Spillover Effects of Employment Protection[1]

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Abstract

Estimates of the impact of employment protection heavily rely on reduced-form methods, assuming that there are no indirect effects between firms. This paper exploits a labor law reform implemented in Portugal in 2009 which restricted the use of fixed-term contracts for large firms above a specific size threshold, to investigate and quantify spillover effects. Standard reduced-form estimates based on the hypothesis of the absence of spillover towards firms for which the reform does not apply yield a negative impact on employment of about 1.5%. However, we find evidence of significant spillovers. The estimation of the macroeconomic effects of the reform with a search and matching model accounting for spillovers yields an almost negligible employment impact of the reform, more than ten times smaller than that obtained with the reduced form estimates. This result underlines that the numerous reduced-form estimates of the impact of employment protection that rely on firm size thresholds must be interpreted with caution.

Keywords: Employment protection legislation, Spillover effects, Directed search and matching.

JEL Codes: J23, J41, J63.

1 Introduction

A large literature has evaluated the effects of employment protection legislation (EPL) by comparing firms targeted by the regulation with those not targeted.[1] Firm size has been extensively used as the stringency of EPL is size dependent in many countries.[2] These evaluations assume that firms not targeted by EPL are not affected by the policy evaluated, so they can be a valid counterfactual for the firms directly targeted.

In this paper, we examine this widely held assumption of no spillover. We provide evidence that spillovers on firms not targeted by EPL can be large at the aggregate level. Our analysis is based on a reform strengthening employment protection for large firms in Portugal. Although the proportion of workers directly impacted by the reform is small, at about 15% of all employees, we show that the spillovers towards firms for which the reform does not apply are significant. We first quantify the impact of the policy on treated firms using reduced-form methods. These estimates indicate a reduction in total employment by about 1.5%. However, the estimation of a structural model accounting for spillovers shows that the overall employment effects are in fact thirteen times smaller.

The reform we examine sought to lower job insecurity by reducing the range of circumstances under which fixed-term contracts (FTCs) could be used by large firms that employed at least 750 workers. Before the policy, it was possible to hire under FTC in new establishments (younger than 2 years) launched by firms, without any restriction. From February 2009, large firms could no longer benefit from exemptions that allow hiring with FTCs without justification in new establishments. The hope of the policy makers was that this reform would encourage large firms to substitute permanent jobs for temporary ones.[3]

We have selected this reform for the following reasons. First, the share of workers directly affected by the reform, around 15%, is small, which allows us to show that the effects of spillovers can

[1] See, for instance: Boeri & Jimeno (2005), Kugler & Pica (2008), Schivardi & Torrini (2008), Martins (2009), Olsson (2009), Centeno & Novo (2012), Gal et al. (2012), Berton et al. (2017), Bornhäll et al. (2016), Hijzen et al. (2017), Olsson (2017), Bjuggren (2018), Ardito et al. (2021), De Paola et al. (2021), Butschek & Jan Sauermann (2022). There is also a complementary literature that considers other types of firm-size differences in regulation. See, for instance: Gourio & Roys (2014), Garcia-Santana & Pijoan-Mas (2014), Garicano et al. (2016), Bachas et al. (2019), Kaplow (2019), Harju et al. (2019), Martins (2019), Ando (2021).

[2] Among OECD countries, this is the case in Australia, Austria, Belgium, the Czech Republic, Denmark, France, Germany, Hungary, Iceland, Korea, Portugal, Spain, Switzerland and Turkey (OECD 2020).

[3] We discuss the law reform in detail in Section 2.2. In the text of the agreement between the government, employers and trade unions that paved the way for this law reform, it was stated that 'using atypical employment, despite important for firms and the economy, should not be used to circumvent the law' and that the measures adopted would reduce precariousness. There may also be a view amongst some policy makers that larger firms tend to have greater scope and discretion to use fixed-term contracts and law reforms may counteract this imbalance in power.

be significant even in a context where the treated population is of limited size. More precisely, in this context, we show that spillovers induce very small biases on reduced-form estimators, because each firm not directly impacted by the reform is only slightly affected by spillovers. But as these firms employ a large part of the population, spillovers have a significant impact at the macroeconomic level. This highlights our finding that spillovers that cannot be detected with sufficient statistical power with reduced-form estimators, because the treated group is too limited in size, may actually exert a significant effect at the macroeconomic level. Secondly, the choice of Portugal allows us to use rich administrative data, covering all employees, establishments, and firms, at different points in time. Third, several countries have recently tried to reduce job insecurity by imposing constraints on fixed-term hiring.[4] It is important to better understand the consequences of these reforms, which are little explored.[5] From this point of view, Portugal, which like France, Italy, Japan, Poland, and Spain has tried to reduce its high proportion of FTCs, is a relevant field for analysis. In addition, we believe that our novel theoretical framework, based on a structural model that describes the consequences of this type of reform on FTCs, open-ended contracts (OECs), establishment creation, unemployment and welfare, is particularly suitable for this analysis.

Specifically, we start by drawing on linked employer-employee longitudinal data (including information on establishments and employment contract types) and regression discontinuity evaluation methods,[6] to examine the causal effects of the reform on the number of new establishments launched by firms of different sizes and, more importantly, firms' hirings under FTCs and OECs.[7]

We find that the reform was successful in reducing the number of FTCs in the new establishments of large firms. However, the number of permanent contracts in these establishments did not increase and, in some of our specifications, even decreased. This is partly because the number of new establishments also declined in large firms. When considering both FTCs and permanent contracts together, we find that they declined significantly. Our results indicate that the FTC restriction did not encourage large firms to hire under permanent contracts instead. These results therefore indicate that there is a limited degree of substitutability between FTCs and permanent contracts when the regulation of FTCs becomes more stringent. Some jobs that may be created under FTCs will not necessarily emerge if the FTC legal framework is not available, at least when the alternative

[4] Denmark in 2013, France in 2013, Japan in 2013, Poland in 2016, Italy in 2018 - see (OECD 2020). Interestingly, in 2019, Portugal extended the reform we analyze here by reducing the 750 threshold to 250.

[5] Cahuc et al. (2020).

[6] Hahn et al. (2001).

[7] We also consider the timing of the appointment and the number of hours of the contracts but neither the wages paid nor the profiles of the workers, which we leave for future research.

involving permanent contracts may have undesirable properties from the perspective of firms.[8]

However, reduced form estimates also show evidence of spillovers to smaller firms, which were not directly targeted by the reform: small firms more exposed to large firms (because of their common geographical and or sectoral location) tend to benefit more from the reduced hiring of FTCs of the latter, as such small firms end up hiring more workers. This suggests that firms used as a control group in our reduced-form analysis are indirectly affected by the reform.

In order to quantify these spillovers and their impact at the aggregate level, we build and estimate a directed search and matching model in which firms of different sizes create establishments that hire temporary and permanent workers. To create establishments, firms look for production opportunities that arrive randomly. Small firms and large firms draw production opportunities in different distributions. Once establishments are created, firms hire workers either on temporary or on permanent contracts, complying with employment protection legislation. Permanent jobs destruction and conversion of temporary into permanent jobs are endogenous. The model accounts for the direct effects of the regulation of temporary jobs on large firms, the indirect effects on small firms not targeted by the regulation, and feedback effects on large firms induced by the behavior of small firms, as illustrated by Figure 1. The model shows that the reform induces large firms to raise the share of permanent contracts, which lowers job destruction. But the more stringent regulation also reduces the creation of jobs and establishments by large firms. Small firms indirectly benefit from the reform: they create more jobs and more establishments. The presence of small firms competing with large firms to hire workers amplifies the negative impact of the reform on the employment of large firms.

Beyond these qualitative results, the model is used to evaluate the bias in the reduced-form estimates induced by the overlook of spillover effects. We estimate the structural parameters of the model and simulate the policy shock. To identify the impact of the reform in line with the reduced form estimates, we use the structural model to calculate the creation and destruction of jobs during the two years following the reform. We then simulate the effect of the reform on total, permanent and temporary steady-state employment. We find that spillover effects have a small impact on the firm-level employment of small firms. To the extent that reduced-form estimates rely on the

[8]This may explain the difference with Centeno & Novo (2012) who find that a reform that increased the employment protection of OECs in Portugal was associated with a high degree of substitutability between open-ended and fixed-term contracts. This explanation is in line with the properties of our model in which the range of jobs profitable with the creation of temporary contracts is larger than that profitable with the creation of permanent contracts. In this framework, firms can easily substitute FTCs for OECs when it is more expensive to use OECs, but may not have an incentive to create OECs when it is more expensive to create FTCs.

comparison of firm-level employment of small and large firms, this implies that the bias in the reduced-form estimates of the impact of the reform on the employment of young establishments of large firms is small, around 1% of the effect, in our context. However, since small firms account for 85% of total employment, their reaction has a sizeable effect on the changes in total employment induced by the reform: estimates of the impact of the reform on total employment which take into account the general equilibrium effects are about 13 times lower than those computed from reduced form estimates which assume that small firms are not impacted.

The structural model is also useful to simulate the impact of the expansion of the FTC regulation to all firms. We find that the employment of all firms is negatively impacted, but to a smaller extent for large firms than when the reform is targeted to them only because small firms lose a competitive advantage when they have to comply with the stringent regulation. Another interest of the structural model is to provide insights on welfare. Note that the directed search model implies that the decentralized equilibrium is efficient conditional on the regulation of employment protection. In this context, welfare is maximum in the absence of layoff costs and regulation of temporary contracts. Nevertheless, the reforms which modify certain parameters of these complex regulations, when they already exist, have non-trivial consequences. Our approach makes it possible to analyze these consequences. We find that the restrictions on FTC creation are detrimental to the welfare of unemployed workers because they have fewer opportunities to find jobs when these restrictions are implemented. The drop in the welfare of unemployed workers reduces the outside option of all employees and consequently their welfare.

Related literature. This paper contributes to three strands of the literature. First, we add to the literature on the effects of job protection cited above in Footnote 1. We contribute to this literature by estimating the impact of a reform of FTCs relying on micro-data combined with a structural model which allows us to estimate the macroeconomic impact of the reform. More specifically, we evaluate the effects of increases in the stringency of the regulation targeted to large firms. This approach allows us to rely on a regression discontinuity design to evaluate the direct impact of the reform on large firms and its spillover effects on other firms. Although theoretical models predict that employment protection has equilibrium effects, these effects have not been empirically evaluated before, as far as we know. We do find that the reform had significant effects on firms whose regulation of temporary contracts remained unchanged. From a methodological perspective, our results point to the importance of accounting for spillover effects to evaluate employment protection legislation,

whether it applies to all firms or to a subset of firms. This means, in particular, that it is unlikely that reduced-form estimates of the effects of employment protection legislation that rely on different groups of firms or workers and on SUTVA (Stable Unit Treatment Value Assumption) yield reliable evaluations.

The second strand of the literature comprises contributions that deal with partial employment protection reforms targeted at FTCs (Booth et al. 2002, Blanchard & Landier 2002, Cahuc & Postel-Vinay 2002, Boeri & Garibaldi 2007, Boeri 2011, Bentolila et al. 2012, García-Pérez et al. 2018, Cahuc et al. 2016, Martins 2021*b*, Hijzen et al. 2017, Cahuc et al. 2020). We elaborate and estimate a model with firms and establishments that comprises temporary and permanent jobs. In the process, we also shed light on the role of establishment creation within firms (a form of 'intrapreneurship') in job creation and worker flows (Haltiwanger et al. 2013). This model is useful to evaluate the effects of employment protection legislation on temporary and permanent contracts that apply differently according to firm and/or establishment size. Insofar as these features are found in the regulations of many countries (OECD 2020), this model can be used to analyze the consequences of employment laws in many different empirically relevant contexts.

Our analysis of spillover effects contributes to the literature that combines reduced form (experimental or quasi-experimental) and structural modeling approaches (see the survey of Todd & Wolpin (2021)). Most of this literature is focused on the analysis of selection problems in the program evaluation approach (Heckman 2010). We contribute to the analysis of spillover effects which is much less developed in this literature (Wise 1985, Wolpin & Todd 2006, Cahuc & Le Barbanchon 2010, Attanasio et al. 2012, Ferrall 2012, Galiani et al. 2015, Lise et al. 2015, Garicano et al. 2016, Gautier et al. 2018, Berger et al. 2021) and non-existent in the literature on employment protection legislation. We relate the outcomes of the structural model to the reduced form estimates to simulate the general equilibrium effects of the reform. We show that spillover effects induce small biases in the estimates of the average effects of the reform on new establishments of large firms (the Average Treatment effects on Treated firms, in the program evaluation approach terminology) because the reform has small spillover effects on the average outcomes of small firms in our context. However, as small firms are numerous and account for a large share of total employment, their reaction has a sizeable effect on the changes in overall employment induced by the reform. Hence, small spillover effects, induced by a small subset of the population, which are difficult to evaluate with reduced form strategies, thus may significantly change the overall impact of reforms because

they diffuse to the whole population.

Outline. The structure of the paper is as follows: Section 2 presents the FTC reform. Section 3 describes the data and descriptive statistics. The empirical results arising from reduced form estimates, including the robustness checks are presented in Section 4. Section 5 proceeds to the analysis of spillover effects. Section 6 presents our structural model. Section 7 presents the calibration, the structural estimation of the model, its relations to the reduced form estimates, and the simulation results. Finally, Section 8 concludes.

2 The fixed-term contract reform

2.1 Institutional context

As in many other countries, FTCs in Portugal are subject to a number of restrictions in their use by firms. This is in contrast to the case of permanent (open-ended) employment contracts which firms can create freely. Specifically, the Labor Code of Portugal indicates that FTCs can only be used to meet a 'temporary need' of the firm.[9] However, as we will discuss in more detail below, FTCs in Portugal can also be adopted by new firms or when a firm launches a new establishment, even if the need for such workers is permanent, i.e. if the jobs to be performed by such workers are expected to last for a long period.

Before the FTC reaches its maximum duration (typically 36 months), the firm (and the worker) decide if the FTC is converted into a permanent contract or if the employment spell is to come to an end. Alternatively, if the maximum duration of the FTC is exceeded, then the contract is legally converted to permanent.[10] When a conversion to permanent occurs, by decision of the parties or implicitly because of its duration or lack of suitable fixed-term motivation, the worker under a now permanent employment contract is automatically subject to much greater legal protection against individual dismissal. This increase in protection is driven by the judicial uncertainty involved in a termination and its cost implications for the employer if the worker challenges the dismissal in

[9] According to article 140 of the Labor Code, valid temporary needs in this context arise when the firm is replacing a worker that is temporarily absent, to conduct a seasonal activity, or to conduct an activity of a time-limited duration (including when the firm is facing a temporary and extraordinary peak in demand). Additionally, FTCs can also be used for 'employment policy reasons', namely when a firm hires a long-term unemployed individual or a worker that is searching for a first job, even if the firm's labour need is not necessarily of a temporary nature. FTCs can also only last for the period required to meet such specific temporary needs.

[10] One or both parties may not regard the contract as permanent, perhaps because they may not be aware of such provisions in employment law. However, the worker may involve the labor inspectorate or an employment tribunal to confirm the nature of the contract as permanent, if appropriate.

court.[11] If the worker is successful in its legal challenge, the firm may be obliged not only to reinstate the worker but also to pay her the salaries during at least part of the duration of the trial, which can last several months or even years.[12]

In striking contrast, a FTC involves little judicial uncertainty in terms of its termination costs. At worst, the employer will need to pay the salaries corresponding to the remainder of the duration of the contract of the worker. The costs in the case of FTCs come largely from the possibility that the worker challenges the nature of FTC in court, arguing that the FTC is in fact a permanent contract - perhaps because the employer's need underpinning the hire was not temporary but permanent or because the maximum legal duration of the FTC was exceeded.

These large gaps in legal protection between FTCs and permanent contracts - and the resulting different costs for firms from choosing one or the other - apply in most countries but particularly so in Portugal, where individual dismissals of permanent contracts are the most restrictive across the OECD (OECD 2014). These circumstances - together with the relatively large size of seasonal or volatile sectors (such as tourism, construction or farming) and the low economic growth rates and resulting economic uncertainty over the last two decades - explain the very large percentage of workers under FTCs in Portugal (22%), the third largest in the European Union.[13]

2.2 The FTC reform

Given the large percentage of workers under FTCs in Portugal and the resulting concerns about labor market segmentation and its potential negative economic and social effects, the government decided to reform its FTC employment law regulations in 2009. Specifically, the government introduced a restriction on the range of cases under which firms could hire workers under FTCs. Law 7/2009, which was published and came into force in February 2009, established that the launching of new establishments could, from then on, only be invoked as a reason for hiring under FTCs in the case of firms with fewer than 750 employees (article 140, number 4). This is in contrast to the

[11] For instance, if the court considers that the legal procedure established in the Labor Code for dismissals was not followed correctly by the firm or that the causes invoked by the firm for the dismissal are not sufficiently strong, then the court may rule the dismissal as void and order that the worker be reinstated in the firm and that the firm pays all interim wages.

[12] Anecdotal evidence suggests that many trials are eventually settled out of court, in which case the firm pays the worker a multiple of the severance that would be due in the case of a lawful economic dismissal for economic reasons. During the period covered in our study, this type of severance corresponded to one month of salary per year of tenure, with a minimum of three monthly salaries.

[13] From a flows perspective, these shares are even higher: of all the workers employed in October 2011 and hired in that year, 70% were employed under FTCs (own calculations, based on the 'Quadros de Pessoal' data described below). Moreover, over 40% of the registrations of newly-unemployed individuals with the public employment service in any month also arise from terminations (non-renewals) of FTCs.

previous version of that article, which was not subject to any restriction in terms of firm size or any other variable.[14]

In other words, up to February 2009, any firm that launched a new establishment (for instance a bank launching a new branch or a food retail chain launching a new restaurant) could hire workers for these establishments under FTCs by simply invoking article 140 above. Moreover, from March 2009, firms with fewer than 750 employees in total could still do so, again simply invoking the same article. On the other hand, firms with 750 or more employees (which we refer to as 'large firms') could still hire under FTCs, but no longer invoking that article.[15] Larger firms could still hire under FTCs for their new establishments but only under the relatively narrow conditions which would qualify as 'temporary needs' and the particular case of hiring long-term unemployed workers (or workers searching for their first jobs). In summary, this reform sought to push firms to make greater use of permanent contracts by requiring larger firms to staff their new establishments mostly through permanent appointments when, before the reform, those firms could hire easily under FTCs.

As to the extent to which the reform could have been anticipated, it should be noted that a tripartite agreement between the government and the main employers' and trade union confederations was signed in June 2008, in order to facilitate the implementation of labor market reforms, including limiting the use of FTCs for large firms. The reform implemented in February 2009 was therefore not a total surprise. But it was unlikely to have had an impact in 2008 because there was considerable uncertainty about its implementation. We verify below that there is no difference in 2008 (and previous years) in the evolution of establishment creations and job creations between firms with less than 750 employees and those above this threshold.

The labor reform of 2009 also introduced a number of other legal changes but none that had an impact at the same firm size threshold that we consider here or any other firm size threshold. One of the other legal changes involved a slight simplification of the judicial process when terminating permanent contracts, again with the goal of promoting hiring under permanent contracts.[16]

[14] See Martins (2009) for an evaluation of an employment law reform in 1989 that simplified dismissals for small firms and Martins (2021*b*) for an evaluation of an employment law reform in 2012 that extended the maximum duration of FTCs. Both evaluations use the same data set used in this paper.

[15] Firm size was defined in the law taking into account exclusively the employment of the firm in Portugal, as indicated in our data set (the employment of multinational firms in other countries was not taken into account).

[16] However, this change, which applied to firms of all sizes, was overruled in 2010 by the country's constitutional court. Also note that a labor reform in 2019 changed again the firm size threshold examined in this study, lowering it from 750 to 250 employees. This more recent change highlights the relevance and visibility of the original reform.

3 Data and descriptive statistics

3.1 Data

Our empirical analysis is based on the 'Quadros de Pessoal' data set. This is a comprehensive matched employer-employee panel, based on a compulsory annual survey, conducted by the Ministry of Employment, of all firms based in Portugal with at least one employee. The data covers all establishments and employees of each firm and includes time-invariant identifiers at the three levels (firms, establishments, and workers), thus allowing us to assign each worker to both her establishment and firm in each year. All worker information concerns the month of October of each year and includes variables such as gender, month and year of birth, schooling, occupation, salary, hours of work, etc. Critically for the purposes of our paper, 'Quadros de Pessoal' also includes information on the month and year when each employment contract started and the type of employment contract of each worker (namely OEC or FTC) as of October of each year.[17]

Given the timing of the reform and the data available, we consider October 2008 as the main reference date for the purpose of establishing the type of firm in terms of its size (namely whether it is a large firm, with 750 or more employees, or not). For each firm, we identify its new establishments (those present in 2010 but not in 2008), as well as the workers employed in such new establishments.[18] We also compute the number of new hires in those new establishments by type of contract, permanent or fixed-term.[19] For workers present in October 2010, we consider their months of employment in the firm, from the time span since their appointment. Moreover, we also consider the number of hours worked per month by each worker to take into account possible part-time differences between contract types across firms.[20]

Figure 2 presents the distribution of the size of the firms considered in our study, as measured by their numbers of employees in 2008. This variable establishes the assignment of firms into the

[17] See Portugal & Varejao (2022), Centeno & Novo (2012), Damas de Matos & Parent (2016) and Silva et al. (2018) for previous studies using the FTC variable in QP. See also Martins (2021*a*) for an analysis of a different form of non-standard work, service providers, not available in QP.

[18] New establishments are defined as those firm/establishment identifiers that were not in operation as of October 2008 but are in operation as of October 2010. Legal experts consider that the definition of new establishments in this context is that of establishments that are not older than 24 months. New hires are defined as workers hired since March 2009, the first full month when the new law was in force, and employed in the new establishments as of October 2010.

[19] In some cases, some of the workers in a given new establishment in 2010 joined the firm before the establishment was created, as firms reallocate experienced workers into new establishments. Those workers are excluded from our counts of new hires in new establishments as they are not subject to the provisions of the law reform. As the data is based on employment as of October of each year, we cannot consider very short employment spells that started after October of one year and ended before October of the following year.

[20] As mentioned above, a worker may be originally hired under a FTC but subsequently converted into a permanent contract: again, our measurement is based on the status of the worker as of October 2010.

control and treatment groups, given the size-dependent restriction introduced by the law reform. We observe as expected a decreasing number of firms as their size increases but no evidence of any relevance of the 750 threshold before the reform. Indeed, we could not find any other reference to this firm size threshold in the Labor Code or any other regulations in Portugal.[21] Furthermore, we did not find any evidence of manipulation of the running variable when conducting the McCrary (2008) test.[22]

3.2 Descriptive statistics of firms before and after the reform

In the main part of our study, we consider a total of 2,875 firms employing between 100 and 2,000 workers as of October 2008. We split our sample into the 150 firms that employ 750 or more employees in 2008 (our treatment group), and the remaining 2,725 firms that employ 749 or fewer employees at that time (our control group). The characteristics of the firms in our sample are gathered in Table 1. Panel A presents different characteristics of these two groups of firms before the reform, in 2008. We find that, on average, larger firms have higher sales, more establishments, higher capital equity and are more likely to be owned by foreign than domestic investors. Larger firms tend to be younger but the difference is not statistically significant. The distributions of these firms across one-digit industries are also similar, except in two cases (both in the manufacturing sector). Their headquarters are more concentrated in the Lisbon region (and less so in the Braga region). Finally, and more directly for what concerns us, the percentage of FTC workers in the two groups of firms is not statistically different, at around 27%. This is a large figure that underlines the importance of FTCs in Portugal before the reform. When considering the number of new establishments as of 2008 (launched since 2006, since, by definition, new establishments are less than two years old), we find that, as could be expected from their size, large firms have more (7.6 compared to 1.2) and that these are larger (83.6 vs 11.2 workers-months-hours). However, both firm size categories have a similar breakdown between FTC and OECs - two-thirds vs one-third, respectively (e.g. 57.7/83.6=69% in the case of large firms and 7.4/11.2=66% in the case of smaller firms). This relationship highlights the significant take-up of the flexibility in recruiting under FTCs in the law before the 2009 reform.

[21] We speculate that the choice of this unusual threshold may have been driven by a 'social dialogue' process between the government and the 'social partners'. Trade unions probably preferred a lower threshold, at 500 employees, while employers may have pushed for a higher threshold, at 1,000, and eventually the Government established a compromise at 750.

[22] The McCrary (2008) test does not reject the null hypothesis of continuity of the running variable underlying the assignment at the discontinuity point. It returns a coefficient of -0.18 with a standard error of $.331$.

In panel B of Table 1, we examine the evolution of the four main outcome variables that we consider following the reform. The period considered is from October 2008 to October 2010. The outcomes of interest are again the number of new establishments opened and the number of new hires in such new establishments, depending on their type of employment contract (FTC, OEC and both types). As for the previous period, larger firms open more new establishments, an average of 7.8, compared to smaller firms, which open an average of 1.8 new establishments. FTCs are now relatively much less widely adopted in larger firms than in smaller firms. In larger firms, the share of FTCs in new establishments dropped from 69% in 2008 to 30% (17.8/59.2) in 2010. In striking contrast, in smaller firms, this share fell from 66% in 2008 to 56% (6.9/12.3) in 2010, a decline that is significantly lower. In relative terms, this decline is more than 55% for large firms compared to only 15% for small firms.[23] The next section examines to what extent these differences between firms with 750 or more employees and smaller firms are related to the 2009 reform.

4 Reduced-form estimates

4.1 Benchmark reduced-form model

Our main empirical analysis is based on a regression discontinuity approach (Hahn et al. 2001, Lee & Lemieux 2010). This approach has the advantage of identifying the impact of the reform by comparing firms of similar sizes, which are unlikely to be affected differently by the 2009 recession, conditional on the covariates. The heterogeneity analysis of the impact of the reform according to the size of the firms is carried out in the tests of robustness. Given the discussion above, we proceed to the pseudo-maximum-likelihood estimation of the following firm-level Poisson regression:[24]

$$Y_i = \exp\left(\alpha_0 + \alpha_1 D_i + \alpha_2 S(Z_i) + \delta_{j(i)} + \epsilon_i\right), \tag{1}$$

in which D_i is a binary indicator equal to one for firms employing 750 or more workers in the period before the reform, which we measure in October 2008, and zero otherwise. $S(Z_i)$ are linear or quadratic polynomials of the running variable, namely the firm total employment before the introduction of the reform in October 2008, centered at 750, and including in some cases interactions

[23] The drop in the share of temporary jobs in small firms may be related to the cyclical volatility of this variable (Damas de Matos & Parent 2016).

[24] Poisson models are more appropriate than linear models when there are many observations equal to zero as in our context (firms that do not create any new establishments). See, e.g., Gourieroux et al. (1984) or Cameron & Trivedi (2010).

with D_i.[25] $\delta_{j(i)}$ are industry fixed effects. ϵ_i is an error term. Standard errors are clustered at the firm size level.

The main dependent variables considered, Y_i, are the numbers of new establishments created between 2009 and 2010 by each firm i, as well as the new hires in such establishments (if any). We consider fixed-term and permanent contracts, in the new establishments (if any) of each firm, either separately or in total. We also investigate the effects on employment in old establishments as well as on the potential creation of new firms to account for the possibility that large firms circumvented the reform by creating new, smaller firms instead of establishments. In our main sample of analysis, we consider all firms in Portugal employing between 100 and 2,000 workers as of October 2008.

Before presenting the main results of our estimates, two remarks are in order. First, let us remark that control group firms that are originally close to the threshold but then grow can become part of the treatment group and thus become subject to the employment law restrictions described here. We find no evidence of distortion of the distribution of firm size in the neighborhood of 750 employees after the reform, which suggests that this effect, if it exists, is negligible.[26] In any case, if this prospect dissuades such control group firms from growing, then the effects we describe here can be considered as downward biased in absolute value, i.e., the true effects are even more negative than those that will be presented. Second, our balancing tests indicate that there are no significant differences at the 750-employee threshold across several variables measured as of October 2008. Our results are presented in Tables A.1 and A.2 in the Appendix.[27] We find no evidence of other covariates jumping at the threshold as virtually all coefficients prove insignificant, across all specifications, based on different polynomials, even at the 10% level.

4.2 Main graphical and regression results

Insofar as the reform imposes constraints on the hiring of new establishments, we start by documenting the impact of the reform on the number of hires of new establishments including both the extensive margin (i.e., the creation of an establishment) and the intensive margin (i.e., the creation

[25] Following the recommendation of Gelman & Imbens (2019), we restrict ourselves to quadratic polynomials of the forcing variable to avoid noisy estimates, sensitivity to the degree of the polynomial, and poor coverage of confidence intervals.

[26] See below, Section 4.2.3

[27] We consider the following covariates: the number of establishments of each firm, the log sales per worker, the log capital equity per worker, dummies for the regional location of the headquarter of each firm (in the main cities of Lisbon, Porto, and Braga), and the average age of the workforce of the firm.

of jobs by new establishments) and then those two margins separately. We then supplement our results by investigating whether the observed decline in employment in new establishments of large firms is compensated by the creation of more jobs in old establishments (those already operational before the reform). Finally, as it may be possible that large firms circumvented the constraints imposed by the reform by creating new firms instead of new establishments, we look at the outcomes of their subsidiaries and associated firms.

4.2.1 Effects on new establishments

All margins: number of hires in new establishments. Our measurement of new hires is based on a period of two years following the introduction of the labor reform (up to October 2010). Moreover, we weight each new hire by the months with the firm and the hours worked in October 2010. We consider FTCs first, then OECs, and finally both together.

Figure 3 presents graphical evidence indicating that the number of new hires under FTCs in new establishments tends to increase with firm size. However, that relationship is interrupted at the legal threshold: the average number of new hires under FTCs is reduced significantly for firms that employ 750 or more workers before the reform. This evidence is consistent with a negative effect of the law reform on the use of FTCs, as intended by the government and as suggested by the descriptive statistics gathered in Table 1.

Table 2 provides further evidence based on the estimation of equation (1). We find in all specifications that a firm size above the 750-employee threshold is associated with a smaller number of new FTC hires in new establishments. The coefficients range between -1.96 (linear) and -1.31 (spline) and are always statistically significant at the 1% level. These findings indicate that FTC hires in new establishments decrease by between one and two log points (corresponding to a 73%-86% interval) in firms above the size threshold. In our preferred specification (quadratic), we obtain a coefficient of -1.46 which corresponds to a 77% decrease in FTC hires. These results emphasize the success of the law reform as far as the restriction of FTCs is concerned.

As to the case of OECs, Figure 4 presents a similar analysis than for FTCs. It considers only those new hires in new establishments under OECs as of October 2010 (i.e., new hires of new establishments between 2009 and 2010, in firms of different sizes as of October 2008). In contrast to the desired impact of the reform, we find no evidence of a positive effect on new permanent hiring in large firms.

Our graphical analysis is confirmed by the estimates reported in Table 3. We do not find any evidence of positive effects of the reform on the hiring under permanent contracts. In all three specifications considered, the coefficients are negative ranging from -0.86 (quadratic) to -0.68 (linear). In two cases, our estimates are statistically significant, even if only at the 10% level.[28]

Finally, when considering the total number of new hires in new establishments, regardless of their contract type, we find evidence of negative effects on employment. Figure 5 presents graphical evidence, which indicates that, consistently with the cases of both fixed-term and permanent new hires, the overall sum of these two types of contracts declines at the firm size threshold at which the law reform imposed restrictions.

These results are supported by the estimates from equation (1) reported in Table 4. We find in all three specifications that a firm size above the 750-employee threshold is associated with a significant drop in hires whatever the contract. The effect from larger firms is negative and always statistically significant, with coefficients ranging between -1.2 (linear) and -0.93 (spline). These coefficients are also economically relevant, as they correspond to a drop in the total number of hires of between 70% and 59%. In what follows, we decompose these effects between establishment creation and hires per new establishment.

Extensive margin: number of new establishments. Table 5 presents our results regarding the creation of new establishments. As before, we consider three specifications, based on different polynomials of the running variable, namely linear, quadratic and linear with a spline on firm size. We find in all cases that a firm size above the 750-employee threshold is associated with a smaller number of new establishments, with coefficients ranging from -0.69 (linear) to -0.59 (spline). This effect corresponds to a drop of about 50% in the number of new establishments per firm and is statistically significant at the 5% level in one specification (quadratic) and at the 10% level in two remaining specifications.[29] These findings are consistent with our graphical analysis from Figure 6 and indicate that the restriction on the use of FTCs in new establishments had the (unintended) effect of reducing the creation of new establishments.

Intensive margin: average number of hires per new establishment. Now, we conduct an analysis focused exclusively on the intensive margin, i.e., hires in new establishments. In other words, we

[28] When considering heteroskedastic-robust standard errors instead of clustering on the running variable, in light of Kolesár & Rothe (2018), one specification delivers significant results at the 5% level.

[29] The firm size running variable is always positive and statistically significant, indicating that the number of new establishments tends to increase by .002 log points for each additional worker that the firm employs in 2008.

disregard the cases of firms that do not open any new establishments. We, therefore, conduct the analysis at the establishment level, comparing the number of new FTCs in new establishments of larger firms and the equivalent number in the case of smaller firms.[30] The results, presented in Table 6, indicate again a significantly smaller number of new FTCs in the new establishments of larger firms. Considering the intensive margin, the coefficient ranges from -3.01 (linear) to -2.35 (spline), and are all statistically significant at the 5% level. When considering the remaining outcomes, permanent new hires and total (FTC and permanent) new hires, again across new establishments, we do not get significant results, despite large negative coefficients in virtually all specifications - see Tables A.3 and A.4. (The corresponding graphical analyses are presented in Figures A.2, A.3 and A.4.) This result highlights the wide compliance with the legal changes and the importance of the extensive margin in the overall effects of the reform.

4.2.2 Effects on old establishments

It is possible that the negative impact of the reform on employment in the new establishments of large firms was offset by job creation in old establishments, defined as those that were already in operation by October 2008, just before the law reform was introduced. First, we consider the differences between treated and control firms in terms of their number of such establishments. On this point, we note that Table A.1 from our balancing tests indicates that there are no significant differences at this threshold, which supports our identification approach. Second, we analyze the potential effects of the reform on new hires in these existing establishments. Tables 7 and 8 present our results, which indicate that larger firms also have fewer new hires under FTCs (and in total) in existing establishments but at a smaller level than in their new establishments. These results are consistent with within-firm spillover effects whereby larger firms that faced increased restrictions in their hiring of FTCs in new establishments also did not expand existing establishments by as much.[31] Additionally, we do not find evidence of significant differences in the growth of total employment of the old establishments of large firms when compared to their smaller counterparts (see Table A.5 in Appendix).

[30] Here we use a linear model insofar as Poisson models are more appropriate than linear models when there are many observations equal to zero, which is not anymore the case for the intensive margin.

