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Financial incentives and labor market duality*

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Abstract

The French labor market is divided between workers in permanent jobs and those who alternate fixed-term contracts with unemployment spells. Among other public policies aiming at reducing this duality, financial incentives could induce employers to lengthen contract duration or favor permanent contracts. This article develops a matching model fitted to the French labor-market characteristics and calibrated on French data. A gradual decrease in unemployment contributions or a firing tax reduces the duality but increases market rigidity and lowers labor productivity. However, decreasing unemployment contributions gradually is less favorable for new entrants than a firing tax and lengthens unemployment spells. An additional contribution levied on short-term contracts to finance a bonus for permanent-contract hirings also decreases labor-market duality and increases activity but without negative impacts on labor-market flexibility and productivity.

JEL Codes: J41, J42, J48 **Keywords:** Duality, public policies

Résumé

Le marché du travail français est segmenté entre les personnes bénéficiant d'un emploi stable et celles alternant contrats temporaires et périodes de chômage. Parmi les solutions envisagées pour réduire cette dualité figurent des incitations financières pour encourager les entreprises à allonger la durée des contrats ou favoriser le recours aux emplois stables. Cet article développe un modèle d'appariement adapté aux caractéristiques du marché du travail français et calibré sur données françaises. Les conclusions suivantes apparaissent : des cotisations dégressives avec l'ancienneté dans le contrat ou une taxe sur les licenciements et sur les fins de contrats temporaires réduisent la segmentation mais au prix d'une plus forte rigidité du marché du travail et d'une plus faible productivité ; par rapport à la taxe, des cotisations dégressives sont moins favorables aux nouveaux entrants et augmentent plus la durée moyenne de chômage ; une surcotisation sur les emplois temporaires, finançant une prime aux embauches en emploi stable, diminue également la segmentation du marché du travail mais elle n'a pas les mêmes effets négatifs sur la flexibilité du marché du travail et la productivité. De ce point de vue les réformes récentes en Italie et en France apparaissent pertinentes.

Mots clés : Segmentation, politiques publiques

1 Introduction

The French labor market is divided between workers in stable jobs and those who alternate fixed-term contracts with unemployment spells. This lack of job stability particularly concerns precarious populations such as unskilled workers, young people, mothers of young children, and second-generation immigrants. This situation is not specific to France, but is also observed in countries of Southern Europe. The economic literature[1] shows that the phenomenon could be related to labor-market institutions and the gap between the employment protection of permanent and fixed-term contracts. Two major articles deal with this topic in France. Blanchard and Landier (2002) show the negative effect of fixed (i.e., short-term) contracts (Contrats à Durée Déterminée: CDDs) on the functioning of the labor market. Staff turnover and the unemployment rate are higher. Cahuc and Postel-Vinay (2002) highlight the inefficiency of the combination of high employment protection and the introduction of short-term contracts. However, in their model, a majority of workers prefer this inefficient *laissez faire*, an attitude that explains the system's persistence. To reduce labor-market duality, these authors suggest harmonizing employment protection for fixed-term contracts with that of permanent contracts, or instituting a single labor contract.[2] However, this type of solution generates legal difficulties and might not win economic and social acceptance. An alternative could be to offer employers financial incentives in favor of stable jobs, either via employment duration or the type of contract (permanent contract (Contrat à Durée Indéterminée: CDI) versus CDD or temporary work).

We examine three proposals for reaching this goal. First, Blanchard and Tirole (2003) introducing a termination tax to finance unemployment benefits, along the lines of the U.S. "experience rating" system. The tax aims at insourcing factoring the social costs of unemployment into the employer's lay-off decision. The second proposal comes from French labor unions. To encourage employers to offer stable jobs, unemployment insurance contributions should decrease gradually, depending on the worker's tenure. This additional contribution in the first months or years is roughly equivalent to a hiring tax spread over several months. Both proposals will increase labor-market flow costs, which could induce employers to lengthen average employment duration. However, the second proposal impacts hiring flows and could have a less favorable impact on employment or well-being than the first proposal, which targets lay-off flows. The third proposal is based on the Italian labor-market reform. An additional contribution is levied on temporary contracts to discourage

[1] See in particular Bassanini and Garnero (2013).

[2] See, especially, the report by Cahuc and Kramarz (2004)

short-term hirings. When an employer turns a temporary contract in permanent one, the surtax is partly or fully refunded. Unlike the first two proposals, the penalty on short-term contracts is linked to support for permanent hirings. We believe this approach will generate a milder increase in labor-market rigidity than the first two proposals.

To study these policies, we use a matching model based on Pissarides (2000), where permanent and temporary jobs are distinct and permanent jobs are endogenously destroyed. Due to the existence of a minimum wage (Smic) in France, real wages cannot be viewed as perfectly flexible, in particular for temporary unskilled jobs. To allow for this, we split the labor market into skilled and unskilled workers. We calibrate the model on French data and simulate three public policies aiming at reducing labor-market duality: a hiring tax, a firing tax, and a surtax on fixed-term contracts to finance a bonus for permanent hirings.

The article is organized as follows. Section 2 describes the labor-market duality in France and introduces the three studied reforms. Then, Section 3 describes the matching model used and Section 4 details its calibration on French data. Section 5 shows the impact of the three stylized reforms. Finally, Section 6 concludes.

2 The French labor-market duality

The French labor market is divided between workers in stable jobs with high employment protection and those who accumulate unemployment spells and short-term contracts. These two categories are compartmentalized, condemning the most precarious workers to a bumpy occupational path. This phenomenon is characteristic of Southern European countries, particular Spain, Portugal, and–to a lesser extent–Italy and France.

The notions of duality and selection are hard to disentangle. A lack of flows between the precarious–jobs and permanent–jobs markets may explain why workers have trouble moving between the two. The main explanation is that the hiring flow into permanent contracts is small because of the high employment protection they offer (See below). This phenomenon is called duality. However, the small flows between the two markets may also be due to a selection mechanism. Firms win the loyalty of their most productive workers by hiring them on permanent contracts. In contrast, they refuse to establish long-term relationships with less productive workers, who are consequently stuck in the precarious jobs market. Empirically, the two phenomena reinforce each other. Duality degrades the employability of non-permanent workers because they are less trained and less experienced. Selection by employers tends to keep them in the second market. In the opposite direction, selection leads firms to offer permanent contracts to workers already employed under permanent contracts, thus reinforcing labor-market duality.

It should be noted that duality is hard to summarize in one quantitative index. In the following section, duality is measured by the share of short-term contracts in total employment and the share of short-term contracts converted into permanent contracts.

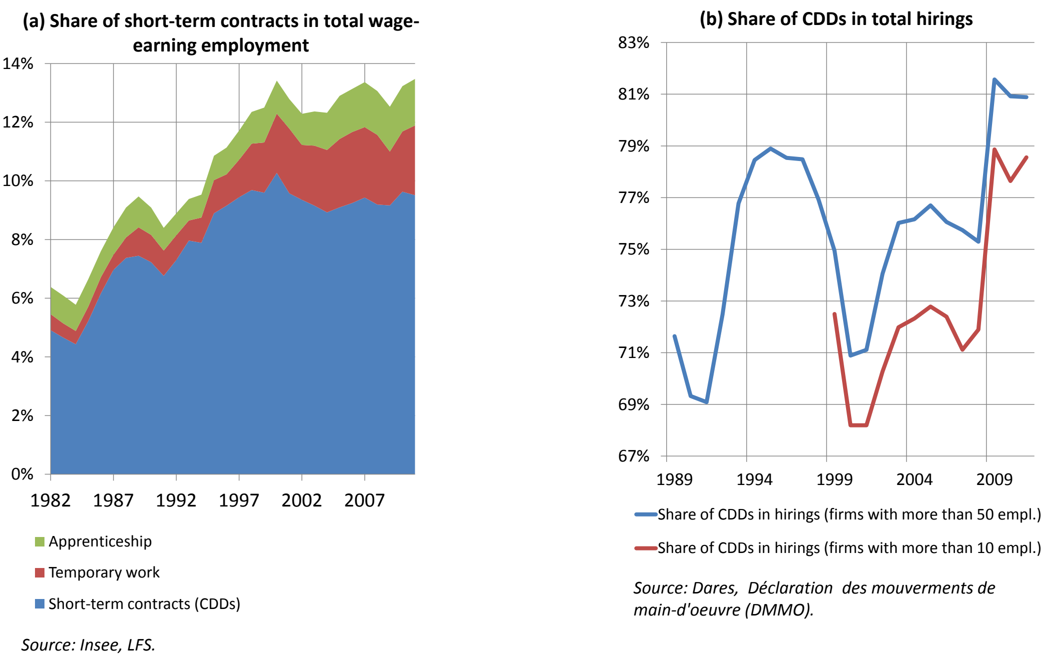
2.1 Duality is essentially due to a gap of employment protection between CDD and CDI

In France, the share of short-term contracts in total wage-earning employment strongly increased during the mid-1980s (Figure 1(a)) owing to the use of CDDs and, since the mid-1990s, to the reliance on temporary workers. CDD hirings are strictly regulated by law. In practice, however, the law is circumvented and CDDs account for almost 80% of hirings, excluding temporary work. As Figure 1(b) shows, this proportion barely increased in the 2008-2009 crisis and is now stable. The level is higher than the mean observed level of the 2000s. However, because of their short duration, CDDs represented only 10% of wage-earning employment in 2010 (12% including temporary workers).

To dismiss a worker in a permanent contract is often a long, risky, and costly process. This may explain why firms use short-term contracts to increase workforce flexibility in order to cope with economic risks. The growing use of CDDs and temporary work has made the labor market more fluid, increasing job creation and destruction. However, this higher employment flexibility, focused solely on short-term contracts, does not seem to have significantly reduced unemployment. It has also helped to reinforce employment protection of insiders to the detriment of outsiders' integration. Moreover, this duality reduces human capital, because of the reduction in training of CDD workers and in firm-specific human capital accumulation. This has a negative impact on labor productivity.

Theoretical analysis confirms these arguments. Blanchard and Landier (2002) and Cahuc and Postel-Vinay (2002) showed that partial flexibility, focused exclusively on short-term contracts, reduces the CDI share and has an even stronger negative impact on flows into and out of CDIs. Such flexibility may thus increase unemployment. The imbalance due to a gap in dismissal costs between permanent and short-term contracts could be more harmful than

Figure 1: Share of temporary contracts in wage-earning employment and hiring



the gap in separation costs. More recently, Cahuc, Charlot, and Malherbet (2012) point out that a strong employment protection of permanent contracts increases flows of short-term jobs. The impact on employment is small but this employment protection significantly reduces the labor productivity, substituting permanent jobs by short-term contracts. International comparisons strengthen these arguments. Bassanini and Garnero (2013) show that higher the employment protection, dualer is the labor market. The employment protection gap between permanent and short-term contracts increases duality.[3] However, this analysis is sensitive to the robustness of the employment protection index (See Bentolila, Cahuc, Dolado, and Le Barbanchon (2012)).

Labor-market duality has social implications. Short-term contracts are concentrated in sensitive population categories, such as young people, women, and unskilled workers, making their employment status precarious. In 2011, CDDs, temporary-work contracts and

[3]Employment protection for short-term contracts focuses on early terminations by employers and on the conditions in which short-term hirings are allowed.

apprenticeships represented one-half of wage-earning jobs held by young people aged 15-24 and one-third of those held by young people aged 15-29 (21% of workers aged 15-29 have CDDs and 5% are temporary workers, compared with 7% and 2% respectively for the 30-49s).[4]. The coexistence of short-term and permanent contracts leads to an unequal distribution of risks induced by economic conditions. Risk exposure is highest for workers under short-term contracts and the most precarious population categories. Furthermore, the advantages of a permanent contract extend beyond the labor market, as a stable job facilitates access to housing and loans.

2.2 Which policy can most reduce duality?

As we noted in the introduction, the most logical solution, and probably the most economically efficient, should aim to bring employment protection under short-term contracts closer to that offered by permanent contracts. For this purpose, CDD hirings could be controlled more strictly through tighter legislation or increased inspections. However, given the relatively limited flexibility of the French labor market, firms will be less able to adjust to demand shocks. A second option would consist, instead, in loosening restrictions on lay-offs by offering guarantees to dismissed workers, streamlining procedures or broadening the range of circumstances in which lay-offs are allowed. But this type of solution is politically and socially hard to accept during a period of crisis and high unemployment. Moreover, it could create legal problems because of the uncertainty surrounding changes in case law and compatibility with ILO agreements ratified by France. A third alternative would be to remove differences between short-term and permanent contracts and create a single labor contract.[5] This solution would pose the same problems as the previous options, depending on whether the new contract offered low employment protection similar to that of short-term contracts or high protection similar to that of permanent contracts.[6]

If employment-protection cannot be achieved between the two types of contract, some second-tier solutions could be envisaged, especially financial incentives. Our article seeks to contribute to public discussion of the issue in France by assessing three proposals.

[4]Source : Insee, 2011 LFS (Enquête Emploi).

[5]See notably the report Cahuc and Kramarz (2004).

[6]Lepage-Saucier, Schleich, and Wasmer (2013) show that the transition from a labor market with two types of contract to a labor market with a unique contract is not necessarily efficient.

Termination tax: This proposal, put forward by economists in the wake of the Blanchard and Tirole (2003) report, is based on the experience of North American countries. In the United States and Canada, each firm's unemployment-insurance contribution is determined by the benefits paid out to previously dismissed workers. This bonus-penalty system–called "experience rating"–is designed to raise employers' awareness of their responsibilities concerning the impact of dismissals on the financial position of unemployment-insurance funds and to make them factor this cost into their decisions. To the extent that system takes into account all breaches of contract entitling dismissed workers to benefits (including termination of temporary and short-term contracts, redundancies, and the mutually agreed terminations applied in France), it offers an incentive to firms to offer stable jobs under permanent contracts rather than short-term contracts. The system also encourages employers to increase their workers' non-specific human capital in anticipation of their possible dismissal. On the other hand, it could discourage firms from hiring less-employable workers because of the greater likelihood of long unemployment spells in case of contract termination. In addition, it could incite firms to hire under very-short-term contracts, which do not make workers eligible for unemployment benefits.

A measure similar to the previous one but simpler consists in taxing breaches and terminations of labor contracts that make workers eligible for unemployment benefits. Unlike in the experience rating system, firms pay the additional cost at the time of dismissal and not in subsequent years, and the cost does not depend on the length of dismissed workers' unemployment spells. It therefore does not encourage firms to increase their workers' employability, but it does not offer an incentive to hire only the more employable workers. The two solutions may also respond differently to economic shocks. Experience rating is less pro-cyclical (See L'Haridon and Malherbet (2010)). Nevertheless, both measures seem to be equivalent as regards the link between employment protection and labor-market duality.

A rich literature, notably in French, details the advantages and disadvantages of such measures. For instance, Cahuc and Zylberberg (2008) show that without a dismissal tax, the volume of lay-offs is too high because firms do not factor in the social cost of unemployment. However, we must take French labor-market characteristics into account, as high employment protection reduces the expected benefits of the measure. Wage rigidity accentuates this effect.[7] Charlot and Malherbet (2010) argue that the new solution must substitute for standard employment protection in order to limit the average unemployment spell. In the

[7] See Cahuc and Malherbet (2001) and Cahuc and Malherbet (2004).

same vein, Blanchard and Tirole (2003) argue that a reduction in the non-monetary costs of dismissals offsets the introduction of a dismissal tax.

Gradually decreasing contributions: The second category of reform proposals is mainly advocated by trade unions.[8] The key proposal is that unemployment-insurance contributions should decrease in proportion to workers' length of service. Labor costs would thus be higher at hiring and then decrease with time. The aim would be to encourage employers to increase employment duration.

An alternative reform consists in raising unemployment-insurance contributions for short term contracts. To our knowledge, there has been no economic assessment of this type of reform. As a dismissal tax, it is likely to reduce labor-market flows and increase both average unemployment spells and job durations. In principle, its impact on the level of unemployment is ambiguous. We assess the proposal and compare it with a dismissal tax. By discouraging hiring rather than job destruction, a declining-contributions system is probably less favorable for employment than a dismissal tax.

Italian-style reform: A third proposal consists in raising unemployment-insurance contributions on short-term contracts to finance a bonus for turning short-term contracts into permanent ones. The Fornero reform in Italy, enacted in July 2012, introduces a tax on short-term contracts (1.4% of gross wages), which is transferred to the unemployment-insurance fund. If the short-term contract is turned into a permanent one, the tax is refunded after the trial period. The amount is limited to the last six monthly payments. Firms are no longer required to justify their use of short-term contracts. Controls and rules to limit substitutes for short-term contracts have been strengthened.

To our knowledge, this Italian reform has not been evaluated. Our article aims to fill the gap using French data. However, to obtain a reform that has no impact on public finances, the "Italian-style" reform in our simulation uses all revenues from the tax on short-term contracts to finance the bonus for turning short-term contracts into permanent ones. This Italian-style reform has a positive impact on public finances as not all short-term contracts are transformed in permanent ones and refunds are capped at six monthly payments.

