The Effectiveness of Hiring Credits*

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Abstract

This paper analyzes the effectiveness of temporary countercyclical hiring credits. Using comprehensive administrative data, we show that the French hiring credit, implemented during the Great Recession, had significant positive employment effects and no effects on wages. Relying on the quasi-experimental variation in labor cost triggered by the hiring credit, we estimate a structural search and matching model. Simulations of counterfactual policies show that the effectiveness of the hiring credit relies to a large extent on its temporary nature and on high binding rigid wages. We estimate that the cost per job created by permanent hiring credits in an environment with flexible wages would have been about 14 times larger.

JEL Classification: C31, C93, J6
Keywords: Hiring credit, labor demand, search and matching model

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1 Introduction

Hiring credits have been used in the United States and in a number of European countries to counteract the employment effects of the 2008-2009 recession.[1] Despite this wide use, many economists think that hiring credits are probably useless during recessions, when aggregate demand is insufficient relative to labor and other resources available in the economy.[2] In fact, there is very little empirical evidence about the effects of countercyclical temporary hiring credits. Evidence on federal programs in the US dates back to the 80s (Perlof and Wachter, 1979, Bishop 1981), and the only recent evidence concerns hiring credits implemented at the U.S. states level (Neumark and Grijalva, 2015). We seize the opportunity of the natural experiment induced by the 2009 French hiring credit to highlight the effectiveness of such counter-cyclical policies. Reduced-form estimates of the employment and wage effects of the French program relying on comprehensive administrative data show that the hiring credit has had a significant impact on employment. Then, we use quasi-experimental variations induced by the program to estimate key structural parameters of a search and matching model. Simulations of this model show that the cost per job created is very sensitive to the type of hiring credit – temporary vs. permanent, generalized to all hires vs. targeted at a small subset of hires –, and to the economic environment – high binding wage floors vs. flexible wages.[3]

The French hiring credit, announced on 4 December 2008, relieved firms from social contributions on new hires until 31 December 2009. The program was arbitrarily restricted, for budgetary reasons, to firms with fewer than 10 employees, and to low-wage workers. We show that these restrictions and other features of the program ensure that its implementation can be considered as a natural experiment. Moreover, only a small fraction of hires were actually eligible for the hiring credits so that the program did not trigger spillover effects.

Our evaluation of the French hiring credit relies on two identification strategies. The

[1] See OECD (2010) for a detailed presentation of hiring credit measures in 2009.

[2] For instance, Becker (2010), Posner (2010) and Gali (2013).

[3] By definition hiring credits provide subsidies to new jobs for a limited time at the beginning of the job spell. Temporary hiring credits are one-off schemes that provide these subsidies during specific periods, whereas permanent hiring credits provide them on a permanent basis. Neumark and Grijalva (2015) report that in 99 of the 147 hiring credits recorded in the United States over the period 1970-2012 are permanent.

difference-in-differences strategy compares the evolution of small firms (between 6 and 10 employees) and medium-size firms (between 10 and 14 employees) from November 2008 until November 2009.[4] The IV strategy compares employment pool $\times$ sector cells with high and low shares of subsidized hires. We use the share of low-wage workers in 2008 as an instrument for the share of subsidized hires. Both strategies yield converging results. The French hiring credit significantly increased by 0.1 percentage point the growth rate of targeted firms. Moreover, the employment effects are concentrated as expected on eligible jobs, i.e. low-wage jobs. The impact of the hiring credit emerged quickly: hires and employment began to rise three months after the introduction of the credit. The evolution of hours worked is similar to that of employment, meaning that firms did not substitute hours of new workers benefiting from the hiring credit for those of incumbent employees. We find no increase in wages associated with the hiring credit, and firms did not increase layoffs in order to hire workers at lower cost. Placebo tests, varying the firms' size bandwidth selecting the estimation sample, confirm our results. Comparing ineligible firms in labor markets with a high or low fraction of subsidized hires, we show that the hiring credit did not trigger equilibrium effects.

Building on these reduced-form analyses, we use quasi-experimental variations in labor cost induced by the program to estimate a structural search and matching model. Given that the French experiment did not trigger equilibrium effects, either through wage effects or effects on labor market tightness, we focus first on the estimation of the labor demand equation, assuming that wages and recruitment costs are not impacted by the hiring credit. We show that the variations in the coverage of the hiring credit and in the tightness across local labor markets allow us to identify two key parameters: the elasticity of the marginal labor productivity (with respect to labor) and the vacancy posting cost. The variations in tightness and job finding rates across local labor markets allow us to identify a third key parameter, i.e. the elasticity of the matching function with respect to the number of job-seekers, as in Borowczyk-Martins et al. (2013).

Introducing directed search with wage posting into the model, in the spirit of Moen (1997), we show that the three structural parameters estimated above are sufficient to define the cost per job created by hiring credits in different cases: exogenous vs. en-

[4] Consistent with the program, we split firms according to their size computed from November 2007 to November 2008, before the program was announced.

dogenous wage, temporary vs. permanent hiring credit, hiring credit generalized to all firms vs. hiring credit targeted at a small subset of firms (sufficiently small to have no impact on the labor market tightness). Using our previous estimates of the structural parameters, we compute the cost per job created by these counterfactual policies. In the baseline scenario, which corresponds to the 2009 French hiring credit, the *gross* cost per job created is around one fourth of the average annual wage. To compute the cost per job created *net* of savings on social benefits, we exploit a survey that provides information about the characteristics of the beneficiaries of the hiring credit. It turns out that the 2009 hiring credit has been very effective, since the net cost per job created is about zero.

Nevertheless, our simulations suggest that the effectiveness of hiring credits is contingent on particular circumstances. In line with Kitao et. al. (2010), we find that the temporary nature of hiring credits plays a key role: hiring credits targeted at a small subset of firms create jobs at a cost multiplied by a factor of four when hiring credits are permanent instead of temporary - temporary credits are available for new hires of a given year.[5] Hiring credits generalized to all firms would have featured only a slightly higher cost per job created than a similar hiring credit targeted at a small subset of firms, as long as wages are exogenous. This result, obtained in a context of high unemployment rates, means that congestion effects induced by the hiring credit are too small to induce significant increases in recruitment costs. When wages are endogenous, the cost per job created by temporary hiring credits generalized to all firms is only slightly higher than the cost per job created by temporary hiring credits targeted at a small subset of firms, because temporary increases in labor market tightness induced by temporary hiring credits have little impact on the expected gains of unemployed workers, and therefore on wages. However, permanent economy-wide hiring credits, which induce permanent increases in labor market tightness, have a stronger impact on the expected gains of unemployed workers and then on wages. We find that the reaction of wages multiplies by about 3 the cost per job created by generalized and permanent hiring credits. All in all, this implies that permanent hiring credits generalized to all firms in a context with flexible wages are very ineffective: their cost per job created is about 14 times higher than that of temporary hiring credits. This casts doubt about the effectiveness of permanent hiring credits, which

[5]Note that permanent hiring credits are different from wage subsidies, as, for a given worker, the credit vanishes after a certain tenure in the firm - one year in our simulations.

are frequent in the US.

Our paper contributes to the empirical debate on the effectiveness of hiring credits as counter-cyclical policies. It is related to Neumark and Grijalva (2015) who analyze state hiring credits in the US.[6] Using a difference-in-differences strategy across US states, Neumark and Grijalva (2015) point to moderate positive employment effects of credits targeting the unemployed during recessions. To our knowledge, our paper is the first empirical evaluation of a temporary hiring credit relying on comprehensive firm-level administrative data. The richness of the data and the quasi-experimental situation induced by the French hiring credit allow us to evaluate the impact of the hiring credit, with proper identification strategies, on a wide range of outcomes not available in previous studies. Moreover, our paper is also the first empirical evaluation of a temporary hiring credit in Europe. European empirical evidence mostly concerns the effects of permanent payroll tax reductions. As both hires and incumbents are eligible for these payroll tax reductions, they imply a large deadweight loss, and their estimated effects only partially inform us about the effects of hiring credits.[7] In Europe, hiring subsidies may also be part of broader strategies to activate the unemployed. In this case, hiring credits are not specifically countercyclical. They are frequently coupled with job search assistance programs, which makes it difficult to distinguish their impact, as in Blundell et. al. (2004).[8]

We also contribute to the literature which builds bridges between quasi-experimental or experimental data and structural estimation, i.e. Attanasio et. al. (2012), Ferral (2012), Gautier et al. (2012), Galiani (2015), Lise et al (2015). Our approach features both internal validity and external validity. The source of the identification of the key structural parameters is quasi-experimental and makes use of a well-defined policy shock. Thus we gain internal validity. Then simulations of the underlying economic model enable

[6]Our work is also related to the evaluations of the New Job Tax Credit (NJTC) implemented in the US during the 70s by Perlof and Wachter (1979) and Bishop (1981). Both studies find positive effects of the program, but their analyses suffer from the economy-wide implementation of the NJTC, which makes it difficult to define a proper counterfactual control group.

[7]Indeed, Goos and Konings (2007), Huttunen et al. (2013), Bennmarker et al. (2009), Egebark and Kaunitz (2013) and Skedinger (2014) find rather small employment effects of permanent payroll tax reduction.

[8]A notable attempt to distinguish the relative effectiveness of the different components of activation strategies is Sianesi (2008). She finds that entering a temporary job subsidy program rather than searching further in open unemployment increased employment rates soon after the program ended in Sweden in the 1990s.

us to discuss the external validity of our reduced-form results. This framework is useful to quantify congestion externalities in search and matching models (Beaudry et al. 2012, 2014, Crépon et al., 2013, Lalive et al. 2013, Gautier et al. 2012). It is closely related to Beaudry et al (2014) who show that the wage elasticity of employment is larger in absolute value at the industry-city level than at the city-level. They argue that the effects of wage shocks at the city-level are damped by congestion externalities induced by the reaction of the city-level labor market tightness. We also find that congestion externalities play a very important role through wages. Congestion externalities exert an upward pressure on wages that significantly reduces the employment effects of economy-wide hiring credits compared with hiring credits targeted at a small subset of firms.

The paper is organized as follows. Section 2 describes the hiring credit scheme (*zéro charges*) implemented in France in 2009. Section 3 presents the data, descriptive statistics and the empirical strategy of the reduced-form approaches. The difference-in-differences estimates are presented in Section 4. The results of the IV estimation are presented in Section 5. Section 6 shows that the French program did not trigger equilibrium effects. Section 7 proceeds to the structural estimation of the search and matching model and evaluates the cost per job created by hiring credits in different environments. The last section concludes.

2 Institutional background

The *zéro charges* (zero contributions) measure was announced by the French President on 4 December 2008. According to the original announcement, any hire (or temporary contract renewal) of a low-wage worker in a firm with fewer than 10 employees occurring from the date of the announcement until 31 December 2009 could benefit during the same year from an employer social contribution relief.[9] The relief is maximal for workers with an hourly wage at the minimum wage level (8,82 euros in 2009). With *zéro charges*, employers do not pay any social contribution at the minimum wage level. The relief then decreases as the hourly wage level rises up to 1.6 times the minimum wage. Figure 1 shows that the hiring credit reduces the labor cost by 12% for a full-time worker paid at the

[9] The new relief is in addition to the existing general social contribution reduction on low wages called the *Fillon reduction*, which has prevailed since the 1990s and concerns all firms in the private sector.

Figure 1: The hiring credit schedule.
Note: The horizontal axis reports the monthly wage (in euros) net of employer social contributions of a full time worker ($1,338$ corresponds to the minimum wage in 2009 in gross terms, i.e. including employees' social contributions, $1,472$ is 1.1 times that amount, $1,605$ is 1.2 times and so on). The vertical axis reports the monthly labor cost. The continuous line displays the labor cost without the hiring credit. The dotted line shows the labor cost with the hiring credit.

minimum wage. The maximum amount of the hiring credit over 12 months represents 2,400 euros. When the wage is 30 percent above the minimum wage, the subsidy rate represents only 4 percent of the labor cost.

Before the first announcement, the policy was not anticipated, because it was kept secret.[10] This is illustrated by Figure 2 which shows that Google searches for the item "hiring subsidy" (*aide embauche*) started to increase in December 2008, once the announcement for the program was made. There is no Google search for the item *zéro charges* before early 2009.

The practical details of the hiring credit were rapidly set out in a decree published on 20 December 2008. To start with, only firms and associations belonging to the private sector could get the hiring credit. Firms and associations had to request the *zéro charges*

[10] For instance the newspaper *Les Echos,* describes in an artilce entitled "Le gouvernement envisage d'accélérer ses paiements et remboursements aux entreprises", published on 27 November 2008, all potential measures that the President Sarkozy was supposed to announce in the Press conference of 4 December 2008. The hiring credit is not mentioned in this article. On 4 December 2008, the article entitled "Sarkozy dévoile un plan de 26 milliards d'euros pour relancer l'économie", summarizing the contents of the press conference, does mention the hiring credit.

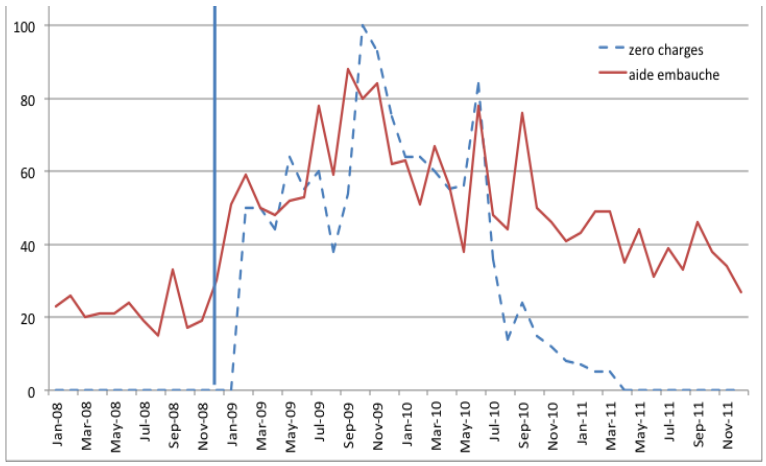

Figure 2: Results of Google search for the policy name.
Note: The vertical axis reports the monthly number of searches for one term relative to the highest point on the figure; "aide embauche" means hiring subsidy. Variations in spellings (e.g. “zéro charges”, “zero charge”) yield similar patterns to “zero charges”. The vertical line indicates the date at which the hiring credit was introduced. Source: Google Trends website.

relief for each hire separately, filling out a one-page form and attaching the labor contract. The claim had to be sent to the French public employment agency (Pôle emploi) which reimbursed for the social contributions payments on eligible hires at the end of each quarter.

Second, to be sponsored, hires had to be for jobs lasting at least one month, and not otherwise sponsored by other targeted special measures, such as even more generous and pre-existing subsidies for some disadvantaged groups (e.g. the long-term unemployed) or apprentices; household jobs were also excluded on the ground of their specific and pre-existing subsidies. The hiring credit was not restricted to firms with net employment growth, and it was not limited to the hiring of the long-term unemployed or any other disadvantaged groups.

