ be the individual retraining and search efforts by unemployed workers.[9] By a suitable normalization and the law of large numbers, e also represents the probability of finding a job in sector 2 after separation from sector 1. The reduced-form specification $\zeta(e)$ captures search effort costs, in utility terms. Utility costs increase with effort but finding a job becomes increasingly difficult, $\zeta' > 0$ and $\zeta'' > 0$. A rapidly increasing function $\zeta(e)$ also captures the difficulty of finding a job due to adverse labour market conditions, such as job rationing (Michaillat, 2012).

Government provides unemployment insurance (UI) benefits b to unemployed workers and enrols them in active labour market programmes (ALMP). These programmes include job search assistance and retraining courses (for an overview, see Card et al., 2010), supporting re-employment over the long run (Lechner et al., 2011).[10] Figure 2 provides an overview of the labour market and reallocation flows.

Let $m \geq 0$ be the amount of active labour market programmes provided to unemployed workers and let the reduced form $\phi(m)$ capture their impact. These programmes increase the likelihood of finding a job, reducing the retraining and search effort cost to $\phi(m)\zeta(e)$, with $\phi(m) \in [0,1]$, $\phi(0) = 1$, $\phi' < 0 < \phi''$: the larger the amount of job search assistance and retraining courses, the more likely to find a job; however, activation programmes become increasingly less efficient.

2.3 | Households

There is a constant mass 1 of households. Households are heterogeneous in their learning capacity. Education is costly but gives direct access to the safe, productive and high paying sector 2.

FIGURE 1 Unemployment rate (per cent) in Europe, 2005. *Source*: Nunez and Livanos (2010).

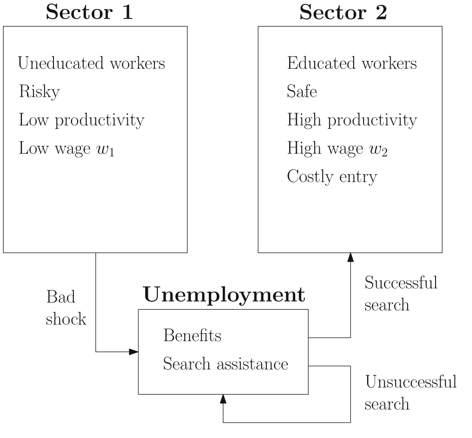

FIGURE 2 Sectors, labour market and reallocation flows.

Endogenous education decisions are made as in Heathcote et al. (2010). Households are arranged by their innate learning ability $n \in [0,1]$, uniformly distributed. Education is a costly process requiring efforts prior to entry in the labour market, in small amount for high ability households and in large amounts for low ability ones.[11] The effort cost $i(n)$ function captures the utility cost of becoming educated, assumed to be continuous and increasing $i' > 0$, with $i(0) = 0$ and $i(n) \to \infty$ for $n \to 1$. Low n indicates low effort cost and high ability. At low ability, efforts cost become very large, reflecting the need of a minimum intellectual capacity for higher education.

The decision to educate or not, equivalently to join sector 2 or sector 1, depends on learning ability, the utility value derived from income in each sector and unemployment risk.

Households are risk averse and, in a static environment, consume their income. With a concave increasing utility function u and labour income tax t_l, the utility after joining sector 2 is

$$V_2 = u((1-t_l)w_2). \tag{1}$$

Given unemployment risk, utility from joining sector 1 is expressed in expected terms:

$$V_1 = (1-s) \cdot u((1-t_l)w_1) + s \cdot u^e, \tag{2}$$

$$u^e = \max_e e \cdot u((1-t_l)w_2) + (1-e) \cdot u(h+b) - \phi(m)\zeta(e).$$

With probability $1-s$, a worker joining sector 1 is hired by a firm having a large survival chance (drawing a large relative productivity shock), in which case the worker keeps its job, earn wages w_1 and pay taxes at rate t_l. With probability s, the worker is hired by a firm with low productivity, which subsequently closes down. In this case, the worker is fired and enjoys expected utility u^e. As seen previously and for a given amount of active labour market programmes m, fired workers spend efforts e at net utility cost $\phi(m)\zeta(e)$ to retrain[12] and find a job in sector 2. By the law of large number and via renormalization, e also represents the probability of finding a job. If unsuccessful, fired workers remain unemployed, consuming welfare benefits b and home production h.

Note that a higher unemployment risk, in the form of a larger separate rate s, reduces the expected utility of joining the sector 1 but leaves the utility of joining the sector 2 untouched, which makes the sector 2 more attractive to a larger group of households. Higher unemployment risk will thus increase the education rate, ceteris paribus. Such a feature of the model is consistent with empirical evidence of higher college enrolment rates during strong unemployment periods (e.g., Betts & McFarland, 1995; Clark, 2011).

2.4 | Government

Taking separation and reallocation flows into account, households can end up in one of three states: employed in sector 1, employed in sector 2 or unemployed. Let N be the fraction of households who decide to educate and δ be the unemployment rate. The respective size of each group is given by

$$L_1 = (1-s)(1-N) \quad L_2 = N + es(1-N) \quad \delta = (1-e)s(1-N). \tag{3}$$

The government provides job search assistance in quantity m at unit cost k to every worker fired from sector 1, and unemployment insurance benefits b to each worker remaining unemployed after job search. It finances expenditures with labour income taxes at rate t_l and firing taxes t_s. Ruling out government debt by imposing balance in the budget, the net fiscal balance satisfies[13]

$$T = t_l w_2 L_2 + t_l w_1 L_1 + t_s s(1-N) - [\delta b + mks(1-N)] = 0. \tag{4}$$

3 | THEORETICAL ANALYSIS

I start with characteristics of equilibria, the response of firms and households to policy changes and continue with properties of optimal policy. I finish with the main theoretical result, an identification of flexicurity as optimal, or non-optimal, policy.

To obtain compact formulas, I use the notation $u_1 \equiv u((1-t_l)w_1)$, $u_h \equiv u(h+b)$ and $u_2 \equiv u((1-t_l)w_2)$. The index refers to the final state of the worker, employed in sector 1, engaged in home production while unemployed or employed in sector 2. Further, I also define $\nabla \equiv (u_1 - u^e)/u_1'$ and $\sigma \equiv g_1(x_1)/(1-s)s$, where $x_i \equiv w_i - t_s$ is a cut-off productivity value to be discussed below. Additional notations capturing elasticities will be presented in due time.

The following technical assumptions provide focus to the analysis. First, the level b of unemployment benefits is low and non-degenerate, in the sense that being hit by the unemployment shock is worse than not being hit by the shock, $u_1 > u^e = e \cdot u_2 + (1-e) \cdot u_h - \phi(m)\zeta(e)$. As a direct consequence, $\nabla > 0$. Second, the distribution of productivity shocks g_1 leads to a moderate separation rate s, such that σ is large enough to have $(1 - t_l - \nabla\sigma) < 0$. As will be shown below, σ measures the responsiveness of firing decisions to the firing tax. The assumption thus ensures some impact of employment protection on firms' firing behaviour.

3.1 | Equilibrium

This section provides basic properties of equilibria, which will be used throughout the theoretical analysis. An equilibrium is defined by households' decisions on education and job search effort to maximize expected life time utility, by firms' decisions on wages and firing to maximize expected profits and by the government to keep its budget balanced. Firing decisions by firms are equivalent to closing decisions. As will be seen below, free entry drives expected firm profits to zero, which will define equilibrium wages. In the model, households' and firms' decisions are endogenous but government policy is exogenous.

3.1.1 | Separation rate

The firm decides to operate if and only if $x - w_i \geq -t_s$. The level $x_i \equiv w_i - t_s$ is the cut-off productivity above which the firm continues to operate and below which it closes down. Clearly policy influences firms' decisions: the higher the firing tax, the lower the rate of firm exits and the flow of workers into unemployment. Given the assumption that productivity in sector 2 can take only one value, separation rates are

$$s \equiv s_1 = \int_0^{x_1} g_1(x)dx, \quad s_2 = 0. \tag{5}$$

3.1.2 | Wages

Taking into account policy on firing, expected profits of a firm in sector $i \in \{1,2\}$ upon entry are

$$\pi_i = \int_{x_i}^{\infty} (x - w_i) g_i(x) dx - s_i t_s = (1 - s_i)\left(x_i^a - w_i\right) - s_i t_s \geqslant 0, \tag{6}$$

where $x_i^a \equiv \int_{x_i}^{\infty} x g_i(x)dx/(1-s_i)$ is the average productivity of surviving firms. Free entry drives expected profits to zero. Given the relative productivity distribution $g_i(x)$ and firing taxes t_s, the sector wage w_i is pinned down by (5) and (6). Since the distribution g_2 stochastically dominates the distribution g_1, wages satisfy $w_2 > w_1$. In the safe sector 2, the wage w_2 simply equals the unique productivity value x_2^a.

3.1.3 | Education

Individuals born with high learning ability (low n) spend low efforts $i(n)$ to educate and join the safe and high paying sector 2. Individuals with low ability (high n) find education efforts too large, will not educate and join the risky and low paying sector 1. In between, there is a household with ability N who is indifferent between the two sectors, satisfying the following condition:

$$V_1 = V_2 - i(N). \tag{7}$$

With a population size normalized to one and uniform distribution of ability n, the quantity N also measures the entry rate into sector 2 (the education rate).

