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Job Protection — It is Good to be an Insider

Abstract

This study develops a search and matching model for labour markets with temporary and permanent contracts. It matches empirical patterns of higher matching rates and lower surplus for temporary workers and predicts an increase in separation taxes leads to a fall in the number of new permanent jobs, an increase in their wages, and stable separation rates because temporary workers shield permanent workers from adverse shocks. We find empirical support using a regional French policy experiment, the “Contrat de Transition Professionnelle”, which increased separation taxes for recently hired permanent workers in firms with fewer than 1,000 workers.

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1 Introduction

Not all jobs are created equal; some are more enjoyable, and some are more highly compensated. Often, the worse jobs also happen to be temporary. Temporary contracts account for the majority, 60%, of new hires in the EU (Arranz et al., 2014) and 14% of the total workforce in 2014 (Eurostat). Many countries apart from Europe, such as Japan and Korea, have seen substantial expansion in temporary contracts making this a truly global phenomenon (e.g. Kawaguchi and Ueno, 2013, Kim and Park, 2006). An increase of such magnitude warrants a closer look at the dynamics of temporary employment because it increases the possibility of an interaction between temporary and permanent employment. Permanent and temporary workers are distinguished by the protection afforded to permanent workers in the form of employer-incurred taxes upon termination. Thus, what happens in a dual labour market if these separation taxes change is of great practical importance¹. How will the proportion of permanent and temporary contracts change? What is the effect on wages and job security?

This study develops a model, based on the framework of Diamond, Mortensen, and Pissarides (DMP), to study dual labour markets and derive the implications of an increase in separation taxes. The main novelties of the model are along two dimensions. First, from a theoretical perspective, the model offers an explanation for the coexistence of different contracts and of the associated wage differential in addition to the heterogeneous match output. Second, from an empirical perspective, the model predicts the following. Conditional on a decrease in total hires², there will be relatively fewer permanent workers, and for those permanent workers who remain, the wage rate will increase. Additionally, separation rates for permanent workers do not change. This latter point is novel and a consequence of firms hiring workers on both types of contracts and temporary workers acting as a buffer to shocks.

France is an example of a dual labour market; since 2000, the share of temporary employees (direct hires and otherwise) has consistently been 10% (13% in 2006, INSEE, Enquete Emploi, 1982 to 2012). France also provides a convenient policy experiment, the ‘Contrat de Transition Professionnelle’ (CTP — Professional Transition Contract) enacted in 2006 to test the model’s predictions. To finance reemployment assistance, CTP increased separation taxes payable to the government for the ‘licenciement économique’ (separation for economic reasons) of permanent workers hired less than two years ago in firms with fewer than 1,000 workers in seven local labour markets. The empirical analysis exploits the matched French DADS and EAE-ESANE, BRN datasets along with the CTP policy³. For identification, because the experimental areas were not representative of France, we use propensity score matching (PSM)⁴. The results support the model. Albeit statistically insignificant, the number of permanent workers hired

1 Dual labour markets have coexisting temporary and permanent contracts. This describes many labour markets, but Spain and France are among the most salient examples.

2 Increasing separation taxes for newly hired permanent workers has an ambiguous effect on total hires if we do not impose the Hosios condition because it acts as a hiring tax simultaneously, potentially countering the congestion externality inherent in search and matching models. If the congestion externality is either weak or countered by the Hosios condition, an increase in dismissal taxes will decrease employment. In this case, the stated results hold.

3 The DADS — Déclaration Annuelle des Données Sociale — is administrative data from France that include wages, demographics, and information on the nature of jobs. It covers 85% of France’s salaried population. The remaining 15%, composed of the self-employed and state employees, was added in 2009. The EAE-ESANE — Élaboration des Statistiques Annuelles d’Entreprises — and BRN — Bénéfice Réel Normal — contain balance sheet information on private firms.

4 PSM uses the probability of being assigned to the treatment group as a matching criterion for the control group and is the appropriate choice because we have relatively few treated areas and a large number of potential control variables.

goes down. Two months after implementation, CTP-affected areas hired 60% fewer permanent workers than the control areas. The proportion of permanent workers to the total stock in affected areas was below that of the control areas by 2 to 10 percentage points after the policy announcement in the time period observed (2006 to 2008). Workers in permanent positions who were not hired during the ongoing year with tenure of less than one year⁵ negotiated hourly wage increases of roughly 7.5% despite not directly benefiting from the policy. Hourly wages of temporary workers show no significant change, while the results on economic activity (total employment and total revenue) are inconclusive, as in the model. Being eligible for the policy had no significant effect on wages or separation casting doubt on its efficacy. Finally, also in line with the model, hazard rates for the vast majority of permanent workers were stable.

Importantly, the model was not designed to match the above empirical findings which means that it is a prediction of the model that was subsequently supported by the data. Instead, the model was set up to match the following empirical regularities of the French labour market. Temporary contracts exhibit a higher matching rate than permanent contracts. In the early 2000s, 80% of new hires in France were temporary (Cahuc and Postel-Vinay, 2002). The model captures this by having a higher market tightness ($\frac{V}{U}$) in that segment⁶. In France, in U 2014, 16% of prime-aged workers (16 to 64 years) were temporary workers (Eurostat). A lower job surplus through lower wages and job satisfaction for observationally equivalent workers are observed in temporary contracts, and not only in France (OECD, 2002). Estimates of the wage gap range up to 14.9% and, for France, the wage gap was 7.5% in 2014 (Dias da Silva and Turrini, 2015). The model captures this factor by allocating a lower surplus to temporary workers. Additionally, as Lokiec (2010) documents, in France, temporary contracts are limited in total duration (18 months) by law and can be renewed once. Accordingly, the model limits temporary contracts to one period.

Firms employ multiple workers, and wages are determined à la Stole and Zwiebel (1996) whereby temporary workers extract part of the hiring costs, and permanent workers extract the separation taxes on top of the hiring costs, which, for newly hired workers, are lower (more on that below). Permanent contracts (in equilibrium, all hired at the same time) transition to full protection with a fixed probability. This feature is a direct reflection of the French labour market legislation at the time mandating lower firing taxes for permanent workers with less than two years of tenure; precisely what the CTP policy experiment changes.

Departing from Diamond-Mortensen and Pissarides (DMP), the production function exhibits DRS, and TFP is subject to idiosyncratic shocks necessitating adjustments in labour. This assumption allows for multi-worker firms, which, in turn, allows permanent and temporary contracts to coexist in the same firms. In standard DMP-style models with linear technology and homogenous workers, firms are indifferent (hence, they hire both temporary and permanent workers) only at a knife-edge value of the productivity-equating marginal benefit of a temporary and permanent contract. With DRS, this level is endogenously attained. Along with a higher probability of matching applicants to a temporary job, this enables firms to hire workers to such contracts despite an ex post surplus smaller than it is for permanent jobs by equalizing the expected surplus workers obtain from applying.

5 Due to data restrictions, I cannot follow individuals for longer than one year.

6 This is reminiscent of Berton and Garibaldi (2012), but the workers in this study are heterogenous in their reservation utility allowing for the coexistence of contract types. Here, workers are homogenous and, as we note later, decreasing returns to scale (DRS) are another ingredient that yields coexistence.

After a review of the relevant literature, Sections 2 and 3 detail the model. Section 4 explains the identification and data, Section 5 shows the results, and Section 6 concludes.

1.1 Related Literature

While the model is inspired by previous work, it differs noticeably from other dual labour market models as it does not require *ex ante* or *ex post* heterogeneity or variable match quality to avoid corner solutions (e.g. Berton and Garibaldi, 2012, House and Zhang, 2012, Tejada, 2017). Permanent status is not decided exogenously (Lindbeck and Snower, 2001) but upon vacancy posting, and full protection is automatically granted after reaching a period of tenure. Stable hazard rates for permanent workers challenge some of the more theoretical literature where higher separation taxes make permanent workers even safer (e.g. Alvarez and Veracierto, 2012, Cahuc and Postel-Vinay, 2002,), pointing to the importance of considering the role of temporary workers as buffers. Further, it is supported by the empirical analysis.

At the same time, the model draws upon previous work by Mortensen and Pissarides (1994) as it features a classic matching function. The mechanism that allows the coexistence of different contracts echoes Moen (1997) where a higher *ex post* surplus is traded for a higher job finding rate. There are multiple workers per firm, much like in Kaas and Kircher (2015) or Acemoglu and Hawkins (2014). Separation taxes are assumed to be exogenous as in Saint-Paul (1998). The wage setting is inspired by Elsby and Michaels (2013), who use the Stole and Zwiebel (1996) approach. Other papers have posited dual labour market set ups. In House and Zhang (2017), different contracts result from adverse selection and hiring costs. Alvarez and Veracierto (2012) grant workers job protection upon reaching a certain tenure. There is also a literature endogenizing dual labour markets via heterogeneous match quality combined with various other frictions; among others, Alonso-Borrego, Fernández-Villaverde, and Galdón-Sánchez (2005), Berton and Garibaldi (2012), Cagesse and Cunât (2008), Gagesse, Cunât and Metzger (2019), Cahuc, Charlot, and Malherbet (2016), and Cao, Shao and Silos (2011). The present study, however, features homogenous workers and uses the interplay of multi-worker firms and separation taxes with Stole and Zwiebel bargaining to reproduce key features such as lower wages for temporary workers.

The descriptive empirical literature on temporary workers has strongly influenced modeling choices in this study and includes Segal and Sullivan (1997), Autor (2001), and Houseman (2003a, 2003b). These authors find higher volatility and lower wages for temporary workers (features accounted for in the model) as well as increased usage in recent decades.

The effects of firing costs have been empirically studied at least since Lazear (1990) but this line of inquiry has been hampered chiefly by lack of finely grained and suitably large data. This, coupled with rare availability of natural/policy experiments, means that studies on the effect of firing costs on temporary workers are scarce and there is still some debate on the direction of the effect of firing costs on wages as well as on different groups of workers⁷. The seminal contribution by Lazear (1990) used cross country and aggregate data to gauge the

⁷ This is also the reason why there has been a relatively extensive literature that relies on positing models and calibrating them to gain insight in lieu of empirical analysis. Examples of this include Hopenhayn and Rogerson (1993), who do not distinguish between permanent and temporary workers, and also Alvarez and Veracierto (2012), who do. While these studies tend to find that turnover is reduced as well as general employment, much of this literature is not concerned with dual labor markets and wage effects are highly dependent on the assumptions about wage formation. Ultimately, it is a matter of analyzing real data to confirm, or disconfirm their findings.

impact of firing costs and finds that worker turnover is diminished. However, the mentioned data limitations do not allow for a more finely grained picture, especially with regards to wages for different groups of workers. Confirming lower turnover, contributions such as Haltiwanger, Scarpetta, and Schweiger (2008, 2014) used firm level data but still compared across countries and are virtually silent about wages. In comparison, this study leverages highly disaggregated individual data from France and has them matched with additional information from firms allowing to assess the impact on wages as well as contract types offered. There are some studies that employ more micro-level data. For instance, Cao, Shao and Silos (2011) use matched employer-employee data from Canada to estimate the parameters of their model. However they do not leverage a policy or natural experiment for identification. They find that increased firing costs increase the inequality between permanent and temporary workers, just like in this study, but no increase in permanent workers' wages. The latter may be due to either insufficient identification or institutional differences relative to France. Also using employer-employee matched data, though sadly restricted to the Vincenza and Treviso provinces of Italy, the study by Leonardi and Pica (2013) on an increase in firing taxes for firms with fewer than 15 workers finds wage reductions at entry. The difference compared to our results may be due to peculiarities of the provinces in the data set and to the structure of the reforms in France versus the structure of the reforms in Italy⁸. Finally, and sadly, their study fully excludes temporary workers from the sample. Centeno and Novo (2014) use matched employer-employee data from Portugal and exploit a reform that increased firing costs in firms with less than 21 workers. They find that increased firing costs led to lower wages for newly hired workers and no changes for incumbents. However, they remain silent about the proportion of temporary workers relative to permanent ones as well as the hazard rate out of employment. Further, identification relies on common trends for treatment and control groups which is questionable as it is likely that firms above 21 workers are systematically different from those below. In contrast, the use of PSM in the present study allows to specifically search for a valid control group.

The above means that, while there is some agreement on firing costs lowering turnover, despite vigorous efforts previous evidence is still imperfect as to who benefits or loses exactly, the effect on wages and with regards to the mix of contract types. This study fills some of this gap finding that lower turnover comes in the form of less hiring overall and that existing permanent workers, while insulated from dismissal, are able to extract higher wages. It does so while accounting for the interaction between temporarily and permanently employed workers, and also addressing identification issues by using PSM. The use of this methodology is by no means new and the closest contribution, in terms of methodology, is the study by Gobillon et al. (2012). They used PSM to evaluate the employment effects of the French Enterprise Zones program of 1997, a similarly localized experiment as the CTP, granting wage-tax exemptions to firms hiring locals and finding transitory expansionary effects.

Finally, there has been some previous work on the CTP itself, but more in the form of very preliminary assessments. Remy and Salzberg (2007) provide an early description and an evaluation of the progress of implementation providing recommendations for future measures.

8 The CTP increased dismissal taxes only for new hires while, in Italy, dismissal taxes increased for established workers in firms with fewer than 15 workers. This would also mean lower wages for new hires in the present set-up as higher rents at a later stage must be compensated for. Alternatively, the results presented here may be different because of institutions such as stronger unionization in France, and the fact that Italian reforms affected small firms where entrants were less likely to be treated equally. More on equal treatment of new entrants in the model section.

A second report, Dole (2010), written by one of the policy designers, contrasts the policy with the conventional reemployment scheme, the CRP (Contrat de Reclassement Personnalisé — Personalized Retraining Contract). The report describes the implementation in more detail and concludes by drawing some practical lessons for future schemes using specific local examples. The report stops short of an econometric analysis, likely due to a lack of readily available data at that time⁹. Bruno et al. (2012) describe the policy in the context of the drive towards Danish style ‘flexicurity’ in France and proceeds to offer a sociological analysis of the types of councilor expertise that was most beneficial to employment seekers and emphasizes that there was a general policy shift toward ‘sustained employability’. This may have been achieved individually but, sadly, is not borne out in the data as the subsequent analysis shows.

2 The Model

Time is discrete and discounted by β . There is a continuum L of risk neutral, infinitely lived, homogenous workers supplying one unit of time per period for work and a continuum F of firms with a Cobb-Douglas production function:

$$F(A_i, L) = A_i n^\alpha, \quad i = L, H \quad A_L < A_H \quad (2.1)$$

$\alpha < 1$ ensures DRS, and n is the number of workers (temporary and permanent). Firms are subject to an iid productivity shocks to either high productivity (H) with probability π_H or low productivity (L)¹⁰. This will also have as a consequence that there are exactly two sizes of firms determined by their productivity. With probability $1 - \delta$, firms dissolve at the end of a period, shed all workers, and are replaced. This means that the number of high productivity firms is given by: $F_H [1 - \delta(1 - \pi_H)]F$ and low productivity firms given by: $F_L = \delta(1 - \pi_H)F$. Those workers losing their job due to discontinuation of the firms, and those fired due to downsizing, enter the labour market in the next period. New firms start with high productivity¹¹.

Permanent and temporary workers are perfect substitutes in production, and differences are due to the types of contract, temporary and permanent, both of which are offered in the equilibrium. Permanent contracts have two phases. There is a probationary period that starts at hiring, where dismissal taxes $f_1 > 0$ apply. These initial permanent contracts are transformed at the rate ζ to even more protected permanent contracts with higher firing taxes $f_2 > f_1$, giving the worker maximum legal protection. This mirrors the set-up in France where, under the conventional scheme in the mid-2000s, there was a two-year period where firms faced lower dismissal taxes for permanent hires. The fact that a fraction of workers transitions every period into the more protected contracts will initially necessitate to keep track of the number of periods the firm has been in existence, j , but it does not alter the sizes of firms, wages paid under different contracts, or the number of total workers hired. Dismissal taxes are relayed as lump sums to firms and workers¹². Temporary contracts are automatically terminated after one period, making the market for temporary work a spot market. Once hired, temporary workers

9 This is a gap that the present study attempts to address.

10 The results would not change qualitatively were we to postulate state-dependent transition rates (e.g. Foster et al., 2008).

11 This can be justified by arguing that entrepreneurs will only start a business when it is profitable at the beginning and is also a common assumption in the DMP literature, e.g. Pissarides, 2000.

12 The exact allocation of these transfers is inconsequential because, in equilibrium, they are never paid.

serve out their term capturing that in France, temporary workers can only be prematurely fired if there is mutual agreement — a serious case of misconduct on the employee's side, a better job opportunity for the employee, or *force majeure*, an extremely rare case of unforeseen economic distress (Lokiec, 2010). Mutual agreement is covered by the negotiation and, in the model, better job opportunities can only come in the next period. Fundamentally, firms in France can determine the length of a temporary contract and equalize it to the time until new information arrives, so premature termination is not necessary. It may seem extreme that temporary workers do not transition to permanent contracts ever, but this captures the harsh reality that, in France, the vast majority temporary workers do not in fact transition to permanent positions¹³. For instance, Berson (2017) reports that in the period 2003 to 2016 only between 10 and 20% of temporary workers held a permanent position one year later. Because this does not necessarily imply employment with the same employer, this is an upper bound of the rate of conversion from a temporary position to a permanent one. Consequently, while the model is by necessity an abstraction, it reflects key properties of French reality and the legal framework. Temporary workers receiving *one* wage payment means there is no benefit from cutting the contract short as no wages are saved.