[8] See Coquet (2010) and Coquet & Sylvain, "L'indemnisation du chômage : éléments pour une réforme", http://www.actualite-de-la-formation.fr/IMG/pdf/DGEFP_note_indemnisation.pdf.

The first two proposals–a dismissal tax and gradually decreasing contributions–make the labor market less flexible because of the incentive to lengthen employment duration. To lessen labor-market duality, it is preferable to reduce short-term contract flows and increase permanent-contract flows rather than aggravating labor-market rigidity. As explained before, it seems hard to simplify CDI dismissals. Incentives to permanent hirings thus seem an economically efficient alternative.

3 Model

To study the impact of these financial incentives, we develop a matching model with endogenous job destruction as described by Pissarides (2000). Several types of models allow an examination of labor-market duality by incorporating short-term and permanent contracts. In the first type, an exogenous proportion of hirings may consist of short-term contracts[9]. The proportion depends implicitly on legislative flexibility regarding short-term contracts. In the second type of model, firms create only short-term contracts, which are converted to permanent ones or terminated.[10] This approach takes into account the trade-off between the two types of contracts but needs a simplification: all permanent hirings follow short-term contracts. A third and more recent category of models endogenizes the contract choice. Caggese and Cunat (2008) assume a higher productivity of permanent contracts. The choice of contract is accordingly determined by a trade-off between the contract type and dismissal costs. Cahuc, Charlot, and Malherbet (2012) introduce heterogeneity in the frequencies of productivity shocks. The frequencies are not observed by employers when they begin their business operations but are known when employers choose to open a vacancy. The choice of contract (and of the duration, for a short-term contract) is made on the basis of this frequency. The model described in this paper uses the second approach, which treats trial periods for permanent contracts as short-term contracts.

3.1 Assumptions

We consider that the trial period becomes a permanent job when the hiring is confirmed. Jobs are divided into those with a costly separation initiated by the employer (mostly permanent contracts) and those with a reduced termination cost (temporary work, short-term contracts, trial periods, and apprenticeship). For simplicity's sake, we shall refer to the first

[9] See, for instance, Cahuc and Postel-Vinay (2002)

[10] See, for instance, Goux and Maurin (2000) or Blanchard and Landier (2002).

situation as "CDI" or "permanent contract" and the second as "CDD" or "short-term contract."

Exit flows from CDIs are not exogenous. They are determined by productivity shocks so as to capture the effect of a dismissal tax. We model productivity as the sum of a perennial component, which reflects the inherent quality of the job/worker match, and an economic component, which reflects hazards on demand for the firm's products.

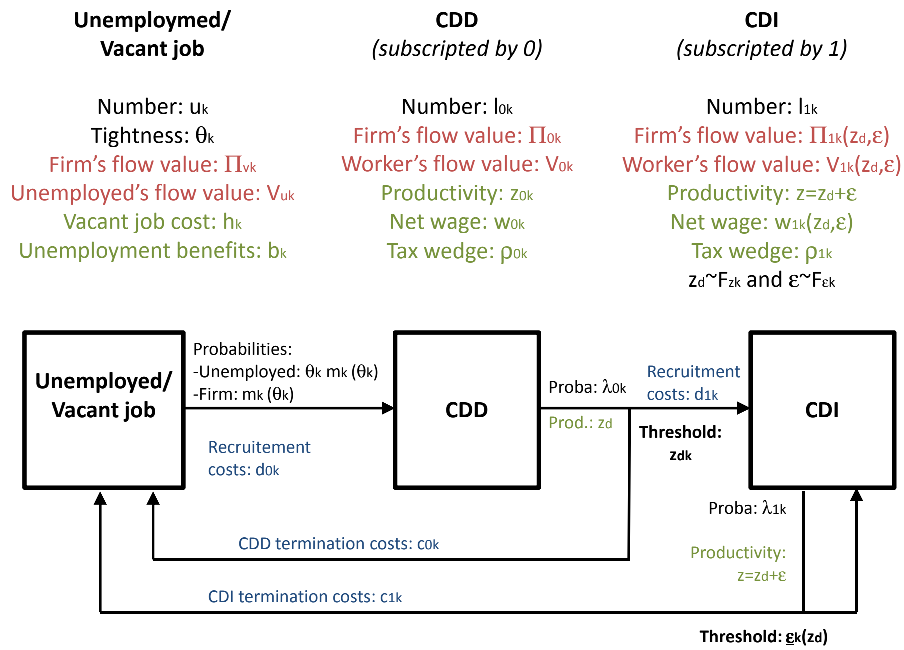
Lastly, we need to take into account the effects of the minimum wage (Smic) on the lowest wages. Cahuc and Zylberberg (1999) highlighted a strong interaction between employment protection and minimum wage: when wages are set by bargaining, dismissal costs have no impact on the unemployment rate because the decrease in hirings is offset by the decrease in breaches of terminations. In particular, employment protection induces lower wages at hiring and curbs the negative effects on hiring. When wages are not negotiated–and especially when they are constrained by the minimum wage–the hiring wage cannot be adjusted. As a result, the negative effect on hiring is not offset by the decrease in terminations. This mechanism concerns earnings at minimum-wage levels but also slightly higher earnings in order to maintain a wage hierarchy.[11] As the French minimum wage (Smic) is high relative to the median wage, we could not ignore the mechanism. Many workers are hired at the minimum wage[12] and their earnings rise with tenure.[13] In order to take it into account, the labor market is divided in two workers category. In the first part, workers are skilled and wages are always negotiated. In the second part, workers are unskilled and are paid at the minimum wage in short-term contracts, whereas their wage is negotiated when they are in a permanent one.

[11] As demonstrated by the diffusion effects when the Smic increases (See Koubi and Lhommeau (2007) and, more recently, by Goarant and Muller (2011) and Aeberhardt, Givord, and Marbot (2012)).

[12] In the 2007 LFS, low-skilled workers in full-time and short-term contracts (CDDs, apprenticeships, temporary work, trial periods) report monthly wages averaging 1.12 times the net minimum wage for 35 hours/week. Workers under permanent contracts are paid 1.45 times the net minimum wage, and high-skilled workers under permanent contracts earn 1.64 times the net minimum wage. Between 2003 and 2009, 26% of workers earning the minimum wage or near the minimum wage had a tenure of less than one year, compared with only 5% of workers paid at twice the net minimum wage or more (See Champsaur (2010) [Expert Group Report]).

[13] Between 1995 and 2007, only 13% of workers present at least five years in the DADS panel maintained their earnings at the minimum-wage level (See Ananian and Calavrezo (2010)).

Figure 2: Model block diagram



3.1.1 Notations

The working population is made up of unskilled and skilled workers. Skill level is subscripted by k, with $k = n$ for unskilled workers and $k = q$ for skilled workers. The two categories are normalized to 1. A proportion l_{0k} is hired under CDDs, l_{1k} under CDIs, and u_k is unemployed. Unemployment benefits are b_k and the cost of a vacancy for a firm is h_k (Figure 2).

We model the matching process between vacancies and unemployed persons by a matching function. When u unemployed are seeking work and firms open v job vacancies, the number of hirings is $M_k(v, u)$, where $M_k(.,.)$ is an increasing function relative to both parameters, with constant scale returns such that $M_k(v, 0) = M_k(0, u) = 0$. Let $\theta_k = v_k/u_k$ the tightness of each labor market. The probability of filling the post is $m_k(\theta_k)$ with $m_k(\theta_k) = M_k(1, 1/\theta_k)$. The probability for an unemployed person of finding a job is $\theta_k m_k(\theta_k)$.

The cost for a firm of hiring a worker under a CDD is d_{0k}, comprising administrative costs and/or taxes. The hired workers' productivity is z_{0k}. The net and gross wages for the job is w_{0k} and $\rho_{0k}w_{0k}$ respectively, where ρ_{0k} is the tax wedge. The contract ends randomly, following a Poisson process of parameter λ_{0k}. At that point, the worker reveals his or her initial productivity z_d in a CDI. Taking this productivity into account, the firm decides whether or not to hire the worker under a CDI. z_d is a random variable, distributed according to the cumulative distribution function F_{zk}. Reservation productivity is noted $\tilde{z}_{dk}$. Below this threshold, the worker is not productive enough to be kept on a permanent basis CDI. The termination costs c_{0k} to the firm and the conversion of the contract into a CDI costs d_{1k} in taxes and expenses.

Once the worker is hired, some economic shocks occur following a Poisson process of parameter λ_{1k}. The shocks change the worker's productivity on the job, which becomes $z = z_d + \varepsilon$. After each shock, the job is maintained only if z is high enough. $\underline{\varepsilon}_k(z_d)$ is also the threshold of ε below which the job is destroyed. In case of termination, the firm pays c_{1k} for the dismissal, a sum that includes taxes. In a permanent contract, the net wage is $w_{1k}(z_d, \varepsilon)$ for an initial productivity of z_d and a possible productivity shock of ε. The tax wedge is ρ_{1k}. For simplicity's sake, we regard the tax wedges ρ_{1k} and ρ_{0k} as independent of the wage, in spite of the progressiveness of taxes and social contributions on labor earnings.

The productivity modelization, using an initial productivity z_d and later shocks ε,[14] allows us to isolate a perennial component of the matching productivity and a variable one. The perennial component is the inherent capabilities of the worker and its compatibility with the job. The variable component reflects the risks on the firm's demand. An alternative modelization, simpler, should be that, for each shock, the productivity is randomly determined following a random process, identical to the process for the initial productivity. In this case, CDI durations follow a Poisson process with a constant termination probability. This does not fit empirical observation as the probability of a CDI exit is decreasing with tenure – the average tenure is higher than the average job duration. This observation is consistent with a selection effect as the jobs with a low perennial component of the productivity are fastly terminated. Then, only jobs with a high productivity last and their duration is higher than the one of other jobs.

3.1.2 Bellman equations

Decisions to create jobs, hire under permanent contracts or terminate permanent or short-term contracts are based on the flow values of the various options. To the firm, the flow

[14] Introduced in Cahuc and Zylberberg (1999).

value of a vacant job is noted Π_{vk}, Π_{0k} for a short-term job and $\Pi_{1k}(z_d, \varepsilon)$ for a permanent one. Initial productivity is z_d and a potential shock is ε. Symmetrically, the worker's flow values are noted V_{uk} if she is unemployed, V_{0k} under a CDD and $V_{1k}(z_d, \varepsilon)$ under CDI.

The firm's flow values correspond to the Bellman equations (1) to (3), where r is the interest rate. Equation (1) expresses the flow value of a firm that opens a vacancy consisting of a per-period fixed cost to keep a vacant job open, h_k, and the returns on a short-term contract $\Pi_{0k} - \Pi_{vk}$ minus the hiring costs d_{0k} with the probability $m_k(\theta_k)$ in each period.

$$\begin{aligned} r\Pi_{vk} &= -h_k + m_k(\theta_k)\left[\Pi_{0k} - \Pi_{vk} - d_{0k}\right] && (1)\\ r\Pi_{0k} &= z_{0k} - \rho_{0k} w_{0k} + \lambda_{0k} F_{zk}(\tilde{z}_{dk})[\Pi_{vk} - \Pi_{0k} - c_{0k}] \\ &\quad + \lambda_{0k} \int_{\tilde{z}_{dk}}^{\infty} [\Pi_{1k}(z_d, 0) - \Pi_{0k} - d_{1k}]\, dF_{zk}(z_d) && (2)\\ r\Pi_{1k}(z_d, \varepsilon) &= z_d + \varepsilon - \rho_{1k} w_{1k}(z_d, \varepsilon) + \lambda_{1k} F_{\varepsilon k}\left(\underline{\varepsilon}_k(z_d)\right)\left[\Pi_{vk} - \Pi_{1k}(z_d, \varepsilon) - c_{1k}\right] \\ &\quad + \lambda_{1k} \int_{\underline{\varepsilon}_k(z_d)}^{\infty} \Big[\Pi_{1k}(z_d, \varepsilon') - \Pi_{1k}(z_d, \varepsilon)\Big]\, dF_{\varepsilon k}(\varepsilon'), \qquad \forall (z_d, \varepsilon) && (3) \end{aligned}$$

For a CDD (Equation (2)) the flow value is the worker's productivity z_{0k} minus the pay roll cost $\rho_{0k} w_{0k}$, minus the returns in case of contract termination, $[\Pi_{vk} - \Pi_{0k} - c_{0k}]$, with the probability $\lambda_{0k} F_{zk}(\tilde{z}_{dk})$ for each period. We add the return on a conversion to a CDI contract with the probability $\lambda_{0k}(1 - F_{zk}(\tilde{z}_{dk}))$. If CDI hiring has an initial productivity of z_d, the CDI value is $\Pi_{1k}(z_d, 0) - \Pi_{0k} - d_{1k}$.

When the job is turned into a CDI with an initial productivity z_d and a potential shock ε (Equation (3)) the firm earns $z_d + \varepsilon$ minus the payroll cost $\rho_{1k} w_{1k}(z_d, \varepsilon)$. The probability of contract termination is $\lambda_{1k} F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))$, in which case the firm loses $\Pi_{vk} - \Pi_{1k}(z_d, \varepsilon) - c_{1k}$. The probability that the shock will not lead to CDI termination is $\lambda_{1k}(1 - F_{\varepsilon k}(\underline{\varepsilon}_k(z_d)))$. If the shock is ε', the value for the firm is $\Pi_{1k}(z_d, \varepsilon') - \Pi_{1k}(z_d, \varepsilon)$.

The flow values for an unemployed person or a CDD or CDI worker are determined in the same way and are given by the Bellman Equations (4) à (6).

$$
\begin{aligned}
rV_{uk} &= b_k + \theta_k m_k(\theta_k)[V_{0k} - V_{uk}] && (4)\\
rV_{0k} &= w_{0k} + \lambda_{0k} F_{zk}(\tilde{z}_{dk})[V_{uk} - V_{0k}] + \lambda_{0k} \int_{\tilde{z}_{dk}}^{\infty} [V_{1k}(z_d, 0) - V_{0k}]\, dF_{zk}(z_d) && (5)\\
rV_{1k}(z_d, \varepsilon) &= w_{1k}(z_d, \varepsilon) + \lambda_{1k} F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))\,[V_{uk} - V_{1k}(z_d, \varepsilon)] \\
&\quad + \lambda_{1k} \int_{\underline{\varepsilon}_k(z_d)}^{\infty} \left[V_{1k}(z_d, \varepsilon') - V_{1k}(z_d, \varepsilon)\right] dF_{\varepsilon k}(\varepsilon'), \qquad \forall (z_d, \varepsilon) && (6)
\end{aligned}
$$

In what follows, we consider that firms can freely enter or exit the market, verifying the free-entry condition $\Pi_{vk} = 0$.

3.1.3 Wage negotiation

As noted earlier, unskilled workers' wages are exogenous and set by the minimum wage. By contrast, wages for permanent jobs and skilled CDD workers are negotiated using a generalized Nash criterion.