[31] Additional explanations may involve uncertainty from firms as to the specific time threshold to define an establishment as 'new' or 'old' for the purposes of the law reform and its lagged effects. For instance, some firms may consider that establishments launched in 2007 may still be considered as 'new' and therefore restrict their hires; such establishments would in any case still be considered as 'new' in 2009, given the perceived duration of the 'new' period of two years. Any diminished hires then could also translate into lower numbers as of 2010.

4.2.3 Effects on all establishments

So far, we have considered new and old establishments separately. We considered now all new hires by each firm, regardless of whether these occurred through new establishments (created after the reform) or existing establishments (already active before the reform was introduced). Consistently with the previous results, regarding new and old establishments, we find again evidence that the reform reduced the usage of FTCs specifically - Table A.6 - and both fixed-term and open-ended contracts generally - Table A.7.

4.2.4 Effects on the creation of small firms by large firms

Let us now consider the possibility that large firms circumvented the reform by creating new, smaller firms that would have been exempted from the novel restriction of new establishments. Although theoretically possible, this phenomenon is unlikely in practice: such new firms would not be able to benefit from the advantages of the brand name of the older firm in terms of consumers' demand, workers' recruitment, and their relationship with suppliers and banking, for instance. There would also be costs in setting up the new firm and from the uncertainty regarding the possibility that these firms would be regarded as new establishments in the context of the law reform.

Nevertheless, we first investigate this issue by inspecting the distribution of firm size in 2010. We find no evidence of bunching below the threshold of 750 employees (see Figure B.1). We complement our analysis by investigating if firms circumvented the reform by creating new firms or expanding existing firms that were originally part of the same holding group. Our findings which rely on additional variables from a different data set, presented in Appendix B (see Tables B.1 and B.2), do not support the assumption that larger firms circumvented the new restriction in the usage of fixed-term contracts by expanding their affiliates instead of creating new establishments.[32]

4.3 Robustness checks

In this subsection, we briefly discuss a number of alternative specifications and samples to our baseline estimates. We proceed in two steps. First, we present several robustness checks for the RDD estimates. One of the robustness checks particularly relevant for our analysis of the impact

[32] We also conducted the analysis separately for domestic and foreign firms to check whether foreign firms reacted more strongly to the reform because of their greater possibility of job creation in geographical areas not covered by the reform, see Table in Appendix B.

of the reform on the whole economy, which we develop below, consists in evaluating its impact on firms the size of which is not in the strict neighborhood of the 750-employee threshold. Second, we complement this analysis by presenting difference-in-differences estimates to explore whether the average estimated effect of the reform for a large range of firm size is similar to the local average treatment effect (LATE) estimates yielded by the RDD.

4.3.1 Regression discontinuity analysis

First, we extend our main specification in equation (1) to control for additional variables regarding firms' characteristics in 2008. If our RDD analysis is delivering causal estimates, the addition of these controls should not lead to significant changes in our results. We consider the variables listed in Table 1: capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables. Tables A.8, A.9, A.10, and A.11 present our results, which are very similar to our benchmark evidence, further supporting a causal interpretation of our RD results. They indicate small negative effects on both the number of new establishments and the number of new hires under OECs - and large negative effects, both on the number of new hires under FTCs and on the total number of new hires.

Second, Figure 7, top left panel, displays placebo tests to check whether our results for 2010 are driven by systematic differences between firms of different sizes along the 750-employee threshold in earlier years. These tests start in 2006 to the extent that earlier changes in the FTCs regulation in 2003 might have impacted the 2003-2005 employment growth of firms of different size differently.[33] It is clear that the significant drop in creation of FTCs in new establishments of large firms is observed only in 2010 for all three specifications (linear, quadratic, spline) of the RDD. Moreover, the absence of difference in the creation of FTCs in 2008 between larger firms and smaller firms confirms the absence of impact of the reform before its implementation (in February 2009), although it could have been anticipated, as explained Section 2.2. Figure A.8, which reports the results for the creation of permanent contracts in new establishments confirms these findings.

Third, Figure 7, shows that these results hold for different bandwidths. In the bottom left panel, we consider the 250-1,250 range, instead of the 100-2,000 considered so far. This implies a significant decrease in our sample size (from 2,875 to 758 firms) but not of our qualitative and quantitative results. Indeed, Figure 7 indicates a similar drop in hires in new establishments under FTCs

[33] Remind that we consider changes in employment over two-year intervals throughout the paper due to the availability of data.

in 2010.[34,35] Moreover, the right panel of Figure 7 displays the RDD estimates with a bandwidth including a "donut hole" (Cattaneo & Titiunik 2022, Dowd 2021) to evaluate whether we get similar findings without including firms the size of which is close to the 750-employee threshold. We get consistent results without the 600-900 range for both the 100-2000 and 250-1250 bandwidths, suggesting that the previous findings are not solely driven by firms whose size is close to the 750-employee threshold.

4.3.2 Difference-in-differences

The results obtained excluding firms close to the 750-threshold suggest that our estimated effects are not only local. To explore this further, we evaluate the impact of the reform with a difference-in-differences estimation to assess its impact on the average number of new hires of large firms. Specifically, we estimate the following model:

$$Y_{it} = \exp\left(\beta_1 After_t + \beta_2 After_t \times Treated_i + \delta_i + \epsilon_{it}\right), \tag{2}$$

in which Y_{it} indicates the (weighted) number of new hires in FTCs or OECs in new establishments of firm i over the two-year period up to year t, $After_t$ is a dummy variable equal to one over the second two-year period, and $Treated_i$ is a dummy variable equal either to one for all firms that employ at least 750 employees in the beginning of each two-year period, or to zero for all firms from 1 to 749 employees. δ_i indicates firm fixed effects, allowing us to conduct longitudinal comparisons. The key parameter is β_2, which captures the effect of the treatment and is estimated for years 2006 to 2010.[36] Regression results are reported graphically in Figure A.9 (and listed in Table A.14). The analysis includes either all firms from one employee or all firms from one employee except those in the 600-900 range to check whether the results are driven by firms close to the 750-employee threshold.

We find that, over the period preceding the 2009 reform, the analysis never produces a statisti-

[34] We present corresponding graphical evidence in Tables A.5, A.6 and A.7.

[35] We consider the range of 283 employees around the cut-off size of 750, following Calonico et al. (2017)'s optimal bandwidth determination method. This leads to an even much smaller sample, of 261 firms, but still significant results, of similar magnitudes as in our previous analyses. These results are gathered in Tables A.12 and A.13.

[36] We consider multiple pairs of years, namely 2010 vs 2008, 2009 vs 2007, 2008 vs 2006, 2007 vs 2005, and 2006 vs 2004. Each year captures the new FTC hires over that year and the year before, in the same way as in our main RD empirical analysis. For instance, our 2010 β_2 estimate will indicate the average change in the new FTC hires in new establishments of the same firm over 2009-2010 when compared to new FTC hires in new establishments of the same firm over 2007-2008.

cally significant difference between larger and smaller firms. However, once the reform is in place, we always find that firms with 750 employees or more decrease their recruitment of workers under FTCs. Moreover, a comparison of Figures 7 and A.9 shows that the point estimates of the RD and the difference-in-differences approach are close, and not statistically different at 95% confidence level. This indicates that the average effect of the reform on all large firms is very close to that of firms in the neighborhood of the 750-employee threshold.

In conclusion, we find that the main results of our RD analysis are remarkably robust to alternative specifications and to a large number of robustness checks. Moreover, these main results also hold in a difference-in-differences analysis, considering the full range of firm sizes, which suggests that the effects are not only local.

5 Evidence on Spillovers

We find robust strong negative employment effects of the restriction of FTCs on large firms. Given the reduced labor demand by large firms, firms not targeted by the reform could end up hiring more workers. This is what we investigate in this section.

We consider here the effects of the reform on the hires of small firms. We ask if small firms more exposed to firms directly affected by the reform (through a common geographical and or sectoral location) tend to benefit more from the reduced hires of FTCs of the latter.

Our analysis of these potential spillovers from large to small firms is again based on a regression discontinuity approach. In our main specification, we follow Dahl et al. (2014) and Dechezleprêtre et al. (2023) and establish dyads corresponding to all pairs of firms with between 1 and 99 employees and firms with between 100 and 2,000 employees that are based in the same region and in the same industry. We choose initially the 1-99 range because we want to ensure no overlap between the range of firms that may be affected by the spillovers and the range of firms where the spillover may originate and which we analyzed in our previous results. Moreover, note that 1-99 firms correspond to 99.1% of all firms and 64.4% of all private-sector employment in 2008 in Portugal. The region definition we consider in our benchmark results is 'concelho' while the industry definition is at the one-digit level.[37] This approach leads to a total of 2.97 million observations, corresponding to pairs between 2,874 large (100-2,000 employees) firms and 165,547 small (1-99 employees) firms,

[37] Portugal is divided into 'distritos' (districts) of which there are 20 in the country, which are in turn divided into 'concelhos' (municipalities) of which there are 308 in the country.

matched across 735 region-industry domains.[38]

We then estimate a modified and extended version of our previous RDD equation, in which we explain the employment outcomes of small firms as a function of the presence of large firms (those that are above the key 750-employee threshold) in the same region-industry space and other variables. The RDD equation that estimates the causal impact of the law reform on the behavior of small firms satisfies:

$$Y_s = \exp\left(\alpha + \beta D_i + \lambda_1 S(Z_i) + \lambda_2 S(Z_s) + \epsilon_{is}\right). \tag{3}$$

In equation (3) each observation is a dyad (s,i) of connected firms where s and i refer respectively to small firms (1-99 employees) and to large firms (100-2000 employees) where the latter corresponds to our baseline sample. D_i is a dummy variable equal to one if firm i in the dyad (s,i) employs 750 or more workers in the period before the reform (October 2008) and zero otherwise. $S(Z_i)$ are different polynomials of the running variable (the large firm's total employment before the introduction of the reform, in October 2008), centered at 750, including in one specification an interaction with D_i. We also consider a similar polynomial but referring to the small firm's employment in the same period, $S(Z_s)$. The main dependent variable considered, Y_s, is the number of new hires from 2009 until 2010 by each small firm s both in fixed-term and permanent contracts.[39] Given the large number of cases of firms without new hires, we again use Poisson models. We cluster standard errors at the level of the baseline (large) firms (Dechezleprêtre et al. 2023).

Our main results are presented in Table 9. We find in all specifications that there is a positive effect from the presence of firms affected by the reform (firms with more than 750 employees) in the same industry-region space. The coefficients are significant at the 5% level and range from 0.07 to 0.08 (except in the model with a spline, in which it is 0.05 and not significant). These results indicate that small firms tend to increase their hiring by at least 7% when they share a labor market with a large firm that happens to be above the 750-employee threshold of relevance in the fixed-term contract reform analyzed here.

In order to assess the robustness of these results, we consider three supplementary specifications, namely a different definition of the local market and two different definitions of the dyads.

[38] These region-industry domains arise only when there is both at least one firm with 1-99 employees and at least one firm with 100-2,000 employees. Only one large (100-2,000) firm cannot be matched to any smaller firm, which explains that we draw on 2,874 large firms in this analysis and not on 2,875 as in our main results.

[39] As in the case of the main regression results, we take again into account the timing of the hire and the hours worked by each employee.

All results are again gathered in Appendix A (see Tables A.15 to A.17).[40]

First, we consider a more aggregated definition of the local labor market, namely 'distritos' (of which there are 20 in the country) and, again, one-digit industries. This approach leads to a total of 16.2 million observations, corresponding to 2,875 large (100-2,000 employees) firms, 223,426 small (1-99 employees) firms, and 162 region-industry domains. Table A.15 presents the results, which again indicate positive effects of above-750 large firms on the employment of 1-99-employee firms that operate in the same region and industry. The coefficients are significant at the 5% or 1% level (except in the case of the linear model).

Second, we consider a wider range of smaller firms (1-249 instead of 1-99) and a larger firm size range from 250 to 2000 employees, then similarly an even wider range of smaller firms (1-499) and a larger firms size range from 500 to 2000 employees. The results are reported in Tables A.16 and A.17, respectively. In both cases, the results are very similar and show that small firms that are connected with policy-affected (large) firms increase their hires both on fixed-term and permanent contracts.

All in all, our findings indicate that the restrictions on the use of fixed-term contracts in establishments created by large firms impacted hires in those firms but also in small firms not directly concerned by the restrictions. This implies that the comparison of the outcomes of large firms targeted by the reform with the outcomes of small firms not directly concerned by the reform may not yield a reliable estimation of the actual impact of the reform. This comparison only shows that the reform had an impact that was different for small and large firms, but it does not allow us to evaluate the effective size of the impact on large firms, small firms, or the overall economy. The next section presents a model which tackles this issue.

6 Structural model

A structural model with general equilibrium adjustments allows us to quantify the overall impact of the reform as it accounts for both the direct impact on treated firms and spillover effects on all firms. The framework is a directed search and matching model with large establishments and endogenous job destruction. Time is discrete and the horizon of individuals is infinite. The structure of the model is depicted in Figure 9. There are large and small (representative) firms that get oppor-

[40] We also find supporting evidence for these spillovers when simply regressing the change in new hires in small firms on the percentage of employment, in a region or region-industry cell, under larger firms subject to the policy reform. We do not present here this simpler regression analysis as we regard the RDD evidence to be a more rigorous test of spillovers.

tunities of creation of multi-worker establishments with probability O_i, $i = \{s, b\}$ (where the index s stands for small and b for big or large) per period. In every period, each establishment can create v job vacancies at an instantaneous cost $C(v)$. $C(v)$ is an homogeneous function of degree $\alpha > 1$. Vacant jobs are filled at rate m, with a standard matching function. Labor contracts are either fixed-term or open-ended. Fixed-term (or 'temporary') contracts have to be either destroyed at zero cost or transformed into open-ended (or 'permanent') contracts after one period. Permanent contracts can be destroyed at any date at red tape cost $F > 0$. When a job is created, it has to be permanent with probability π. π is a policy parameter that represents the stringency of regulation of temporary contracts. In order to match the Portuguese labor market regulation, it is assumed that π takes two values, π_ℓ for the less stringent regulation and $\pi_h > \pi_\ell$ for the most stringent one.[41]

In the benchmark situation, in place before the reform, the less stringent regulation applies to all young establishments, meaning that $\pi = \pi_h$ for old establishments, in principle older than two years. But there is some uncertainty about the way to precisely define what a young establishment is. Accordingly, we assume that the establishments become old with probability $\rho > 0$ in each period. When they become old, they have to comply with the more stringent regulation, which imposes to create the share $\pi_h > \pi_\ell$ of permanent contracts. After the reform, establishments created by large firms, above 750 employees, had to comply with the stringent regulation from their date of creation. Henceforth, we present the model before the reform. The analysis of the impact of the reform will be discussed in a second stage.

Establishments are heterogeneous in two dimensions. First, young establishments can comply with the less stringent regulation π_ℓ, while old establishments must comply with the more stringent one, π_h. In what follows, the type-π of an establishment corresponds to the type-π of regulation to which it complies, meaning that an establishment changes its type when it becomes old. Second, establishments are also heterogeneous with respect to productivity. The output per job in a type-(z, π) establishment is equal to the product $z \times \varepsilon$, where $z > 0$ is establishment specific and constant over time, whereas ε is match specific, independent of z. Contrary to z, ε changes over time. For the sake of simplicity, it is assumed that $\varepsilon = \varepsilon_u$ on starting jobs. Then ε changes in each period with probability λ. A productivity change is a draw in a distribution with support $(-\infty, \varepsilon_u]$ whose cumulative distribution is denoted by G. All establishments are destroyed with probability μ per

[41] We assume that π is a variable directly controlled by the government for the sake of simplicity. It is possible to endogenize this parameter in this class of model as in Cahuc et al. (2016, 2020) to provide a richer a micro-foundation of the firms' choice between open-ended and temporary contracts. This however implies an additional layer of complexity that is not necessary for studying the macroeconomic impact of the reform we are interested in.

period.[42]

We start by presenting the behavior of establishments and workers to determine the effects of labor market regulation at the establishment level. Then, we analyze the properties of the labor market equilibrium, accounting for the effects of labor market regulations on establishment creation.

6.1 Behavior of establishments and workers

Search is directed on the worker and firm sides. In each labor market, the type-(z,π) employers post labor contracts (permanent and temporary) that yield a promised inter-temporal expected utility $W(z,\pi)$ to workers hired in the establishment. These contracts are not renegotiable and apply throughout the employer-employee relationship. Unemployed workers are matched with vacant jobs according to a matching function homogeneous of degree one. In consequence, if there are u unemployed persons and v vacant jobs in a labor market, the exit rate from unemployment and the rate at which vacancies are filled are respectively equal to $\theta m(\theta)$ and $m(\theta)$ where $\theta = v/u$ stands for the labor market tightness and $m(\theta)$, twice continuously differentiable, satisfies the following conditions: $m'(\theta) < 0, m''(\theta) < 0, m(0) = 0$.

The search activity of job seekers can be directed toward their preferred market. The mobility of workers between labor markets is perfect. On-the-job search is impossible.

Workers. The hypothesis of directed search by workers and perfect mobility implies that the expected utility of an unemployed person is the same in all labor markets, so it will simply be denoted by W_u. Let b denote the instantaneous gains of an unemployed person. The expected utility W_u of a person in search of work satisfies the no-arbitrage condition:

$$W_u = b + \beta\theta(z,\pi)m(\theta(z,\pi))W(z,\pi) + \beta\left[1 - \theta(z,\pi)m(\theta(z,\pi))\right]W_u \quad \forall(z,\pi) \tag{4}$$

where β stands for the discount factor. The no-arbitrage condition defines a decreasing relation between the labor market tightness $\theta(z,\pi)$ and the promised utility in employment $W(z,\pi)$. Differentiation

[42] In the empirical part we introduce a third dimension of heterogeneity: establishments created by large and small firms have different job vacancy cost functions $C(v)$, to account for potential differences in recruitment policies. We present the case without this heterogeneity in the main text for the sake of clarity. The general case with this heterogeneity is presented in Appendix C.

of equation (4) with respect to $\theta(z,\pi)$ and $W(z,\pi)$ keeping W_u constant yields:

$$\frac{\partial\theta(z,\pi)}{\partial W(z,\pi)} = \frac{-\theta(z,\pi)}{(1-\eta)\left[W(z,\pi)-W_u\right]}, \tag{5}$$

where $\eta \equiv -\frac{\theta m'(\theta)}{m(\theta)}$ is the elasticity of the matching function with respect to unemployment. This equation shows that the tightness is lower on labor markets where the employment value promised by firms is higher.

Establishments. To analyze the optimal behavior of establishments, we start by computing the values of marginal filled jobs and vacant jobs in all type-(z,π) establishments. In each period t, the timing is as follows:

1. Matches occur thanks to vacancies posted in $t-1$;
2. The match-specific productivity parameter ε is observed;[43]
3. Jobs whose productivity is too small are destroyed;
4. Remaining and new workers produce and get paid;
5. Next period regulation is observed;[44]
6. Vacancies and contracts are posted;
7. Establishments are destroyed with probability μ.

6.2 Partial equilibrium

We start by analyzing the partial equilibrium, conditional on the expected utility of unemployed workers W_u, which will be determined afterwards.

Let $V(z,\pi)$ stands for the value of the marginal vacant job in type-(z,π) establishments. For the sake of simplicity, and without loss of generality, the surpluses of filled jobs are written on the equilibrium path, where the value of marginal vacant jobs is equal to zero. Let us denote the surplus of a starting marginal permanent job by $S_p(z)$ and that of a marginal temporary job by $S_t(z)$. The surpluses of starting permanent and temporary marginal jobs in type-(z,π) establishments are:

$$S_k(z) = W_k(z) - W_u + J_k(z), \quad k = \{p,t\}, \tag{6}$$

[43] It is equal to ε_u for all new matches and it changes with probability λ from period $t-1$ to period t, in which case the new value of ε is drawn in the stationary distribution the CDF of which is denoted by G.

[44] This is the regulation that will apply to jobs filled thanks to the vacancies that are currently posted.

where p stands for permanent and t for temporary. The expected profit, value to the worker and surplus of matches between a worker and a job offer from type-(z,π) establishments are:

$$D(z,\pi) = \pi D_p(z) + (1-\pi)D_t(z), \quad D = \{J, W, S\}, \tag{7}$$

where J denotes the value of a marginal job to the establishment, S the surplus of a marginal job, and W the expected utility of the worker on this job.

The surpluses of jobs are computed in Appendix C.1. The surplus of temporary jobs, which can be destroyed at no cost at the end of the first period of employment, is bigger than that of permanent jobs, meaning that firms always prefer to create temporary jobs. This implies that the regulatory constraint is binding, or to put it differently that the share of creation of permanent jobs is equal in equilibrium to π in type-(z,π) establishments.

The value of a marginal vacant job to type-(z,π) establishments is equal to its marginal cost plus its expected gains:

$$V(z,\pi) = \max_{W} -C'(v) + \beta(1-\mu)\left[m(\theta)J(z,\pi) + [1-m(\theta)]\,V^{+}(z,\pi)\right] \tag{8}$$

where $V^{+}(z,\pi)$ denotes the future value of marginal job vacancies, which is equal to zero in equilibrium. The relation between θ and W is defined by equation (4). Maximization with respect to W using the fact that $J = S - (W - W_u)$, yields the traditional Hosios-Diamond-Pissarides (HDP) condition:

$$W(z,\pi) - W_u = \eta S(z,\pi). \tag{9}$$

Using the definition (4) of W_u, this condition defines a decreasing relation between the labor market tightness and the surplus of type-(z,π_ℓ) establishments:

$$\theta(z,\pi)m(\theta(z,\pi)) = \frac{(1-\beta)W_u - b}{\beta\eta S(z,\pi)} \tag{10}$$

The surplus of starting jobs (computed in Appendix C.1), which shows up at the denominator of equation (10), increases with the productivity parameter z and decreases with the stringency of regulation of temporary jobs π. This implies that the labor market tightness is lower in the labor pool of establishments with higher productivity parameter z. The labor market tightness is also lower in the labor pools of establishments subject to lower stringency of regulation of temporary

jobs.

In equilibrium, the value of the marginal vacant job in type-(z,π) establishments, $V(z,\pi)$, is equal to zero for all (z,π), which implies, using equation (8):

$$\underbrace{C'(v)}_{\text{Marginal cost}} = \underbrace{\beta(1-\mu)m(\theta(z,\pi))J(z,\pi)}_{\text{Expected marginal gain conditional on establishment's survival}} \tag{11}$$

This condition, together with the HDP condition (9), the definition of the surpluses (equations (6) and (7)) and equation (10), implies that the number of vacant jobs in a type-(z,π) establishment is defined by:

$$v(z,\pi) = \left\{ v | C'(v) = (1-\mu)\frac{1-\eta}{\eta}\frac{(1-\beta)W_u - b}{\theta(z,\pi)} \right\} \tag{12}$$

At this stage, we can define the partial (i.e., for a given value of W_u) equilibrium values of $\theta(z,\pi)$ and $v(z,\pi)$, from equations (10) and (12) (using the definition of the surplus provided in Appendix C.1 which shows that the surplus increases with the productivity parameter z and decreases with the stringency of regulation of temporary jobs when W_u is constant). It is easily checked that when productivity is higher, firms post more job vacancies which are more easily filled (i.e., $v(z,\pi)$ increases and $\theta(z,\pi)$ decreases with z) because more workers show up when the surplus of jobs is higher. For the same reason, the opposite occurs when the labor market regulation is more stringent. The surplus of jobs drops, which implies that $v(z,\pi)$ decreases and $\theta(z,\pi)$ increases with π. Still for the same reason, when the expected discounted utility of unemployed workers is higher, the surplus of jobs is smaller which implies fewer job vacancies and higher labor market tightness.

Partial equilibrium effects of the regulation of temporary contracts. The previous results allow us to shed light on the effects of the regulation of temporary contracts on the outcomes at the establishment level (i.e., for a given value of W_u). This is useful to figure out the impact of changes in the regulation on an establishment – which becomes old and consequently subject to a more stringent regulation for instance– while the situation of other establishments remains unchanged.

1/ In each establishment, the duration of vacancies, $1/m(\theta(z,\pi))$, increases with the stringency of the labor market regulation measured by the mandatory share of permanent contracts π. This comes from the fact that the stringency of the regulation reduces the surplus of filled jobs. The lower surplus decreases the value of the contracts offered by the establishment, which increases the labor market tightness because job seekers direct their search toward other establishments.

2/ The number of job vacancies decreases with the stringency of labor market regulation π. According to equation (12), the optimal number of vacancies in each establishment is determined by the equality between the marginal cost of vacant jobs and their marginal gain, which decreases with the labor market tightness. Since the marginal cost is increasing (C is convex) and the stringency of regulation increases the labor market tightness, the number of vacancies is lower when the regulation of temporary jobs is more stringent.

3/ From the two previous results, it is clear that more stringent regulations of temporary contracts reduce the number of hires.

4/ A more stringent labor market regulation, corresponding to increases in π, has an ambiguous impact on employment because there is less job creation but also less job destruction when establishments must create a larger share of permanent jobs. Figure 8, which displays the effects of π on several outcomes of the establishment for arbitrary values of the parameters of the model, shows that total employment can decrease with π. In the situation displayed in this figure, a more stringent regulation of temporary jobs decreases the number of permanent jobs, decreases the number of temporary jobs, and the total number of jobs.

6.3 Labor market equilibrium before the reform

Now, we determine the equilibrium of the model accounting for the adjustment of the expected utility of unemployed workers and for establishment creation. The size of the labor force is equal to $\mathcal{N}$, which is an exogenous variable. Establishments are created by large and small firms. In each period, there is a number of production opportunities, denoted by O_i, $i = \{s, b\}$, available to small and large firms respectively. Production opportunities are heterogeneous. A type-z production opportunity allows firms to create a type-z establishment, where z is the productivity parameter drawn in the cumulative distribution function $\Gamma_i(z)$, $i = \{s, b\}$. All establishments are destroyed at an exogenous rate μ once they have been created. Firms create an establishment only if the productivity z of the production opportunity is above the threshold:[45]

$$\bar{z}(\pi_\ell) = \{z | S(z, \pi_\ell) = 0\}, \tag{13}$$

[45] It is shown in Appendix C.2 that $\Pi(z, \pi_\ell) \geq 0 \Leftrightarrow S(z, \pi_\ell) \geq 0$.

which implies that the number of establishments created by type-i firms, $i = \{s, b\}$, in each period is given by:

$$E_i = \underbrace{O_i}_{\text{\# of production opportunities}} \times \underbrace{[1 - \Gamma_i(\bar{z}(\pi_\ell))]}_{\text{Prob. to create an establishment}}. \tag{14}$$

Moreover, when they are transformed into old establishments facing the more stringent regulation, type-(z, π_h) establishments continue hiring workers only if z is larger than the reservation value:

$$\bar{z}(\pi_h) = \{z | S(z, \pi_h) = 0\}. \tag{15}$$

In this context, W_u, $\bar{z}(\pi_\ell)$ and $\bar{z}(\pi_h)$ are determined by equations (13), (15) and the resource constraint:

$$\underbrace{\mathcal{N} - \mathcal{U}(W_u, \bar{z}(\pi_\ell), \bar{z}(\pi_h))}_{\text{Labor supply}} = \underbrace{L(W_u, \bar{z}(\pi_\ell), \bar{z}(\pi_h))}_{\text{Labor demand}}, \tag{16}$$

where $\mathcal{U}(.)$ is the aggregate number of unemployed workers computed in Appendix C.4 and $L(.)$ is the aggregate employment computed in Appendix C.3.

Equation (16) displays the equality between labor supply, on the left-hand side, and labor demand, on the right-hand side. The labor supply function, displayed on Figure 10, depicts a positive relationship between the expected value of unemployed workers W_u and employment, equal to $\mathcal{N} - \mathcal{U}$, because a higher employment rate increases the expected value of unemployed workers, whose probability to find jobs raises when employment increases.[46] The labor demand function displays a decreasing relation between employment and W_u because higher values of W_u reduce the surplus of jobs, then profits and the incentive to create jobs. Since labor supply increases with W_u and labor demand decreases with W_u, equation (16) defines a unique value of W_u if it exists, which is assumed.

The labor market equilibrium condition (16) determines the equilibrium value of the expected utility of unemployed workers W_u. This allows us to compute the equilibrium values of the labor market tightness and employment in each establishment, relying on previous results of Section 6.2, which derived the values of these variables conditional on W_u. The number of establishments is determined by the arrival of production opportunities O_i, $i = \{s, b\}$, and by the productivity thresholds $\bar{z}(\pi_\ell)$ and $\bar{z}(\pi_h)$ defined by equations (13) and (15).

[46] As stated by equation (4) which implies a positive relationship between the job finding probability $\theta m(\theta)$ and W_u. See Appendix C.4 for more details.

In this setup, rises in the stringency of regulations of temporary contracts, corresponding to increases in the share of permanent jobs in total job creation in young establishments (π_ℓ), in old establishments (π_h), or in the rate ρ at which establishments become old, reduce job creation in each establishment where the regulation becomes more stringent. The more stringent regulation also increases the reservation productivity above which establishments are created, which contributes to lower establishment creation. These effects reduce labor demand, i.e. move the labor demand curve downwards in the (L, W_u) plane, as shown in Figure 10. On the other hand, the more stringent regulation decreases the value of the expected utility of unemployed workers at a given employment level, as it can be deduced from equation (10) which shows that W_u decreases with π through the negative impact of π on the job surplus. Therefore, the labor supply curve shifts upwards, which dampens the negative impact of the regulation stringency on employment. Hence, the total effect of increases in the stringency of the regulation of temporary contracts moves the equilibrium values of W_u, the welfare of unemployed workers and employment L from points A to B on Figure 10. This indicates that the reform reduces the welfare of unemployed workers, whose probability to find a job is reduced but has an ambiguous impact on total employment because the drop in the share of temporary jobs in job creation reduces job destruction.

6.4 Labor market equilibrium after the reform

The model has clear qualitative predictions about the effects of the Portuguese reform of temporary contracts. Let us remind that this reform changed the situation of young establishments created by large firms, over 750 employees, which had to comply with the more stringent regulation from their date of creation, instead of after the date at which they became "old" before the reform. The situation of establishments created by small firms remained unchanged. Hence, this reform created a competitive advantage for small firms. If there were free entry for all firms and if all firms had the same production opportunities, whatever their size, establishments would have been created by small firms only, after the reform, because their competitive advantage would have allowed them to totally crowd out large firms. This is not what happened. Thus, there are some constraints on establishment creation. This can be due to limited access to financial markets, lack of opportunities, fewer managerial resources, and less information... In our model, this is taken into account by the limited number of opportunities of creation of establishments, O_i, $i = \{s, b\}$, for small and large firms respectively. It is assumed that these numbers of opportunities to create new establish-

ments are not affected by the reform, meaning that O_s and O_b remain constant before and after the reform. Since the reform is only about contract types, there is no reason to believe that it would affect opportunities for establishment creation.

Although the number of opportunities of creation of new establishments is not affected by the reform, the creation of establishments is impacted because the productivity thresholds $\bar{z}(\pi_\ell)$ and $\bar{z}(\pi_h)$ (defined equations (13) and (15)) above which establishments are created depend on labor market regulation. This dependency arises through two different channels. First, there is a direct effect on large firms: the more stringent regulation decreases the surplus of jobs created by large firms in their young establishments, which raises $\bar{z}(\pi_h)$, the reservation productivity of establishments created by large firms, and accordingly diminishes the number of establishments created by those firms. Second, there are indirect effects, which dampen the negative impact on establishment creation by large firms, because small firms benefit from the drop in market tightness induced by the drop in the profitability of large firms, which diminishes $\bar{z}(\pi_\ell)$ and then fosters the creation of establishments by small firms. The full impact of the reform is the sum of these direct and indirect effects. Quantifying the overall effects of the reform requires the estimation of the parameters of the model.

7 Calibration, estimation and simulations of the structural model

In this section, we begin by detailing how the parameters of the model are determined. We then present the estimation method and discuss identification before proceeding to the evaluation of the reform. Additional details are provided in Appendix D.

7.1 Model parametrization, calibration and estimation

There are 22 parameters to set of which 5 are directly parametrized and 17 are jointly calibrated and estimated. These parameters are evaluated before the reform, over the period 2003-2008. We first present the assumptions about functional forms before reporting the values of baseline parameters and presenting the estimation of the remaining parameters.

Assumptions about functional forms. We assume that the vacancy cost function is homogeneous of degree $\alpha > 1 : C(v) = c_i v^\alpha$, $i = \{s, b\}$, where $c_i > 0$.[47] The matching function is Cobb-Douglas

[47] We bring to the data a more complete version of the model presented in the previous section in which the vacancy

and homogeneous of degree one. The probability to fill a vacancy is given by $m(\theta) = m_0\theta^{-\eta}$ where η is the elasticity of the matching function with respect to unemployment and $m_0 > 0$ is a scaling parameter. The distribution G of match-specific productivity is uniform on the interval $[1-\bar{\epsilon}, 1+\bar{\epsilon}]$. The establishment-specific productivity z is drawn in a generalized extreme value (G.E.V) distribution (different for establishments created by large and small firms) with CDF $\Gamma_i(\gamma_{i1}, \gamma_{i2}, \gamma_{i3})$, $i = \{s, b\}$, where $\gamma_{i3} > 0, \gamma_{i2} \in \mathbb{R}$, and $\gamma_{i3} \in \mathbb{R}$ stand respectively for the scale, the shape and the location parameters of the distribution.

Parametrization (baseline parameters). We first set a subset of parameters using direct empirical counterparts or following standard practice in the literature. Time is discrete. We set the model's period to a year and the discount factor $\beta = \frac{1}{1+r} = 0.952$ is set to match an annual interest rate of 5%. The elasticity of the matching function, η, is equal to 0.5, in line with standard calibration and estimates in the literature.[48] The arrival rate of match-specific productivity shocks, λ, is normalized to one, which implies that the job destruction rate depends on the variance of the match-specific productivity shocks ϵ, estimated from our data. The conversion rate, ρ, of young establishments into old establishments is equal to 0.5 to match the regulation according to which an establishment becomes old after about two years. The exogenous establishment destruction rate, μ, matches the empirical establishments' annual death rate, equal to 0.17. All these values are reported in the first panel of Table 10.

Calibration and estimation. At this stage, we are left with 17 parameters to estimate: parameters c_s, c_b and α of the vacancy cost function, the lay-off costs F, the instantaneous utility of unemployment b, the scale parameter of the matching function m_0, parameter $\bar{\epsilon}$ of job-specific productivity, the shares of permanent jobs in job creation, π_{ij}, $i = \{s, b\}; j = \{h, \ell\}$ and the parameters of the generalized extreme value distributions for small and large firms $\gamma_{i1}, \gamma_{i2}, \gamma_{i3}$, $i = \{s, b\}$. For the estimation, we split these 17 parameters into two vectors $\Theta \equiv \{b, m_0\}$ and $\Omega \equiv \{W_u, F, \bar{\epsilon}, c_s, c_b, \alpha, \pi_{s\ell}, \pi_{sh}, \pi_{b\ell}, \pi_{bh}, \gamma_{s1}, \gamma_{s2}, \gamma_{s3}, \gamma_{b1}, \gamma_{b2}, \gamma_{b3}\}$, which also includes the value of unemployment W_u. As it is usual in this type of procedure, W_u is not a primitive parameter *per se*, but is a scalar that is a combination of all the parameters of the model.[49] We rely on a procedure in which we calibrate the parameters of Θ using information about the population and the unemployment

cost function can differ across firm type. This version of the model is presented and solved in Appendix C.