3.1.4 | Aggregates

Since each firm hires exactly one worker, the final number of firms in each sector is given by L_1 and L_2. Given the Ricardian production technology, inelastic labour supply and average productivities x_i^a, the total market production in each sector and gross domestic product are respectively,

$$X_1 = x_1^a L_1, \quad X_2 = x_2^a L_2, \quad X = X_1 + X_2. \tag{8}$$

3.2 | Policy response

In this section, I investigate the impact of policy reforms on the behaviour of firms, the behaviour of households and the budget of the government. These investigations are confronted with intuition and provide elementary results for the analysis of optimal welfare policies, to be considered in subsequent sections. In particular, the section shows that employment protection impacts education decisions and can be used to regulate self-insurance against unemployment risk, which will play a role in flexicurity arrangements.

3.2.1 | Firms behaviour

The only uncertainty lies in sector 1 and the only decision by firms is firing: firms may close down and fire their workers if their productivity level is too low.

Using (5) and (6), the sensitivity of profit to the cut-off productivity x_1 is given by $d\pi_1/dx_1 = -(x_1 - w_1 + t_s)g_1(x_1)$. By the envelope theorem, $d\pi_1/dw_1 = -(1-s)$ and $d\pi_1/dt_s = -s$. Combining, the sensitivity to policy of the equilibrium wage w_1 and the separation rate s, characterizing firing decisions, is given by

$$\frac{dw_1}{dt_s} = -\frac{s}{1-s}, \quad \frac{ds}{dt_s} = -\sigma s, \quad \sigma = \frac{g_1(x_1)}{(1-s)s}. \tag{9}$$

As expected, a larger firing tax t_s reduces the separation rate. Because more unproductive jobs are kept alive with a larger tax, the average productivity in sector 1 is lower. Free entry and zero expected profits then require a lower equilibrium wage.

3.2.2 | Household behaviour

In our static and inelastic labour supply framework, households take only two decisions: education and, if unemployed, search efforts. I characterize search efforts decisions first.

If unemployed, workers choose search efforts to maximize the likelihood of finding a job in the safe sector, taking into account the effort cost of searching, the support m from active labour market programmes and the value of unemployment benefits b. Formally, they choose effort e to maximize expected utility u^e, defined in (2). Differentiating and equating to zero, job search efforts satisfy

$$\phi(m)\zeta'(e) = u((1-t_l)w_2) - u(h+b). \tag{10}$$

Total differentiation then characterizes search response to policy changes,

$$de = -\varepsilon_w w_2 e \cdot dt_l - \varepsilon_b (1-e) \cdot db + \varepsilon_m \cdot dm, \tag{11}$$

where

$$\varepsilon_w \equiv \frac{u_2'}{e\phi\zeta''} > 0, \quad \varepsilon_b \equiv \frac{u_h'}{(1-e)\phi\zeta''} > 0, \quad \varepsilon_m \equiv -\frac{\phi'\zeta'}{\phi\zeta''} > 0.$$

Elasticity parameters ε_i capture the strength of the search response to policy changes. For instance, when unemployment benefits b are small and increased, by concavity of the utility function u, the elasticity ε_b is large and the search response e drops much.

I continue with education decisions, characterized by the fraction N of households who choose to become educated. The result is collected in the following:

Lemma 1. (Education response). *The response of education decisions to all policy changes is unambiguous*:

$$dN = \eta_1 w_1 (1-s)(1-N)dt_l - \eta_2 w_2 (1-es)dt_l + \eta_h (1-e)s(1-N)db + \eta_s s(1-N)dt_s \\ - \eta_m s(1-N)dm, \tag{12}$$

where dN captures education variations, dt_l changes in the labour income tax rate, db changes in unemployment benefits, dt_s changes in the firing tax rate and dm changes *in the amount of active labour market programmes, and where the following notation is introduced:*

$$\eta_1 \equiv \frac{u_1^{'}}{(1-N)i^{'}} > 0, \quad \eta_2 \equiv \frac{u_2^{'}}{Ni^{'}} > 0, \quad \eta_h \equiv -\frac{u_h^{'}}{(1-N)i^{'}} < 0,$$

$$\eta_s \equiv (1-t_l-\nabla\sigma)\eta_1 < 0, \quad \eta_m \equiv \frac{-\phi^{'}\zeta}{(1-N)i^{'}} > 0.$$

Proof. The fraction N is defined by $i(N) = V_2 - V_1$, as per (7). Total differentiation of (2) provides the variation of expected utility V_1 with policy changes,

$$du^e = -u_2^{'}w_2 e dt_l + u_h^{'}(1-e)db + \left[-\phi^{'}\zeta\right]dm,$$

$$dV_1 = u_h^{'}(1-e)sdb - u_2^{'}w_2 esdt_l + \left[-\phi^{'}\zeta\right]sdm - u_1^{'}w_1(1-s)dt_l - (1-t_l-\nabla\sigma)u_1^{'}sdt_s.$$

Total differentiation of $i(N) = V_2 - V_1$ then leads to (12). The sign of η_s follows from the technical assumption $(1-t_l-\nabla\sigma) < 0$. ∎

The new variables η_1, η_2, η_h, η_s and η_m introduced in the lemma capture the response of education decisions to policy changes. Whether education increases or decreases after a change in firing taxes dt_s, for instance, is given by the sign of η_s.

The result conforms with intuition, in a ceteris paribus mode. Higher unemployment benefits $db > 0$ reduce the loss due to sector 1 separation, so decreases education efforts. Higher employment protection $dt_s > 0$ reduce the incentive to educate, because the separation rate and thus the unemployment risk in sector 1 are reduced.[14] Active labour market programmes $dm > 0$ reduce education efforts, since these programmes reduce the likelihood of remaining unemployed in case of a sector 1 separation.

Lemma 1 is also consistent with theoretical studies showing that unemployment insurance decrease education efforts if the main beneficiaries of insurance are uneducated workers (Dellas, 1997) while employment protection has negative impacts on education incentives in numerical analyses (Charlot & Malherbet, 2013).

The lemma exhibits a third channel through which employment protection influences economic equilibrium, a small contribution to the literature: next to firing and job creation, employment protection also influences incentives to educate, a self-insurance mechanism against unemployment risk. As will be discussed in subsequent sections, this self-insurance mechanism plays a key role in the setup of flexicurity policy arrangements: lower employment protection is one way to stimulate education incentives and thus self-insurance.

3.2.3 | Fiscal impacts

Labour markets and the fiscal balance (4) are impacted by education decisions dN, firing (separation) decisions ds and job search decisions de. Effective tax rates τ^N, τ^S and τ^E for each margin capture the influence of behaviour on *net* tax revenue,

$$dT = (N + es(1-N))w_2 dt_l + (1-s)(1-N)\cdot w_1 dt_l + (1-t_l)s(1-N)\cdot dt_s - (1-e)s(1-N)\cdot db \\ - ks(1-N)\cdot dm + \tau^N \cdot dN + \tau^S \cdot (1-N)ds + \tau^E \cdot s(1-N)de, \tag{13}$$

where

$$\tau^E \equiv t_l w_2 + b, \quad \tau^S \equiv t_s + [e t_l w_2 - (1-e)b] - km - t_l w_1, \quad \tau^N \equiv t_l w_2 - t_l w_1 - s\tau^S.$$

τ^E represents the effective tax rate on labour market participation, τ^S the effective tax rate on firing and τ^N the effective tax rate on sector 2 entry. For every unemployed person who finds a new job, there is a fiscal gain τ^E, summing up extra revenue $t_l w_2$ and spared unemployment benefits b. The fiscal impact of job separation τ^S sums up the firing tax t_s paid by firms and the average tax revenue gain from separation $e t_l w_2 - t_l w_1$ minus the unemployment insurance spending $(1-e)b$ and active labour market policy spending km. Net tax revenue rises by τ^N for each additional person who educates, adding the differences in workers' tax bills $t_l w_2 - t_l w_1$ across sectors and removing the average tax revenue τ^S from firing, which occurs with probability s.

3.3 | Welfare maximization

This section derives some properties of welfare maximizing policy and builds useful intuition to understand the main theoretical result of the paper, which will be provided in Section 3.4. Thanks to the properties presented here, links with the existing literature can also be established. The section investigates in particular the gains that can be derived from active labour market policies when unemployment benefits are large, typical of flexicurity arrangements. It also exhibits the moral hazard associated with unemployment insurance, which plays a role in any optimal welfare policy, including flexicurity.

Throughout the paper, I use a utilitarian welfare criteria. Because of free entry, firms make no profit so the social welfare function restricts to welfare V_i of entrants in sector i and the cost of entry in sector 2:

$$V = (1-N)\cdot V_1 + N \cdot V_2 - \int_0^N i(n)dn. \tag{14}$$

The following technical characterization helps analyse optimal policy:

Lemma 2. (Optimality conditions). *The policy which maximizes utilitarian welfare V defined in (14) and satisfies the government budget constraint defined in (4) verifies:*

$$dV/db = \left[u_h' - \left(1 - \tau^N \eta_h + \tau^E \varepsilon_b\right)\lambda\right](1-e)s(1-N) = 0,$$

$$dV/dt_s = -\left[(1 - t_l - \nabla\sigma)u_1' - \left(1 - t_l - \tau^S \sigma + \tau^N \eta_s\right)\lambda\right]s(1-N) = 0,$$

$$dV/dm = \left[-\phi'\zeta - \left(k + \tau^N \eta_m - \tau^E \varepsilon_m\right)\lambda\right]s(1-N) = 0,$$

where λ is the Lagrange multiplier related to the fiscal constraint, the effective tax rates τ^N, τ^E and τ^S are defined in (13), the education response variables η_h, η_s and η_m are defined in (12) and the search response variables ε_b and ε_m are defined in (11).