Wages of negotiated short-term jobs are set at hiring and cannot be renegotiated before the end of the contract. For skilled workers, the firm's surplus during the negotiation is $S_{0q}^f = (\Pi_{0q} - d_{0q}) - \Pi_{vq}$ and the worker's surplus is $S_{0q}^e = V_{0q} - V_{uq}$. With γ_{0q} the skilled CDD workers' negotiation power, the negotiation program is the following:

$$\max_{w_{0q}} \left[S_{0q}^e\right]^{\gamma_{0q}} \left[S_{0q}^f\right]^{1-\gamma_{0q}}$$

Regarding Equations (2) and (5) –or, more directly, Equations (30) and (33) in Appendix A.1–, S_{0q}^f and S_{0q}^e are linear functions of w_{0q} with the slopes $-\rho_{0q}/(r + \lambda_{0q})$ and $1/(r + \lambda_{0q})$, respectively. The solution of the maximization program is the following:

$$\gamma_{0q} S_{0q}^f = (1 - \gamma_{0q}) \rho_{0q} S_{0q}^e \tag{7}$$

In contrast, the CDI wage–whatever the skill level–can be renegotiated at any time after hiring, including at the signing contract. This is therefore anticipated during the hiring process, and the hiring wage is negotiated as the contract were already in force. Accordingly, regardless of when the negotiation takes place, the firm negotiates depending on its surplus $S_{1k}^f(z_d, \varepsilon) = \Pi_{1k}(z_d, \varepsilon) - (\Pi_{vk} - c_{1k})$. The worker's surplus is given by $S_{1k}^e(z_d, \varepsilon) = V_{1k}(z_d, \varepsilon) - V_{uk}$. The CDI worker's negotiation power is noted γ_{1k}. The negotiated wage is also determined by the following maximization program:

$$\forall (z_d, \varepsilon), \quad \max_{w_{1k}(z_d,\varepsilon)} [S^e_{1k}(z_d,\varepsilon)]^{\gamma_{1k}} \left[S^f_{1k}(z_d,\varepsilon)\right]^{1-\gamma_{1k}}$$

According to the Bellman Equations (3) and (6) (or (31) and (34) in Appendix A.1), $S^f_{1k}(z_d,\varepsilon)$ and $S^e_{1k}(z_d,\varepsilon)$ are linear functions of w_{1k}. Their slope ratio is ρ_{1k}. The solution of the program is thus:

$$\forall (z_d, \varepsilon), \quad \gamma_{1k} S^f_{1k}(z_d,\varepsilon) = (1-\gamma_{1k})\rho_{1k} S^e_{1k}(z_d,\varepsilon) \tag{8}$$

Using the Bellman equations, we show that the wage is determined by $w_{1k}(z_d,\varepsilon) = (1-\gamma_{1k}) r V_{uk} + \frac{\gamma_{1k}}{\rho_{1k}}(z_d + \varepsilon + r c_{1k})$ (See Appendix A.2). The CDI wage increases with the productivity current value $z_d + \epsilon$, the termination costs, and the flow value of unemployment, which is the worker's downturn point in the wage negotiation. In what follows, we write $S^t_{0k} = S^f_{0k} + \rho_{0k} S^e_{0k}$ and $S^t_{1k}(z_d,\varepsilon) = S^f_{1k}(z_d,\varepsilon) + \rho_{1k} S^e_{1k}(z_d,\varepsilon)$.[15]

3.2 Model equilibrium

3.2.1 Reservation productivities

CDI maintained: When a shock occurs, with a new productivity $z_d + \varepsilon$, the contract is maintained if $S^f_{1k}(z_d,\varepsilon) \geq 0$ and $S^e_{1k}(z_d,\varepsilon) \geq 0$. Equation (8) shows that these conditions obtain if and only if $S^t_{1k}(z_d,\varepsilon) \geq 0$. The productivity shock threshold $\underline{\varepsilon}_k(z_d)$, above which the firm does not dismiss the worker, is also defined by:

$$\forall\ z_d, \quad S^t_{1k}(z_d, \underline{\varepsilon}_k(z_d)) = 0 \tag{9}$$

Equation (9) gives the job destruction (Equation (10)), implicitly yielding the value of $\underline{\varepsilon}_k(z_d)$ (See Appendix A.3 for calculations).

$$\forall\ z_d, \quad 0 = \underline{\varepsilon}_k(z_d) + z_d - r(\rho_{1k} V_{uk} - c_{1k}) + \frac{\lambda_{1k}}{r+\lambda_{1k}} \int_{\underline{\varepsilon}_k(z_d)}^{\infty} (\varepsilon' - \underline{\varepsilon}_k(z_d)) dF_{\varepsilon k}(\varepsilon') \tag{10}$$

$\underline{\varepsilon}_k(z_d)$ is a decreasing function of z_d. The higher the initial productivity, the fewer are the shocks ε leading to dismissal. For a given z_d, $\underline{\varepsilon}_k(z_d)$ reduces with c_{1k} and increases with V_{uk}. In other words, a high dismissal cost decreases the probability of a contract termination. By contrast, a higher reservation wage increases the probability.

[15] Strictly speaking, these do not represent the collective surpluses, which are slightly more complex: $S^c_{0k} = S^e_{0k} + S^f_{0k}$ and $S^c_{1k}(z_d,\varepsilon) = S^f_{1k}(z_d,\varepsilon) + S^e_{1k}(z_d,\varepsilon)$. The wage-negotiation results (7) and (8) show that, when wages are negotiated, both expressions are proportional and have the same sign. More precisely, $S^c_{0q} = (1-\gamma_{0q} + \gamma_{0q}/\rho_{0q}) S^t_{0q}$ et $S^c_{1k}(z_d,\varepsilon) = (1-\gamma_{1k} + \gamma_{1k}/\rho_{1k}) S^t_{1k}(z_d,\varepsilon)$.

CDI hiring: At the end of a CDD, the employer decides to turn the contract into a permanent one if and only if $z_d \geq \tilde{z}_{dk}$, i.e., if and only if the hiring flow value is sufficiently high compared with the dismissal flow value. The first value is $\Pi_{1k}(z_d,0) - \Pi_{0k} - d_{1k}$ and the second $\Pi_{vk} - \Pi_{0k} - c_{0k}$. Accordingly, the CDI hiring will occur if and only if $S^f_{1k}(z_d,0) \geq d_{1k} + c_{1k} - c_{0k}$. The productivity threshold $\tilde{z}_d$, above which the worker is hired permanently, is given by:

$$S^f_{1k}(\tilde{z}_{dk},0) = d_{1k} + c_{1k} - c_{0k} \tag{11}$$

Using the results of wage bargaining (8), Equation (11) is rewritten:

$$S^t_{1k}(\tilde{z}_{dk},0) = \frac{1}{1-\gamma_{1k}}[d_{1k} + c_{1k} - c_{0k}] \tag{12}$$

Suppose that the CDI dismissal costs are high enough such that $d_{1k} + c_{1k} - c_{0k}$ is strictly positive. Then, $S^t_{1k}(\tilde{z}_{dk},0)$ is also strictly positive. For the initial productivities z_d lower than $\tilde{z}_{dk}$ but sufficiently high to obtain $S^t_{1k}(z_d,0) > 0$, the worker and the firm can find a wage such that the both win to a CDI hiring. However, when the contract is signed, the worker could upwards renegotiate her wage, using the threat of the dismissal costs. Anticipating this "holdup", the employer prefers terminating the contract.

The CDI hiring equation is given by the following Equation (13), in which $\underline{\varepsilon}_k(\tilde{z}_{dk})$ is set by Equation (14). Equation (13) comes directly from Equation (10) whereas Equation (14) is deduced from Equation (12) (See Appendix A.3).

$$0 = \underline{\varepsilon}_k(\tilde{z}_{dk}) + \tilde{z}_{dk} - r(\rho_{1k}V_{uk} - c_{1k}) + \frac{\lambda_{1k}}{r+\lambda_{1k}} \int_{\underline{\varepsilon}_k(\tilde{z}_{dk})}^{\infty} (\varepsilon - \underline{\varepsilon}_k(\tilde{z}_{dk})) dF_{\varepsilon k}(\varepsilon) \tag{13}$$

$$\underline{\varepsilon}_k(\tilde{z}_{dk}) = -\frac{r+\lambda_{1k}}{1-\gamma_{1k}}[d_{1k} + c_{1k} - c_{0k}] \tag{14}$$

Using the CDI hiring equation, we obtain the reservation productivity $\tilde{z}_{dk}$ required for a CDI, depending on V_{uk} and the exogenous parameters of the model. $\tilde{z}_{dk}$ is thus a growing and linear function of the unemployment flow value. If this value is high, the worker can negotiate a higher wage, so that the CDI hiring will occur only for high initial productivities z_d.

For a given V_{uk} the reservation productivity $\tilde{z}_{dk}$ increases with d_{1k} and c_{1k} and decreases with c_{0k}. CDI hiring and dismissal costs discourage hirings. By contrast, CDD dismissal costs are an incentive to maintain the job by offering the worker a CDI. Moreover, the threshold

$\tilde{z}_{dk}$ increases with ρ_{1k}, as a high tax wedge reduces the collective surplus to maintain the job. ρ_{0k} and d_{0k} does not impact the CDI hiring equation.

3.2.2 Skilled-workers equilibrium

Labor demand: The labor-demand equation is given by Equation (15), where Λ_q is set by Equation (16), $\varepsilon_q(z_d)$ by Equation (10) and $\tilde{z}_{dq}$ by the CDI hiring equations (13-14) (See Appendix A.4 for calculation).

$$m_q(\theta_q) = \frac{h_q(r+\lambda_{0q})}{(1-\gamma_{0q})\Lambda_q} \tag{15}$$

with:

$$\begin{aligned}\Lambda_q &= z_{0q} - \lambda_{0q}\left[F_{zq}(\tilde{z}_{dq})c_{0q} + \left(1-F_{zq}(\tilde{z}_{dq})\right)(d_{1q}+c_{1q})\right] - (r+\lambda_{0q})d_{0q} - r\rho_{0q}V_{uq} \\ &\quad - \frac{\lambda_{0q}}{r+\lambda_{1q}}\left[1-\gamma_{1q}+\gamma_{1q}\frac{\rho_{0q}}{\rho_{1q}}\right]\int_{\tilde{z}_{dq}}^{\infty}\varepsilon_q(z_d)dF_{zq}(z_d)\end{aligned} \tag{16}$$

The unemployment flow value V_{uq} of skilled workers decreases demand for this type of workers. The tightness of this labor market θ_q is a decreasing function of V_{uq}. Tightness also decreases with the cost of a vacant job h_q and the workers' bargaining power in CDD and CDI[16] (γ_{0q} and γ_{1q}, respectively). It increases with the CDD productivity z_{0q}.

Concerning the tax and social-contribution parameters, levies d_{0q}, d_{1q}, c_{1q} and ρ_{1q} increase labor costs and so reduce labor demand. For a given V_{uq}, they decrease labor-market tightness θ_q. The impact of CDD termination costs c_{0q} is ambiguous, as it partially reduces the "holdup" phenomenon, which, in turn, increases tightness. The tax wedge effect ρ_{0d} also has an indeterminate impact on θ_q as it reduces the collective surplus but increases the share of the firm's surplus in the wage negotiation (See Table 1).

Labor supply: The labor supply equation is given by Equation 17 (See Appendix A.4 for calculation). The unemployment flow value V_{uq} is an increasing function depending on the tightness θ_q, as the unemployed expect to find work more easily if tightness is greater.

$$\theta_q m_q(\theta_q) = \frac{(rV_{uq}-b_q)(r+\lambda_{0q})\rho_{0q}}{\gamma_{0q}\Lambda_q} \tag{17}$$

Moreover, the unemployment flow value increases with unemployment benefits b_q and the CDD worker's negotiation power, γ_{0q}. By contrast, it decreases with the CDI worker's

[16] This last point needs the hypothesis, which is verified in practice, $\rho_{0q} < \rho_{1q}$.

Table 1: Impact of tax and social-contribution parameters for skilled workers (negotiated wages under CDDs)

	Labor-demand curve	Labor-supply curve	Impact on: θ_q	V_{uq}	$\tilde{z}_{dq}$
d_{0q}	↓	↑	↓	↓ *	↓
d_{1q}	↓	↑	↓	↓ *	?
c_{0q}	?	?	?	?	↓
c_{1q}	↓	↑	↓	↓ *	?
ρ_{0q}	?	↑	?	↓[č]	↓[č]
ρ_{1q}	↓	↑	↓	↓ *	?

*Note: Demonstration of the results are given in Appendix A.4. Some results, marked *, can be directly deduced from the shifts in labor supply and demand curves. Moreover, the results indicated by ** require an assumption about the value of η_q, verified in practice.*

Interpretation: The labor-demand curve, plotted in the plane (V_{uq},θ_q), shifts toward the low values of θ_q when d_{0q} increases, whereas the labor-supply curve shifts toward the high values of θ_q. At equilibrium, an increase of d_{0q} reduces θ_q. The impact of c_{0q} on the labor supply and demand curves is ambiguous.

negotiation power, γ_{1q}.[17]

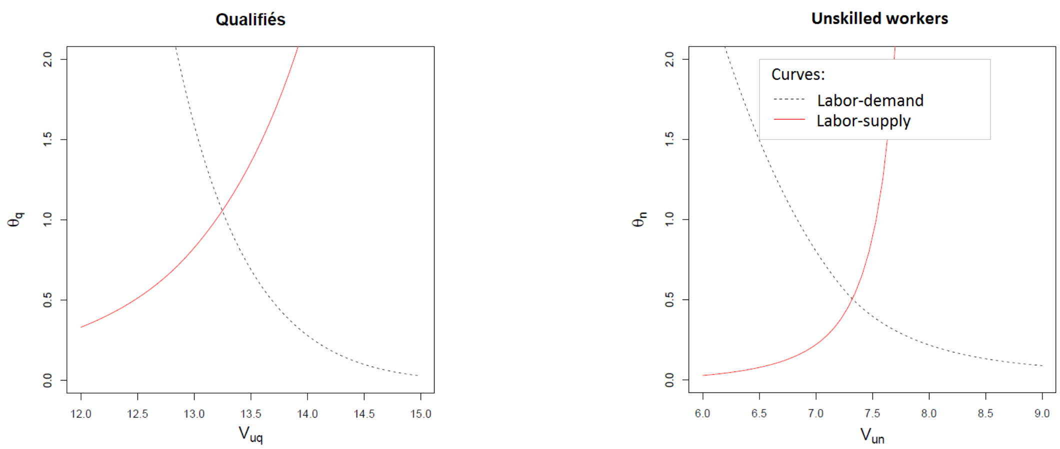
Because of the CDD wage negotiation, the impact of the tax and social-contribution parameters is symmetrical to those of the labor-demand equation. For a given labor-market tightness θ_q, d_{0q}, d_{1q}, c_{1q} and ρ_{1q} reduce V_{uq}. ρ_{0q} also reduces V_{uq} as the tax wedge diminishes the collective surplus of a CDD matching and decreases the worker's share of this surplus (See Appendix A.4 for the demonstration). c_{0q} has also an ambiguous effect by reducing the "holdup" phenomenon.

Equilibrium: Equilibrium is deduced from labor demand and supply curves (See Figure 3). The cost of a vacancy h_q reduces labor-market tightness and the unemployment flow value. Unemployment benefits, b_q, and the CDD worker's negotiation power in CDD, γ_{0q}, also decrease the tightness. However, b_q positively impacts the unemployment flow value, whereas γ_{0q} has an ambiguous effect–positive on wages, negative on job access.

The impact of d_{0q}, d_{1q}, c_{1q} and ρ_{1q} on V_{uq} is directly deduced from the shifts in labor supply and demand curves. All four parameters reduce the unemployment flow value. They

[17] Under the hypothesis, verified in practice, $\rho_{0q} < \rho_{1q}$.

Figure 3: Labor market equilibrium for skilled and unskilled workers



decrease the tightness of the labor market using the labor demand but increase it concerning the labor supply. However, the calculation shows that the first mechanism is stronger and, consequently, the four parameters decrease *in fine* the labor market tightness. The impact of c_{0q} and ρ_{0q} on V_{uq} and θ_q are ambiguous for the same previous reasons. But we can show that ρ_{0q} reduces V_{uq} (See Appendix A.4).

$\tilde{z}_{dk}$ variations are also valuable, notably for assessing the impact of duality, because they show how tax and social-contribution parameters modify the probability of being hired under a permanent contract after a CDD. Accordingly, an increase in d_{0q}, c_{0q} and ρ_{0q} decreases $\tilde{z}_{dq}$ and so increases the likelihood of being hired under a CDI. Our intuitions are the following: d_{0q} increases the initial hiring cost, what encourages employers to extend short-term contracts by CDI. c_{0q} directly encourages CDI hiring rather than CDD termination; ρ_{0q} reduces the CDI cost relative to the CDD cost. d_{1q}, c_{1q} and ρ_{1q} have an ambiguous impact on these hiring probabilities, as they directly reduce the benefits of CDI but reduce the unemployment flow value V_{uq}. This tempers wage claims in CDI, increasing the CDI hiring probability.

3.2.3 Unskilled-workers equilibrium

Labor demand: As CDD wages are not negotiated, labor supply and demand differ from those of the skilled workers (Equation (18): see Appendix A.5 for calculation).

$$m_n(\theta_n) = \frac{h_n(r+\lambda_{0n})}{\Lambda_n^{(d)}} \tag{18}$$

with:

$$\Lambda_n^{(d)} = z_{0n} - \rho_{0n} w_{0n} - \lambda_{0n} \left[F_{zn}(\tilde{z}_{dn}) c_{0n} + (1 - F_{zn}(\tilde{z}_{dn}))(d_{1n} + c_{1n})\right] - (r + \lambda_{0n}) d_{0n} - \frac{\lambda_{0n}(1-\gamma_{1n})}{r+\lambda_{1n}} \int_{\tilde{z}_{dn}}^{\infty} \varepsilon_n(z_d) dF_{zn}(z_d) \tag{19}$$

Labor demand is still a decreasing function of the unemployment flow value. It falls with the cost of a vacancy, w_{0n}, and the CDI worker's bargaining power, γ_{1n}. By contrast, it rises with CDD productivity, z_{0n}.

As they increase the labor cost, d_{0n}, d_{1n}, c_{1n}, ρ_{0n} and ρ_{1n} reduce labor demand. However, the impact of the termination cost c_{0n} is ambiguous. As with skilled workers, the termination cost raises the hiring cost but also moderates the "holdup" phenomenon (Table 2).

Table 2: Impact of tax and social-contribution parameters for unskilled workers (CDD paid at minimum wage rate)

	Labor-demand curve	Labor-supply curve	Impact on: θ_n	V_{un}	$\tilde{z}_{dn}$
d_{0n}	$\downarrow$	0	$\downarrow$ *	$\downarrow$ *	$\downarrow$
d_{1n}	$\downarrow$	$\uparrow$	?	$\downarrow$ *	$\uparrow$
c_{0n}	?	$\downarrow$	$\downarrow$	?	$\downarrow$
c_{1n}	$\downarrow$	?	?	?	$\uparrow$
ρ_{0n}	$\downarrow$	0	$\downarrow$ *	$\downarrow$ *	$\downarrow$
ρ_{1n}	$\downarrow$	$\uparrow$	?	$\downarrow$ *	?