[48] See e.g. Petrongolo & Pissarides (2001).

[49] See e.g. Flinn (2006) for a similar approach.

rate and we estimate the coordinates of vector Ω with the generalized method of moments (GMM) using information on temporary jobs. The GMM estimator $\hat{\Omega}$ minimizes the following quadratic function:

$$\hat{\Omega} = \arg\min_{\Omega} \left[\mathbf{p} - \mathbf{p}\left(\Omega\right)\right]' \Lambda^{-1} \left[\mathbf{p} - \mathbf{p}\left(\Omega\right)\right] \tag{17}$$

where $\mathbf{p}$ is a vector composed of the percentiles of the empirical distributions of the numbers of temporary jobs in young and old establishments belonging to small and large firms, $\mathbf{p}\left(\Omega\right)$ its theoretical counterpart computed from the model, and Λ^{-1} a symmetric and positive definite weighting matrix.[50] Note that the optimal vector Θ cannot be estimated independently of Ω, all parameters being jointly set using an iterative process described in Appendix D. Calibrated and estimated parameters are reported in the second and third panels of Table 10 respectively.

Identification. The instantaneous utility of unemployment, b, and the scale parameters of the matching function, m_0, are informed by the size of the labor force and the unemployment rate: we compute total employment in the private sector– equal to 2.515 million –, the total number of unemployed – equal to 0.279 million – and the size of the labor force – equal to 5.486 million.[51] The remaining parameters are informed by the distributions of the number of FTCs for each type of establishment (young or old and belonging to a small or to an old firm). F, the firing cost applying to permanent contracts is informed by the distribution of FTCs because firing costs affect total job creation. W_u and $\bar{\epsilon}$ are informed by the number of FTCs because these parameters affect the surplus of new jobs and then job creation. The parameters of the vacancy posting cost functions, c_s, c_b and α, determine the number of vacancies posted by firms and then the number of hires under both types of contracts. The productivity distribution parameters,$\gamma_{s1}, \gamma_{s2}, \gamma_{s3}, \gamma_{b1}, \gamma_{b2}, \gamma_{b3}$, are informed by the distribution of the number of jobs in the establishments since we have a relation between establishment productivity z and the number of jobs at the establishment level. All these parameters are then informed by the distribution of the number of jobs. The four remaining parameters concerning the regulation of FTCs, $\pi_{s\ell}, \pi_{sh}, \pi_{b\ell}$ and π_{bh}, are specifically informed by the distribution of the number of FTCs in the four types of establishments.

Hence, despite the model being jointly identified, each parameter is informed by a particular

[50] In practice, we use a standard two-step feasible GMM where we *(i)* minimize (17) taking the identity matrix $\Lambda = \mathcal{I}$ as a weighting matrix to get a preliminary estimator of Ω, denoted $\hat{\Omega}_1$, then *(ii)* compute an efficient matrix $\Lambda = \mathbf{p}(\hat{\Omega}_1)\mathbf{p}(\hat{\Omega}_1)'$ and minimize again (17) to get the final estimator $\hat{\Omega}$.

[51] These values are obtained from OECD data by averaging over 2003-2008. To obtain the number of unemployed workers, we multiplied the average number of unemployed over the period by 0.7 (to take into account the fact that all workers are not looking for paid employment in the private sector).

mechanism that affects the selected moments: vacancy posting, job creation, distribution of employment in the economy, and the share of FTCs in hires in all types of establishments. The number of FTCs, computed in equation (D.1) in Appendix D combines these different mechanisms and hence is determined by the parameters we estimate.

The values of estimated parameters and their standard errors are reported in Panel 3 of Table 10. The fit of the model is presented on Figure 11. This figure shows that the model reproduces quite precisely the distributions of the number of temporary jobs in all types of establishment, and is therefore consistent with empirical observation. This visual impression is confirmed by the Hansen over-identification test - the null hypothesis is not rejected - which supports the validity of our structural approach.

7.2 Simulation results

Conditional on the structural parameters of the model, estimated before the reform, we simulate the policy shock. In order to clarify the logic of our simulation exercises, we start by explaining the relation between the reduced form estimates and the outcomes of the structural model to show how we identify the impact of the reform in the structural model. Then, we simulate the effects of the reform on large firms, directly targeted and the spillover effects on small firms, which correspond to the effect depicted by Arrow 2 in Figure 1. This allows us to evaluate the bias in the reduced form estimates of the impact of the reform on large firms due to the overlook of the reaction of small firms. The bias depends on the effects of the reform on small firms and on feedback effects on large firms induced by the reaction of small firms, as depicted by Arrow 3 in Figure 1. Finally, we estimate the impact of the reform on the whole economy accounting for all direct and spillover effects.

7.2.1 Identification of the impact of the reform in the structural model

To analyze the relationship between the reduced form estimates and the structural model, it is useful to rely on the causal inference framework (Rubin 1974, Imbens & Rubin 2015) which distinguishes treated and non-treated units and whether the treatment – the reform in our framework – is implemented. In this framework, the *potential* outcome of firm i can be written as a function of two indicator variables:

$$y_i(T_i, I),$$

where $T_i \in \{0,1\}$ is equal to one if firm i is treated and $I \in \{0,1\}$ is equal to one if the treatment is implemented. In the absence of spillover effects on non-treated firms, which is the Stable Unit Treatment Value Assumption (SUTVA), $y_i(0,1) = y_i(0,0)$ for all i. But, in general, there are between-firm spillovers in market economies, as suggested by our reduced-form analysis of spillovers. In our model, when the reform has effects on a non-zero measure of firms, their behavior has an impact on the expected utility of unemployed workers, which induces spillover effects on all firms.

In our RDD framework, the reduced form estimate of the average treatment effect on the treated (ATT) relies on the Poisson regression model – equation (1)– which can be written as:[52]

$$\mathbb{E}(y_i|x_i,T_i,I) = \exp\left(\alpha_0 + \alpha_1 T_i \times I + \alpha_2 x_i + \alpha_3 I + \frac{\sigma^2}{2}\right), \tag{18}$$

where x_i is the vector of running and control variables and σ is the standard error of the error term ε_i defined in equation (1). Equation (18) implies that coefficient α_1 can be written as:

$$\alpha_1 = \underbrace{\log\left(\frac{\mathbb{E}(y_i|x_i,T_i=1,I=1)}{\mathbb{E}(y_i|x_i,T_i=1,I=0)}\right)}_{\text{Impact on large firms}} - \underbrace{\log\left(\frac{\mathbb{E}(y_i|x_i,T_i=0,I=1)}{\mathbb{E}(y_i|x_i,T_i=0,I=0)}\right)}_{\text{Impact on small firms}}$$

The first term on the right-hand side is the log difference of the expected outcome of large firms, which are treated, between the situation where the reform is implemented and the situation where it is not implemented. The second term is the same difference for small firms, not assigned to treatment.

The empirical counterpart of the previous formula is then given by:

$$\hat{\alpha}_1 = \underbrace{\log\left(\frac{\sum\limits_{i|T_i=1} y_i(1,1)}{\sum\limits_{i|T_i=1} y_i(0,0)}\right)}_{\text{Impact on large firms}} - \underbrace{\log\left(\frac{\sum\limits_{i|T_i=0} y_i(0,1)}{\sum\limits_{i|T_i=0} y_i(0,0)}\right)}_{\text{Impact on small firms}} \tag{19}$$

Under SUTVA, we get $\sum\limits_{i|T_i=0} y_i(0,1) = \sum\limits_{i|T_i=0} y_i(0,0)$, which implies that $\hat{\alpha}_1$ defined in equation (19) becomes:

$$\hat{\alpha}_1^* = \log\left(\frac{\sum\limits_{i|T_i=1} y_i(1,1)}{\sum\limits_{i|T_i=1} y_i(0,0)}\right)$$

The comparison of $\hat{\alpha}_1$ with $\hat{\alpha}_1^*$ provides an estimator of the bias which arises when SUTVA is not

[52] We assume that all firms assigned to treatment are effectively treated as the treatment is mandatory.

fulfilled:

$$\widehat{Bias} = \hat{\alpha}_1 - \hat{\alpha}_1^* = \underbrace{-\log\left(\frac{\sum_{i|T_i=0} y_i(0,1)}{\sum_{i|T_i=0} y_i(0,0)}\right)}_{\text{Impact on small firms}} \tag{20}$$

Hence, the first term on the right-hand side of equation (19) stands for the unbiased estimator, when SUTVA is satisfied, whereas the second term is the bias induced by the impact of the reform on small firms.

We adjust the parameter $\pi_{b\ell}$, which captures the change in regulation following the reform, to satisfy equation (19) where $\hat{\alpha}_1$ is retrieved from our reduced form estimates and the $y_i(T_i, I)$ are computed from the structural model. The pre-reform $y_i(T_i, I)$ are the steady state values computed from the benchmark structural estimation described in the previous section. The post-reform values are computed assuming that all structural parameters remain unchanged, except $\pi_{b\ell}$, which is adjusted to fulfill equation (19).[53]

In the benchmark exercises, $y_i(T_i, I)$ is the number of net entries into temporary jobs in new establishments during the two years following the reform.[54] We find that parameter $\pi_{b\ell}$ changes from 0.29 (its estimated pre-reform value as reported in Table 10) to 0.70 (its post-reform value as evaluated with the structural model).[55] Our robustness checks and difference-in-differences analysis show that our RDD results are not only local. Hence, the reduced-form results characterize a large population of firms, which is consistent with the coverage of our structural model.

Before presenting the results on the impact of the reform, we check that the simulations of the model provide results consistent with the reduced-form estimates. To do this, we compare the value of $\hat{\alpha}_1$ predicted with the structural model – by computing the right-hand side term of equation (19) with the post-reform value of $\pi_{b\ell}$ equal to 0.70 instead of 0.29 before the reform– with those obtained with the reduced-form approach for other outcomes than the number of net entries into temporary jobs in new establishments, i.e. permanent and total employment. The comparison of Column $U \rightarrow L_p$ of Table 11 with the reduced form estimates in Table 3 and Column $U \rightarrow L$ of

[53] A potential concern is that the recession which occurred in 2009, just after the implementation of the reform in February 2009, might have had a different impact on firms of different sizes, implying that the reduced-form estimates might capture both the impact of the reform and of the recession. Appendix F deals with this issue.

[54] Appendix E provides further details about the transitory dynamics and the identification of the post-reform value of parameter $\pi_{b\ell}$ that matches the reduced-form estimate of the impact of the reform on this outcome, reported in Table 2.

[55] We select the coefficient of Column (2) of Table 2, equal to -1.461, as reported in Table 11, Column $U \rightarrow L_t$, row $\hat{\alpha}_1$ of Panel "Reduced form estimates for young establishments of large firms". Supplementary tables A.18 and A.19 report the results when the value of coefficient $\hat{\alpha}_1$ is taken from Column (1) and Column (3) of Table 2 respectively. The comparison with Table 11 shows that the results lead to similar qualitative conclusions as those presented below, deduced from Table 11.

Table 11 with the reduced form estimates in Table 4 shows that the values of $\hat{\alpha}_1$ simulated with the structural model are all in the 95% confidence interval of the reduced form estimates.[56]

Now, in what follows, we analyze the outcomes of the model when $\pi_{b\ell}$ changes from its pre-reform value to its post-reform value. We evaluate: *(i)* The effects on employment of new establishments of large firms; *(ii)* The spillover effects on small firms and their feedback on large firms; *(iii)* The bias in the reduced form estimates induced by spillover effects; *(iv)* The impact of the reform on the whole economy; *(v)* The consequences of the expansion of the reform to all firms.

7.2.2 Effects on employment of new establishments of large firms

According to the structural model, the reform has a strong negative impact on the employment of new establishments created by large firms. Large firms created fewer establishments (see Table 12), and fewer vacancies which are more difficult to fill because unemployed workers direct their job search towards other establishments than those created by large firms (see Table 13). Temporary jobs in young establishments of large firms drop by about 77% and permanent jobs drop by 37%. Hence, employment collapses dramatically, by about 50%, in those establishments (see Row "Large firm-Young", Panel "General Equilibrium" in Table 11). Overall, the reform is strongly detrimental to the young establishments of large firms.

7.2.3 Spillover effects

Spillovers on small firms. Our evaluation of the spillover effects of the reform on small firms is reported in the top panel of Table 11, which displays percentage changes between the pre-reform and the post-reform steady states.

The reform increases employment in the establishments created by small firms because they benefit from a competitive advantage from the reform which limits the creation of temporary jobs for large firms. The restrictions on the creation of temporary jobs for young establishments of large firms induce unemployed workers to look for jobs more in other establishment types which can fill their vacancies at a higher rate (as shown by Table 13). Small firms also benefit from the reform because it reduces the welfare of unemployed workers. This raises job surpluses, lowers job sepa-

[56] For instance, Row $\hat{\alpha}_1$, Column $U \to L_p$ in Panel "Reduced form estimates for young establishments of large firm", of Table 11 reports $\hat{\alpha}_1 = -0.22$ for the impact of the reform on permanent employment of young establishments of large firms. This value of $\hat{\alpha}_1$ is in the 95% confidence interval of the reduced form estimate of $\hat{\alpha}_1$ reported in Column (2) of Table 3.

ration rates, and raises the conversion rate of temporary jobs into permanent jobs. The increase in employment of the establishments of small firms arises from the increase in their size and from the rise in the number of establishments created by small firms, as shown by Table 12. Table 11 shows that employment increased by about 1.2% in establishments of small firms, and the impact is of the same order of magnitude for temporary and permanent jobs.

Spillovers on large firms. Spillover effects on large firms can be deduced from Panel "Partial equilibrium" of Table 11 which displays the impact of the reform at partial equilibrium, where it is assumed that W_u is fixed. This is equivalent to assuming that the outcome y_{-i} of all firms different from i is unchanged. The comparison of the panel "General Equilibrium" with the panel "Partial Equilibrium" shows how the general equilibrium effects of the reform affect not only small but also large firms. Spillover effects to large firms increase employment by 0.5%, permanent employment by 0.7%, and temporary employment by 0.3% in young establishments of large firms.[57] The reform decreased the expected gains of unemployed workers W_u. This raised job surpluses and boosted job creation of both large and small firms. Hence, the reform has a less negative impact on large firms in general equilibrium than in partial equilibrium, once the adjustment of W_u is taken into account.

7.2.4 Bias in reduced form estimates

The fact that the average employment change of establishments not directly impacted by the reform is much smaller – in absolute value – than that of those which are directly impacted implies that the bias in the reduced-form estimates of the average treatment effect on the treated defined by equation (20) is small. Table 11, Row "Bias", shows that neglecting the employment adjustment in young establishments created by small firms – which belong to the non-treated group in the reduced-form approach – induces a bias that overestimates the effect of the reform on the percentage employment changes of young establishments of large firms by about 1%[58] and the bias is limited for all the outcomes of young establishments of large firms. The bias is almost identical, equal to -0.012 for all employment outcomes of young establishments of large firms[59] because the bias is equal to the indirect impact of the reform on the employment of young establishments of small

[57] These figures are obtained by subtracting figures reported in Panel "Partial equilibrium" from those reported in Panel "General equilibrium".

[58] This figure is obtained by dividing the value of $\widehat{Bias}$ by that of $\hat{\alpha}_1$ in Panel "Reduced form estimates for young establishments of large firms" of Table 11.

[59] See row $\widehat{Bias}$ Panel "Reduced form estimates for young establishments of large firms" of Table 11.

firms induced by the drop in W_u. This drop has an impact of identical magnitude on temporary and permanent employment of these establishments. The bias is much larger for old establishments of large firms (in this case, the control group is made up of the old establishments of small firms) because old establishments of large firms are mostly indirectly impacted by the reform.

7.2.5 Impact of the reform on the whole economy

Employment. The impact of the reform on aggregate employment is reported in Table 11, Rows "All". Panel "Impact computed from reduced-form estimates wrongly assuming SUTVA" shows that aggregate employment decreases by 1.3% when employment effects are computed from the reduced-form estimate (wrongly) assuming that small firms are not impacted by the reform. Accounting for general equilibrium effects divides this figure by about 13 since the impact of the reform on total employment drops to about minus 0.1%. Similar large differences arise for the stock of permanent and temporary jobs. Looking at flows leads to even more striking results since the number of transitions from unemployment to employment increases at general equilibrium while it decreases at partial equilibrium.[60]

The large difference between the results obtained with and without accounting for the reaction of small firms arises from the large share of small firms in total employment. The reform is targeted to a small subset of firms, the share of which in total employment equals 15%. It has small spillover effects on the average outcomes of small firms. But since small firms are numerous and account for a large share of total employment, their reaction has a strong effect on total employment. These results show that small spillover effects, induced by a small subset of the population, that may be difficult to measure with reduced-form strategies because they diffuse on a large share of the population, may significantly change the overall impact of reforms.

Welfare. The model provides information about the welfare effects of the reform. The welfare of unemployed workers, W_u, is reduced by the reform because the restrictions on the creation of temporary jobs reduce the number of job vacancies and the exit rate from unemployment – as shown in Table 14. The average welfare of workers of small firms is lower after the reform for two reasons. First, their outside option W_u is lower. This means that, conditional on productivity, the welfare of workers is lower after the reform. Second, small firms create establishments with lower

[60] The total number of transitions from unemployment to employment increases at general equilibrium but there are fewer transitions from temporary jobs to permanent jobs implying a drop in permanent employment and in total employment.

productivity (the threshold value of z above which small firms create establishments drops). This induces a composition effect that decreases the average welfare of the employees of small firms. For large firms, the drop in W_u exerts the same negative effect on welfare. However, contrary to small firms, large firms create establishments with higher productivity after the reform (the threshold value of z above which large firms create establishments increases). This contributes to improving the average welfare of employees of large firms. The combination of these two effects raises the average welfare of permanent workers and reduces that of temporary workers in large firms. All in all, the average welfare of all workers is lower after the reform despite the positive impact of the reform on the share of permanent jobs.

7.2.6 Counterfactual: Expansion of the reform to all firms

The presence of spillover effects implies that the evaluation of the expansion of the reform to all firms needs to account for non-trivial interactions that cannot be deduced from reduced form estimates. To illustrate this point, we simulate the impact of the reform assuming that it applies to all firms and that the share of temporary jobs in job creation changes in the same proportion in small and large firms.[61]

Employment. Now, employment of small firms drops after the reform (see Table 15). However, employment drops less in large firms than when the reform applied to large firms only, because small firms, which are also negatively impacted by the reform now, do not benefit anymore from a competitive advantage (as shown by comparing the Panel "General Equilibrium" in Table 11 and Table 15). Aggregate employment drops by 0.45% when the reform applies to all firms instead of 0.1% when it applies to large firms only,[62] but it decreases less than if we had mechanically deduced the impact on large firms from the reduced form estimates, neglecting the general equilibrium effects.

Welfare. Expanding the reform to all firms has a much bigger negative impact on the welfare of unemployed workers, which drops by 5.4% – Table 16, compared with the situation where the reform applies to large firms only, in which welfare drops by 0.7% – Table 14. Due to the composition effects described above in Section 7.2.5, the reform raises the welfare of permanent workers in

[61] The reform targeted to large firms implies a change in $\pi_{b\ell}$ from 0.29 to 0.70, i.e. a 142% change in absolute term as estimated for large firms. We assume here that $\pi_{s\ell}$ changes in the same proportion for small firms.

[62] See rows "All" of Panel "General Equilibrium" in Table 11 and Table 15.

young establishments of small firms. However, conditional on productivity, the average welfare of all workers is lower after the reform. This finding indicates that flexibility at the margin, allowing firms to hire temporary workers, significantly improves labor market efficiency in our context.

8 Conclusion

The large share of atypical work observed in many countries - and the labor market segmentation that may follow - can have negative effects on both efficiency and equity. It has therefore prompted many different policy responses, several of which have been evaluated. This paper examines one such response, a labor law reform implemented in Portugal in 2009 which restricted the use of fixed-term contracts only in new establishments of large firms.

We first conduct an evaluation of this reform by drawing on linked employer-employee longitudinal data and regression discontinuity methods, exploiting the sharp and distinctive threshold between large and small firms. In our microeconometric analysis, we find that the reform was successful but only in the sense that it led to a decrease in the number of new FTCs. The reform had a significant unintended cost as the number of new establishments declined and the number of permanent contracts did not increase. When considering these different margins together, the reform led to an overall reduction in the total number of new jobs. However, the estimate of spillover effects on small firms, which were not targeted directly by the reform, leads to a much more mixed conclusion, insofar as job creation by these small firms almost compensated for the losses of jobs in large firms.

From a more methodological perspective, our paper illustrates the importance of complementing reduced-form estimations of the effects of reforms with structural models. Reduced form strategies, which evaluate reforms of employment protection legislation by comparing a treatment group, to which the reform applies, to a control group, to which the reform does not apply, are very powerful at identifying the direct causal impact of reforms. Nevertheless, our framework clearly shows that such non-structural methods cannot fully identify and quantify the effects of the reform under scrutiny insofar as job creation, job destruction, and employment of establishments created by firms that belong to the control group are also impacted by the reform, which induces feedback spillovers to the treated group. From this perspective, our approach complements these non-structural approaches by using a unified framework which reproduces the direct effect evaluated

by the reduced-form strategy and quantifies the indirect effects. It shows that the indirect effects may be quantitatively significant even for reforms that cover a small subset of individuals (15% of employment in our case).

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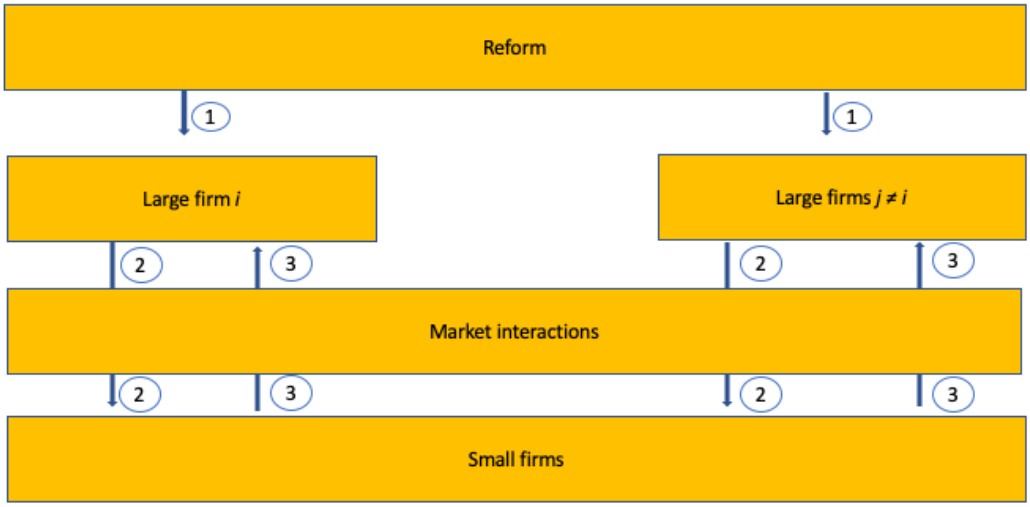
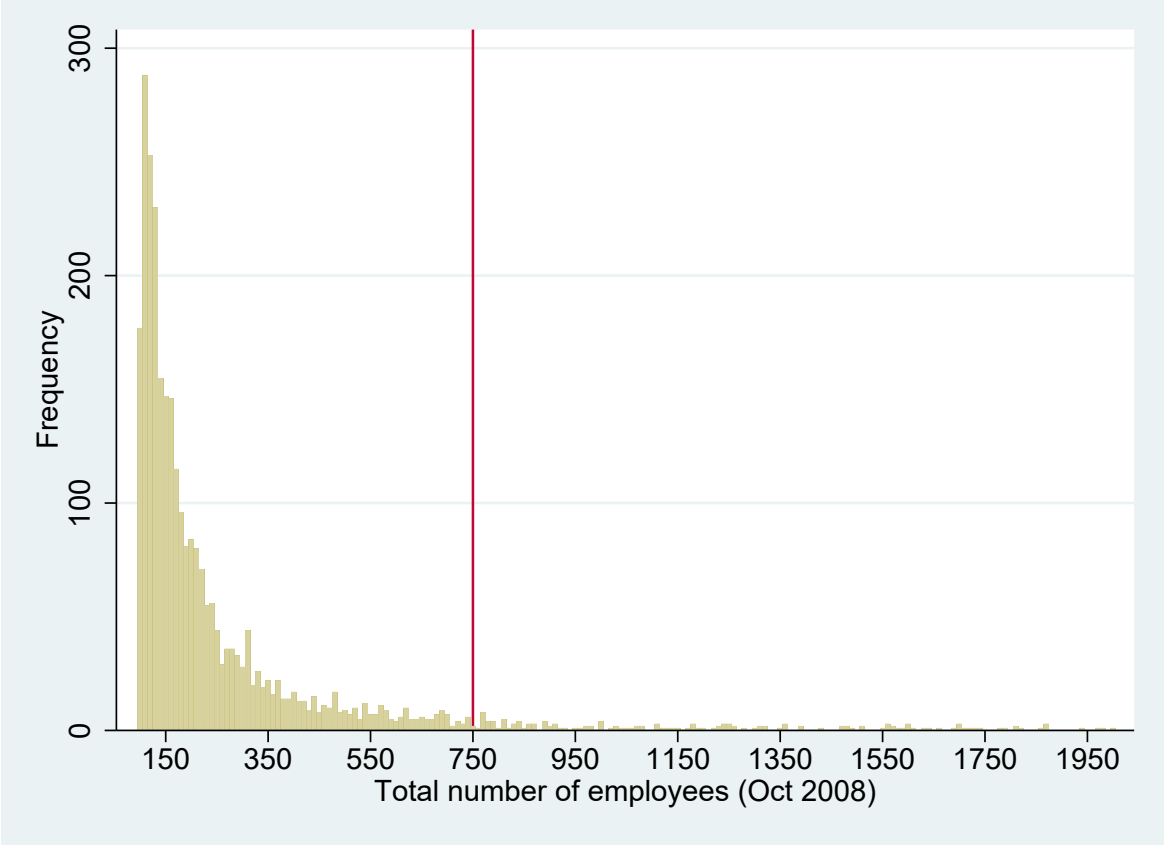
9 Figures

Figure 1: **Direct and spillover effects of the reform**



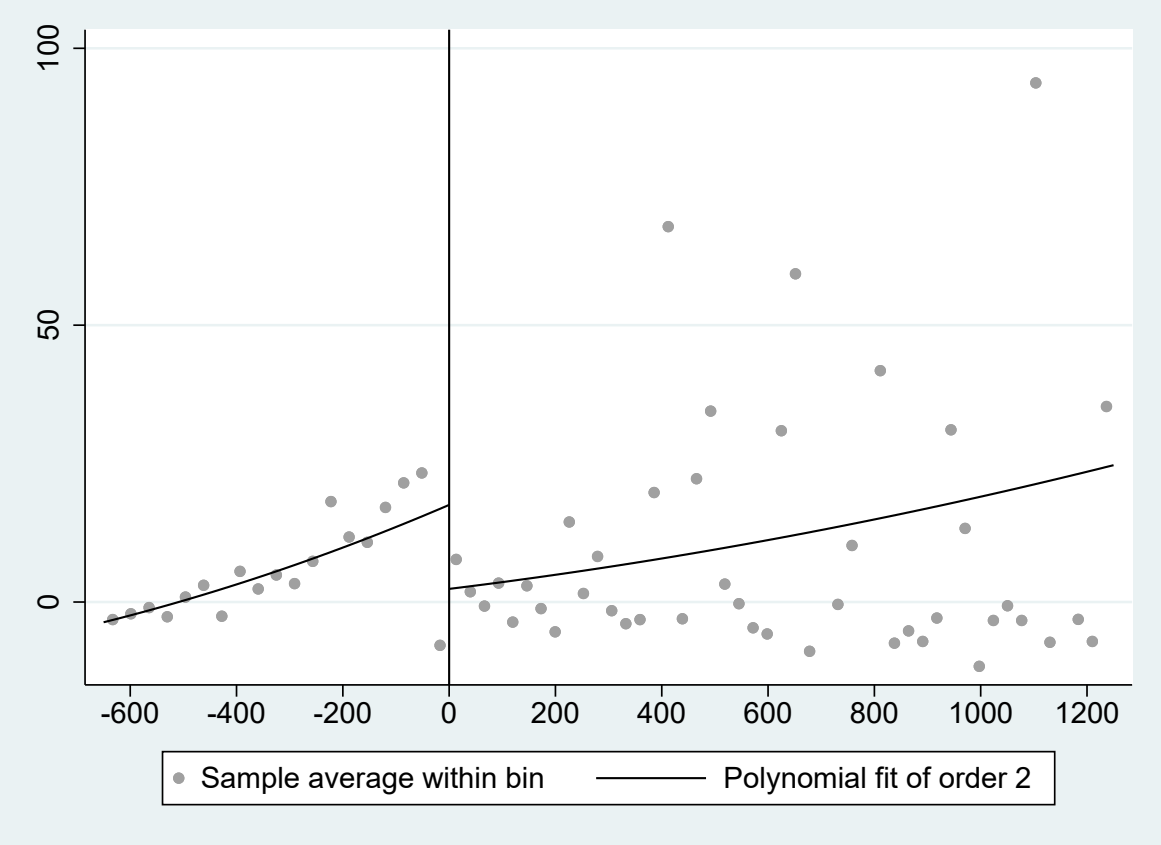
Notes: This Figure illustrates the impact of the reform on large and small firms. Arrow 1 represents the direct effect of the reform on large firms, Arrow 2 the spillover effects on small firms, which are mediated by market interactions, and Arrow 3 the feedback effects on large firms, including interactions between large firm i and large firms $j \neq i$.

Figure 2: **Distribution of (2008) firm sizes**



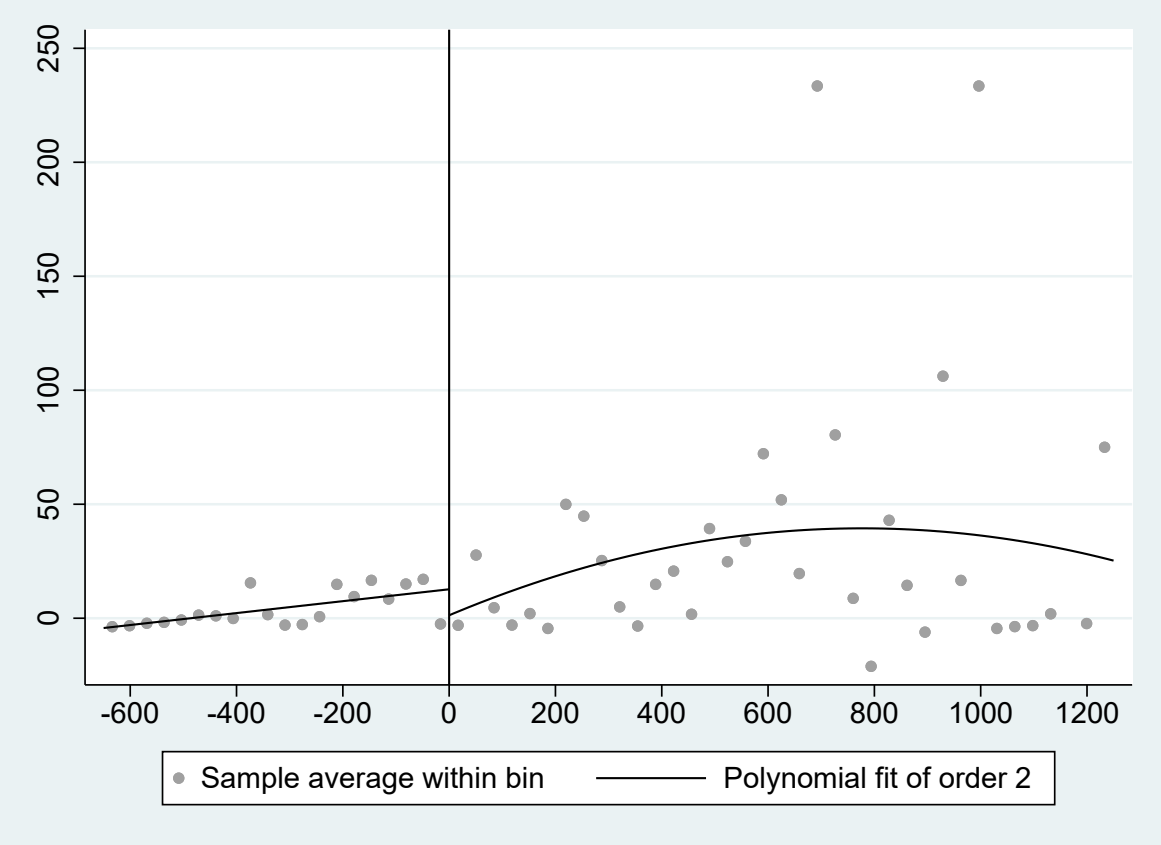
Notes: Firm size is measured by the total number of employees of each firm in (October) 2008. Own calculations based on the 'Quadros de Pessoal' data set.