Third, only entities with fewer than 10 full-time equivalent employees[11] on average

[11] The size criteria are very precise and follow the usual rules set in the labor code (see cerfa n° 13838-01). Only ordinary employees are kept in the computation of the size (thus excluding apprentices and temporary agency employees and those hired as part of a labor market program). The size is computed as the average of the end-of-month number of employees from January to November 2008. Fixed-term workers contribute *pro rata temporis* their number of days present in the firm over the month. This means that fixed-term workers hired on the 15th of the month working full-time represent 0.5 employees. However, workers hired on permanent contracts are counted as 1 employee during the month no matter

between January and November 2008 could apply. Hence, the period used to define the size criteria ends just before the announcement of the policy, on 4 December 2008. A growing firm reaching 10 or more employees over the year 2009 could still continue to receive subsidies and apply for new hires until the end of 2009. This meant that the size criteria could not be manipulated by firms wishing to benefit from the hiring credit.

Fourth, applying firms must not have fired any workers for economic reasons on the same job over the 6 months preceding the hiring date, nor must they have fired this particular worker over the same period from any other job, and they must have paid all their previous social contributions.

On 16 November 2009, the policy was extended to hires occurring up to 30 June 2010. On this occasion, the duration of the hiring credit was extended for up to 12 months from the hiring date, instead of the cutoff date of 31 December 2009 for the initial scheme. This new rule was also applicable to hires made in 2009 before the announcement of the extension, and which already benefited from *zéro charges*. Firms below the average of 10 full-time equivalent employees from January 2009 to December 2009 were also eligible for the extended program for their new hires in 2010. Hence it is more challenging to study the effects of the policy in 2010, as some firms treated in 2009 may not have been able to apply in 2010, because eligibility for the extended period was then based on the average size over 2009. As a consequence, we focus on outcomes in 2009, and leave the analysis of subsequent years to future research.

The hiring credit was initially part of a wider array of policies designed to cope with the 2008-2009 crisis. Within that array, this is the only item specifically targeted at small firms, and the only item directly altering the labor cost. The exact size threshold of 10 employees was mostly determined by the government budget constraints. Broadly speaking, there were no other explicit legal changes in this period that exerted a varying impact on firms with less or more than 10 employees.

While there are some minor discontinuities at the 10-employee threshold in the French legislation[12], we do not see any accumulation of firms just below the threshold (see Figure

what day of the month they were hired on. All wage-earners working part-time, either on fixed-term or permanent contracts, are accounted *pro rata temporis* their regular number of hours during the month, excluding overtime hours. For instance, wage-earners working mornings only are counted as 0.5 employee.

[12] An increase in the contribution rate for continuing vocational training of 0.55% to 1.05%, an obligation of monthly payments of social security contributions (instead of quarterly payments), an obligation for

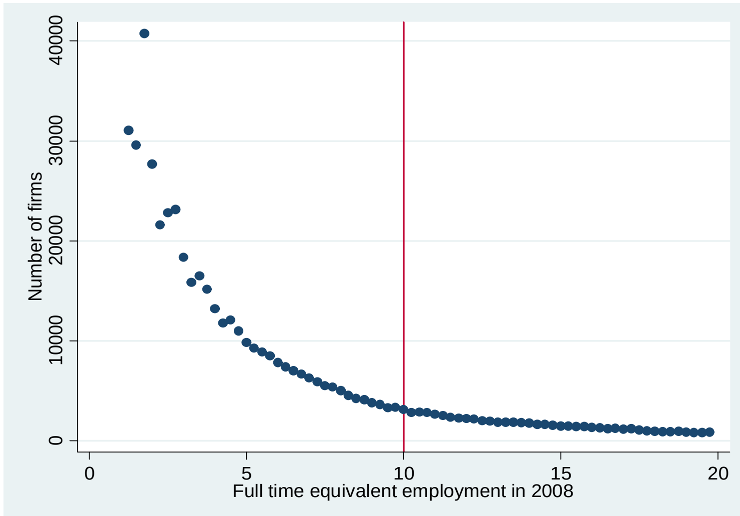

Figure 3: Firm size density. Source DADS.

3). This suggests that the changes in the labor cost or in the labor regulations at the threshold are not significant, nor salient enough to lead firms to sort. Such a sorting might have meant that firms below and above the threshold were reacting differently to the business cycles. This is in line with Ceci-Renaud and Chevalier (2010) who do not find any bunching at the 10-employee threshold. This contrasts with the accumulation of firms just below the 50-employee threshold, as reported by Gourio and Roys (2014) and Garicano et al. (2013). The difference in patterns around the 10 and 50-employee threshold is probably due to the greater change in costs at the 50-employee threshold and its greater saliency: As Garicano et al. (2014, p. 14) put it, "Although there are some regulations that bind when a firm (or less often, a plant) reaches a lower threshold such as 10 or 20 employees, 50 is generally agreed by labour lawyers and business people to be the critical threshold when costs rise significantly".

3 Data and empirical strategy

3.1 Data

We use administrative data from two distinct sources:

payment of transport subsidies and the loss of the possibility of a simplified balance sheet.

- the *Déclarations Administratives de Données Sociales* ("DADS") built by the French Statistical Institute (INSEE) from the social contributions declarations of firms. Each year firms declare the employment spells, the number of hours worked, and the associated wages for each worker.

- the administrative file produced by the French Public Employment Agency (*Pôle emploi*) which administered the payment of the subsidy, designated as the "hiring credit file". It contains information on the firms which enrolled in the *zéro charges* program, the level of the hiring wage, and the exact amount and duration of the subsidy received.

The DADS cover about 85% of French wage earners. Civil servants from the French central, regional and local administrations (general government) and workers from the public health care sector or employed by householders (e.g. for house-keeping or child care) do not appear in this employment register (until 2009). We append the employment registers from 2005 to 2009,[13] creating a panel of firms.[14] We restrict the sample to firms in the for-profit private sector and we drop the agricultural sector as well as associations. We also drop workers in temporary help agencies, as we do not know in which firms they actually work, as well as the 1% of firms with the highest employment growth rates in the sample. All relevant information pertaining to firm size, the number of hires, separations, the wage levels and the duration of contracts is taken from the DADS data set which describes the universe of firms relevant to our evaluation. The eligibility condition based on the size threshold (full-time equivalent) is also computed from the employment register.

Our two data sets can be matched using the firm identifier. This enables us to compute the take-up rate, which corresponds to the fraction of small firms actually benefiting from the hiring credit in 2009. The take-up rate amounts to 24%. This low figure is the product of the hiring rate of low-wage workers and the take-up rate conditional on hiring low-wage workers, which we define as the attention rate. The attention rate (the share of subsidized hires among eligible hires with wages below 1.6 times the minimum wage and contract

[13] The specification concerning the type of labor contract, either fixed-term or open-ended, is not available before 2005. Since the type of contract is used to compute the number of full time equivalent workers, as explained in footnote 11, we cannot use the DADS before 2005.

[14] There is no permanent identifier for individual workers. Our data are not a panel of individual workers.

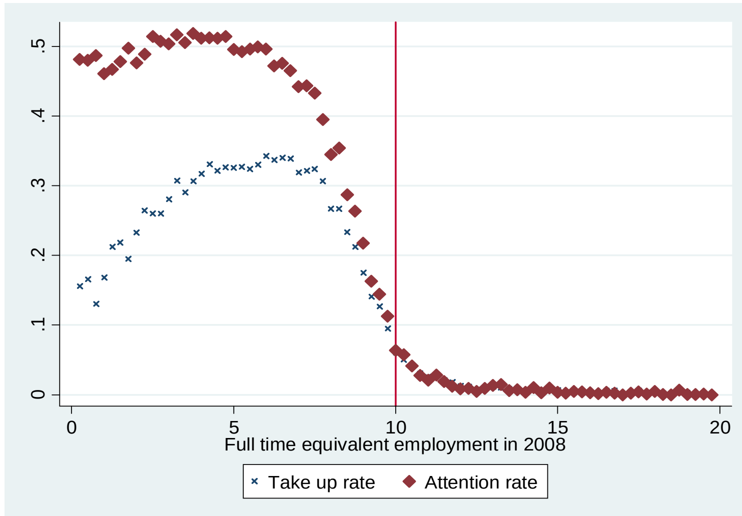

Figure 4: Fraction of firms and of hires that benefited from the hiring credit by firm size in 2009.

Note : The take-up rate is the share of firms below 10 employees benefiting from the hiring credit in 2009; the attention rate is the share of hires with wages below 1.6 times the minimum wage lasting one month or more and which were subsidized in 2009. The number of full-time equivalent employees is measured over the first 11 months of 2008.

duration above one month) amounts to 47%. Figure 4 displays the take-up rate and the attention rate by firm size in 2008 (i.e. according to the eligibility criteria). The take-up rate sharply decreases for firms with 8 employees or more and goes to zero for firms larger than 12 employees. Similarly the attention rate drops before the threshold and it is positive, around 3%, for firms with a workforce of 10 to 12 employees.

To the extent that, as discussed above, firms were not able to manipulate their size to meet the eligibility criterion, the drop in the attention rate before the threshold of 10 employees and the positive fraction of firms from 10 to 12 employees benefiting from the hiring credit are likely the consequences of measurement error. The eligibility criterion is difficult to measure precisely in the employment register at our disposal. In particular, according to the legal rules, workers hired on permanent contracts are considered to be present in the firm from the beginning of the month, even if they have been hired during the month. Since we only observe the type of contract at the end of the year for every worker, we are unable to know whether workers have been hired on permanent or temporary contracts because temporary contracts may have been converted into permanent contracts. Another reason could be that computing the eligibility criterion is a complex task, especially for small firms. Only ordinary employees are kept in the size computation, excluding apprentices and diverse categories of employees benefiting from other subsidies; employees contribute *pro rata temporis* but overtime hours are not taken into account. These features of the eligibility criteria may induce firms to overestimate their size and to refrain from claiming *zéro charges*. The resulting absence of discontinuity in the take-up rate prevents us from using a regression discontinuity design.

3.2 Empirical strategy of the reduced-form approach

The hiring credit may influence employment through its impact on hires and on separations. To see this, let us consider the law of motion of employment which determines the level of employment at the end of the current period

$$L = L_{-1} + H - S, \tag{1}$$

where L_{-1} stands for employment inherited from the previous period, H denotes the number of entries and S is the number of separations.

Hiring credits aim at increasing employment through their effect on hires. However, it is possible that firms benefit from important amounts of hiring credits while the effects on net employment are negligible. Becker (2010) and Posner (2010), reacting to the Hiring Incentives to Restore Employment (HIRE) Act passed in the US in 2010, argued that it will increase churning and wages with very little effect on employment. In our context, churning is potentially an important concern to the extent that worker flows in excess of those strictly necessary to achieve a given change in employment are large in France (Abowd et al., 1999).

If the hiring credit increases employment, it is nevertheless possible that its impact on hours worked is limited, because firms have incentives to substitute hours of subsidized employees for those of non subsidized employees. Therefore, it is also important to analyze the response of hours of work.

In what follows, we estimate the impact of the hiring credit on employment, wages, hours of work, hires and separations, using two different identification strategies: a difference-in-differences strategy and an IV strategy. The difference-in-differences strategy contrasts the evolution of employment in firms with fewer than 10 employees and firms with more than 10 employees before and after the reform was implemented. The IV strategy contrasts the evolution of employment in employment pool $\times$ sector cells with high or low treatment intensity after the reform was implemented. We instrument the treatment intensity by the share of low-wage workers in the cell in 2008 (before the reform).

4 Difference-in-differences

This section presents the difference-in-differences econometric model and our main results on the effects of the hiring credit on employment, hours worked, wages, hires and separations.

4.1 Econometric model

We analyze yearly cohorts of firms. We select, for each cohort t, firms whose size criterion in year $t-1$ is around the cut-off (that is 10 full-time equivalent employees, calculated at the average of end-of-month *pro-rata temporis* headcounts between January and November of year $t-1$) and estimate the following difference-in-differences model:

$$Y_{it} = \alpha + \beta Z_{it} + \gamma D_t + \delta Z_{it} D_t + X_{it} b + u_{it} \tag{2}$$

where Y_{it} is the outcome of firm i in period t, Z_{it} an eligibility dummy equal to 1 if the firm size in period $t-1$ is below 10, D_t a dummy for year 2009 when subsidies can be claimed, X_{it} a vector of covariates. δ is our parameter of interest. It captures the differential evolution of the group targeted by the hiring credit. It can be interpreted as an Intention-To-Treat parameter. Accordingly, we refer, in this section, to firms with fewer than 10 employees in year $t-1$ as our "treatment" group, even if they do not claim the hiring credit. Note that because we define our eligibility dummy for every year, the treatment effect estimate is robust to potential mean-reversion bias that could occur if the definitions of the control and treatment groups had been based on the size of firms in 2008 only.

In the benchmark estimations, the bandwidth goes from 6 (included) to 14 (excluded) full-time employees in the previous year.[15] In Table 1, we report characteristics of our 2009 cohort. These characteristics are measured in 2008. In the first three columns, we compare small and medium size firms. Small (i.e. eligible) firms operate less frequently in manufacturing industry and slightly more often in retail, transport and merchant services than non-eligible medium size firms. They are slightly more frequently located in the Parisian area and the South-Eastern part of France, and less frequently in the North West part of France. Almost half of small firms have sales of less than 2 million euros, while three medium-size firms out of four exceed that mark. Small firms are also younger: 13 percent have existed for less than 5 years vs. 10 percent for medium-size firms. The composition of the workforce (in 2008) differs between small and medium-sized firms. Small firms have more white collar employees, while medium-sized firms have more blue collar workers. Finally, the share of low-paid workers and that of part-time workers are both higher in small firms. These variables are included in the regressions to control for these differences.

4.2 Results

The validity of difference-in-differences estimations is heavily dependent on the common trend assumption. We describe the common trend for treated firms with previous size between 6 and 10 (excluded) and control firms with previous size from 10 to 14 in Figure 5. The outcome is average employment growth in each group.[16] Employment is computed at the firm level. Employment in year t is defined as employment on 30 November of year t. This ensures that employment in 2008 is not influenced by the hiring credit

[15] In the Appendix, we present a robustness analysis where we vary the bandwidth around the 10-employee cutoff.

[16] We focus on the effect of the hiring credit on the growth rate of employment rather than on the employment level for the following reason. The common trend assumption on the employment level requires identical differences in employment levels between year t and year $t-1$ for the control and the treatment group before 2009, i.e. $\bar{L}_t^C - \bar{L}_{t-1}^C = \bar{L}_t^T - \bar{L}_{t-1}^T$ where $\bar{L}_t^j$ stands for average employment of group j ($j = C$ for the control group and $j = T$ for the treatment group) in year $t < 2009$. We checked that this assumption is not fulfilled. This is not surprising inasmuch as the impact of productivity shocks or labor costs shocks on the employment level are expected to increase with the size of the firm. This is the case, for instance, when the wage elasticity of labor demand is constant. To see this, consider a simple static model, where the production function is $F(L)$ and the labor cost is equal to the net wage w times the labor wedge ϕ. The optimal level of employment satisfies $F'(L) = w\phi$. This equation implies that a one percent change in labor cost induces a change in employment level that is proportional to the initial employment level of the firm, i.e. $\mathrm{d}L = L\varepsilon \mathrm{d}\phi/\phi$, where $\varepsilon = F'(L)/LF''(L)$ denotes the elasticity of labor demand with respect to the labor cost $w\phi$.