*Note: The demonstration of results is given in Appendix A.4. Some results, marked *, can be directly deduced from the shift in labor supply and demand curves.*

Interpretation: The labor demand curve, plotted in the plane (V_{un},θ_n), shifts to the low values of θ_q when d_{0n} rises, whereas the labor-supply curve does not change. At equilibrium, an increase of d_{0n} reduces θ_n. The impact of c_{0n} on the labor-supply curve is ambiguous.

Labor supply: Equation (20) is the labor-market supply (See Appendix A.5). The unemployment flow value increases with the labor-market tightness, θ_n, unemployment benefits, b_q, the minimum wage, w_{0n}, and the CDI worker's bargaining power, γ_{1n}.

$$\theta_n m_n(\theta_n) = \frac{(rV_{un} - b_n)(r+\lambda_{0n})}{\Lambda_n^{(o)}} \quad (20)$$

with:

$$\Lambda_n^{(o)} = w_{0n} - rV_{un} - \frac{\lambda_{0n}\gamma_{1n}}{\rho_{1n}(r+\lambda_{1n})}\int_{\tilde{z}_{dn}}^{\infty} \varepsilon_n(z_d)dF_{zn}(z_d) \quad (21)$$

For a tightness θ_n, c_{0n} increases the probability of being hired under a permanent contract and consequently the unemployment flow value, V_{un}. By contrast, d_{1n} decreases the probability of obtaining a CDI, reducing V_{un}. The impact of c_{1n} is undetermined because it decreases the probability of a CDI hiring but increases employment duration and the negotiated wage. The tax wedge for CDDs, ρ_{0n}, and the hiring cost, d_{0n}, have no impact on the labor-supply equation, as the wage is not negotiated in CDD. Consequently, the costs are entirely supported by the firm. ρ_{1n} decreases V_{un} because it reduces the probability of being hired under a CDI, as the wage is negotiated.

Equilibrium: As with skilled workers, equilibrium is obtained from by the labor supply and demand equations. Labor-market tightness decreases with the cost of a vacancy, h_n, unemployment benefits, b_n, the minimum wage, w_{0n}, and the CDI worker's bargaining power, γ_{1n}. By contrast, it rises with CDD productivity z_{0n}. The unemployment flow value, V_{un}, decreases with h_n and increases with b_n and z_{0n}. The impact of the minimum wage, w_{0n}, and the CDI worker's bargaining power, γ_{1n}, on V_{un} are undetermined. They increase wages for CDDs and CDIs respectively, but reduce hirings.

Table 2 summarizes the impact of tax and social-contribution variables on equilibrium. Higher taxes and contributions have a negative or ambiguous impact on V_{un}, θ_n and $\tilde{z}_{dn}$.

3.2.4 Unemployment

The Beveridge curve, shown in Equation (22) (See Appendix A.5 for calculation), gives the unemployment rate. The latter decreases with labor-market tightness. It increases with the probability of a productivity shock during a CDI, λ_{1k}, the probability of CDD termination, λ_{0k}, and the probability of being unemployed at the end of a CDD, $F_{zk}(\tilde{z}_{dk})$.

$$u_k = \frac{1}{1 + \theta_k m_k(\theta_k)\left[\frac{1}{\lambda_{0k}} + \frac{1}{\lambda_{1k}} \int_{\tilde{z}_{dk}}^{\infty} \frac{dF_{zk}(z_d)}{F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}\right]} \tag{22}$$

3.3 Labor market participation and the total economy

The working populations, N_k, are determined by the individual trade-off between labor and leisure (Cahuc and Carcillo (2007)). Inactivity income and leisure preferences are random variables (See Appendix A.7). As the utility of entering the market rises with the unemployment flow value, the probability of labor-market participation, Ψ_k, grows with V_{uk}.

We examine the two labor markets in parallel in a broader framework aiming at reproducing the whole economy. We consider a closed economy with capital and labor as inputs. The different types of labor–CDD or CDI, skilled or unskilled–are perfectly substitutable but differ by their productivity, z. In the long-term equilibrium, the value added is thus given, to within a constant factor, by $\sum_{k\in\{q,n\}} N_k[l_{0k}z_{0k} + l_{1k}\overline{z}_{1k}]$ where the $\overline{z}_{1k}$ values are the average CDI productivity values for each skills level (See Appendix A.8 for calculation).

General government is funded by payroll taxes, capital taxes, and taxes generated by labor market flows. General government has fixed expenditures and distributes unemployment benefits.

4 Calibration on French data

We calibrate the model using French data between 2003-2011 using an annual time unit. The self-employed workers are not taken into account. Some parameters are directly estimated while others are calibrated in order to make the model reflect some labor-market characteristics.

Labor-market flows: We estimate labor-market flows using the Labor Force Survey (LFS: in France, Enquête Emploi) with a quarterly panel. The measured transition probabilities (Table 5 in Appendix B.1) indicate λ_{0k} values of 1.52 for skilled workers and 1.64 for unskilled workers–for an average CDD duration of 8 and 7 months respectively. $F_{zk}(\tilde{z}_{dk})$ values are 40.8% for skilled workers and 57.1% for unskilled workers. At the end of a CDD, a skilled worker has 6 chances in 10 of staying on under a CDI; an unskilled worker, 4 chances in 10. The CDI average duration is 10 years for skilled workers and 7 years for unskilled workers. Unemployment durations are 5 and 6 months respectively. These values, lower than those actually observed, reflect the model's choice of a systematic unemployment transition between jobs (See Appendix B.1).

Using the LFS to compare CDI termination rates and average CDI tenure, we can assess the extent and regularity of productivity shocks on the labor market. If the shocks were large but infrequent, employers would dismiss their workers at almost every shock. As a result, mean tenure would be close to the average CDI duration. If, instead, the shocks were frequent but small, we would also observe substantial selection. Workers with high initial productivity, z_{dk}, would remain employed for a long period. Consequently, the average tenure of the stock of workers, which comprises highly productive workers, would exceed the average CDI duration as the low-productive workers do not keep their jobs for long. In practice, the average CDI tenure for skilled and unskilled workers as measured in the LFS is 2.7 and 3.4 longer respectively than the average CDI duration.

Wages: The LFS measures the ratio of average net wages between CDIs and CDDs. The average net wage for CDIs is 1.67 times that of CDDs for skilled workers, versus 1.28 for unskilled workers. On average, skilled workers earn 1.78 times more than unskilled workers.

Tax wedges: The tax wedge is the gap between the wage paid by the employer and the wage actually received by the worker. It captures the difference between purchasing power and labor costs, comprising social contributions, income tax, and VAT. For simplicity's sake, we do not take into account the labor costs that are not included in workers' compensation. We posit a homogeneous income tax rate of 10% (See, for instance, Laffargue (1996)). Supposing that 59% of the VAT is paid by households (See Conseil des impôts, 2001), national accounting data for 2010 put the average VAT rate on household consumption at 7.9%. The average employer's social contribution rate is 35.8%, calculated as the ratio of net wages to gross wages. This average is differentiated by skill because of the contribution exemption for low wages. Taking the mean payrolls and relative wages in the LFS, and factoring in the contribution exemption, we find employer's social contributions rates of 13.8% for unskilled CDD workers, 32.5% for unskilled CDI workers, 35.2% for skilled CDD workers, and 41.0% for skilled CDI workers. Private-sector employees contribute 21.5% of their gross wages. The total tax wedge is 1.74 and 2.02 for unskilled workers under CDDs and CDIs respectively, and 2.06 and 2.15 for skilled workers under CDDs and CDIs respectively.

Unemployment benefits: On the basis of wage levels for skilled and unskilled workers, unemployment benefits represent 67.2% of the average of the most recent wages for skilled workers and 72% for unskilled workers because of the contribution exemption for the latter.

Hiring and termination costs: Kramarz and Michaud (2009) show that CDD hiring costs are not significant, so that $d_{0k} = 0$. CDD termination costs c_{0k} are zero because the short-term contract allowance can be regarding as deferred compensation. Kramarz and Michaud (2009), also conclude that CDI hiring costs are equal to 3% of annual compensation and are linear with respect to wages. Consequently, we set d_{1k} at 3% of average wages at the start of a CDI, irrespective of the worker's skill level.

Dismissal costs are harder to calibrate. Abowd and Kramarz (2003) find high dismissal costs, with a large fixed cost. These results are confirmed by Kramarz and Michaud (2009). Fixed costs are particularly high for collective dismissals. On average, at the median wage level, dismissal costs are equivalent to 8 months' wages. However, the costs include severance pay, which should be treated as deferred wages in a wage-negotiation situation (Lazear (1990)). Subtracting severance pay, we assume that dismissal costs are equal to 5 months' mean wages at the end of a CDI (Cheron (2009)).

Bargaining power: Like Abowd and Allain (1996), we set CDI workers' bargaining power at 0.4.[18] We calibrate skilled CDD workers' bargaining power so that the ratio between their

[18] Cahuc, Gianella, Goux, and Zylberberg (2002) find 0.2%.

CDD and CDI wages is consistent with observations. Note that the bargaining power of 0.19 is lower than for CDI workers and that such a negotiation power would lead to a lower CDD wage for unskilled workers if CDD wages were negotiated.

Matching functions: The matching functions are Cobb-Douglas functions–$M_k(v,u) = M_{0k}v^{1-\eta_k}u^{\eta_k}$ with u and v the number of unemployed and vacancies, respectively. The m_k functions are written $m_k(\theta) = M_{0k}\theta^{-\eta_k}$. There is no consensus on the unemployment elasticity of the matching function. To our knowledge, the only estimate on French data is the one by Maillard (1997). However, the data are sensitive and the results of 0.6 or 0.7–depending on the specification–are higher than the figures for other countries. That is why we use 0.3 for each labor market, consistent with the recent results by Borowczyk-Martins, Jolivet, and Postel-Vinay (2012) on U.S. data, which correct endogeneity bias. In particular, if firms know that they will have trouble hiring, they may not advertise vacancies. We calibrate M_{0k} coefficients.

Productivity: The stochastic processes z_d and ε–defined by the cumulative distribution functions F_{zk} and $F_{\varepsilon k}$–follow a uniform law between z_{dk}^{min} and z_{dk}^{max} for z_d and between ε_k^{min} and 0 for ε, with $\varepsilon_k^{min} < 0$. By setting 0 as the maximum for ε, we aim to simplify the model, for we assume that the most recently created jobs are those best suited to a changing economic environment.

For unskilled workers, we normalize maximal productivity z_{dn}^{max} to 1. The other bounds–z_{dq}^{max}, z_{dn}^{min}, z_{dq}^{min}, ε_q^{min} and ε_n^{min}–are calibrated. This calibration notably ensure that the average productivity ratio between unskilled ans skilled workers is equal to the ratio of average labor compensation, i.e., that $\overline{(z_q)}/\overline{(z_n)}$ equal to $\overline{(\rho w)}_q/\overline{(\rho w)}_n$.

Labor supply: The labor-market participation rate is given by $\Psi_k(V_{uk}) = \Psi_{0k}\,{V_{uk}}^{\mu_k}$.[19] Labor market elasticity μ_k is set at 0.2 for both skilled and unskilled workers (Cahuc and Carcillo (2007) and Chetty (2012)). The Ψ_{0k} values are set to obtain the observed participation rate.

Interest rate: The interest rate r is 4% (Petrongolo and Pissarides (2001)).

Calibrated parameters: For each labor market, two degrees of freedom remain. We arbitrarily choose to set h_k at the level of z_{dk}^{max} and z_{0k} at 30% of the segment $[z_{dk}^{min}, z_{dk}^{max}]$.

[19] Formally, this means that the law of $U^{-1}(U(\zeta/r)+\xi)$ follows the cumulative distribution function $\Psi_k(x) = \Psi_{0k}x^{\mu_k}$ on the support $[1, \Psi_{0k}^{-1/\mu_k}]$ (See Appendix A.7).

The model parameters for both labor markets are summarized in Table 6 of Appendix C. The corresponding equilibrium is described in Tables 7 and 8 of the same appendix.

Ultimately, a 1% increase in the tax wedge raises the unemployment rate by 0.34 percentage points. In the (WS-PS) model, where the curve (PS) is horizontal in the long term and the tax-wedge elasticity of real labor costs in the (WS) curve is assumed to equal unity, such a sensitivity of the unemployment rate to the tax wedge corresponds to a quasi-elasticity of 3 of the negotiated wage to the unemployment rate in the (WS) curve. Empirical estimates based on French data for this parameter show an impact between 2 (L'Horty and Sobczak (1997)) and 6 (Cotis, Méary, and N. (1998) and Bonnet and Mahfouz (1996)). Moreover, a 1% increase in the minimum wage (Smic) destroys 0.21% of employment. Such a variation seems to be reasonable given the distribution of low wages, the estimates of the labor-cost elasticity of jobs used in the literature, and the available measures of the Smic's diffusion effect (Aeberhardt, Givord, and Marbot (2012)).

5 Three stylized public policies

We simulate the three reforms introduced in Section 2.2 using the model calibrated on French data. Some results–particularly the ones for job and unemployment stocks–are sensitive to the calibration. The effects on unemployment should be interpreted with caution. However, all results concerning labor market flows are robust to the parameter choices. The simulation results are summarized in Table 3.

5.1 "Gradually decreasing contributions" reform

We model the introduction of an additional contribution of 2 percentage points of gross wages[20] during the first year of employment, representing (*ex ante*) 0.1% of GDP. The additional contribution is equivalent to a hiring tax such as d_{0k} equal to 1.7% of annual gross wages.[21] This entails a cost for the employer of €306 and €447 for hiring unskilled and skilled workers respectively. The additional contribution is offset by a uniform decrease in labor contributions (ρ_{0k} and ρ_{1k}), corresponding to 0.26 percentage points of gross wages. Thanks to this decrease, the reform is neutral *ex ante* on the public finances, i.e., before

[20] Gross wages equal net wages plus VAT, income tax, and employees' social contributions. Total labor costs consist of gross wages plus employers' social contributions.

[21] The gap with the additional-contribution rate reflects the fact that life expectancy in the job during the first year is necessarily lower than 1 year.

taking into account agents' behavioral changes due to the reform.

By imposing a financial penalty on CDD hirings, the reform reduces labor-market flexibility, lengthening average unemployment and CDI durations by 0.13 months and 0.21 years respectively. As hirings are more expensive, employers have an incentive to decrease employee turnover and so to keep workers in their jobs. The reform also increases the share of CDI hirings at the end of CDDs. The employment rate rises for CDIs and falls for CDDs. This phenomenon is more pronounced for unskilled workers than for skilled workers. As the first are paid at the minimum wage level, the entire tax is supported by the firm. For skilled workers, wages are negotiated, so that the tax burden is shared between the worker and the employer.

As entry and exit flows are smaller, the matching is less efficient and CDI labor productivity decreases (by 0.51%). The impact on total productivity is a less negative -0.33% owing to the increase in the number of CDIs compared with CDDs. In all, value added decreases by 0.28%. Wages fall because of lower labor productivity and in spite of the tax wedge reduction. Excluding the 0.86% decline in wages of skilled CDD workers–due to the fact that the hiring tax is factored into the wage negotiation–most of the wage decrease is concentrated among unskilled CDI workers. By contrast, wages of skilled CDI workers do not change. The loss of productivity is sufficiently modest to be offset by the decrease in the tax and social-contribution parameters.

5.2 "Termination tax" reform

In this section, we model the introduction of a tax on labor-contract terminations, set at 16% of the worker's last gross monthly wage. We summarize the reform by an increase in the separation cost for all types of contract except CDDs converted to CDIs. In the model, therefore, we apply comparable increases to c_{0k} and c_{1k}, equivalent to 0.1 points of GDP. For the employer, the tax represents €245 at the end of a CDD not converted to a CDI and €340 at the end of a CDI for an unskilled worker (for a skilled worker, the tax comes to €356 and €597 respectively). As previously, the introduction of a termination cost is offset by a decrease in the tax wedge equal to 0.26% of the gross wage, in order to preserve fiscal neutrality.

The effects of this reform are relatively similar to those of the previous one, for employers anticipate the termination tax during the hiring negotiation. Thus, by encouraging employers to maintain the jobs, the reform increases the average CDI duration. Here, the incentive is direct–in contrast to the hiring tax, for which the incentive was the expectation of a higher replacement cost. Consistently with intuition, the impact on average duration is stronger then with the previous reform. We estimate it at 0.25 additional years versus 0.21. The reform also discourages hiring because of the expectation of a higher termination cost. Unemployment duration increases less than under the previous reform, by 0.11 months versus 0.13. This finding, as well, is consistent with intuition, since the incentive is less direct than the previous one. The employment rate rises 0.45 points for CDIs and falls 0.37 points for CDDs.