Proof. Welfare maximization with the government budget constraint implies $dV=(1-N)dV_1+NdV_2+\lambda dT=0$. By (11), $de/dt_s=0$ and $de/dt=-\varepsilon_w w_2 e$, $de/db=-\varepsilon_b(1-e)$ and $de/dm=\varepsilon_m$. By (9), $ds/dt=ds/dm=ds/b=0$ and $ds/dt_s=-\sigma s$. Using computations in the proof of Lemma 1, (9), (11)–(13),

$$\begin{aligned}\frac{dV}{db}&=(1-N)\frac{d}{db}V_1+N\frac{d}{db}V_2+\lambda\frac{d}{db}T\\&=(1-N)\left(u_h^{'}(1-e)s\right)+0+\lambda\left(-\left(1+\tau^N\eta_h+\tau^E\varepsilon_b\right)(1-e)s(1-N)\right)\\&=\left[u_h^{'}-\left(1+\tau^N\eta_h+\tau^E\varepsilon_b\right)\lambda\right](1-e)s(1-N).\end{aligned}$$

Expressions for dV/dt_s and dV/dm are obtained in a similar fashion. ■

Several properties of optimal policy can be derived from Lemma 2, including moral hazard limitations. These properties and related economic intuition are compiled in the following proposition and its subsequent discussion:

Proposition 1. (Optimal policy characteristics). *The social welfare maximizing policies have the following properties*:

a. *Unemployment insurance is limited*:

$$\frac{u_1^{'}}{u_h^{'}}=\frac{1}{1+\tau^E\varepsilon_b}<1,\quad u_1>u_h.$$

b. *Employment protection t_s partially internalizes firing cost externalities*:

$$t_s=t_l w_1+[(1-e)b-t_l w_2 e]+km+\nabla.$$

c. *Optimal active labour market policies m depend on costs and search behaviour*:

$$\frac{du^e/dm}{du_1/dc_1}=\frac{-\phi^{'}\zeta}{u_1^{'}}=k-\tau^E\varepsilon_m,$$

where the effective tax rate τ^E is defined in (13) and the search response variables ε_b and ε_m are defined in (11).

Proof. Consequences from the first order conditions in Lemma 2. Details are contained in Online Appendix A. ■

I discuss each part of the proposition in turn.

Part (a) of the proposition illustrates the moral hazard cost of unemployment insurance. The less elastic job search efforts are (the closer to zero the ε-elasticities), the smaller the moral hazard cost, the closer insurance is to full consumption smoothing ($u_1 = u_h$) between workers in the good state (sector 1 workers not hit by the unemployment shock) and the bad state (sector 1 workers hit by the shock). Low public finance costs of insurance (low tax revenue losses and unemployment benefits, $\tau^E = t_l w_2 + b$) also push towards full consumption smoothing.

Part (b) of the proposition shows that using a firing tax as employment protection is optimal, as it internalizes negative firing externalities. It plays the same role as in Baumann and Staehler (2006), as well as in Blanchard and Tirole (2008). Firms who fire a worker create a fiscal externality, as there is one person less paying taxes $t_l w_1$, one person more who collects an average net benefit $(1-e)b - t_l w_2 e$ and extra spending km on active labour market policies. Firing also creates a utility loss $\nabla = (u_1 - u^e)/u_1'$, expressed in income equivalent terms. All these externalities justify the use of a firing tax. Note that the externalities are only partially internalized through the firing tax, as labour tax revenues from successfully re-employed workers ($t_l w_2 e$) also contribute to the financing of unemployment insurance ($(1-e)b$) and active labour market policies (km).

Note also that part (a) and part (b) generalize the optimality results[15] from Blanchard and Tirole (2008) to the case of moral hazard. Indeed, in the special case of a single sector 1 ($N = 0$), no moral hazard ($\varepsilon_b = 0$) nor reallocation ($e = 0$) and no active labour market policies ($m = 0$), full insurance is optimal ($h + b = (1 - t_l)w_1$) and it is financed by firing taxes only ($t_l = 0$).

Finally, part (c) of the proposition shows that active labour market optimal policy also depends on other policies. The leftmost part of the optimality conditions represents the marginal welfare benefit of the policy m, measuring expected welfare utility gains of a fired worker relative to a retained worker. The optimality condition equates the marginal welfare benefit of the policy, on the left, with its marginal cost, on the right. Larger unemployment benefits b increase the participation tax $\tau^E = t_l w_2 + b$ and thus decrease the net marginal cost of active labour market policy: every person put back to work thanks to spending m saves costs b and brings revenue $t_l w_2$. The larger the unemployment insurance benefits, the more attractive active labour market programmes, typical of flexicurity arrangements. This can explain why flexicurity measures were first introduced by Northern European countries in the 1990's, who started with high unemployment benefits levels and subsequently introduced large-scale activation measures. In the next subsection, I will perform a formal analysis of the complementarity of all the policy instruments which are part of flexicurity.

3.4 | Flexicurity as optimal policy

This section contains the main analytical result of the paper. I show that flexicurity is the optimal policy combination under certain circumstances, providing criteria which separate cases where flexicurity is optimal from cases where it is not.

There is no formal definition of flexicurity. The common understanding is provided in relative terms: flexicurity is a combination which exploits policy complementarity. In its policy discussion sense and its etymological basis, flexicurity compensates workers for the loss generated by low employment protection (flexibility) with generous insurance and assistance programmes (security): security is provided in *exchange* for flexibility.

I therefore analyse complementarity of the three instruments of flexicurity in welfare maximization. Flexicurity (or flexicurity arrangements) correspond to the case of job protection and unemployment insurance being substitutes; job protection and activation measures being substitutes; while unemployment insurance and activation measures are complements. Formally, two policy instruments x and y are complements if $\frac{d}{dy}\frac{d}{dx}V > 0$ and substitutes in the alternative case.[16]

I provide three preliminary results to characterize policy complementarities, discuss each of them and conclude with a general result.[17]

3.4.1 | Unemployment insurance and active labour market programmes

Complementarity of unemployment benefits b and activation measures m is characterized by:

Lemma 3. *At the optimum maximizing welfare V,*

$$sign\left(\frac{d}{dm}\frac{d}{db}V\right) = sign\left(\frac{\varepsilon_b \tau^E}{(1-e)\phi}\frac{1}{\zeta_B}\phi' - \eta_h s\left(\varepsilon_m \tau^E - k\right)\right),$$

where the effective tax rate τ^E is defined in (13), the education response variable η_h is defined in (12) and the search response variables ε_b and ε_m are defined in (11).

Proof. At the optimum and using Lemma 2, $\frac{d}{db}V = \left[u_h' - (1-\tau^N\eta_h + \tau^E\varepsilon_b)\lambda\right]\,(1-e)s(1-N) = 0$, so $\frac{d}{dm}\frac{d}{db}V = (1-e)s(1-N)\frac{d}{dm}\left[u_h' - (1-\tau^N\eta_h + \tau^E\varepsilon_b)\lambda\right]$. The sign of $\frac{d}{dm}\frac{d}{db}V$ is thus equal to the sign of $\frac{d}{dm}\left[u_h' - (1-\tau^N\eta_h + \tau^E\varepsilon_b)\lambda\right]$. Differentiation, substitutions and simplification, using the fact that $\lambda > 0$, lead to the expression given in the lemma. ■

The following corollary considers a case where unemployment insurance and active labour market programmes are complements and when they are substitutes. Alternative, interesting cases appear when the model is extended (see Section 5).

Corollary 1. *Consider a country where the education response to unemployment benefits is large ($|\eta_h|$ is large). Then at the optimum maximizing welfare V:*

a. *If activation measures are cost-effective relative to unemployment benefits (k small and b large):*

$$\frac{d}{dm}\frac{d}{db}V > 0.$$

b. *If activation measures are not cost-effective relative to unemployment benefits (k large and b small):*

$$\frac{d}{dm}\frac{d}{db}V < 0.$$

Proof. In part (a), when activation measures are cost-effective or unemployment benefits are large, $\varepsilon_m \tau^E - k > 0$, given $\tau^E = t_l w_2 + b$. With a large $|\eta_h|$, $\eta_h < 0$, the sign of $\frac{d}{dm}\frac{d}{db}V$ is positive, by the lemma. In part (b), $\varepsilon_m \tau^E - k < 0$. ∎

The intuition for the corollary is the following. If unemployment benefits and the education response are large, many households avoid the costly entry into the safe sector 2: choosing the easy-access but risky sector 1 is attractive, as generous benefits are provided in case of unemployment. The quantity $\varepsilon_m \tau^E - k$ represents the marginal gain of one more unit of activation measures, taking tax gains of re-employment into account. When this marginal gain is positive, strong activation measures complements large unemployment benefits: putting more people back to work with large assistance helps reduce the aggregate costs of high unemployment benefits.

For this aggregate expenditures reason, flexicurity is more likely to be optimal in large continental European welfare states, where unemployment benefits are high and long-term unemployment prevalent, than Anglo-Saxon welfare states, where benefits are low and unemployment spells short.