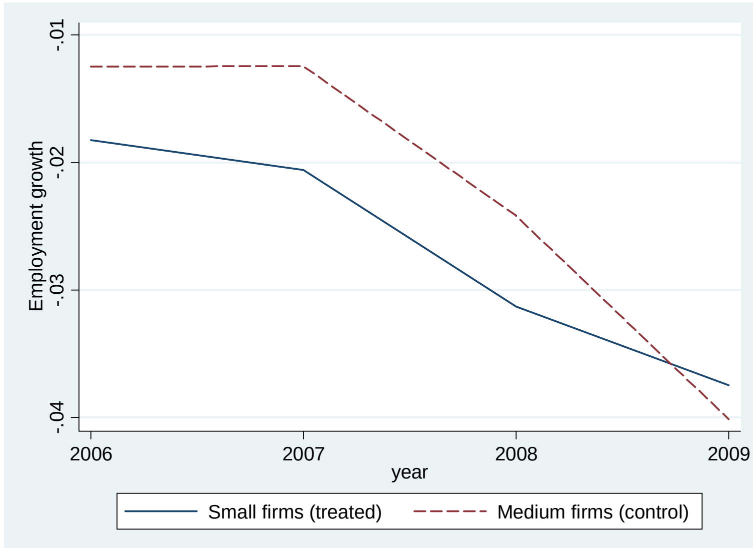

Figure 5: Average employment growth rate in firms in the treated and control groups.
Note: Growth rate of employment between 30 November of year $t-1$ and year t. The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 December to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 December to 30 November).

that was announced on 4 December 2008. Let $L_{i,t}$ denote employment in firm i on 30 November of year t; average employment growth for each group is $\frac{1}{N_t}\sum_i \frac{L_{i,t}-L_{i,t-1}}{L_{i,t-1}}$ where N_t is the number of firms in the group. Figure 5 shows that the difference in employment growth rates between the treatment group and the control group is negative and constant from 2006 to 2008. In 2009, this difference becomes positive: the growth rate of the treatment group drops by 0.9 percentage points while that of the control group drops by 1.6 percentage points.[17] Figure 6 shows that the same phenomenon arises for hours of work: the average growth rate of total hours of work per firm of the treatment group is below that of the control group from 2006 to 2008 and becomes larger than that of the control group in 2009. This points to positive treatment effects, that we estimate below.

[17]The average employment growth is negative for the treatment group and the control group all along the period. This is because new entrants, which typically account for a significant share of employment growth, are excluded from the sample. Bear in mind that, by construction, we cannot include new entrants since we study the behavior of firms that had between 6 and 14 full time equivalent employees the previous year.

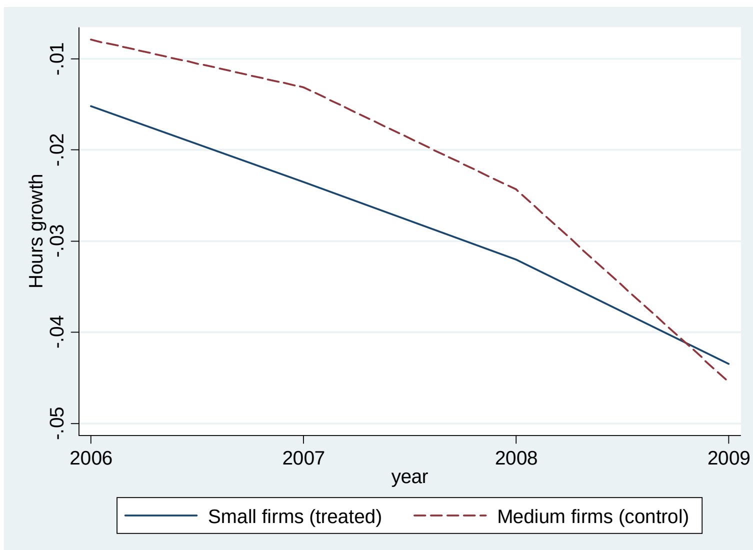

Figure 6: Average hours growth rate in firms in the treated and control groups.
Note: Growth rate of the number of hours worked within each firm between November of year t and November of year $t-1$. The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 December to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 December to 30 November).

In Table 2, we present our difference-in-differences estimates for different outcomes (in rows) and specifications (in columns). In column 1, our baseline sample comprises all cohorts from 2006 to 2009 without covariates. In column 2, we add covariates control which include year, sector and regions dummies, as well as their interactions, dummies for firm age, for firms with sales below 2 million euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). In column 3, we restrict the sample to cohorts 2008 and 2009 (to avoid potential specification errors related to underlying trends). To deal with serial correlation problems which could lead to misleadingly small standard errors (Bertrand et al, 2004) we follow the approach suggested by Cameron and Miller (2015): we compute the cluster-robust standard errors at progressively broader levels, starting at the firm level, then the employment pool sector unit level, and eventually the employment pool level.

The results are very stable. They indicate that the hiring credit increased the employment growth rate of the treatment group by about 0.8 percentage points (column 2, line 4 of Table 2). Table 2 shows that the impact of the hiring credit on the growth of hours of work is similar to that on employment, indicating that firms did not reduce working hours on existing jobs to compensate for new hires. The last row of Table 2 shows that the hiring credit had no impact on the survival of firms, meaning that the hiring credit raised employment in surviving firms. Indeed, estimates on the subsample of surviving firms are identical to that of all firms, as shown in Table 12 in appendix.[18]

Table 3 displays separately the impact of the hiring credit on eligible jobs – jobs paying below 1.6 times the minimum wage that last at least one month – and on ineligible jobs.[19] The hiring credit has a strong positive and significant impact on employment and hours for eligible jobs only. The impact for non eligible jobs is rather positive, but not

[18] Our estimates are not weighted by firm size. This could bias our results if, for instance, the elasticity of labor demand depends on the size of firms. We checked that estimates provided in the course of the paper yield results similar to weighted estimates. This is illustrated by Table 13 in appendix which shows the weighted estimates corresponding to those displayed in Table 2.

[19] The number of observations in Table 3 is smaller than in Table 2 because it excludes firms with eligible jobs only and firms with ineligible jobs only. The last column of Table 3 displays the difference-in-differences estimates for all jobs with this smaller sample. Results are identical to those displayed in Table 2, corresponding to the full sample also comprising firms without jobs either below or above 1.6 times the minimum wage.

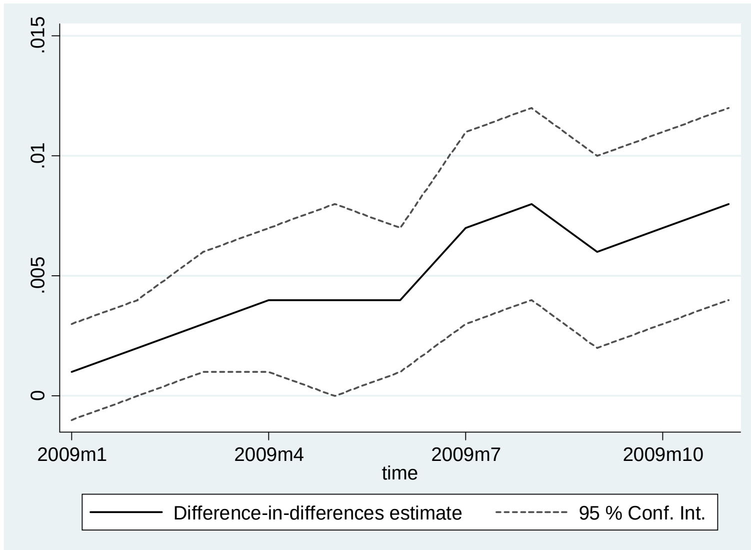

Figure 7: Difference-in-differences estimates of the impact of the hiring subsidy on the employment growth rate.
Note: The outcome is $(L_{m,t} - L_{t-1})/L_{t-1}$ where $L_{m,t}$ denotes employment at the end of month m of year t and L_{t-1} employment on 30 November of year $t-1$. Estimations include years and covariates presented in Table 2, column 2.

significantly different from zero. This means that the hiring credit has had a positive impact on total employment and total hours mainly through its impact on eligible jobs, and very marginally on ineligible jobs.

Our data set allows us to show the evolution of employment month-by-month over the year 2009. Figure 7 displays the difference-in-differences estimates for the effect on employment month by month over the year 2009. The estimated impact of the hiring credit increases steadily over the year. The same is true for hours worked, as shown on Figure 8. In line with the literature on dynamic labor demand, our results indicate that employment may react quickly to shocks on labor costs, with a delay that is clearly infra-annual (Hamermesh, 2013). All in all, these results suggest that *zéro charges* has had a significant and quick impact on employment. Appendix A.3 provides a number of robustness checks of our baseline results, including year placebo tests and placebo size cutoffs.

Since the hiring credit decreased the total labor cost of firms in the treatment group

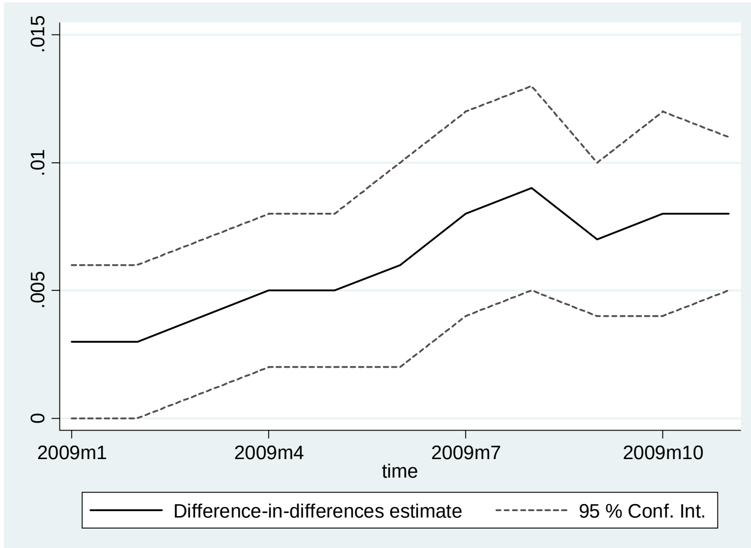

Figure 8: Difference-in-differences estimates of the impact of the hiring subsidy on the growth rate of hours worked.
Note: The outcome is $(h_{m,t} - h_{t-1})/h_{t-1}$ where $h_{m,t}$ denotes hours of work in month m of year t and h_{t-1} hours of work in November of year $t-1$. Estimations include years and covariates presented in Table 2, column 2.

by 0.2 percent[20] and increased total employment by 0.8 percent, our estimates point to an employment elasticity with respect to the change in labor cost induced by the hiring credit of around -4, belonging to the 95% confidence interval $[-6, -2]$.

The strong employment impact of zero charges relies on the absence of wage increases and on the absence of increased churning of workers, as shown in appendices A.1 and A.2. Even if wages and labor turnover did not increase, this figure may at first sight seem incredibly high, compared to usual estimates of labor demand elasticities. For instance, Kramarz and Philippon (2001) and Abowd et al. (2006) found that the elasticity of employment with respect to the minimum wage is about -2 for men and -1.5 for women in France. Crepon and Desplatz (2001), using a different empirical strategy, found an elasticity equal to -0.8 for all workers. The strong employment impact is not due to an intertemporal substitution effect, where firms would have frontloaded hirings before the

[20] In November 2009, firms in the treatment group got 3.6 million euros from *zéro charges* while their labor cost during that month was 1.75 billion euros, which corresponds to a decrease of 0.21% in labor cost. Over the course of year 2009, *zéro charges* decreased the labor cost of firms in the treatment group by 0.14%. The amount of subsidies paid by *zéro charges* increased progressively during 2009.

end of the first hiring credit period. We verify that the effect is still as strong in the service industries where production cannot be easily re-scheduled and buffered using inventories. The results are available upon request.

The strong employment impact of *zéro charges* can be explained by the fact that a temporary decrease in average labor cost can have stronger employment effects when it is induced by a hiring credit than by wage changes that apply to all employees. To show this, let ε stand for the elasticity of contemporaneous employment, L, when the change in average labor cost per worker is due to a temporary change in the wage cost w of all incumbent and entrant workers. This is the standard definition of labor demand elasticity when the payroll equals wL. Let ε_σ stand for the elasticity of employment with respect to the average labor cost per worker when the change in average labor cost per worker is due to *zéro charges*. Bear in mind that the hiring credit alters the cost of entrants (i.e. new hires) only. The relation between employment and hires is given by the law of motion of employment (1). Let us assume that ε is identical in all firms and that the hiring credit does not increase churning of workers and wages, which is the case for *zéro charges* as shown below. We get (see appendix A.4)

$$\varepsilon = \eta\varepsilon_\sigma \tag{3}$$

where η is the share of employees that benefit from the hiring credit on 30 November 2009 in firms with positive take-up of *zéro charges*. As long as $\eta < 1$, the employment elasticity induced by the hiring credit is larger, in absolute value, than that induced by a proportional change in the wage cost of all workers. The reason is that subsidizing the jobs of incumbent workers in firms that recruit yields no employment effects: all it does is to create windfalls for firms. Using hiring credits is a means to target subsidies at marginal jobs, which yields positive employment effects, without providing subsidies to incumbent workers, which yields no employment effects. In the limit case where $\eta = 1$ (which would happen if the take-up rate were 100% and the whole workforce were renewed over the course of a year), the two elasticities are identical because the entire workforce of firms that benefit from the hiring credit is subsidized.

All in all, we find that ε, the elasticity of employment with respect to labor cost induced by a change in wage, is smaller, in absolute value, than when the labor cost is modified by the hiring credit. The 95% interval confidence of the elasticity ε is $[-1.5, -0.5]$,[21] which is in line with previous estimates obtained for France. We show in appendix A.3.3 that this estimate is likely a lower bound for the absolute value of the elasticity of employment, which becomes larger when the difference-in-differences model is estimated with bandwidths that exclude firms with positive take-up rates from the control group.

5 IV strategy: variations in treatment intensity across labor markets

In this section, we implement an alternative identification strategy to measure the impact of *zéro charges*, in which we exploit variations in the treatment intensity across local sector-specific labor markets.

5.1 Econometric model

We group firms into cells wherein the intensity of the treatment differed. Cells are defined as sectors in employment pools (or commuting zones). We distinguish 348 employment pools,[22] and 5 sectors (manufacturing, construction, retail and transport, hotels and restaurants, and other merchant services). We propose to use variation in treatment intensity across cells to estimate the impact of the measure on employment among treated firms. Treatment intensity can be measured by the share of subsidized hires among small firms in each cell. In cells where there is a larger share of subsidized hires among small firms, *zéro charges* should entail a larger effect on the growth rate of employment among these firms.[23] Formally, our equation of interest is:

$$Y_{jk} = \alpha + \delta I_{jk} + \beta X_{jk} + v_{jk} \tag{4}$$

[21] The share of employees that benefit from the hiring credit on 30 November 2009 in firms with positive take-up of *zéro charges* amounts to 0.26 which implies that $\varepsilon = -4 \times 0.26 \simeq -1$ with a 95% confidence interval equal to $[-1.5, -0.5]$.

[22] We use the 348 *zones d'emploi* provided by INSEE, the French national statistical office. A *zone d'emploi* is a geographic area wherein most workers reside and work, and in which companies can find most of the labor needed for the jobs offered. The definition of *zone d'emploi* is based on the flow of commuting workers observed in the 2006 Census.