Figure 3: **New hires under fixed-term contracts in new establishments**



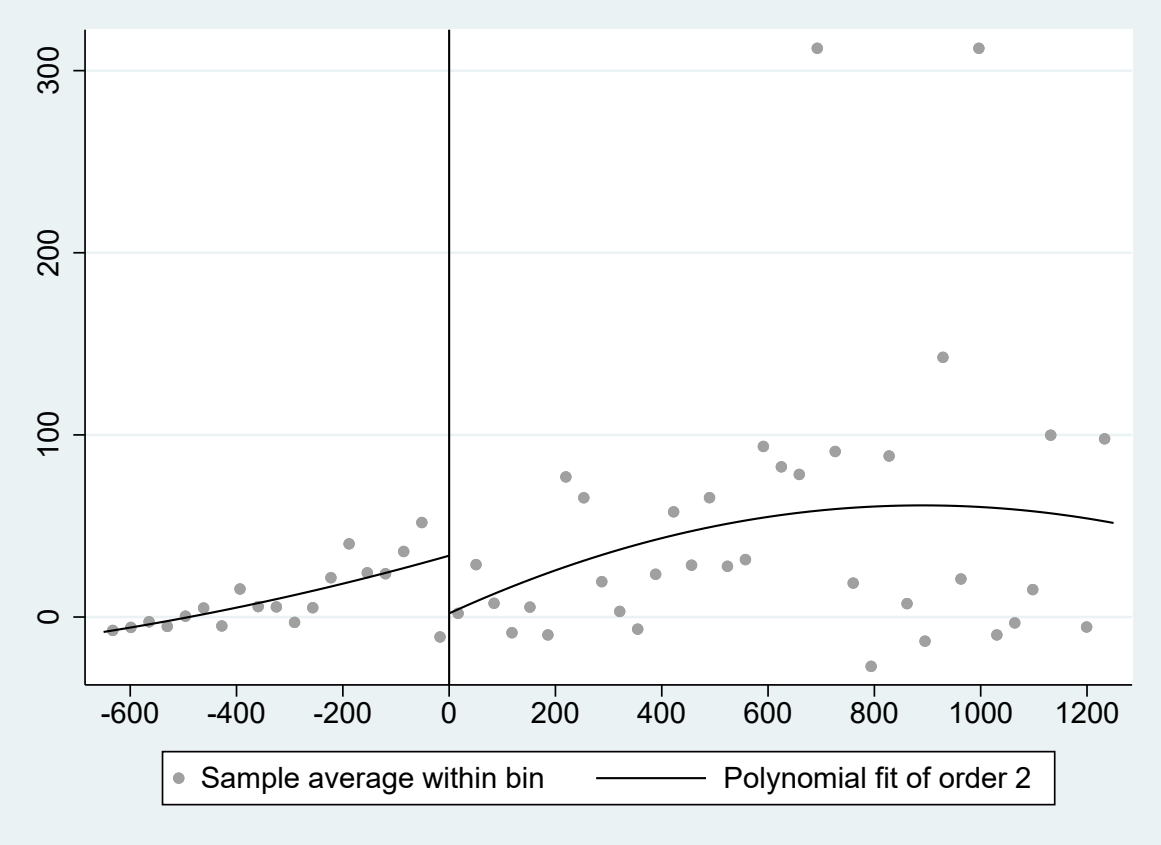
Notes: Dependent variable: total employment-month-hours (divided by 1,000) of new fixed-term contracts in new establishments (all margins). New employment contracts are those created from March 2009. Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data. We use binned sample means following Calonico et al. (2015). We also partial out one-digit industry effects, following the evidence above of some differences in the distribution of firms in some sectors. Firms that do not open new establishments are considered as well, with a value of new hires of zero.

Figure 4: **New hires under permanent contracts in new establishments**



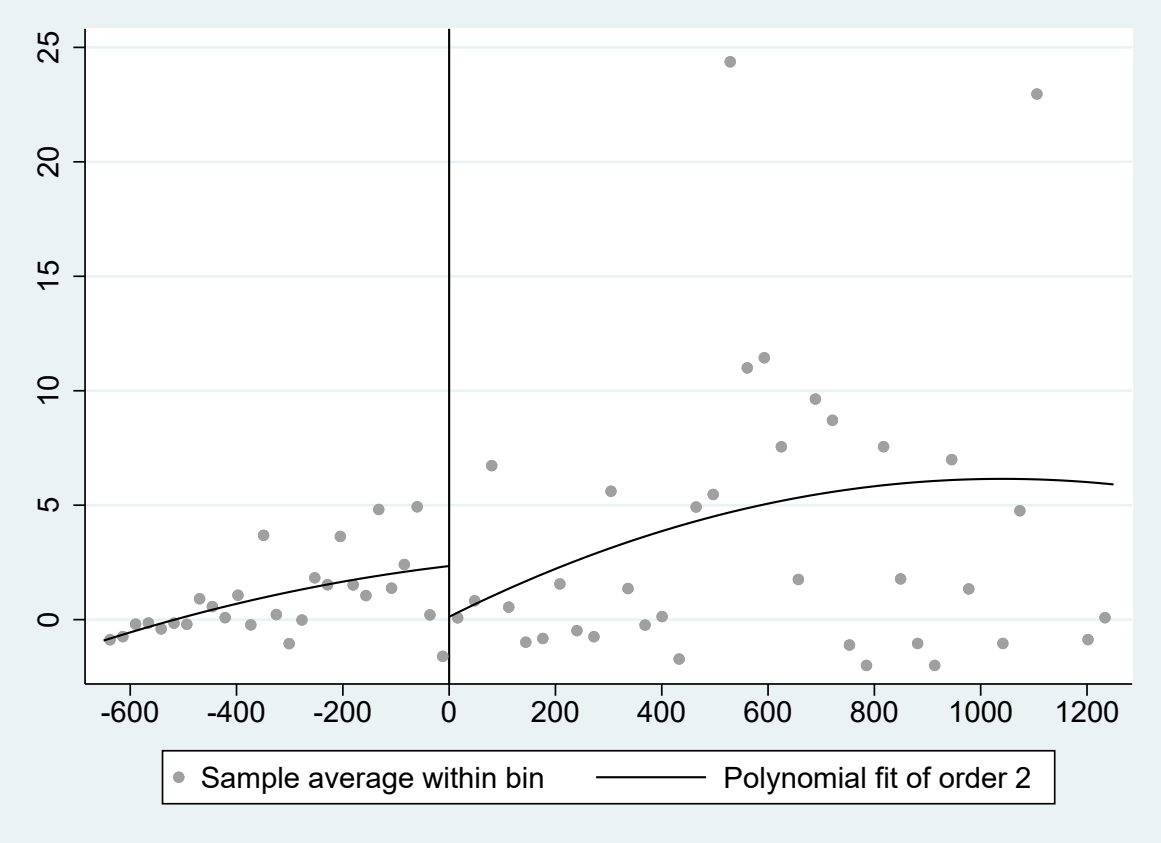
Notes: Dependent variable: total employment-month-hours (divided by 1,000) of new permanent contracts in new establishments (all margins). New employment contracts are those created from March 2009. Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data. We use binned sample means following Calonico et al. (2015). We also partial out one-digit industry effects, following the evidence above of some differences in the distribution of firms in some sectors. Firms that do not open new establishments are considered as well, with a value of new hires of zero.

Figure 5: **New hires under fixed-term and permanent contracts in new establishments**



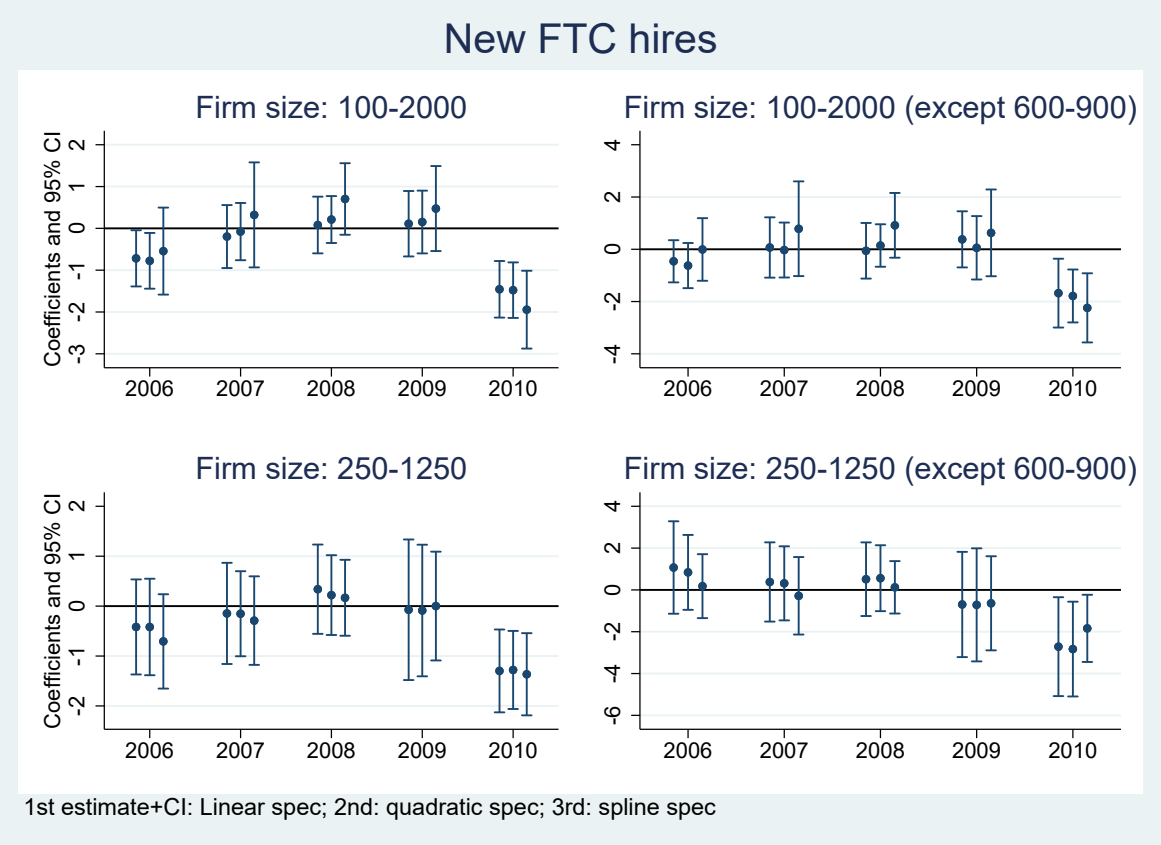
Notes: Dependent variable: total employment-month-hours (divided by 1,000) of new fixed-term and permanent contracts in new establishments. Firm size is centered at 750 employees (all margins). New employment contracts are those created from March 2009. Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Own calculations using 'Quadros de Pessoal' data. We use binned sample means following Calonico et al. (2015). We also partial out one-digit industry effects, following the evidence above of some differences in the distribution of firms in some sectors. Firms that do not open new establishments are considered as well, with a value of new hires of zero.

Figure 6: **New establishments by 2010**



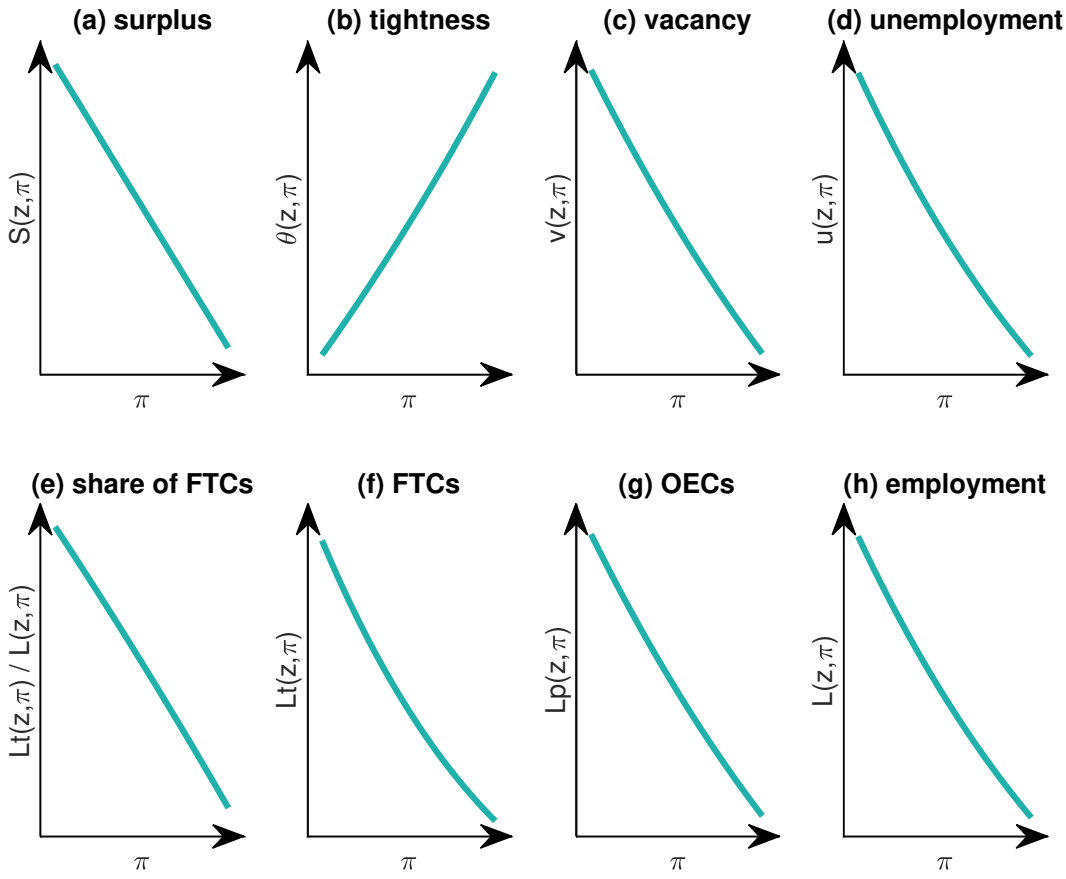
Notes: Dependent variable: number of new establishments (created in 2009 or 2010) by firms of different sizes (total number of employees) in 2008. Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data. We use binned sample means following Calonico et al. (2015). We also partial out one-digit industry effects, following the evidence above of some differences in the distribution of firms in some sectors. Firms that do not open new establishments are considered as well, with a value of new hires of zero.

Figure 7: **RDD estimates for different years and different bandwidths**



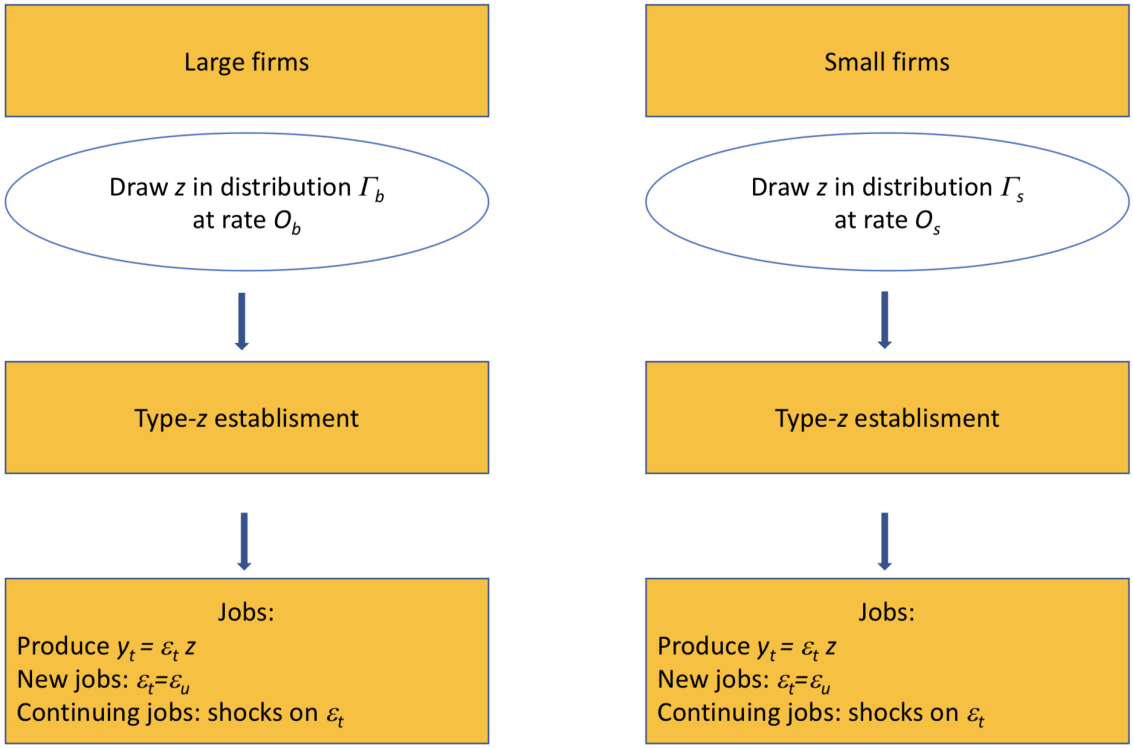
Notes: Dependent variable: number of net creations of fixed-term contracts (weighted by hours) in new establishments from year $t-2$ to year t. Firms that do not open new establishments are considered as well, with a value of new hires of zero. RDD estimates from coefficient α_1 of equation (1) for different bandwidths and different years. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set.

Figure 8: **The effects of more stringent regulation of temporary contracts π on the outcomes at the establishment level.**



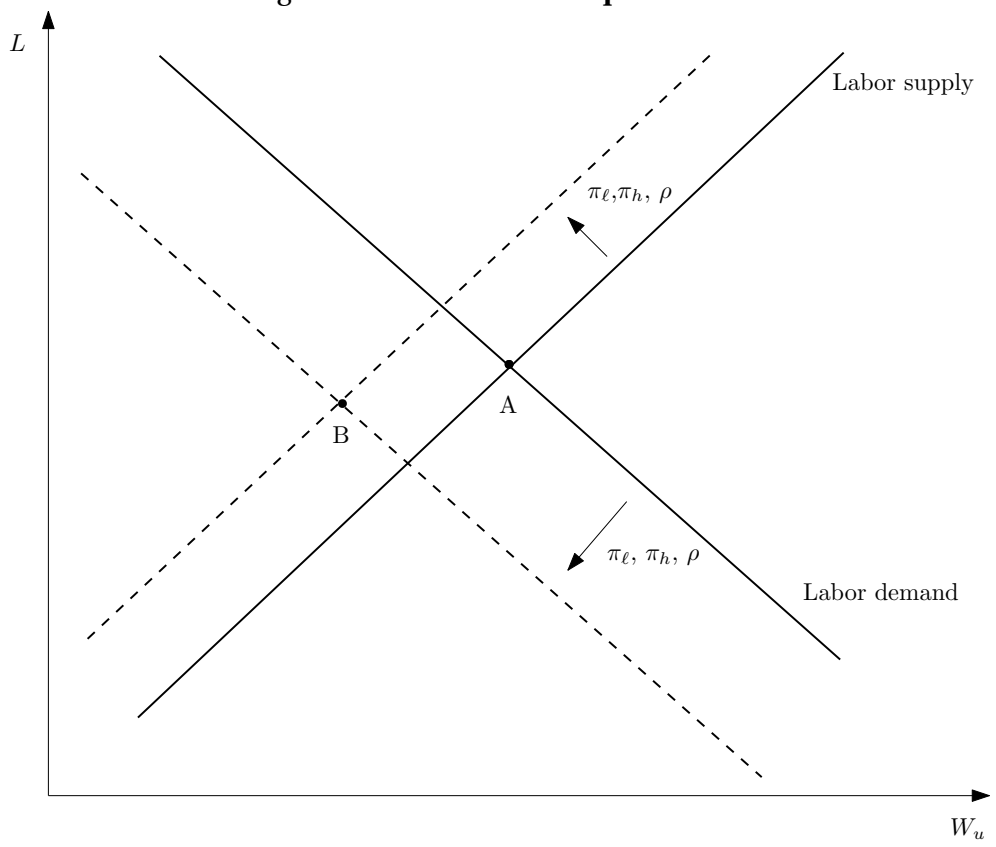
Notes: This figure shows comparative exercises for arbitrary calibrated values of the parameters. Each panel presents variations of an outcome variable associated with increasing values of π, corresponding with a more stringent regulation.

Figure 9: **Structure of the theoretical model**



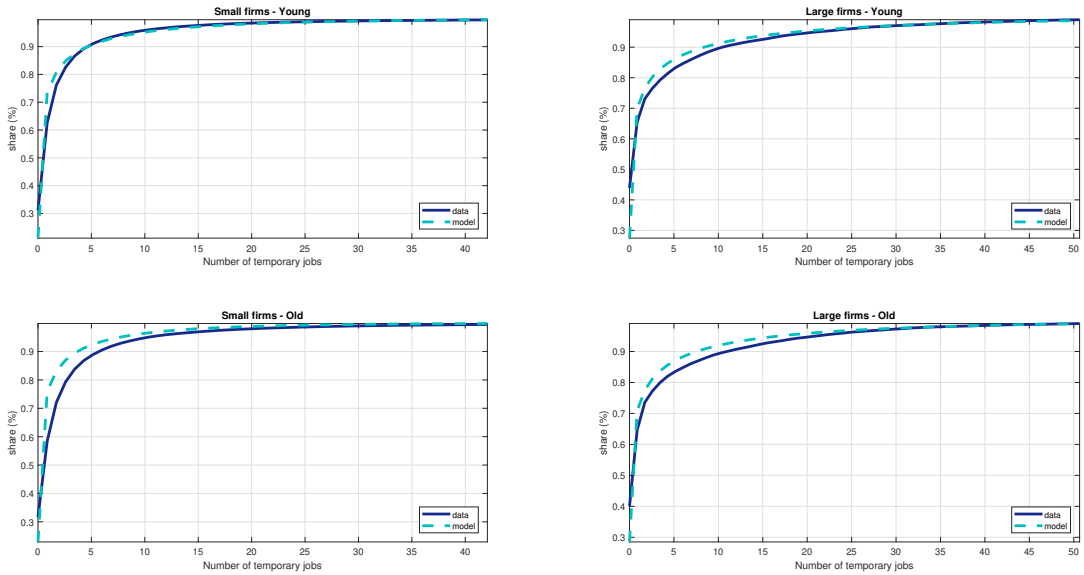
Notes: This figure displays the structure of the theoretical model which comprises representative firms, which can be either large or small. Firms draw opportunities of creation of new multi-worker establishments with probability O_i per period, where $i = \{s, b\}$ s and b stand for small and big (or large) firms respectively.

Figure 10: **Labor market equilibrium**



Notes: This figure displays the labor market equilibrium in the employment (L) and welfare of unemployed workers (W_u) plane before and after a change in labor market regulation. A is the initial equilibrium (given by the intercept of the continuous lines). B is the equilibrium after an increase in the stringency of labor market regulation (given by the intercept of the dashed lines). The thin black arrow lines describe the effect of an increase in the stringency of labor market regulation.

Figure 11: **Empirical and predicted distributions of the number of temporary jobs in establishments**



Notes: This figure displays the empirical and the predicted distributions of the number of temporary jobs in young and old establishments created by small and large firms before the reform.

10 Tables

Table 1: Descriptive statistics, firms (2008)

	Larger firms		Smaller firms		Difference	
	Mean	SD	Mean	SD	Diff	t
Panel A: 2008 values						
Firm size (uncentered)	1200.99	357.81	213.46	133.79	-987.54***	(-33.67)
Annual sales (€million)	240.96	759.89	32.89	143.49	-208.07**	(-3.35)
Firm age	27.92	46.85	31.81	47.79	3.89	(0.99)
Number of establishments	22.45	40.51	5.02	9.38	-17.43***	(-5.26)
Capital equity (€million)	50.47	151.49	6.18	34.81	-44.30***	(-3.58)
Domestic private ownership (%)	60.59	47.70	71.64	44.03	11.05**	(2.77)
Foreign ownership (%)	20.00	38.57	15.80	35.32	-4.20	(-1.30)
Farming and extracting industries	0.01		0.01		0.01	(0.78)
Food, clothing	0.09		0.18		0.09***	(3.69)
Chemicals, metal, electrics	0.09		0.15		0.06*	(2.32)
Other manufacturing	0.05		0.04		-0.01	(-0.38)
Construction, trade	0.23		0.26		0.03	(0.82)
Hotels, restaurants	0.09		0.07		-0.02	(-0.67)
Information, financial, real estate	0.09		0.05		-0.05	(-1.92)
Administrative services	0.11		0.06		-0.05	(-1.88)
Education, health	0.24		0.16		-0.08*	(-2.20)
Other services	0.01		0.03		0.01	(1.47)
Lisbon headquarters	0.60		0.35		-0.25***	(-6.07)
Porto headquarters	0.15		0.18		0.02	(0.79)
Braga headquarters	0.04		0.09		0.05**	(2.96)
Percentage FTC	0.26	0.24	0.28	0.25	0.02	(1.22)
New establishments	7.64	17.94	1.21	3.60	-6.43***	(-4.34)
Fixed-term new hires	57.67	128.18	7.35	24.19	-50.31***	(-4.75)
Permanent new hires	25.98	66.71	3.83	23.22	-22.14***	(-4.01)
Fixed-term and perm new hires	83.64	163.56	11.19	36.48	-72.46***	(-5.36)
Panel B: 2010 values						
New establishments	7.76	20.07	1.78	4.84	-5.98***	(-3.64)
Fixed-term new hires	17.84	40.16	6.85	22.37	-11.00**	(-3.33)
Permanent new hires	41.31	102.03	5.42	27.01	-35.89***	(-4.30)
Fixed-term and perm new hires	59.16	117.23	12.27	41.07	-46.89***	(-4.88)
Observations	150		2,725		2,875	

Notes: 'Larger firms' are those that employed between 750 and 2,000 employees in 2008. 'Smaller firms' are those that employed between 100 and 750 employees in 2008. Panel A concerns the characteristics of the two types of firms as of 2008, before the reform, while Panel B presents the main outcomes of interest following the reform, in 2010. 'Firm age' is measured in years since the creation of the firm. 'Percentage FTC' indicates the percentage of all employees that have fixed-term contracts. For Panel A: 'New establishments' indicates the number of new establishments created between October 2006 and October 2008; 'Fixed-term (permanent) new hires' indicates the number of workers in fixed-term (permanent) contracts in 2008 as hired by new establishments (created between October 2006 and October 2008) of each type of firms ('smaller' or 'larger'). For Panel B: 'New establishments' indicates the number of new establishments created between October 2008 and October 2010; 'Fixed-term (permanent) new hires' indicates the number of workers in fixed-term (permanent) contracts in 2010 as hired by new establishments (created October 2008 and October 2010) of each type of firms ('smaller' or 'larger'). The number of workers is weighted by hours worked and months with the firm and divided by 1,000. Significance levels: * 0.10, ** 0.05, *** 0.01. Own calculations based on the 'Quadros de Pessoal' data set.

Table 2: Effects on fixed-term contracts in new establishments

	(1)	(2)	(3)
Large firm	-1.961	-1.461	-1.314
	(.476)***	(.337)***	(.315)***
Firm size (centered)	.003	.002	.003
	(.0003)***	(.0003)***	(.0003)***
Firm size^2		-1.12e-06	
		(3.34e-07)***	
Firm size*Large firm			-.002
			(.0006)***
Const.	3.062	3.298	3.412
	(.386)***	(.380)***	(.388)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in fixed-term contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. Tenure- and hours-weighted employment measure. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 3: Effects on permanent contracts in new establishments

	(1)	(2)	(3)
Large firm	-.680	-.863	-.713
	(.641)	(.444)*	(.427)*
Firm size (centered)	.002	.003	.004
	(.0005)***	(.0004)***	(.0005)***
Firm size^2		-1.43e-06	
		(3.94e-07)***	
Firm size*Large firm			-.002
			(.0007)***
Const.	2.008	2.646	2.735
	(.354)***	(.344)***	(.362)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in permanent contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 4: Effects on both fixed-term and permanent contracts in new establishments

	(1)	(2)	(3)
Large firm	-1.203	-1.065	-.931
	(.480)**	(.331)***	(.316)***
Firm size (centered)	.002	.003	.004
	(.0003)***	(.0003)***	(.0004)***
Firm size^2		-1.26e-06	
		(2.95e-07)***	
Firm size*Large firm			-.002
			(.0005)***
Const.	3.296	3.735	3.838
	(.339)***	(.330)***	(.340)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in both fixed-term and permanent contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 5: Effects on the number of new establishments per firm

	(1)	(2)	(3)
Large firm	-.695	-.654	-.589
	(.395)*	(.312)**	(.313)*
Firm size (centered)	.002	.002	.003
	(.0003)***	(.0002)***	(.0003)***
Firm size^2		-7.32 e-07	
		(2.64 e-07)***	
Firm size*Large firm			-.001
			(.0005)***
Const.	1.779	2.052	2.084
	(.246)***	(.244)***	(.258)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Poisson regression of the number of new establishments (created in 2009 and 2010) of each firm, as measured in October 2010. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 6: Effects on fixed-term contracts in new establishments, establishment-level analysis

	(1)	(2)	(3)
Large firm	-3.009	-2.726	-2.346
	(1.190)**	(1.148)**	(1.087)**
Firm size (centered)	.003	.003	.005
	(.0009)***	(.0009)***	(.001)***
Firm size^2		-2.38 e-06	
		(8.45e-07)***	
Firm size*Large firm			-.005
			(.002)***
Const.	3.546	4.366	4.839
	(.920)***	(1.013)***	(1.106)***
Obs.	7610	7610	7610

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all (2009-2010) new establishments of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Linear regression of new hires in fixed-term contracts in each new establishment of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 7: Effects on fixed-term contracts in existing establishments before the reform

	(1)	(2)	(3)
Large firm	-.604	-.533	-.387
	(.331)*	(.190)***	(.184)**
Firm size (centered)	.002	.002	.003
	(.0002)***	(.0002)***	(.0002)***
Firm size^2		-1.69e-06	
		(1.96e-07)***	
Firm size*Large firm			-.003
			(.0003)***
Const.	3.864	4.457	4.603
	(.225)***	(.198)***	(.201)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2005. Poisson regression of new hires in fixed-term contracts in all existing establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 8: Effects on fixed-term and permanent contracts in existing establishments before the reform

	(1)	(2)	(3)
Large firm	-.432	-.571	-.428
	(.266)	(.165)***	(.153)***
Firm size (centered)	.002	.002	.003
	(.0002)***	(.0002)***	(.0002)***
Firm size^2		-1.46e-06	
		(1.47e-07)***	
Firm size*Large firm			-.003
			(.0003)***
Const.	4.379	4.999	5.134
	(.174)***	(.164)***	(.172)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in both fixed-term and permanent contracts in all existing establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 9: Spillover effects on the number of new fixed-term and permanent contracts in small firms

	(1)	(2)	(3)
Large firm	.070	.080	.049
	(.034)**	(.033)**	(.284)
Firm size	-1.00e-05	-.00002	.00002
	(.00003)	(.00003)	(.00003)
Firm size^2		-8.77e-08	
		(2.92e-08)***	
Firm size*Large firm			-.0001
			(.00006)*
Firm (1-99) size	.040	.098	.040
	(.0001)***	(.0004)***	(.0001)***
Firm (1-99) size^2		-.0007	
		(5.31e-06)***	
Firm (1-99) size*Large firm			-.00005
			(.0004)
Const.	7.107	6.673	7.124
	(.016)***	(.016)***	(.019)***
Obs.	2972680	2972680	2972680

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all dyads of firms in Portugal employing between 100 and 2000 workers in October 2008 and firms employing between 1 and 100 workers that operate in the same one-digit industry and region ('concelho'). Poisson regression of new hires in both fixed-term and permanent contracts in each 1-99 firm by October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the 100-2000 firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for 100-2000 firms employing 750 or more workers in 2008. Standard errors clustered at the 100-2000 firm identifierr. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table 10: Parameters values of the search and matching model

Description	Symbol	Value	Sources
1. Baseline parameters			
Annual discount factor	β	0.9524	Standard
Elasticity of the matching function	η	0.5	(Petrongolo & Pissarides 2001)
Productivity shock arrival rate	λ	1	Normalization
Establishments' aging rate	ρ	0.5	Portuguese labor code
Establishments' attrition rate	μ	0.17	'Quadros de Pessoal'
2. Calibrated parameters			
			Targets
Flow utility of unemployment	b	-54.2632	Average # of unemployed workers
Scale parameter of the matching function	m_0	0.4657	Average # of employed workers
3. Estimated parameters			
			Standard errors (S.E)
Common Parameters (small and large firms)			
Value of unemployment	W_u	430.2893	$(7.9161e-05)$
Firing costs	F	16.1107	(0.0008)
Upper and lower bounds of the idiosyncratic productivity	$\bar{\varepsilon}$	1.0310	(0.0352)
Elasticity of the vacancy cost function	α	1.3921	(0.0121)
Specific parameters for establishments created by small firms			
Scale parameter of the vacancy cost function	c_s	2.8081	(0.0004)
Share of permanent jobs created in young establishments	$\pi_{s\ell}$	0.1226	(0.0068)
Share of permanent jobs created in old establishments	π_{sh}	0.2080	(0.0787)
G.E.V distribution location parameter	γ_{s_1}	-0.2760	(0.0327)
G.E.V distribution scale parameter	γ_{s_2}	20.4001	(0.0008)
G.E.V distribution shape parameter	γ_{s_3}	31.0728	(0.0004)
Specific parameters for establishments created by large firms			
Scale parameter of the vacancy cost function	c_b	0.3786	(0.0030)
Share of permanent jobs created in young establishments	$\pi_{b\ell}$	0.2914	(0.0430)
Share of permanent jobs created in old establishments	π_{bh}	0.3304	(0.0572)
G.E.V distribution location parameter	γ_{b_1}	-0.3032	(0.0285)
G.E.V distribution scale parameter	γ_{b_2}	14.1732	(0.0018)
G.E.V distribution shape parameter	γ_{b_3}	13.2708	(0.0044)

Notes: G.E.V stands for Generalized Extreme Value (the firm specific productivity distribution). Standard errors in parentheses for estimated parameters. For more details on how the parameters obtain, see Section 7.1 and Appendix D.

Table 11: Reform impact computed from general equilibrium, partial equilibrium and reduced form estimates with the value of $\hat{\alpha}_1 = -1.461$ reported in Column (2) of Table 2

	Stock			Net Inflows			Ouflows		Conversions
	L	L_p	L_t	$U \to L$	$U \to L_p$	$U \to L_t$	$L_p \to U$	$L_t \to U$	$L_t \to L_p$
Establishment type									
					General equilibrium				
Small firm-Young	1.2218	1.2210	1.2232	1.2218	1.2213	1.2232	−5.0121	1.2424	1.2207
Small firm-Old	1.1922	1.1929	1.1840	1.1828	1.1826	1.1840	−1.9374	1.2018	1.1817
Large firm-Young	−50.0649	−37.9874	−76.5191	−49.1958	−18.8724	−76.5191	−28.7067	−76.3287	−76.5644
Large firm-Old	−9.7032	−10.5125	1.5029	1.5004	1.5009	1.5029	−9.4557	1.5308	1.4963
All	−0.0977	−0.0774	−0.3016	0.1797	0.7579	−0.3016	−10.5177	−1.1456	−0.1848
					Partial equilibrium				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−50.6065	−38.6600	−76.7740	−49.7469	−19.7527	−76.7740	−22.4489	−76.5897	−76.8178
Large firm-Old	−10.9923	−11.7861	0	0	0	0	−6.3190	0	0
All	−1.2969	−1.2769	−1.4981	−1.0222	−0.4532	−1.4981	−7.2003	−2.3626	−1.3784
					Impact computed from reduced form estimates wrongly assuming SUTVA				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−50.6676	−38.7354	−76.8028	−49.8090	−19.8513	−76.8028	−24.9448	−76.6192	−76.8470
Large firm-Old	−10.7671	−11.5674	0.3152	0.3139	0.3147	0.3152	−7.6668	0.3250	0.3109
All	−1.2765	−1.2566	−1.4771	−0.9998	−0.4276	−1.4771	−8.5748	−2.3283	−1.3593
					Reduced form estimates for young establishments of large firms				
$\hat{\alpha}_1$	−0.7066	−0.4900	−1.4611	−0.6893	−0.2213	−1.4611	−0.2869	−1.4533	−1.4630
$\widehat{Bias}$	−0.0121	−0.0121	−0.0122	−0.0121	−0.0121	−0.0122	0.0514	−0.0123	−0.0121
					Reduced form estimates for old establishments of large firms				
$\hat{\alpha}_1$	−0.1139	−0.1229	0.0031	0.0031	0.0031	0.0031	−0.0798	0.0032	0.0031
$\widehat{Bias}$	−0.0119	−0.0119	−0.0118	−0.0118	−0.0118	−0.0118	0.0196	−0.0119	−0.0117

Notes: This table displays the impact of the reform estimated from the structural model and from the reduced form estimates with the value of $\hat{\alpha}_1 = -1.461$ reported in Column (2) of Table 2 which reports the estimate of the impact of the reform on temporary employment. Other values of $\hat{\alpha}_1$ reported in the table are simulated as explained in Section 7.2.1. All figures are variations in percentage between the pre-reform and the post-reform steady states except for rows $\hat{\alpha}_1$ and $\widehat{Bias}$ which report values defined by equation (19). L is total employment, L_p is permanent employment, L_t is temporary employment. $U \to X$ is the percentage change in the number of net entries into $X = L, L_p, L_t$ over periods of two years. A similar notation applies to outflows from employment. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types. Rows "All" report the evaluation of the impact of the reform on aggregate outcomes, computed by aggregating the reaction of old and young establishments of large and small firms. Figures account for the variation in the number of establishments of firms. Hence, 1.2218 in the first row, first column, means that employment (including temporary and permanent jobs) of all young establishments of small firms increased by 1.2218% on average. $\hat{\alpha}_1$ is the reduced form estimate assuming SUTVA computed from equation (19) and $\widehat{Bias}$ is the bias in the estimate defined in the same equation. Panel "Partial equilibrium" reports results assuming that the value of unemployment, W_u is constant. Panel "Impact computed from reduced from estimates wrongly assuming SUTVA" reports the evaluation of the impact of the reform computed by applying $\hat{\alpha}_1$, assuming that the control group for young establishments of large firms are the young establishments of small firms and that the control group for old establishments of large firms are the old establishments of small firms.