The next corollary investigates the role of job search frictions in flexicurity arrangements.

Corollary 2. *Consider a country where job search frictions are large, so that the difficulty of finding a job increases fast* (ζ_B *is large*). *Then at the optimum maximizing welfare* V:

a. *If activation measures are cost-effective relative to unemployment benefits* (k *small and* b *large*):

$$\frac{d}{dm}\frac{d}{db}V > 0.$$

b. *If activation measures are not cost-effective relative to unemployment benefits* (k *large and* b *small*):

$$\frac{d}{dm}\frac{d}{db}V < 0.$$

Proof. When ζ_B is large, job search frictions are large, as the utility costs for job search $\zeta(e) = \zeta_A + (\zeta_C - \zeta_A)e^{-\zeta_B(1-e)}$ and thus the difficulty of finding a job increase rapidly, given $\zeta' = \zeta_B(\zeta - \zeta_A)$ and $\zeta'' = \zeta_B^2(\zeta - \zeta_A)$. Then, the sign of $\frac{d}{dm}\frac{d}{db}V$ is defined by the sign of the second term from Lemma 3. The rest follows the proof for Corollary 1. ∎

The intuition for this corollary is the same as for Corollary 1, except for the reasons behind the large number of unemployed workers. With Corollary 1, there are many unemployed workers because education decisions are very sensitive to unemployment benefits ($|\eta_h|$ large), so generous unemployment benefits attract many households to the risky sector 1. With

Corollary 2, there are many unemployed workers because search frictions are large and it is difficult to find a job. In both cases, putting more people back to work with large assistance helps to reduce aggregate expenditures for unemployment benefits, when activation measures are cost-effective.

As a consequence, flexicurity policy arrangements, with generous unemployment benefits and strong active labour market programmes, are more likely to help when job search frictions are large.

3.4.2 | Unemployment insurance and employment protection

Substitutability of optimal unemployment benefits b and firing taxes t_s is characterized by:

Lemma 4. *At the optimum maximizing welfare V,*

$$sign\left(\frac{d}{dt_s}\frac{d}{db}V\right)=sign(\eta_s),$$

where the education response variable η_s is defined in (12).

Proof. Similar to the proof of Lemma 3, $\frac{d}{dt_s}\frac{d}{db}V$ has the sign of $(1-e)s(1-N)$ $\frac{d}{dt_s}\left[u_h'+\lambda\tau^N\eta_h-\lambda\tau^E\varepsilon_b\right]$. In the first order condition $\frac{d}{db}V=u_h'-(1-\tau^N\eta_h+\tau^E\varepsilon_b)\lambda=0$ in Lemma 2, u_h' represents the marginal gain of one extra unit of unemployment insurance and $-(1-\tau^N\eta_h+\tau^E\varepsilon_b)$ its marginal public finance cost. As the former is positive and the latter negative, $\lambda>0$. Since $\frac{d}{dt_s}u_h'=\frac{d}{dt_s}\tau^E=\frac{d}{dt_s}\varepsilon_b=0$, the sign of $\frac{d}{dt_s}\frac{d}{db}V$ equals the sign of $\frac{d}{dt_s}[\tau^N\eta_h]$, a derivative which, after algebraic manipulation, is shown to equal $-\eta_h s(1-t-\sigma\tau^S)$. From the first and second conditions from Lemma 2 follows that $1-t-\tau^S\sigma$ and $1-t-\nabla\sigma$ have the same sign. Then $\eta_s=(1-t-\nabla\sigma)\eta_1$ and $\eta_1>0$ imply that $-\eta_h s(1-t-\sigma\tau^S)$ has the same sign as $-\eta_h s\eta_s$. Noting that $\eta_h<0$ concludes. ■

I discuss complementarity of insurance and protection in two noteworthy cases.

First, when education is exogenous ($dN=\eta_s=0$), optimal unemployment insurance and optimal employment protection are independent, $\frac{d}{dt_s}\frac{d}{db}V=0$. The sequencing of events provides the intuition in this case. Households only choose search efforts, which take place after firing. Whether employment protection is high or low, whether the flow into unemployment is low or large, public insurance impacts search efforts of *each* unemployed the same way. Protection regulates the flow into the bad state (unemployment) and insurance the flow out of the bad state (into re-employment), independently. In contrast, when education is endogenous, the household choice of sector is jointly impacted by the likelihood of entering the bad state if sector 1 is chosen (regulated by employment protection) and by the comfort in this state (impacted by unemployment insurance).

Second, when education is endogenous ($\eta_s<0$), unemployment insurance and employment protection are substitutes, $\frac{d}{dt_s}\frac{d}{db}V<0$. As the discussion of Lemma 1 made clear, low employment protection invites increased self-insurance against the unemployment risk through education. The idea is thus to reduce employment protection to attract more people into the costly but safe, educated and productive sector, curbing inflows into unemployment and allowing higher welfare, through unemployment insurance, for workers remaining in the bad state. Low employment protection can be used to reduce the moral hazard cost of high public insurance: a marginal decrease of employment protection allows for a marginal increase of unemployment benefits, as more households join the safe sector.[18]

3.4.3 | Active labour market programmes and employment protection

Substitutability of activation measures m and firing taxes t_s is characterized by:

Lemma 5. *At the optimum maximizing welfare V,*

$$sign\left(\frac{d}{dt_s}\frac{d}{dm}V\right) = sign(\eta_m \eta_s),$$

where the education response variables η_m and η_s are defined in (12).

Proof. Following the same steps as in the proof of Lemma 4, one has that $\frac{d}{dt_s}\frac{d}{dm}V$ has the sign of $\eta_m s(1 - t_l - \sigma\tau^S)$. Noting that $1 - t - \tau^S\sigma$ and $1 - t - \nabla\sigma$ have the same sign, that $\eta_s = (1 - t - \nabla\sigma)\eta_1$ and that $\eta_1 > 0$ concludes. ∎

Consider the case of endogenous education ($\eta_s < 0$ and $\eta_m > 0$). Then optimal employment protection and activation measures are substitutes, $\frac{d}{dt_s}\frac{d}{dm}V < 0$.

The intuition is similar to the endogenous education case in Lemma 4. Activation measures generate a similar moral hazard effect as unemployment insurance. Low employment protection encourages higher entry into the costly but safe sector as self-insurance against unemployment risk, reducing the moral hazard cost of activation measures and allowing to provide more assistance.

3.4.4 | All three instruments

Building on Lemmas 3–5 and subsequent discussions, one obtains the following characterization of optimal policy with considerations on inequality and the role of the state:

Proposition 2. (Optimal policy). *When education is responsive to labour market policies ($|\eta_h|$ is large) or job search frictions are large (ζ_B is large), and when active labour market programmes are cost-effective relative to unemployment insurance (k is small, relative to b), the labour market policy maximizing welfare V has the following characteristics*:

a. *Unemployment benefits b and active labour market programmes m are complements, to which employment protection (firing taxes t_s) is a substitute*:

$$\frac{d}{dm}\frac{d}{db}V > 0, \quad \frac{d}{dt_s}\frac{d}{db}V < 0, \quad \frac{d}{dt_s}\frac{d}{dm}V < 0.$$

b. *If aversion for low-end inequality is large, the optimal policy corresponds to flexicurity (with large unemployment benefits b, large active labour market programmes m and small firing taxes t_s).*
c. *If aversion for state benefits is large, the policy associates low unemployment benefits b and small active labour market programmes m to a high level of employment protection t_s.*

Proof. Part (a) is a corollary of Lemmas 3–5. Aversion for low-end inequality can be captured by changing households expected utility to $V_i - A \cdot I((1-t_1)w_1 - (h+b))$, where A represents the strength of inequality aversion and the function $I \geq 0$ is increasing. The social welfare function then becomes $V(1-N) \cdot V_1 + N \cdot V_2 - \int_0^N i(n)dn - AI$. Optimality conditions are adjusted accordingly. In particular, $dV/db = \left[u_h^{'} - (1-\tau^N \eta_h + \tau^E \varepsilon_b)\lambda\right] \quad (1-e)s(1-N) = 0$ in Lemma 2 becomes $dV/db = \left[u_h^{'} - (1-\tau^N \eta_h + \tau^E \varepsilon_b)\lambda\right](1-e) \quad s(1-N) + AI^{'} = 0$. Adjustments carry through Lemmas 3–5 without changing qualitative outcomes. Adjustments to part (a) of Proposition 1 on the other hand lead to convergence of u_1 and u_h when inequality aversion A becomes large, which requires high and increasing unemployment benefits. Adding part (a) proves part (b). Part (c) is proved in a similar fashion. Details are contained in Online Appendix F. ■

I conclude with four observations. First, Proposition 2 shows that flexicurity may or may not be the optimal welfare policy, when its conditions are satisfied. The only certainties are the complementarity of unemployment benefits and active labour market programmes (either both large or both small) and the substitutability of employment protection (low if unemployment benefits and active labour market programmes are large, or vice-versa).

Second, assume that unemployment benefits are set at a high level because of strong aversion for low-end inequality. Then flexicurity is the optimal welfare policy when conditions of Proposition 2 are satisfied, as part (b) applies. Assume on the other hand that households are reluctant to count on state support in case of hardship. Then arrangements opposite to flexicurity are optimal, as per part (c) of the proposition. Part (b) of the proposition also holds if there are other reasons than inequality aversion for unemployment benefits to be large, without influencing active labour market policies nor employment protection.