[23] This design was used to evaluate the effect of the federal minimum wage in the United States using cross-state variation in the fraction of low wage workers (Card, 1992).

where Y_{jk} is the employment growth rate[24] between November 2008 and November 2009 averaged across eligible firms (with 6 to 10 employees in 2008) in commuting zone j and producing in sector k, I_{jk} is the share of subsidized hires in treated firms in 2009 and captures the treatment intensity, X_{jk} is the set of controls at the cell level.

The share of subsidized hires may be correlated with the error term v_{jk} to the extent that the take-up rate is endogenous. As an instrument for the treatment intensity, we use the share of eligible hires (below 1.6 the minimum wage) in small firms in 2008, denoted E_{jk}^{2008}. Note that this share is measured before the introduction of the program. The share of eligible hires in 2009 would probably be more correlated with treatment intensity but it is also endogenous, since firms can always shift their wage offers to be eligible for the hiring credit. Therefore it cannot be used as an instrument.

One concern with our instrument could be that it also affects employment growth directly. For example this would be the case if the business cycle has differential effects for low-wage or high-wage workers. To limit this concern, we include the average value of the employment growth rates for the medium-size firms in the same cell as an independent variable. The set of controls also includes key cell characteristics (the distribution of firms' age, the share of firms with sales below 2 million euros in the previous year and the share of part-time workers in the previous year).

The IV strategy can only succeed if there is variation in the share of low-pay hires across employment pool $\times$ sector cells in 2008. This is the case as shown in figure 9 which displays the distribution of this share among the 348 employment pool $\times$ 5 sector cells in our sample (i.e. 1656 observations, in total, given that some pools do not feature all sectors). In 2008, the share of eligible hires among small firms (with 6 to 10 employees to be consistent with our baseline estimates) averages 0.545 with a standard deviation of 0.132.

5.2 Results

We first estimate equation (4) using weighted OLS (weights are the relative employment size of each cell as measured among 6-10 employees firms). Columns 1 and 2 of Table 4

[24] Henceforth, we focus on employment for the sake of clarity. Results on hours of work, which are not statistically different from those obtained on employment, are consistent with those obtained with the difference-in-differences strategy.

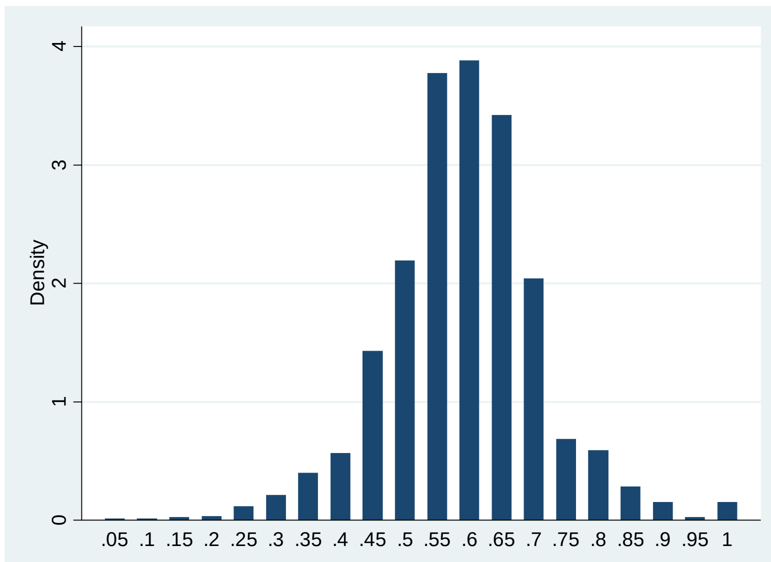

Figure 9: Density of the share of eligible hires in 2008 among small firms.
Note: The share of eligible hires is the share of hires that are paid between the minimum wage and 1.6 times the minimum wage among small firms. The group of small firms comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 December to 30 November). The share is calculated for each of the 348 employment pools $\times 5$ sector cells in our sample (1696 observations, in total, given that some pools do not feature all sectors).

show that a higher share of subsidized hires is associated with a higher growth rate of employment. However, the presence of confounding variables, influencing the employment growth rate and the share of subsidized hires, can imply that OLS estimates are biased. For instance, commuting zones where entrepreneurs are more dynamic may create more jobs and may have lower take-up rates of the hiring credit because their opportunity cost of applying for the hiring credit is higher. Columns 3 and 4 of Table 4 show the results of the IV estimation. The upper panel reports the estimates of the first stage. It shows that the share of eligible hires in 2008 is a strong predictor of the treatment intensity in 2009. The coefficients of the second-stage estimation, reported in the bottom panel, are larger than those obtained with OLS, but they are consistent with the estimates obtained with the difference-in-differences strategy.[25] We checked that restricting the sample to cells with at least 10, or 30 firms between 6 and 10 employees, does not alter these results.

To check further that our two identification strategies yield consistent results, we regress the difference-in-differences equation (2) on the sample made of the employment pool $\times$ sector units. To do so, for each unit and each year we compute the average growth rates of employment and hours worked separately for the two groups of firms (treatment or control). We weight each employment pool $\times$ sector unit by its employment size among firms from 6 to 14 full-time equivalent employees in the previous year. The results, in the supplementary Table 14, are similar to those of Table 2. If we restrict our sample to employment pool $\times$ sector units with at least 10, or 30 firms with 10 to 14 employees present in a given year, results remain unchanged.

6 Equilibrium effects

The validity of our identification strategies relies on the assumption that the control group is not affected by the policy. This is a well-known assumption of the difference-in-differences strategy. It is also important in our IV strategy, where we control for local sector-specific shocks using the employment growth rate of firms above 10 employees. However, the control group could be affected through the two following mechanisms which

[25] To compare these estimates with the benchmark intention to treat estimates obtained in table 2, one needs to account for the share of subsidized hires among small firms. In our sample, the weighted average value of this share is 0.17. Using the value of the coefficient of the fourth column of table 4 this leads to effects at the mean value of $0.17 \times 0.066 = 0.11$ percentage points on the employment growth rate.

are detailed in the structural model estimated below. First, the supplementary hires induced by the hiring credit might increase labor market tightness and thus the recruiting costs for all firms. Second, firms benefiting from the hiring credit may also increase wages, and firms in the control group may need to increase their own hiring wages to attract workers. In our context, it is unlikely that the control group has been affected by the hiring credit for the following reasons: the hiring credit subsidized about 1% of all jobs only in the economy;[26] the hiring credit had no effect on wages as shown in appendix A.1.

Nevertheless, to deal with this issue, we check whether employment of the control group has been impacted by the share of subsidized hires in their employment pool and in their sector. If there are equilibrium effects that reduce the impact of the hiring credit, we should observe lower growth rates of employment among non-eligible firms in areas with a higher share of subsidized hires. We adopt the same definition of cells as in the previous section (348 employment pools $\times$ 5 sectors).

Within each of the $1,656$ employment pool $\times$ sector units for which we have observations in both the treatment and the control groups for 2008 and 2009, we compute the ratio of subsidized hires in 2009 to all hires observed in 2008 among firms with 0 to 14 full-time equivalent employees in 2008, denoted S_{jk}, where j stands for the employment pool and k for the sector. The average value of S_{jk}, is 0.210, and its standard deviation is 0.087. We also compute for each unit the average growth rate of employment and of hours worked from December 2008 to November 2009 among firms having from 10 to 14 full-time equivalent employees in the previous year. We then compare the labor market outcomes across units with different shares of subsidized hires. To achieve this, we estimate the following model :

$$Y_{jk} = \alpha + \beta_1 S_{jk} + \beta_2 S_{j(-k)} + \beta_3 S_{(-j)k} + bX_{jk} + u_{jk} \tag{5}$$

where Y_{jk} stands for the average growth rate of employment or of hours worked in firms with 10 to 14 full-time equivalent employees belonging to employment pool j and sector k, $S_{j(-k)}$ is the number of subsidized hires in 2009 divided by all hires in 2008 in firms

[26]About 20 percent of workers are employed in firms with fewer than 10 employees. The take-up rate of *zéro charges* amounts to 24 percent, and 26 percent of workers employed on 30 November 2009 in firms with positive take-up benefit from the hiring credit. Thus, the share of jobs that benefit from *zéro charges* in November 2009 was equal to $0.20 \times 0.24 \times 0.26 = 1.2$ percent.

with 0 to 14 employees operating in employment pool j and belonging to sectors other than k; and $S_{(-j)k}$ is the number of subsidized hires in 2009 divided by all hires in 2008 in firms with 0 to 14 employees operating in employment pools other than j but belonging to sector k. The term u_{jk} is a residual. In this setting S_{jk} and $S_{j(-k)}$ together account for the equilibrium effects that may occur within the employment pool j whatever the sector, while $S_{(-j)k}$ accounts for the equilibrium effects that could arise from interactions with firms in the same sector as the unit under consideration but outside the employment pool j. We also include a number of cell-specific controls X_{jk} such as the distribution of firms' age, the share of firms with sales below 2 million euros in the previous year and the share of part-time workers in the previous year. To better account for the labor market situation, the set of control variables X_{jk} also includes the change in the survival rate of firms within the unit between 2008 and 2009,[27] as well as the employment growth rate in 2009 observed in the same sector as the unit but in employment zones located nearby.[28] If the sum of coefficients β is significantly different from zero, this indicates the presence of equilibrium effects.

As in the previous section, the number of subsidized hires in 2009 might be affected by unobserved shocks that also affect employment and hours of the control group, meaning that the ratios S of subsidized hires in 2009 are potentially endogenous in equation (5). For this reason, in each employment pool $\times$ sector unit, the ratios S of subsidized hires in 2009 are instrumented by the corresponding shares of eligible hires in 2008 among all hires the same year (when the subsidy was not yet implemented). This amounts to substituting the number of subsidized hires in 2009 at the numerator of S by the number of eligible hires in 2008 in firms with less than 10 employees.

Columns 1 and 3 of Table 5 present the results of the OLS estimation of equation (5) when the employment growth of medium-sized firms is regressed on the share of subsidized hires S_{jk} in the employment pool $\times$ sector units. There is a statistically significant positive correlation between the share of subsidized hires in 2009 and the

[27] Table 16 shows that the hiring rate had no impact on the survival rate of firms.

[28] In the previous section dealing with IV estimates of the impact of the hiring credit on small firms, labor market specificities of each cell were controlled by the employment growth of the medium-sized firms in the same cell. In the present context, we control labor market specificities of each cell with the employment growth in neighborhood employment zones because the employment growth of firms of size different from 10 to 14 employees is potentially correlated with the share of subsidized hires in the same cell.

growth rates of employment in 2009. However, this correlation cancels out when the share of subsidized hires is instrumented by its value in the previous year and when the set of controls is included, as shown by column 7. Table 6, which presents the first step of the IV estimation shows that the shares of subsidized hires in 2009 are strongly correlated with the instruments. Columns 2, 4, 6 and 8 of Table 5 present the results when the employment growth of medium-sized firms is regressed on the share of subsidized hires in the employment pool $\times$ sector units, S_{jk} and on the shares $S_{j(-k)}$ and $S_{(-j)k}$. No significant equilibrium effects are detected in the IV estimates. These results remain unchanged if we restrict our sample to all employment pool $\times$ sector units with at least 30 or 100 units. All in all, these results suggest that the hiring credit had no impact on the medium-sized firms.

7 Gross and net costs per job created

In this section, we first compute the cost per job created by *zéro charges* under the assumption that there are no equilibrium effects. This assumption is consistent with the results of section 6. Only a small share of firms were eligible for this temporary hiring credit, in a context where the minimum wage was binding and unemployment was high, so that we do not observe any equilibrium effects. In the second part of this section, we simulate how equilibrium effects could affect the cost per job created, if the hiring credit were implemented in different economic environments, at different scales and on different time spans.

7.1 Cost per job created by *zéro charges*

Based on our estimates, it is possible to compute the gross cost per job created by the hiring credit in the treatment group. The cost per job created by the hiring credit, c_σ, is a simple function of the contemporaneous wage w and of the employment elasticity with respect to the change in average labor cost induced by the hiring credit (see appendix A.4):

$$c_\sigma = -\frac{w}{\varepsilon_\sigma} \tag{6}$$

Since we estimated that $\varepsilon_\sigma = -4$, this formula also indicates that the cost per job created is equal to 25% of the cost of a job. Accordingly, at the end of 2009, the monthly cost of creating one job amounts to around 700 euros.[29]

This is a gross cost, because it ignores the savings generated by job creation in terms of unemployment and other social benefits that would have been paid in the absence of the measure. It also ignores the remaining social contributions paid by employees on these additional jobs. We exploit a survey, presented in appendix A.4, which allows us to precisely evaluate the savings permitted by *zéro charges* on social benefits. To this end we rely on two key assumptions. First, consistent with our estimation of the impact of *zéro charges* on net job creation, we assume that the number of jobs created by *zéro charges* reduced non-employment by the same amount. Second, we assume that social benefits would have been paid to individuals identical to the beneficiaries of *zéro charges* if they had remained on the dole. We find that the savings amount to about 700 euros per month. This makes the net cost of the hiring credit per created job equal to zero.

7.2 Estimation of structural parameters

The previous estimated costs hold for a small and temporary hiring credit program which subsidized about 1% of all jobs in the economy and had no equilibrium effects. Moreover, this hiring credit was implemented during a recession, in a context where the minimum wage was binding and unemployment was high. A hiring credit covering more hires or occurring in different environments might entail equilibrium effects which could change significantly the impact of the policy, as suggested by Beaudry et al. (2012, 2014), Crépon et al., (2013), Lalive et al. (2013), Gautier et al. (2012). To shed light on this issue, we estimate a search and matching model which enables us to account for equilibrium effects. We start by analyzing the case of exogenous wage. The situation of endogenous wage is studied in a second stage.

[29] Alternatively, we can directly compute the cost per job created from the treatment effect estimate. As shown by table 11, there are $646,717$ jobs in the treatment group at the end of 2008. According to table 2 our estimate of coefficient δ when the dependent variable is $\Delta L/L_{-1}$ in equation (2), equals 0.008. Thus, the number of jobs created in the treatment group is $0.008 \times 646,717 = 5,173$. The *zéro charges* hiring credit provided 3.6 million euros to the firms of the treatment group in our sample at the end of the period, i.e. in November 2009. Accordingly, at the end of 2009, the monthly cost of creating one job amounts to 700 euros.

7.2.1 The search and matching model with exogenous wage

We consider a discrete time economy where a representative firm identical to that presented in appendix A.4 produces an output with labor. The revenue function of the firm in period t is equal to $A_t R(L_t)$, where R is an increasing and concave function with respect to labor L_t, and $A_t > 0$ is a productivity parameter. The firm needs to post vacant jobs to hire workers. A vacant job costs c_V units of output per period. In each period, the sequence of decisions is as follows: 1) vacant jobs are posted; 2) workers are hired; 3) production takes place and wages are paid; 4) an exogenous proportion q_t of workers quit the firm. The assumption of exogenous job separation, which allows us to simplify the analysis, is consistent with the finding that the hiring credit did not induce firms to increase labor turnover in order to benefit from the subsidy (appendix A.2).