Briefly summarizing, at the beginning of its life, a firm hires permanent workers *once*, initially only subject to dismissal costs f_1 , and never dismisses them until dissolving. Over time, firms carry these workers over to every period as a stock and these permanent workers transition at rate ζ to more protected contracts with f_2 . This is independent of productivity. If productivity however is high, firms may in these periods also hire temporary workers. Firms and workers meet through the matching function:

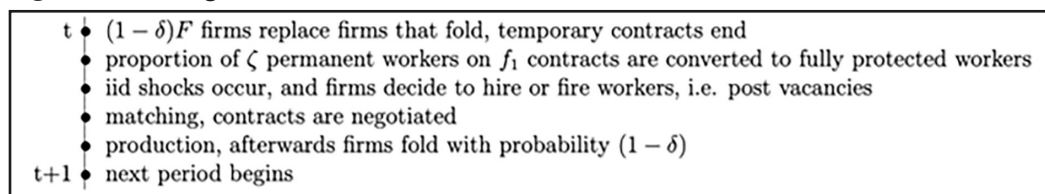
$$m(V, U) \tag{2.2}$$

$\frac{\partial m}{\partial U} > 0$, $\frac{\partial^2 m}{\partial^2 U} < 0$, $\frac{\partial m}{\partial V} > 0$, $\frac{\partial^2 m}{\partial^2 V} < 0$ where U is unemployed and V is vacancies. Denote $\theta = \frac{V}{U}$ the labour market tightness, and $p(\theta)$ and $q(\theta)$, the matching probability of workers and firms, respectively. With a continuum of workers, the law of large numbers means the firms obtain the number of workers determined by the matching probabilities. Posting a vacancy costs c . Firms offer protected vacancies or unprotected contracts. Firing taxes are relayed as a lump sum to firms and workers.

Wages are negotiated via Stole and Zwiebel (1996) bargaining, a generalization of Nash Bargaining (Nash, 1953) to a multi-worker set-up. Workers appropriate their own marginal product and the impact their hiring will have on the other workers' wages through diminishing their marginal product¹⁴. The model does not feature unemployment benefits, chiefly for simplicity, but there is evidence that benefits have little impact on wages. Jäger et al. (2018) find little wage response for all types of workers (high and low bargaining positions) to exogenous changes in unemployment insurance.

13 Conceptually, it would be relatively straightforward to allow for temporary contracts to be converted to permanent contracts at the end of their duration. However, this would necessitate the introduction of another group of temporary contracts, those that can potentially be converted, which would only exist in recently founded firms. This would necessitate the derivation of another wage schedule and also a taxonomy of multiple cases, some of which would be counterfactual because only new firms would hire temporary workers. While picking out the right sub-case from among these would introduce more realism while retaining the results of the current version of the model, the cost would be a much more cumbersome exposition an already rather complex model and the gain would be limited.

14 We make the implicit assumption that negotiation breakdown and a match that dissolves is legally interpreted as dismissal even if the worker decides to 'walk away'. Workers in France at the time had an incentive not to directly quit but to shift the blame to the employer as they could then collect unemployment benefits (French Labour Code: JORF no214 du 13 Septembre 2002) thus making it a credible threat, particularly if the employer and worker separate in a disagreement over salary.

Figure 1 Timing of the model.

Importantly, new permanent hires are assumed to receive the same wage as incumbents of similar observables (i.e. those still subject to lower firing costs) due to equal treatment contracts (see Snell and Thomas, 2010) or pay-scales (which can even be seen as independent of incumbents). This allows firms to commit to the initial dismissal taxes for permanent positions from the start and to offer separate contracts from temporary ones. Otherwise, firms could negotiate an upfront payment¹⁵.

In equilibrium, firms post vacancies of both types until indifferent and workers direct their search; that is, play a mixed strategy trading off a higher ex post surplus for higher ex ante job finding rates (see Moen, 1997). The number of permanent workers retained in the low productivity state delivers zero marginal profits in case of low productivity. Up to the aforementioned level of employment, firms avoid separation taxes and, thus, permanent workers are ex post more profitable. Beyond this point, employers would either incur a loss by paying dismissal taxes on permanent workers or show an operational loss. This serves as justification for why this equilibrium with both types of contracts is likely to prevail and is appropriate for study.

2.1 Value Functions

Since we are solving for a steady state, subscripts for the period will be suppressed.

2.1.1 The Firms' Problem

The value, $V_H(A_H, n_{PHO,j}^-, n_{PHN,j}^-, j)$ for a high-productivity firm that has survived j periods has the recursive form:

$$\begin{aligned}
 V_H(A_H, n_{PHO,j}^-, n_{PHN,j}^-, j) = & A_H \left(n_{PHO,j} + n_{PHN,j} + n_{TH} \right)^\alpha - n_{PHN,j} w_{PHN} - n_{TH} w_T - n_{PHO,j} w_{PHO} \\
 & - (n_{PHN,j} - n_{PHO,j} - n_{PHN,j}^+) \frac{c}{q(\theta_p)} - n_{TH}^+ \frac{c}{q(\theta_t)} \\
 & + \beta \delta \pi_H V_H(A_H, n_{PHO,j} + \zeta n_{PHN,j}, (1 - \zeta) n_{PHN,j}, j+1) \\
 & + \beta \delta (1 - \pi_H) V_L(A_L, n_{PHO,j} + \zeta n_{PHN,j}, (1 - \zeta) n_{PHN,j}, j+1) \quad \forall j
 \end{aligned} \tag{2.3}$$

¹⁵ This does have an empirical basis. Bewley (1999, 2004) furnishes early, survey-based evidence from the United States that firms use pay scales to avoid offering new workers different wages from those of comparable incumbents, controlling for skill and tenure for, moral/social reasons. Montorn'es and Sauner-Leroy (2015) provide evidence from a 2007 survey among French firms, concluding that pay scales are a major recruiting tool, while potential government enforcement of agreements also seems to play a role. Interestingly, pay scales are thought to be more relevant in highly unionized industries (Bewley, 1999), which is consistent with France's exceptionally high union coverage (98% according to the OECD, despite relatively low union membership). It is tempting to conclude that individual-level bargaining does not have significant influence on wages given such high union coverage. However, in practice, these agreements provide merely a floor, and workers are paid on average 47% above these wages (Fulton, 2015). Thus there is plenty of room for individual bargaining and dismissal costs to play a role. Snell et al. (2017), using German data, uncover evidence that there is no differential dynamic and no 'catch up' as workers transition from freshly hired to incumbent (but the data are still rather recent). Dube et al. (2019), using US retail data, find workers are sensitive to equal pay considerations. Saez et al. (2019) find that a payroll tax cut in Sweden for young workers increased wages in affected firms across the board and conjecture that 'pay equity concerns' within the firms; that is, (implicit) pay scales or equal treatment contracts, are the cause.

Where n_{TH} and $n_{PHN,j}$ decision variables of the firm. n_{TH} denotes temporary workers hired in the current period. $n_{PHN,j}$ will be the number of workers that the firm will have at the end of the period, i.e. any new hires and $n_{PHN,j}^-$. $n_{PHN,j}^-$ is the number of workers remaining in less protected permanent contracts that the firm starts with from the previous period. $n_{PHO,j}^-$ indicates the permanent workers that obtained full protection in any of the j previous period which since in the high productivity state no worker is fired is equal to $n_{PHO,j}$, the number of fully protected workers working this period at this firm. Clearly, a firm that is looking to hire, will be able to save hiring costs if it already has a stock of workers $n_{PHO,j}^- + n_{PHN,j}^-$. The relative number of less and fully protected permanent workers depends on how many periods the firm has survived and will be presented in section 2.4 in detail. ζ is the transition rate of permanent workers to the more protected state and in the final line of (2.3) we already substituted the number of permanent workers with either level of protection as they will be present at the start of the next period constituting $n_{PHO,j+1}^-$ and $n_{PHN,j+1}^-$ (in case of high productivity) or $n_{PLO,j+1}^-$ and $n_{PLN,j+1}^-$ (in case of low productivity). Wages are denoted w_{PHN} , w_{PHO} and w_T where the subscripts P and T denote permanent and temporary workers and the subscripts N and O denote the less and more protected permanent workers. The H subscript denotes the productivity of the firm in the current period (suppressed for temporary workers as they only exist in high productivity states). The future values are discounted at β and δ (discounting and destruction probability) and the relative number of different permanent workers in the future are determined by how many permanent workers transition at probability ζ into the more protected status. Let us note again that this means that a firm starts any period with a certain number of permanent workers with either f_1 or f_2 protection, keeps them in both states of productivity (and in equilibrium does not hire any additional permanent workers, unless it is the first period after creation), and then at the end of the period, the less protected permanent workers transition with probability ζ to the higher protection and then the firm enters with this new mix of permanent workers into the new period. Temporary and permanent contracts are offered to indifference, and firms are bound by the equal treatment clause for new permanent hires¹⁶. Firms reducing employment, not hiring temporary workers and potentially dismissing workers with protection, have the value function:

$$\begin{aligned}
 V_L(A_L, n_{PLO,j}^-, n_{PLN,j}^-) = & A_L (n_{PLN,j} + n_{PLO,j})^\alpha - n_{PLO,j} w_{PLO} - n_{PLN,j} w_{PLN} - 1_{n_{PLN,j} < n_{PLN,j}^-} f_2 (n_{PLN,j}^- - n_{PLN,j}) \\
 & - 1_{n_{PLO,j} < n_{PLO,j}^-} f_2 (n_{PLO,j}^- - n_{PLO,j}) + \beta \delta \pi_H V_H(A_H, n_{PLO,j} + \zeta n_{PLN,j}, (1 - \zeta) n_{PLN,j}, j + 1) \\
 & + \beta \delta (1 - \pi_H) V_L(A_L, n_{PLO,j} + \zeta n_{PLN,j}, (1 - \zeta) n_{PLN,j}, j + 1)
 \end{aligned} \tag{2.4}$$

Where the decision variables of the firm are $n_{PLN,j}$ and $n_{PLO,j}$ which are analogous to above the numbers of workers of either f_1 or f_2 protection at the end of this period. Essentially, the firm is deciding how many of these workers to keep. Notation follows the same convention as above. A few differences to (2.3) merit comment. The indicator functions in the fourth and fifth term mean that firms only consider the firing taxes at the margin if they actually downsize and the numbers at the end of the period of permanent workers of either protection level is below the number the firm started with in this period, $n_{PLN,j}^-$ and $n_{PLO,j}^-$. This means the firm does not have to consider firing taxes as far as size decisions are concerned as, during hiring, they were

¹⁶ This ensures firms cannot negotiate an upfront payment prior to concluding a permanent contract.

not hiring beyond the point where a permanent worker would get paid more than they produce at low productivity. The firing costs do however feature in the wage negotiation. There will be no temporary workers since hiring them incurs higher costs than retaining a permanent worker in a period of low productivity.

2.1.2 Worker Value Functions

These value functions are derived assuming permanent workers are never fired unless the firm ceases to exist. We also do not refer to the size of the firm, since there are only two sizes that map one to one to the productivity. The value function for unemployment, Y (after matching happened and, thus, represents the fallback) satisfies:

$$Y = \beta p(\theta_p)W_{PHN} + \beta(1-p(\theta_p))Y = \beta p(\theta_T)W_{TH} + \beta(1-p(\theta_T))Y \quad (2.5)$$

where W_{PHN} and W_{TH} are the values of being employed as a newly hired permanent worker (i.e. with low protection f_l) and being temporarily employed, respectively. Slightly transformed to: $p(\theta_p)W_{PHN} + (1-p(\theta_p))Y = p(\theta_T)W_{TH} + (1-p(\theta_T))Y$ the equation shows that applying for a temporary or a permanent job needs to ex ante provide the same payoff. It implicitly defines the labor market tightnesses for permanent and temporary positions as $\theta_p = \frac{V_p}{\mu U}$ and $\theta_T = \frac{V_T}{(1-\mu)U}$ where V_p and V_T are aggregate numbers of permanent and temporary vacancies (to be derived below), and U is the number of aggregate unemployed. Again, we suppress time subscripts since we solve for the Steady State. Also, note that in equilibrium low productivity firms do not hire workers at all so workers do not enter these from unemployment but rather transition into low productivity with an employer they matched with before. μ is the proportion of unemployed electing to apply for a permanent position. For this proportion to be stable, the above condition needs to hold, equalizing ex ante returns from applying for any type of position. Value functions for protected/permanent workers are:

$$W_{PHN} = w_{PHN} + (1-\zeta)\beta\delta\pi_H W_{PHN} + \zeta\beta\delta\pi_H W_{PHO} + \zeta\beta\delta(1-\pi_H)W_{PLO} + (1-\zeta)\beta\delta(1-\pi_H)W_{PLN} + \beta(1-\delta)Y \quad (2.6)$$

$$W_{PHO} = w_{PHO} + \beta\delta\pi_H W_{PHO} + \beta\delta(1-\pi_H)W_{PLO} + \beta(1-\delta)Y \quad (2.7)$$

$$W_{PLN} = w_{PLN} + (1-\zeta)\beta\delta\pi_H W_{PHN} + \zeta\beta\delta\pi_H W_{PHO} + \zeta\beta\delta(1-\pi_H)W_{PLO} + (1-\zeta)\beta\delta(1-\pi_H)W_{PLN} + \beta(1-\delta)Y \quad (2.8)$$

$$W_{PLO} = w_{PLO} + \beta\delta\pi_H W_{PHO} + \beta\delta(1-\pi_H)W_{PLO} + \beta(1-\delta)Y \quad (2.9)$$

where the first value function is for newly hired permanent workers, and the second is for permanent workers after their probation period. The third value function is for new permanent workers in less productive firms (they do not exist in equilibrium), the fourth for permanent workers after their probation period in a low productivity firm. Lower case w 's denote wages where the subscripts are analogous to the value subscripts. Workers that go into unemployment remain unemployed for one period and only then may find another job. We see the probability for the less protected workers to transition to more protection, ζ , present in the value function for the less protected workers. The probabilities, π_H and π_L of the firm entering or remaining in higher or lower productivity are also reflected in all the value functions as this has a direct effect on the wage of the workers. Finally, in case of destruction of the firm, common in all above

value functions, with probability $1 - \delta$, even permanent workers return to unemployment. For temporary workers, the value function is:

$$W_{TH} = w_{TH} + \beta Y \quad (2.10)$$

For these workers, they essentially get their wages and immediately return to unemployment in the next period, reflecting the precariousness of temporary employment.

2.2 Wages

Wages are determined via the generalization of Nash bargaining by Stole and Zwiebel (1996). Workers and firms negotiate over the marginal surplus of the match and have bargaining weights η for workers and $1 - \eta$ for firms. Temporary and permanent workers enjoy the same bargaining weight and only differ in the surplus of the match, permanent jobs being subject to firing taxes f_1 for or f_2 for the two classes of permanent workers. Additionally, temporary jobs are limited to one period. Solving for wages of temporary and both stages of workers poses some complications since there are three groups of workers influencing each other's wage surplus. To solve, we invoke Lemma 1 which states:

Lemma 1. *The derivatives of the wages of all groups potentially present in one firm with respect to one group of employees are the same for each wage:*

$$\begin{aligned} \frac{\partial w_{PHO}}{\partial n_{PHO,j}} &= \frac{\partial w_{PHN}}{\partial n_{PHN,j}} = \frac{\partial w_{TH}}{\partial n_{PHO,j}} \\ \frac{\partial w_{PHO}}{\partial n_{PHN,j}} &= \frac{\partial w_{PHN}}{\partial n_{PHN,j}} = \frac{\partial w_{TH}}{\partial n_{PHN,j}} \\ \frac{\partial w_{PHO}}{\partial n_{TH}} &= \frac{\partial w_{PHN}}{\partial n_{TH}} = \frac{\partial w_{TH}}{\partial n_{TH}} \\ \frac{\partial w_{PLO}}{\partial n_{PLO,j}} &= \frac{\partial w_{PLN}}{\partial n_{PLO,j}} \\ \frac{\partial w_{PLO}}{\partial n_{PLN,j}} &= \frac{\partial w_{PLN}}{\partial n_{PLN,j}} \end{aligned}$$

Proof in the appendix.

The proof is done by taking the FOC's from the generalized Nash Bargaining a la Stole and Zwiebel and taking the further derivative with respect to the respectively other quantity of workers. We are now equipped to solve for the wages of the workers¹⁷.