Third, conditions in Proposition 2 are sufficient but not necessary. There can be other cases where the optimal policy is flexicurity, even if active labour market programmes are not cost-effective (k is large relative to b), but when they have a sanction component. Section 5 and Online Appendix C provide details.

Fourth, endogenous education is key for the result, as the discussion of the self-insurance channel through education in Lemma 4 makes clear: low protection of jobs in the risky sector invites for more self-insurance against the unemployment risk through costly education, giving access to the safe sector and mitigating the moral hazard cost of public insurance. As discussed above, optimal employment protection is independent of both optimal insurance and optimal activation measures with exogenous education, which is far from the idea of policy complementarity at the heart of flexicurity.

4 | ELEMENTARY EMPIRICAL ANALYSIS

The elementary empirical analysis confronts two theoretical predictions to the data. On its own, the analysis is a modest contribution to the empirical literature, extending results from Boeri et al. (2012). At the country level, that study documents a negative link between education rates and employment protection and a positive link between education rates and the sum of expenditures on unemployment insurance and active labour market policies. The small extension presented here documents a positive link between education rates and expenditures on unemployment insurance, as well as a positive link between education rates and expenditures on active labour market policies.[19] This section provides first a summary of analytical results, as preparation for the confrontation.

4.1 | Summary of analytical results

The main results from the theoretical analysis in Section 3 are the following. First, flexicurity is the optimal welfare policy from a normative standpoint in some cases, and it is not in other cases (Lemmas 3–5). Second, the optimal levels of unemployment insurance and employment protection are unrelated, which is inconsistent with the substitutability and complementarity mechanisms at the heart of flexicurity, when education decisions are not influenced by unemployment insurance, employment protection nor active labour market policies (Lemma 4). Third, the optimal level of unemployment insurance is below full-insurance and the optimal level of employment protection only partially internalizes the firing externality, due to firms ignoring the impact of their firing decisions on public finances and the wider economy (Proposition 1a,b). Fourth, although high levels of employment protection reduce the inflow into unemployment, a ceteris paribus welfare gain, and can fully internalize the firing externality in the absence of moral hazard and education responses (Proposition 1b), high levels of employment protection are suboptimal when certain conditions are met (Proposition 2). Fifth, active labour market policies are more attractive when unemployment benefits are high (Proposition 1c).

The sixth and last result is the most important, as it provides sufficient (but not necessary) conditions for flexicurity policies to be optimal: when aversion for low-end inequality is large, education is responsive to the flexicurity policy instruments and active labour market policies are cost effective relative to unemployment insurance, flexicurity is the optimal welfare policy (Proposition 2).

Education decisions, the firing externality and moral hazard associated with various labour market policies all play a role in these results. Absent education decisions and moral hazard and consistent with Blanchard and Tirole (2008), employment protection should be high enough to fully internalize the firing externality, leading to full unemployment insurance. With education decisions and moral hazard however, employment protection is confronted to a trade-off between the internalization of the firing externality and the self-insurance effect of education efforts. Because education gives access to safer and more productive sectors, it reduces the unemployment risk. Education is however costly. Ceteris paribus, high employment protection reduces the incentive for the costly education efforts, as it reduces the unemployment risk in the risky sectors, accessible without education. Low employment protection on the other hand is an incentive for self-insurance against unemployment risks through education, mitigating the moral hazard cost of unemployment insurance and active labour market policies, which can be provided to a larger extent.

4.2 | Empirical support

To assess the empirical relevance of the theory presented in Section 2, I confront two theoretical predictions resulting from Section 3 to the data.

As noted in the summary Section 4.1, flexicurity policies may or may not be optimal in the normative framework presented here. In that framework, flexicurity is the optimal welfare policy for instance when aversion for low-end inequality is large, education is responsive to labour market policy and active labour market policies are cost effective relative to unemployment insurance. Because generous unemployment benefits make the last condition more likely to hold, flexicurity is more likely to be optimal in large welfare states, which are more prominent in continental Europe than other OECD countries. The first theoretical prediction is thus that flexicurity arrangements are more likely to be witnessed in continental Europe than in other OECD countries.

Flexicurity arrangements are characterized by a negative relationship between employment protection and unemployment insurance, a negative relationship between employment protection and active labour market policies and a positive relationship between unemployment insurance and active labour market policies. Figure 3, which displays pairwise relationships in 2010 for OECD countries, provides support for the theoretical prediction.[20] It shows indeed that labour market policies in continental Europe (bottom part of the figure) had a pattern consistent with flexicurity arrangements, the R^2 coefficients indicating a negative relationship between employment protection and unemployment insurance, a negative relationship between employment protection and active labour market policies as well as a robust positive relationship between unemployment insurance and active labour market policies. By contrast, the slopes and R^2 coefficients for the entire set of OECD countries (top part of the figure) show no clear relationships (if not a positive relationship) between employment protection and unemployment insurance respectively active labour market policies. As shown in Online Appendix G, similar patterns hold for other periods between 1990 and 2005.

The second theoretical prediction is that the ratio of unemployment benefits to employment protection indices, as well as the ratio of spending on active labour market programmes to employment protection indices, are larger in countries with high education rates. As reminded in the summary Section 4.1, flexicurity arrangements, with large unemployment insurance, large active labour market programmes and low employment protection, are more likely to be optimal if education is a self-insurance mechanism against unemployment risk. By contrast, the optimal levels of employment protection and unemployment insurance are independent if education decisions are not responsive, in my theory. As long as governments are able to identify and implement optimal welfare arrangements at least to some degree, a high unemployment insurance to employment protection ratio (resp. active labour market programmes to employment protection ratio) is thus more likely to be part of policy in countries where education is responsive. Because the responsiveness of education decisions is not easy to observe, I use education rates as a proxy. If, for instance, poor education infrastructure is a reason for low education rates and sluggish education responses to changes in economic circumstances, the education rate is a good proxy for education responsiveness. Summing up, the theory predicts that unemployment benefits/employment protection and active labour market policies/employment protection ratios are larger in countries with larger education rates.

Boeri et al. (2012) provide an empirical analysis which serves as a first test of this theoretical prediction. They consider the ratio of total expenditures related to unemployment, which adds unemployment insurance to active labour market programmes spending, over an employment protection index. Using an unbalanced panel for OECD countries between 1985 and 2000, they

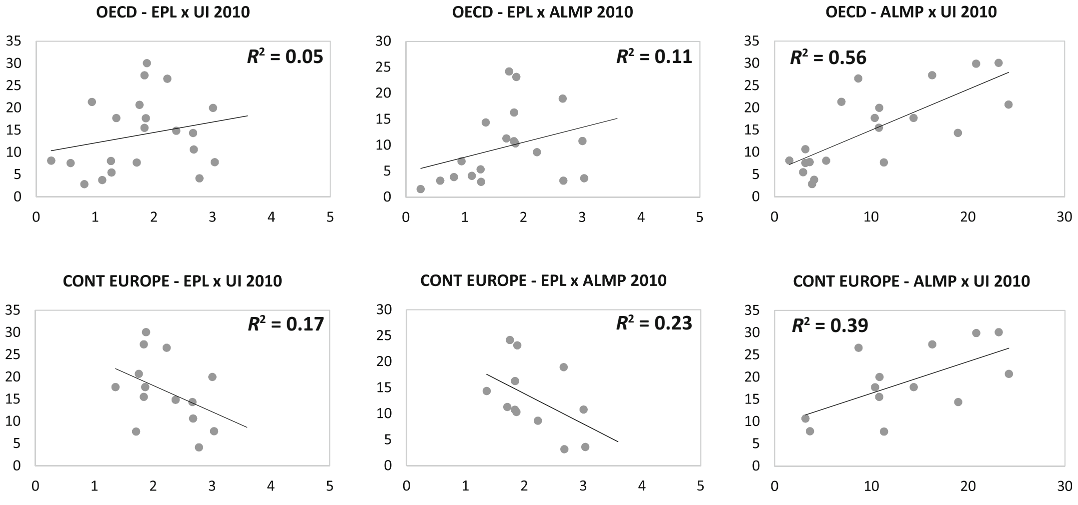

FIGURE 3 Labour market policy relationships, OECD and continental Europe, 2010. *Source*: OECD (Employment Protection Database, Labour Market Programmes).

regress the ratio over the fraction of the population with low education and a number of control variables. They find that the ratio is negatively correlated with the low education variable. In other words, the ratio is higher in countries with large education rates. This empirical finding is consistent with my theoretical prediction. The ratio they consider however sums up the two ratios involved in my theoretical prediction. It could thus be that the theoretical prediction only holds for one of the two ratios, unemployment benefits/employment protection, or active labour market policies/employment protection, but not both.

To verify that the prediction holds for both ratios, I thus perform a small extension of the empirical analysis from Boeri et al. (2012). That extension consists in splitting their ratio in two. Instead of one, I then perform two regressions: once the ratio of unemployment expenditures over the employment protection index is regressed over the education rate and the same control variables; another time it is the ratio of active labour market programme expenditures over the employment protection index. Thanks to new data releases, I can also perform the empirical analysis over a longer time range, from 1985 to 2010. For an immediate interpretation of results and for data reasons, I use the fraction of the population with a high education as independent variable, rather than the fraction of the population with a low education. For comparison purposes, the reminder of the econometric specifications, control variables and data sources are used as in Boeri et al. (2012). Details can be found in Online Appendix G.