A vacant job posted in period t is matched with a worker with probability $m_t \in [0, 1]$ in the period and remains vacant with probability $1 - m_t$. The probability to fill a vacant job is determined by a matching function: $m(\theta_t) = \bar{m}\theta_t^{-\mu}$, where $\theta_t = V_t/U_{t-1}$, equal to the ratio of the number of job vacancies V_t over the number of unemployed workers U_{t-1}, denotes the labor market tightness; $\bar{m}$ is a positive parameter and μ belongs to the interval $(0, 1)$.

Let us denote by w_t the wage in period t and by $\Pi(Z_t, L_{t-1})$ the value function of the firm, where $Z_t = (A_t, w_t, m_t, q_{t-1})$. Let β denote the discount factor and $\mathbb{E}_t$ the expectation operator. The value function of the firm satisfies

$$\Pi(Z_t, L_{t-1}) = \max_{V_t} A_t R(L_t) - w_t L_t - c_V V_t + \beta \mathbb{E}_t \Pi(Z_{t+1}, L_t)$$

subject to the law of motion of employment:

$$L_t = (1 - q_{t-1})L_{t-1} + m_t V_t$$

When the wage is exogenous, the equilibrium values of employment and of the labor market tightness are defined by the labor demand equation derived from the solution of the maximization problem of the firm and by the law of motion of the unemployment rate $u_t = 1 - L_t$:

$$A_t R_L(L_t) = w_t + \frac{c_V}{m(\theta_t)} - \beta(1 - q_t)\mathbb{E}_t \frac{c_V}{m(\theta_{t+1})} \tag{7}$$

$$u_t = u_{t-1} + q_{t-1}(1 - u_{t-1}) - \theta_t m(\theta_t) u_{t-1}. \tag{8}$$

Our objective is to estimate the parameters μ, c_V and $\alpha = LR_{LL}(L)/R_L(L)$, the elasticity of the marginal productivity of labor with respect to labor, which we interpret as a structural parameter of the model (this term is indeed constant if function R is homogeneous). The annual discount factor β is set at 0.95. It is shown, in appendix A.6, that these parameters, together with the job separation rate q_t and the duration of job vacancies, $1/m(\theta_t)$, which are directly observable in our data, allow us to compute the elasticity of employment with respect to different types of hiring credit: temporary, permanent, targeted at a small subset of jobs, generalized to all jobs.

We conduct the structural estimation of parameters μ, c_V and α in two steps.

First, using data on job finding rates and tightness at the employment pool level from the public employment service and from the Labor Force Survey, we estimate the parameters of the matching technology. The elasticity μ is identified using variations of job finding rates and labor market tightness over time within employment pools – see appendix A.7 for more details on the data and on the estimation. In the spirit of Borowczyk-Martins et al. (2013), we address potential endogeneity issues using an IV strategy based on past values of the labor market tightness. The results of the estimation are presented in Table 7. We obtain an elasticity of the matching function with respect to the unemployment rate, μ, around 0.45.

Second, we estimate the production technology parameters, namely the elasticity of the marginal productivity of labor, α, and the cost of posting a vacancy c_V. These parameters are obtained by conducting a structural estimation of the labor demand – see appendix A.7. The identification strategy, which relies on the natural experiment triggered by *zéro charges*, is similar to the IV strategy developed in section 5. We estimate the labor demand of small firms, which are eligible for the program. The policy shock entails exogenous variations in labor cost that are used to identify the production technology parameters. In employment pools where the shock on labor cost is larger because the share of hires eligible for the hiring credit is larger, average employment effects should also be larger. These differences in employment effects yield the elasticity of the marginal productivity of labor. The estimation strategy is complemented to as well recover the vacancy posting cost. The effects of the hiring credit on employment are larger where hiring costs are lower. Hiring costs depend on the time needed to fill a vacancy. In a tight labor market, where vacancy duration is large, the hiring credit is less effective. Using heterogeneity in the effects of the hiring credits across local labor markets with low or large vacancy duration, we identify the vacancy posting cost. Both parameters - the elasticity and the vacancy cost - are identified using the average values over 2006-2008 in firms with 6 to 10 full-time employees of the share of eligible hires, of the duration of job vacancies and of the job separation rate, as instruments for the hiring credit and the hiring cost in 2009. Note that the structural estimation of the labor demand is greatly simplified by the fact that the identifying shock has no impact on wages and labor market tightness, as shown in section 6. The results of the estimation are presented in Table 8. The annual cost of a vacant job represents 12% of the annual wage. Since the average duration of a job vacancy is about 0.2 year, the hiring cost amounts to 2.4% of the annual wage, which is in line with the available empirical evidence.[30] These values imply that the micro elasticity of employment to a change in labor cost, which is about -1, is consistent with the difference-in-differences and the IV estimates presented above.[31]

7.2.2 The search and matching model with endogenous wages

In order to analyze the impact of the hiring credit in a framework where wages are endogenous, we consider a directed search and matching model with wage posting in the spirit of Moen (1997). The assumption of wage posting reduces the number of structural parameters to estimate compared to a model with wage bargaining. Namely, since we do not need to estimate the bargaining power of workers, the parameters of the model with exogenous wage allow us to recover the elasticity of employment when wages are endogenous.

The economy comprises a large number of labor pools or "islands" indexed by i in which there is a representative firm identical to that described above. The mobility of workers between labor pools is perfect. Unemployed workers are assumed to have perfect information on the situation in each labor pool. They get an instantaneous income b and their search activity can be directed toward their preferred employment pool. At every

[30] Kramarz and Michau (2010) estimate that hiring costs represent 2.8% of the wage bill in France. Flinn (2006) finds that the flow vacancy cost is 1.5% of the annual labor cost at the minimum wage in the US. For an overview on several countries, see Manning (2011) Table 2, p 983.

[31] This elasticity is defined by equation (A4) in appendix A.4.

instant, the number of hires in each labor pool is determined by a matching function identical to the one considered hitherto. In each labor pool, the employers with vacant jobs post a hiring wage. This wage is not renegotiable, and applies throughout the employer-employee relationship. The solution to this model and the computation of the elasticities of employment are presented in appendix A.8.

We find that the macro elasticity of employment to a change in labor cost following a temporary hiring credit affecting all firms is lower in absolute value when wages are endogenous than when they are exogenous. The difference in elasticities depends on the parameters of the matching function. If there are important search externalities, wages are strongly affected by changes in labor market tightness and this damps the employment response to the hiring credit.[32] The impact on wages is greater when the hiring credit is permanent because a permanent hiring credit, which increases the labor market tightness in all future dates, has a stronger impact on the expected gains of unemployed workers than a temporary hiring credit, which exerts an upward pressure on labor market tightness only temporarily.[33] We next gauge the quantitative importance of these differences in employment responses using the estimation of the parameters of the search and matching model.

7.3 Cost per job created in different contexts

Table 9 displays the gross cost per job created expressed in percentage of the labor cost per job in different contexts. These costs are computed using the elasticities of employment with respect to labor costs derived from the structural model in the neighborhood of the steady state (see appendices A.4, A.6 and A.8). The steady state values of the model are computed over the 2005-2008 pre-recession period used for the estimation of the structural parameters.

We consider the cost per job created when the hiring credit is either temporary or permanent, when it is either targeted at a small subset of firms or accessible to all firms, and when wages are either rigid or flexible. This makes eight scenarios, all presented

[32] This appears clearly from comparison of the expressions for the macro elasticity with exogenous wage (equation (A13)) and endogenous wage (equation (A34)) which shows that the difference between these elasticities depends on the elasticity of the matching function μ.

[33] See the discussion of equation (A38) in apprendix A.8.

in Table 9. This Table shows that *zéro charges* was implemented in the most favorable situation: it was temporary, targeted at a small subset of firms, and it occurred in a context where wages were rigid.

7.3.1 Permanent versus temporary hiring credits

The cost per job created by permanent hiring credits targeted at a small subset of firms in the same environment would have been four times larger than if they had been implemented for one year only. This result is an immediate consequence of the relation between the elasticity of employment with respect to a change in average labor cost per job induced by a change in the wage of all workers, ε, and the elasticity of employment with respect to a change in average labor cost per job induced by a temporary hiring credit, $\varepsilon_\sigma = \eta\varepsilon$ where η stands for the share of employees that benefit from the hiring credit on 30 November 2009 in firms with positive take-up of *zéro charges*. In our setup, η is about 25%. When the hiring credit becomes permanent, η goes to one and the cost per job created by the hiring credit is increased by a factor of four.[34] Accordingly, hiring credits are more effective at creating jobs at a low cost when they apply on short periods of time.

Table 9 shows that the cost per job created by hiring credits accessible to all firms is only slightly bigger than the cost per job created by hiring credits targeted at a small subset of firms when the wage is exogenous. This means that hikes in recruitment costs induced by the increase in the labor market tightness associated with economy-wide hiring credits have only a small impact on employment. This result is the consequence of small hiring costs as stressed above in section 7.2.1.

7.3.2 Endogenous versus exogenous wages

The comparison of cases with endogenous and exogenous wages shows that the costs per job created are very close in these two cases when the hiring credit is temporary. Note that they are identical when the hiring credit is targeted at a small subset of firms. This result is a consequence of the assumption of decreasing marginal productivity of labor. This implies that each firm optimally increases the number of hires when the hiring credit

[34] The cost per job created of a permanent hiring credit is equal to that of permanent employment subsidy if the firms and the government face the same interest rate, which is assumed here.

is implemented instead of increasing the hiring wage as long as the labor market tightness remains unchanged.[35] In this context, the increase in the reservation wage of workers, induced by the hike in the labor market tightness, is the only channel through which the hiring credit exerts an impact on wages. Namely, in the period where the hiring credit is implemented, firms are induced to post more job vacancies, which pushes the labor market tightness up. The improvement in job finding raises the reservation wages and then the equilibrium wages. The size of this effect is smaller when the hiring credit is temporary rather than permanent, as discussed above. Indeed, in our setup, this mechanism has a small impact on employment creation when the hiring credit is temporary since it increases the cost per job created by about one point of percentage. The small impact of the reaction of wages relies in particular on the relative low elasticity of the job matching function with respect to the unemployment rate, which is estimated at 0.45 in our framework.

Nevertheless, the cost per job created by an economy-wide permanent hiring credit is very high when wages are endogenous: it is about 3 times higher than when wages are rigid, and 14 times higher than in the most favorable situation, where the hiring credit is temporary and targeted at a small subset of firms with rigid wages. It is worth noting that this result is obtained in an economy where the steady state unemployment rate is relatively high, equal to 8.3%. The reaction of wages has bigger effects when the unemployment rate is lower. For instance, the reaction of wages implies that the cost per job created by economy-wide hiring credits is 23 times higher instead of 14 times higher than the targeted temporary credit when the steady state unemployment rate is 7% instead of 8.3%.[36] Accordingly, the comparison with the case of an economy-wide permanent hiring credit with exogenous wages indicates that the reaction of wages has a very strong impact on the cost per job created when hiring credits are permanent. This suggests that such hiring credits are clearly not effective.

[35] See the discussion in appendix, equation (A30). This mechanism is the consequence of decreasing marginal productivity of labor. It also holds in a model with wage bargaining instead of wage posting. It has been highlighted by Stole and Zwiebel (1996) and examined further in a search and matching model by Cahuc et al. (2008).

[36] To get this result, we apply the formulas derived in Appendix to compute the elasticities and we use the labor market tightness consistent with the labor flow equilibrium equation (8) in steady state when the unemployment rate is equal to 0.07 instead of 0.083, assuming that all other parameters remain constant.

8 Conclusion

This paper shows that a hiring credit targeted at small firms and low wage workers did have a significant impact on employment in France during the 2008-2009 recession. All in all, the hiring credit was very effective. It allowed the government to create jobs at zero net cost in a short period of time.

The estimation of a search and matching model shows, however, that the effectiveness of this hiring credit relied on very special circumstances: it was temporary, it was targeted at a small subset of firms and it was implemented in a context with high binding wage floors and high unemployment. Among all these elements that have favored the effectiveness of the hiring credit, it appears that its temporary nature was key. The temporary nature of the hiring credit allows the government to lower the cost of entrants but not that of incumbent workers with limited effects on wages which need time to adjust. This implies that hiring credits can be effective to boost job creation at a low cost if they are implemented on short periods of time. The search and matching model suggests that this conclusion also holds true for economy-wide hiring credits and even when the minimum wage in not binding. Nevertheless, a counterpart of this positive conclusion is that hiring credits create jobs at very high costs when they are implemented permanently, especially when there are no high wage floors. This suggests that they should be avoided in such circumstances.

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Table 1: The characteristics of eligible/ineligible and treated/untreated firms in 2008

Nb employees in 2008	Eligible 6-10	Ineligible 10-14	Diff test p-value	Treated 6-10	Untreated 6-10	Diff test p-value
Manufacturing	.159	.195	.0000	.138	.166	.0000
Construction	.184	.185	.6620	.191	.182	.0460
Retail and transport	.308	.294	.0000	.325	.302	.0000
Hotels and restaurants	.097	.087	.0000	.148	.081	.0000
Merchant services	.252	.239	.0000	.199	.269	.0000
Parisian area	.238	.232	.0360	.153	.265	.0000
North-West	.243	.254	.0000	.261	.238	.0000
North-East	.121	.125	.0600	.129	.118	.0000
South-East	.268	.261	.0260	.307	.255	.0000
South-West	.130	.128	.2700	.150	.124	.0000
Sales below 2 millions euros	.473	.218	.0000	.534	.453	.0000
Young firm (age below 5 years)	.133	.100	.0000	.131	.134	.4820
Mean share of...						
... male managers	.207	.218	.0000	.161	.222	.0000
... female managers	.120	.116	.0000	.101	.126	.0000
... male white-collar	.080	.074	.0020	.096	.075	.0000
... female white-collar	.209	.184	.0000	.254	.195	.0000
... male blue-collar	.346	.365	.0000	.351	.344	.0140
... female blue-collar	.037	.043	.0000	.036	.037	.5350
Mean share of ...						
...low-wage workers	.610	.594	.0000	.709	.593	.0000
...part-time workers	.263	.214	.0000	.255	.239	.0000
Nb. of obs.	70,998	30,912	-	17,017	53,981	-

Source : DADS (Insee). Note : Low-wage workers earn between the minimum wage and 1.6 times this amount (on an hourly basis). Part-time workers work below 80 percent of normal working hours. The number of employees corresponds to the full-time equivalent in 2008 (average from 1 January to 30 November). The number of observations corresponds to the number of firms in the sample.