Proposition 1. *The bargained wages $w_{TH}, w_{PHN}, w_{PHO}, w_{PLN}$ and w_{PLO} for firms that have survived j periods are given by:*

$$w_{TH} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_T) \frac{c}{q(\theta_T)} \right) \quad (2.11)$$

17 Following Cahuc and Wasmer (2001), we assume that the wage bill does not explode as total employment goes to zero, so:

$$\begin{aligned} \lim_{n_{TH}+n_{PHO,j}+n_{PHN,j} \rightarrow 0} w_{PHN} &= 0 \\ \lim_{n_{TH}+n_{PHO,j}+n_{PHN,j} \rightarrow 0} w_{PHO} &= 0 \\ \lim_{n_{TH}+n_{PHO,j}+n_{PHN,j} \rightarrow 0} w_{TH} &= 0 \\ \lim_{n_{PLO,j}+n_{PLN,j} \rightarrow 0} w_{PNO} &= 0 \\ \lim_{n_{PLO,j}+n_{PLN,j} \rightarrow 0} w_{PLO} &= 0 \end{aligned}$$

$$w_{PHN} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta)f_1 - \beta\delta\zeta \frac{(f_2 - f_1)}{1 - \eta} \right) \quad (2.12)$$

$$w_{PLN} = \eta \left(\frac{\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta)f_1 - \beta\delta\zeta \frac{(f_2 - f_1)}{1 - \eta} \right) \quad (2.13)$$

$$w_{PHO} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta)f_2 \right) \quad (2.14)$$

$$w_{PLO} = \eta \left(\frac{\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta)f_2 \right) \quad (2.15)$$

Proof in the appendix.

As we can see, just like in a standard search model, wages increase in the bargaining power, τ_p , the marginal product of labor (adjusted for the impact this worker will have on other worker's marginal product - the standard spillover effect from Stole and Zwiebel) and the job finding rate as well as the hiring costs. The dismissal costs for the two types of permanent workers also increase the wages of these workers. Note how wage for newly hired permanent workers the wage is lower because these workers cannot extract high dismissal taxes in their bargaining. If f_2 is sufficiently high, the prospect of extracting it in the future may decrease the wage of new hires more than current dismissal taxes f_1 increase them. Another important point to note is that we do not index the wages by j , the time the firm has survived. This is because, as we will see in the section below, because the *total* number of workers will remain the same, only the composition of permanent workers will shift over time from less to more protected permanent workers.

2.3 Allocations

Highly productive firms hire workers until marginal costs equal marginal benefits satisfying:

$$\begin{aligned} \alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - \eta \left[\frac{\alpha^2 A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) \right. \\ \left. + (1 - \beta\delta)f_1 - \beta\delta\zeta \frac{(f_2 - f_1)}{1 - \eta} \right] - (1 - \beta\delta\pi_H) \frac{c}{q(\theta_p)} = 0 \end{aligned} \quad (2.16)$$

$$\begin{aligned} \alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - \eta \left[\frac{\alpha^2 A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_T) \left(\frac{c}{q(\theta_T)} \right) \right] - \frac{c}{q(\theta_T)} = 0 \end{aligned} \quad (2.17)$$

Here, we must consider the effect of hiring one type of worker on the wages paid to the other two types of workers. Permanent workers confer the benefit of future saved hiring taxes,

and temporary workers do not extract firing taxes through wages. Firms need to be indifferent between the two types of hires, thus:

$$\eta \left(\beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta) f_1 - \beta\delta \zeta \frac{(f_2 - f_1)}{1 - \eta} \right) + (1 - \beta\delta\pi_h) \frac{c}{q(\theta_p)} = \eta \beta p(\theta_t) \frac{c}{q(\theta_t)} + \frac{c}{q(\theta_t)} \quad (2.18)$$

This equation relates market tightness in temporary and permanent labour markets when firms hire both types of worker. Workers too are indifferent. The proportion of permanent workers is determined by how many permanent workers will be profitable in the low-productivity state and will, therefore, be hired during the high productivity phase, implying $n_{PHN,j} + n_{PHN,j} = n_{PLO,k} + n_{PLN,k} \forall j \neq k$. Therefore, firms hire permanent workers until the following holds:

$$\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - \eta \left[\frac{\alpha^2 A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta) f_1 - \beta\delta \zeta \frac{(f_2 - f_1)}{1 - \eta} \right] = 0 \quad (2.19)$$

The first term is the marginal product, and the second term is the benefit of not having to look for this worker in the future. The remaining terms are the wages for permanent workers in such a firm. The cost of finding the workers is not included since the firm already has the workers and does not need to search. We emphasize that permanent workers are only hired in the first period of a firm's existence and, after that, an ever increasing proportion of them enjoys full protection.

2.4 How many fully protected Permanent Workers?

To figure this out, we must first pin down how many workers are initially hired on a permanent contract upon the firm's creation. This is easy as we simply can solve the first order condition for $n_{PHO,0} = 0$. Let us denote the initially hired permanent workers as n_{PHN}^* .

$$\alpha A_H (n_{PHN}^* + n_{TH})^{\alpha-1} - \eta \left[\frac{\alpha^2 A_H (n_{PHN}^* + n_{TH})^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta) f_1 - \beta\delta \zeta \frac{(f_2 - f_1)}{1 - \eta} \right] - (1 - \beta\delta\pi_h) \frac{c}{q(\theta_p)} = 0, j = 0 \quad (2.20)$$

$$\alpha A_L (n_{PHN}^*)^{\alpha-1} - \eta \left[\frac{\alpha^2 A_L (n_{PHN}^*)^{\alpha-1}}{1 - \eta(1 - \alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta) f_1 - \beta\delta \zeta \frac{(f_2 - f_1)}{1 - \eta} \right] = 0, j = 0 \quad (2.21)$$

where we used the insight that the number of permanent workers hired in the high productivity state is determined by how many workers the firm wants to retain in the low productivity state. The remainder of workers in the high productivity state will be temporary workers, which pins down the relative number of workers even though at the margin the firm will be indifferent between them. We can now see that, since permanent workers of either type never leave unless

the firm goes under is always n_{PHN}^* and merely the proportions of permanent workers with dismissal costs f_1 versus f_2 shift, which implies:

$$n_{PHN}^* = n_{PHN,j} + n_{PHO,j} = n_{PLN,j} + n_{PLO,j} \quad \forall j \quad (2.22)$$

We can show the total number of permanent workers that enjoy protection of dismissal costs f_2 , $n_{PHO,j}$, after having transitioned with rate ζ from having f_1 as dismissal costs, is determined at a firm that has survived for j periods by:

$$n_{PHO,j} = n_{PLO,j} = \sum_0^j n_{PHN}^* (1 - \zeta)^j \zeta \quad \forall j \quad (2.23)$$

The number of workers only enjoying f_1 is conversely for a firm that has survived j periods given by:

$$n_{PHN,j} = n_{PLN,j} = n_{PHN}^* - n_{PHO,j} \quad \forall j \quad (2.24)$$

In what follows, wherever possible we will use the equations $n_{PHO,j} + n_{PHN} = n_{PHN}^* \quad \forall j$ and $n_{PLO,j} + n_{PLN} = n_{PHN}^* \quad \forall j$ to simplify notation and stress that we do not have to keep track of j for wages and overall allocations.

2.5 Unemployment Dynamics

As in the DMP framework, the stock of unemployed evolves according to:

$$U_s' = (1 - \delta)F_H(n_{TH} + n_{PHN}^*) + (1 - \delta)F_L n_{PHN}^* + \delta F_H n_{TH} - m(\mu U, V_p) - m((1 - \mu)U, V_T) \quad (2.25)$$

where the F_H and F_L are the numbers of firms of high and low productivity respectively which evolve deterministically according to the iid shocks and are given for high productivity by: $F_H = [1 - \delta(1 - \pi_H)]F$ and for low productivity by: $F_L = \delta(1 - \pi_H)F$. In the first term above we have used the fact that the number of permanent workers (either enjoying f_1 or f_2) always adds up to n_{PHN}^* in all firms. In equilibrium, no permanent workers are fired (unless the firm folds), and only highly productive firms hire temporary workers. Finally, the number of vacancies is defined by:

$$V_p = (1 - \delta)F \frac{n_{PHN}^*}{q(\theta_p)}$$

$$V_T = \pi_H F \frac{n_{TH}}{q(\theta_T)}$$

where the first equation reflects that only newly created firms (i.e. those that replace the destroyed firms) hire permanent workers and the second equation reflects that every firm, no matter where it started (being just created or coming from high or low productivity in the past), if it is of high productivity now, will search for temporary workers.

3 Steady State and Results

3.1 Equilibrium

Definition 1: In equilibrium firms are posting vacancies until the returns are equalized to the costs, workers direct their search until indifferent between applying for a permanent or a temporary vacancy and flows in and out of employment are equalized. A dual labour market

equilibrium is characterized by n_{PHN}^* ¹⁸, n_{TH} , $n_{PHO,j} \forall j$, $n_{PHN,j} \forall j$, U , μ , θ_p , θ_T , w_{TH} , w_{PLO} , w_{PHO} , w_{PLN} and w_{PHN} that satisfy the following equations:

$$n_{PHN}^* + n_{TH} = \left[\left(\frac{1-\eta}{1-\eta(1-\alpha)} \right) \frac{\alpha A_H}{\eta \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + \eta(1-\beta\delta)f_1 - \eta\beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} + (1-\beta\delta\pi_H) \frac{c}{q(\theta_p)}} \right]^{\frac{1}{1-\alpha}} \quad (3.1)$$

$$n_{PHN}^* = \left[\left(\frac{1-\eta}{1-\eta(1-\alpha)} \right) \frac{\alpha A_L}{\eta \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + \eta(1-\beta\delta)f_1 - \eta\beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} - \beta\delta\pi_H \frac{c}{q(\theta_p)}} \right]^{\frac{1}{1-\alpha}} \quad (3.2)$$

$$n_{PHO,j} = n_{PLO,j} = \sum_0^j n_{PHN}^* (1-\zeta)^j \zeta \quad \forall j \quad (3.3)$$

$$n_{PHN,j} = n_{PLN,j} = n_{PHN}^* - n_{PHO,j} \quad \forall j \quad (3.4)$$

$$w_{TH} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_T) \frac{c}{q(\theta_T)} \right) \quad (3.5)$$

$$w_{PHN} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} \right) \quad (3.6)$$

$$w_{PLN} = \eta \left(\frac{\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} \right) \quad (3.7)$$

$$w_{PHO} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_2 \right) \quad (3.8)$$

$$w_{PLO} = \eta \left(\frac{\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_2 \right) \quad (3.9)$$

$$\eta \left(\beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} \right) + (1-\beta\delta\pi_H) \frac{c}{q(\theta_p)} = \eta \beta p(\theta_T) \frac{c}{q(\theta_T)} + \frac{c}{q(\theta_T)} \quad (3.10)$$

$$p(\theta_p)(W_{PHN} - Y) = p(\theta_T)(W_{TH} - Y) \quad (3.11)$$

$$U_S' = (1-\delta)F_H(n_{TH} + n_{PHN}^*) + (1-\delta)F_L n_{PHN}^* + \delta F_H n_{TH} - m(\mu U, V_p) - m((1-\mu)U, V_T) \quad (3.12)$$

where μ is defined:

$$\mu = \frac{V_p}{\theta_p U} \quad (3.13)$$

¹⁸ In equilibrium permanent workers are only hired in the first period and then transition to full protection. Recall equation (2.24) for their exact distribution.

The number of vacancies is defined by:

$$V_p = (1 - \delta)F \frac{n_{PHN}^*}{q(\theta_p)}$$

$$V_T = \pi_H F \frac{n_{TH}}{q(\theta_T)}$$

Finally, for completeness' sake, we repeat the number of high and low productivity firms as:

$$F_H = [1 - \delta(1 - \pi_H)]F$$

$$F_L = \delta(1 - \pi_H)F$$

3.2 Impact of an Increase in f_1

This section examines the scenario when f_1 , the first period with an increase in firing taxes for permanent workers. We assume that the increase in f_1 is bounded above by $f_2 - f_1$, so f_1 may never exceed f_2 . This is the focus of the following comparative statics as it is precisely what happened in the policy experimentation examined below.

3.2.1 Employment Growth or Decline?

Whether total employment increases or decreases after a rise in f_1 depends on market tightness (amplified if the elasticity of matching w.r.t. vacancies is larger) and, therefore, on the cost of recruitment, as is the case under the CTP policy. If the latter drops sufficiently, we see an increase in employment. This is because firms that compete too aggressively impose negative congestion externalities upon each other in the matching. f_1 acts as an indirect hiring tax and mitigates this dynamic. Since $\frac{\partial(n_{PHN}^* + n_{TH})}{\partial f_1} = \frac{1}{1-\alpha}(n_{PHN}^* + n_{TH})\alpha$ where α is a fraction whose denominator is positive and whose numerator is given below in (3.14) and can be either positive or negative, such that the reduction in hiring costs outweighs the increase in firing taxes. So, we can derive the following relationship:

$$0 = \eta \left(c\beta \frac{\partial \theta_p}{\partial f_1} + \beta p(\theta_p) + \beta f_1 \frac{\partial p(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} + (1 - \delta\beta) + \beta \delta \frac{\zeta}{1 - \eta} \right) - (1 - \delta\beta\pi_H) \frac{c}{q(\theta_p)^2} \frac{\partial q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} \quad (3.14)$$

defining f_1^* beyond which an increase in f_1 decreases employment.

3.2.2 The Proportion of Permanent Workers and the Effect on Wages

An initial observation is that there is a close connection between the proportion of new permanent workers and the wages that are paid to those workers. If wages increase and total employment goes down, the model makes clear predictions. If, however, the hiring costs decrease sufficiently, there may be cases that are consistent with lower wages as well as lower proportions of permanent workers. In what follows, we outline three cases. To establish the cases, we consider the following two equations that are the derivative of the employment decisions for n_{PHN}^* and $n_{PHN}^* + n_{TH}$, respectively, that is, the number of permanent workers and

total employment in a high-productivity firm. Both are rearranged to yield the elasticity of employment relative to firing taxes.

$$\frac{f_1 \frac{\partial n_{PHN}^*}{\partial f_1}}{n_{PHN}^*} = \frac{\left(\frac{-f_1}{1-\alpha} \right) \left[\eta \left(c\beta \frac{\partial \theta_p}{\partial f_1} + \beta p(\theta_p) + \beta f_1 \frac{\partial_p(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} + (1-\delta\beta) + \beta\delta \frac{\zeta}{1-n} \right) + \delta\beta\pi_H \frac{c}{q(\theta_p)^2} \frac{\partial_q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} \right]}{\eta \left(\beta_p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{f_2-f_1}{1-\eta} \right) - \beta\delta\pi_H \frac{c}{H_q(\theta_p)}} \quad (3.15)$$

$$\frac{f_1 \frac{\partial(n_{PHN}^* + n_{TH})}{\partial f_1}}{n_{PHN}^* + n_{TH}} = \frac{\left(\frac{-f_1}{1-\alpha} \right) \left[\eta \left(c\beta \frac{\partial \theta_p}{\partial f_1} + \beta p(\theta_p) + \beta f_1 \frac{\partial_p(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} + (1-\delta\beta) + \beta\delta \frac{\zeta}{1-n} \right) - (1-\delta\beta\pi_H) \frac{c}{q(\theta_p)^2} \frac{\partial_q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} \right]}{\eta \left(\beta_p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{f_2-f_1}{1-\eta} \right) - (1-\beta\delta\pi_H) \frac{c}{q(\theta_p)}} \quad (3.16)$$

These two equations are similar and only differ in as far as the decision on total employment considers the cost of hiring a worker in the first place, whereas the decision on permanent workers considers the situation as to how many of them would be retained. Now, we can state three results covering three cases:

Result 1. If n_{PHN}^* and $n_{PHN}^* + n_{TH}$ (total employment) decrease as f_1 increases, this leads to a decrease in $\frac{n_{PHN}^*}{n_{PHN}^* + n_{TH}}$ while wages w_{PHN} for recent permanent workers increase.

This occurs if both numerators of (3.15) and (3.16) are negative, which is the case when the increase in f_1 increases the wages of recently hired permanent workers more than the resulting reduction in vacancy posting reduced the aggregate costs of labour search by alleviating the congestion externality. The denominator of (3.15) is more negative than that of (3.16) due to the positive term $\frac{c}{q(\theta_p)^2} \frac{\partial_q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1}$ in (3.16), which increases it. Additionally, the denominator of (3.16) is larger, further reducing its numerical value and establishing that (3.15) is more negative than (3.16), which reduces the ratio of permanent workers relative to total employment.

Result 2. If there is a decrease in n_{PHN}^* and an increase in $n_{PHN}^* + n_{TH}$ as a result of an increase in f_1 , this leads to a decrease in $\frac{n_{PHN}^*}{n_{PHN}^* + n_{TH}}$ while wages w_{PHN} for recent permanent workers increase.