Table 12: Effect of the reform on the number of establishments

	Partial eq. after reform	General eq. after reform
Establishment type		
Small firm-Young	0	0.09
Small firm-Old	0	0.09
Large firm-Young	-10.27	-9.97
Large firm-Old	-10.28	-9.97

Notes: This table displays the impact of the reform estimated from the structural model on the number of establishments of different types of firm. All figures are variations in percentage between the pre-reform and the post-reform steady states. "Small firm-Young" stands for the young establishments of small firms. A similar notation applies to other establishment types.

Table 13: Impact of the reform on worker flows

Establishment type	Unemployment exit rate $U \to L$	Unemployment exit rate $U \to L_p$	Unemployment exit rate $U \to L_t$	Vacancy filling rate $V \to L$	Vacancy filling rate $V \to L_p$	Vacancy filling rate $V \to L_t$	Separation rate $L_p \to U$	Separation rate $L_t \to U$	Conversion rate $L_t \to L_p$
	General equilibrium								
Small firm-Young	-1.7493	-1.7493	-1.7493	1.7804	1.7804	1.7804	-3.9604	-1.5193	3.4746
Small firm-Old	-1.8720	-1.8720	-1.8720	1.9077	1.9077	1.9077	-3.9604	-1.5193	3.4746
Large firm-Young	17.0456	183.9925	-51.6036	-14.5632	107.2986	-64.6734	-3.9604	-1.5193	3.4746
Large firm-Old	-2.0624	-2.0624	-2.0624	2.1058	2.1058	2.1058	-3.9604	-1.5193	3.4746
	Partial equilibrium								
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	20.3988	192.1283	-50.2172	-16.9427	101.5253	-65.6572	0	0	0
Large firm-Old	0	0	0	0	0	0	0	0	0

Notes: This table displays the impact of the reform estimated from the structural model on worker flows. All figures are variations in percentage between the pre-reform and the post-reform steady states flow rates. $U \to X$ is the percentage change in the exit rate from unemployment to $X = L, L_p, L_t$. A similar notation applies to separation rates. $V \to X$ is the percentage change in the vacancy filling rate with any type of job ($X = L$), a permanent job ($X = L_p$) or a temporary job ($X = L_t$). "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types. To avoid complexities in the interpretation of the results due to composition effects induced by the reallocation of jobs across establishment types, changes in vacancy rates, separation rates and conversion rates are reported for a single value of the establishment productivity parameter z, equal to the median value of z of the young establishments of large firms.

Table 14: Welfare effects of the reform

	W_p	W_t	W_u
Establishment type			
Small firm-Young	-1.14	-0.60	
Small firm-Old	-0.44	-0.60	
Large firm-Young	13.27	-0.73	
Large firm-Old	0.18	-0.65	
Total	-0.07	-0.80	-0.73

Notes: This table displays the welfare impact of the reform estimated from the structural model. Figures report the changes in the average welfare of different categories of workers by establishment type. All figures are variations in percentage between the pre-reform and the post-reform steady states. W_u stands for the discounted expected utility of unemployed workers defined by equation (4), W_p is the welfare of permanent workers and W_t denotes the welfare of temporary workers. W_p and W_t are defined in Appendix C.7. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types.

Table 15: Employment effects assuming that the reform applies to all firms

	Stock			Net Inflows			Ouflows		Conversions
	L	L_p	L_t	$U \to L$	$U \to L_p$	$U \to L_t$	$L_p \to U$	$L_t \to U$	$L_t \to L_p$
Establishment type									
					General equilibrium				
Small firm-Young	−21.8581	−15.4142	−33.7271	−21.4186	−1.4742	−33.7271	−46.8884	−33.5208	−33.7539
Small firm-Old	1.3683	0.7499	9.1244	9.1145	9.1128	9.1244	−40.1243	9.2668	9.1059
Large firm-Young	−46.4468	−33.4947	−74.8166	−45.5147	−12.9923	−74.8166	−61.3077	−74.5858	−74.8716
Large firm-Old	−0.9892	−1.9040	11.6777	11.6565	11.6593	11.6777	−50.0691	11.9027	11.6240
All	−0.4491	−0.3063	−1.8833	1.8303	6.8501	−1.8833	−50.4812	−2.0236	−1.8639
					Partial equilibrium				
Small firm-Young	−28.1621	−22.2356	−39.0781	−27.7578	−9.4221	−39.0781	4.1085	−38.9611	−39.0932
Small firm-Old	−7.0396	−7.6008	0	0	0	0	−3.2139	0	0
Large firm-Young	−50.6065	−38.6600	−76.7740	−49.7469	−19.7527	−76.7740	−22.4489	−76.5897	−76.8178
Large firm-Old	−10.9923	−11.7861	0	0	0	0	−6.3190	0	0
All	−8.8593	−8.7256	−10.2022	−6.7984	−2.2165	−10.2022	−7.3070	−10.5480	−10.1544

Notes: This table displays the impact of the reform simulated from the structural model assuming that the reform applies to all firms. All figures are variations in percentage between the pre-reform and the post-reform steady states except for rows $\hat{\alpha}_1$ and $\widehat{Bias}$ which report values defined by equation (19). L is total employment, L_p is permanent employment, L_t is temporary employment. $U \to X$ is the percentage change in the number of net entries into $X = L, L_p, L_t$ over periods of two years. A similar notation applies to outflows from employment. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types. Rows "All" report the evaluation of the impact of the reform on aggregate outcomes, computed by aggregating the reaction of old and young establishments of large and small firms. Figures account for the variation in the number of establishments of firms. Hence, -21.8581 in the first row, first column, means that employment (including temporary and permanent jobs) of all young establishments of small firms decreased by 21.8581% on average in general equilibrium. Panel "Partial equilibrium" reports results assuming that the value of unemployment, W_u is constant.

Table 16: Welfare effects assuming that the reform applies to all firms

	W_p	W_t	W_u
Establishment type			
Small firm-Young	4.72	−4.45	
Small firm-Old	−3.04	−4.42	
Large firm-Young	−3.19	−4.87	
Large firm-Old	−3.58	−4.80	
Total	−3.02	−6.22	−5.39

Notes: This table displays the welfare impact of the reform estimated from the structural model assuming that the reform applies to all firms. Figures report the changes in the average welfare of different categories of workers by establishment type. All figures are variations in percentage between the pre-reform and the post-reform steady states. W_u stands for the discounted expected utility of unemployed workers defined equation by (4), W_p is the welfare of permanent workers and W_t denotes the welfare of temporary workers. W_p and W_t are defined in Appendix C.7. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types.

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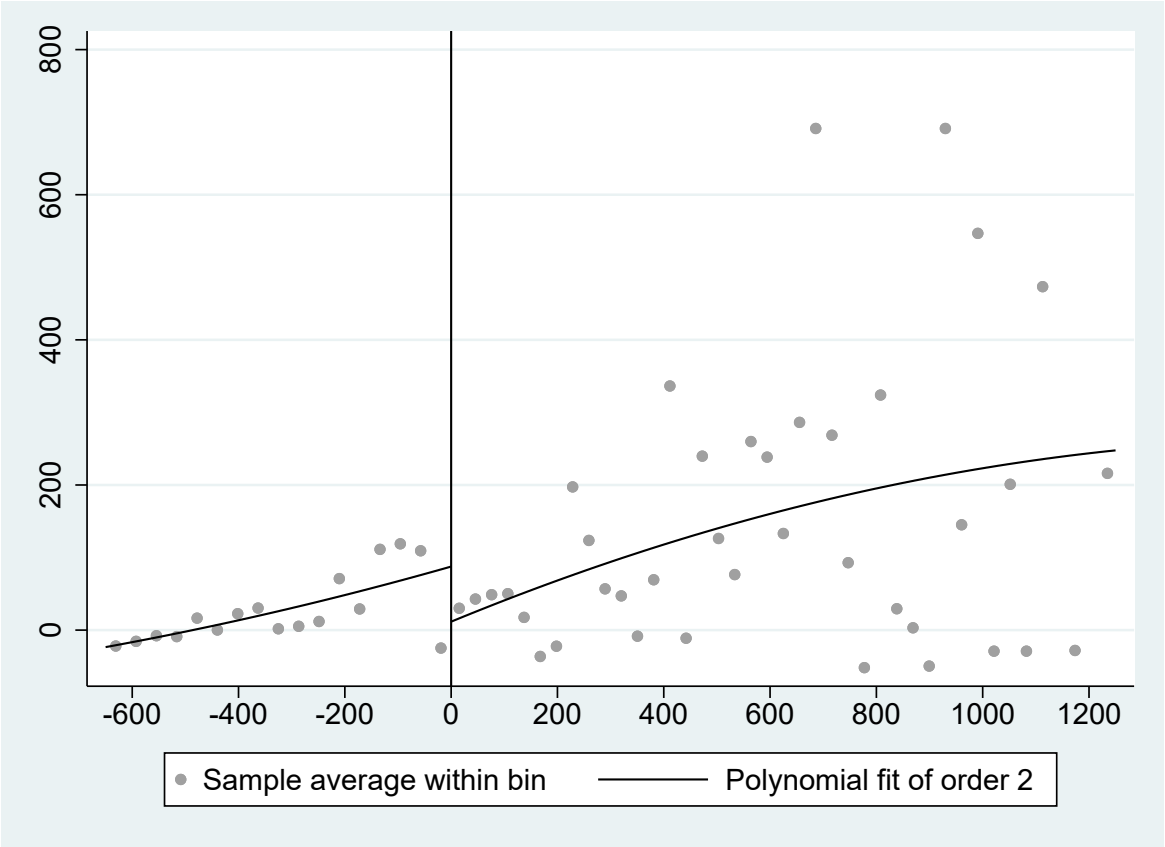
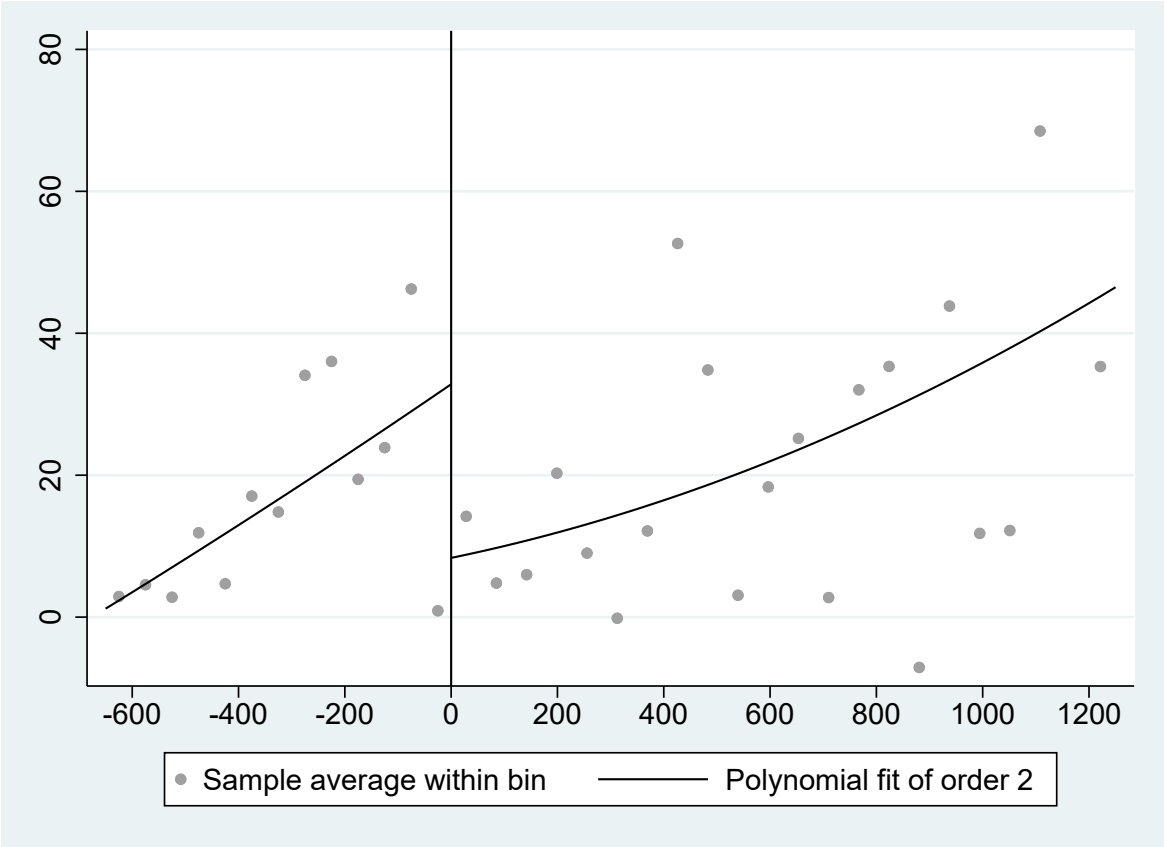
A Supplementary figures and tables

Figure A.1: **Workers in new establishments in 2010**



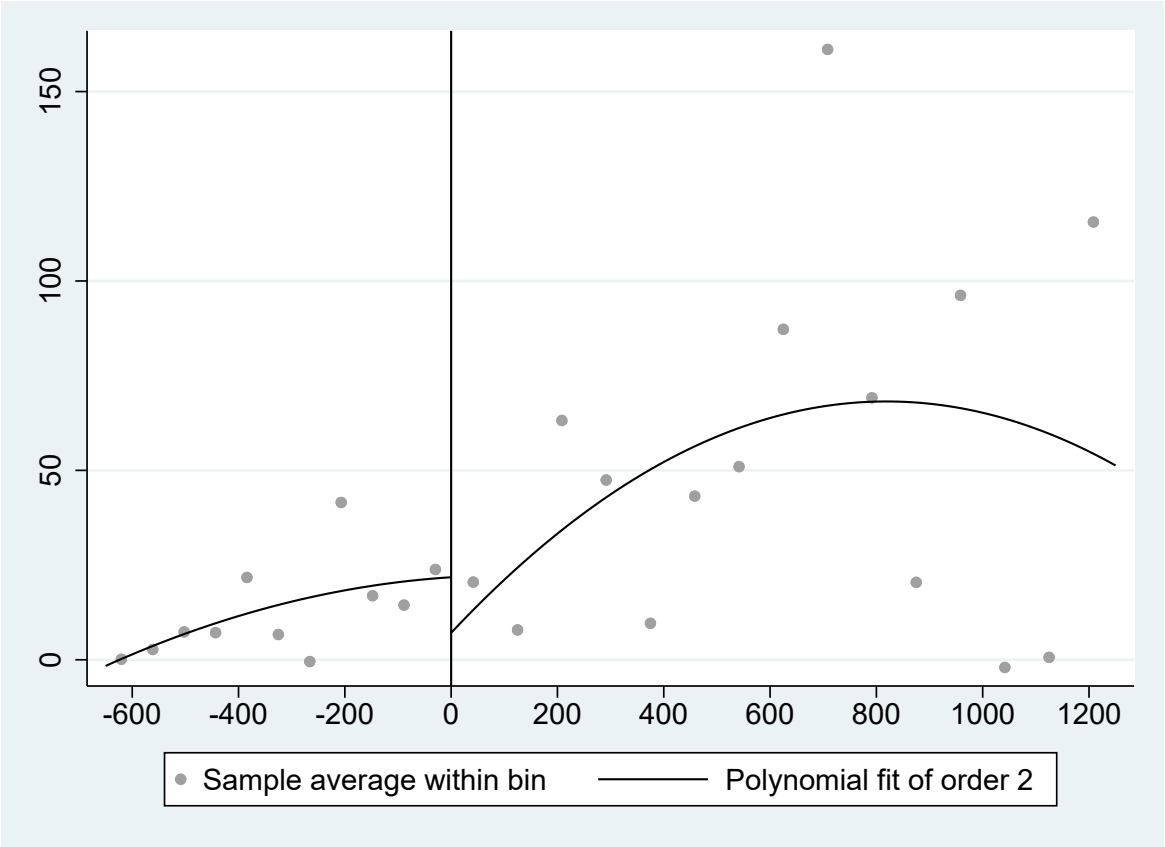
Notes: Outcome variable: total employment-month-hours (divided by 1,000) of all workers in new establishments. Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data.

Figure A.2: **Effects on fixed-term contracts in new establishments (Intensive margin only)**



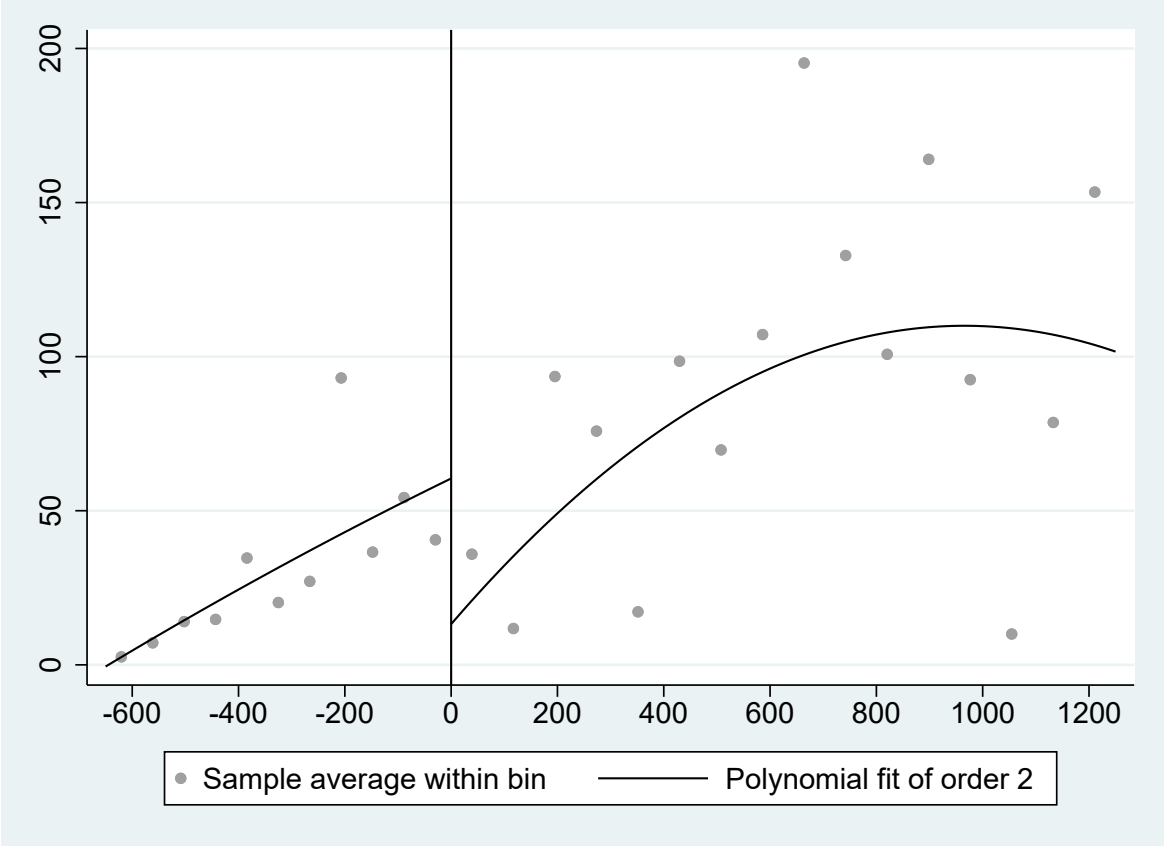
Notes: Outcome variable: total employment-month-hours (divided by 1,000) of new fixed-term contracts in new establishments, considering only firms that opened at least one new establishment from 2009. (New employment contracts are those created from March 2009.) Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data.

Figure A.3: **Effects on permanent contracts in new establishments (Intensive margin only)**



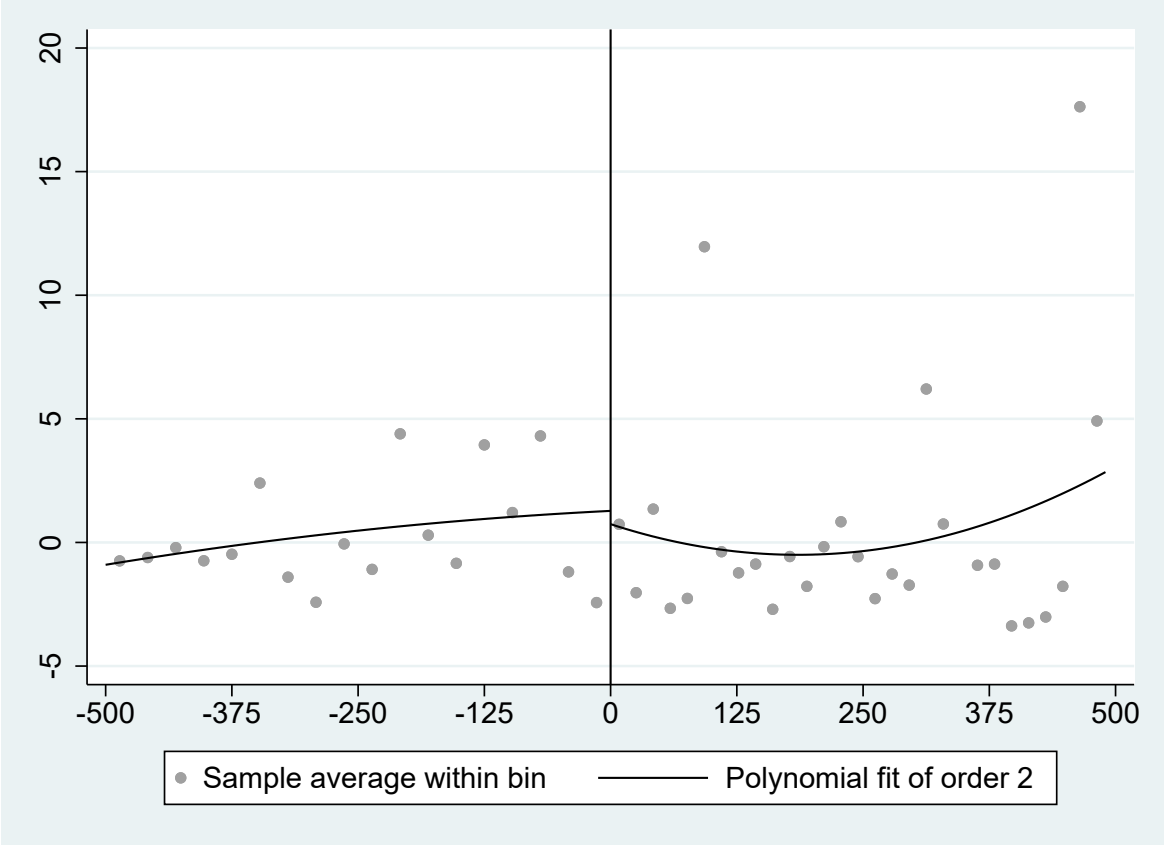
Notes: Outcome variable: total employment-month-hours (divided by 1,000) of new permanent contracts in new establishments, considering only firms that opened at least one new establishment from 2009. (New employment contracts are those created from March 2009.) Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data.

Figure A.4: **Effects on both fixed-term and permanent contracts in new establishments (Intensive margin only)**



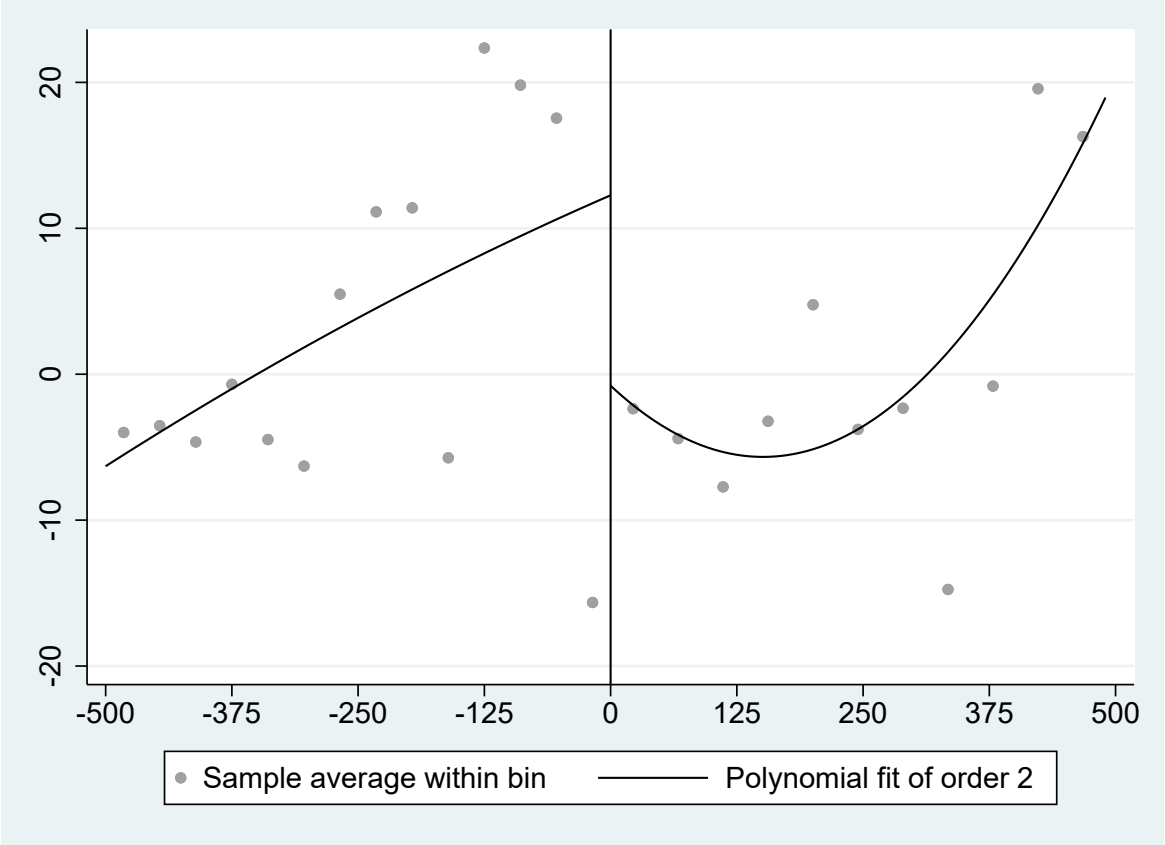
Notes: Outcome variable: total employment-month-hours (divided by 1,000) of new fixed-term and permanent contracts in new establishments, considering only firms that opened at least one new establishment from 2009. (New employment contracts are those created from March 2009.) Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data.

Figure A.5: **New establishments by 2010, shorter range**



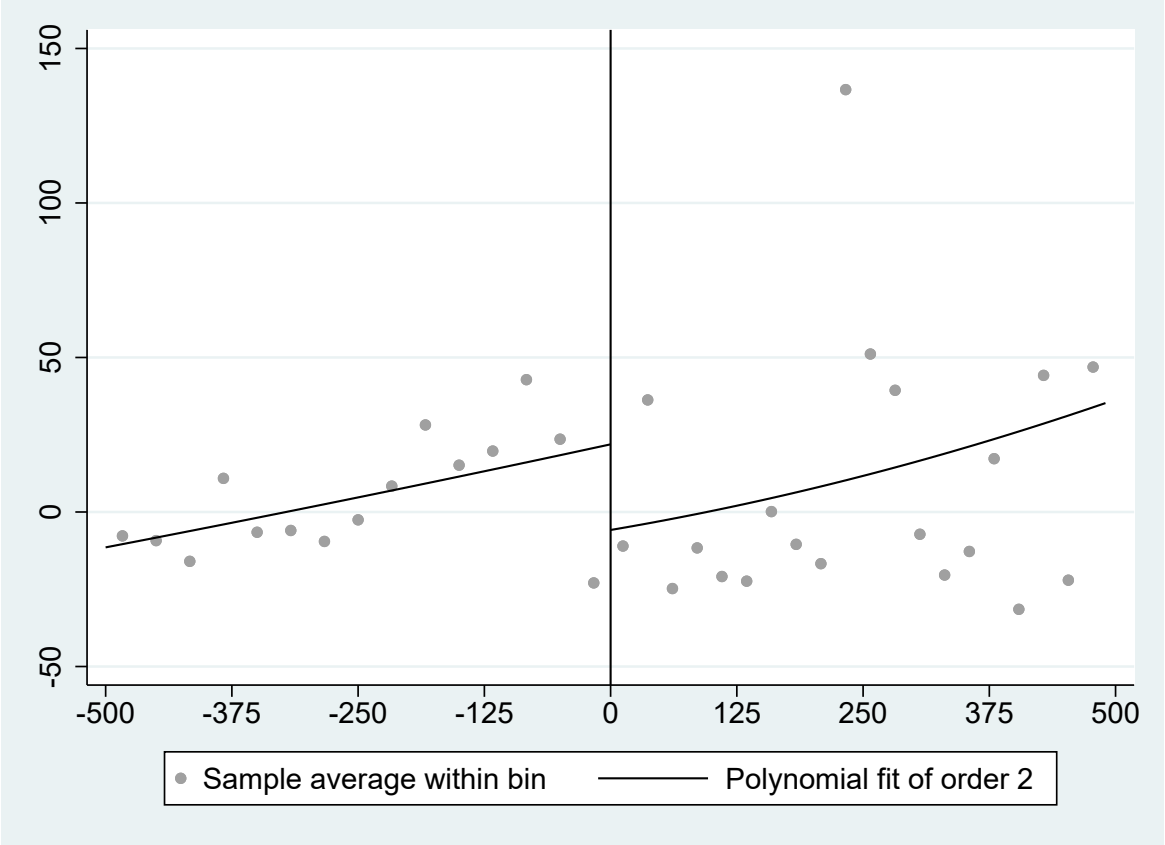
Notes: Dependent variable: number of new establishments (created in 2009 or 2010) by firms of different sizes (total number of employees) in 2008. Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data.

Figure A.6: **New hires under fixed-term contracts in new establishments, shorter firm size range**



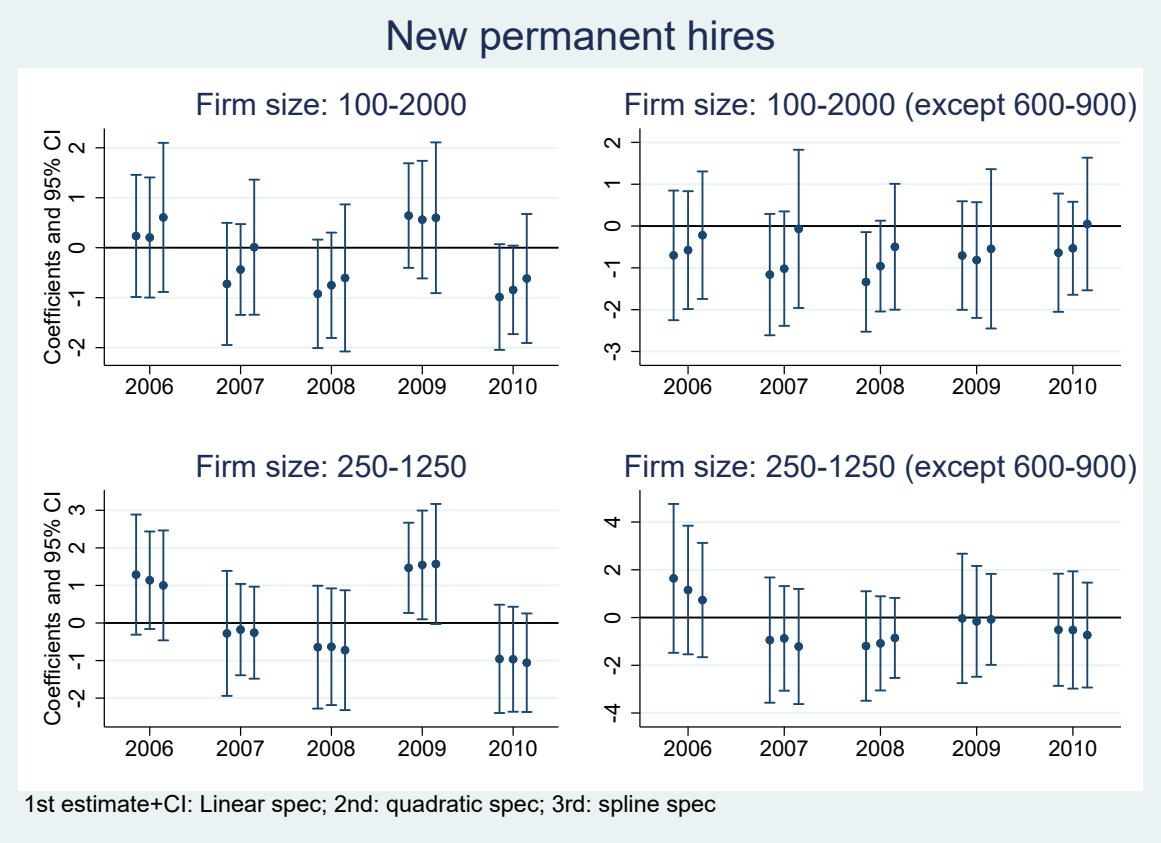
Notes: Dependent variable: total employment-month-hours (divided by 1,000) of new fixed-term contracts in new establishments. (New employment contracts are those created from March 2009.) Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Firm size is centered at 750 employees. Own calculations using 'Quadros de Pessoal' data.