The outcome of the regressions, using the same three specifications as in Boeri et al. (2012), is provided in Table 1.

The coefficients for the HIEDU variable are those of interest. The variable is the fraction of the population with a high education. As shown in the table, all these coefficients are positive and statistically significant at the 1 per cent confidence level. The other coefficients are consistent with the analysis of Boeri et al. (2012). The table thus provides empirical evidence that high unemployment insurance over employment protection ratios, as well as high active labour market policies over employment protection ratios, are more frequent in OECD countries with high education rates. This empirical finding provides support for the second theoretical prediction of my normative framework.

TABLE 1 Estimating UI, ALMP and EP trade-offs, OECD countries (1985–2010).

	Unemployment insurance (UI) and employment protection (EP) trade-offs			Active labour market policies (ALMP) and employment protection (EP) trade-offs		
	ln (1 + UIexp/EP)			ln (1 + ALMPexp/EP)		
	(1)	(2)	(3)	(4)	(5)	(6)
HIEDU	0.029***	0.028***	0.046***	0.026***	0.024***	0.034***
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)
topMKTCAP * UBprog	0.342***	0.273***	0.196**	0.282***	0.281***	0.243**
	(0.090)	(0.097)	(0.089)	(0.085)	(0.095)	(0.093)
ATTITUDES		−6.984*	−5.809		−9.150*	−9.952*
		(4.204)	(3.845)		(5.250)	(5.050)
OPEN	0.007***	0.005***	0.007***	0.006***	0.005***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.712***	0.945***	0.837***	0.497***	0.730***	0.470*
	(0.166)	(0.202)	(0.219)	(0.159)	(0.210)	(0.243)
Period dummies	No	No	Yes	No	No	Yes
R^2	0.343	0.366	0.515	0.318	0.348	0.444
No. observations	143	111	111	135	105	105
No. countries	27	26	26	27	26	26

Note: Standard errors are reported in parenthesis. *UIexp* = Unemployment insurance benefits per unemployed (PPP). *ALMPexp* = Spending of active labour market programmes per unemployed (PPP). *EP* = Employment protection index (OECD, Version 1). *HIEDU* = share of the population with higher education. *topMKCTCAP * UBprog* = Interaction variable of a dummy for countries in the top quartile of stock market capitalization and progressiveness of the UI system (equal to the ratio of the replacement rates at 67 and 150 per cent of the average wage). *ATTITUDES* = measure of social sanctions against moral hazard. *OPEN* = trade turnover over GDP.

***Significance at the 1 per cent level; **Significance at the 5 per cent level; *Significance at the 10 per cent level.

Source: Online Appendix G and Boeri et al. (2012).

5 | EXTENSIONS AND VARIATIONS

With some adjustments, the analytical results from Section 3 still hold when the model is extended along two dimensions, sanctions in active labour market programmes and multi-sector job search, or modified along a risk dimension.

5.1 | Active labour market programmes with sanctions

Monitoring and sanctions are part of certain active labour market programmes (see Card et al., 2010). To include these components in the model, the output from home production is shrunk to $\psi(m)h$, using a reduced form $\psi(m) \in [0,1]$, $\psi(0) = 1$, and $\psi' < 0$. Then, the larger the provision of activation measures, which include monitoring and sanctions, the lower the time for home production. Utility when unemployed (2) becomes

$$u^e = \max_e e \cdot u((1-t_l)w_2) + (1-e) \cdot u(\psi(m)h + b) - \phi(m)\zeta(e).$$

With some changes, results presented in Section 3 carry through. Proposition 2 in particular still holds, provided the value of home production h is small enough.

In the model extension, the impact of active labour market programmes on education incentives becomes ambiguous. Education efforts can now increase with activation programmes ($\eta_m < 0$) if the sanction effect dominates the assistance effect. There are then additional cases where optimal unemployment insurance and active labour market programmes are complement, even if activation measures are *not* cost-effective relative to unemployment benefits (when k is large and b is small). Details are included in Online Appendix C.

5.2 | Multi-sector job search

The model can be extended to the case of multi-sector job search. For simplicity, Section 3 assumed that unemployed workers, after losing their job in sector 1, can only look for jobs in sector 2. Most of the results hold when unemployed workers can look for jobs not only in sector 2, but also in sector 1.

In the extension, dismissed workers first look for jobs in sector 1. After A unsuccessful attempts, a social case worker admits the unemployed worker into the costly assistance and retraining programmes, giving access to sector 2. Job search in sector 1 is captured in the model the same way job search in sector 2 is captured, assuming sector-specific utility costs for job search. Writing e_1 for the job search efforts in sector 1 and $\zeta_1(e_1)$ for the utility cost of these job search efforts, the utility (2) from joining sector 1 becomes

$$V_1 = (1-s) \cdot u((1-t_1)w_1) + s \cdot u^e - \zeta_1(e_1).$$

When job search only takes place in sector 2, the firm closure rate and the sector 1 separation rate are identical. It is no longer the case when job search takes place in the two sectors. In the extension, the firm closure rate is $c = \int_0^{x_1} g(x)dx$. The separation rate decreases with search efforts and increases with the closure rate, $s = (1-e_1)c^A$.

Theoretical results are established in the same fashion as in the original model. The algebraic developments are longer and some additional assumptions are required to obtain tractable and clear-cut results. The main flexicurity result of the paper (Proposition 2) continues to hold with the extended model if one updates a technical assumption and if the difficulty of finding a job in sector 1 increases rapidly with job search effort (ζ_1'' is large). The latter assumption may hold when the risky sector 1 is becoming obsolete, due for instance to Schumpeterian creative destruction processes. Details are included in Online Appendix D.

5.3 | Risk in the innovative sector

Innovation is a risky process. For simplicity, we assumed so far that unemployment risk in sector 1 was larger than innovation risk in sector 2 and ignored the innovation risk. The opposite assumption could be made, low unemployment risk in sector 1 and large innovation risk in sector 2. In that case, firms in sector 2 may have to close down in case of unsuccessful innovation, introducing a risk of unemployment in sector 2. To contrast outcomes in the two cases, one could thus assume that unemployment risk only applies to sector 2, instead of assuming, as was done so far, that unemployment risk only applies to sector 1.

The impact of labour market policies on education choices, and, ultimately, welfare, changes. While unemployment insurance and active labour market programmes make education less interesting in the original case, they do the opposite in the variation of the model. Theoretical results are derived in the same fashion as in the original model but differ. The main difference concerns complementarity results in optimal policy. Lemma 4 in particular is adjusted to

$$sign\left(\frac{d}{dt_s}\frac{d}{db}V\right)=sign\left(\eta_s\left[\frac{1}{\eta_2}+\frac{\tau^N}{1-N}\right]\right).$$

Depending on education responses and labour market conditions, optimal employment protection and unemployment insurance may become complement, rather than substitutes. For instance, if education responses and the separation rate are large, meaningful unemployment benefits are best associated with tight employment protection (i.e., $\frac{d}{dt_s}\frac{d}{db}V>0$).[21] Reducing inflows into unemployment indeed will increase welfare when there are many separations and unemployment insurance costs are large. Outcomes are similar for the complementarity between employment protection and active labour market programmes. Details are contained in Online Appendix E.

The data presented in Figure 1 and related references from Section 2 provide evidence of a negative link between education and unemployment risk. For simplicity, the original model assumed away unemployment risk in sector 2, accessible with education. If unemployment risk was added in sector 2, but remained lower than in sector 1, the conclusions from the original model would hold qualitatively, as education would still represent self-insurance against unemployment risk, simply to a lower extent.

If, on the other hand, unemployment risk in sector 2 was larger than in sector 1, the link between education and unemployment risk would become positive and the self-insurance effect would disappear, as well as the conditional results on the optimality of flexicurity arrangements. Instead, the modified model presented above shows that employment protection and unemployment insurance should in certain circumstances become complement. It could be that the unemployment risk in sectors requiring high education becomes larger than the unemployment risk in sectors requiring no education, in the future. There is for instance evidence that research and development is becoming less productive (Bloom et al., 2020) and that patents are becoming less disruptive (Park et al., 2023). If such phenomena continue, innovation may become riskier to the point that jobs in innovative sectors become very uncertain and that the link between education and unemployment risk changes from negative to positive. Whether such an inversion of the link takes place in the future is unknown, but it is a possibility.

6 | DISCUSSION

Results from this paper are compared with the related literature and then used for policy implications. The analysis from the paper is then confronted to actual policies in developed countries. The discussion relies on the summary of results provided in Section 4.1.

6.1 | Comparison with related literature

I compare results in this paper and in the closely related literature, in terms of model components or research topic. The analytical results from this paper are most of the time consistent with those of the related literature, but not always. I start with consistent findings and finish with differences.

Chetty (2008) investigates the optimal level of unemployment benefits when households can be liquidity constrained. He finds that the optimal level depends on job search behaviour and liquidity constraints. I also find that the optimal unemployment benefits depend on search behaviour (ε_b in part (a) of Proposition 1). Since the modelling of search decisions in my theory is borrowed from Chetty (2008) but I abstract from liquidity constraints, similarity and differences in outcomes are not surprising.