This result is straightforward as it entails that the numerator of (3.15) is negative while that of (3.16) is positive on account of the term $\frac{c}{q(\theta_p)^2} \frac{\partial_q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1}$, which captures that it has become cheaper to hire permanent workers (as well as temporary workers) but not cheap enough to reduce the wages of permanent workers in the low-productivity firms. The effect is to reduce the number of permanent workers and increase the overall hires, which naturally only occurs with an increase in temporary workers. This dynamic establishes that the ratio of permanent to total employment falls.

Result 3. *If there is an increase in n_{PHN}^* and in $n_{PHN}^* + n_{TH}$, there is an ambiguous effect of f_1 on n_{PHN}^* and an ambiguous effect on wages w_{PHN} .*

This is the most involved result, and there are two sub-cases involved. The ambiguity arises because if the numerator of (3.15) and (3.16) is positive, that of (3.15) is naturally larger because of the additional positive term $\frac{c}{q(\theta_p)^2} \frac{\partial q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1}$. However, it is not clear if (3.15) or (3.16) is larger since the denominator of (3.16) is larger, thus diminishing the effect. We find that which effect dominates depends on the following inequality:

$$\begin{aligned} & \frac{\eta \left(c\beta \frac{\partial \theta_p}{\partial f_1} + \beta p(\theta_p) + \beta f_1 \frac{\partial p(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1} + (1 - \delta\beta) + \beta\delta \frac{c}{1-n} \right) + \delta\beta\pi_H \frac{c}{q(\theta_p)^2} \frac{\partial q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1}}{\eta \left(\beta_p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1 - \beta\delta)f_1 - \beta\delta\zeta \frac{f_2 - f_1}{1-\eta} \right) - \beta\delta\pi \frac{c}{H_q(\theta_p)}} \\ & < - \frac{\frac{c}{q(\theta_p)^2} \frac{\partial q(\theta_p)}{\partial \theta_p} \frac{\partial \theta_p}{\partial f_1}}{\frac{c}{q(\theta_p)}} \end{aligned} \quad (3.17)$$

If this inequality holds, we have a decrease in the ratio of permanent to total employment and the reverse if it does not hold. Inspection of the left-hand side and right-hand side of (3.17) reveals that the left-hand side represents a measure of the reaction of wage costs for permanent workers to firing taxes (net of any additional effects and a higher marginal product due to downsizing) while the right-hand side represents the elasticity of the hiring costs. Naturally, if the elasticity of the hiring costs with respect to firing taxes is higher, this implies that the cost of hiring workers is falling faster than the cost of retaining them. This means that the marginal hiring decision is affected more favorably than the retention decision. Once we realize that this wider hiring margin translates to more temporary workers while the retaining margin translates to more permanent workers, it is clear that a greater hiring elasticity with respect to firing taxes translates to a decrease in permanent workers relative to total employment.

3.2.3 What Happens to Hazard Rates?

One result is that when separation taxes for recent hires f_1 increase, this does not alter hazard rates for recent permanent matches or established permanent matches. This is due to the buffering effect of temporary workers in the same firms as the following paragraph outlines:

Recently hired permanent workers are not dismissed in the model at this stage as there is no instance in the model where their firm would become less productive when they are still recently hired¹⁹. Further, since these workers then transition to even higher dismissal taxes, this increase in their initial dismissal taxes will balance their hazard rate out of employment to that of established permanent workers. Therefore, we must determine what happens to the hazard rates of these workers. Higher initial dismissal taxes can increase the possibility of an external hiring option of established permanent workers (if not countered by lower hiring costs) and, therefore, increase wages, rendering their marginal surplus negative. In a linear set

¹⁹ Even if the firm were still in the current period when higher firing taxes were instituted, firms would not fire the permanent workers but would be forced to pay them a higher wage. Naturally, firms will also not hire more permanent workers in such a situation and will actually curtail their hiring.

up, this would make established permanent workers more expensive and, thus, increase the chance of their dismissal. Yet, the set-up of this study is bounded below by $-f_2$ as the impact of f_1 on the external hiring option is always less than 1-1²⁰ and permanent worker employment is always at the level of zero marginal profits in the low-productivity state. Additionally, any employment beyond this point is taken up by temporary workers who provide a buffer for permanent workers against adverse shocks. This means that the decreased profit for an established permanent worker is strictly below f_2 , and since firms would have to pay f_2 to dismiss them, dismissal will never occur. This is in contrast to a model with linear technology where contracts are essentially independent. In this type of model, a permanent worker is hired up to zero marginal profits ex ante, but also includes the ex post marginal worker instead of a temporary worker with potentially negative profits well exceeding $-f_2$. Therefore, such a worker is more likely to encounter productivity low enough to be dismissed²¹. A similar logic applies to firing taxes for established workers, f_2 . They do not lead to a changed frequency of dismissals. This follows from (3.2), which states that the number of permanent workers is fixed as the number of workers retained in the event of a bad shock. This reaffirms that permanent workers are already as safe as they can be, only experiencing termination if a firm ceases operations. Looking at wage equation (3.5) if there is an increase in firing taxes f_2 , this will reduce the firms' surplus from matches if hiring costs do not decrease too much (in which case even more permanent workers are hired and certainly none are fired), but the surplus over which the firm bargains includes the firing taxes; that is, it is $\frac{c}{q(\theta p)} + f_2$ and it increases with wages preventing the firm from firing permanent workers. To summarize:

Result 4. *In a dual labour market equilibrium, an increase in f_1 (or f_2) will not lead to a change in the hazard rates out of employment for existing permanent matches.*

In the model, separation taxes do not influence job security for permanent workers because temporary workers absorb the blow. Releasing temporary workers is cheaper. This is a result of firm's motivation to protect core workers from adverse productivity shocks (noted by, e.g. Houseman et al., 2003) to avoid separation taxes and unevenly distributing risk. Further, since temporary workers are only hired for a fixed period and would not assume another contract upon expiration, we expect no measured change in hazard rates of temporary workers.

4 Empirical Application

4.1 Policy Experiment in France — The CTP Scheme

For identification, this study exploits a policy experiment, the 'Contrat de Transition Professionnelle', or CTP, that introduced exogenous variation in initial separation taxes among different regions in France. The CTP policy experiment increased separation taxes for economic layoffs of permanent workers hired less than two years ago in firms with fewer than 1,000 workers. These workers were hired up to the same level as workers with more than two

20 This is because of discounting, the counterbalancing of lower hiring costs and imperfect pass-through of the firing taxes because of bargaining as well as the fact that the increase in f_1 is bounded above by $f_2 - f_1$.

21 An alert reader may argue that this may also apply to the current set-up if there are more than two states of productivity. This overlooks the fact that if there were multiple productivity states, the number of permanent workers would be determined by the zero profit condition in the least productive state.

Figure 2 Differences between CRP and the CTP scheme.

CRP	CTP
- If 2 years of tenure, employer pays 2 months gross wages - if 2 years of tenure, 80% of gross salary allocated for unemployment for 12 months - if less than 2 years, 57% of salary or 40.4%+fixed payment proportional to duration	- no conditions on tenure for employer, 2 months gross wages - 80% of gross salary for 12 months allocated for unemployment benefits, no conditions - upon finding job, a reward is paid to worker (half of remaining allocation for scheme)

years' tenure. This means, in terms of the model, that $f_1 = f_2$. This action financed additional reemployment measures, provided more support for retraining and professional assessment, and provided funds for unemployment benefits. The policy equalized initial separation taxes in the model f_1 to the later separation taxes in the model f_2 (details below). The policy was enacted on 15 April 2006 in seven 'zone d'emploi' (Employment Zones). These zones are the subject of this study^{22,23}. In 2009, 18 more areas were added, followed by seven more in 2010²³.

For eligible workers, there was a slightly higher unemployment benefit if they had tenure with their previous employer of less than two years and a reward from what was left of the allocated funds for finding a job. The data analysis does not find any effect of these aspects²⁴. The CTP cost 3,170 euros per client versus 2,225 euros for the CRP scheme. This was borne by firms in assigned zones who could not opt out, increasing separation taxes. Under the CRP, firms would have to pay two months of gross salaries (plus social contributions) to the 'Pole Emploi' (employment agency), but only for workers with at least two years of tenure. Otherwise, the payment would be lower and proportional to the duration of the tenure. Under the CTP, no such condition applied (Dole, 2010, Remy and Salzberg, 2007). This, in terms of the model, constitutes an increase in dismissal taxes. Importantly, this is also borne out in the data showing fewer permanent workers and higher wages for workers able to use the CTP as a bargaining chip. The figure below summarizes the most important aspects.

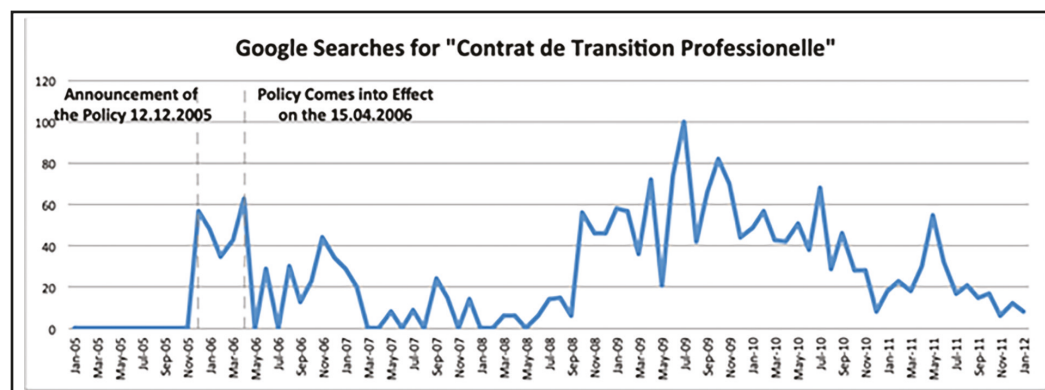
The employment zones assigned to the CTP in 2006 were Toulon, Valenciennes, Charlevilles-Mézières, Montbéliard, Saint Dié, Vitry, and Morlaix. The then Minister of Employment, Jean-Louis Borloo, announced the CTP on 12 December 2005 in 'La Tribune' (Le Monde, 2005). The CTP came into effect on 15 April 2006. The zones are economically deprived areas with declining heavy industries (shipping, steel production, etc.). For instance, the employment share of services was 71.9% in 2005 as opposed to 78.6% nationwide. Therefore, PSM is used to find a valid comparison group.

²² Employment zones are 'areas where most of the working age population resides and works' (INSEE)

²³ The reasons why these were not used are twofold. First, in 2009, the employment zones were reassigned reflecting changing living and working patterns. The focus on 2005 to 2008 means that the Great Recession is less of a concern because it hit France late, in 2009.

²⁴ These aspects are not specifically accounted for in the model. The reason is that the reward for finding a job and the slightly higher unemployment benefit counteracted each other. Thus, adding them to the model would have complicated it vastly without providing additional insight. This choice is justified in the subsequent data analysis, which shows no signs of workers currently eligible for the CTP negotiating any change to wages; only workers that could use the CTP as a threat against employers did so. This seems to indicate that these two aspects of the policy did in fact neutralize each other. It is, unfortunately, not possible to tell with the data at hand if individual workers found jobs faster with the help of the policy, but the overall negative effect on employment makes this unlikely. A perspective might be that the Labour Force Survey/'Enquête d'Emploi' could rectify this; however, sadly, the survey does not record the location of employers, current or previous (the qualifying criterion for benefitting from the policy), making it impossible to isolate the effect of the policy.

Figure 3 Results for Google searches. 100% in July 2009 corresponds to the highest number of searches.



Source: Google Trends.

One concern a reader may have is whether this policy was truly a surprise to firms and employees. The following graph provides some evidence:

The first interest on Google appears in December 2005, the month of the announcement, and there is another peak in April 2006 when the policy came into effect. Later peaks correspond to expansions of the CTP into other zones²⁵. While not excluding this possibility, this means that our propensity score, using data up to December 2005, is less likely to be confounded by agents having advance knowledge of the policy and trying to outsmart policy makers.

4.2 The Data

There are two main data sources — the DADS-Postes Fichiers, providing information on workers, and EAE-ESANE, containing balance sheet information on firms. For the analysis of flow and stock numbers of workers, the BRN was matched with DADS. For the propensity score, an auxiliary dataset was used containing publicly available information on unemployment in the employment zones and summary statistics from the main data sources. It is worth remembering that the data in this auxiliary dataset contain the information the policy designers had at their disposal at the time.

The DADS (or ‘Déclaration Anuelle des Données Sociales’, Annual Declaration of Social Insurance Data) contains social insurance data collected for administrative purposes and covers 85% of salaried employees in France each year, except for employees of the central government (ministries), public health workers, and people employed by individual households (cleaners, childcare workers, etc.). Individual identifiers are reassigned each year to ensure anonymity. However, the data include information for the current and previous year, so we can follow individuals over time. Extra-territorial activities are excluded. Variables include salaries, employment duration (during the year), the date of commencement and termination of the match²⁶, area of residence and work (down to commune level), the nature of the job, and employer and some individual information (age, sex, etc.) We match these observations with the EAE-ESANE datasets using the firm-identifier, the ‘SIREN’ (INSEE, 2012). The datasets

²⁵ Other search items such as ‘Flexicurité’, or search items related to the experimentation areas, did not yield any significant changes.

²⁶ If either are beyond the timeframe of the dataset, the date is given as the first and last day in the observed period.

are available from 1993 onward, but the focus is on 2005 to 2008 because after 2005, we know whether the worker had a CDI-Contrat de Duration Indetermine; that is, a permanent contract, CDD-Contrat de Duration Determine, a temporary contract and CTT — Contrat de Travail Temporaire, and a temporary contract (employment agencies). There are a number of other contracts in the data, for instance, elected offices, but these three types constitute the vast majority. We choose the cut-off of 2008 to avoid the possibility of the Great Recession contaminating the data and because, in 2009, employment zones were reassigned. Further, 2009 was when information on state employees and the self-employed were added to the DADS, which may make the datasets less than 100% comparable between 2008 and 2009.

The EAE-ESANE (or ‘Elaboration des Statistiques Annuelles d’Entreprises’) datasets provide yearly balance sheet information on a sample of firms that covers approximately 10% of firms (agriculture and heavy industry are covered completely). The variables include net revenue, number of employees on 31 December, nature of principal activity, geographical area of activity (down to commune level), net assets, investment, and so on. The BRN (‘Bénéfice Régime Réel Normaux’) dataset contains balance sheet information as well and covers roughly 80% of total sales in the economy, which it achieves by covering firms beyond e 763k in revenue (e230k for services). Since both the EAE-ESANE and the BRN datasets are samples (albeit large ones), their representativeness is difficult to ascertain.

4.3 Empirical Methodology — Propensity Score Matching

PSM is used at the employment zone level to identify a group of control areas using nearest-neighbor matching with replacement. First, we look at overall trends in permanent and temporary employment and, subsequently, we conduct PSM-adjusted regressions to examine the effect of the policy on hourly wages and employment hazard rates out of employment. To estimate the effect of the CTP on the seven employment zones, we could use OLS. However, we would have to search for many controls, and several observations would simply not be comparable to those affected²⁷. Considering the above, we use PSM to find a comparison group for the experiment.

Clearly, CTP zones (column 1) are not representative of France (column 3). The share of permanent workers is higher, manufacturing is overrepresented, and services are underrepresented. Unemployment is higher as is the proportion of unqualified workers. The average wage is lower by a euro, but income per employment stint is higher. This can be explained by the higher proportion of permanent workers. Finally, the proportion of locals with local jobs is higher, indicating low mobility. The control zones (column 2) chosen by propensity scores are similar to the treatment zones. The share of permanent workers is closer by 1% and the share of manufacturing by 0.4%. The service sector share is not closer, indicating it was not important in determining the probability of assignment, which is surprising. Unemployment is higher in the control group, indicating some overshooting. The match is better for hourly

²⁷ Regression discontinuity is also not suitable, first, due to general equilibrium effects as affected firms employ most workers. Second, and perhaps more critically, the threshold of 1,000 employees is an important determinant of more demanding employment protection legislation and other legal requirements firms must fulfill, and firms are naturally able to perfectly sort into size categories as has been explored by Garicano et al. (2016). This provides ample reason to believe that firms that find it worthwhile to hire more than 1,000 workers differ systematically from those that do not, which violates the as-if-random assumption necessary for regression discontinuity design (e.g. Lee and Lemieux, 2010). For instance, since 2002, firms with more than 1,000 employees had to provide the ‘congé de reclassement’, a reemployment programme even more stringent than the CTP (Code de Travail L. 321-4-3 and 321-10 to 321-16, all passed in 2002).