Figure A.7: **New hires under fixed-term and permanent contracts in new establishments, shorter firm size range**



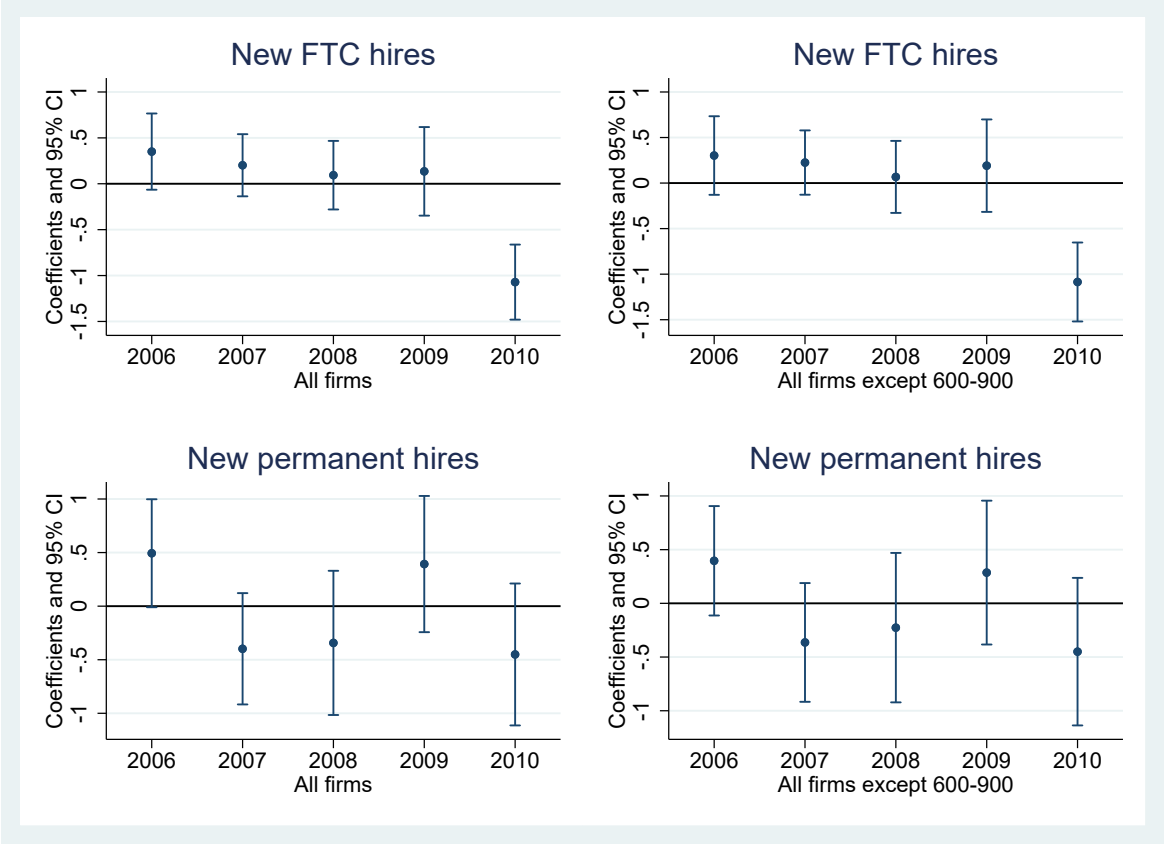
Notes: Dependent variable: total employment-month-hours (divided by 1,000) of new fixed-term and permanent contracts in new establishments. Firm size is centered at 750 employees. (New employment contracts are those created from March 2009.) Data obtained following controlling for ten one-digit industry effects and 0.1% winsorizing. Own calculations using 'Quadros de Pessoal' data.

Figure A.8: **RDD estimates for the creation of permanent contracts for different years and different bandwidths**



Notes: Dependent variable: number of net creations of permanent contracts (weighted by hours) in new establishments from year $t-2$ to year t. Firms that do not open new establishments are considered as well, with a value of new hires of zero. RDD estimates from coefficient α_1 of equation (1) for different bandwidths and different years. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set.

Figure A.9: **Difference-in-Differences analysis, FTCs and permanent hires in new establishments, multiple years**



Notes: Each bar represents a set of difference-in-differences analyses over the period 2006-2010 (equation 2). The analysis compares new FTC hires in new establishments over two pairs of two years. The specification assigns treatment status to firms with at least 750 employees in the year before the second pair of years (similarly to the main RD analysis). For instance, the 2010 estimate follows from comparing new FTC hires in new establishments over 2009 and 2010 of each firm that employed 750 or more employees in 2008, on the one hand, and the new FTC hires in new establishments over 2007 and 2008 of the same firm, on the other hand. Specifications including firm fixed effects. The figure considers all firms (from one employee) in the base year (2004 to 2008), except firms with between 600 and 900 employees (in the cases indicated in the figure). Own calculations using 'Quadros de Pessoal' data.

Table A.1: Balancing tests 1/2

	(1)	(2)	(3)
Number of establishments			
Large firm	-3.565	-4.067	-4.113
	(3.388)	(4.222)	(3.968)
Firm size (centered)	.021	.021	.020
	(.003)***	(.005)***	(.017)
Const.	17.806	17.560	17.386
	(2.030)***	(1.608)***	(3.467)***
Obs.	2875	2875	2875
R^2	.187	.187	.187
Log sales per worker			
Large firm	-.281	-.305	-.274
	(.188)	(.197)	(.193)
Firm size (centered)	.0004	.0004	.001
	(.0002)**	(.0002)**	(.0007)
Const.	-3.294	-3.306	-3.172
	(.223)***	(.224)***	(.257)***
Obs.	2631	2631	2631
R^2	.234	.234	.234
Log capital per worker			
Large firm	-.578	-.555	-.502
	(.325)*	(.341)	(.344)
Firm size (centered)	.0004	.0003	.001
	(.0003)	(.0003)	(.001)
Const.	-4.348	-4.336	-4.156
	(.355)***	(.357)***	(.399)***
Obs.	2595	2595	2595
R^2	.155	.155	.155

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Regression of different variables regarding each firm as of October 2008. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. The first (second) column considers a linear (quadratic) specification in the running variable, while the third specification considers a linear specification including an interaction with the treatment variable (spline specification). Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.2: Balancing tests 2/2

	(1)	(2)	(3)
Lisbon headquarter			
Large firm	-.036	.001	-.020
	(.063)	(.065)	(.065)
Firm size (centered)	.0002	.0002	-.0002
	(.00005)***	(.00006)***	(.0002)
Const.	.669	.687	.608
	(.066)***	(.066)***	(.077)***
Obs.	2875	2875	2875
R^2	.152	.153	.154
Porto headquarter			
Large firm	.0004	-.001	-.005
	(.054)	(.055)	(.055)
Firm size (centered)	-7.91e-06	-6.43e-06	-.00008
	(.00005)	(.00005)	(.0002)
Const.	.124	.123	.109
	(.044)***	(.045)***	(.054)**
Obs.	2875	2875	2875
R^2	.016	.016	.016
Braga headquarter			
Large firm	-.002	-.022	-.018
	(.033)	(.031)	(.030)
Firm size (centered)	-.00003	-7.55e-06	.00007
	(.00003)	(.00003)	(.0001)
Const.	.025	.015	.029
	(.027)	(.027)	(.034)
Obs.	2875	2875	2875
R^2	.066	.067	.067
Workers' age			
Large firm	-2.918	-4.955	-6.457
	(5.065)	(5.078)	(4.761)
Firm size (centered)	-.002	.00004	-.030
	(.004)	(.004)	(.021)
Const.	44.183	43.186	37.539
	(4.634)***	(4.759)***	(5.841)***
Obs.	2875	2875	2875
R^2	.078	.078	.079

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Regression of different variables regarding each firm as of October 2008. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. The first (second) column considers a linear (quadratic) specification in the running variable, while the third specification considers a linear specification including an interaction with the treatment variable (spline specification). Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.3: Effects on permanent contracts in new establishments, establishment-level analysis

	(1)	(2)	(3)
Large firm	-.561	-.268	-.005
	(2.667)	(2.764)	(2.878)
Firm size (centered)	.004	.004	.006
	(.002)*	(.002)**	(.002)***
Firm size^2		-2.47e-06	
		(1.99e-06)	
Firm size*Large firm			-.005
			(.004)
Const.	2.830	3.680	3.914
	(1.160)**	(1.101)***	(1.229)***
Obs.	7610	7610	7610
R^2	.02	.02	.02

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all (2009-2010) new establishments of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Linear regression of new hires in permanent contracts in each new establishment of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.4: Effects on fixed-term and permanent contracts in new establishments, establishment-level analysis

	(1)	(2)	(3)
Large firm	-3.571	-2.994	-2.350
	(3.215)	(3.287)	(3.347)
Firm size (centered)	.007	.007	.011
	(.003)**	(.002)***	(.003)***
Firm size^2		-4.85e-06	
		(2.42e-06)**	
Firm size*Large firm			-.010
			(.005)**
Const.	6.377	8.046	8.753
	(1.671)***	(1.741)***	(1.957)***
Obs.	7610	7610	7610
R^2	.014	.016	.016

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all (2009-2010) new establishments of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Linear regression of new hires in fixed-term and permanent contracts in each new establishment of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.5: Effects on total employment of old establishments of large firms

	(1)	(2)	(3)
Large firm	-4.062	8.314	4.004
	(25.898)	(34.788)	(34.928)
Firm size (centered)	-.054	-.066	-.041
	(.032)*	(.045)	(.018)**
Firm size^2		-.00004	
		(.00006)	
Firm size*Large firm			-.047
			(.103)
Const.	-36.675	-30.617	-29.527
	(17.367)**	(11.770)***	(11.197)***
Obs.	2875	2875	2875
R^2	.034	.037	.035

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Regression of the difference in total employment in 2010 with respect to total employment of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.6: Effects on fixed-term contracts in all (continuing and new) establishments

	(1)	(2)	(3)
Large firm	-.858	-.680	-.534
	(.298)***	(.174)***	(.169)***
Firm size (centered)	.002	.002	.003
	(.0002)***	(.0002)***	(.0002)***
Firm size^2		-1.60e-06	
		(1.79e-07)***	
Firm size*Large firm			-.003
			(.0003)***
Const.	4.205	4.725	4.871
	(.204)***	(.182)***	(.185)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Poisson regression of the number of new fixed-term contracts in all (continuing and new) establishments, as measured in October 2010. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects, capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables (Lisbon, Porto and Braga). Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.7: Effects on fixed-term and permanent contracts in all (continuing and new) establishments

	(1)	(2)	(3)
Large firm	-.588	-.667	-.524
	(.239)**	(.144)***	(.134)***
Firm size (centered)	.002	.002	.003
	(.0002)***	(.0001)***	(.0002)***
Firm size^2		-1.43e-06	
		(1.29e-07)***	
Firm size*Large firm			-.003
			(.0002)***
Const.	4.665	5.248	5.379
	(.163)***	(.153)***	(.158)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Poisson regression of the number of new fixed-term and permanent contracts in all (continuing and new) establishments, as measured in October 2010. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects, capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables (Lisbon, Porto and Braga). Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.8: Robustness: Effects on the number of new establishments per firm (additional controls)

	(1)	(2)	(3)
Large firm	-.653	-.609	-.807
	(.441)	(.361)*	(.286)***
Firm size (centered)	.0007	.0008	-.0002
	(.0004)	(.0004)*	(.001)
Firm size^2		-1.05e-06	-2.21e-06
		(4.12e-07)**	(1.62e-06)
Firm size*Large firm			.002
			(.003)
Const.	.706	1.069	.926
	(.296)**	(.251)***	(.326)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Poisson regression of the number of new establishments (created in 2009 and 2010) of each firm, as measured in October 2010. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects, capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables (Lisbon, Porto and Braga). Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.9: Robustness: Effects on fixed-term contracts in new establishments (additional controls)

	(1)	(2)	(3)
Large firm	-1.796	-1.343	-1.300
	(.445)***	(.367)***	(.346)***
Firm size (centered)	.002	.002	.002
	(.0004)***	(.0004)***	(.001)**
Firm size^2		-1.02e-06	-7.59e-07
		(3.65e-07)***	(1.34e-06)
Firm size*Large firm			-.0005
			(.002)
Const.	2.613	2.815	2.843
	(.424)***	(.423)***	(.447)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in fixed-term contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. Tenure- and hours-weighted employment measure. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects, capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables (Lisbon, Porto and Braga). Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.10: Robustness: Effects on permanent contracts in new establishments (additional controls)

	(1)	(2)	(3)
Large firm	-.756	-.841	-.954
	(.606)	(.443)*	(.514)*
Firm size (centered)	.002	.003	.002
	(.0005)***	(.0004)***	(.002)
Firm size^2		-1.24e-06	-2.35e-06
		(4.02e-07)***	(2.01e-06)
Firm size*Large firm			.002
			(.004)
Const.	1.673	2.224	2.087
	(.416)***	(.418)***	(.515)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in permanent contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects, capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables (Lisbon, Porto and Braga). Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.11: Robustness: Effects on both fixed-term and permanent contracts in new establishments (additional controls)

	(1)	(2)	(3)
Large firm	-1.180	-1.021	-1.084
	(.438)***	(.332)***	(.372)***
Firm size (centered)	.002	.003	.002
	(.0003)***	(.0003)***	(.001)**
Firm size^2		-1.08e-06	-1.56e-06
		(2.97e-07)***	(1.36e-06)
Firm size*Large firm			.0009
			(.002)
Const.	2.938	3.308	3.253
	(.369)***	(.367)***	(.410)***
Obs.	2875	2875	2875

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Poisson regression of new hires in both fixed-term and permanent contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects, capital equity, foreign ownership share, domestic private ownership share, sales, number of establishments, firm age, and three regional dummy variables (Lisbon, Porto and Braga). Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.12: Robustness: Effects on fixed-term contracts in new establishments with Calonico et al. (2017)' optimal bandwidth determination method

	(1)	(2)	(3)
Large firm	-.889	-.881	-1.055
	(.454)*	(.450)*	(.474)**
Firm size (centered)	.0007	.0007	.0004
	(.001)	(.002)	(.002)
Firm size^2		-2.01e-07	
		(6.55e-06)	
Firm size*Large firm			.002
			(.003)
Const.	-1.632	-1.632	-1.706
	(.938)*	(.938)*	(.950)*
Obs.	261	261	261

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal in a bandwidth of 283 employees around the cut-off size of 750 workers in October 2008. Poisson regression of new hires in fixed-term contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. Tenure- and hours-weighted employment measure. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.13: Robustness: Effects on both fixed-term and permanent contracts in new establishments with Calonico et al. (2017)' optimal bandwidth determination method

	(1)	(2)	(3)
Large firm	-1.165	-1.376	-1.491
	(.494)**	(.635)**	(.731)**
Firm size (centered)	.003	.004	.002
	(.001)**	(.002)**	(.001)
Firm size^2		5.57e-06	
		(5.29e-06)	
Firm size*Large firm			.005
			(.003)
Const.	-.860	-.923	-1.115
	(.672)	(.664)	(.672)*
Obs.	261	261	261

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal in a bandwidth of 283 employees around the cut-off size of 750 workers in October 2008. Poisson regression of new hires in both fixed-term and permanent contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.14: Robustness: DID analysis

	2006	2007	2008	2009	2010
FTC new hires, All firms					
After	-.355	.243	7.487	7.009	-6.946
	(.046)***	(.043)***	(.042)***	(.039)***	(.032)***
After*Treated	.350	.202	.094	.135	-1.071
	(.212)*	(.173)	(.190)	(.246)	(.209)***
Obs.	15878	19484	22476	26396	32924
FTC new hires, All firms (except 600-900)					
After	-.345	.244	7.497	7.015	-6.949
	(.045)***	(.043)***	(.042)***	(.039)***	(.031)***
After*Treated	.302	.225	.068	.191	-1.086
	(.220)	(.180)	(.202)	(.259)	(.221)***
Obs.	15772	19362	22354	26270	32778
Permanent new hires, All firms					
After	-.244	.292	.684	.137	.359
	(.078)***	(.057)***	(.055)***	(.047)***	(.045)***
After*Treated	.494	-.398	-.343	.393	-.451
	(.257)*	(.265)	(.343)	(.324)	(.338)
Obs.	14752	17662	20042	24276	33700
Permanent new hires, All firms (except 600-900)					
After	-.249	.288	.662	.193	.357
	(.079)***	(.057)***	(.052)***	(.040)***	(.043)***
After*Treated	.396	-.364	-.226	.286	-.450
	(.260)	(.282)	(.355)	(.342)	(.350)
Obs.	14650	17558	19938	24156	33550

Notes: The columns present different estimates of a difference-in-differences model, covering two sets of two years each, over the period 2006-2010. The main sample used is composed of all firms in Portugal that can be followed over two periods of two years each. In two cases, firms with a size of between 600 and 900 employees in some cases. Own calculations based on the QP data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.15: Robustness: spillover effects, different region definition

	(1)	(2)	(3)
Large firm	.032	.044	.673
	(.020)	(.022)**	(.238)***
Firm size	.00003	.00002	.00004
	(.00002)	(.00002)	(.00002)**
Firm size^2		-4.82e-08	
		(2.17e-08)**	
Firm size*Large firm			-.00005
			(.00004)
Firm (1-99) size	.042	.097	.042
	(.0001)***	(.0003)***	(.0001)***
Firm (1-99) size^2		-.0007	
		(4.06e-06)***	
Firm (1-99) size*Large firm			.0009
			(.0003)***
Const.	7.051	6.635	7.060
	(.010)***	(.011)***	(.011)***
Obs.	1.62e+07	1.62e+07	1.62e+07

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all dyads of firms in Portugal employing between 100 and 2000 workers in October 2008 and firms employing between 1 and 100 workers that operate in the same one-digit industry and region ('distrito'). Poisson regression of new hires in both fixed-term and permanent contracts in each 1-99 firm by October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the 100-2000 firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for 100-2000 firms employing 750 or more workers in 2008. Standard errors clustered at the 100-2000 firm identifier. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.16: Robustness: spillover effects, wider small firm definition (1)

	(1)	(2)	(3)
Large firm	.072	.069	-.125
	(.035)**	(.033)**	(.131)
Firm size	-.00002	-4.51e-06	1.00e-05
	(.00003)	(.00003)	(.00003)
Firm size^2		-9.03e-08	
		(2.95e-08)***	
Firm size*Large firm			-.00009
			(.00006)
Firm (1-249) size	.019	.050	.019
	(.00005)***	(.0002)***	(.00005)***
Firm (1-249) size^2		-.0002	
		(1.12e-06)***	
Firm (1-249) size*Large firm			-.0003
			(.0002)
Const.	7.471	7.088	7.485
	(.016)***	(.017)***	(.020)***
Obs.	3020002	3020002	3020002

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all dyads of firms in Portugal employing between 250 and 2000 workers in October 2008 and firms employing between 1 and 249 workers that operate in the same one-digit industry and region ('concelho'). Poisson regression of new hires in both fixed-term and permanent contracts in each 1-249 firm by October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the 250-2000 firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for 250-2000 firms employing 750 or more workers in 2008. Standard errors clustered at the 250-2000 firm identifier. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.17: Robustness: spillover effects, wider small firm definition (2)

	(1)	(2)	(3)
Large firm	.140	.091	.171
	(.054)***	(.051)*	(.104)
Firm size	-.00008	-.00005	-.0005
	(.00007)	(.0001)	(.0004)
Firm size^2		-3.55e-08	
		(1.13e-07)	
Firm size*Large firm			.0004
			(.0004)
Firm (1-500) size	.011	.028	.011
	(.00006)***	(.0003)***	(.00008)***
Firm (1-500) size^2		-.00004	
		(6.59e-07)***	
Firm (1-500) size*Large firm			-.00003
			(.0001)
Const.	7.671	7.354	7.616
	(.025)***	(.026)***	(.059)***
Obs.	456167	456167	456167

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all dyads of firms in Portugal employing between 500 and 2000 workers in October 2008 and firms employing between 1 and 499 workers that operate in the same one-digit industry and region ('concelho'). Poisson regression of new hires in both fixed-term and permanent contracts in each 1-499 firm by October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the 500-2000 firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for 500-2000 firms employing 750 or more workers in 2008. Standard errors clustered at the 500-2000 firm identifier. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table A.18: Reform impact computed from general equilibrium, partial equilibrium and reduced form estimates assuming SUTVA with the value of $\hat{\alpha}_1 = -1.961$ reported in Column (1) of Table 2

	Stock			Net Inflows			Ouflows		Conversions
	L	L_p	L_t	$U \to L$	$U \to L_p$	$U \to L_t$	$L_p \to U$	$L_t \to U$	$L_t \to L_p$
Establishment type									
					General equilibrium				
Small firm-Young	1.4063	1.4055	1.4080	1.4063	1.4058	1.4080	−5.7886	1.4301	1.4051
Small firm-Old	1.3723	1.3730	1.3628	1.3614	1.3611	1.3628	−2.2891	1.3833	1.3601
Large firm-Young	−57.5195	−44.6364	−85.7385	−56.5925	−24.2531	−85.7385	−33.5867	−85.5940	−85.7730
Large firm-Old	−11.1751	−12.1071	1.7302	1.7274	1.7280	1.7302	−11.2565	1.7623	1.7226
All	−0.1125	−0.0937	−0.3016	0.2075	0.8143	−0.3016	−12.4783	−1.2488	−0.1704
					Partial equilibrium				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−57.9971	−45.2588	−85.8989	−57.0805	−25.1049	−85.8989	−27.3002	−85.7584	−85.9324
Large firm-Old	−12.6261	−13.5380	0	0	0	0	−7.4269	0	0
All	−1.4889	−1.4703	−1.6761	−1.1729	−0.5760	−1.6761	−8.5270	−2.6454	−1.5419
					Impact computed from reduced form estimates wrongly assuming SUTVA				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−58.1087	−45.4037	−85.9366	−57.1944	−25.3032	−85.9366	−29.5062	−85.7972	−85.9701
Large firm-Old	−12.3775	−13.2975	0.3625	0.3611	0.3619	0.3625	−9.1774	0.3738	0.3576
All	−1.4667	−1.4482	−1.6520	−1.1480	−0.5485	−1.6520	−10.2393	−2.6061	−1.5201
					Reduced form estimates for young establishments of large firms				
$\hat{\alpha}_1$	−0.8701	−0.6052	−1.9616	−0.8485	−0.2917	−1.9616	−0.3496	−1.9517	−1.9640
$\widehat{Bias}$	−0.0140	−0.0140	−0.0140	−0.0140	−0.0140	−0.0140	0.0596	−0.0142	−0.0140
					Reduced form estimates for old establishments of large firms				
$\hat{\alpha}_1$	−0.1321	−0.1427	0.0036	0.0036	0.0036	0.0036	−0.0963	0.0037	0.0036
$\widehat{Bias}$	−0.0136	−0.0136	−0.0135	−0.0135	−0.0135	−0.0135	0.0232	−0.0137	−0.0135

Notes: This table displays the impact of the reform estimated from the structural model and from the reduced form estimates with the value of $\hat{\alpha}_1 = -1.961$ reported in Column (1) of Table 2 instead of $\hat{\alpha}_1 = -1.46$ reported in Column (2) of Table 11. Other values of $\hat{\alpha}_1$ reported in the table are simulated as explained in Section 7.2.1. All figures are variations in percentage between the pre-reform and the post-reform steady states except for rows $\hat{\alpha}_1$ and $\widehat{Bias}$ which report values defined by equation (19). L is total employment, L_p is permanent employment, L_t is temporary employment. $U \to X$ is the percentage change in the number of net entries into $X = L, L_p, L_t$ over periods of two years. A similar notation applies to outflows from employment. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types. Rows "All" report the evaluation of the impact of the reform on aggregate outcomes, computed by aggregating the reaction of old and young establishments of large and small firms. Figures account for the variation in the number of establishments of firms. Hence, 1.4063 in the first row, first column, means that employment (including temporary and permanent jobs) of all young establishments of small firms increased by 1.4063% on average. $\hat{\alpha}_1$ is the reduced form estimate assuming SUTVA computed from equation (19) and $\widehat{Bias}$ is the bias in the estimate defined in the same equation. Panel "Partial equilibrium" reports results assuming that the value of unemployment, W_u is constant. Panel "Impact computed from reduced from estimates wrongly assuming SUTVA" reports the evaluation of the impact of the reform computed by applying $\hat{\alpha}_1$, assuming that the control group for young establishments of large firms are the young establishments of small firms and that the control group for old establishments of large firms are the old establishments of small firms.

Table A.19: Reform impact computed from general equilibrium, partial equilibrium and reduced form estimates with the value of $\hat{\alpha}_1 = -1.314$ reported in Column (3) of Table 2

	Stock			Net Inflows			Ouflows		Conversions
	L	L_p	L_t	$U \to L$	$U \to L_p$	$U \to L_t$	$L_p \to U$	$L_t \to U$	$L_t \to L_p$
Establishment type									
					General equilibrium				
Small firm-Young	1.1518	1.1511	1.1531	1.1518	1.1513	1.1531	−4.7189	1.1713	1.1508
Small firm-Old	1.1239	1.1245	1.1162	1.1150	1.1148	1.1162	−1.8082	1.1330	1.1140
Large firm-Young	−47.2276	−35.5463	−72.8140	−46.3870	−17.0562	−72.8140	−26.9211	−72.6120	−72.8621
Large firm-Old	−9.1455	−9.9083	1.4167	1.4144	1.4148	1.4167	−8.8034	1.4429	1.4104
All	−0.0921	−0.0717	−0.2976	0.1692	0.7313	−0.2976	−9.8062	−1.1002	−0.1864
					Partial equilibrium				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−47.7854	−36.2275	−73.1016	−46.9537	−17.9333	−73.1016	−20.8801	−72.9064	−73.1481
Large firm-Old	−10.3712	−11.1202	0	0	0	0	−5.9135	0	0
All	−1.2238	−1.2037	−1.4264	−0.9648	−0.4114	−1.4264	−6.7291	−2.2489	−1.3125
					Impact computed from reduced form estimates wrongly assuming SUTVA				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−47.8285	−36.2798	−73.1239	−46.9974	−18.0003	−73.1239	−23.3018	−72.9291	−73.1708
Large firm-Old	−10.1553	−10.9101	0.2972	0.2960	0.2967	0.2972	−7.1241	0.3065	0.2932
All	−1.2042	−1.1841	−1.4065	−0.9433	−0.3867	−1.4065	−7.9764	−2.2164	−1.2945
					Reduced form estimates for young establishments of large firms				
$\hat{\alpha}_1$	−0.6506	−0.4507	−1.3139	−0.6348	−0.1985	−1.3139	−0.2653	−1.3067	−1.3157
$\widehat{Bias}$	−0.0115	−0.0114	−0.0115	−0.0115	−0.0114	−0.0115	0.0483	−0.0116	−0.0114
					Reduced form estimates for old establishments of large firms				
$\hat{\alpha}_1$	−0.1071	−0.1155	0.0030	0.0030	0.0030	0.0030	−0.0739	0.0031	0.0029
$\widehat{Bias}$	−0.0112	−0.0112	−0.0111	−0.0111	−0.0111	−0.0111	0.0182	−0.0113	−0.0111

Notes: This table displays the impact of the reform estimated from the structural model and from the reduced form estimates with the value of $\hat{\alpha}_1 = -1.314$ reported in Column (3) of Table 2 instead of $\hat{\alpha}_1 = -1.46$ reported in Column (2) of Table 11. Other values of $\hat{\alpha}_1$ reported in the table are simulated as explained in Section 7.2.1. All figures are variations in percentage between the pre-reform and the post-reform steady states except for rows $\hat{\alpha}_1$ and $\widehat{Bias}$ which report values defined by equation (19). L is total employment, L_p is permanent employment, L_t is temporary employment. $U \to X$ is the percentage change in the number of net entries into $X = L, L_p, L_t$ over periods of two years. A similar notation applies to outflows from employment. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types. Rows "All" report the evaluation of the impact of the reform on aggregate outcomes, computed by aggregating the reaction of old and young establishments of large and small firms. Figures account for the variation in the number of establishments of firms. Hence, 1.1518 in the first row, first column, means that employment (including temporary and permanent jobs) of all young establishments of small firms increased by 1.1518% on average. $\hat{\alpha}_1$ is the reduced form estimate assuming SUTVA computed from equation (19) and $\widehat{Bias}$ is the bias in the estimate defined in the same equation. Panel "Partial equilibrium" reports results assuming that the value of unemployment, W_u is constant. Panel "Impact computed from reduced from estimates wrongly assuming SUTVA" reports the evaluation of the impact of the reform computed by applying $\hat{\alpha}_1$, assuming that the control group for young establishments of large firms are the young establishments of small firms and that the control group for old establishments of large firms are the old establishments of small firms.

Table A.20: Reform impact computed from general equilibrium, partial equilibrium and reduced form estimates with the value of $\hat{\alpha}_1 = -1.461$ reported in Column (2) of Table 2 assuming that large and small firms are hit differently by the 2009 recession

	Stock			Net Inflows			Ouflows		Conversions
	L	L_p	L_t	$U \to L$	$U \to L_p$	$U \to L_t$	$L_p \to U$	$L_t \to U$	$L_t \to L_p$
Establishment type									
					General equilibrium				
Small firm-Young	0.8434	0.8429	0.8442	0.8433	0.8431	0.8442	−5.7257	0.8561	0.8427
Small firm-Old	0.8223	0.8228	0.8163	0.8155	0.8154	0.8163	−5.1823	0.8273	0.8149
Large firm-Young	−42.8638	−30.0667	−70.8988	−41.9431	−9.7977	−70.8988	−14.8290	−70.6386	−70.9607
Large firm-Old	−8.3407	−9.0218	1.0687	1.0695	1.0724	1.0687	−10.2386	1.0885	1.0640
All	−0.0675	−0.0442	−0.3013	0.1224	0.6408	−0.3013	−10.3237	−0.9831	−0.2098
					Partial equilibrium				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−43.3149	−30.6187	−71.1287	−42.4014	−10.5103	−71.1287	−12.2748	−70.8753	−71.1890
Large firm-Old	−9.2758	−9.9473	0	0	0	0	−4.8854	0	0
All	−0.8978	−0.8748	−1.1287	−0.7087	−0.1965	−1.1287	−5.1653	−1.8252	−1.0353
					Impact computed from reduced form estimates wrongly assuming SUTVA				
Small firm-Young	0	0	0	0	0	0	0	0	0
Small firm-Old	0	0	0	0	0	0	0	0	0
Large firm-Young	−43.3416	−30.6512	−71.1424	−42.4286	−10.5518	−71.1424	−9.6562	−70.8878	−71.2033
Large firm-Old	−9.0883	−9.7642	0.2504	0.2519	0.2549	0.2504	−5.3326	0.2590	0.2471
All	−0.8838	−0.8608	−1.1149	−0.6937	−0.1789	−1.1149	−5.3857	−1.8019	−1.0228

Notes: This table displays the impact of the reform estimated from the structural model and from the reduced form estimates with the value of $\hat{\alpha}_1 = -1.461$ reported in Column (2) of Table 2 assuming that large and small firms are hit differently by the 2009 recession as explained in Appendix F. All figures are variations in percentage between the pre-reform and the post-reform steady states. L is total employment, L_p is permanent employment, L_t is temporary employment. $U \to X$ is the percentage change in the number of net entries into $X = L, L_p, L_t$ over periods of two years. A similar notation applies to outflows from employment. "Small firm-Young" stands for the young establishments created by small firms. A similar notation applies to other establishment types. Rows "All" report the evaluation of the impact of the reform on aggregate outcomes, computed by aggregating the reaction of old and young establishments of large and small firms. Figures account for the variation in the number of establishments of firms. Hence, 0.8434 in the first row, first column, means that employment (including temporary and permanent jobs) of all young establishments of small firms increased by 0.8434% on average. Panel "Partial equilibrium" reports results assuming that the value of unemployment, W_u is constant. Panel "Impact computed from reduced from estimates wrongly assuming SUTVA" reports the evaluation of the impact of the reform computed by applying $\hat{\alpha}_1$, assuming that the control group for young establishments of large firms are the young establishments of small firms and that the control group for old establishments of large firms are the old establishments of small firms.

B Outcome of subsidiaries and associated firms of large firms

This appendix is devoted to the analysis of the impact of the reform on the outcome of subsidiaries and associated firms of large firms

We first analyze this issue by displaying the distribution of firm size in 2010 on Figure B.1. We find again no evidence of bunching below the threshold of 750 employees. This result indicates that firms did not try to manipulate their size to evade the law reform, for instance by creating new affiliates (not considered for the firm size measurement in the law and also outside our main data set 'Quadros de Pessoal') when they were close to the critical size.

Second, we investigate if firms circumvented the reform by creating new firms or expanding existing firms that were originally part of the same holding group. We do this by merging to our data additional variables from a different data set, SCIE. This firm-level, yearly data set is compiled by Statistics Portugal (INE), including accounting and financial information on all firms in Portugal, and can be merged to QP through common firm identifiers. Specifically, we consider a variable in this data set indicating the 'gains and losses from subsidiaries and associated firms and joint activities' in 2010. While this variable does not indicate the number of such subsidiary firms or their number of employees, it provides information on the potential relevance of such affiliated firms. We then estimate similar regression discontinuity models as those used in our main specification, considering different transformations of this novel variable.