As CDI duration increases more than with the previous reform, the impact on productivity is more negative at -0.37% against -0.33%. The impact on value added is close to that of the previous reform, at -0.29% versus -0.28%.

Table 3: Reforms neutral *ex ante* on the public finance

		decreasing contrib.	termination tax	Italian style
Unskilled workers	V_{un}	-0.007	-0.004	+0.005
	$F_{zn}(\tilde{z}_{dn})$ (in %)	-0.32	-0.14	-1.13
	Average unemployment duration (in month)	+0.19	+0.16	+0.08
	Average CDI duration (in year)	+0.25	+0.27	-0.15
	u_n (in % of working population)	-0.03	-0.09	+0.11
	l_{0n} (ditto)	-0.53	-0.51	-0.07
	l_{1n} (ditto)	+0.55	+0.59	-0.04
	CDD hirings (ditto)	-0.86	-0.83	-0.12
	CDI hirings (ditto)	-0.29	-0.32	+0.23
	Productivity (in %)	-0.53	-0.56	+0.14
Skilled workers	V_{uq}	+0.004	+0.004	+0.011
	$F_{zq}(\tilde{z}_{dq})$ (in %)	-0.30	-0.06	-1.19
	Average unemployment duration (in month)	+0.00	+0.00	-0.07
	Average CDI duration (in year)	+0.12	+0.17	-0.16
	u_q (in % of working population)	-0.08	-0.09	-0.10
	l_{0q} (ditto)	-0.14	-0.15	-0.02
	l_{1q} (ditto)	+0.22	+0.24	+0.12
	CDD hirings (ditto)	-0.21	-0.23	-0.03
	CDI hirings (ditto)	-0.08	-0.13	+0.16
	Productivity (in %)	-0.20	-0.24	+0.07
Economy	Average unemployment duration (in month)	+0.13	+0.11	+0.04
	Average CDI duration (in year)	+0.21	+0.25	-0.15
	Unemployment rate (in % of working population)	-0.05	-0.09	+0.03
	CDD employment rate (ditto)	-0.37	-0.37	-0.05
	CDI employment rate (ditto)	+0.41	+0.45	+0.04
	CDD hirings (ditto)	-0.61	-0.59	-0.08
	CDI hirings (ditto)	-0.21	-0.25	+0.20
	Average CDD net wage (in %)	-0.15	-0.16	-0.33
	Average CDI net wage (in %)	-0.20	-0.19	+0.12
	Employment (in thousands)	+11	+22	-3
	Pay roll (in %)	+0.02	+0.07	+0.09
	CDI productivity (in %)	-0.51	-0.55	+0.14
	Productivity (in %)	-0.33	-0.37	+0.14
	Value added (in %)	-0.28	-0.29	+0.13
	Public administrations balance (in % of GDP)	+0.02	+0.04	+0.03

For skilled and unskilled workers alike, a termination tax is more favorable than gradually decreasing contributions in terms of unemployment flow values, which we can regard as equivalent to the well-being of new entrants. We find comparable results for average unemployment duration. However, gradually decreasing contributions have a more positive effect on the CDD-to-CDI conversion rate. The unemployment rate is relatively similar.

5.3 "Italian-style" reform

This third reform introduces an additional contribution on CDDs of 2.7% of the gross wage, equivalent to 0.1 points of GDP. To offset the tax and so ensure the reform's *ex ante* fiscal neutrality, CDI hirings at the end of CDDs are subsidized at the rate of 26% of the gross monthly wage on hiring. The subsidy amounts to €581 for unskilled workers and €997 for skilled workers.

The effects are very different from those of the first two reforms. There are more CDD-to-CDI conversions. The increase in the unemployment flow value is more significant, at 0.005 points or €272 for unskilled workers compared with a negative 0.004 points or -€359 for the gradually decreasing contributions. For skilled workers, the increase comes to 0.11 points versus 0.004 points with gradually decreasing contributions.

Contrary to the first two reforms, employers are incited to hire under CDIs and the labor market is less rigid. CDI entries rise by 0.2 points of the working population per year, compared with a 0.2-point decline with gradually decreasing contributions. CDD entries are slightly fewer, down 0.08 points. This reflects the ambiguous effect of higher CDI entry and exit rates and a larger tax wedge for CDDs. However, the decline in CDD entries is clearly smaller than with gradually decreasing contributions, which entail a 0.61-point loss.

This greater flexibility reflects the average unemployment and CDI durations. Average unemployment duration increases 0.04 per month, less than for the first two reforms (the increase with gradually decreasing contributions is 0.13). CDI duration decreases by 0.15 per year, whereas it increases with the first two reforms (up 0.21 with gradually decreasing contributions).

The share of short-term contracts in total employment decreases by a modest 0.05 points, compared with a more significant decline of 0.4 points under the other two reforms. The higher contributions on CDDs increase the share of CDIs in total employment. However, this effect is offset by the decrease of CDI entry costs d_{1k}, which raises the CDD share of total employment.[22] This result, paradoxical at first sight, is due to the fact that the reduction in d_{1k} costs raises the unemployment flow value and hence CDI exits. This effect is clearly stronger than the first one. By contrast, a uniform decrease in wage contributions under the previous reforms has only a slight impact on the share of short-term contracts in total employment.

Owing to a higher labor-market flexibility, the reform raises productivity (by 0.14%), unlike the first two reforms (for example, gradually decreasing contributions lower it by 0.33%). As a result, CDI wages rise 0.12% while CDD wages skilled workers shed 0.93% because of the wider tax wedge and despite the expectation of a hiring subsidy in the wage negotiation.

5.4 ***Ex post*** fiscal neutrality of the reforms

The reforms described above are calibrated so as to be fiscally neutral *ex ante*. Theoretically, it is preferable to ensure *ex post* neutrality, after agents change their behavior in response to the reform. This alternative approach yields results more sensitive to calibration, with a multiplier effect that is channeled through the (fragile) estimate of the impact on the fiscal balance. Moreover, it does not reflect actual practice, for reforms are calibrated on an *ex ante* basis because of the uncertainty of agents' responses to the reform.

The three reforms we have modeled generate a fiscal surplus. In *ex post* neutral reforms, the tax wedge is uniformly reduced to offset the surplus. The wedge is set at 0.27 points of the gross wage for the gradually decreasing contributions (putting the total decrease at 0.53 points), at 0.53 points for the termination tax putting the total decrease at 0.79 points), and 0.45 points for the "Italian" reform (curtailing the rise in contributions on CDDs to 2.3 points). Taking into account the *ex post* constraint on the fiscal balance does not significantly modify the results (See Table 12 in Appendix E) but leads to more favorable results in terms of employment.

[22] See Table 9 in Appendix D. This table summarizes the opposite effect of an increase of the CDI entry costs.

6 Conclusions

This article develops a matching model whose originality is its use of two different approaches. First, the model distinguishes between short-term and permanent jobs. Hiring under permanent contracts is endogenous and determined, in particular, by a stable productivity level for the job-worker match. This level is observed during an initial job under a short-term contract. Second, permanent job destructions are endogenous and take into account the long-term productivity component and productivity shocks. The shocks notably reflect the uncertainties concerning demand for the firm's products. We perform quantitative simulations based on the model's calibration on French labor-market characteristics.

Consistently with intuition, introducing a termination tax or gradually decreasing contributions reduces labor-market duality, which we can define as the share of short-term contracts (such as CDDs, temporary work, and trial periods) in total employment or as the share of short-term contracts converted to CDIs. However, the reduction in duality is obtained at the price of lower labor-market flexibility and its consequences, i.e., lower labor productivity, wages, and growth.

In keeping with the first intuition, a termination tax has a more positive effect than gradually decreasing contributions on the well-being of labor-market new entrants and average unemployment duration. These results are independent of the calibration. Our numerical simulations show that a termination tax provides a greater stimulus to employment but weighs on labor productivity.

The third reform we examined, inspired by the recent Italian policy, consists in an additional contribution on short-term contracts that finances a bonus for employers who hire a worker under a permanent contract after the short-term contract expires. Unlike the first two reforms, the third preserves labor-market flexibility and has a positive impact on growth and labor productivity. It diminishes labor-market duality by reducing the share of short-term contracts leading to unemployment. However, it generates only a modest decline in the share of short-term contracts in total employment.

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Appendix

A - Intermediate calculations and expressions of variables necessary for results analysis

A.1 - Simplified Bellman equations

After factoring in the free-entry condition ($\Pi_{vk} = 0$), the Bellman equations (équations (1)-(6)) can be rewritten as follows.

$$\begin{aligned}
\Pi_{0k} &= d_{0k} + h_k/m_k(\theta_k) && (23)\\
(r+\lambda_{0k})\Pi_{0k} &= z_{0k} - \rho_{0k}w_{0k} - \lambda_{0k}\left[F_{zk}(\tilde{z}_{dk})c_{0k} + (1-F_{zk}(\tilde{z}_{dk}))\,d_{1k}\right] \\
&\quad + \lambda_{0k}\int_{\tilde{z}_{dk}}^{\infty} \Pi_{1k}\,(z_d,0))\,dF_{zk}(z_d) && (24)\\
(r+\lambda_{1k})\Pi_{1k}\,(z_d,\varepsilon) &= z_d + \varepsilon - \rho_{1k}w_{1k}(z_d,\varepsilon) - \lambda_{1k}F_{\varepsilon k}\left(\underline{\varepsilon}_k(z_d)\right)c_{1k} \\
&\quad + \lambda_{1k}\int_{\underline{\varepsilon}_k(z_d)}^{\infty} \Pi_{1k}\left(z_d,\varepsilon'\right)dF_{\varepsilon k}(\varepsilon') && (25)
\end{aligned}$$

$$\begin{aligned}
(r+\theta_k m_k(\theta_k))\,V_{uk} &= b_k + \theta_k m_k(\theta_k)V_{0k} && (26)\\
(r+\lambda_{0k})\,V_{0k} &= w_{0k} + \lambda_{0k}F_{zk}\,(\tilde{z}_{dk})\,V_{uk} + \lambda_{0k}\int_{\tilde{z}_{dk}}^{\infty} V_{1k}\,(z_d,0)\,dF_{zk}(z_d) && (27)\\
(r+\lambda_{1k})\,V_{1k}\,(z_d,\varepsilon) &= w_{1k}(z_d,\varepsilon) + \lambda_{1k}F_{\varepsilon k}\left(\underline{\varepsilon}_k(z_d)\right)V_{uk} + \lambda_{1k}\int_{\underline{\varepsilon}_k(z_d)}^{\infty} V_{1k}\left(z_d,\varepsilon'\right)dF_{\varepsilon k}(\varepsilon') && (28)
\end{aligned}$$

Introducing S_{0k}^f, S_{0k}^e, $S_{1k}^f(.,.)$ et $S_{1k}^e(.,.)$, these equations become:

$$\begin{aligned}
S_{0k}^f &= \frac{h_k}{m_k(\theta_k)} && (29)\\
(r+\lambda_{0k})S_{0k}^f &= z_{0k} - \rho_{0k}w_{0k} - \lambda_{0k}\left[F_{zk}(\tilde{z}_{dk})c_{0k} + (1-F_{zk}(\tilde{z}_{dk}))\,(d_{1k}+c_{1k})\right] - (r+\lambda_{0k})d_{0k} \\
&\quad + \lambda_{0k}\int_{\tilde{z}_{dk}}^{\infty} S_{1k}^f(z_d,0)dF_{zk}(z_d) && (30)\\
(r+\lambda_{1k})S_{1k}^f(z_d,\varepsilon) &= z_d + \varepsilon - \rho_{1k}w_{1k}(z_d,\varepsilon) + rc_{1k} + \lambda_{1k}\int_{\underline{\varepsilon}_k(z_d)}^{\infty} S_{1k}^f\left(z_d,\varepsilon'\right)dF_{\varepsilon k}(\varepsilon') && (31)
\end{aligned}$$

$$\begin{aligned}
\theta_k m_k(\theta_k)S_{0k}^e &= rV_{uk} - b_k && (32)\\
(r+\lambda_{0k})\,S_{0k}^e &= w_{0k} - rV_{uk} + \lambda_{0k}\int_{\tilde{z}_{dk}}^{\infty} S_{1k}^e(z_d,0)dF_{zk}(z_d) && (33)\\
(r+\lambda_{1k})\,S_{1k}^e(z_d,\varepsilon) &= w_{1k}(z_d,\varepsilon) - rV_{uk} + \lambda_{1k}\int_{\underline{\varepsilon}_k(z_d)}^{\infty} S_{1k}^e\left(z_d,\varepsilon'\right)dF_{\varepsilon k}(\varepsilon') && (34)
\end{aligned}$$

Defining S^t_{0k} and $S^t_{1k}(.,.)$ by $S^t_{0k} = S^f_{0k} + \rho_{0k} S^e_{0k}$ and $S^t_{1k}(z_d,\varepsilon) = S^f_{1k}(z_d,\varepsilon) + \rho_{1k} S^e_{1k}(z_d,\varepsilon)$ for all z_d and ε values:

$$
\begin{aligned}
S^t_{0k} &= \frac{h_k}{m_k(\theta_k)} + \frac{\rho_{0k}}{\theta_k m_k(\theta_k)}(rV_{uk} - b_k) && (35) \\
(r+\lambda_{0k})\, S^t_{0k} &= z_{0k} - \lambda_{0k}\left[F_{zk}(\tilde{z}_{dk})c_{0k} + (1 - F_{zk}(\tilde{z}_{dk}))\,(d_{1k} + c_{1k})\right] - (r+\lambda_{0k})d_{0k} \\
&\quad - r\rho_{0k}V_{uk} + \lambda_{0k}\left[1 - \gamma_{1k} + \gamma_{1k}\frac{\rho_{0k}}{\rho_{1k}}\right]\int_{\tilde{z}_{dk}}^{\infty} S^t_{1k}(z_d,0)\,dF_{zk}(z_d) && (36) \\
(r+\lambda_{1k})\, S^t_{1k}(z_d,\varepsilon) &= z_d + \varepsilon - r(\rho_{1k}V_{uk} - c_{1k}) + \lambda_{1k}\int_{\underline{\varepsilon}_k(z_d)}^{\infty} S^t_{1k}\left(z_d,\varepsilon'\right)dF_{\varepsilon k}(\varepsilon') && (37)
\end{aligned}
$$

A.2 - Wages

From the results of wage negotiations (7) and (8), we can deduce Equations (38)-(41).

$$
\begin{aligned}
S^e_{0k} &= \frac{\gamma_{0q}}{\rho_{0q}} S^t_{0k} && (38) \\
S^f_{0k} &= (1 - \gamma_{0q}) S^t_{0k} && (39) \\
S^e_{1k}(z_d,\varepsilon) &= \frac{\gamma_{1q}}{\rho_{1q}} S^t_{1k}(z_d,\varepsilon), \quad \forall z_d,\varepsilon && (40) \\
S^f_{1k}(z_d,\varepsilon) &= (1 - \gamma_{1q}) S^t_{1k}(z_d,\varepsilon), \quad \forall z_d,\varepsilon && (41) \\
& && (42)
\end{aligned}
$$

From Equation (34) and using Equation (38), we obtain:

$$
(r+\lambda_{1k})\, S^t_{1k}(z_d,\varepsilon) = \frac{\rho_{1k}}{\gamma_{1k}}(w_{1k}(z_d,\varepsilon) - rV_{uk}) + \lambda_{1k}\int_{\underline{\varepsilon}_k(z_d)}^{\infty} S^t_k\left(z_d,\varepsilon'\right)dF_{\varepsilon k}(\varepsilon') \qquad (43)
$$

Substracting from Equation (37), we obtain $w_{1k}(z_d,\varepsilon) = (1-\gamma_{1k})rV_{uk} + \frac{\gamma_{1k}}{\rho_{1k}}(z_d + \varepsilon + rc_{1k})$ for all (z_d,ε). We use the same method to calculate the wage under a short-term contract for unskilled workers:

$$
\begin{aligned}
w_{0q} = &\ (1-\gamma_{0q})rV_{uq} \\
&+ \frac{\gamma_{0q}}{\rho_{0q}}\left\{z_{0q} - \lambda_{0q}\left[F_{zq}(\tilde{z}_{dq})c_{0q} + (1 - F_{zq}(\tilde{z}_{dq}))(d_{1q} + c_{1q})\right] - (r+\lambda_{0q})d_{0q}\right\} \\
&+ \lambda_{0q}\left[\frac{\gamma_{0q}(1-\gamma_{1q})}{\rho_{0q}} - \frac{\gamma_{1q}(1-\gamma_{0q})}{\rho_{1q}}\right]\int_{\tilde{z}_{dk}}^{\infty} S^t_{1k}(z_d,0)\,dF_{zk}(z_d) \qquad (44)
\end{aligned}
$$

A.3 - Reservation productivities for permanent hirings (CDIs) and continuation of permanent employment

Continuation of permanent employment: Integrating Equation (37) for ε from $\underline{\varepsilon}_k(z_d)$ to ∞, we calculate $\int_{\underline{\varepsilon}_k(z_d)}^{\infty} S_{1k}^t(z_d,\varepsilon')dF_{\varepsilon k}(\varepsilon')$ and, using (37) again, we obtain:

$$S_{1k}^t(z_d,\varepsilon)=\frac{\varepsilon}{r+\lambda_{1k}}+\frac{z_d-r(\rho_{1k}V_{uk}-c_{1k})}{r+\lambda_{1k}F_{\varepsilon k}\left(\underline{\varepsilon}_k(z_d)\right)}+\frac{\lambda_{1k}}{(r+\lambda_{1k})(r+\lambda_{1k}F_{\varepsilon k}\left(\underline{\varepsilon}_k(z_d)\right))}\int_{\underline{\varepsilon}_k(z_d)}^{\infty}\varepsilon' dF_{\varepsilon k}(\varepsilon') \tag{45}$$

Using Equation (45) and the relation $S_{1k}^t(z_d,\underline{\varepsilon}_k(z_d))=0$, we obtain Equation (10) for job destruction, which implicitly yields the value of $\underline{\varepsilon}_k(z_d)$ for all z_d.