Table 1a CTP versus control zones, pre-policy characteristics

	CTP Zones	Control Zones	France (-CTP Zones)
Stock of Permanent Workers	67.1% (4.64)	66.9% (1.39)	65.1% (5.87)
Manufacturing Share	20.8% (11.2)	20.0% (11.5)	19.6% (9.1)
Services Share	71.9% (11.35)	79.0% (11.5)	78.1% (9.6)
Unemployment	9.3% (5.4)	10.4% (4.5)	8.0% (6.3)
Change in Unemployment since 04	-0.66% (0.544)	-0.04% (0.35)	-0.30% (6.3)
Permanent Share Predicted by Productivity Proxy	57.2% (1.7)	57.4% (1.2)	57.0% (2.6)
Participation Rate	70.7% (4.7)	70.6% (4.4)	71.4% (2.8)
Proportion of Unqualified Workers	17.7% (4.38)	14.8% (3.8)	14.6% (3.9)
Average Age of Workers	39.2 (0.7)	38.6 (0.3)	39.5 (0.8)
Average hourly Wages in 05 (Euro)	14.22 (0.81)	14.01 (0.73)	14.55 (2.78)
Average Gross Income in 05 (Euro)	14258.76 (1207)	14023.09 (743)	13732 (1976)
Non-Residents in Workforce	48.8% (18.0)	52.6% (8.95)	70.5% (27.2)
Locals with Local Job	79.5% (9.6)	78.1% (4.65)	67.8% (19.6)

Variables refer to the value in December of 2005.

Standard Errors in parentheses.

Source: Author's calculations using DADS and Census Data (INSEE).

wages, income, proportion of non-residents, and the proportion of residents with local jobs, a measure of isolation. This indicates that wages, income, and the degree of isolation were the most important characteristics of these struggling regions in determining the application of the CTP. Additionally, policy makers seem keenly aware that in addition to income, the degree of influx from other regions is an important sign of economic well-being. After all, influx shows that the area is attracting outsiders by offering opportunity. Finally, it is worth noting that the average control zone is approximately one third in size relative to the average CTP (treatment) zone. This can be seen in the number of employed workers at the end of 2005: 62,619 on average in the CTP and 37,069 in control zones.

Recently, there have been contributions such as King and Nielsen (2019) that caution against the naive use of PSM. Their main argument is that as the Propensity score is merely a summary of the determinants of the probability, it is entirely possible that a similar score may be hiding a very dissimilar combination of determinant factors. The focus of the method

Table 1b Various Distance Measures of CTP zones in comparison to France and the Control Group

	Distance to France	Distance to Control Group
Euclidian Distance	34.75	31.87
Size Distance	10.67	9.13
Correlation	0.95	0.96
Correlation Transformed to Euclidian Distance	0.2	0.18
Squared Correlation	0.91	0.93
Chebychev Distance	25.19	22.24
Manhattan Distance	23.46	19.13
Shape Distance Component 1	3.13E-15	4.34E-15
Shape Distance Component 2	32.98	30.15
Shape Distance Component 3	3.29E-15	3.22E-15

To ensure consistency, nominal variables have been normalized.

Source: Author's calculations using DADS and Census Data (INSEE).

on the nearest match of this score may lead to the selection of observations that have a similar score because of a combination of factors that randomly matches the combined score, King and Nielsen (2019) refer to this as excessive "pruning". This produces the danger that the control group is more different from the treatment group than the general population. To address this, King and Nielsen (2019) suggest to, at least, provide the reader with a measure of the presence and severity of the problem and calculate measures of distance of the individual members of the treatment group to the general population average and to the matched control. Since there is no generally agreed upon measure of distance in this context, the table below shows various measures from Euclidean distance, over Correlation to Chebychev distance and Shape Distance. It will reassure the reader that every single measure shows that PSM has yielded a control group that is more similar to the treatment group.

While the distance measures are not 0 and the correlation measures are not 1 for the control groups, there seems to be some marked improvement relative to the rest of France across the board. This indicates that PSM has in fact not selected a control group that is only superficially, i.e. in the assignment probability, similar to the treatment group. While the overall distance of traits of the control group is closer to the treatment group, the probability of assignment is closer as well, which means we have improved the comparability of treatment and control without incurring a high cost of imbalance of traits. Equipped with some degree of confidence in the matching methodology, we can now turn to describing the empirical results.

5 Empirical Results

Now, we proceed to test the predictions using the CTP policy experiment. To summarize, permanent workers are bugged from shocks, and the model has predictions concerning the impact of an increase in the firing tax; relevantly, in the case of less economic activity, fewer permanent workers, higher wages, and stable hazard rates for permanent workers²⁸. First, we

28 If economic activity declines, wages for temporary workers increase.

move to total inflows and employment stocks. Flows denote new hires in that period and stocks denote incumbents. There is a negative impact on permanent hires after implementation of the policy albeit not significantly. This is encouraging, but other models predict similar results. Regressions have further implications for wages and hazard rates. The match being affected interacts if it was created after implementation. This implies interaction with indicators if the match was permanent in a firm below 1,000 workers and involves a worker eligible and/or who had a permanent job before, and so on. There are controls for age, sex, socioeconomic category, for example, not reported for brevity. There are four specifications. The first looks at averages. The second adds controls for the type of firm (affected by the policy, newly founded, etc.). The third specification includes if workers previously held permanent positions. The fourth specification adds information if a worker was eligible for the scheme. The predictions, increased wages in conjunction with fewer permanent workers and stable hazard rates, are not rejected. Hours worked are also tested along with total income, which decreases with economic activity.

5.1 Flows and Stocks of Employment

5.1.1 General Employment Impact

Figure 4 shows average inflows of workers in treatment and control areas normalized by their values in December 2005, when the policy was announced. The figure shows 2,172 incoming workers in the CTP and 1,265 incoming workers in the control areas, on average. This reflects that the average control area is approximately 30% smaller than the average treatment area but, otherwise, quite similar. In fact, we see little difference in the employment trajectory before the policy is implemented (April 2006). This confirms the groups' share trends, indicating the propensity score was successful in identifying control zones sufficiently similar to the treatment zones. Additionally, there also is no clear trend in general employment flows in the treatment zones after the policy announcement, which is disappointing, but the model is ambiguous concerning the general employment effect. There is a seasonal pattern; substantial hiring occurs in January and in July. We see a smaller spike each year, however, this may be due to the impending Great Recession. Looking at the stock of workers (Figure 5), employment declined

Figure 4 The total flows have been normalized to their values of December 2005, the time the policy was announced: 2,172 on average in CTP areas and 1265 in control areas. The dashed lines represent (bootstrapped) confidence intervals.

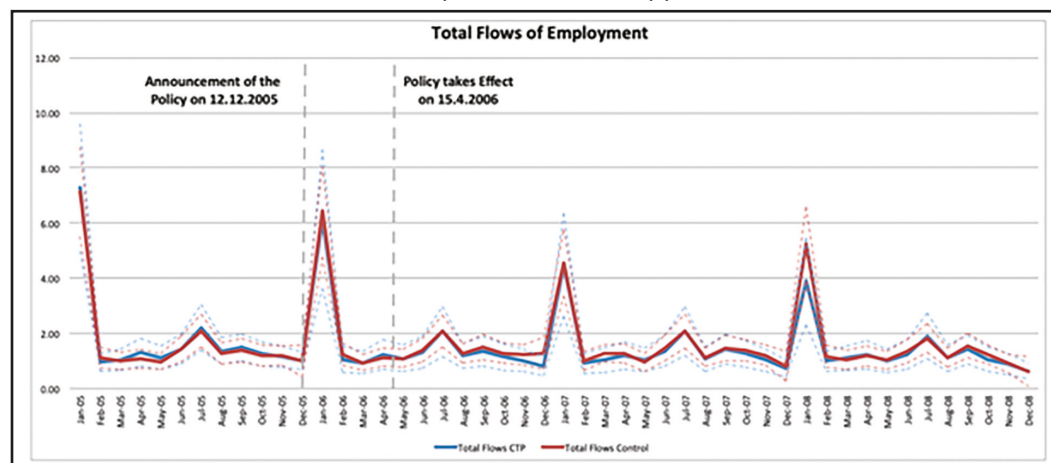
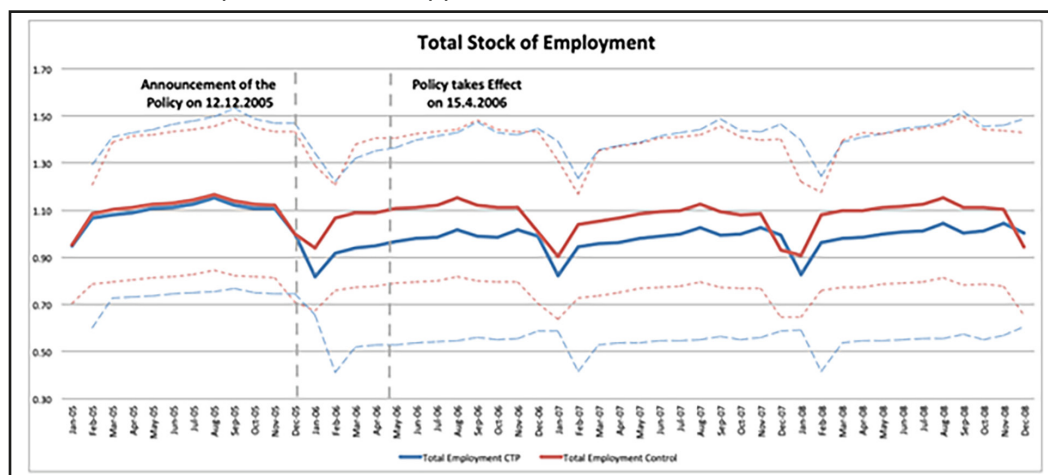


Figure 5 The total stocks have been normalized to their values for December 2005: 62,619 workers on average in the CTP zones and 37,069 in the control zones. The dashed lines represent (bootstrapped) confidence intervals.



relative to control areas after the announcement, although not statistically significantly. This (weakly) indicates reduced economic activity due to more expensive workers, which is one possibility outlined by result 1 in the model when the increased firing taxes are too large and go beyond correcting for high incentives that encourage firms to hire workers. The increased help for workers seeking jobs is not efficient. However, disentangling the positive effects of the improved job-seeking assistance and the negative effects of the firing taxes would necessitate information on the job finding rates of the unemployed, which, unfortunately, we do not have since the data only cover the employed.

5.1.2 Impact on Permanent Employment

The model predicts fewer permanent workers (results 1 and 2). This section provides evidence that supports this. For flows of permanent workers, the groups share the same trend; that is, fewer permanent workers are hired. There is a spike of 9% in permanent employment in the control areas in August 2006, after the implementation of the policy, that is not shared by CTP areas, although they share the same trend and hire in similar numbers. Such an event seems missing in 2007, but in September 2008, we observe a relative rise in permanent hires in the control group. Note that the significance levels of the difference between the treatment and control groups for flows²⁹ reach the 10% level only twice, once in July 2005 and then in July 2007. To summarize, the treatment areas show fewer permanent hires, but not statistically significantly. Since temporary workers are employed for a shorter period, this means we may observe a decrease in economic activity³⁰.

The control group has a higher proportion of permanent workers than CTP areas of between two and 10 percentage points, starting in January 2006, after the policy was reported in *Le Monde* (12 December 2005). This means that firms immediately adjusted their stock of permanent workers as a response to the policy. The beginning of the year is typically a time of higher permanent work contract flows, as can be seen in the seasonal pattern in Figure 4, which

²⁹ Available upon request.

³⁰ The appendix shows that durations for permanent workers decreased.

Figure 6 The dashed line shows the 10% (bootstrapped) confidence intervals around the ratios depicted in the same color.

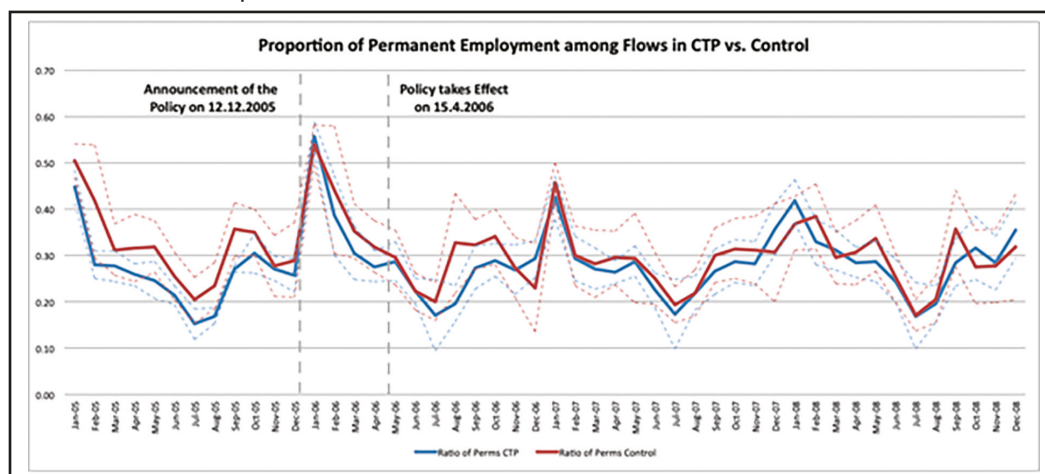
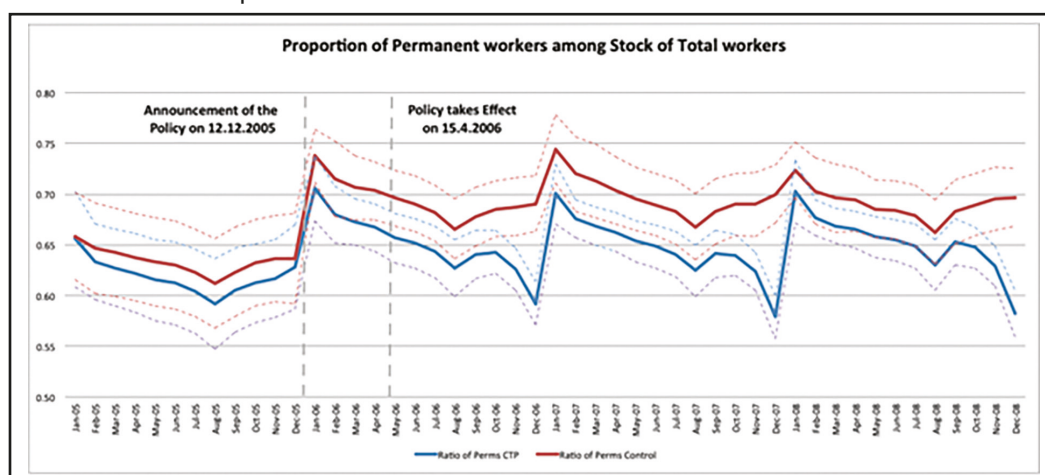
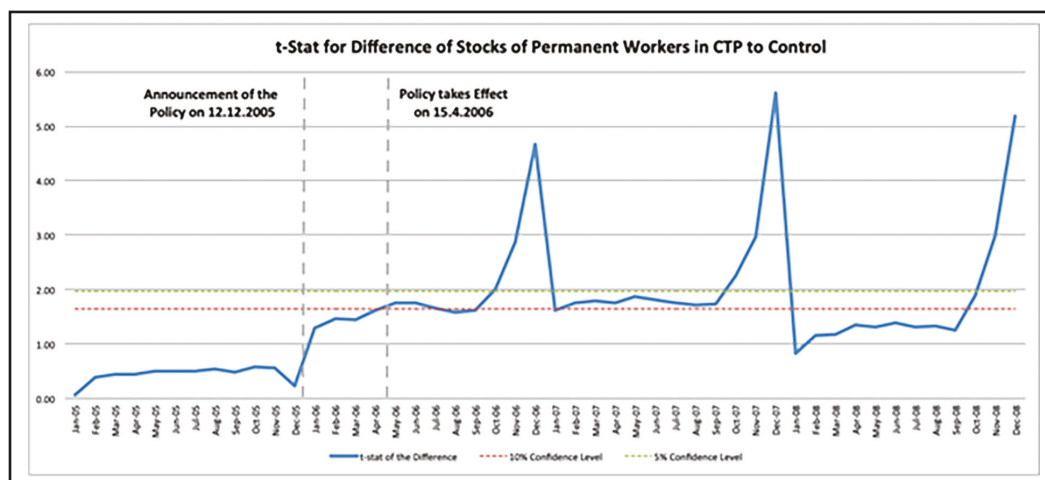


Figure 7 The dashed line shows the 10% (bootstrapped) confidence intervals around the ratios depicted in the same color.



may have been a factor. It is further noticeable that the confidence intervals cease, including for the other group, at the time of the policy announcement. Figure 8 shows the statistical significance of the difference between the ratios of permanent workers of the treatment and control areas. The difference is not significant before the policy at any conventional significance level and, precisely when the policy is announced, the ratio in treatment areas drops and becomes statistically significantly different at the 10% level (and higher) for most months. This is evidence in favor of the model (but not exclusive to it). Results 1 and 2 predict fewer permanent workers as a response to increased initial firing taxes along with less employment. An important question is: What was the margin of adjustment? From the graphs, in particular figure 5, we see that employment always dips between November and December of any given year. This applies to temporary jobs and permanent jobs. The ratio of permanent jobs increases rather strongly at the beginning of each year, only to peter out throughout the year and regain ground once again at the beginning of the next year. The end of the year is a time when many jobs, permanent and temporary, are terminated. However, relatively more temporary jobs are dissolved automatically increasing the proportion of permanent jobs. Incidentally, the policy was announced at exactly that time (December 2005), so the firms could adjust immediately.