Table 2: Difference-in-differences estimates of the impact of the hiring credit on various labor market outcomes in 2009

Cohorts	2006-2009	2006-2009	2008-2009
Covariates	No	Yes	Yes
Emp. growth	.010***	.008***	.009***
	(.002; .002; .002; .002)	(.002; .002; .002; .002)	(.002; .002; .002; .002)
Hours growth	.010***	.009***	.008***
	(.002; .002; .002; .002)	(.002; .002; .002; .002)	(.002; .002; .002; .002)
Hiring rate	.014***	.012***	.019***
	(.005; .004; .004; .004)	(.004; .004; .004; .004)	(.005; .004; .004; .004)
Sep. rate	.005	.004	.010**
	(.005; .004; .004; .004)	(.004; .004; .004; .004)	(.005; .004; .004; .004)
Survival rate	.000	.000	−.000
	(.001; .001; .001; .001)	(.001; .001; .001; .001)	(.001; .001; .001; .001)
Nb. Obs	405,376	405,376	206,845

Source : DADS (Insee). Note : this Table presents our difference-in-differences estimates for different outcomes (rows) and different specifications (columns). The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). We consider as outcomes the growth rate of employment between 30 November of year t-1 and year t; the growth rate of the number of hours worked between November of year t-1 and November of year t; the number of hires from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; the number of separations from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; the survival rate from 30 November year t-1 to 30 November year t. As covariates, we include year, sector and regions dummies, as well as their interactions; we also include dummies for firm age, firms with sales below 2 million euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). Standard deviations in parentheses, respectively, not clustered, clustered at the firm level, at the employment pool X sector level, at the employment pool level. There are 348 employment pools ("zones d'emploi", Insee) and 5 sectors. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 3: Difference-in-differences estimates of the impact of the hiring credit for eligible and ineligible jobs on various labor market outcomes in 2009

	Eligible jobs	Ineligible jobs	All jobs
Employment growth	.010***	.002	.008***
	(.003)	(.004)	(.002)
Hours growth	.012***	.005	.008***
	(.003)	(.004)	(.002)
Hiring rate	.011***	.005	.008**
	(.004)	(.008)	(.004)
Separation rate	.001	.003	.000
	(.004)	(.008)	(.004)
Nb. Observations	349,996	349,996	349,996

Source : DADS (Insee). Note : this Table presents our difference-in-differences estimates for different outcomes (rows) and different types of jobs (columns): eligible jobs below 1.6 times the minimum wage that last at least one month; ineligible jobs above 1.6 times the minimum wage or that last less than one month; all jobs. The treatment group comprises firms of size between 6 (included) and 10 (excluded) full time equivalent employees in the previous year (average from 1 January to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 January to 30 November). We consider as outcomes the growth rate of employment between 30 November of year t-1 and year t; the growth rate of the number of hours worked between November of year t-1 and November of year t; the number of hires from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; the number of separations from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; As covariates, we include year, sector and regions dummies, as well as their interactions; we also include dummies for firm age, firms with sales below 2 million euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 4: Cross-unit estimates of the impact of the hiring credit on employment growth rates in 2009, based on OLS and IV

	OLS		IV-2SLS	
Covariates	No	Yes	No	Yes
			First stage	
			Share of subsidized hires	
Share of eligible hires in 2008			.435*** (.021)	.420*** (.020)
R^2			.812	.826
			Second stage	
	Employment growth			
Share of subsidized hires	.027*** (.012)	.032*** (.011)	.058*** (.022)	.066*** (.023)
R^2	.509	.511		
Nb. Observations	1,656	1,656	1,656	1,656

Source : DADS (Insee). Note : This table presents estimates based on cross-cell differences in the intensity of treatment in 2009. Each cell corresponds to one employment pool and one sector. Within each cell the treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). Each cell is weighted by its relative employment size as measured among 6-10 employees firms. We consider as outcome the growth rate of employment between 30 November of year t-1 and year t. The share of subsidized hires is instrumented with the share of eligible hires (i.e. hires in small firms with wages between the minimum wage and 1.6 times the minimum wage) in the corresponding cell in 2008. Covariates include the distribution of firms' age in the cell, the share of firms with sales below 2 million euros in the previous year, the share of part-time workers in the previous year and the employment growth rate of the control group in the same cell. Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 5: Cross-unit estimates of equilibrium effects on the growth rates of employment in 2009 among firms with 10-14 employees, based on OLS and IV

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS				IV 2SLS - Second stage			
Covariates	No		Yes		No		Yes	
S_{jk}	.097***	.055*	.071	.052*	.088**	.071	.067	.089
	(.035)	(.029)	(.045)	(.029)	(.036)	(.096)	(.046)	(.103)
$S_{j(-k)}$		$-.022$		.013		$-.007$		.002
		(.033)		(.035)		(.101)		(.104)
$S_{(-j)k}$		.047		.030		.027		$-.006$
		(.047)		(.052)		(.095)		(.099)
Test $S_{jk} + S_{j(-k)} + S_{(-j)k} = 0$ (p-value)		.1000		.094		.3622		.3981
R^2	.344	.356	.356	.360				
Nb. Observations	1,656	1,656	1,656	1,656	1,656	1,656	1,656	1,656

Source : DADS (Insee). Note: The dependent variable is the average growth rate of employment over 12 months from 1 December 2008 to 30 November 2009 in each employment pool x sector unit, among firms with 10 to 14 full-time equivalent employees in the previous year. The independent variables are the ratios of subsidized hires, which correspond to three variables: (1) the number of subsidized hires in 2009 divided by the number of hires in the employment pool x sector unit in 2008, among firms with 0 to 14 full-time equivalent employees in the previous year; (2) the same ratio but measured among firms belonging to the same employment pool and to other sectors than the one considered for the dependent variable; (3) the same ratio but measured among firms belonging to the same sector and to other employment pools than the one considered for the dependent variable. In the IV regressions, these ratios are instrumented by the corresponding shares of eligible hires in 2008, i.e. the ratios of the eligible hires in 2008 to total hires in 2008, among firms with 0 to 14 full-time employees in the previous year. As covariates, we include dummies for distribution of firms' age, the share of firms with sales below 2 million euros in the previous year, the share of part-time workers in the previous year, change in the survival rate of firms within the cell between 2008 and 2009, as well as the employment growth rate in 2009 in the same sector as the cell but in employment zones located nearby. Weights are used: for each employment pool x sector unit the weight equals total employment among firms with less than 14 full-time equivalent employees in the previous year. Robust standard errors in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 6: First stage of the instrumental variable estimates of equilibrium effects.

IV 2SLS - First stage		
Covariates	No	Yes
	S_{jk}	
Z_{jk}	.409***	.414***
	(.027)	(.024)
$Z_{j(-k)}$	.471***	.438***
	(.038)	(.030)
$Z_{(-j)k}$	.292***	.239***
	(.029)	(.031)
Test $Z_{jk} = Z_{j(-k)} = Z_{(-j)k} = 0$ (p-value)	.0000	.0000
	$S_{j(-k)}$	
Z_{jk}	.219***	.205***
	(.051)	(.034)
$Z_{j(-k)}$	.678***	.661***
	(.029)	(.025)
$Z_{(-j)k}$	−.086**	−.085***
	(.036)	(.031)
Test $Z_{jk} = Z_{j(-k)} = Z_{(-j)k} = 0$ (p-value)	.0000	.0000
	$S_{(-j)k}$	
Z_{jk}	.007*	.011***
	(.004)	(.003)
$Z_{j(-k)}$	−.002	−.011
	(.010)	(.007)
$Z_{(-j)k}$	.617***	.601***
	(.005)	(.005)
Test $Z_{jk} = Z_{j(-k)} = Z_{(-j)k} = 0$ (p-value)	.0000	.0000
Nb. Observations	1,656	1,656

Source : DADS (Insee). Note: The dependent variables are the ratios of subsidized hires, which correspond to three variables: First panel: the number of subsidized hires in 2009 divided by the number of hires in the employment pool x sector unit in 2008, among firms with 0 to 14 full-time equivalent employees in the previous year. Second panel: the same ratio but measured among firms belonging to the same employment pool and to other sectors than the one considered for the dependent variable. Third Panel: the same ratio but measured among firms belonging to the same sector and to other employment pools than the one considered for the dependent variable. The independent variables are the instruments used in the second stage, i.e. the corresponding shares of eligible hires in 2008 (i.e. the ratios of the eligible hires in 2008 to total hires in 2008, among firms with 0 to 14 full-time equivalent employees in the previous year) As covariates, we include dummies for distribution of firms' age, the share of female or male workers with different occupations (managers, white-collar or blue-collar workers), lagged employment growth and lagged hiring rate rates, the change in the survival rate of firms within the unit between 2008 and 2009, as well as the employment growth rate in 2009 in the same sector as the unit but in employment zones located nearby. Weights are used: for each employment pool x sector unit the weight equals total employment among firms with less than 14 full-time equivalent employees in the previous year. Robust standard errors in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 7: Estimates of the parameters of the matching function.

	(1)	(2)
Dep. var.	Job finding rate (log)	
	OLS	IV
Labor market tightness (log)	$.654^{***}$ (.018)	$.545^{***}$ (.060)
Year FE	Yes	Yes
Employment pool FE	Yes	Yes
Nb. Observations	1,392	1,044

Source : Pôle emploi and Enquête emploi (Labor Force Survey, Insee) Note: Estimation of the parameter of the job matching function equation (A15) on 348 employment pools from 2006 to 2009. (1) Standard (within) OLS ; (2) IV regression. As an instrument we use the lagged value of the labor market tightness. Robust standard errors in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 8: Estimates of the parameters of the production technology and of the search cost.

	(1)	(2)	
	OLS	IV	
		First stage	
Dep. var.		Average hiring credit	Hiring cost
Share eligible hires		.030*** (.003)	−.012 (.098)
Duration of vacant jobs		.020* (.012)	.210*** (.053)
Separation rate		.015*** (.001)	.165*** (.005)
		Second stage	
Dep. var.		Employment growth	
Average hiring credit (a_1)	.689*** (.123)	1.009*** (.261)	
Hiring cost (b_1)	−.102*** (.028)	−.117*** (.037)	
Controls	Yes	Yes	
Nb. Observations	1,603	1,603	

Source : Pôle emploi and DADS (Insee). Note: This table presents the estimation of equation (A19). In the OLS and the second stage of the IV estimation, the dependent variable is the average growth rate of employment from 1 December 2008 to 30 November 2009 in each employment pool x sector unit, among firms with 6 to 10 full-time equivalent employees in the previous year. The independent variables are the average hiring credit per employee and the hiring cost as defined in equation (A19). As covariates, we include the employment growth in firms with 10 to 14 full-time equivalent employees in the previous year, the distribution of firms age in the cell and the share of firms with sales below 2 million euros in the previous year. The average hiring credit per employee and the hiring cost are instrumented by the corresponding average values of the share of eligible hires, of the duration of job vacancies and of the job separation rate among firms with 6 to 10 full-time employees over 2006-2008. Weights are used: for each employment pool x sector unit the weight equals total employment among firms with 6 to 10 full-time equivalent employees in the previous year. Robust standard errors in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 9: Cost per job created (in percentage of the labor cost per job) by hiring credits in different contexts

Hiring credit:	To small subset of firms		To all firms	
	Temporary	Permanent	Temporary	Permanent
Exogenous wage	26.1	100.0	27.1	112.7
Endogenous wage	26.1	100.0	27.9	360.4

Note: The cost per job created is gross, and as such it does not account for the savings induced by job creation in terms of unemployment and other social benefits that would have been paid in the absence of the measure. It also ignores the remaining social contributions paid by employees on these additional jobs. Hiring credits which are targeted at "small subset of firms" entail no equilibrium effects. Hiring credits which are available to all firms entail equilibrium effects. Temporary hiring credits last one year. The cost per job created is computed using the formula derived in appendices A4, A6 and A8. The discount factor, β, is set to 0.95. The estimation of the structural model yields: $\mu = 0.45, \alpha = -0.99$ and the annual cost of a vacant job cv/w=0.12. The values of the other parameters are computed over the period 2005-2008. The exit rate from employment, q, and the duration of job vacancies 1/m are computed from the DADS. We get q=0.5, 1/m=0.2. The unemployment rate is computed from the French Labor Force Survey (Enquête emploi), which yields u=0.083. The share of employees that benefit from the hiring credit on 30 November 2009 in firms with positive take-up and from the "hiring credit file" in 2009 is computed from the DADS. We get $\eta = 0.26$.

A Appendix

A.1 Wages

The hiring credit may raise individual net wages. It may also induce firms to hire workers with fewer skills at lower wages, since the hiring credit decreases with the wage as shown on Figure 1. To evaluate the impact of the hiring credit on wages, we use our difference-in-differences approach, where the dependent variable is the difference in log wages.[37] Let w_{it} be the average hourly wage of workers in firm i in year t and $\tilde{w}_{it-1}$ their average hourly wage in the previous year (if they worked), either in firm i, or in any other firm. Workers who did not work in the previous year are excluded[38]. For each firm i and year t, the dependent variable is $\ln w_{it} - \ln \tilde{w}_{it-1}$ for all workers present in firm i on 30 November of year t. This variable allows us to compare the evolution of wage changes in small and medium-sized firms controlling for individual past wages. If the hiring credit did indeed have an impact on wages, that should be apparent for the entrants eligible for the hiring credit – i.e. workers hired during the current year, paid below 1.6 times the minimum wage, and who worked in the firm at least one month. Figure 10 shows the evolution of the wages of these workers in the small and medium-sized firms over the years 2006-2009. Contrary to what we see for employment and hours of work, there is no break in the common trend in 2009. This suggests that the hiring credit had no impact on wages. This is confirmed by Table 15 which displays the difference-in-differences estimates for the wages of all workers, for the wages of incumbent workers paid below 1.6 times the minimum wage, and for the wages of entrants eligible for the hiring credit. In all cases, the estimates point to a null effect of the hiring credit on wages. This result is not surprising in the French context, where there is a high minimum wage and collective agreements that cover more than 90 percent of employees and that are most often binding for small firms.

A.2 Churning and separations

Table 2 shows that the hiring credit has a positive, although non-significant, impact on the separation rate. Consistent with this result, the hiring credit has a bigger impact on the hiring rate than on employment growth, although the difference is not significantly different from zero. It may be suspected that this result reflects some strategic behavior of firms which might replace incumbent workers with new workers to benefit from the hiring credit.

Let us provide evidence which suggests that this is not the case. Using French data over the period 1987-1990, Abowd et al. (1999) estimate that each job created in a given year is associated with 3 hires and 2 separations. Davis et al. (2012) also find that hires rise more than one-for-one with job creation in the US. This relation indicates that a higher incidence of recently formed matches at more rapidly growing firms generates higher separation rates. There are two reasons for this. One is purely mechanical: at given quit rate, the separation rate, equal to the number of separations during the period divided by employment at the beginning of the period (or by the average of employment at the beginning and at the end of the period), increases when employment grows faster. Another reason flows from the fact that filling a job

[37]Note that although the DADS is not a panel, it does provide the wage in the previous year for each worker.

[38]This exclusion results in a lower number of observations in Table 4 than in Table 2.

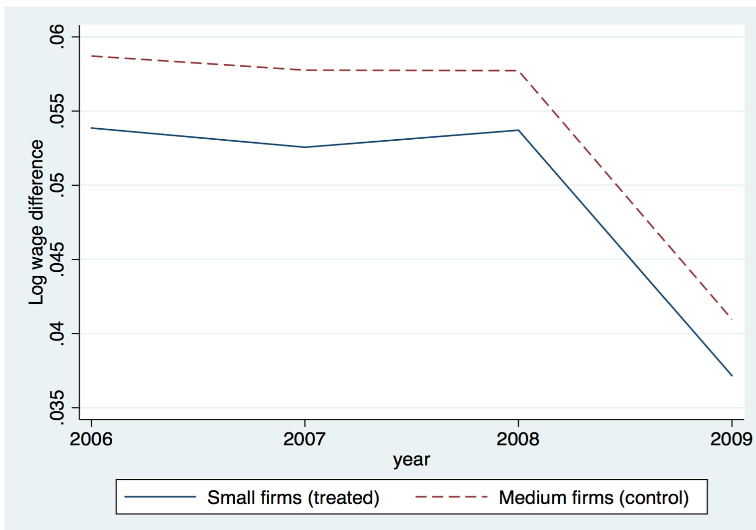

Figure 10: Average log wage difference of entrants eligible for the hiring credit in firms in the treated and control groups.