Andersen and Svarer (2014) investigate the joint provision of unemployment insurance and workfare. These activation measures can be seen as a part of active labour market policies. The authors document the complementarity of activation measures and unemployment insurance in optimal policy, as activation measures (workfare) reduce the moral hazard impact of insurance. This result is consistent with my analysis, although the reduction of moral hazard operates through a different channel. In my analysis indeed, the insurance moral hazard is reduced by lower employment protection, which stimulates self-insurance through education.

Pavoni and Violante (2007) primarily consider the optimal combination of unemployment insurance, active labour market policies and social assistance.[22] There is a moral hazard cost to unemployment insurance, as it reduces job search incentives. In the analysis that the authors provide, active labour market policies, in the form of monitoring, mitigate the moral hazard cost of unemployment insurance. As the human capital of unemployed workers declines over time, job search becomes inefficient, at which point social assistance becomes preferable. As in my results with responsive education or strong labour market frictions, unemployment insurance and active labour market policies are complements. My analysis however misses the dynamic component but adds a role for employment protection and self-insurance via education.

Boeri et al. (2012) use a political economy model to differentiate between policy environments with either complementary or substitute levels of employment protection and unemployment insurance. Their theory predicts low levels of employment protection and high levels of unemployment insurance when the education rate is high, which they show is empirically verified in OECD countries. If education is responsive, which is more likely to lead to high education rates, my theory predicts that flexicurity arrangements are more likely to be optimal (see Section 4.2). Theoretical predictions on policy design are thus consistent across the two models, although mechanisms differ: labour market policy emerges as a political economy equilibrium in their model, while it is the result of welfare maximization with a utilitarian criteria in mine.[23]

Algan and Cahuc (2009) document the influence of civic attitudes on labour market policies, high civic attitudes being empirically associated with higher unemployment benefits and lower employment protection, as in flexicurity arrangements, because households are less likely to cheat on the receipt of unemployment benefits. In my analysis, the two optimal policies are independent when education decisions are exogenous but substitute when conditions for flexicurity are met. Assume that individuals in countries with high civic values feel more responsible for their own economic destiny and thus base more of their education choices on economic prospects than on intellectual satisfaction, family expectations or other non-economic factors.

Then, education in high civic countries is less likely to be exogenous and flexicurity more likely to be optimal, consistent with the finding from Algan and Cahuc (2009).

Heathcote et al. (2010) quantify the welfare impact of raising inequality in the US, leaving policy untouched. Their analysis can thus not be directly compared with mine. However, their findings on self-insurance resonate with key features of my analysis. They find indeed that self-insurance via education has a greater impact on welfare than self-insurance through savings or through labour supply. My model abstracts from savings and labour supply decisions but self-insurance via education plays a key role in optimal labour market policy.

My results depart, on the other hand, from those of Blanchard and Tirole (2008). Because the model I use is an extension of their model, a number of results carry through. As in their paper, firing taxes (employment protection) internalize a firing externality, firms neglecting the public finance impact of their decisions. Absent moral hazard and education decisions, employment protection should be high for full internalization of the externality and full unemployment insurance, in both Blanchard and Tirole (2008) and my analysis (see Section 3.3). With moral hazard and education decisions however, employment protection should be low when the optimality conditions for flexicurity are satisfied, given a trade-off between incentives for self-insurance and internalization of the firing externality (see Section 4.1). The model of Blanchard and Tirole (2008) thus generates optimality results which are not consistent with flexicurity. In the extension of their model that I consider, flexicurity can be optimal.

Brown et al. (2009) is the only joint analysis of the three policy instruments of flexicurity. They numerically find that the implementation of a policy mix similar to the Danish flexicurity setup would reduce unemployment in Germany. Because they treat employment protection as a firing cost, the potential complementarity of firing taxes and unemployment benefits highlighted by Blanchard and Tirole (2008) is not present. As I use firing taxes rather than firing costs, I can identify cases where optimal employment protection and unemployment insurance are complements and other cases where they are substitutes, without any preconception of what their optimal level should be.

6.2 | Policy implications

Flexicurity has belonged to the European Union strategy for reducing unemployment for at least a decade (European Commission, 2010). From a theoretical normative standpoint, whether and when flexicurity is optimal has not been completely clear. Section 3.4 provide some theoretical conditions for flexicurity to be optimal with a utilitarian welfare criteria, which this section translates into policy recommendations.

The first and main general policy implication is that flexicurity is an optimal policy mix when education decisions respond to policy, active labour market programmes are cost-effective relative to unemployment insurance and there is a separate reason for unemployment benefits to be high, such as aversion for low-end inequality. The same conclusion holds if education decisions are not influenced much by policy but if labour market frictions are large, such that finding a job is difficult.

By contrast, countries with no separate reasons for unemployment benefits to be high may find flexicurity less attractive. In fact, the polar opposite of flexicurity, with strong employment protection but little financial nor operational assistance to unemployed workers, can be optimal if there are separate reasons for unemployment benefits to be low, such as unemployment stigma or a reluctance to rely on the state in case of hardship.

The third policy implication is that the use of firing taxes contributes to the financing of unemployment benefits and active labour market programmes, as a mean to internalize firing cost externalities. This implication extends a conclusion from Blanchard and Tirole (2008) to moral hazard and active labour market programmes.

A few caveats are in order to close the section. First, the policy implications are derived on the basis of comparative statics results. In reality, households' and firms' responses can be sluggish. This is particularly true for education, which is typically undertaken once in life. A reform of the unemployment insurance, for instance, will only impact the education decisions from children and future generations. One conjecture is that all three policy instruments involved in flexicurity are confronted with the same sluggishness, so that the flexicurity results from Section 3.4 continue to hold in a dynamic setting. Confirming this conjecture is left to future research.

Second, results hold under the assumption that the unemployment risk is larger for low-educated than for high-educated workers, consistent with past empirical evidence. If innovation became riskier in the future, or some other changes in the environment took place, to the point that unemployment risk became larger for high-educated workers, education would no longer represent self-insurance against the unemployment risk and the results presented in this paper would change, as made clear at the end of Section 5.

Third, a focus on low-end inequality leads to the main analytical results and policy implications. If policy concerns include other dimensions of inequality, results and their implications might evolve. Additional policy instruments, such as different income tax rates for sector 1 and sector 2 workers, may also influence optimal policy combinations. For instance, if inequality is measured by a Gini coefficient on net income and inequality aversion is large, the optimal policy may seek to have as many households in the intermediate income state (sector 1 work) and as few households in the low-income state (unemployment) and the high-income state (sector 2 work) as possible, by combining large employment protection (which reduces flows into unemployment) and progressive income taxes (which reduces incentives to educate and join sector 2). Optimal policy analyses in such wider settings constitute another area for future research.

6.3 | Confrontation with actual policy

In this section, I investigate to which extent theoretical outcomes from the paper and actual policies in developed countries are aligned.

In spite of the attention that policy advisors recommend on flexicurity, few developed countries have full flexicurity policies in place. An illustration appears in Figure 4, which provides the social policy and education data for the last year used in the empirical analysis from Section 4, two additional indicators as well top and bottom quartile values for each variable.[24] From the 22 countries appearing in the table, none had in 2010 a combination of employment protection in the bottom quartile, unemployment benefits in the top quartile and active labour market expenditures in the top quartile of the sample. Policies in two countries, Denmark and the Netherlands, are however close. Compared with other countries, inequality aversion in these two countries is large. For Bargain et al. (2014), tax-benefit data further points to Rawlsian preferences—focusing on low-end inequality—in these two and other Nordic countries, as opposed to low inequality aversion and utilitarian views in Southern Europe. Using education rates as a proxy (as in Section 4) also shows a fairly large education responsiveness in these

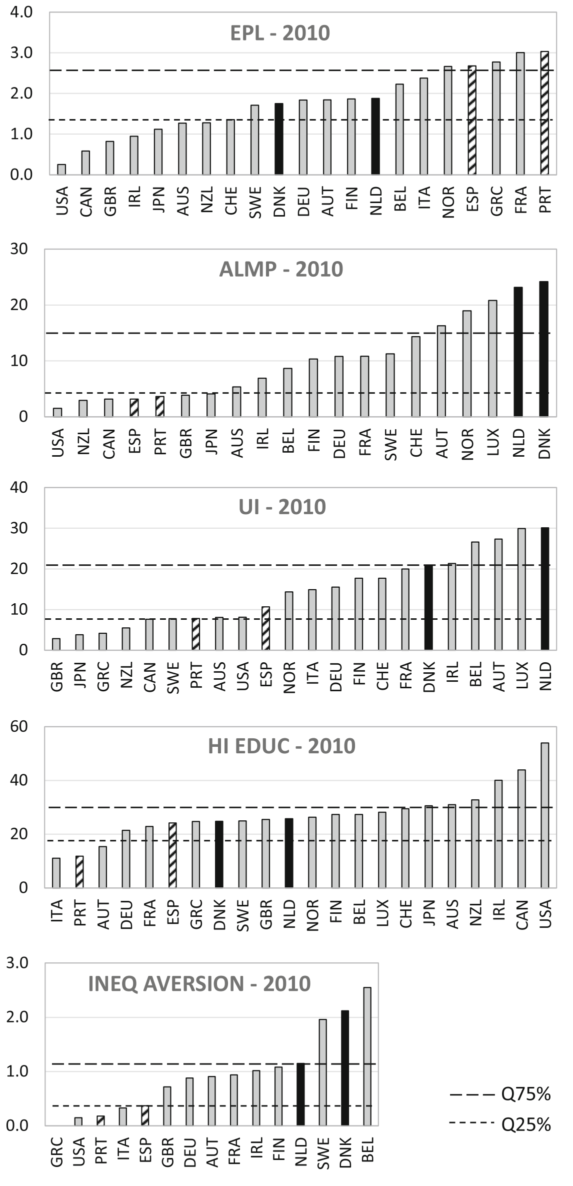

FIGURE 4 Labour market and economic data, OECD countries, 2010.

countries. The main policy conclusion from the theoretical analysis is that the flexicurity mix is optimal if, for instance, education decisions are sensitive to policy, active labour market policies are cost-effective and low-end inequality aversion is strong (see Section 6.2). This conclusion and actual flexicurity policies in Denmark and the Netherlands in 2010 thus appear generally consistent.[25] Theoretical results from Section 3.4 can thus be seen as an ex-post motivation for the policy experiments that these countries initiated at the end of last century (for details, see Andersen & Svarer, 2007).