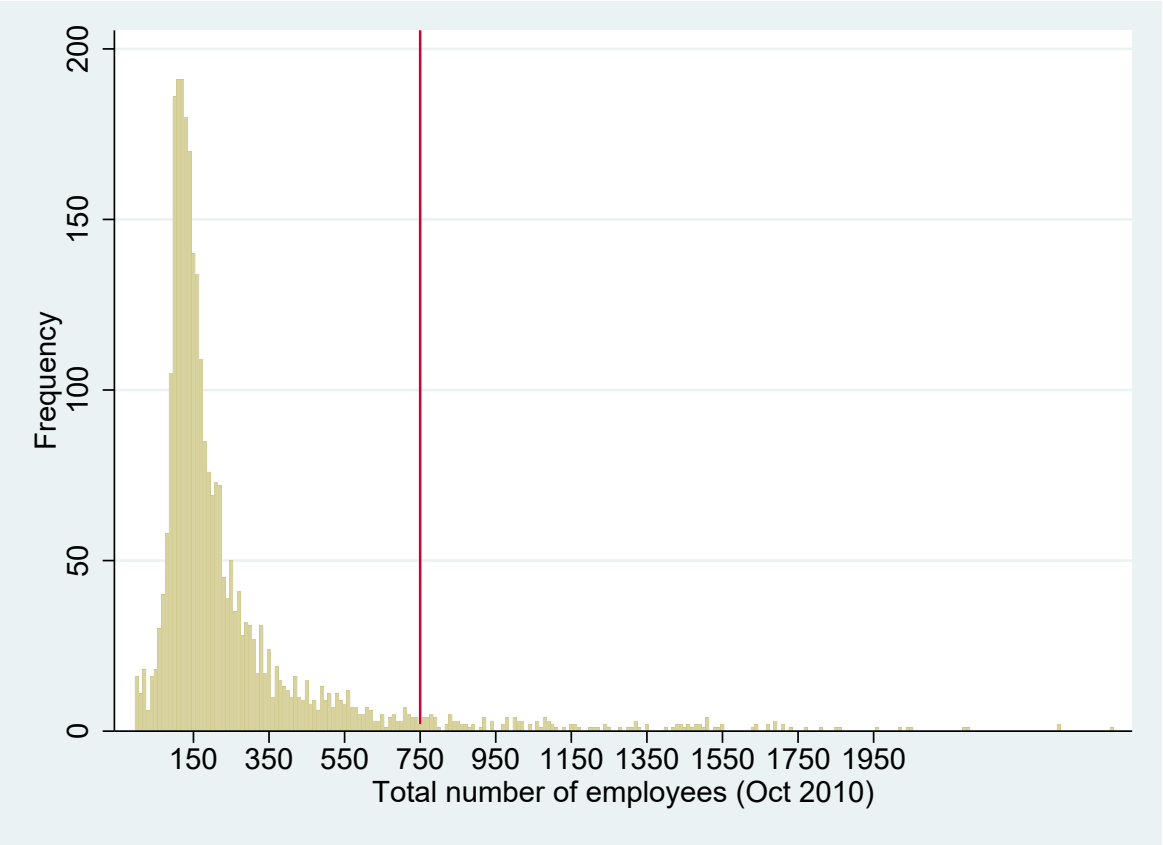
Tables B.1 and B.2 present our results, considering separately the extensive and intensive margins, respectively. In the first case, we consider a linear probability model, taking as our dependent variable a dummy variable equal to one if the SCIE variable above is different from zero. This will be a sufficient condition to indicate that the firm has at least one subsidiary or associated firm or joint activity. Our results, in panel 1 of Table B.1, indicate that the the 750-employee threshold does not have a positive effect on non-zero subsidiary gains and losses. Indeed, the effects are significantly negative in all cases, which suggests that the reform may have even slowed down the activity of large firms.[63]

However, when restricting the sample to firms in the 250 to 1250 employee range - Panel 2 of Table B.1 -, we find insignificant results. Similarly, when considering different extensive margins (ratios of such earnings/losses by different measures of the main firm financial results - net profits, gross operating surplus, and gross added value, in panels 1, 2 and 3, respectively, of Table B.2), we again find either insignificant results or marginally significant results. In conclusion, our evidence does not support an alternative potential explanation that larger firms circumvented the new restriction in the usage of fixed-term contracts by expanding their affiliates instead of creating new establishments. If anything, our results suggest that this channel may also have been negatively affected by the reform. This result is in line with the view that large firms typically expand their businesses using their own brands

Finally, in a heterogeneity analysis, we conducted the analysis separately for domestic and foreign firms, finding consistent results for each group. However, the point estimates are larger (in absolute terms) for the latter group (Table B.3). This difference may follow from the greater scope for foreign firms to conduct their growth in multiple countries and hints at potential effects from employment laws on foreign direct investment. Note that a small number of the domestic firms considered here will also be multinational firms but our data set does not provide information on that. We also considered the possibility that larger firms could make greater use of temporary work agencies following the 2009 reform. Our data does not indicate in which firms the workers of these agencies are placed (in QP these workers are registered with the temporary work agencies) but we found that: 1) temporary work agencies represent less than 3% of total employment in the country; and 2) the employment of these agencies declined by 24% between 2008 and 2010. These two results indicate that this potential additional margin of adjustment was not relevant in our case.

[63] A related interpretation is that some firms may have been unsure about their perimeter for the purpose of the law and considered that other firms with a legal relationship with the parent firm could be regarded as part of the main firm.

Figure B.1: **Distribution of (2010) firm sizes**



Notes: Firm size is measured by the total number of employees of each firm in (October) 2010. Own calculations based on the 'Quadros de Pessoal' data set, considering only firms that employed between 100 and 2,000 employees as of October 2008.

Table B.1: Robustness: Potential effects in terms of subsidiaries (as opposed to establishments), 1/2

	(1)	(2)	(3)
Intensive margin 1 (all firms)			
Large firm	-.208	-.189	-.184
	(.072)***	(.074)**	(.074)**
Firm size (centered)	.0004	.0004	.0006
	(.00006)***	(.00006)***	(.0002)***
Firm size^2		-7.25e-08	1.75e-07
		(6.64e-08)	(2.56e-07)
Firm size*Large firm			-.0005
			(.0005)
Const.	.532	.542	.582
	(.034)***	(.036)***	(.055)***
Obs.	2724	2724	2724
R^2	.039	.04	.04
Intensive margin 2 (firms with 250-1,250 employees)			
Large firm	-.095	-.017	-.027
	(.092)	(.102)	(.105)
Firm size (centered)	.0003	.00004	.0003
	(.0001)**	(.0002)	(.0006)
Firm size^2		-5.54e-07	-1.30e-07
		(3.23e-07)*	(1.06e-06)
Firm size*Large firm			-.0005
			(.001)
Const.	.478	.476	.507
	(.051)***	(.051)***	(.089)***
Obs.	740	740	740
R^2	.059	.063	.063

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Regressions of different measures of subsidiary relevance of each firm in 2010. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Panel 2 includes only firms with 2008 employment between 250 and 1250 employees. Standard errors clustered at the firm size level. Own calculations based on the SCIE ('Sistema de Contas Integradas das Empresas') data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table B.2: Robustness: Potential effects in terms of subsidiaries (as opposed to establishments), 2/2

	(1)	(2)	(3)
Extensive margin 1 (net profits)			
Large firm	-.035	-.021	-.020
	(.048)	(.052)	(.051)
Firm size (centered)	.0001	.00009	.0001
	(.00004)***	(.00005)**	(.0002)
Firm size^2		-5.33e-08	2.64e-09
		(5.11e-08)	(2.09e-07)
Firm size*Large firm			-.0001
			(.0004)
Const.	.106	.114	.123
	(.022)***	(.022)***	(.043)***
Obs.	2666	2666	2666
R^2	.013	.014	.014
Extensive margin 2 (gross operating surplus)			
Large firm	.007	.016	.015
	(.033)	(.036)	(.037)
Firm size (centered)	.00003	.00002	-.00002
	(.00002)	(.00003)	(.00009)
Firm size^2		-3.29e-08	-7.45e-08
		(2.94e-08)	(9.77e-08)
Firm size*Large firm			.00008
			(.0002)
Const.	.040	.045	.038
	(.014)***	(.014)***	(.021)*
Obs.	2666	2666	2666
R^2	.006	.007	.007
Extensive margin 3 (gross added value)			
Large firm	-.023	-.017	-.017
	(.011)**	(.010)*	(.011)
Firm size (centered)	.00003	.00002	.00003
	(9.39e-06)***	(9.21e-06)**	(.00003)
Firm size^2		-1.91e-08	-7.48e-09
		(8.59e-09)**	(3.44e-08)
Firm size*Large firm			-.00002
			(.00008)
Const.	.025	.027	.029
	(.005)***	(.006)***	(.009)***
Obs.	2666	2666	2666
R^2	.011	.013	.013

Notes: The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2000 workers in October 2008. Regressions of different measures of the extensive margins of subsidiary relevance of each firm in 2010 (considering the ratios of such earnings/losses by different measures of the main firm financial results - net profits, gross operating surplus, and gross added value). The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Control variables are 10 industry fixed effects. Standard errors clustered at the firm size level. Own calculations based on the SCIE ('Sistema de Contas Integradas das Empresas') data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

Table B.3: Robustness: Effects on all new hires in new establishments of domestic and foreign firms

	(1)	(2)	(3)
Domestic-owned firms			
Large firm	-.953	-.953	-.859
	(.499)*	(.375)**	(.368)**
Firm size (centered)	.002	.002	.003
	(.0003)***	(.0003)***	(.0003)***
Firm size^2		-9.86e-07	
		(3.12e-07)***	
Firm size*Large firm			-.002
			(.0006)***
Const.	3.154	3.535	3.622
	(.349)***	(.332)***	(.339)***
Obs.	2340	2340	2340
Foreign-owned firms			
Large firm	-1.898	-1.296	-1.110
	(.873)**	(.545)**	(.521)**
Firm size (centered)	.003	.003	.004
	(.0007)***	(.0006)***	(.0007)***
Firm size^2		-1.76e-06	
		(6.65e-07)***	
Firm size*Large firm			-.003
			(.001)***
Const.	4.794	5.505	5.482
	(.852)***	(.893)***	(.884)***
Obs.	535	535	535

Notes: Domestic firms (top panel) are those that are 100% owned by domestic investors. Foreign firms (bottom panel) are defined as those that have a positive share of foreign ownership of their capital equity. All data concerns employment in Portugal only. The columns present different specifications of a (sharp) regression discontinuity model. The sample used is composed of all firms in Portugal employing between 100 and 2,000 workers in October 2008. Poisson regression of new hires in both fixed-term and permanent contracts in all new establishments of each firm in October 2010. Employment is weighted by the months with the firm and the hours worked of each new hire. The running variable (total number of workers of the firm in 2008) is centered at 750, when it takes value zero. The key regressor (Large firm) is a dummy variable taking value one for firms employing 750 or more workers in 2008. Standard errors clustered at the firm size level. Own calculations based on the 'Quadros de Pessoal' data set. Significance levels: * 0.10, ** 0.05, *** 0.01.

C Theoretical model

This appendix presents the solution of the theoretical model. We start by presenting the computation of the surplus of jobs before presenting the value of establishments. Then, we derive the aggregate labor demand $L(W_u)$ and aggregate labor supply.

C.1 Job surplus

This appendix presents the computation of job surpluses. In all what follows, for the sake of simplicity, and without loss of generality, it is assumed that the value of vacant jobs is equal to zero, which holds true in equilibrium.

C.1.1 Surplus of continuing permanent jobs

Let us compute the value of the surplus of continuing permanent marginal jobs of productivity εz in a type-(z,π) establishment. The value for workers and firms are (assuming that there are no dismissal costs when the firm is destroyed):

$$\begin{aligned} W_p^c(\varepsilon,z) &= w_p^c(\varepsilon,z) + \beta(1-\mu)\lambda \int \max\left[W_p^c(\varepsilon,z), W_u\right] \mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)W_p^c(\varepsilon,z) + \beta\mu W_u \\ J_p^c(\varepsilon,z) &= \varepsilon z - w_p^c(\varepsilon,z) + \beta(1-\mu)\lambda \int \max\left[J_p^c(\varepsilon,z), -F\right] \mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)J_p^c(\varepsilon,z) \end{aligned}$$

Therefore, from the definition of the surplus:

$$S_p^c(\varepsilon,z) = W_p^c(\varepsilon,z) - W_u + J_p^c(\varepsilon,z) + F$$

and the two previous equations we get:

$$S_p^c(\varepsilon,z) = \varepsilon z - (1-\beta)\left(W_u - F\right) + \beta\mu F + \beta\lambda \int \max\left[S_p^c(\varepsilon,z), 0\right] dG(\varepsilon) + \beta(1-\lambda)S_p^c(\varepsilon,z) \tag{C.1}$$

C.1.2 Surplus of starting permanent jobs

The relation between the surplus of a starting permanent jobs $S_p(z)$, which starts with productivity ε_u by assumption, and a continuing permanent job is:

$$S_p^c(\varepsilon_u,z) = S_p(z) + F \tag{C.2}$$

This relation together with the definition (C.1) of $S_p^c(\varepsilon,z)$ yields:

$$S_p(z) = z\varepsilon_u - (1-\beta)W_u - \beta(1-\mu)F + \beta(1-\mu)\lambda \int \max\left[S_p^c(\varepsilon,z), 0\right] \mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)S_p^c(\varepsilon_u,z)$$

C.1.3 Reservation productivity

The expression of the surplus of continuing job implies that continuing permanent jobs are destroyed when the productivity drops below the reservation value R:

$$R(z) = \left\{R | S_p^c(R,z) = 0\right\} \tag{C.3}$$

which implies, from equation (C.1):

$$R(z) = \frac{1}{z}\left[(1-\beta)\left(W_u - F\right) + \beta\mu F\right] - \frac{\beta(1-\mu)\lambda}{1-\beta(1-\mu)(1-\lambda)} \int_{R(z)}^{\infty} \left(\varepsilon - R(z)\right) \mathrm{d}G(\varepsilon) \tag{C.4}$$

It can be easily checked that this equation defines a positive relation between the reservation value $R(z)$ and the expected value of unemployed workers, W_u. Using once again equation (C.1) and the definition of the reservation productivity (C.3) we can also write the surplus of a continuing job as follows:

$$S_p^c(\varepsilon, z) = \frac{z\left[\varepsilon - R(z)\right]}{1-\beta(1-\mu)(1-\lambda)} \tag{C.5}$$

Therefore, the relation (C.2) between the surplus of starting and continuing jobs yields:

$$S_p(\varepsilon, z) = \frac{z\left[\varepsilon - R(z)\right]}{1-\beta(1-\mu)(1-\lambda)} - F \tag{C.6}$$

Since the reservation value $R(z)$ increases with W_u, the two previous equations imply that the surpluses of permanent jobs decrease with the expected value of unemployed workers, W_u.

C.1.4 Surplus of temporary jobs

Temporary jobs are destroyed instead of transformed if the productivity is below the threshold value:

$$T(z) = \{T | S_p(T, z) = 0\}$$

Using equations (C.1) and (C.4), this implies that:

$$T(z) = R(z) + \frac{F}{z}\left[1-\beta(1-\mu)(1-\lambda)\right] \tag{C.7}$$

Now, let us compute the value of the surplus of starting temporary jobs in a type-(z,π) establishment. The value for workers and firms are respectively:

$$\begin{aligned} W_t(z) &= w_t(z) + \beta(1-\mu)\lambda \int \max\left[W_p(\varepsilon, z), W_u\right] \mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)W_p(\varepsilon_u, z) + \beta\mu W_u \\ J_t(z) &= z\varepsilon_u - w_t(z) + \beta(1-\mu)\lambda \int \max\left[J_p(\varepsilon, z), 0\right] \mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)J_p(\varepsilon_u, z) \end{aligned}$$

Therefore, the surplus of a temporary job:

$$S_t(z) = W_t(z) - W_u + J_t(z)$$

can be written as follows:

$$\begin{aligned} S_t(z) &= \beta(1-\mu)\lambda \int \max\left[S_p(\varepsilon, z), 0\right] \mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)S_p(\varepsilon_u, z) \\ &\quad + \beta(1-\mu)F - \beta(1-\mu)\lambda \int \max\left[S_p^c(\varepsilon, z), 0\right] \mathrm{d}G(\varepsilon) - \beta(1-\mu)(1-\lambda)S_p^c(\varepsilon_u, z) \end{aligned}$$

From this equation and from equation (C.1), we can show that the surplus of temporary jobs is bigger than the surplus of permanent starting jobs. We get:

$$\begin{aligned} S_t(z) - S_p(z) = \beta(1-\mu)F + \beta(1-\mu)\lambda \int_{T(z)}^{\infty} S_p(\varepsilon, z)\mathrm{d}G(\varepsilon) + \beta(1-\mu)(1-\lambda)S_p(\varepsilon_u, z) \\ -\beta(1-\mu)\lambda \int_{R(z)}^{\infty} S_p^c(\varepsilon, z)\mathrm{d}G(\varepsilon) - \beta(1-\mu)(1-\lambda)S_p^c(\varepsilon_u, z) \end{aligned}$$

Using the relation:

$$S_p^c(\varepsilon, z) = S_p(\varepsilon, z) + F,$$

we can write the difference between the two surpluses, $S_t(z) - S_p(z)$, as follows:

$$S_t(z) - S_p(z) = \beta(1-\mu)\lambda \left[- \int_{R(z)}^{T(z)} S_p(\varepsilon, z) \mathrm{d}G(\varepsilon) + G(R)F \right] \tag{C.8}$$

Since, by definition $S_p(T(z), z) = 0$ and $S_p(\varepsilon, z)$ increases with ε, and $T(z) > R(z)$, the integral $\int_{R(z)}^{T(z)} S_p(\varepsilon, z) \mathrm{d}G(\varepsilon)$ is negative, which implies that $S_t(z) - S_p(z) > 0$. Thus, the surplus of temporary jobs is larger than the surplus of starting permanent jobs.

Equation (C.8) together with equation (C.2) implies that:

$$S_t(z) = S_p^c(\varepsilon_u, z) + \beta(1-\mu)\lambda \int_{T(z)}^{R(z)} \left[S_p^c(\varepsilon_u, z) \right] \mathrm{d}G(\varepsilon) - F\left[1 - \beta\lambda(1-\mu)\left[1 - G(T(z))\right]\right] \tag{C.9}$$

Since the surplus of continuing permanent jobs $S_p^c(\varepsilon_u, z)$ decreases with W_u, and R increases with W_u, as shown above, this last equation implies, together with equation (C.7) that the surplus of temporary jobs decreases with W_u.

Finally, we get a simple expression of the surplus of starting job in a type-(z, π) establishments:

$$S(z, \pi) = (1-\pi) S_t(z) + \pi S_p(z)$$

which can be written, using the previous equations:

$$S(z,\pi) = \frac{z\left(\varepsilon - R(z)\right)}{1 - \beta(1-\mu)(1-\lambda)} + (1-\pi)\beta(1-\mu)\lambda \int_{T(z)}^{R(z)} \frac{z\left(\varepsilon - R(z)\right)}{1 - \beta(1-\mu)(1-\lambda)} \mathrm{d}G(\varepsilon) - F\left[1 - (1-\pi)\beta(1-\mu)\lambda G(T(z))\right] \tag{C.10}$$

This expression of the surplus shows that it can be expressed as function of the single endogenous variable W_u by using the expressions of $R(z)$ (from equation (C.4)) and $T(z)$ (from equation (C.7)). Moreover, since we have shown that the job surplus of permanent and temporary jobs decrease with W_u (see equations (C.6) and (C.9)) the job surplus of starting jobs also decreases with W_u.

C.2 The value of type-(z, π) establishments

Let us analyze the properties of type-(z, π) establishments. As indicated in footnote 42, we assume that establishments created by large and small firms can have different vacancy cost functions, which are homogeneous of degree $\alpha > 1$:

$$C_i(v) = c_i v^\alpha, \quad i = \{s, b\}$$

where $c_i > 0$ can be different for small firms ($i = s$) and large firms ($i = b$). We also assume that the stringency of regulation of temporary contracts can be different in establishments managed by large and small firms, because firms of different size can have different abilities to cope with the regulation. Therefore, we denote by π_{ih} and $\pi_{i\ell}$ the minimum share of permanent jobs created by old and young establishments respectively created by type-i firms.

From above, we know that the value of marginal jobs $J(z, \pi_{ij})$ does not depend on the number of jobs in the establishment. Therefore, the optimality condition for the number of vacancies

$$C_i'(v_{ij}) = \beta(1-\mu) m(\theta(z, \pi_{ij})) J(z, \pi_{ij}), \quad i = \{s, b\}; j = \{h, \ell\} \tag{C.11}$$

does not depend on the number of jobs in the establishment: it is constant over time if the environment of the establishment is stationary. In this setup, it is easy to compute the steady state value of a type-(z, π) establishments. Note also that function $\theta(z, \pi)$, which is determined by equation (10), which stems from the

Hosios condition and the non-arbitrage condition of unemployed workers, depends on the establishment type-(z,π) but does not depend of the properties of the vacancy cost function of the establishment.

Let us first compute the net values of type-(z,π_{ih}) establishments created by large and small firms, which are defined, at any date t, as the present value of profits induced by the hires from date $t+1$, net of creation costs of job vacancies from date t. By definition, this value is net of the present value of profits induced by past job vacancies. Establishments are destroyed with probability μ at the end of every period $t \geq 0$.

At each date $t \geq 1$, there are $v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))$ job creations in type-(z,π_{ih}) establishment created by type-i firms, and each job creation yields an expected gain equal to $J(z,\pi_{ih})$. Therefore, the present value of all job creations, that will occur from date 1 to infinite in a type-(z,π_{ih}) establishment created by type-i firm, is equal to:

$$v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))\sum_{t=1}^{\infty}\left[\beta(1-\mu)\right]^t J(z,\pi_{ih}) = \frac{v(z,\pi_{ih})m(\theta(z,\pi_{ih}))\beta(1-\mu)J(z,\pi_{ih})}{1-\beta(1-\mu)}$$

The present cost of job vacancies (created from date 0) is equal to $\sum_{t=0}^{\infty}\left[\beta(1-\mu)\right]^t C_i\left[v_i(z,\pi_{ih})\right]$. Thus, we get:

$$\Pi_i(z,\pi_{ih}) = \frac{v(z,\pi_{ih})m(\theta(z,\pi_{ih}))\beta(1-\mu)J(z,\pi_{ih}) - C_i\left[v_i(z,\pi_{ih})\right]}{1-\beta(1-\mu)}$$

The homogeneity of degree α of the vacancy cost function C_i implies that $C_i'(v) = \alpha C_i(v)/v$. Using this condition together with the previous equation, the optimality condition (11) and the Hosios condition, which implies that $J(z,\pi_{ih}) = (1-\eta)S(z,\pi_{ih})$, we get

$$\Pi_i(z,\pi_{ih}) = \frac{(\alpha-1)v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))\beta(1-\mu)(1-\eta)S(z,\pi_{ih})}{\alpha\left[1-\beta(1-\mu)\right]}, i = s,b. \tag{C.12}$$

Using equation (10), we get:

$$\Pi_i(z,\pi_{ih}) = \frac{(\alpha-1)(1-\mu)(1-\eta)}{\alpha\left[1-\beta(1-\mu)\right]\eta}u_i(z,\pi_{ih})\left[(1-\beta)W_u - b\right] \tag{C.13}$$

This equation implies that $\Pi_i(z,\pi_h)$ increases with z because when z is higher, the surplus of jobs is also higher and it is possible to attract more unemployed workers, $u_i(z,\pi)$, in the labor pool of the establishment. Equation (C.12) implies that $\Pi_i(z,\pi) > 0$ for all z such that $S(z,\pi) > 0$ because equation (10) implies that the labor market tightness is positive, and goes to infinite when $S(z,\pi)$ goes to zero. This means that if $S(z,\pi) \leq 0$, the establishment cannot promise a utitly $W(z,\pi) > W_u$ which implies that it cannot recruit workers. This implies that type-(z,π_{ih}) establishments whether they are created by small of large firms, are created (or continue to hire from the date at which they have to be transformed from type-$\pi_{i\ell}$ to type-π_{ih}) only if their productivity type z is above the threshold:

$$\bar{z}(\pi_{ih}) = \{z | S(z,\pi_{ih}) = 0\}. \tag{C.14}$$

These reservation productivities can be defined as function of the single endogenous variable W_u. To do so, we use the definition of the job surplus (C.10) together with its properties described below equation (C.10). Since job surpluses decrease with W_u and increase with z, equation (C.14) implies that $\bar{z}(\pi_{ih})$ increases with W_u.

Now, let us compute the net value of type-$(z,\pi_{i\ell})$ establishments. Let us start to remark that the threshold value of productivity z above which establishments are created is identical for type-$\pi_{i\ell}$ and type-π_{ih} establishments because $S(z,\pi_{ih}) < S(z,\pi_{i\ell})$ and all establishments need to have permanent jobs created by large and small firms.

In type-$(z,\pi_{i\ell})$ establishments created by type-i firms, at each date $t \geq 1$, there are $v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))$ job creations and each job creation which yields an expected gain equal to $J(z,\pi_{i\ell})$. It is assumed that es-

tablishments can be transformed into type-(z,π_{ih}) establishment from the end of period $t=1$, i.e., young establishments are young at least one period. For all dates $t>1$, the per period probability that type-$(z,\pi_{i\ell})$ establishments are transformed into type-(z,π_{ih}) establishments is equal to ρ and the probability of destruction is equal to μ. Therefore, the present value of all job creations, that will occur from date 1 to infinite in type-$(z,\pi_{i\ell})$ establishments created by type-i firms is equal to:

$$v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))J(z,\pi_{i\ell})\sum_{t=1}^{\infty}(1-\rho)^{t-1}\left[\beta(1-\mu)\right]^t+v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))J(z,\pi_{ih})\sum_{t=2}^{\infty}\left[1-(1-\rho)^{t-1}\right]\left[\beta(1-\mu)\right]^t.$$

Since

$$\begin{aligned}\sum_{t=1}^{\infty}(1-\rho)^{t-1}\left[\beta(1-\mu)\right]^{t-1} &= \frac{1}{1-\beta(1-\mu)(1-\rho)}\\ \sum_{t=1}^{\infty}\left[1-(1-\rho)^{t-1}\right]\left[\beta(1-\mu)\right]^{t-1} &= \frac{\rho\beta(1-\mu)}{\left[1-\beta(1-\mu)\right]\left[1-\beta(1-\mu)(1-\rho)\right]}\end{aligned}$$

we get the present value of all job creations:

$$\frac{\beta(1-\mu)}{1-\beta(1-\mu)(1-\rho)}\left[v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))J(z,\pi_{i\ell})+\frac{\rho\beta(1-\mu)}{1-\beta(1-\mu)}v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))J(z,\pi_{ih})\right]$$

The present cost of job vacancies (created from date 0) is equal to:

$$\frac{1}{1-\beta(1-\mu)(1-\rho)}\left(C_i\left[v_i(z,\pi_{i\ell})\right]+\frac{\rho\beta(1-\mu)}{\left[1-\beta(1-\mu)\right]}C_i\left[v_i(z,\pi_{ih})\right]\right)$$

Therefore, we get:

$$\begin{aligned}\Pi_i(z,\pi_{i\ell}) &= \frac{v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))\beta(1-\mu)J(z,\pi_{i\ell})-C_i\left[v_i(z,\pi_{i\ell})\right]}{1-\beta(1-\mu)(1-\rho)}\\ &\quad+\beta\rho(1-\mu)\max\left[\frac{v(z,\pi_{ih})m(\theta(z,\pi_{ih}))\beta(1-\mu)J(z,\pi_{ih})-C_i\left[v_i(z,\pi_{ih})\right]}{\left[1-\beta(1-\mu)\right]\left[1-\beta(1-\mu)(1-\rho)\right]},0\right]\end{aligned} \tag{C.15}$$

since C_i is homogeneous of degree $\alpha>1$, the first order condition for the creation of type-j, $j=\{h,\ell\}$, establishments created by type-i, $i=\{s,b\}$, firms, the optimality condition for vacancies (C.11) can be written:

$$C_i'\left[v_i(z,\pi_{ij})\right]=\frac{\alpha}{v_i(z,\pi_{ij})}C_i\left[v_i(z,\pi_{ij})\right]=m(\theta(z,\pi_{ij}))\beta(1-\mu)J(z,\pi_{ij})$$

Substituting in (C.15) yields:

$$\Pi_i(z,\pi_{i\ell})=\frac{(\alpha-1)\beta(1-\mu)}{\alpha\left[1-\beta(1-\mu)(1-\rho)\right]}\left[v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))J(z,\pi_{i\ell})+\frac{\rho\beta(1-\mu)v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))\max\left[J(z,\pi_{ih}),0\right]}{\left[1-\beta(1-\mu)\right]}\right]$$

and, with the Hosios condition, which implies that $J=(1-\eta)S$, we get:

$$\Pi_i(z,\pi_{i\ell})=\frac{(\alpha-1)(1-\eta)\beta(1-\mu)}{\alpha\left[1-\beta(1-\mu)(1-\rho)\right]}\left[v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))S(z,\pi_{i\ell})+\frac{\rho\beta(1-\mu)v_i(z,\pi_{ih})m(\theta(z,\pi_{ih}))\max\left[S(z,\pi_{ih}),0\right]}{1-\beta(1-\mu)}\right]$$

Since $S(z,\pi_{ih})$ increases with z, this expression of $\Pi_i(z,\pi_{i\ell})$ implies that type-(z,π_{ih}) establishments, whether they are created by small of large firms, are created only if their productivity type z is above the threshold:

$$\bar{z}(\pi_{i\ell})=\{z|S(z,\pi_{i\ell})=0\}. \tag{C.16}$$

with $\bar{z}(\pi_{i\ell})<\bar{z}(\pi_{ih})$ because $\pi_{i\ell}<\pi_{ih}$ and $S(z,\pi)$ decreases with π. For the same reasons as for $\bar{z}(\pi_{ih})$, these reservation productivities can be defined as decreasing functions of the single endogenous variable W_u.

C.3 Aggregate labor Demand

This appendix computes the relation between the number of jobs in the economy and the present value of unemployment W_u. This corresponds to function $L(W_u, \pi_\ell, \pi_h)$ in the main text. More precisely, as indicated above in Appendix C.2, we consider a more general case than that presented in the main text since we assume that the stringency of regulation of temporary contracts can be different in establishment managed by large and small firms. Therefore, we denote by π_{ih} and $\pi_{i\ell}$ the minimum share of permanent jobs created by old and young establishments respectively created by type-i firms and we define the function $L(W_u, \bar{z}(\pi_{s\ell}), \bar{z}(\pi s_h), \bar{z}(\pi_{b\ell}), \bar{z}(\pi_{bh}))$. To define this function, we first define the number of jobs at all ages of each establishment type-$(z, \pi_{ij}), i = \{s, b\}; j = \{h, \ell\}$. Then, we compute the number of each establishment type-(z, π_{ij}) and their age distribution. Finally, adding the employment of each establishment type we can define total employment $L(W_u, \bar{z}(\pi_{s\ell}), \bar{z}(\pi s_h), \bar{z}(\pi_{b\ell}), \bar{z}(\pi_{bh}))$.

Number of jobs in type-$(z, \pi_{i\ell})$ establishments. We start by computing the number of jobs in young establishments created by type-$i = \{s, b\}$ firms. To do this, we compute, for each of these establishments, the number of jobs in each period from its period of creation. The job creation rate is $m(\theta(z, \pi_{i\ell}))v_i(z, \pi_{i\ell})$. Since the spell of temporary job equals one period, the number of temporary jobs in a type-$(z, \pi_{i\ell})$ establishment is:

$$L_{it}(z, \pi_{i\ell}) = (1 - \pi_{i\ell})m(\theta(z, \pi_{i\ell}))v_i(z, \pi_{i\ell}) \tag{C.17}$$

Together with equations (10) and (12), this equation implies that $L_{it}(z, \pi_{i\ell})$ can be defined as function of the single endogenous variable W_u. In our context, equations (10) and (12) can be written as follows:

$$\theta(z, \pi_{ij})m(\theta(z, \pi_{ij})) = \frac{(1 - \beta)W_u - b}{\beta\eta S(z, \pi_{ij})} \tag{C.18}$$

$$C_i'(v_i(z, \pi_{ij})) = (1 - \mu)\frac{1 - \eta}{\eta}m(\theta(z, \pi_{ij}))\beta S(z, \pi_{ij}) \tag{C.19}$$

The first equation together with the definition (C.10) of the surplus defines a positive relation between the labor market tightness $\theta(z, \pi_{ij})$ and W_u (because the exit rate from unemployment $\theta m(\theta)$ increases with θ). Then, since $m'(\theta) < 0$ and $C_i''(v_i(z, \pi_{ij})) > 0$, the second equation defines a negative relation between $v_i(z, \pi_{ij})$ and W_u. Using these two results in equation (C.17) which defines $L_{it}(z, \pi_{i\ell})$, we find that $L_{it}(z, \pi_{i\ell})$ decreases with W_u.

The job destruction rate of permanent jobs is equal to $\lambda G(R(z))$. Temporary jobs are transformed into permanent jobs with probability $1 - \lambda G(T(z))$, where $T(z) = \{T | S_p(T, z) = 0\}$ is the threshold value of productivity below which temporary jobs are destroyed. Thus, the law of motion of the number of permanent jobs in a type-$(z, \pi_{i\ell})$ establishment is:

$$L_{ip}^+(z, \pi_{i\ell}) = L_{ip}(z, \pi_{i\ell})\left[1 - \lambda G(R(z))\right] + m(\theta(z, \pi_{i\ell}))v_i(z, \pi_{i\ell})\left[\pi_{i\ell} + (1 - \pi_{i\ell})\left[1 - \lambda G(T(z))\right]\right]$$

Let us denote by $L_i^\tau(z, \pi_{i\ell})$ the number of jobs in type-$(z, \pi_{i\ell})$ establishments τ periods after their period of creation. We know that $L_i^0(z, \pi_{i\ell}) = 0$ and that the number of temporary jobs is constant from $\tau = 1$, since vacant jobs posted at $\tau = 0$ are filled at $\tau = 1$ and temporary jobs last one period only. Thus the law of motion of $L_{ip}^+(z, \pi_{i\ell})$ is of the form $x_{\tau+1} = ax_\tau + b$, with $x_0 = 0$, which implies that $x_\tau = b\sum_{n=1}^{\tau} a^{n-1}$, we get

$$L_{ip}^\tau(z, \pi_{i\ell}) = m(\theta(z, \pi_{i\ell}))v_i(z, \pi_{i\ell})\left[\pi_{i\ell} + (1 - \pi_{i\ell})\left[1 - \lambda G(T(z))\right]\right]\sum_{n=1}^{\tau}\left[1 - \lambda G(R(z))\right]^{n-1} \tag{C.20}$$

The same proof as that used for equation (C.17) shows that $L_{ip}^\tau(z, \pi_{i\ell})$ can be expressed as a decreasing function of the single endogenous variable W_u.

Adding the number of temporary and permanent jobs in each period, we find that the total number of

jobs in type-$(z,\pi_{i\ell})$ establishments τ periods after their period of creation is:

$$L_i^\tau(z,\pi_{i\ell}) = m(\theta(z,\pi_{i\ell}))v_i(z,\pi_{i\ell})\left(1-\pi_{i\ell}+[\pi_{i\ell}+(1-\pi_{i\ell})[1-\lambda G(T(z))]]\sum_{n=1}^{\tau}[1-\lambda G(R(z))]^{n-1}\right)$$

Number of jobs in type-(z,π_{ih}) establishments. Now, we have to compute the number of jobs in type-(z,π_{ih}) establishments, i.e. type-$(z,\pi_{i\ell})$ establishments converted into type-(z,π_{ih}) because they became old. One must distinguish the establishments which continue hiring when they are converted into type-(z,π_{ih}) establishments (because their type is $z \geq \bar{z}(\pi_{ih})$) and those which stop hiring (such that $z < \bar{z}(\pi_{ih})$).

Let us start by establishments which continue hiring when they are converted. Let us denote by τ_ℓ the age at which the type-$(z,\pi_{i\ell})$ establishment has been transformed into a type-(z,π_{ih}) establishment.

The job creation rate is $m(\theta(z,\pi_{ih}))v_i$. Since temporary jobs last one period, the number of temporary jobs in a type-(z,π_{ih}) establishment is:

$$L_{it}(z,\pi_{ih}) = (1-\pi_{ih})m(\theta(z,\pi_{ih}))v_i(z,\pi_{ih}). \tag{C.21}$$

The same proof as that used for equation (C.17) shows that $L_{it}(z,\pi_{ih})$ can be expressed as a decreasing function of the single endogenous variable W_u.