The derivative of $\underline{\varepsilon}_k$ is $\frac{d\underline{\varepsilon}_k}{dz_d}(z_d)=-\frac{r+\lambda_{1k}}{r+\lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}$. The partial derivative of $\underline{\varepsilon}_k(z_d)$ is $\frac{\partial\underline{\varepsilon}_k}{\partial\rho_{1k}}(z_d)=\frac{r(r+\lambda_{1k})V_{uk}}{r+\lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}$, $\frac{\partial\underline{\varepsilon}_k}{\partial V_{uk}}(z_d)=\frac{r(r+\lambda_{1k})\rho_{1k}}{r+\lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}$ and $\frac{\partial\underline{\varepsilon}_k}{\partial c_{1k}}(z_d)=-\frac{r(r+\lambda_{1k})}{r+\lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}$.

Using $S_{1k}^t(z_d,\underline{\varepsilon}_k(z_d))=0$ again, we can rewrite Equation (45) very simply:

$$S_{1k}^t(z_d,\varepsilon)=\frac{\varepsilon-\underline{\varepsilon}_k(z_d)}{r+\lambda_{1k}} \tag{46}$$

CDI hiring: We obtain Equation (14) directly from Equation (12) (yielding $S_{1k}^t(\tilde{z}_{dk},0)$ as a function of $d_{1k}+c_{1k}-c_{0k}$) and Equation (46) above.

A.4 - Equilibrium for skilled workers

Supply and demand equations: We derive the labor-demand equation from Equations (29) and (36), using Equations (39) and (46) (with $\varepsilon=0$). We use the same method to calculate the labor-supply equation using Equations (32) and (36) and Equations (38) and (46).

When tax-wedge parameters are altered, the shifts in supply and demand curves (given in columns 2 and 3 of Table 1) are obtained directly, except for the effect of ρ_{0q} on labor supply. For this, we need to rewrite the supply equation as follows:

$$\theta_q m_q(\theta_q)=\frac{(rV_{uq}-b_q)(r+\lambda_{0q})}{\gamma_{0q}\left(\Lambda_q^c/\rho_{0q}+\Lambda_q^v\right)}$$

with Λ_q^c and Λ_q^v independant of ρ_{0q} :

$$\begin{cases} \Lambda_q^c & = & z_{0q} - \lambda_{0q}\left[F_{zq}(\tilde{z}_{dq})c_{0q} + \left(1 - F_{zq}(\tilde{z}_{dq})\right)(d_{1q} + c_{1q})\right] - (r + \lambda_{0q})d_{0q} \\ & & -\frac{\lambda_{0q}(1-\gamma_{1q})}{r+\lambda_{1q}} \int_{\tilde{z}_{dq}}^{\infty} \underline{\varepsilon}_q(z_d)dF_{zq}(z_d) \\ & = & (r + \lambda_{0q})S_{0q}^f + \rho_{0q}w_{0q} > 0 \\ \Lambda_q^v & = & -rV_{uq} - \frac{\lambda_{0q}\gamma_{1q}}{(r+\lambda_{1q})\rho_{1q}} \int_{\tilde{z}_{dq}}^{\infty} \underline{\varepsilon}_q(z_d)dF_{zq}(z_d) = (r + \lambda_{0q})S_{0q}^e - w_{0q} \end{cases}$$

Shift in θ_q, V_{uq} and $\tilde{z}_{dq}$: When the comparison of shifts in supply and demand curves enables us to deduce the direction of the V_{uq} variation, we ca determine whether θ_q is increasing, decreasing or constant from the fact that Equations (15) and (17) yield $\theta_q = (rV_{uq} - b_q)\rho_{0q}(1 - \gamma_{0q})/\gamma_{0q}/h_q$.

We can also determine the impact of other variables on θ_q, V_{uq} and $\tilde{z}_{dq}$. For this purpose, we need to calculate the variablesŠ directly derivatives from the tax and social-contribution parameters. We define Y_k by $Y_k = {}^t[\theta_k, V_{uk}, \tilde{z}_{dk}]$ and X_k be define by $X_k = {}^t[d_{0k}, d_{1k}, c_{0k}, c_{1k}, \rho_{0k}, \rho_{1k}]$. For skilled workers, taking the labor-demand Equation (15), the ratio between the labor-supply and labor-demand Equations (15) and (17) and the CDI-hiring (13), we can write $M_q dY_q = P_q dX_q$ with:

$$M_q = \begin{bmatrix} -\frac{\eta_q}{\theta_q} & \frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial V_{uq}} & \frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial \tilde{z}_{dq}} \\ -\frac{1}{\theta_q} & \frac{r}{rV_{uq}-b_q} & 0 \\ 0 & r\rho_{1q} & -1 \end{bmatrix}$$

$$P_q = \begin{bmatrix} -\frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial d_{0q}} & -\frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial d_{1q}} & -\frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial c_{0q}} & -\frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial c_{1q}} & -\frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial \rho_{0q}} & -\frac{1}{\Lambda_q}\frac{\partial \Lambda_q}{\partial \rho_{1q}} \\ 0 & 0 & 0 & 0 & -\frac{1}{\rho_{0q}} & 0 \\ 0 & -\frac{r+\lambda_{1q}F_{\varepsilon q}\left(\underline{\varepsilon}_q(\tilde{z}_{dq})\right)}{1-\gamma_{1q}} & \frac{r+\lambda_{1q}F_{\varepsilon q}\left(\underline{\varepsilon}_q(\tilde{z}_{dq})\right)}{1-\gamma_{1q}} & -\frac{\gamma_{1q}r+\lambda_{1q}F_{\varepsilon q}\left(\underline{\varepsilon}_q(\tilde{z}_{dq})\right)}{1-\gamma_{1q}} & 0 & -rV_{uq} \end{bmatrix}$$

$$\begin{cases} \frac{\partial \Lambda_q}{\partial V_{uq}} & = & -\rho_{0q}r - \lambda_{0q}\left[(1-\gamma_{1q})\rho_{1q} + \gamma_{1q}\rho_{0q}\right] \displaystyle\int_{\tilde{z}_{dq}}^{+\infty} \frac{rdF_{zq}(z_d)}{r + \lambda_{1q}F_{\varepsilon q}\left(\underline{\varepsilon}_q(z_d)\right)} \ < \ 0 \\ \frac{\partial \Lambda_q}{\partial \tilde{z}_{dq}} & = & -\frac{\lambda_{0q}\gamma_{1q}\rho_{0q}}{(1-\gamma_{1q})\rho_{1q}}(d_{1q} + c_{1q} - c_{0q})f_{zq}(\tilde{z}_{dq}) \ < \ 0 \end{cases}$$

$$\left\{\begin{array}{lcl}
\frac{\partial \Lambda_q}{\partial d_{0q}} & = & -(r+\lambda_{0q}) \ < \ 0 \\
\frac{\partial \Lambda_q}{\partial d_{1q}} & = & -\lambda_{0q}(1-F_{zq}(\tilde{z}_{dq})) \ < \ 0 \\
\frac{\partial \Lambda_q}{\partial c_{0q}} & = & -\lambda_{0q}F_{zq}(\tilde{z}_{dq}) \ < \ 0 \\
\frac{\partial \Lambda_q}{\partial c_{1q}} & = & -\lambda_{0q}\displaystyle\int_{\tilde{z}_{dq}}^{+\infty}\left[1-\frac{r}{r+\lambda_{1q}F_{\varepsilon q}\left(\underline{\varepsilon}_q(z_d)\right)}\left(1-\gamma_{1q}+\gamma_{1q}\frac{\rho_{0q}}{\rho_{1q}}\right)\right]dF_{zq}(z_d) \ < \ 0 \\
\frac{\partial \Lambda_q}{\partial \rho_{0q}} & = & -rV_{uq}-\frac{\lambda_{0q}\gamma_{1q}}{(r+\lambda_{1q})\rho_{1q}}\displaystyle\int_{\tilde{z}_{dq}}^{\infty}\underline{\varepsilon}_q(z_d)dF_{zq}(z_d) \\
\frac{\partial \Lambda_q}{\partial \rho_{1q}} & = & \frac{\lambda_{0q}\gamma_{1q}\rho_{0q}}{(r+\lambda_{1q})\rho_{1q}^2}\displaystyle\int_{\tilde{z}_{dq}}^{\infty}\underline{\varepsilon}_q(z_d)dF_{zq}(z_d) \\
 & & -\lambda_{0q}V_{uq}\left(1-\gamma_{1q}+\gamma_{1q}\frac{\rho_{0q}}{\rho_{1q}}\right)\displaystyle\int_{\tilde{z}_{dq}}^{\infty}\frac{rdF_{zq}(z_d)}{r+\lambda_{1q}F_{\varepsilon q}\left(\underline{\varepsilon}_q(z_d)\right)} \ < \ 0
\end{array}\right.$$

We thus obtain $\frac{dY_q}{dX_q}$ par $\frac{dY_q}{dX_q}=M_q^{-1}P_q$.

$$M_q^{-1}=\frac{1}{\det M_q}\left[\begin{array}{ccc}
-\frac{r}{rV_{uq}-b_q} & \frac{1}{\Lambda_q}\left(\frac{\partial \Lambda_q}{\partial V_{uq}}+r\rho_{1q}\frac{\partial \Lambda_q}{\partial \tilde{z}_{dq}}\right) & -\frac{r}{\Lambda_q(rV_{uq}-b_q)}\frac{\partial \Lambda_q}{\partial \tilde{z}_{dq}} \\
-\frac{1}{\theta_q} & \frac{\eta_q}{\theta_q} & -\frac{1}{\theta_q\Lambda_q}\frac{\partial \Lambda_q}{\partial \tilde{z}_{dq}} \\
-\frac{r\rho_{1q}}{\theta_q} & \frac{\eta_q \, r\rho_{1q}}{\theta_q} & -\frac{\eta_q \, r}{\theta_q(rV_{uq}-b_q)}+\frac{1}{\theta_q\Lambda_q}\frac{\partial \Lambda_q}{\partial V_{uq}}
\end{array}\right]$$

with $\det M_q=\frac{\eta_q \, r}{\theta_q(rV_{uq}-b_q)}-\frac{r\rho_{1q}}{\theta_q\Lambda_q}\frac{\partial \Lambda_q}{\partial \tilde{z}_{dq}}-\frac{1}{\theta_q\Lambda_q}\frac{\partial \Lambda_q}{\partial V_{uq}} \ > \ 0.$

The variations of the functions are summarized in Table 1. Results are taken directly from previous equations, except for ρ_{0q}.

For this variable, we must make an assumption about the value of η_q with respect to γ_{1q}.

$$\left\{\begin{array}{lcl}
\frac{dV_{uq}}{d\rho_{0q}} & = & \frac{1}{\theta_q\rho_{0q}}\left(\frac{\rho_{0q}}{\Lambda_q}\frac{\partial \Lambda_q}{\partial \rho_{0q}}-\eta_q\right) \\
\frac{d\tilde{z}_{dq}}{d\rho_{0q}} & = & \frac{r\rho_{1q}}{\theta_q\rho_{0q}}\left(\frac{\rho_{0q}}{\Lambda_q}\frac{\partial \Lambda_q}{\partial \rho_{0q}}-\eta_q\right) \\
\text{avec :} & & \\
\frac{\rho_{0q}}{\Lambda_q}\frac{\partial \Lambda_q}{\partial \rho_{0q}} & = & \gamma_{0q}\frac{(r+\lambda_{0q})S_{0q}^e-w_{0q}}{(r+\lambda_{0q})S_{0q}^e}
\end{array}\right.$$

Thus $\frac{dV_{uq}}{d\rho_{0q}}$ and $\frac{d\tilde{z}_{dq}}{d\rho_{0q}}$ are negative if and only if $\eta_q>\gamma_{0q}\left(1-\frac{w_{0q}}{(r+\lambda_{0q})S_{0q}^e}\right)$. We regard this condition as being satisfied (it is met for a large window of allowed parameters). This condition is notably met if the unemployment elasticity η_q of the matching function satisfies the Hosios condition ($\eta_q=\gamma_{0q}$, *cf.* Hosios (1990)).

A.5 - Equilibrium for unskilled workers

Demand and supply equations: We deduce the labor-demand equation (18) from Equations (29) and (30), using Equations (41) and (46) (with $\varepsilon=0$). We use the same method to calculate the labor-supply equation using Equations (20) using Equations (32) and (33) and Equations (40) and (46).

Shift in θ_n, V_{un} and $\tilde{z}_{dn}$: Using Equations (13), (18) and (20), we can write $M_n dY_n = P_n dX_n$ with:

$$M_n = \begin{bmatrix} \frac{\eta_n}{\theta_n} & -\frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial V_{un}} & 0 \\ \frac{1-\eta_n}{\theta_n} & \frac{1}{\Lambda_n^{(o)}}\frac{\partial \Lambda_n^{(o)}}{\partial V_{un}} - \frac{r}{rV_{un}-b_n} & \frac{1}{\Lambda_n^{(o)}}\frac{\partial \Lambda_n^{(o)}}{\partial \tilde{z}_{dn}} \\ 0 & r\rho_{1n} & -1 \end{bmatrix}$$

$$P_n = \begin{bmatrix} \frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial d_{0n}} & \frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial d_{1n}} & \frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial c_{0n}} & \frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial c_{1n}} & \frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial \rho_{0n}} & \frac{1}{\Lambda_n^{(d)}}\frac{\partial \Lambda_n^{(d)}}{\partial \rho_{1n}} \\ 0 & 0 & 0 & -\frac{1}{\Lambda_n^{(o)}}\frac{\partial \Lambda_n^{(o)}}{\partial c_{1n}} & 0 & -\frac{1}{\Lambda_n^{(o)}}\frac{\partial \Lambda_n^{(o)}}{\partial \rho_{1n}} \\ 0 & -\frac{r+\lambda_{1n}F_{\varepsilon n}(\underline{\varepsilon}_n(\tilde{z}_{dn}))}{1-\gamma_{1n}} & \frac{r+\lambda_{1n}F_{\varepsilon n}(\underline{\varepsilon}_n(\tilde{z}_{dn}))}{1-\gamma_{1n}} & -\frac{\gamma_{1n}r+\lambda_{1n}F_{\varepsilon n}(\underline{\varepsilon}_n(\tilde{z}_{dn}))}{1-\gamma_{1n}} & 0 & -rV_{un} \end{bmatrix}$$

$$\begin{cases} \frac{\partial \Lambda_n^{(d)}}{\partial V_{un}} = -\lambda_{0n}(1-\gamma_{1n})\rho_{1n}\int_{\tilde{z}_{dn}}^{\infty}\frac{rdF_{zn}(z_d)}{r+\lambda_{1n}F_{\varepsilon n}(\underline{\varepsilon}_n(z_d))} < 0 \\ \frac{\partial \Lambda_n^{(o)}}{\partial V_{un}} = -r-\lambda_{0n}\gamma_{1n}\int_{\tilde{z}_{dn}}^{\infty}\frac{rdF_{zn}(z_d)}{r+\lambda_{1n}F_{\varepsilon n}(\underline{\varepsilon}_n(z_d))} < 0 \\ \frac{\partial \Lambda_n^{(d)}}{\partial \tilde{z}_{dn}} = \lambda_{0n}(d_{1n}+c_{1n}-c_{0n})f_{zn}(\tilde{z}_{dn}) + \frac{\lambda_{0n}(1-\gamma_{1n})}{r+\lambda_{1n}}\underline{\varepsilon}_n(\tilde{z}_{dn})f_{zn}(\tilde{z}_{dn}) = 0 \\ \frac{\partial \Lambda_n^{(o)}}{\partial \tilde{z}_{dn}} = -\frac{\lambda_{0n}\gamma_{1n}}{(1-\gamma_{1n})\rho_{1n}}(d_{1n}+c_{1n}-c_{0n})f_{zn}(\tilde{z}_{dn}) < 0 \end{cases}$$