Note: Eligible entrants are workers hired during the current year, paid below 1.6 times the minimum wage and who worked at least one month in the firm. The average log wage difference for each group is $\frac{1}{N_i}\sum_i \ln w_{it} - \ln \tilde{w}_{it-1}$ where w_{it} is the average hourly wage of eligible entrants in firm i in year t and $\tilde{w}_{it-1}$ their average hourly wage in the previous year, if they worked, either in firm i, or in any other firm; N_i is the number of firms in the group. The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 December to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 December to 30 November).

requires finding the right match with the right worker, which is not always the case with the first hire. Accordingly, if the hiring credit fosters job creation, it may also increase churning, even in the case where firms to do not strategically raise their separations in order to hire new workers at lower cost.[39]

The upper chart of Figure 11 shows the relation between the hiring rate and the employment growth rate in small-size and medium-size firms over the period 2006-2008. The vertical axis displays the average annual hiring rate[40] by growth rate bins. Hires increase more than one-for-one with job creation in all firms. Over the period 2006-2008, the relation between hires and employment growth is similar in small-size and in medium-size firms.

If the hiring credit had induced employers to replace incumbent workers with new workers to benefit from the subsidy in 2009, the hiring rate, at a given employment growth rate, would have been higher in small firms, eligible for the hiring credit, than it was in medium-size firms not eligible for the hiring credit. The bottom panel of Figure 11 shows that this is not the case. The relation between hires and employment growth is similar in small-size and medium-size firms before and after 2009. This means that the hiring credit did not induce firms to increase labor turnover in order to benefit from the subsidy.

A.3 Robustness checks

In this appendix we perform a number of additional estimations to check the robustness of our baseline results. We run year placebo tests. We also consider placebo size cutoffs and changes in the bandwidth.

A.3.1 Year placebo tests

We perform a series of year placebo tests using cohorts from 2006 to 2008. We use the specification of column 3 in Table 2 as if the policy had been implemented in December 2006 (using cohorts 2006 and 2007) or December 2007 (using cohorts 2006, 2007 and 2008). Table 17 shows that employment, hours, hires and separations of the treatment and the control groups did not evolve differently either in 2007 or in 2008, contrary to 2009 when *zéro charges* was introduced. These results reinforce the relevance of the common trend assumption. They also rule out the possibility that our estimates of the impact of *zéro charges* are driven by reversion to the mean.

A.3.2 Size placebo tests

A potential concern is that our results may reflect the fact that firms of different sizes behave differently during the business cycle, especially at the beginning of recessions. Moscarini and Postel Vinay (2012) have shown that large firms (above 500 employees) destroy proportionally more jobs in net terms relative to small firms (below 20 employees) when unemployment is above trend in France. This phenomenon is not necessarily a concern in our case, because

[39]Assume that each hire induces s separations. If s remains constant, the separation rate, defined as S/L_{-1} increases with H. This is also the case if the separation rate is defined as $2S/(L + L_{-1})$, as in Davis et al. (1996).

[40]The hiring rate of year t is the number of hires from 1 December of year $t-1$ to 30 November of year t divided by employment on 30 November of year $t-1$.

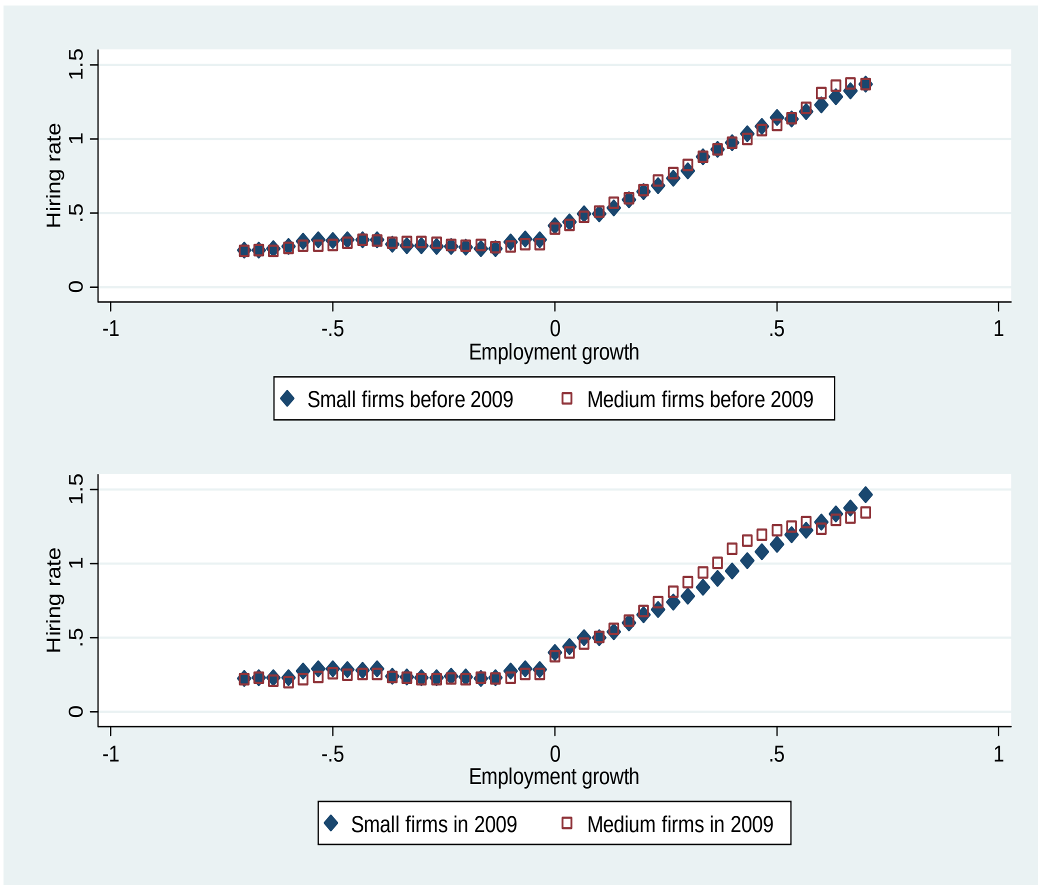

Figure 11: Hiring rate and employment growth rate in small size and medium size firms. Note: The upper chart displays the average of the mean hiring rate by employment growth rate bins over 2006-2008. The bottom chart displays the average hiring rate by employment growth rate bins in 2009. Dots represent 6-bin moving averages. Small size firms have 6-10 (excluded) full-time equivalent employees in the previous year. Medium size firms have 10-14 full-time equivalent employees in the previous year. Source: DADS.

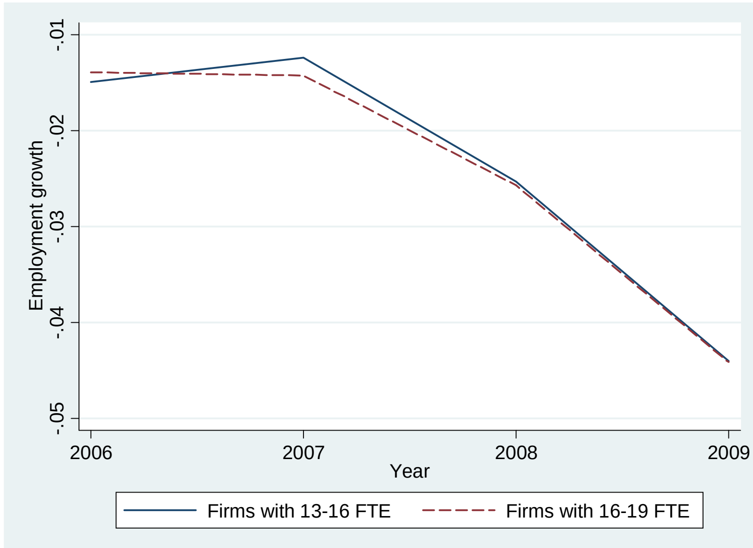

Figure 12: Average employment growth rates in placebo groups.
Note: Growth rate of employment between 30 November of year $t-1$ and year t. One group comprises firms of size between 13 (included) and 16 (excluded) full-time equivalent employees in the previous year (average from 1 December to 30 November). The other group comprises firms of size from 16 (included) to 19 full-time equivalent employees in the previous year.

the difference in the firm size in our control and treatment groups is very small compared to the situation studied by Moscarini and Postel-Vinay. Nevertheless, we check that there is no systematic difference in the evolution of employment and hours across firms of different size in 2009.

If firms of size between 6 and 10 employees in 2008 behaved differently in 2009 from firms of size between 10 to 14 employees because of differences in size and not because of the hiring credit, we would expect firms with 13 to 16 employees to behave differently from firms with 16 to 19 employees.[41] Figure 12 compares the average employment growth rate for firms with 13 to 16 (excluded) employees in previous year and firms with 16 to 19 employees in previous year. The difference in employment growth across these groups does not change in 2009. This result is confirmed by the difference-in-differences estimates for these two groups of firms.[42] This indicates that the difference in employment growth across our treatment and control groups does not stem from differences in behavior due to differences in size.

A.3.3 Changing the bandwidth

Our benchmark difference-in-differences estimates are based on a sample which includes some treated firms featuring a lower take-up than others (between 8 and 10 employees), and a residual

[41] We avoid making comparisons using firms with 10 to 12 employees in the previous year, only a tiny fraction of which have benefited from the subsidy as shown by figure 4.

[42] We do not present these estimates to save space. The results are available upon request.

take-up among control firms (between 10 and 12 employees, see Figure 4). Table 16 presents the estimates for different bandwidths. The difference-in-differences estimates are higher when the treatment group includes firms with higher take-up rates (column 1 to 3). Column 4 shows that the estimates are also higher when the control group excludes firms with residual take-up. The corresponding estimates of elasticity of employment with respect to the change in labor cost induced by *zéro charges* equal -1.43 and -1.95 when the bandwidth goes from 5 to 15 employees and falls in the range [5,8]-[13,16] employees, respectively.[43] All in all, these results suggest that our benchmark estimate of the elasticity of employment with respect to the change in labor cost induced by the hiring credit is conservative: it is likely a lower bound for the elasticity that might be larger than 4 in absolute value.

A.4 Micro elasticity of employment

This appendix presents a model of the firm used to compute the elasticity of employment with respect to the average labor cost per worker and the cost per job created induced by a hiring credit. We consider a discrete time, partial equilibrium model of a firm which produces an output with labor. The revenue function of the firm in period t is equal to $A_t R(L_t)$, where R is an increasing and concave function with respect to labor L_t, and $A_t > 0$ is a productivity parameter. The firm needs to post vacant jobs to hire workers. A vacant job costs c_V per period. In each period, the sequence of decisions is as follows: 1) vacant jobs are posted; 2) workers are hired; 3) production takes place and wages are paid; 4) separations occur at exogenous rate q_t. A vacant job posted in period t is matched with a worker with probability $m_t \in [0,1]$ in the period and remains vacant with probability $1 - m_t$.

Let us denote by w_t the wage in period t and by $\Pi(Z_t, L_{t-1})$ the value function of the firm, where $Z_t = (A_t, w_t, m_t, q_{t-1})$. Let β denotes the discount factor and $\mathbb{E}_t$ the expectation operator. The value function of the firm satisfies

$$\Pi(Z_t, L_{t-1}) = \max_{V_t} A_t R(L_t) - w_t L_t - c_V V_t + \beta \mathbb{E}_t \Pi(Z_{t+1}, L_t)$$

subject to the law of motion of employment:

$$L_t = (1 - q_{t-1}) L_{t-1} + m_t V_t \tag{A1}$$

For the sake of simplicity, it is assumed that the constraint $V_t \geq 0$ is never binding. The first order condition is

$$A_t R_L(L_t) - w_t + \beta \mathbb{E}_t \left[\Pi_L(Z_{t+1}, L_t) \right] = \frac{c_V}{m_t} \tag{A2}$$

The envelope theorem together with the first order condition (A2) implies that in every period

$$\Pi_L(Z_t, L_{t-1}) = \frac{(1 - q_{t-1}) c_V}{m_t} \tag{A3}$$

Thus, the first order condition implies that employment is defined by

$$A_t R_L(L_t) = w_t + \frac{c_V}{m_t} - \beta \mathbb{E}_t \left[\frac{(1 - q_t) c_V}{m_{t+1}} \right]$$

[43] As explained in footnote 21 these elasticities imply labor demand elasticity with respect to the wage equal to $-1.43 = -5.5 \times 0.26$ and $-1.95 = -7.5 \times 0.26$ respectively.

This equation implies that the elasticity of employment with respect to the contemporaneous wage is, in the neighborhood of steady state:

$$\varepsilon = \frac{\mathrm{d}L_t}{\mathrm{d}w_t}\frac{w_t}{L_t} = \frac{w}{\alpha\left(w + \frac{1-\beta(1-q)}{m}c_V\right)} \tag{A4}$$

where $\alpha = LR_{LL}(L)/R_L(L)$ stands for the elasticity of the marginal productivity of labor with respect to labor. Now, assume that there is a non anticipated temporary hiring subsidy in period t denoted by σ_t. The profit in period t is

$$A_t R(L_t) - w_t L_t - (c_V - m_t\sigma_t)V_t \tag{A5}$$

This implies that the first order condition in period t for the optimal choice of V_t is:

$$A_t R_L(L_t) = w_t - \sigma_t + \frac{c_V}{m_t} - \beta\mathbb{E}_t\left[\frac{(1-q_t)c_V}{m_{t+1}}\right] \tag{A6}$$

The average labor cost per worker in a firm with L_t workers and H_t hires that gets a hiring credit σ_t per hire boils down to:

$$\psi_t = w_t - \sigma_t\frac{H_t}{L_t} \tag{A7}$$

The elasticity of employment with respect to the average labor cost per worker when the change in labor cost is due to the temporary hiring subsidy σ_t, is:

$$\varepsilon_\sigma = -\frac{\mathrm{d}L_t}{\mathrm{d}\sigma_t}\frac{\mathrm{d}\sigma_t}{\mathrm{d}\psi_t}\frac{\psi_t}{L_t}$$

Equations (A4), (A6) and (A7) imply, in the neighborhood of steady state and $\sigma = 0$, where $\psi = w$, that:

$$\varepsilon_\sigma = \frac{L}{H}\varepsilon \tag{A8}$$

In order to interpret this expression when the take-up of the hiring credit is smaller than one, let us denote by $\mathcal{L}_t = \bar{L}_t + L_t$ total employment where $\bar{L}_t$ stands for employment of firms that do not benefit from the hiring credit and L_t for employment of firms that benefit from the hiring credit. Assuming that the wage is identical in all firms, the average cost per employee becomes $\psi_t = w_t - \sigma_t\frac{H_t}{\mathcal{L}_t}$ where H_t denotes the hires of firms with positive take-up. It is easily checked that we get, in the neighborhood of steady state and $\sigma = 0$:

$$\varepsilon_\sigma = -\frac{\mathrm{d}\mathcal{L}}{\mathrm{d}\sigma}\frac{\mathrm{d}\sigma}{\mathrm{d}\psi}\frac{\psi}{\mathcal{L}} = \frac{L}{H}\varepsilon$$

where H stands for the number of hires of firms with positive take-up.