To compute the number of permanent jobs, we need to know the number of creations and destructions of permanent jobs and the rate of transformation of temporary jobs into permanent jobs. The job destruction rate of permanent jobs is equal to $\lambda G(R(z))$. Temporary jobs are transformed into permanent jobs with probability $1-\lambda G(T(z))$, where $T(z) = \{T|S_p(T,z)=0\}$ is the threshold value of productivity below which temporary jobs are destroyed. At date τ_ℓ, the number of permanent jobs is:

$$L_{ip}^{\tau_\ell}(z,\pi_{i\ell},\pi_{ih}) = L_{ip}^{\tau_\ell-1}(z,\pi_{i\ell})[1-\lambda G(R(z))] + \pi_{ih}m(\theta(z,\pi_{ih}))v_i(z,\pi_{ih}) + L_{it}(z,\pi_{i\ell})[1-\lambda G(T(z))] \tag{C.22}$$

Thus, the law of motion of the number of permanent jobs in type-(z,π_{ih}) establishments is for $\tau > \tau_\ell$ is:

$$L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih}) = L_{ip}^{\tau-1}(z,\pi_{i\ell},\pi_{ih})[1-\lambda G(R(z))] + \pi_{ih}m(\theta(z,\pi_{ih}))v_i(z,\pi_{ih}) + L_{it}(z,\pi_{ih})[1-\lambda G(T(z))] \tag{C.23}$$

This equation shows that the number of permanent jobs in type-(z,π_{ih}) establishments of age τ created by large firms, denoted by $L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih})$, is given by an equation of the form $x_\tau = ax_{\tau-1}+b$, with $x_0 = L_{ip}^{\tau_\ell}(z,\pi_{i\ell},\pi_{ih})$, which implies that:

$$\begin{aligned} L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih}) &= [1-\lambda G(R(z))]^{\tau-\tau_\ell} L_{ip}^{\tau_\ell}(z,\pi_{i\ell},\pi_{ih}) \\ &\quad + m(\theta(z,\pi_{ih}))v_i(z,\pi_{ih})[\pi_{ih}+(1-\pi_{ih})[1-\lambda G(T(z))]]\sum_{i=\tau_\ell}^{\tau-1}[1-\lambda G(R(z))]^{i-\tau_\ell} \end{aligned} \tag{C.24}$$

The same proof as that used for equation (C.17) shows that $L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih})$ can be expressed as a decreasing function of the single endogenous variable W_u.

Adding temporary and permanent jobs, we find that the total number of jobs in establishments that have been transformed into type-(z,π_{ih}) establishments at age τ_ℓ is defined as:

$$L_i^{\tau_\ell}(z,\pi_{i\ell},\pi_{ih}) = L_{it}(z,\pi_{ih}) + L_{ip}^{\tau_\ell}(z,\pi_{i\ell},\pi_{ih})$$

where $L_{it}(z,\pi_{ih})$ and $L_{ip}^{\tau_\ell}(z,\pi_{i\ell},\pi_{ih})$ are defined by equations (C.21) and (C.22) respectively at date τ_ℓ and by equations (C.21) and (C.24) at dates $\tau > \tau_\ell$.

Let us now compute the number of jobs in type-$(z,\pi_{i\ell})$ establishments that stop hiring when they are converted into type-(z,π_{ih}) establishments. In these establishments, there are no temporary jobs. Permanent jobs decrease at rate $\lambda G(R(z))$. Accordingly, the total number of jobs in a type-$(z,\pi_{i\ell})$ establishment

that have not been transformed into a type-(z,π_{ih}) establishment at age τ_ℓ is:

$$L_{i0}^{\tau}(z,\pi_{i\ell},\pi_{ih}) = [1-\lambda G(R(z))]^{\tau-\tau_\ell}\left\{L_{ip}^{\tau_\ell-1}(z,\pi_{i\ell})\left[1-\lambda G(R(z))\right] + \left[1-\lambda G(T(z))\right]L_{it}(z,\pi_{i\ell})\right\}. \tag{C.25}$$

The age distribution of establishments. Once the total number of jobs in each establishment type has been computed, one needs to compute the age distribution of all types of establishments. This distribution is computed in steady state. As shown in Appendix C.2, entrepreneurs create an establishment if $z \geq \bar{z}(\pi_{i\ell})$.

Now, we have to compute the age distribution of type-(z,π_{ih}) establishments and type-$(z,\pi_{i\ell})$ establishments created by $i=\{s,b\}$ firms. Remind that establishments are destroyed with probability μ from their period of creation $\tau=0$ (meaning that the entrepreneur draw a production opportunity z and create job vacancies at $\tau=0$, but a productivity shock which occurs with probability μ at the end of period 0 implies that the firm never reaches periods $\tau\geq 1$), whereas (young) type-$(z,\pi_{i\ell})$ establishments can be transformed into (old) type-(z,π_{ih}) establishment at probability ρ from period $\tau=1$. Since $O_i\Gamma_i'(z)$ establishments are created in every period by type-i firms, $i=\{s,b\}$, the number of type-$(z,\pi_{i\ell})$ establishments of age τ belonging to type-i firms in each period is equal to:

$$(1-\mu)^{\tau}(1-\rho)^{\tau-1}O_i\Gamma_i'(z) \tag{C.26}$$

The conversion rate of type-$(z,\pi_{i\ell})$ establishments is equal to ρ, which implies that

$$\rho(1-\mu)^{\tau_\ell}(1-\rho)^{\tau_\ell-2}O_i\Gamma_i'(z)$$

type-$(z,\pi_{i\ell})$ establishments of age τ_ℓ belonging to type-i firms are converted into type-(z,π_{ih}) establishments at each date. The probability of death per period of each of these establishments is equal to μ. Therefore, there are

$$\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}O_i\Gamma_i'(z) \tag{C.27}$$

type-(z,π_{ih}) establishments of age τ belonging to type-i firms which have been converted at age $\tau_\ell\leq\tau$ at each date.

Total number of jobs in the economy. Now, from above, we can compute the total number of jobs in the economy. From equation (C.26) we deduce that the total number of jobs in type-$\pi_{i\ell}$ establishments is:

$$\sum_{i=s,b}O_i\sum_{\tau=1}^{\infty}(1-\mu)^{\tau}(1-\rho)^{\tau-1}\int_{\bar{z}(\pi_{i\ell})}^{\infty}L_i^{\tau}(z,\pi_{i\ell})\mathrm{d}\Gamma_i(z). \tag{C.28}$$

Equation (C.27) implies that the total number of jobs in type-π_h establishments is given by:

$$\sum_{i=s,b}O_i\sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}\left[\int_{\bar{z}(\pi_{ih})}^{\infty}L_i^{\tau}(z,\pi_{i\ell},\tau_{ih})\mathrm{d}\Gamma_i(z)+\int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})}L_{i0}^{\tau}(z,\pi_{i\ell},\tau_{ih})\mathrm{d}\Gamma_i(z)\right]. \tag{C.29}$$

The total number of jobs is obtained by summing (C.28) and (C.29) is equal to:

$$\begin{aligned} L \;=\; & \sum_{i=s,b}O_i\sum_{\tau=1}^{\infty}(1-\mu)^{\tau}(1-\rho)^{\tau-1}\int_{\bar{z}(\pi_{i\ell})}^{\infty}L_i^{\tau}(z,\pi_{i\ell})\mathrm{d}\Gamma_i(z) \\ & +\sum_{i=s,b}O_i\sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}\left[\int_{\bar{z}(\pi_{ih})}^{\infty}L_i^{\tau}(z,\pi_{i\ell},\pi_{ih})\mathrm{d}\Gamma_i(z)+\int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})}L_{i0}^{\tau}(z,\pi_{i\ell},\pi_{ih})\mathrm{d}\Gamma_i(z)\right] \end{aligned} \tag{C.30}$$

From this equation and the definitions of L_i^{τ}, it is clear that aggregate demand in the economy is a function of $W_u,\bar{z}(\pi_{s\ell}),\bar{z}(\pi_{sh}),\bar{z}(\pi_{b\ell}),\bar{z}(\pi_{bh})$. We showed that L_i^{τ} can be defined as a decreasing function of the single endogenous variable W_u. Similarly, $\bar{z}(\pi_{s\ell}),\bar{z}(\pi s_h),\bar{z}(\pi_{b\ell}),\bar{z}(\pi_{bh})$ can be defined as increasing functions of

the single endogenous variable W_u, as stated in Section 6.2. Therefore, these results together with equation (C.30) imply that aggregate labor demand can be defined as a decreasing function of the endogenous variable W_u, denoted by $L(W_u, \pi_{s\ell}, \pi_{sh}, \pi_{b\ell}, \pi_{bh})$.

C.4 Aggregate labor supply

This appendix computes the relation between total unemployment and the present value of unemployment W_u. This corresponds to function $\mathcal{U}(W_u, \pi_\ell, \pi_h)$ in the main text. More precisely, as indicated above in Appendix C.2, we consider a more general case than that presented in the main text since we assume that the stringency of regulation of temporary contracts can be different in establishment managed by large and small firms. Therefore, we denote by π_{ih} and $\pi_{i\ell}$ the minimum share of permanent jobs created by old and young establishments respectively created by type-i firms and we define the function $\mathcal{U}(W_u, \pi_{s\ell}, \pi_{sh}, \pi_{b\ell}, \pi_{bh})$.

To define this function, we use the age distributions of type-(z, π_{ij}) establishments computed in Appendix C.3, which imply that the sum of all unemployed workers can be written as follows:

$$\mathcal{U} = \sum_{i=s,b} O_i \sum_{\tau=1}^{\infty} (1-\mu)^{\tau}(1-\rho)^{\tau-1} \int_{\bar{z}(\pi_{i\ell})}^{\infty} u(z, \pi_{i\ell}) \mathrm{d}\Gamma_i(z) + \sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty} \sum_{\tau=\tau_\ell}^{\infty} \rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2} \left[\int_{\bar{z}(\pi_{ih})}^{\infty} u(z, \pi_{ih}) \mathrm{d}\Gamma_i(z) \right] \quad \text{(C.31)}$$

where

$$u(z, \pi_{ij}) = \frac{v_i(z, \pi_{ij})}{\theta(z, \pi_{ij})}.$$

Therefore, aggregate unemployment, $\mathcal{U}$, can be written as function of the unknown variables W_u, $\bar{z}(\pi_{s\ell})$, $\bar{z}(\pi_{sh})$, $\bar{z}(\pi_{b\ell})$, $\bar{z}(\pi_{bh})$, i.e., $\mathcal{U}(W_u, \bar{z}(\pi_{s\ell}), \bar{z}(\pi_{sh}), \bar{z}(\pi_{b\ell}), \bar{z}(\pi_{bh}))$, where $\bar{z}(\pi_{ij})$, $i = \{s, b\}$, $j = \{h, \ell\}$ are increasing function of the single endogenous variable W_u, as stated in Section 6.2.

Moreover, we know from equations (C.18) and (C.19) that $v_i(z, \pi_{ij})$ and $\theta(z, \pi_{ij})$ can be defined as functions of the single endogenous variable W_u, and that $v_i(z, \pi_{ij})$ decreases with W_u while $\theta(z, \pi_{ij})$ increases. Therefore, $u(z, \pi_{ij})$ can be defined as a decreasing function of the single endogenous variable W_u. Finally, using these results to compute the derivative of u with respect to W_u in equation (C.31) shows that u decreases with W_u. Accordingly, aggregate labor supply, equal to $\mathcal{N} - \mathcal{U}(W_u, \bar{z}(\pi_{s\ell}), \bar{z}(\pi s_h), \bar{z}(\pi_{b\ell}), \bar{z}(\pi_{bh}))$ increases with W_u.

C.5 Labor market equilibrium

The equilibrium value of the expected utility of unemployed workers, W_u, is obtained from the resource constraint which equalizes labor supply $\mathcal{N} - \mathcal{U}$ – where u is defined by equation (C.31) – with labor demand L, as defined by equation (C.30). It follows that:

$$\mathcal{N} - \mathcal{U}(W_u, \bar{z}(\pi_{s\ell}), \bar{z}(\pi s_h), \bar{z}(\pi_{b\ell}), \bar{z}(\pi_{bh})) = L(W_u, \bar{z}(\pi_{s\ell}), \bar{z}(\pi s_h), \bar{z}(\pi_{b\ell}), \bar{z}(\pi_{bh})) \quad \text{(C.32)}$$

C.5.1 Hiring costs

Aggregate hiring costs are computed by summing the hiring costs of all establishments. Using as above the definition of aggregate employment provided by equation (C.30), we get:

$$\begin{aligned} \mathcal{H} \quad = \quad & \sum_{i=s,b} O_i \sum_{\tau=1}^{\infty} (1-\mu)^{\tau}(1-\rho)^{\tau-1} \int_{\bar{z}(\pi_{i\ell})}^{\infty} C_i(v_i(z, \pi_{i\ell})) \mathrm{d}\Gamma_i(z) \\ & + \sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty} \sum_{\tau=\tau_\ell}^{\infty} \rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2} \int_{\bar{z}(\pi_{ih})}^{\infty} C_i(v_i(z, \pi_{ih})) \mathrm{d}\Gamma_i(z) \end{aligned} \quad \text{(C.33)}$$

where $C_i(v_i(z,\pi_{ij}))$ stands for the hiring cost of type-(z,π_{ij}) establishments.

C.5.2 Firing costs

Firing costs paid by each establishment depend on the number of destructions of permanent jobs since there are no firing costs for the destruction of temporary jobs. In each period, the probability destruction of permanent jobs in type-(z,π_{ij}) establishments is equal to $G(R(z))$ and firing costs for each job destruction amount to F. Therefore, using again equation (C.30) which defines total employment, we can compute the total number of permanent jobs and then total firing costs:

$$\begin{aligned}\mathcal{F} = &\sum_{i=s,b} O_i \sum_{\tau=1}^{\infty}(1-\mu)^{\tau}(1-\rho)^{\tau-1}F\int_{\bar{z}(\pi_{i\ell})}^{\infty} L_p^{\tau}(z,\pi_{i\ell})G(R(z))\mathrm{d}\Gamma_i(z) \\ &+\sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}F\int_{\bar{z}(\pi_{ih})}^{\infty} L_p^{\tau}(z,\pi_{i\ell},\pi_{ih})G(R(z))\mathrm{d}\Gamma_i(z) \\ &+\sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}F\int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})} L_{p0}^{\tau}(z,\pi_{i\ell},\pi_{ih})G(R(z))\mathrm{d}\Gamma_i(z)\end{aligned} \tag{C.34}$$

C.6 Job flows

This appendix defines the destruction rate of permanent jobs and the rate of conversion of temporary jobs into permanent jobs for young and old establishments created by small and large firms.

C.6.1 Permanent job destruction

In each period, the probability destruction of permanent jobs in type-(z,π_{ij}), $i=\{b,s\}$; $j=\{h,\ell\}$, establishments is equal to $G(R(z))$. Therefore, we can compute the job destruction rate of type-(z,π_{ij}) establishment from the number of permanent jobs in each establishment and from their age distribution.

Average permanent job destruction rate in young establishments. Using the definition of the number of permanent jobs in type-$(z,\pi_{i\ell})$ establishments of age τ, provided by equation (C.20), and the age distribution of establishments, provided in Appendix C.3, we find that the permanent job destruction rate in young establishments created by type-i, $i=\{b,s\}$ firms is:

$$pjd_{i\ell} = \frac{\sum_{i=s,b} O_i \sum_{\tau=1}^{\infty}(1-\mu)^{\tau}(1-\rho)^{\tau-1}\int_{\bar{z}(\pi_{i\ell})}^{\infty} L_p^{\tau}(z,\pi_{i\ell})G(R(z))\mathrm{d}\Gamma_i(z)}{\sum_{i=s,b} O_i \sum_{\tau=1}^{\infty}(1-\mu)^{\tau}(1-\rho)^{\tau-1}\int_{\bar{z}(\pi_{i\ell})}^{\infty} L_p^{\tau}(z,\pi_{i\ell})\mathrm{d}\Gamma_i(z)}$$

Average permanent job destruction rate in old establishments. Using the definition of the number of permanent jobs in type-(z,π_{ih}) establishments of age τ, provided by equation (C.24), and the age distribution of establishments, provided in Appendix C.3, we find that the permanent job destruction rate in old establishments created by type-i, $i=\{b,s\}$ firms is:

$$\begin{aligned}pjd_{ih} = &\frac{\sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}\int_{\bar{z}(\pi_{ih})}^{\infty} L_p^{\tau}(z,\pi_{i\ell},\pi_{ih})G(R(z))\mathrm{d}\Gamma_i(z)}{\sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}\left(\int_{\bar{z}(\pi_{ih})}^{\infty} L_p^{\tau}(z,\pi_{i\ell},\pi_{ih})\mathrm{d}\Gamma_i(z)+\int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})} L_{p0}^{\tau}(z,\pi_{i\ell},\pi_{ih})\mathrm{d}\Gamma_i(z)\right)} \\ &+\frac{\sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}\int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})} L_{p0}^{\tau}(z,\pi_{i\ell},\pi_{ih})G(R(z))\mathrm{d}\Gamma_i(z)}{\sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty}\sum_{\tau=\tau_\ell}^{\infty}\rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2}\left(\int_{\bar{z}(\pi_{ih})}^{\infty} L_p^{\tau}(z,\pi_{i\ell},\pi_{ih})\mathrm{d}\Gamma_i(z)+\int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})} L_{p0}^{\tau}(z,\pi_{i\ell},\pi_{ih})\mathrm{d}\Gamma_i(z)\right)}\end{aligned}$$

C.6.2 Conversion of temporary jobs into permanent jobs

Temporary jobs last one period and are converted with probability $[1-G(T(z))]$ and destroyed with the complementary probability in type-$(z,\pi_{ij}), i=\{b,s\}; j=\{h,\ell\}$, establishments. Therefore, the average conversion rate of temporary jobs in type-(z,π_{ij}) establishments is:

$$tc_{ij}=\frac{\int_{\bar{z}(\pi_{ij})}^{\infty}(1-\pi_{ij})m(\theta(z,\pi_{ij}))v_i(z,\pi_{ij})\left[1-G(T(z))\right]\mathrm{d}\Gamma_i(z)}{\int_{\bar{z}(\pi_{ij})}^{\infty}(1-\pi_{ij})m(\theta(z,\pi_{ij}))v_i(z,\pi_{ij})\mathrm{d}\Gamma_i(z)}.$$

C.7 Welfare

The equilibrium welfare of unemployed workers, W_u, is determined by the labor market equilibrium condition (C.32). This appendix computes the average welfare of permanent and temporary workers in type-(z,π), $i=\{b,s\}; j=\{h,\ell\}$ establishments. In equilibrium, the contracts posted by firms split the total surplus according to the sharing rule defined by (9):

$$W(z,\pi)-W_u=\eta S((z,\pi)$$

Since the surplus of each job is a linear function of its production, as shown by equations (C.5), (C.6) and (C.9), the average welfare of permanent and temporary worker can be computed from the production of establishments and from their age distribution.

C.7.1 Welfare of permanent workers

Permanent workers in young establishments. Since all jobs start at the highest productivity $\varepsilon_{\max}$, the surplus of all jobs in type-$(z,\pi_{i\ell})$ establishments of age $\tau=1$, is equal to $S_p(z,\varepsilon_{\max})$. This implies that the sum of welfare of permanent workers in a type-$(z,\pi_{i\ell})$ establishment of age $\tau=1$ is equal to:

$$\bar{W}_{ip}^{1}(z,\pi_{i\ell})=\pi_{i\ell}v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))\left[\eta S_p(z,\varepsilon_{\max})+W_u\right]$$

All jobs draw a new productivity level ε in each period. Therefore, when $\tau>1$, using the definition of the expected production of type-$(z,\pi_{i\ell})$ establishments of age τ provided by equation (**??**), we can compute the sum of welfare of permanent workers in these establishments, denoted by $\bar{W}_{ip}^{\tau}(z,\pi_{i\ell})$:

$$\begin{aligned}\bar{W}_{ip}^{\tau}(z,\pi_{i\ell})=&\underbrace{\pi_{i\ell}v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))}_{\text{New permanent jobs}}\left[\eta S_p(z,\varepsilon_{\max})+W_u\right] \\ &+\underbrace{(1-\pi_{i\ell})v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))\left[1-G(T(z))\right]}_{\text{Permanent jobs which were temporary in previous period}}\left[\eta S_p^c\left(z,\frac{T(z)+\varepsilon_{\max}}{2}\right)+W_u\right] \\ &+\underbrace{\left(L_{ip}^{\tau}(z,\pi_{i\ell})-v_i(z,\pi_{i\ell})m(\theta(z,\pi_{i\ell}))(1-\pi_{i\ell})\left[1-G(T(z)\right]+\pi_{i\ell}\right)}_{\text{Permanent jobs with at least 2 periods seniority}}\left[\eta S_p^c\left(z,\frac{R(z)+\varepsilon_{\max}}{2}\right)+W_u\right]\end{aligned} \tag{C.35}$$

where $L_{ip}^{\tau}(z,\pi_{i\ell})$ stands for the expected number of permanent jobs in type-$(z,\pi_{i\ell})$ establishments of age τ, defined equation (C.20); $S_p(z,\varepsilon_{\max})$ stands for the surplus of starting permanent jobs defined by equation (C.6) and $S_p^c(z,\varepsilon)$ is the surplus of continuing jobs with productivity ε defined by equation (C.5).

Permanent workers in old establishments. Using the definition of the expected production of type-(z,π_{ih}), $i=\{b,s\}$ establishments of age $\tau>1$ that were previously complying with the less stringent regulation $\pi_{i\ell}$ and which continue hiring after being constrained to comply with the stringent regulation π_{ih}, i.e. whose $z>\bar{z}(\pi_{ih})$, provided by equation (**??**), we can compute the sum of welfare of permanent workers in

these establishments:

$$\bar{W}_{ip}^{\tau}(z,\pi_{ih},\pi_{i\ell}) = \underbrace{\pi_{ih} v_i(z,\pi_{ih}) m(\theta(z,\pi_{ih}))}_{\text{New permanent jobs}} \left[\eta S_p(z,\varepsilon_{\max}) + W_u\right] \tag{C.36}$$

$$+\underbrace{(1-\pi_{ih}) v_i(z,\pi_{ih}) m(\theta(z,\pi_{ih}))\left[1-G(T(z))\right]}_{\text{Permanent jobs which were temporary in previous period}} \left[\eta S_p^c\left(z,\frac{T(z)+\varepsilon_{\max}}{2}\right) + W_u\right]$$

$$+\underbrace{\left(L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih}) - v_i(z,\pi_{ih}) m(\theta(z,\pi_{ih}))\left((1-\pi_{ih})\left[1-G(T(z)\right]+\pi_{ih}\right)\right)}_{\text{Permanent jobs with at least 2 periods seniority minus new temp jobs}} \left[\eta S_p^c\left(z,\frac{R(z)+\varepsilon_{\max}}{2}\right) + W_u\right]$$

where $L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih})$ stands for the expected number of permanent jobs in type-$(z,\pi_{i\ell})$ establishments of age τ defined by equation (C.3).

Permanent workers in establishments which stop hiring. The sum of welfare of permanent workers in establishments which stop hiring when they are constrained to comply with the stringent regulation π_{ih}, i.e., whose $z \in [\bar{z}(\pi_{i\ell}), \bar{z}(\pi_{ih})]$, is:

$$\bar{W}_{i0}^{\tau}(z,\pi_{i\ell},\pi_{ih}) = L_{0p}^{\tau}(z,\pi_{i\ell},\pi_{ih}) \left[\eta S_p^c\left(z,\frac{R(z)+\varepsilon_{\max}}{2}\right) + W_u\right]$$

where $L_{0p}^{\tau}(z,\pi_{i\ell},\pi_{ih})$ is defined equation (C.25).

The total welfare of permanent workers can be computed by summing the welfare of all permanent workers in all types of establishments using the previous definitions and the age distribution of establishments provided in Appendix C.3. We get:

$$\begin{aligned}\bar{W}_p \;=\; & \sum_{i=s,b} O_i \sum_{\tau=1}^{\infty} (1-\mu)^{\tau}(1-\rho)^{\tau-1} \int_{\bar{z}(\pi_{i\ell})}^{\infty} \bar{W}_{ip}^{\tau}(z,\pi_{i\ell}) \mathrm{d}\Gamma_i(z) \\ & + \sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty} \sum_{\tau=\tau_\ell}^{\infty} \rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2} \left[\int_{\bar{z}(\pi_{ih})}^{\infty} \bar{W}_{ip}^{\tau}(z,\pi_{ih},\pi_{i\ell}) \mathrm{d}\Gamma_i(z) + \int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})} \bar{W}_{i0}^{\tau}(z,\pi_{i\ell},\pi_{ih}) \mathrm{d}\Gamma_i(z)\right]\end{aligned} \tag{C.37}$$

The average welfare of permanent workers is equal to $\bar{W}_p$ divided by the number of permanent workers, L_p, which is equal to:

$$\begin{aligned}L_p \;=\; & \sum_{i=s,b} O_i \sum_{\tau=1}^{\infty} (1-\mu)^{\tau}(1-\rho)^{\tau-1} \int_{\bar{z}(\pi_{i\ell})}^{\infty} L_{ip}^{\tau}(z,\pi_{i\ell}) \mathrm{d}\Gamma_i(z) \\ & + \sum_{i=s,b} O_i \sum_{\tau_\ell=2}^{\infty} \sum_{\tau=\tau_\ell}^{\infty} \rho(1-\mu)^{\tau}(1-\rho)^{\tau_\ell-2} \left[\int_{\bar{z}(\pi_{ih})}^{\infty} L_{ip}^{\tau}(z,\pi_{i\ell},\pi_{ih}) \mathrm{d}\Gamma_i(z) + \int_{\bar{z}(\pi_{i\ell})}^{\bar{z}(\pi_{ih})} L_{i0}^{\tau}(z,\pi_{i\ell},\pi_{ih}) \mathrm{d}\Gamma_i(z)\right]\end{aligned} \tag{C.38}$$

C.7.2 Welfare of temporary workers

Temporary jobs last one period in all establishments. Therefore, the average expected utility of temporary workers in type-$(z,\pi_{ij}), i=\{b,s\}; j=\{h,\ell\}$, establishments easily obtains. We get:

$$WT_{ij} = \frac{\int_{\bar{z}(\pi_{ij})}^{\infty} (1-\pi_{ij}) m(\theta(z,\pi_{ij})) v_i(z,\pi_{ij}) \left[\eta S_t(z) + W_u\right] \mathrm{d}\Gamma_i(z)}{\int_{\bar{z}(\pi_{ij})}^{\infty} (1-\pi_{ij}) m(\theta(z,\pi_{ij})) v_i(z,\pi_{ij}) \mathrm{d}\Gamma_i(z)}$$

where $S_t(z)$ stands for the surplus of temporary jobs defined equation (C.9).

D Estimation procedure

This appendix details the estimation procedure of the structural model. The estimation requires to estimate 17 parameters as well as the value of unemployment W_u as explained in the text. Let us denote by b, the instantaneous utility of unemployment; m_0, the scale parameter of the matching function; F, the layoff costs; $\bar{\epsilon}$, the match-specific productivity parameter; c_i, $i = \{s,b\}$ and α, the vacancy cost function parameters; π_{ij}, $i = \{s,b\}$, $j = \{h,\ell\}$, the parameters capturing the stringency of the regulation; and finally $\gamma_{i1}, \gamma_{i2}, \gamma_{i3}$, $i = \{s,b\}$, the generalized extreme value distribution parameters where $\gamma_{i1} > 0$ and $(\gamma_{i2}, \gamma_{i3}) \in \mathbb{R}^2$ stand for the the scale, the shape and the location parameters of the distribution respectively. To estimate the model, we split the 17 parameters into two distinct vectors $\Theta \equiv \{b, m_0\}$ and $\Omega \equiv \{W_u, F, \bar{\epsilon}, c_s, c_b, \alpha, \pi_{s\ell}, \pi_{sh}, \pi_{b\ell}, \pi_{bh}, \gamma_{s1}, \gamma_{s2}, \gamma_{s3}, \gamma_{b1}, \gamma_{b2}, \gamma_{b3}\}$, and we use the following iterative procedure to estimate their values:

1. Conditional on vectors Θ and Ω, we compute the four firm-specific endogenous thresholds, $\bar{z}(\pi_{ij})$, $i = \{s,b\}$, $j = \{h,\ell\}$, by equalizing the surplus of starting jobs (using equations (C.4) and (C.6)) to zero according to the definitions of $\bar{z}(\pi_{ij})$ provided in Appendix C.2.

2. Making use of $\bar{z}(\pi_{ij})$, $i = \{s,b\}$, $j = \{h,\ell\}$ together with equation (14), we pin down the number of production opportunities, O_i, $i = \{s,b\}$ of small and large firms.

3. We calibrate the two parameters b and m_0 of Θ, using the definitions of aggregate employment (equation (C.30)) and aggregate unemployment (equation (C.31)) to match their empirical counterparts.

4. Then conditional on previously computed variables and on Ω, we compute the theoretical distributions of the number of temporary jobs in young and old establishments created by large and small firms. To do so, we use the percentiles of these distributions to identify parameters: W_u, F, $\bar{\epsilon}$, c_s, c_b, α, π_{sh}, $\pi_{s\ell}$, π_{bh}, $\pi_{b\ell}$, γ_{s1}, γ_{s2}, γ_{s3}, γ_{b1}, γ_{b2}, γ_{b3} from the expression of the number of temporary jobs, which can be written, using equations (C.17), (C.18) and (C.19):

$$L_{it}(z,\pi_{ij}) = (1-\pi_{ij})m_0 \left[\frac{(1-\beta)W_u - b}{m_0\beta\eta S(z,\pi_{ij})}\right]^{\left(\frac{1}{1-\alpha}-\eta\right)\frac{1}{1-\eta}} \left((1-\mu)\frac{1-\eta}{\eta c_i \alpha}\left[(1-\beta)W_u - b\right]\right)^{\frac{1}{\alpha-1}} \tag{D.1}$$

   where the closed-form expression of the surplus $S(z,\pi_{ij})$ is given by (C.10).

5. Let us denote by $\mathbf{p}$ and $\mathbf{p}(\Omega)$ the vectors of the empirical and theoretical distribution of the number of temporary jobs in young and old establishments belonging to small and large firms respectively. We then compute the squared distance between the empirical and the theoretical distributions:

$$\left[\mathbf{p} - \mathbf{p}\left(\Omega\right)\right]' \Lambda^{-1} \left[\mathbf{p} - \mathbf{p}\left(\Omega\right)\right] \tag{D.2}$$

   where Λ^{-1} is a symmetric and positive weighting matrix.

6. We then iterate on Ω and repeat the iterative procedure until a minimum is reached.

For the sake of completeness, some additional details are worth mentioning. First, note that the optimal vector Θ cannot be estimated independently of Ω, all parameters being jointly determined in the inner loop of the iterative procedure. Second, the iterative procedure described above breaks down in two steps: (i) we start by implementing a global method to identify the relevant parametric zone. In other terms, we implemented the procedure on a large grid of initial values for Ω; (ii) we then refine the estimation procedure (using a local search method) and implementing a standard two-step feasible GMM. More accurately, we minimize (D.2) taking the identity matrix $\Lambda = \mathcal{I}$ as a weighting matrix to get a preliminary estimator of Ω which we denote by $\hat{\Omega}_1$. We next compute the efficient matrix $\Lambda = \mathbf{p}(\hat{\Omega}_1)\mathbf{p}(\hat{\Omega}_1)'$ and minimize again (D.2) to get an efficient estimator of Ω.

E Identification of the post-reform value of parameter $\pi_{b\ell}$

This appendix details how we adjust parameter $\pi_{b\ell}$, which captures the change in regulation following the reform, to satisfy equation (19) where $\hat{\alpha}_1$ is retrieved from our reduced form estimates and the $y_i(T_i, I)$ are computed from the structural model. The pre-reform $y_i(T_i, I)$ are the steady state values computed from the benchmark structural estimation described in Section 7.1. The post-reform values are the post-reform steady state values where all structural parameters remain unchanged, except $\pi_{b\ell}$, which is adjusted to fulfill equation (19).

In the benchmark exercises, $y_i(T_i, I)$ is the number of net entries into temporary jobs in new establishments during two years following the implementation of the reform estimated from the value of coefficient $\hat{\alpha}_1$ reported in Table 11. Since, by definition, new establishments start with zero jobs, the number of net entries is equal to the number of jobs in new establishments two years after the reform.

The block recursivity of the model implies that the labor market tightness $\theta(z, \pi)$ is determined independently from the employment level and instantaneously jumps to its post-reform steady state value in each labor market when the reform is implemented. Then, according to equation (12), the number of hires per period, equal to $m(\theta(z, \pi))v(\theta(z, \pi))$, jumps to its post-reform steady state value. The surpluses of jobs and the productivity thresholds defined in Appendix C.1 also jump. Similarly, equations (13) and (15) imply that $\bar{z}(\pi_\ell)$ and $\bar{z}(\pi_h)$ jump to their post-reform steady state values. Consistent with our reduced form estimates, this allows us to compute the number of net entries into temporary jobs in new establishments two years before (in the pre-reform steady state) and two years after (in the post-reform steady state) the reform from equations (C.17) to (C.25).

F Accounting for the potential differential impact of the recession on small and large firms

This appendix is devoted to the analysis of the robustness of our results when one accounts for the potential different impact of the 2009 recession on small and large firms as explained in Footnote 53. In the benchmark case, the impact of the reform is estimated by adjusting parameter $\pi_{b\ell}$ to satisfy equation (19) assuming that all other structural parameters remain constant, equal to their pre-reform value. In this appendix, we adjust $\pi_{b\ell}$ and simultaneously change the parameters of the productivity distributions of the establishments of large and small firms between the pre-reform and the post-reform periods. We proceed as follows. First, we compute for small and large firms the variation in the median, the mean and the variance of the empirical productivity distributions between periods 2006-2008 and 2009-2010. Second, starting from the parameters of the extreme value distributions, Γ_i, $i = \{b, s\}$, estimated before the reform in our benchmark estimation, we calibrate the post-reform parameters of these Γ_i distributions and parameter $\pi_{b\ell}$ to satisfy equation (19) and to match the variation in the median, the mean and the variance of the empirical productivity distributions between before and after the reform.

The comparison of the results of this approach, reported Table A.20, with the benchmark case, reported Table 11, shows that large firms have been less impacted by the reform according to this new estimation, because large firms have been more severely hit by the recession than small firms. To put it differently, according to this alternative evaluation, a part of the drop in relative employment of large firms from 2008 to 2010 is the consequence of their more important exposure to the recession compared to small firms. However, the results according to which equilibrium effects are quantitatively important to evaluate the overall impact of the reform remain unchanged. Assuming that SUTVA is satisfied implies that the reform reduced overall employment by 0.9% (Row 'All', first column of the bottom panel of Table A.20) and this result is divided by 13 (Row 'All', first column of the top panel of Table A.20) when general equilibrium effects are accounted for. This is the same figure as that of the benchmark case reported in Table 11.