$$\begin{cases} \frac{\partial \Lambda_n^{(d)}}{\partial d_{0n}} = -(r+\lambda_{0n}) < 0 \\ \frac{\partial \Lambda_n^{(d)}}{\partial d_{1n}} = -\lambda_{0n}(1-F_{zn}(\tilde{z}_{dn})) < 0 \\ \frac{\partial \Lambda_n^{(d)}}{\partial c_{0n}} = -\lambda_{0n}F_{zn}(\tilde{z}_{dn}) < 0 \\ \frac{\partial \Lambda_n^{(d)}}{\partial c_{1n}} = -\lambda_{0n}\int_{\tilde{z}_{dq}}^{\infty}\left[1-\frac{r(1-\gamma_{1n})}{r+\lambda_{1n}F_{\varepsilon n}(\underline{\varepsilon}_n(z_d))}\right]dF_{zq}(z_d) < 0 \\ \frac{\partial \Lambda_n^{(d)}}{\partial \rho_{0n}} = -w_{0n} < 0 \\ \frac{\partial \Lambda_n^{(d)}}{\partial \rho_{1n}} = -\lambda_{0n}(1-\gamma_{1n})V_{un}\int_{\tilde{z}_{dn}}^{\infty}\frac{rdF_{zn}(z_d)}{r+\lambda_{1nF_{\varepsilon n}(\underline{\varepsilon}_n(\tilde{z}_{dn}))}} < 0 \end{cases}$$

$$
\begin{cases}
\frac{\partial \Lambda_n^{(o)}}{\partial d_{0n}} & = & 0 \\
\frac{\partial \Lambda_n^{(o)}}{\partial d_{1n}} & = & 0 \\
\frac{\partial \Lambda_n^{(o)}}{\partial c_{0n}} & = & 0 \\
\frac{\partial \Lambda_n^{(o)}}{\partial c_{1n}} & = & \frac{\lambda_{0n}\gamma_{1n}}{\rho_{1n}} \int_{\tilde{z}_{dn}}^{\infty} \frac{rdF_{zn}(z_d)}{r+\lambda_{1nF_{\varepsilon n}\left(\underline{\varepsilon}_n(\tilde{z}_{dn})\right)}} \ > \ 0 \\
\frac{\partial \Lambda_n^{(o)}}{\partial \rho_{0n}} & = & 0 \\
\frac{\partial \Lambda_n^{(o)}}{\partial \rho_{1n}} & = & -\frac{\lambda_{0n}\gamma_{1n}}{\rho_{1n}} \left[V_{un} \int_{\tilde{z}_{dn}}^{+\infty} \frac{rdF_{zn}(z_d)}{r+\lambda_{1nF_{\varepsilon n}\left(\underline{\varepsilon}_n(\tilde{z}_{dn})\right)}} + \frac{1}{(r+\lambda_{1n})\rho_{1n}} \int_{\tilde{z}_{dn}}^{+\infty} -\underline{\varepsilon}_n(z_d) F_{zn}(z_d) \right] \ < \ 0
\end{cases}
$$

We thus obtain $\frac{dY_n}{dX_n}$ par $\frac{dY_n}{dX_n} = M_n^{-1} P_n$.

$$
M_n^{-1} = \frac{1}{\det M_n} \begin{bmatrix}
\frac{r}{rV_{un}-b_n} - \frac{1}{\Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial V_{un}} - \frac{r\rho_{1n}}{\Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial \tilde{z}_{dn}} & -\frac{1}{\Lambda_n^{(d)}} \frac{\partial \Lambda_n^{(d)}}{\partial V_{un}} & -\frac{1}{\Lambda_n^{(o)}\Lambda_n^{(d)}} \frac{\partial \Lambda_n^{(d)}}{\partial V_{un}} \frac{\partial \Lambda_n^{(o)}}{\partial \tilde{z}_{dn}} \\
\frac{1-\eta_n}{\theta_n} & -\frac{\eta_n}{\theta_n} & -\frac{\eta_n}{\theta_n \Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial \tilde{z}_{dn}} \\
\frac{(1-\eta_n)r\rho_{1n}}{\theta_n} & -\frac{\eta_n r\rho_{1n}}{\theta_n} & -\frac{\eta_n}{\theta_n}\left(\frac{r}{rV_{un}-b_n} - \frac{1}{\Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial V_{un}}\right) + \frac{(1-\eta_n)}{\theta_n \Lambda_n^{(d)}} \frac{\partial \Lambda_n^{(d)}}{\partial V_{un}}
\end{bmatrix}
$$

with $\det M_n = \frac{\eta_n}{\theta_n}\left(\frac{r}{rV_{un}-b_n} - \frac{1}{\Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial V_{un}}\right) - \frac{\eta_n r\rho_{1n}}{\theta_n \Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial \tilde{z}_{dn}} - \frac{(1-\eta_n)}{\theta_n \Lambda_n^{(d)}} \frac{\partial \Lambda_n^{(d)}}{\partial V_{un}} \ > \ 0.$

The variations of the functions are summarized in Table 2. Results are taken directly from previous equations, except for the impact of hiring and firing costs d_{1n} and c_{1n} on $\tilde{z}_{dn}$. These derivatives can be rewritten as:

$$
\begin{cases}
\det M \frac{d\tilde{z}_{dn}}{dd_{1n}} & = & \frac{(1-\eta_n)r\lambda_{0n}\rho_{1n}}{\theta_n \Lambda_n^{(d)}} \int_{\tilde{z}_{dn}}^{+\infty} \frac{\lambda_{1n}\left[F_{\varepsilon n}\left(\underline{\varepsilon}_n(\tilde{z}_{dn})\right) - F_{\varepsilon n}\left(\underline{\varepsilon}_n(z_d)\right)\right] dF_z(z_d)}{r+\lambda_{1n}F_{\varepsilon n}\left(\underline{\varepsilon}_n(z_d)\right)} \\
& & + \frac{\eta_n\left[r+\lambda_{1n}F_{\varepsilon n}\left(\underline{\varepsilon}_n(\tilde{z}_{dn})\right)\right]}{(1-\gamma_{1n})\theta_n} \left(\frac{r}{rV_{un}-b_n} - \frac{1}{\Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial V_{un}}\right) \ > \ 0 \\
\det M \frac{d\tilde{z}_{dn}}{dc_{1n}} & = & \frac{(1-\eta_n)r\lambda_{0n}\rho_{1n}}{\theta_n \Lambda_n^{(d)}} \int_{\tilde{z}_{dn}}^{+\infty} \frac{\lambda_{1n}\left[F_{\varepsilon n}\left(\underline{\varepsilon}_n(\tilde{z}_{dn})\right) - F_{\varepsilon n}\left(\underline{\varepsilon}_n(z_d)\right)\right] dF_z(z_d)}{r+\lambda_{1n}F_{\varepsilon n}\left(\underline{\varepsilon}_n(z_d)\right)} \\
& & + \frac{\eta_n r\rho_{1n}}{\theta_n \Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial c_{1n}} + \frac{\eta_n\left[r\gamma_{1n}+\lambda_{1n}F_{\varepsilon n}\left(\underline{\varepsilon}_n(\tilde{z}_{dn})\right)\right]}{\theta_n} \left(\frac{r}{rV_{un}-b_n} - \frac{1}{\Lambda_n^{(o)}} \frac{\partial \Lambda_n^{(o)}}{\partial V_{un}}\right) \ > \ 0
\end{cases}
$$

A.6 - Unemployment rate

In equilibrium, the CDD exit flow should be equal to the CDD hiring flow, i.e. $\lambda_{0k} l_{0k} = \theta_k m_k(\theta_k) u_k$.

Let G_k the cumulative distribution function of the initial productivities of the current CDIs, z_d. For low values of dz_d, the exit flow for initial productivities between z_d and $z_d + dz_d$

is the approximation $\lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))[G_k(z_d+dz_d)-G_k(z_d)]l_{1k}$. The entry flow is equal to $\lambda_{0k}[F_{zk}(z_d+dz_d)-F_{zk}(z_d)]l_{0k}$. Let f_{zk} and g_k be the density fuctions for F_{zk} and G_k. We obtain:

$$\forall\ z_d > \tilde{z}_{dk},\ \lambda_{0k}f_{zk}(z_d)l_{0k} = \lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))g_k(z_d)l_{1k} \tag{47}$$

With $\int_{\tilde{z}_{dk}}^{\infty} g_k(z_d)dz_d = 1$, we deduce the relation (48):

$$l_{1k} = \frac{\lambda_{0k}}{\lambda_{1k}}\int_{\tilde{z}_{dk}}^{\infty}\frac{dF_{zk}(z_d)}{F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}l_{0k} \tag{48}$$

From (48) and the previous relation between l_{0k} and u_k, we deduce $l_{1k} = \frac{\theta_k m_k(\theta_k)}{\lambda_{1k}}\int_{\tilde{z}_{dk}}^{\infty}\frac{dF_{zk}(z_d)}{F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}u_k$. Using $1 = u_k + l_{0k} + l_{1k}$, we obtain Equation (22), which gives the unemployment rate.

A.7 - Labor Market participation

An individual decides to enter the labor market regarding on the utilities of working or not. If she decides to enter the market, her utility is $U(V_{uk})$ where U is a growing and concave function. If she stays inactive, her utility is $U(\zeta/r)+\xi$ with ζ the inactivity earnings, ζ/r is the flow value of this income and ξ the preference for leisure. ξ et ζ are random variables, observed during the choice. Note the law of $U^{-1}(U(\zeta/r)+\xi)$, *a priori* different for each skill level, and Ψ_k its cumulative distribution function. Then, $\Psi_k(V_{uk})$ is the rate of labor market participation.

A.8 - Calculation of average CDI stock and CDI exit flows

Proportion of CDI employees, who have not ewperienced a productivity shock: For given values of k and z_d, we distinguish between CDI workers who did not experience a productivity shock (they represent $\pi_k(z_d)$ of all CDI workers), and those who did.

Between z_d and z_d+dz_d and for a duration of dt, with low values for dz_d and dt, the number of workers who have experienced an initial productivity shock and remain in CDIs is $\lambda_{1k}(1-F_{\varepsilon k}(\underline{\varepsilon}_k(z_d)))g_k(z_d)l_{1k}\pi_k(z_d)dz_d dt$. The number of workers having undergone an initial productivity shock and having experienced a new shock that leads to a contract termination is approximately $\lambda_{1k}F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))g_k(z_d)l_{1k}(1-\pi_k(z_d))dz_d dt$. At equilibrium, the stability of the number of CDI workers having experienced a productivity shock requires the following condition: $(1-F_{\varepsilon k}(\underline{\varepsilon}_k(z_d)))\pi_k(z_d) = F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))(1-\pi_k(z_d))$. Wz deduce that $\pi_k(z_d) = F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))$.

Cumulative distribution functions G_k of initial productivities: From Equations(47) and (48), it follows that the density g_k of CDI initial productivities is given by:

$$g_k(z_d) = \frac{\frac{f_{zk}(z_d)}{F_{\varepsilon k}(\epsilon_k(z_d))}}{\int_{\tilde{z}_{dk}}^{\infty} \frac{dF_{zk}(z_d)}{F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))}} \text{ pour } z_d \in [\tilde{z}_{dk}, +\infty[\tag{49}$$

Average CDI productivity: Distinguishing between CDI workers before and after a productivity shock and using $\pi_k(z_d) = F_{\varepsilon k}(\underline{\varepsilon}_k(z_d))$, we obtain:

$$E_k^{\text{CDI}}[z|z_d] = z_d + \int_{\underline{\varepsilon}_k(z_d)}^{\infty} \varepsilon dF_\varepsilon(\varepsilon)$$

In practice, with $F_{\varepsilon k}$ uniform on $[\varepsilon_k^{min}, 0]$, we obtain $\int_{\underline{\varepsilon}_k(z_d)}^{\infty} \varepsilon dF_{\varepsilon k}(\varepsilon) = \int_{\underline{\varepsilon}_k(z_d)}^{0} \frac{\varepsilon d\varepsilon}{-\varepsilon_k^{min}} = (1 - F_{\varepsilon k}(\underline{\varepsilon}_k(z_d)))\frac{\underline{\varepsilon}_k(z_d)}{2}$, yielding:

$$E_k^{\text{CDI}}[z|z_d] = z_d + (1 - F_{\varepsilon k}(\underline{\varepsilon}_k(z_d)))\frac{\underline{\varepsilon}_k(z_d)}{2}$$

Average CDI productiviy is logically given by:

$$E_k^{\text{CDI}}[z] = \int_{\tilde{z}_{dk}}^{\infty} E_k^{\text{CDI}}[z|z_d] dG_k(z_d)$$

Average CDI wage and average wage at CDI termination: Using $w_{1k}(z_d, \varepsilon) = (1 - \gamma_{1k}) r V_{uk} + \frac{\gamma_{1k}}{\rho_{1k}}(z_d + \varepsilon + r c_{1k})$ (cf. Appendix A.2), we calculate the average CDI wage:

$$E_k^{CDI}[w] = (1 - \gamma_{1k}) r V_{uk} + \frac{\gamma_{1k}}{\rho_{1k}} \left(E_k^{\text{CDI}}[z] + r c_{1k} \right)$$

Moreover, $E_k^{CDI}[w|z_d] = (1 - \gamma_{1k}) r V_{uk} + \frac{\gamma_{1k}}{\rho_{1k}} \left(z_d + \int_{\underline{\varepsilon}_k(z_d)}^{\infty} \varepsilon dF_{\varepsilon k}(\varepsilon) + r c_{1k} \right)$.

To calculate the average wage at the end of a CDI (needed to calibrate unemployment benefits b_k and the firing costs c_{1k}), we note that $E_k^{\text{fin CDI}}[w|z_d] = E_k^{CDI}[w|z_d]$. As CDI exit and entry flows are equal, the cumulative distribution function of z_d is identical for the both flows. Hence:

$$E_k^{\text{fin CDI}}[w] = \int_{\tilde{z}_{dk}}^{\infty} E_k^{CDI}[w|z_d] \frac{dF_z(z_d)}{1 - F_z(\tilde{z}_{dk})}$$

B - Calibration

B.1 - Measurement of labor market flows

We estimate labor-market flows from the French labor-force survey (LFS: in French, Enquête Emploi), used as a quarterly panel. Individuals are classified by skill level, using the standard French socio-occupational categories: "skilled workers" comprise executives, higher intellectual occupations, and intermediate occupations; other categories are classified as "unskilled workers." We also classify individuals by employment status: CDI (after the trial period), CDD (short term contracts and CDI during the trial period), unemployed, and inactive.

Workers in a trial period are identified as CDI workers with less than 3 months' tenure. All job changes away from CDIs are treated as transitions from the CDI category to the CDD category.

We consider that an individual's state is defined by a Markov chain, which supposes the absence of memory effects in the transition probabilities.

For each skill level k and on average during the 2003-2011 period, we calculate the state-transitions matrix $T_k^{1/4}$ by quarter. Using this matrix, we calculate the stationnary distribution ω_k (which is close to the proportion observed in the LFS in 2003-2011) and the generator matrix Γ_k of the Markov process, with $T_k^{1/4} = \exp(-\Gamma_k/4)$ (cf. Table 4). Indexes (i, j) of matrix Γ_k, for $i \neq j$, correspond to the parameter of the exponential law for the transition from state i to state j. The diagonal terms are defined by $(\Gamma_k)_{ii} = -\sum_{j \neq i}(\Gamma_k)_{ij}$.

Table 4: Transition probabilities before reprocessing (matrixes Γ_k)

Skilled workers

from... \ to...	Inactivity	Unemployment	CDD	CDI
Inactivity	-0.15	0.08	0.05	0.02
Unemployment	0.88	-2.14	1.25	0.01
CDD	0.23	0.39	-1.39	0.77
CDI	0.05	0.02	0.03	-0.10

Unskilled workers

from... \ to...	Inactivity	Unemployment	CDD	CDI
Inactivity	-0.15	0.09	0.05	0.01
Unemployment	0.89	-2.07	1.17	0.02
CDD	0.28	0.65	-1.52	0.58
CDI	0.07	0.04	0.04	-0.15

Next, we need to reprocess the generator matrixes to allow for the fact that some flows cannot occur in the model framework. These flows need to be constrained by treating them as transitions through one or more intermediate states. For instance, we consider that an observed transition from a CDI to a CDD corresponds in the model to an initial transition to unemployment followed by a second transition to a CDD. In this framework, all flows between the modelŠs scope of coverage and the "out-of-scope" status (economic inactivity) go through the unemployment state.[23] For entries into the model's scope, our choice reflects the fact that all transitions into (payroll) employment necessarily involve a job-seeking period, however brief. By contrast, for exits from the model, our choice enables us to capture all exits from employment. In particular, if we were to ignore exits to retirement, we would greatly underestimate CDI exit rates and therefore estimate average CDI durations inconsistent with reality. Our modeling choice implies shorter unemployement spells than in reality. This reflects the fact that, in the framework of our model, exits from unemployment encompass all successful job searches, including those that do not entail an actual unemployment spell in the strict sense.