Figure 8 The dashed lines show the 10% (bootstrapped) confidence intervals and the 5% confidence interval.



The reader may wonder, why the proportion of the stock of permanent workers in the treatment zones is falling so much relatively to the control zones in November/December of each year as we can see in figure 7. This is due to the overall reduction in hiring that we can observe in figure 5 as well as a shift of employers to use temporary workers more extensively and employ them for slightly longer (but still temporary) time horizons in response to the changed regime. This may be especially pronounced in the final months of the fiscal and budgetary year because decision makers may not have fully internalized their lower “budget” of permanent vacancies yet since the CTP was novel, but the exact dynamics are beyond the scope of this study.

We are tempted to construct graphs for all subsets of firms, but this may be misleading since there are general equilibrium effects between firms with less than and more than 1,000 workers, and in such graphs it is not possible to control for confounding factors. The aggregate of the treatment and control zones is informative since the propensity score balances potential confounding factors. This is why we move on to propensity score adjusted regressions.

5.2 Regression Results

Now, we examine hourly wages, hazard rates out of employment, hours worked, and income by conducting PSM-adjusted regressions at the match (employment stint) level. Higher wages occur with firing taxes in other models also (e.g. Garibaldi and Violante, 2005), but they still support the model when coupled with the above results of fewer permanent workers and lower employment overall, consistent with result 1. In fact, only higher wages are consistent with lower employment in the model. We conduct propensity score adjusted difference-in-difference regressions (interacting variables if the match was in an affected zone) on the sample of treated and control employment zones. The unit of observation is the match between worker and firm. Constant hazard rates (i.e. later match formation) constitute evidence in favor of the model. In the model, permanent workers are only fired in particularly hard times regardless of the level of f . This means that firms reduce their use of labour, not through higher hazard rates for permanent workers, but through less hiring.

5.2.3 Hourly Wages

For wages the regression specifications are:

$$\log(\text{hourlywage}) = a_1 + b_1X_1 + c_1X_2 + kY \quad (5.1)$$

$$\log(\text{hourlywage}) = a_2 + b_2X_1 + c_2X_2 + d_2X_3 + e_2X_4 + kY \quad (5.2)$$

$$\log(\text{hourlywage}) = a_3 + b_3X_1 + c_3X_2 + d_3X_3 + e_3X_4 + f_3X_5 + kY \quad (5.3)$$

$$\log(\text{hourlywage}) = a_4 + b_4X_1 + c_4X_2 + d_4X_3 + e_4X_4 + f_4X_5 + g_4X_6 + h_4X_7 + kY \quad (5.4)$$

The a 's are intercepts. X_1 is the indicator of the match existing in a CTP zone after implementation; that is, after 15 April 2006, X_2 interacts being in one of the seven affected CTP zones after implementation with being in a permanent match. $X_3 - X_6$ respectively interact being in the CTP zones (after implementation) with an indicator if it is a match in a firm with fewer than 1,000 workers (the upper threshold for the CTP scheme), a permanent position in a firm with fewer than 1,000 workers, if the worker previously held a permanent job (i.e. an 'insider') and, importantly, an interaction of being in a CTP zone after implementation if the worker previously held a permanent job and the match itself is permanent and would be subject to higher firing taxes in case of dissolution. X_7 adds various interactions (see footnote) of being eligible, previously employed, and so on. The interaction reported in the table below is the interaction of being in an affected zone (after implementation) with an indicator if the worker was eligible for the policy before the current job; that is, the worker held a permanent job in a CTP zone before, potentially benefitted from the policy, and holds a permanent job. This variable is important if we want to determine if the policy had any effect beyond increasing dismissal taxes. Finally, kY is a vector of additional controls such as a proxy for productivity, year fixed effects, firm size, sectors of activity, age, and sex³¹.

Table 2 reports the results for regressions with the log of hourly wage as a dependent variable. Flows are workers newly hired in that year while stocks denote incumbents.

The first column shows that for newly hired workers, there is no significant effect in the first (most naive) specification. However, in the second column for the stock of workers, we see that the workers who found a permanent job were able to negotiate a 7.4% higher wage (albeit only significant at 10%). This is in line with the model's prediction that permanent workers negotiate a higher salary as separation taxes increase. The second specification in the third column shows that newly hired workers in firms with less than 1,000 workers obtain a lower wage (only significant at 10%), which is surprising, but reassuringly the finding does not hold once we add further controls. There is no significant estimate for newly hired or retained workers.

The third specification explores the situation among newly hired workers. In the fifth column, it seems (significant at 10%) that permanent workers hired in firms with fewer than

31 Unreported controls in the first specification also include: age, age squared, blue or white-collar jobs, sex, a proxy for firm productivity, if the job was in manufacturing or services, if it was a permanent job, year controls, if the worker is a resident, and interactions of year and permanent indicators. I do not report the results on indicators individually, such as being in an affected zone, being a permanent worker, due to space concerns and because they do not reveal anything of interest. The second specification adds indicators of firm size, if it was a new firm, and various interaction terms. The third specification adds controls if the workers held permanent jobs before in the control group and if workers were eligible. The third specification interacts the indicators with year dummies. The fourth specification via X_7 adds combinations of controls for having held a permanent job before, being eligible for the policy while holding a permanent job now, and being in the control group.

Table 2 Impact on hourly Wages

Dependent variable: log hourly wage								
Regression specification:	(1) flow	(2) stock	(3) flow	(4) stock	(5) flow	(6) stock	(7) flow	(8) stock
CTP zone (post 15.4.2006)	0.003 (0.01)	0.056 (0.036)	-0.014 (0.026)	0.015 (0.033)	-0.015 (0.021)	0.014 (0.032)	-0.014 (0.027)	0.015 (0.025)
CTP x permanent job	-0.039 (0.03)	0.074* (0.042)	0.008 (0.043)	-0.048 (0.04)	0.004 (0.040)	-0.049 (0.038)	0.0004 (0.043)	-0.05 (0.035)
CTP x firm below 1000			0.03 (0.028)	0.006 (0.022)	0.031 (0.022)	0.006 (0.022)	0.03 (0.026)	0.006 (0.018)
CTP x firm below 1000 x permanent job			-0.067* (0.039)	0.013 (0.029)	-0.065* (0.036)	0.013 (0.024)	-0.064* (0.037)	0.013 (0.032)
CTP x previously held permanent job					0.0279* (0.0144)	0.059*** (0.022)	0.012 (0.014)	0.0026 (0.031)
CTP x previously held permanent job x holds permanent job							0.04* (0.023)	0.075*** (0.029)
CTP x previously held permanent job in CTP x permanent job							-0.164 (0.123)	-0.132 (0.081)
average sample size (per pair)	113938	162996	113938	162996	113938	162996	113938	162996
R^2	0.41	0.49	0.42	0.49	0.42	0.49	0.42	0.50

Note: Bootstrapped Standard Errors, additional controls unreported.

1,000 workers obtain a 6.4% lower wage, which is mitigated by workers who held a permanent job before having a 2.8% higher wage. It appears that new hires are willing to take a lower wage initially to gain a permanent position but leverage the CTP. Considering the average from the first specification does not expose a clear trend; the effects seem to cancel out. However, the sixth column reveals that workers who held a permanent position previously and are now working in a CTP region will increase their wages by 5.9% in the long run (i.e. in the stock of workers), significant at 1%. This is in line with workers extracting more surplus.

Moving to the fourth specification in columns 7 and 8 that includes controls for workers eligible for the policy, we see that it is not workers eligible for the CTP who are negotiating higher wages. It is those workers who have better adherence to the labour force as they had permanent jobs in the last 12 months. Thus, these workers were eligible for the policy. The wage increases by 4% for newly hired workers and 7.5% for the stock of workers^{32,33}. This indicates that the policy interferes with bargaining by raising the prospective firing taxes and, thus, lowering the outside option for the employer. This is evidence that the economic effect worked through the mechanisms outlined in the model. The reemployment efforts of the policy itself may have helped individuals to find a job, but there seems to be no effect on the quality of the match. Further, since fewer permanent workers are recruited, while it is possible that eligible workers were more likely to find a job³³, the policy did not have a positive aggregate effect. This is

32 Firms with fewer than 1,000 workers were not significantly affected, which shows a general equilibrium effect.

33 The Labour Force Survey did not provide indication of whether workers were eligible.

not surprising considering the experimental nature of the policy. Since many councilors had different expertise, and part of the objective was to determine what expertise is more helpful, it seems plausible that the net effect of the efforts did not systematically differ from the standard approach. That temporary workers negotiate higher wages, although insignificantly, points to less economic activity.

In summary, there is a wage increase for permanent workers, supporting the theory as these are workers whose initial firing taxes were changed, which, with a lower ratio of permanent workers is consistent with results 1 and 2. The treatment effect for temporary workers is positive but insignificant. One caveat is that better workers may have been hired in permanent positions, inflating estimates. This cannot be tested as we cannot follow workers over the years.

5.2.4 Hazard Rates

The next piece of evidence is if the hazard rates do not change with dismissal taxes. Other models (e.g. Alvarez and Veracierto, 2012) predict that hazard rates decrease for permanent workers. However, in our model, permanent workers already enjoy the most stable employment relationship possible. The following proportional hazard models are fitted:

$$\lambda_i = \lambda_0 \exp(b_1 X_{i1} + c_1 X_{i2} + kY) \quad (5.6)$$

$$\lambda_i = \lambda_0 \exp(b_2 X_{i1} + c_2 X_{i2} + d_2 X_{i3} + e_2 X_{i4} + kY) \quad (5.7)$$

$$\lambda_i = \lambda_0 \exp(b_3 X_{i1} + c_3 X_{i2} + d_3 X_{i3} + e_3 X_{i4} + f_3 X_{i5} + kY) \quad (5.8)$$

$$\lambda_i = \lambda_0 \exp(b_4 X_{i1} + c_4 X_{i2} + d_4 X_{i3} + e_4 X_{i4} + f_4 X_{i5} + g_4 X_{i6} + h_4 X_{i7} + kY) \quad (5.9)$$

λ_i is the individual hazard rate, and λ_0 the baseline. The covariates alter the baseline hazard multiplicatively and are the same as previously. Crucially, the reported part of X_{i7} is now an indicator of a match not being in a CTP zone, but the worker has potentially benefitted from the CTP policy and currently holds a permanent job.

Table 3 reports the hazard rate estimates using a proportional hazard Cox model. Except for permanent workers newly hired in firms with fewer than 1,000 workers and who are less likely to be fired (only in the second specification, column 3, and only significant at the 10%-level, which makes sense as they are now more expensive to fire), no estimates in the first three specifications are significant. Importantly, there is no significant effect on the stock of workers with any contract. This makes sense in the context of the model as the firing tax prevents firms from firing permanent workers as a response to higher separation taxes. Temporary workers to whom the firing taxes do not apply will be fired at the same rate as before (particularly since temporary workers are hired for fixed terms). Since workers lose their jobs at the same occasions, we should not expect any change in the hazard rates.

The fourth specification has some significant estimates. Column 7 shows that eligible workers with a permanent job in a CTP region now have a lower hazard rate (down to 0.2 of the baseline), significant at 5%, and eligible workers who obtained a permanent job have a hazard rate increased by the factor 3 although this is only significant at 10%. This may reflect the structure of the differences between CTP and CRP. Firms may hire permanent workers under the CRP with no intention of letting them stay on after two years. Under the CTP, this is not

Table 3 Hazard Rates

Hazard rate (Cox-model)								
Regression specification:	(1) flow	(2) stock	(3) flow	(4) stock	(5) flow	(6) stock	(7) flow	(8) stock
CTP zone (post 15.4.2006)	-0.100 (0.142)	0.018 (0.091)	0.011 (0.243)	0.218 (0.316)	0.0148 (0.24)	0.243 (0.252)	0.007 (0.218)	0.236 (0.272)
CTP x permanent job	0.142 (0.184)	-0.037 (0.087)	0.039 (0.326)	-0.179 (0.251)	0.063 (0.354)	-0.183 (0.249)	0.073 (0.276)	-0.176 (0.218)
CTP x firm below 1000			-0.168 (0.212)	-0.162 (0.338)	-0.172 (0.212)	-0.171 (0.255)	-0.172 (0.199)	-0.16 (0.295)
CTP x firm below 1000 x permanent job			-0.433* (0.223)	0.159 (0.255)	0.142 (0.218)	0.166 (0.232)	0.144 (0.193)	0.155 (0.203)
CTP x previously held permanent job					-0.096 (0.108)	-0.157 (0.187)	-0.084 (0.113)	-0.138 (0.204)
CTP x previously held permanent job x holds permanent job							-1.496* *(0.7)	0.535 (1.6)
CTP x previously held permanent job in CTP x holds permanent job							1.201* (0.705)	-0.442 (1.567)
average sample size (per pair)	114187	163508	114187	163508	114187	163508	114187	163508
R^2	0.106	0.069	0.126	0.087	0.132	0.108	0.132	0.109

Note: Bootstrapped Standard Errors, additional controls unreported.

R^2 based on alternative measure proposed by Allison (1995).

possible. This does not overturn the conclusion of separation taxes being inconsequential for hazard rates of permanent workers, as we can see in columns 1 to 6 and column 8. Additionally, because it is only recent hires and not workers subject to higher separation taxes in general, this is a composition effect. Finally, hazard rates of the stock of workers is unaffected. In summary, hazard rates are stable as result 4 suggests³⁴.

5.2.5 Hours Worked and Income

For firms not hiring new workers (permanent or temporary), a reduction in economic activity, beyond hiring fewer workers, may be reflected by fewer hours worked by those already hired. For hours worked and income, respectively, this was the set of regressions:

$$\log(hours) = a_4 + b_4X_1 + c_4X_2 + d_4X_3 + e_4X_4 + f_4X_5 + g_4X_6 + h_4X_7 + kY \quad (5.10)$$

$$\log(income) = a_4 + b_4X_1 + c_4X_2 + d_4X_3 + e_4X_4 + f_4X_5 + g_4X_6 + h_4X_7 + kY \quad (5.11)$$

Table 4 reports the results on hours worked and total income. The covariates are the same as previously for the fourth specification. However, now several indicators from X7 are reported: if a worker previously held a permanent job in a CTP area and holds any type of job in a CTP area currently, if a worker employed either in a CTP or control area

³⁴ In the appendix, duration is explored. We find that workers were hired later, meaning their hazard rates did not change, but utilization decreased.

Table 4 Hours worked and total income

Dependent variable:	hours worked		income	
Regression specification:	flow	stock	flow	stock
CTP zone (post 15.4.2006)	0.043 (0.088)	0.070 (0.074)	0.031 (0.071)	0.154 (0.099)
CTP x permanent job	-0.092 (0.084)	-0.042 (0.107)	-0.087 (0.108)	-0.156 (0.184)
CTP x new firm	-0.432** (0.241)	-0.116 (0.426)	-0.469** (0.233)	-0.169 (0.399)
CTP x firm below 1000	-0.016 (0.132)	-0.02 (0.085)	0.014 (0.128)	-0.093 (0.077)
CTP x firm below 1000 x permanent job	0.063 (0.147)	-0.018 (0.119)	-0.003 (0.144)	0.072 (0.137)
CTP x new firm x permanent job	0.636*** (0.269)	0.045 (0.337)	0.591** (0.281)	0.176 (0.296)
CTP x previously held permanent job in CTP	0.509* (0.349)	-0.018 (0.386)	0.537* (0.387)	0.011 (0.385)
Previously held permanent job in CTP	-0.502* (0.358)	0.178 (0.386)	-0.557 (0.401)	0.176 (0.389)
CTP x previously held permanent job x holds permanent job	0.142** (0.073)	-0.033 (0.086)	0.178 (0.081)	0.089 (0.103)
CTP x previously held permanent job in CTP x holds permanent job	-0.908** (0.436)	0.096 (0.407)	-1.075* (0.555)	-0.029 (0.415)
Previously held permanent job in CTP x holds permanent job	0.866** (0.476)	-0.109 (0.393)	1.006* (0.599)	-0.0454 (0.398)
average sample size (per pair)	114156	163325	114212	165508
R^2	0.37	0.37	0.39	0.40

Note: Bootstrapped Standard Errors, additional controls unreported.

formerly held a permanent job in a CTP area and held a current job in a CTP area, if a worker previously held a permanent job while currently holding a permanent job in a CTP area, if a worker holds a permanent job in a CTP area currently and previously held a permanent job in a CTP area and, finally, if a worker previously held a permanent job in a CTP area and is currently holding a permanent job but not necessarily in a CTP area. There seems to be a redistribution of hours worked from newly hired temporary workers towards permanent workers in new firms only, which reflects fewer overall hires, but permanent workers are used more. In column 1, workers benefitting from the policy directly work more hours in CTP but less (approximately 50%) in other regions. Eligible permanent workers in a CTP region worked less.