Other countries in the sample with large low-end inequality aversion and high education rates would be candidates for flexicurity policies, according to the results from this paper, but had no such arrangements in place (Belgium, Ireland, Finland and Sweden). All was in place in

2010 for flexicurity in these countries, except for large active labour market programmes. Loosely speaking, we might thus see flexicurity as the Northern European version of optimal labour market policies.[26]

The polar opposite to flexicurity—strong employment protection but low unemployment benefits and small active labour market programmes—may also be optimal, according to results in Section 3.4 (specifically, part [c] of Proposition 2). Strong labour market frictions would for instance lead to such an outcome, coupled with a reason for low unemployment benefits, such as strong aversion for state support.

As shown in Figure 4, only 2 out of the 22 countries in the sample had a combination of employment protection in the top quartile, unemployment benefits in the bottom quartile and active labour market expenditures in the bottom quartile (Portugal and Spain). Both of these countries have a low inequality aversion, in international comparison, which can be interpreted as reluctance to rely on the state in case of hardship. The education rate proxy in Spain indicates a fairly large education responsiveness, but not in Portugal. The unemployment rate in 2010 was however fairly large in that country too, higher than the average over European countries. This may indicate that finding a job was difficult in Portugal in 2010, a sign of stronger-than-average labour market frictions. Actual policy arrangements in 2010 in these two countries and policy implications from this paper thus appear consistent.

Some data is missing for the two other Southern European countries of the empirical sample (Greece and Italy). Averaged values over the four Southern European countries are also consistent with the policy implications from the paper, with relatively high employment protection, low unemployment benefits, small active labour market programmes, low inequality aversion and high unemployment rates (suggesting strong labour market frictions). In this sense and again loosely speaking, we may see strong employment protection with small financial and operational assistance to unemployed as the Southern European version of optimal labour market policies.

7 | CONCLUDING REMARKS

Little is known about the optimality of flexicurity policies, from a normative, economic theory point of view. The paper provides a normative analysis and identifies conditions under which flexicurity is an optimal welfare policy combination, which depend crucially on the education behaviour of households. If education choices are unrelated to economic conditions, because intellectual satisfaction is the prime objective of education or for other reasons, the optimal level of employment protection is unrelated to the optimal level of unemployment insurance and active labour market programmes. In absence of complementarity, flexibility cannot be exchanged for security, at the heart of flexicurity. If, however, education choices depend on economic conditions, flexicurity can be optimal, as low employment protection provides incentives for costly self-insurance against unemployment risk through education, mitigating the moral hazard cost of unemployment insurance and activation programmes. Beyond education behaviour, the analysis has identified other sufficient (but not necessary) conditions for flexicurity to be optimal, namely cost-effective active labour market policies relative to unemployment benefits, as well as aversion for low-end inequality. Furthermore, flexicurity is more likely to be optimal when labour market frictions are large, such that finding a job is difficult.

To maintain tractability and obtain analytical results despite the number of policy instruments, the model was kept simple. Depending on the simplification, the optimal flexicurity results presented in the paper may or may not hold if the simplifications are removed.

Comparative statics results should for instance continue to hold in a dynamic framework. The self-insurance component of education, encouraged with low employment protection, is still there if households can self-insure against unemployment with savings, even if the education insurance component is smaller. Quantitative analysis by Heathcote et al. (2010) actually find that self-insurance through education is larger than through savings.

While job destruction is affected by policy in the model, job creation is not. Ceteris paribus, employment protection, unemployment insurance and active labour market policies each reduce the incentive to self-insure with education, as well as job creation. Vacancy posting is indeed hurt directly by employment protection and indirectly, through the outside options of workers, by unemployment insurance and active labour market policies. It remains to be seen if the policy complementarity results which apply with self-insurance also apply with job creation.

It could further be interesting to embed the model into a dynamic setting with productive capital, to investigate the transition path dynamics of policies related to flexicurity. All of these modifications are left for future research.

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ENDNOTES

[1] Higher productivity in the high-skill sector is consistent with the empirical assortative matching literature (e.g., Haltiwanger et al., 1999).

[2] To be more precise, the cumulative distributions are related by first-order stochastic dominance, $\int_{-\infty}^{y} g_2(x)dx \leq \int_{-\infty}^{y} g_1(x)dx$ with a strict inequality over some interval. As a consequence, the average productivity in sector 2 (expected value for the distribution g_2) is strictly greater than the average productivity in sector 1 (expected value for g_1).

[3] In reality, firms or workers could also invest in innovation to increase productivity and avoid separation, which can be influenced by employment protection (e.g., Belot et al., 2007). The addition of endogenous innovation to the theory is left to future research.

[4] Severance payments mandated by policy have the same effect as a bundled firing tax with unemployment benefits. The bundling would, however, make the analysis of the optimal degree of complementarity between unemployment insurance and employment protection less transparent.

[5] Alternatively, we could assume that there is a financial intermediation sector with perfect competition and which is costless.

[6] Aguiar et al. (2013) find that home production increases during unemployment. For simplicity I assume employed workers do not engage in home production.

[7] The impact of that assumption on results is investigated in Section 5.

[8] Under certain conditions, the main results of the paper hold when that assumption is dropped, as shown in Section 5.

[9] For ease of presentation, I will only refer to search efforts in the continuation.

[10] Some active labour market programmes also include monitoring and sanctions. As discussed in Section 5, results hold when the model includes these components.

[11] To keep the model tractable, I only consider education before entry into the labour market and do not consider on-the-job training (for links between employment protection and on-the-job training, see Suedekum & Ruehmann, 2003).

[12] Because retraining programmes are more targeted, assisted and vocational in nature than the typical formal education received prior to labour market entry and to simplify the analysis, I assume that the efficiency of retraining does not depend on ability, $\phi(m,n)=\phi(m)$.

[13] Exogenous and constant government consumption expenditures can be added to the model without changing analytical results.

[14] See (9) and recall the technical assumption implying moderate s and large σ, so the wage w_1 reduction effect is dominated by the separation rate s reduction effect.

[15] Specifically, propositions 1 and 2 from Blanchard and Tirole (2008).

[16] For instance, if the provision of policy x increases welfare ($\frac{d}{dx}V>0$), then the increase in welfare will be larger ($\frac{d}{dx}V$ will be larger) when there is a provision of policy y, which translates as $\frac{d}{dx}V$ being larger when y is larger, i.e., as $\frac{d}{dy}\frac{d}{dx}V>0$.

[17] For ease of presentation, I provide the results with specifications for certain reduced-forms, namely $\zeta(e)=\zeta_A+(\zeta_C-\zeta_A)e^{-\zeta_B(1-e)}$ and $i(n)=i_0-i_1\cdot\ln(1-n)$. Results with general specifications and different labour income tax rates in the two sectors are contained in Online Appendix B.

[18] Lemma 1 showed that unemployment insurance reduces education incentives, ceteris paribus. Lemma 4 is a relative rather than absolute result, which holds in general equilibrium: low employment protection *mitigates* the negative education incentive of unemployment insurance.

[19] The extension I provide implies the finding of Boeri et al. (2012), but not the other way around: for instance, a strong positive link between education rates and expenditures on UI and no link between education rates and expenditures on ALMPs can be sufficient to generate a positive link between education rates and the sum of expenditures on UI and ALMPs.

[20] See Online Appendix G for details on variables and data.

[21] Strong education responses make $1/\eta_2$ small. Large separation rates and high unemployment benefits mean that an increase in education has a negative impact on the fiscal balance, as many people joining sector 2 are losing their jobs and each unemployed worker is costly for the state, so $\tau^N<0$. Then $\eta_s<0$ implies $\frac{d}{dt_s}\frac{d}{db}V>0$.

[22] Pavoni and Violante (2007) also consider the role of taxes and employment subsidies.

[23] At the individual level in my model, households base their decisions on labour market policy (as per Lemma 1), so the individual education choice is a consequence of policy. Welfare maximization defines policy taking this behaviour into account and ends up with flexicurity being optimal for certain education behaviours (among other conditions, as defined for instance in Proposition 2), so policy design is a consequence of education behaviour at the country level. Similarly, policy design is an outcome of education levels in Boeri et al. (2012).

[24] Values and sources are provided in Online Appendix H.

[25] Because data is lacking for ε_m, the condition $\varepsilon_m\tau^E-k>0$ on the cost-effectiveness of active labour market policies cannot be verified (see Corollary 1).

[26] Austria also had a policy mix in 2010 similar to flexicurity, even though education rates are lower than average.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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