In practice, we reprocess the matrixes as follows. First, we weight the Γ_k lines by the stationary distribution ω_k. The matrix obtained is written $(\omega_k \Gamma_k)$. During a short period dt, the value of the flow from the state i to the state j $(j \neq j)$ is $(\omega_k \Gamma_k)_{ij} dt$. If this transition is not possible in the model framework and needs to pass through the intermediary state e, the reprocessing of the matrix $(\omega_k \Gamma_k)$ involves setting the coefficient (i, j) to 0, adding $(\omega_k \Gamma_k)_{ij}$ to the coefficients (i, e) and (e, j) and substracting $(\omega_k \Gamma_k)_{ij}$ from the coefficient (e, e). The reprocessing matrix $\hat{\Gamma}_k$ is calculated by linking the lines of the processed matrix $(\widehat{\omega_k \Gamma_k})$ to the stationnary distribution ω_k.

The matrix $\hat{\Gamma}_k$ (See Table 5) also give the transition probabilities in continuous time from one state to another (parameters of exponential laws). For instance, the duration of the transition from unemployment to CDD for a skilled worker follows an exponential law of parameter 2.58, which represents an average unemployment duration of 5 months.

[23]The reprocessing thus consists of the following operations:

- CDI→CDD = CDI→unemployment + unemployement→CDD
- unemployment→CDI = unemployment→CDD + CDD→CDI
- inactivity→CDD = inactivity→unemployment + unemployment→CDD
- inactivity→CDI = inactivity→unemployment + unemployment→CDD+ CDD→CDI
- CDD→inactivity = CDD→unemployment + unemployment→inactivity
- CDI→inactivity = CDI→unemployment + unemployment→inactivity.

Table 5: Transition probabilities after reprocessing (matrixes $\hat{\Gamma}_k$)

Skilled workers

de... \ vers...	Inactivity	Unemployment	CDD	CDI
Inactivity	-0.15	0.15	0	0
Unemployment	2.00	-4.59	2.58	0
CDD	0	0.62	-1.52	0.90
CDI	0	0.10	0	-0.10

Unskilled workers

de... \ vers...	Inactivity	Unemployment	CDD	CDI
Inactivity	-0.15	0.15	0	0
Unemployement	1.66	-3.75	2.09	0
CDD	0	0.94	-1.64	0.70
CDI	0	0.15	0	-0.15

B.2 - Calibration

After arbitrarily choosing the h_k and setting the z_{0k} values in the interval $[z_{dk}^{min}, z_{dk}^{max}]$, nodegrees of freedom remain in the model. The reason is that five parameters need to be determined in each labor market: λ_{1k}, z_{dk}^{min}, ε_k^{min} and M_{0k}, as well as w_{0n} for unskilled workers and γ_{0q} for skilled workers. These five parameters must comply with the following five constraints: average CDI and CDD wage rate, average unemployment duration, average CDI duration, CDI tenure, and proportion of CDDs converted to CDIs. These five parameters are obtained by numerical optimization.

However, d_{1k}, c_{1k} and b_k are known only conditional upon CDI entry and exit wages. In practice, we determine these three parameters determined by iteration. Their values quickly converge in two or three steps.

We arbitrarily set z_{dq}^{max} to 1. We then take all variables relating to skilled workers and fit them proportionally to ensure that the average-wage ratio between skilled and unskilled workers matches the LFS observations.

The parameters and the model equilibrium are summarized in Tables 6, 7 and 8 of Appendix C.

C - Model parameters and simulations

Table 6: Model parameters

	Variable	Unskilled workers	Skilled workers
CDD hiring costs	d_{0k}	0	0
CDI hiring costs	d_{1k}	0.021	0.039
CDD dismissal costs	c_{0k}	0	0
CDI dismissal costs	c_{1k}	0.28	0.52
CDD tax wedge	ρ_{0k}	1.74	2.06
CDI tax wedge	ρ_{1k}	2.02	2.15
CDD termination probability	λ_{0k}	1.64	1.52
CDI productivity-shock probability	λ_{1k}	0.40	0.26
Constant factor of matching function	M_{0k}	3.36	2.48
Unemployment elasticity of matching function	η_k	0.3	0.3
CDD productivity	z_{0k}	0.63	1.30
Minimal productivity when CDI extended	z_{dk}^{min}	0.47	1.13
Maximal productivity when CDI extended	z_{dk}^{max}	1	1.70
Lower bound of productivity shocks	ϵ_k^{min}	-0.78	-1.07
Cost of a vacancy	h_k	1	1.70
Unemployment benefits	b_k	0.20	0.32
CDD bargaining power	γ_{0k}	-	0.19
CDI bargaining power	γ_{1k}	0.4	0.4
Wage under CDD	w_{0k}	0.24	-
Interest rate	r	4 %	
Constant factor of labor supply	Ψ_{0k}	0.29	0.34
Labor-supply elasticity	μ_k	0.2	0.2

Table 7: Equilibrium of each labor market

	Variable	Unskilled workers	Skilled workers
Unemployment flow value	V_{uk}	7.3	13.2
Reservation productivity for CDI hiring	$\tilde{z}_{dk}$	0.77	1.36
Labor-market tightness	θ_k	0.51	1.06
Average unemployment duration (months)	$1/(\theta_k m_k(\theta_k))$	5.8	4.7
Average CDI duration (years)		6.9	9.6
Unemployment rate (% of working population)	u_k	11.9	5.8
Employment rate (ditto)	$l_{0k} + l_{1k}$	88.1	94.2
CDD employment rate (ditto)	l_{0k}	15.1	9.7
CDI employment rate (ditto)	l_{1k}	73.0	84.5
CDD average net wage*	w_{0k}	0.24	0.34
CDD average productivity	z_{0k}	0.63	1.30
CDI average net wage*	$\overline{w}_{1k}$	0.33	0.58
CDI average productivity	$\overline{z}_{1k}$	0.75	1.37
Average net wage*		0.31	0.55
Average productivity		0.73	1.36
Net unemployment benefits* (€/month)		824	1 343
CDD average net wage* (ditto)		980	1 428
CDI average net wage* (ditto)		1 350	2 388
Average net wage* (ditto)		1 287	2 288
CDI hiring cost (in euros)		1 065	1 947
CDI dismissal cost (ditto)		13 772	25 753
Number of unemployed (million)		1.9	0.6
Number of CDD workers (ditto)		2.4	1.0
Number of CDI workers (ditto)		11.8	9.1
Working population (ditto)	N_k	16.2	10.7

* Net wages and benefits are calculated after taxes, including VAT.

Table 8: Main macro-economic agregates

	Value
GDP (€bn/year)	1937
Workers compensation (ditto)	1033
Gross payroll* (ditto)	760
Net payroll* (ditto)	498
Working population, excluding self-employed workers (million)	26.9
Number of unemployed (ditto)	2.5
Number of CDD workers (ditto)	3.5
Number of CDI workers (ditto)	20.9

*Net wages are calculated after tax, including VTA. Gross wages exclude employer contributions but include employee contributions.

Table 9: Impact of a hiring tax... (equal to 0.1% of GDP)

		...on CDD	...on CDI	...on all contract
Unskilled workers	V_{un}	-0.020	-0.024	-0.022
	$F_{zn}(\tilde{z}_{dn})$ (%)	-0.30	+0.83	+0.20
	Average unemployment duration (months)	+0.23	+0.13	+0.19
	Average CDI duration (years)	+0.23	+0.39	+0.30
	u_n (% of working population)	+0.07	-0.07	+0.01
	l_{0n} (ditto)	-0.50	-0.43	-0.47
	l_{1n} (ditto)	+0.43	+0.50	+0.46
	CDD hirings (ditto)	-0.82	-0.70	-0.77
	CDI hirings (ditto)	-0.28	-0.50	-0.38
	Productivity (%)	-0.49	-0.64	-0.56
Skilled workers	V_{uq}	-0.019	-0.034	-0.025
	$F_{zq}(\tilde{z}_{dq})$ (%)	-0.28	+0.83	+0.21
	Average unemployment duration (months)	+0.01	+0.02	+0.02
	Average CDI duration (years)	+0.11	+0.30	+0.19
	u_q (% of working population)	-0.06	-0.06	-0.06
	l_{0q} (ditto)	-0.13	-0.14	-0.13
	l_{1q} (ditto)	+0.19	+0.20	+0.19
	CDD hirings (ditto)	-0.20	-0.21	-0.21
	CDI hirings (ditto)	-0.08	-0.25	-0.15
	Productivity (%)	-0.18	-0.31	-0.24
Economy	Average unemployment duration (months)	+0.17	+0.10	+0.14
	Average CDI duration (years)	+0.20	+0.37	+0.27
	Unemployment rate (% of working population)	+0.02	-0.06	-0.02
	CDD employment rate (ditto)	-0.36	-0.32	-0.34
	CDI employment rate (ditto)	+0.30	+0.33	+0.31
	CDD hirings (ditto)	-0.59	-0.52	-0.56
	CDI hirings (ditto)	-0.20	-0.41	-0.29
	Average CDD net wage (%)	-0.21	-0.17	-0.20
	Average CDI net wage (%)	-0.34	-0.47	-0.39
	Employment (thousands)	-15	+3	-8
	Pay roll (%)	-0.23	-0.29	-0.26
	CDI productivity (%)	-0.46	-0.62	-0.27
	Productivity (%)	-0.29	-0.45	-0.12
	Value added (%)	-0.35	-0.44	-0.39
	Fiscal balance (% of GDP)	+0.03	+0.02	+0.03

Table 10: Impact of a termination tax… (equal to 0.1% of GDP)

		… on CDD	… on CDI	… on all contract
Unskilled workers	V_{un}	-0.013	-0.020	-0.017
	$F_{zn}(\tilde{z}_{dn})$ (%)	-1.45	+0.79	-0.11
	Average unemployment duration (months)	+0.30	+0.12	+0.20
	Average CDI duration (years)	+0.04	+0.41	+0.25
	u_n (% of working population)	+0.20	-0.12	+0.02
	l_{0n} (ditto)	-0.52	-0.46	-0.48
	l_{1n} (ditto)	+0.32	+0.59	+0.47
	CDD hirings (ditto)	-0.85	-0.76	-0.79
	CDI hirings (ditto)	-0.02	-0.52	-0.31
	Productivity (%)	-0.29	-0.68	-0.51
Skilled workers	V_{uq}	-0.006	-0.027	-0.018
	$F_{zq}(\tilde{z}_{dq})$ (%)	-1.28	+0.81	-0.04
	Average unemployment duration (months)	+0.00	+0.02	+0.01
	Average CDI duration (years)	-0.05	+0.32	+0.16
	u_q (% of working population)	-0.07	-0.07	-0.07
	l_{0q} (ditto)	-0.13	-0.16	-0.14
	l_{1q} (ditto)	+0.20	+0.23	+0.21
	CDD hirings (ditto)	-0.20	-0.24	-0.22
	CDI hirings (ditto)	+0.07	-0.26	-0.12
	Productivity (%)	-0.08	-0.33	-0.23
Economy	Average unemployment duration (months)	+0.21	+0.09	+0.14
	Average CDI duration (years)	+0.01	+0.39	+0.23
	Unemployment rate (% of working population)	+0.09	-0.10	-0.02
	CDD employment rate (ditto)	-0.37	-0.35	-0.35
	CDI employment rate (ditto)	+0.25	+0.41	+0.34
	CDD hirings (ditto)	-0.60	-0.56	-0.57
	CDI hirings (ditto)	+0.01	-0.42	-0.24
	Average CDD net wage (%)	-0.29	-0.16	-0.22
	Average CDI net wage (%)	-0.19	-0.44	-0.33
	Employment (thousands)	-30	+16	-4
	Pay roll (%)	-0.17	-0.19	-0.19
	CDI productivity (%)	-0.27	-0.67	-0.50
	Productivity (%)	-0.12	-0.49	-0.33
	Value added (%)	-0.24	-0.43	-0.35
	Fiscal balance (% of GDP)	+0.05	+0.05	+0.05

Table 11: Impact of an increase in the tax wedge... (equal to 0.1% of GDP)

		...on CDD	...on CDI	...on all contract
Unskilled workers	V_{un}	-0.019	-0.012	-0.012
	$F_{zn}(\tilde{z}_{dn})$ (%)	-0.29	+0.06	+0.02
	Average unemployment duration (months)	+0.22	+0.02	+0.04
	Average CDI duration (years)	+0.21	-0.04	-0.02
	u_n (% of working population)	+0.07	+0.10	+0.10
	l_{0n} (ditto)	-0.47	+0.07	+0.02
	l_{1n} (ditto)	+0.40	-0.16	-0.12
	CDD hirings (ditto)	-0.78	+0.11	+0.03
	CDI hirings (ditto)	-0.27	+0.03	+0.01
	Productivity (%)	-0.47	+0.08	+0.04
Skilled workers	V_{uq}	-0.023	-0.022	-0.022
	$F_{zq}(\tilde{z}_{dq})$ (%)	-0.34	+0.06	+0.02
	Average unemployment duration (months)	-0.05	+0.01	+0.01
	Average CDI duration (years)	+0.13	-0.02	-0.01
	u_q (% of working population)	-0.15	+0.03	+0.02
	l_{0q} (ditto)	-0.15	+0.03	+0.01
	l_{1q} (ditto)	+0.30	-0.06	-0.02
	CDD hirings (ditto)	-0.23	+0.04	+0.01
	CDI hirings (ditto)	-0.09	+0.01	+0.00
	Productivity (%)	-0.22	+0.04	+0.01
Economy	Average unemployment duration (months)	+0.14	+0.02	+0.03
	Average CDI duration (years)	+0.19	-0.03	-0.01
	Unemployemnt rate (% of working population)	-0.02	+0.07	+0.06
	CDD employment rate (ditto)	-0.35	+0.05	+0.01
	CDI employment rate (ditto)	+0.33	-0.15	-0.11
	CDD hirings (ditto)	-0.57	+0.08	+0.02
	CDI hirings (ditto)	-0.20	+0.02	+0.00
	Average CDD net wage (%)	-0.52	-0.00	-0.06
	Average CDI net wage (%)	-0.33	-0.13	-0.14
	Employment (thousands)	-6	-27	-26
	Pay roll (%)	-0.21	-0.26	-0.25
	CDI productivity (%)	-0.44	+0.10	+0.05
	Value added (%)	-0.31	-0.04	-0.07
	Fiscal balance (% of GDP)	+0.05	+0.01	+0.02

Table 12: *Ex post* balanced reforms

		decreasing contrib.	termination tax	Italian style
Unskilled workers	V_{un}	+0.006	+0.022	+0.027
	$F_{zn}(\tilde{z}_{dn})$ (%)	-0.35	-0.19	-1.17
	Average unemployment duration (months)	+0.15	+0.07	+0.01
	Average CDI duration (years)	+0.27	+0.32	-0.12
	u_n (% of working population)	-0.14	-0.30	-0.06
	l_{0n} (ditto)	-0.55	-0.56	-0.10
	l_{1n} (ditto)	+0.69	+0.86	+0.16
	CDD hirings (ditto)	-0.91	-0.92	-0.17
	CDI hirings (ditto)	-0.31	-0.35	+0.21
	Productivity (%)	-0.58	-0.65	+0.08
Skilled workers	V_{uq}	+0.028	+0.052	+0.051
	$F_{zq}(\tilde{z}_{dq})$ (%)	-0.33	-0.10	-1.23
	Average unemployment duration (months)	-0.00	-0.01	-0.09
	Average CDI duration (years)	+0.12	+0.19	-0.14
	u_q (% of working population)	-0.09	-0.12	-0.13
	l_{0q} (ditto)	-0.15	-0.17	-0.03
	l_{1q} (ditto)	+0.24	+0.29	+0.16
	CDD hirings (ditto)	-0.23	-0.26	-0.05
	CDI hirings (ditto)	-0.09	-0.14	+0.15
	Productivity (%)	-0.21	-0.27	+0.05
Economy	Average unemployment duration (in month)	+0.10	+0.04	-0.02
	Average CDI duration (in year)	+0.23	+0.28	-0.13
	Unemployment rate (in % of working population)	-0.12	-0.23	-0.08
	CDD employment rate (ditto)	-0.39	-0.40	-0.07
	CDI employment rate (ditto)	+0.53	+0.68	+0.22
	CDD hirings (ditto)	-0.63	-0.64	-0.11
	CDI hirings (ditto)	-0.22	-0.26	+0.20
	Average CDD net wage (%)	-0.09	-0.03	-0.24
	Average CDI net wage (%)	-0.04	+0.10	+0.38
	Employment (thousands)	+39	+77	+41
	Pay roll (%)	+0.29	+0.61	+0.53
	CDI productivity (%)	-0.57	-0.67	+0.05
	Productivity (%)	-0.37	-0.46	+0.07
	Value added (%)	-0.21	-0.15	+0.24
	Fiscal balance (% of GDP)	-0.00	-0.00	-0.00