For income (column 3), we see a redistribution away from newly hired temporary workers towards newly hired permanent workers. Although the results on individually affected workers are significant at 10%, we see redistribution. This seems to counter the general equilibrium effect as workers that are eligible and have a permanent job seem to be worse off in CTP regions. At the same time, eligible workers seem to be better off in and outside CTP regions when they

obtain permanent jobs. A worker outside a CTP region makes approximately 50% more if they are newly hired³⁵. So, we detect a decrease in economic activity.

5.2.6 Revenue

Revenue, reported in table A1 in appendix A, was summed for each firm in the treatment and control groups and averaged. Values were normalized by the 2005 value. There is a reduction of approximately 2.8% in the treatment group in 2006 versus 2005 and even in 2007 the treatment group recovered to reach the output level of 2005. The control group's output, however, was higher by 0.9% in 2006, and in 2007 it was 7%. This is evidence of diminished economic activity in treatment areas.

6 Conclusion

This study developed a DMP-style matching model featuring a dual labour market with DRS in production. Central features of dual labour markets, such as coexisting permanent and temporary contracts, lower surplus for temporary workers, and tenure-dependent dismissal taxes for permanent workers are reproduced, and a link is made between permanent and temporary workers where temporary workers exist to buffer permanent workers from adverse productivity shocks and consequent downsizing. Generally, temporary workers are fired more often, which, together with lower surplus and/or wages, raises the question why workers would take such a job. Most models of dual labour markets explain this with ex-ante or ex-post heterogeneity. The key mechanism is that unemployed workers apply for lower-wage temporary jobs but are compensated by higher matching rates, consistent with observed patterns. The empirical predictions of the model regarding an increase in initial dismissal taxes, are that the ratio of permanent workers relative to total employment will be lower, but hazard rates of permanent matches out of employment will remain unaffected.

These predictions are tested using a labour market experiment in France, the CTP, exploiting matched DADS and EAE-ESANE datasets. The results support the model. CTP areas exhibit less employment and there is a reduction in the hiring of permanent workers in treatment areas of between 2 to 10 percentage points. The overall stock of workers is lower, which is statistically significant. Temporary workers are hired later, constituting a reduction in their use. A 7.5% increase in wages for workers leverages the increased separation taxes and provides stronger support. There is no significant impact on wages for workers eligible for the policy before their current match, so the policy itself did not impact the quality of the matches, likely due to the experimental nature of the policy. More supportive of the model is that hazard rates for permanent workers do not go down.³⁶ Lower output in CTP areas reinforces this conclusion.

Workers improved their bargaining position at the cost of fewer permanent jobs and a lower aggregate duration of matches. Importantly, permanent workers are shielded from firing by temporary workers. Separation taxes do not seem to influence job security in dual labour markets for any contract type but increase the gulf between them and create more

³⁵ Such workers are hired late in the year and cannot earn as much, inflating the estimates. This is reflected in insignificant results for the stock as workers have the same time to earn.

temporary contracts. This is consistent with the argument put forward by Blanchard and Tirole (2003) that reducing the protection gap between temporary and permanent workers would be beneficial to those trapped in temporary positions now. Unfortunately, the policy exacerbated the duality of the labour markets, which stems from linking a proactive policy with separation taxes. This strongly highlights the necessity to carefully consider financing and its interplay with institutions.

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A Appendix - Additional Tables

	Revenue Treatment	Revenue Control
2005	1	1
2006	0.972	1.009
2007	0.997	1.067

B Mathematical Appendix

Proof of Proposition 1

Proof. This proposition is a special case of Elsby and Michaels (2013) proposition 1, therefore it will highlight the differences. Let us start with the surplus of the firms for the workers derived from high productivity expressed in (2.3) and low productivity expressed (2.4). We will denote $\frac{\partial V_H(\cdot)}{\partial n^*} = J_H(\hat{n})$ and equally $\frac{\partial V_L(\cdot)}{\partial n^*} = J_L(\hat{n})$. This will be done for temporary workers (in high productivity firms) and for permanent workers of both protection levels:

$$J_H(n_{TH}) = \alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{TH}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{TH}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{TH}} - w_{TH} \quad (F.1)$$

This is the most simple case, since temporary workers, by definition, are not impacting any future surplus and are not able to extract any surplus in the form of dismissal costs. The surplus they present is almost straightforwardly like in the standard Stole and Zwiebel(1996) set up where an additional worker produces and has an impact on the wages of their coworkers. Let us move on to the permanent worker with lower level of protection f_1 :

$$J_H(n_{PHN,j}) = \alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{PHN,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{PHN,j}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{PHN,j}} - w_{PHN} \\ + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta(f_2 - f_1) \quad (F.2)$$

A permanent worker with the lower level of protection can extract their impact on the production and on the wages of the other workers, just like the temporary workers above. However, on top of this, they may extract the potential savings on future hiring costs of this type as well as extract the dismissal costs f_1 . However, they will have to give up some surplus to compensate the employer for the future risk of them transitioning to the full protection f_2 .

$$J_H(n_{PHO,j}) = \alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{PHO,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{PHO,j}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{PHO,j}} - w_{PHO} \\ + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \quad (F.3)$$

We see that now that the worker is fully protected, they can now extract f_2 and also the entire surplus from their marginal production and their impact on the other workers' wages as well as the potential future savings on hiring costs.

$$J_L(n_{PLN,j}) = \alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLN,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLN,j}} - w_{PLN} \\ + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta(f_2 - f_1) \quad (F.4)$$

Here, we realize that the employer is not hiring any temporary workers and therefore such workers do not feature in the surplus. Also, since firms will potentially hire workers in the future, the employer can economize in case of a positive productivity in the next period. The worker extracts dismissal costs f_1 . Finally, we have to take into account the possibility that this worker in the next period may transition to full protection and then the dismissal cost is f_2 and the surplus of this worker needs to justify this in the current period.

$$J_L(n_{PLO,j}) = \alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLO,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLO,j}} - w_{PLO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \quad (F.5)$$

Here, again we use the fact that the employer is not hiring any temporary workers and therefore such workers do not feature in the surplus. Also, since firms will potentially hire workers in the future, the employer can economize in case of a positive productivity in the next period. Finally, part of the surplus is the dismissal cost since if negotiation breaks down, the employer would have to pay f_2 . Next, we look at the surplus for the various workers and impose the equilibrium conditions of marginal surplus value, i.e. $J_H(n_{PHN,j}) = \frac{c}{q(\theta_p)} + f_1$, $J_H(n_{PHO,j}) = \frac{c}{q(\theta_p)} + f_1$, $J_H(n_{TH,j}) = \frac{c}{q(\theta_T)}$, $J_L(n_{PLN,j}) = f_1$, $J_L(n_{PLO,j}) = f_2$.

We now impose Nash Surplus sharing in any of the other matches outside of the one being currently negotiated, which implies that: $w_{PHN} - Y = \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right)$, $w_{PHO} - Y = \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right)$, $w_{PLN} - Y = \frac{\eta}{1-\eta} f_1$ and $w_{PLO} - Y = \frac{\eta}{1-\eta} f_2$, and we can use this to express the values of being employed as:

$$W_{TH} = w_{TH} + \beta Y \quad (F.6)$$

$$W_{PHN} = w_{PHN} + (1-\zeta) \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) + \zeta \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \zeta \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 + (1-\zeta) \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_1 + \beta Y \quad (F.7)$$

$$W_{PHO} = w_{PHO} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 + \beta Y \quad (F.8)$$

$$W_{PLN} = w_{PLN} + (1-\zeta) \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) + \zeta \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \zeta \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 + (1-\zeta) \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_1 + \beta Y \quad (F.9)$$

$$W_{PLO} = w_{PLO} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 + \beta Y \quad (F.10)$$

We now further use the Bargaining solution: $w_{PHN} - Y = \frac{\eta}{1-\eta} J_H(n_{PHN})$, $w_{PHO} - Y = J_H(n_{PHO})$, $w_{PLN} - Y = J_H(n_{PLN})$, $w_{PLO} - Y = J_H(n_{PLO})$ and $w_{TH} - Y = J_H(n_{TH})$. Using our above solutions for the constituent parts, we obtain solutions for all wages:

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH,j})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{TH,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{TH,j}} - n_{TH,j} \frac{\partial w_{TH}}{\partial n_{TH,j}} - w_{TH} \right] \\ & = (1-\eta) [(w_{TH} + \beta Y) - Y] \\ & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH,j})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{PHN,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{PHN,j}} - n_{TH,j} \frac{\partial w_{TH}}{\partial n_{PHN,j}} - w_{PHN} \right. \\ & \quad \left. + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \end{aligned} \quad (F.11)$$

$$= (1-\eta) \left[w_{PHN} + \beta Y + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta)f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta)f_1 + \zeta f_2) - Y \right] \quad (F.12)$$

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{PHO,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{PHO,j}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{PHO,j}} - w_{PHO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ &= (1-\eta) \left[\left(w_{PHO} + \beta Y + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 \right) - Y \right] \end{aligned} \quad (F.13)$$

$$\begin{aligned} & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLN,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLN,j}} - w_{PLN} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \\ &= (1-\eta) \left[w_{PLN} + \beta Y + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta)f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta)f_1 + \zeta f_2) - Y \right] \end{aligned} \quad (F.14)$$

$$\begin{aligned} & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLO,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLO,j}} - w_{PLO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ &= (1-\eta) \left[\left(w_{PLO} + \beta Y + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 \right) - Y \right] \end{aligned} \quad (F.15)$$

We now look at Y and find that:

$$Y = \beta (1-p(\theta_p)) Y + \beta p(\theta_p) W_{PHN} \quad (F.16)$$

Which is:

$$Y = \beta (1-p(\theta_p)) Y + \beta p(\theta_p) \left[\frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) + Y \right] \quad (F.17)$$

So we can write:

$$Y = \beta Y + \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \quad (F.18)$$

Imposing this on (F.11) and (F.15) yields:

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{TH}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{TH}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{TH}} - w_{TH} \right] \\ &= (1-\eta) \left[w_{TH} - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.19)$$

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{PHN,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{PHN,j}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{PHN,j}} - w_{PHN} \right. \\ & \quad \left. + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \\ &= (1-\eta) \left[w_{PHN} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta)f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta)f_1 + \zeta f_2) \right. \\ & \quad \left. - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.20)$$

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - n_{PHN,j} \frac{\partial w_{PHN}}{\partial n_{PHO,j}} - n_{PHO,j} \frac{\partial w_{PHO}}{\partial n_{PHO,j}} - n_{TH} \frac{\partial w_{TH}}{\partial n_{PHO,j}} - w_{PHO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ &= (1-\eta) \left[w_{PHO} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.21)$$

$$\begin{aligned} & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLN,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLN,j}} - w_{PLN} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \\ &= (1-\eta) \left[w_{PLN} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta) f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta) f_1 + \zeta f_2) \right. \\ & \quad \left. - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.22)$$

$$\begin{aligned} & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLO,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLO,j}} - w_{PLO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ &= (1-\eta) \left[w_{PLO} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.23)$$

At this point, we impose Lemma 1 (proved below) and are finally able to state that the above equation are First Order Differential Equations of the form:

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - (n_{PHN,j} + n_{PHO,j} + n_{TH}) \frac{\partial w_{TH}}{\partial n_{TH}} - w_{TH} \right] \\ &= (1-\eta) \left[w_{TH} - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.24)$$

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - (n_{PHN,j} + n_{PHO,j} + n_{TH}) \frac{\partial w_{PHN}}{\partial n_{PHN,j}} - w_{PHN} \right. \\ & \quad \left. + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \\ &= (1-\eta) \left[w_{PHN} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta) f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta) f_1 + \zeta f_2) \right. \\ & \quad \left. - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.25)$$

$$\begin{aligned} & \eta \left[\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1} - (n_{PHN,j} + n_{PHO,j} + n_{TH}) \frac{\partial w_{PHO}}{\partial n_{PHO,j}} - w_{PHO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ &= (1-\eta) \left[w_{PHO} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.26)$$

$$\begin{aligned} & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - (n_{PLN,j} + n_{PLO,j}) \frac{\partial w_{PLN}}{\partial n_{PLN,j}} - w_{PLN} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \\ &= (1-\eta) \left[w_{PLN} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta) f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta) f_1 + \zeta f_2) \right. \\ & \quad \left. - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.27)$$

$$\begin{aligned} & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - (n_{PLN,j} + n_{PLO,j}) \frac{\partial w_{PLO}}{\partial n_{PLO,j}} - w_{PLO} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ & = (1-\eta) \left[w_{PLO} + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 - \beta p(\theta_p) \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_1 \right) \right] \end{aligned} \quad (F.28)$$

where $\partial n_{TH} = \partial n_{PHN,j} = \partial n_{PHO,j} = \partial (n_{PHO,j} + n_{PHN,j} + n_{TH})$ and $\partial n_{PLN,j} = \partial n_{PLO,j} = \partial (n_{PLO,j} + n_{PLN,j})$ because increasing the total number of employees marginally is the same as increasing one group of them marginally. They therefore have the solutions:

$$w_{TH} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_T) \frac{c}{q(\theta_T)} \right) \quad (F.29)$$

$$w_{PHN} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} \right) \quad (F.30)$$

$$w_{PLN} = \eta \left(\frac{\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_1 - \beta\delta\zeta \frac{(f_2-f_1)}{1-\eta} \right) \quad (F.31)$$

$$w_{PHO} = \eta \left(\frac{\alpha A_H (n_{PHO,j} + n_{PHN,j} + n_{TH})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_2 \right) \quad (F.32)$$

$$w_{PLO} = \eta \left(\frac{\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1}}{1-\eta(1-\alpha)} + \beta p(\theta_p) \left(\frac{c}{q(\theta_p)} + f_1 \right) + (1-\beta\delta)f_2 \right) \quad (F.33)$$

This concludes the proof.

Proof of Lemma 1:

Proof: Take equation (F.14), and equation (F.15) for the case when productivity is low (We showcase the way to prove the Lemma on the relatively simple case of low productivity, but the method is equally applicable to the high productivity case.) and solve them for w_{PLN} and w_{PLO} under the assumption that there are no currently hired workers present since the firm is, if anything, downsizing:

$$\begin{aligned} w_{PLN} = & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLN,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLN,j}} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_1 - \beta \delta \frac{\eta}{1-\eta} \zeta (f_2 - f_1) \right] \\ & - (1-\eta) \left[\beta Y + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + (1-\zeta)f_1 + \zeta f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} ((1-\zeta)f_1 + \zeta f_2) - Y \right] \end{aligned} \quad (F.34)$$

and:

$$\begin{aligned} w_{PLO} = & \eta \left[\alpha A_L (n_{PLO,j} + n_{PLN,j})^{\alpha-1} - n_{PLN,j} \frac{\partial w_{PLN}}{\partial n_{PLO,j}} - n_{PLO,j} \frac{\partial w_{PLO}}{\partial n_{PLO,j}} + \beta \delta \pi_H \frac{c}{q(\theta_p)} + f_2 \right] \\ & - (1-\eta) \left[\beta Y + \beta \delta \pi_H \frac{\eta}{1-\eta} \left(\frac{c}{q(\theta_p)} + f_2 \right) + \beta \delta (1-\pi_H) \frac{\eta}{1-\eta} f_2 - Y \right] \end{aligned} \quad (F.35)$$

then, take the derivative with respect to n_{PLO} and n_{PLN} of both. We obtain two relatively simple equation:

$$\frac{\partial w_{PLN}}{\partial n_{PLO}} = \eta \left[\alpha(\alpha-1)(n_{PLO} + n_{PLN})^{\alpha-2} - n_{PLN} \frac{\partial^2 w_{PLN}}{\partial n_{PLN} \partial n_{PLO}} - \frac{\partial w_{PLO}}{\partial n_{PLN}} - n_{PLO} \frac{\partial^2 w_{PLO}}{\partial n_{PLN} \partial n_{PLO}} \right] \quad (F.36)$$

and:

$$\frac{\partial w_{PLO}}{\partial n_{PLN}} = \eta \left[\alpha(\alpha-1)(n_{PLO} + n_{PLN})^{\alpha-2} - n_{PLN} \frac{\partial^2 w_{PLN}}{\partial n_{PLO} \partial n_{PLN}} - \frac{\partial w_{PLN}}{\partial n_{PLO}} - n_{PLO} \frac{\partial^2 w_{PLO}}{\partial n_{PLO} \partial n_{PLN}} \right] \quad (F.37)$$

We can combine these two and get a solution for $\frac{\partial w_{PLO}}{\partial n_{PLN}}$ and $\frac{\partial w_{PLN}}{\partial n_{PLO}}$ which, because of the symmetry of these equations, are in fact the same.

$$\frac{\partial w_{PLO}}{\partial n_{PLN}} = \frac{\partial w_{PLN}}{\partial n_{PLO}} = \frac{\eta - \eta^2}{1 - \eta^2} \left[\alpha(\alpha-1)(n_{PLO} + n_{PLN})^{\alpha-2} - n_{PLN} \frac{\partial^2 w_{PLN}}{\partial n_{PLN} \partial n_{PLO}} - n_{PLO} \frac{\partial^2 w_{PLO}}{\partial n_{PLN} \partial n_{PLO}} \right] \quad (F.38)$$

We now use this result to rearrange equation (F.37) to obtain:

$$\frac{\partial w_{PLO}}{\partial n_{PLN}} = \eta \left[\alpha(\alpha-1)(n_{PLO} + n_{PLN})^{\alpha-2} - n_{PLO} \frac{\partial^2 w_{PLN}}{\partial n_{PLN} \partial n_{PLO}} - \frac{\partial w_{PLO}}{\partial n_{PLN}} - n_{PLN} \frac{\partial^2 w_{PLO}}{\partial^2 \partial n_{PLN}} \right] \quad (F.39)$$

We do the same for (F.34) and get:

$$\frac{\partial w_{PLN}}{\partial n_{PLN}} = \eta \left[\alpha(\alpha-1)(n_{PLO} + n_{PLN})^{\alpha-2} - n_{PLO} \frac{\partial^2 w_{PLO}}{\partial^2 n_{PLN}} - \frac{\partial w_{PLN}}{\partial n_{PLN}} - n_{PLN} \frac{\partial^2 w_{PLN}}{\partial^2 \partial n_{PLN}} \right] \quad (F.40)$$

The second term in parentheses, we can rearrange with the help of (F.5) to replace $\frac{\partial^2 w_{PLO}}{\partial^2 n_{PLN}}$ by $\frac{\partial^2 w_{PLN}}{\partial n_{PLO} \partial n_{PLN}}$ to obtain:

$$\frac{\partial w_{PLN}}{\partial n_{PLN}} = \eta \left[\alpha(\alpha-1)(n_{PLO} + n_{PLN})^{\alpha-2} - n_{PLO} \frac{\partial^2 w_{PLN}}{\partial n_{PLO} \partial n_{PLN}} - \frac{\partial w_{PLN}}{\partial n_{PLN}} - n_{PLN} \frac{\partial^2 w_{PLN}}{\partial^2 \partial n_{PLN}} \right] \quad (F.41)$$

We can now clearly see the symmetry between equations: (F.39) and (F.41) and can solve them, since they are first order differential equations in exactly the same manner, which clearly implies:

$$\frac{\partial w_{PLN}}{\partial n_{PLN}} = \frac{\partial w_{PLO}}{\partial n_{PLN}} \quad (F.42)$$

which allows that we can solve for the wage in much the same way as Elsby and Michaels (2013).

The proof for the other pairs and triples is analogous and for brevity omitted (available upon request). This concludes the proof.

C Appendix (not intended for publication) - Efficiency Properties of the Model

This section is to provide a brief description of the efficiency properties of this model. As is the case with most models of this class, the presence of congestion externalities and of exogenous bargaining weight makes obtaining efficiency in a decentralized equilibrium rather challenging. Firstly, to deal with the congestion externality, we need to impose the Hosios condition which ensures that at the margin, an employer posting an additional vacancy takes into account the negative impact this vacancy will have at the margin on every other vacancy in the economy. The Hosios condition implies that the marginal elasticity of the matching function with respect to vacancies $\frac{\partial mV}{\partial Vm}$ is the same as the bargaining weight of the employers, $1 - \eta$ (Hosios, 1990). On the other hand, it is well established that a model with Stole and Zwiebel bargaining exhibits an over-hiring incentive for firms that is not negated if we impose the Hosios condition (Mortensen, 2009). As Hawkins (2010) demonstrates, we additionally need a hiring tax. Now, with regard to the model of this paper, we do not have a hiring tax, but a dismissal tax which partially makes hiring less attractive, but primarily dis-incentivises dismissals. In some sense, the following discussion is a vindication of Blanchard and Tirole's (2003) argument why there should be moderate dismissal taxes and why there should not be different contracts available. Let us say we impose the Hosios Condition. Then, since we cannot impose hiring taxes in this set up because we want to match institutional arrangements of France, we need to use the suboptimal tool of dismissal taxes to combat the excessive hiring incentive. If we completely counter this incentive, we may have the optimal level of workers hired in high productivity states, be they permanent or temporary, but we will either not have the optimal number of workers retained in the low productivity state or we will have too costly to create and too short lived temporary contracts. More specifically if (despite it not being optimal), the number of permanent workers exceeds that which would yield zero profits in the low productivity case, firms would retain more workers than they would with optimal hiring taxes because it would cost them less. If, on the other hand firms hire temporary workers beyond this level, these workers will leave no matter what, even in case of high productivity, because of the limitation in duration of temporary contacts and thus firms would spend more resources rehiring them on vacancy posting than in the constrained (by matching frictions) optimum. What emerges from this is the following. From a theoretical point of view, we will not be able to decentralize the Social Planner's allocation in this economy if we restrict ourselves to the tools of the French labour market institutions. Even if we impose the Hosios Condition, so the congestion externality will be taken care of and therefore there will be no increase in employment if f_1 rises, we may still be in the territory of "too high" unemployment. This means if we observe a decrease in employment, the likelihood of a decrease in welfare is higher. The below analysis finds (albeit statistically insignificant) evidence for fewer matches and for lower revenue.

D Appendix (not intended for publication) - Adjacent Labour Markets

This appendix extends the basic model to include other, not directly affected, labour markets. This could be another region, but it could also be another unaffected sector. It is important that there are hurdles of switching beyond just search with frictions. The conclusion of this extension is that there may be spillover effects to other labour markets.

D.1 Including Migration to other Labour Markets

Since a change in the market equilibrium of one region or segment of the labour market causes in- or out migration, it is important to include such a mechanism in the model to gauge trans-regional effects or the effects on other labour market segments of a policy change. Specifically, since the CTP-policy only affects firms below 1000 workers, what happens to firms above 1000 workers? The basic set up is extended by stipulating there exist two separate regions/sectors with potentially different parameters and unemployed workers are subject to a moving cost λ distributed on $[0, \infty]$ according to a CDF $G_i(\lambda)$, $G(0) > 0$, $G(\infty) = 1$, $i = 1, 2$ capturing that some people move with ease and others not at all and this might follow different dynamics in different regions. Workers move at the beginning of a period before all other events. Employed workers will not move, as this would complicate the analysis. This moving cost is redrawn every period in an iid fashion. Now assume that the two economies start with equalized Utilities for unemployed workers.

$$W_{Y1,t}(A_1, L_{1t}) = W_{Y2,t}(A_2, L_{2t}) \quad (D.1)$$

where A_i denotes the set of parameters in the economy. Imagine there is a shock to economy 1 increasing the value of being unemployed (imagine an increase in productivity A_H , or f_1). Now:

$$W_{Y1,t}(A_1^*, L_{1t}) > W_{Y2,t}(A_2, L_{2t}) \quad (D.2)$$

Some workers in economy 2 will migrate to economy 1. They will do this until:

$$W_{Y1,t}(A_1^*, L_{1t+x} + G_2(\tilde{\lambda}_t) L_{2t+x}) = W_{Y2,t}(A_2, L_{2t+x} - G_2(\tilde{\lambda}_t) L_{2t+x}) + \tilde{\lambda}_{t+x} \quad (D.3)$$

in period t . All workers with moving cost below $\tilde{\eta}_t^*$ will move. As each period there is a new random draw of the moving costs this will be repeated until we reach period N where:

$$\begin{aligned} W_{Y1,t+N}(A_1^*, L_{1t} + G_2(\tilde{\lambda}_t) L_{2t} + \dots + G_2(\tilde{\lambda}_{t+N}) L_{2,t+N}) \\ = W_{Y2,t+N}(A_2, L_{2t} - G_2(\tilde{\lambda}_t) L_{2t} - \dots - G_2(\tilde{\lambda}_{t+N}) L_{2,t+N}) + \tilde{\lambda}_{t+N} \end{aligned} \quad (D.4)$$

where $\tilde{\eta}_{t+N}^* = 0$. This is when both economies provide the same value of unemployment and migration stops. As time progresses, migration diminishes as fewer workers are in economy 2 and a lower proportion will migrate as the difference between the unemployment value between regions shrinks. A positive shock (one increasing the surplus of workers) to economy 1 will transmit to economy 2 drawing labour from it mitigating the shocks on economy 1.

Absent migration the value of unemployment continue to change after a change in parameters, since the model does not immediately jump to its new steady state. The speed and

impact of migration will be influenced by transition dynamics, but transition dynamics would not influence the direction of migration or any effects of migration. To summarize:

Definition D.1. *Equilibrium (MS) is defined by two sets of $n_{PHNi,j}, n_{THi}, n_{PHOi,j}, n_{PLNi,j}, n_{PLOi,j}, V_{SPi}, V_{STi}, U_{Si}, \theta_{Ti}, \theta_{Pi}, w_{THi}$ and $w_{PHNi,j}, w_{PHOi,j}, w_{PLNi,j}, w_{PLOi,j}$ ($i=1,2$) that satisfy their equivalent equations to (4.1-4.12). It will be a Nash equilibrium for $f > f_D$ given by (D.1). Additionally, equation (D.1) pins down the number of workers in each economy in equilibrium given productivity and labour market parameters c_i and f_{ii}*

Result D.1. *In equilibrium (MS) any change in parameters increasing expected surplus of unemployed workers (increase in f_i , F , A_H, A_L, π_H , or δ decrease in L) in one region/labour market segment causes migration from the other region/labour market segment, which is equivalent to an increase in f_1 for that region/labour market segment and mutes initial effects in the destination.*

Results 1-4 are still valid in equilibrium (MS). Migration mutes the effects but cannot reverse them. Therefore, firms above 1000 workers should behave similarly to firms below 1000 workers in the data. So, the estimates in the main body are a lower bound estimate.

E Appendix (not intended for publication) - Details on Methodology

E.1 Propensity Score Matching - Concepts

Propensity Score Matching (PSM) uses assignment likelihood as balancing score, and each parameter is weighted by its influence on the likelihood. For a discussion see Angrist and Prischke, 2009. For this we need an estimate of the likelihood, propensity score, which is obtained using Probit or Logit-models. For PSM to be valid two assumptions are important:

1. common support - the propensity score cannot be "too perfect", as we would then not have any comparison group

$$0 < p(X_i) < 1, \forall X_i \quad (\text{E.1})$$

2. Conditional Independence - parameters used to construct the propensity score must not influence potential outcomes

$$E(Y_{i,1}^0 - Y_{i,0}^0 \mid p(X_i), D=1) = E(Y_{i,1}^0 - Y_{i,0}^0 \mid p(X_i), D_{i,1}=0) \quad (\text{E.2})$$

The second assumption warrants more explanation. Not being assigned should not influence outcomes. For example, a professor who tells two equally gifted students one is a "good" student and nothing to the other to measure the effect of being supportive. This may have a negative effect on the latter and conditional independence would be violated. We would not only measure the positive effect of being supportive to one student but the combined effect of supporting one student and discouraging the other. There are two steps:

1. estimate the Propensity Score for each region to be CTP using an auxiliary dataset
2. run regressions for matched regions on the large dataset to get PS-adjusted estimates

This allows the use of regional information and control for individual variation. Unfortunately, one drawback of PSM is regressions produce invalid standard errors. The comparison group may be similar by accident, because variation brought a zone closer to CTP-zones. This may bias standard errors. Sadly, there is no standard procedure for standard errors for PSM. The literature uses bootstrapped standard errors though there is no formal justification (Abadie and Imbens (2008)). Lacking alternatives, the paper follows the literature using bootstrapped standard errors.

E.2 Propensity Score Matching in Practice

To implement the first step, an auxiliary dataset is constructed containing information about employment zones. This was from the website of the INSEE and from summary statistics from the DADS and EAE-ESANE datasets. There is information on unemployment, average wages, stock of permanent employment, population, employment participation, industrial composition etc. It is used to estimate a logit model giving us an estimate of the likelihood:

$$CTP2006 = aX \quad (\text{E.3})$$

where X is a vector of controls (including intercept) like the actual and predicted stock of permanent workers (predicted by estimates of productivity), share of manufacturing and services, unemployment, trend in unemployment between 2004 and December 2005, participation rate, average hourly wages, average gross income, share of nonresidents in 2005 and share of residents that held a local job.

Once the PS is estimated 1-1 matching is used to find the closest match, estimate the effect on the large DADS-EAE-ESANE dataset and (as is standard) the effects are averaged over all zones. For employment and the proportion of permanent contracts the graph shows flows and stocks for different sub-groups. For wages, hazard rates and duration the full dataset is used to obtain Propensity Score adjusted regression estimates. For standard errors, the auxiliary dataset is redrawn 100 times and the procedure is repeated.

F Appendix (not intended for publication) - Results on Duration of Matches

If hazard rates are constant, this could mean firms do not adapt and may not desire to do so which would contradict the model as it means the separation taxes only affect newly hiring firms. At the same time we see fewer workers in the stock of workers and also a lower proportion of permanent employees. This seeming contradiction can be reconciled by realizing that firms hire workers later in the year to decrease their use of labour but once they are hired they will be fired at the same rate as before. The following specifications were tested:

$$\log(\text{duration}) = a_1 + b_1 X_1 + c_1 X_2 + kY \quad (\text{F.1})$$

$$\log(\text{duration}) = a_2 + b_2 X_1 + c_2 X_2 + d_2 X_3 + e_2 X_4 + f_2 X_5 + g_2 X_6 + kY \quad (\text{F.2})$$

$$\log(\text{duration}) = a_3 + b_3 X_1 + c_3 X_2 + d_3 X_3 + e_3 X_4 + f_3 X_5 + g_3 X_6 + kY \quad (\text{F.3})$$

$$\log(\text{duration}) = a_4 + b_4 X_1 + c_4 X_2 + d_4 X_3 + e_4 X_4 + f_4 X_5 + g_4 X_6 + h_4 X_7 + kY \quad (\text{F.4})$$

Independent variables are treatment effect, X_1 and treatment effect on permanent matches X_2 in the first specification. In the second specification controls for new firms in treatment areas are added, X_3 , for generally affected firms, X_4 , for permanent jobs in affected firms, X_5 and for matches in new firms that were permanent and in the treatment area, X_6 . For the third iteration controls are added if workers held permanent jobs in the treatment area. Estimates are

Table F.1 Impact on Duration

Dependent variable: log of duration								
Regression specification:	(1) flow	(2) stock	(3) flow	(4) stock	(5) flow (alt. contr.)	(6) stock (alt. contr.)	(7) flow	(8) stock
CTP zone (after 15.4.2006)	0.067 (0.06)	0.105 (0.107)	0.063 (0.087)	0.057 (0.087)	0.053 (0.080)	0.059 (0.108)	0.054 (0.101)	0.062 (0.127)
CTP x permanent job	-0.080 (0.074)	-0.131 (0.13)	-0.027 (0.117)	-0.012 (0.117)	-0.049 (0.106)	-0.009 (0.159)	-0.244** (0.116)	-0.013 (0.161)
CTP x new firm			-0.509*** (0.186)	0.002 (0.186)	-0.506*** (0.175)	-0.009 (0.367)	-0.506*** (0.179)	-0.013 (0.337)
CTP x firm below 1000			0.064 (0.148)	0.057 (0.148)	0.066 (0.141)	0.055 (0.133)	0.066 (0.137)	0.053 (0.126)
CTP x firm below 1000 x permanent job			-0.115 (0.196)	-0.129 (0.196)	-0.113 (0.176)	-0.126 (0.184)	-0.112 (0.159)	-0.125 (0.159)
CTP x new firm x permanent job			0.578* (0.319)	-0.074 (0.319)	0.548* (0.305)	-0.055 (0.361)	0.544* (0.308)	-0.052 (0.333)
Previously held permanent job in CTP x currently holds permanent job							0.046 (0.307)	0.172 (0.339)
average sample size (per pair)	114187	163508	114187	163508	114187	163508	114187	163508
R^2	0.24	0.29	0.24	0.29	0.24	0.30	0.25	0.31

Note: Bootstrapped Standard Errors, additional controls unreported.

insignificant and not reported as estimates. Being eligible and holding a permanent job is X_7 in the fourth specification.

Table F.1 reports results for the regressions on log of duration. The first specification shows no significant result. The second specification reveals in column 3 duration for newly hired workers in newly founded firms is lower by 50.9%, significant at the 1% level. It shows that duration for permanent workers hired by newly founded firms is 57.8% longer, but only significantly at 10%. Apparently, temporary workers are hired later in newly founded firms due to the CTP-policy. There is no significant effect on the stock of workers. The third and fourth specifications (column 5 and 7) show newly hired workers experience lower duration in newly established firms once the CTP takes effect. The difference is large, 50% and highly significant at 1%. Workers hired permanently experience a 54% higher duration (10% level significance) confirming that the reduction in duration is borne by temporary workers among new hires in new firms. Workers that held a job from the year's beginning do not show a significant change which indicates that the time when workers get fired does not change, but when they get hired.

To summarize, the data do not contradict the model. Duration goes down for new hires, but not for existing matches, pointing to less economic activity.