Let us now determine the cost per job created by a temporary subsidy on all wages in period t and by the hiring subsidy σ_t in the neighborhood of steady state and $\sigma_t = 0$. The cost per job created by the subsidy which decreases all wages by an amount $-\mathrm{d}w$ is:

$$c = -\frac{L\mathrm{d}w}{\mathrm{d}L} = -\frac{w}{\varepsilon} \tag{A9}$$

The cost per job created by the hiring credit is equal to

$$c_\sigma = \frac{H\mathrm{d}\sigma}{\mathrm{d}L} = \frac{H}{L}\frac{w}{\frac{\mathrm{d}L}{\mathrm{d}\sigma}\frac{w}{L}} \tag{A10}$$

Since $\frac{\mathrm{d}L}{\mathrm{d}\sigma} = -\frac{\mathrm{d}L}{\mathrm{d}w}$ (see equation (A6)) and $\varepsilon = \frac{H}{L}\varepsilon_\sigma$ (see equation (3)), the cost per job created by the hiring credit is

$$c_\sigma = -\frac{w}{\varepsilon_\sigma}$$

A.5 Computation of net cost per job created

In order to evaluate the savings permitted by *zéro charges* on social benefits, we use a survey conducted by the public employment service *Pôle Emploi* in November - December 2009 on the beneficiaries of *zéro charges*. *Pôle Emploi* interviewed 3,083 firms and a total of 3,996 employees who benefited from *zéro charges* between 1 January and 30 June 2009, out of 270,755 beneficiaries recorded during that period. The survey collected the gender, age, and education of the recruits, the main reason for recruitment (creation of a new job, replacement of another worker, contract renewal, temporary needs, etc.), as well as the type of contract (permanent or temporary), the profession, the monthly wage and the sector of firms. More interestingly, it also included a question on the personal situation of workers immediately *before* the recruitment took place: employed, registered or unregistered unemployed, in training or at school, on sick or maternal leave, or inactive. The corresponding breakdown is presented in Table 10 for workers less than 26 years old (64% of the recruits) and those 26 years old or more. We use this information to estimate the savings on social benefits induced by the jobs created by zéro charges. To do so we compute the social benefits that would have been received by the beneficiaries if they had remained on the dole.

In 2009, the average unemployment insurance benefit (called *Allocation de Retour à l'Emploi*) was 970 euros per month, but only 50% of the registered unemployed received it (DARES, 2012). About 10% received unemployment assistance (called *Allocation de Solidarité Spécifique*, a means tested scheme) which amounted to 450 euros. Another 10% received the minimum income (called *Revenu de Solidarité Active*, also about 450 euros for a single person without children), and 30% did not receive any benefit. This gives a (weighted) average cost of 575 euros for the registered unemployed. As for those not registered, they do not receive unemployment benefits as registration is a prior condition. But they are eligible for the minimum income of 450 euros per month, which inactive people are as well, for which studies show a typical take-up rate of 2/3.[44] This provides an average cost of 300 euros per month for the unregistered unemployed and the other inactive individuals, but only for those 26 years old or older, since younger unemployed / inactive people are not eligible for this minimum income scheme. Students may be eligible for scholarships, but these are rather rare. The main benefit for students is one of the three main housing benefits schemes, the average amount of which is about 200 euros per month. We apply the same take-up of 2/3, as for the minimum income, which gives an average benefit of 133 euros per month for students. For trainees, there is a specific benefit (called *ARE formation*) for those unemployed and eligible for the insurance benefit, which was 975 euros on average in 2009.

[44] See http://www.social-sante.gouv.fr/IMG/pdf/1_Le_non-recours_au_rSa_et_ses_motifs.pdf

Since only about half of the unemployed are eligible for the insurance benefit, we apply a take-up rate of 50%, which gives a monthly cost of about 485 euros. There might be other benefits for non-employed trainees but they are scarcer and we neglect them. Finally, we consider that, in the absence of the jobs created by *zéro charges*, those employed immediately before being hired on these jobs would have been unemployed otherwise, and would then have received the same average benefit as the registered unemployed (since they would have just ended an employment period, they would probably have registered rather than forgo job search support and unemployment benefits). Adding all these benefits, and using the weights of the various populations (less or more than 26 years old, and by status), as provided in Table 10, gives an average benefit per worker of 460 euros per month. To these savings one must add the social contributions paid by the additional *employees* hired on jobs created by *zéro charges*, which amount to 23% of gross wages, or about 235 euros per month on average given the observed hiring wages. All in all, each job created by *zéro charges* generates monthly net savings of 695 euros. This estimate excludes the cost of social in-kind services (such as counselling, case-management and health services) typically more important for unemployed and inactive persons than for those in employment. It also takes into account only the basic amount of the minimum income, excluding all supplements for couples and children.

A.6 Macro elasticity of employment with exogenous wage

This appendix computes the macro elasticity of employment with respect to the change in the contemporaneous labor cost in the neighborhood of steady state of the search and matching model presented in section 7.2.1. We first compute the micro elasticity with respect to a temporary change in the wage w_t. The equilibrium values of employment and of the labor market tightness in period t are given by equations (7) and (8), which can be written, in the neighborhood of steady state, denoting without time subscript the steady state values of the unemployment rate u, of the labor market tightness θ and of the job separation rate q:

$$A_t R_L(L_t) = w_t + \frac{c_V}{\bar{m}\theta_t^{-\mu}} - \beta(1-q)\frac{c_V}{m(\theta)} \tag{A11}$$

$$1 - L_t = u + q(1-u) - \bar{m}\theta_t^{1-\mu} u \tag{A12}$$

where $L_t = 1 - u_t$. Differentiation of these equations yields the macro elasticity of contemporaneous employment with respect to labor cost when there is a temporary change in the wage w_t. Then, applying relation (3) which states that $\varepsilon_\sigma = \varepsilon/\eta$, where[45] $\eta = H/L$ we get the macro elasticity of contemporaneous employment with respect to labor cost when there is a temporary change in labor cost induced by a temporary hiring credit in a context where the wage is exogenous:

$$\varepsilon_\sigma(\text{macro, temp, exo}) = \frac{1}{\eta\alpha\left[1 + \frac{c_V}{m(\theta)w}\left([1-\beta(1-q)] - \frac{\mu}{q\alpha(1-\mu)}\right)\right]} \tag{A13}$$

[45]Since all firms are identical in the model, H/L can be interpreted indifferently as the average hiring rate of all firms or of the firms that benefit from the hiring credit. In the simulations of the impact of the various hiring credits, it is assumed that the take-up rate is constant and that H/L is the average hiring rate of all firms that benefit from the hiring credit.

where $\alpha = LR_{LL}(L)/R_L(L)$.

Similarly, the macro elasticity of steady state employment with respect to labor costs when the change in labor cost is induced by a permanent hiring credit in a context where the wage is exogenous, is:

$$\varepsilon_\sigma(\text{macro, perm,exo}) = \frac{1}{\alpha\left[1 + \frac{c_V}{w}\frac{[1-\beta(1-q)]}{m(\theta)}\left(1 - \frac{\mu}{(1-\mu)\alpha u}\right)\right]} \tag{A14}$$

A.7 Estimation of the search and matching model

This appendix presents the estimation of the parameters of equations (7) and (8).

A.7.1 Matching technology

We first estimate the parameters of the matching function m_t: $\bar{m}$ and μ. Taking logs of the definition of the matching technology, we obtain the following underlying structural relation :

$$\log(H/U) = (1-\mu)\log(V/U) + \nu$$

where $\nu = \log \bar{m}$. We use variations across employment pools over time to identify the parameter μ. Let us denote j the employment pool (commuting zone). Yearly data on unemployment stocks (U_{jt}) at the employment pool level are computed by the French statistical institute (*Insee*) using the French Labor Force Survey (*Enquête Emploi*). Vacancies data (V_{jt}) come from the French Employment Agency (*Pôle emploi*). *Pôle emploi* posts vacancies that firms send to the Agency. This is a free service and *Pôle emploi* estimates that they deal with almost 50% of the total of French vacancies. Combining these data, we measure the tightness θ_{jt} at the employment pool level. Hiring data (H_{jt}) are observed in our main dataset *DADS*. Let us denote f_{jt} the yearly job finding rate (H_{jt}/U_{jt}). We estimate the following equation

$$\log f_{jt} = a_1 \log\theta_{jt} + \sum_t b_t 1\left[year = t\right] + c_j + \nu_{jt} \tag{A15}$$

where j is one of the 348 employment pools (commuting zones) and the year t varies from 2006 to 2009, as in the main text. The estimation controls for year dummies and employment pool fixed effects (c_j). The equation is estimated both by standard (within) OLS and IV regression. As an instrument for the current labor market tightness we use past values of the labor market tightness. This addresses potential endogeneity issues (see Borowczik et al. 2013). For instance, an improvement in the matching technology (increase in $\bar{m}$) can increase θ and reduce the unemployment rate.

Table 7 shows the estimates of the coefficient a_1 using OLS in column 1 and using IV in column 2. Both estimates are highly significant. Taking the IV estimation as our preferred estimate, μ, the elasticity of the matching function with respect to the unemployment rate, amounts to 0.45.

A.7.2 Production technology and search costs

We now estimate the parameters of the production technology and the search cost: A, α, c_V. Assuming that c_V/m is small with respect to w the labor demand in period t can be written:

$$\log R_L(L_t) = \log(w_t) + \frac{c_V}{w_t}\left[\frac{1}{m_t} - \frac{\beta(1-q_t)}{m_{t+1}}\right] - \zeta_t \tag{A16}$$

where $\zeta_t = -\log(A_t)$. Estimating directly (A16) is plagued with well-known endogeneity issues between the wage level and the productivity level. Relying on our specific exogenous policy shock, we set out an alternative structural estimation. In 2009, when the hiring credit is implemented, the structural demand equation can be written:

$$\log R_L(L_t) = \log(w_t - \sigma) + \frac{c_V}{w_t - \sigma}\left[\frac{1}{m_t} - \frac{\beta(1-q_t)}{m_{t+1}}\right] - \zeta_t \tag{A17}$$

We can then compute the first difference between equation (A17) (in 2009) and equation (A16) (in 2008) for firms eligible for the hiring credit.

$$\alpha\Delta\log L_t = -\frac{\sigma}{w_t} + \frac{c_V}{w_t}\left(\frac{1}{1-\sigma/w_t}\left[\frac{1}{m_t} - \frac{\beta(1-q_t)}{m_{t+1}}\right] - \left[\frac{1}{m_{t-1}} - \frac{\beta(1-q_{t-1})}{m_t}\right]\right) - \Delta\zeta_t \tag{A18}$$

where Δ is the difference operator: $\Delta x_t = x_t - x_{t-1}$, $\alpha = LR_{LL}(L)/R_L(L)$ is the elasticity of the marginal productivity of labor with respect to labor that we interpret as a structural parameter of the model. To get this expression, we use the facts, shown in appendix A.1, that the hiring credit had no effect on wages and that w_t/w_{t-1} is negligible with respect to σ/w_{t-1}, and we take a first order approximation of $\log R_L(L_t)$ in the neighborhood of $L_t = L_{t-1}$.

We aggregate the analysis at the employment pool $\times$ sector level. This is the finer level at which we observe the labor market tightness and consequently the duration of vacancies. We again use administrative data on the vacancies posted at the Employment Agency to compute the duration of vacancies ($1/m_{jkt}$). We assume that $\beta = 0.95$. We compute the wage and the job separation rates from the DADS database. The amount of the hiring credit obtained by small firms comes from the "hiring credit file" which contains information on the firms enrolled in the *zéro charges* program. We estimate the following equation:

$$\Delta\log L_{jkt} = a_1\frac{\sigma_{jk}}{w_{jkt}} + b_1\frac{1}{1-\sigma_{jk}/w_{jkt}}\left[\frac{1}{m_{jkt}} - \frac{\beta(1-q_{jkt})}{m_{jkt+1}}\right] + c_1\Delta\log L^{med}_{jkt} + c_2 X_{jkt} + \nu_{jkt} \tag{A19}$$

where j stands for employment pool and k for sector, and t is year 2009. $\Delta\log L^{med}_{jkt}$ is the employment growth rate of medium-sized firms between 2008 and 2009 in employment pool j and sector k. X_{jkt} is a set of covariates characterizing the population of small firms in the corresponding cell. While the above specification partly deals with the endogeneity issue of the wage, it can still be the case that the amount of hiring credit is correlated with productivity shocks in 2009 or unobserved factors of the cell associated with employment growth. For example, a positive productivity shock stimulates both employment and the average amount of subsidy (via a greater number of subsidized hires). This is the same endogeneity issue as in the IV identification strategy presented in the main text. The identification strategy is then as follows: first, we control for market-level covariates and the employment growth in the control group; second, we use the average values of the share of eligible hires, of the duration of job vacancies and of the job separation rate of firms with 6 to 10 full-time employees over 2006-2008, as instruments for the amount of the subsidy received in 2009 and for the hiring cost. Estimates of a_1 and b_1 using this strategy are shown in table 8. They are significantly different from zero. Taking the IV estimation as our preferred estimate (column 2), we obtain $\hat{\alpha} = -0.99, \widehat{c/w} = 0.12$.

A.8 Macro elasticity of employment with endogenous wage

This appendix presents the impact of the hiring credit in a directed search and matching model with wage posting in the spirit of Moen (1997) described in the main text. We characterize the steady state equilibrium in a first step. Then, we analyze the impact of temporary and permanent hiring credits.

A.8.1 Stationary equilibrium without hiring credit

The hypothesis of directed search by workers and perfect mobility implies that the expected utility of an unemployed person is the same in all the labor pools, so it will simply be denoted by $W_{u,t}$. Assuming further that the job destruction rate q_t is identical in each labor pool, the expected utility $W_{ei,t}$ of a person employed in labor pool i in period t satisfies:

$$W_{ei,t} = w_{i,t} + \beta \left[(1 - q_t)W_{ei,t+1} + q_t W_{u,t+1}\right] \tag{A20}$$

If the instantaneous gain b of an unemployed person is the same everywhere, the expected utility $W_{u,t}$ of a person in search of work satisfies:

$$W_{u,t} = b + \beta \left[\theta_{i,t+1} m(\theta_{i,t+1}) W_{ei,t+1} + (1 - \theta_{i,t+1} m(\theta_{i,t+1})) W_{u,t+1}\right] \quad \forall i, t \tag{A21}$$

Differentiating the previous equation (holding $W_{u,t}$ constant) defines a relation between $W_{ei,t}$ and $\theta_{i,t}$:

$$\frac{\partial \theta_{i,t}}{\partial W_{ei,t}} = \frac{-\theta_{i,t}}{(1-\mu)\left(W_{ei,t} - W_{u,t}\right)} \tag{A22}$$

The employers post wages, which are constant and non renegotiable. We focus on the stationary equilibrium where:

$$W_{ei} = \frac{w_i + \beta q W_u}{1 - \beta(1-q)}$$

From the definitions of W_{ei} and W_u we have

$$W_{ei} - W_u = \frac{w_i - (1-\beta)W_u}{1 - \beta(1-q)} \tag{A23}$$

and therefore:

$$\frac{\partial \theta_i}{\partial w_i} = \frac{-\theta_i}{(1-\mu)\left(w_i - (1-\beta)W_u\right)}$$

For a given number of unemployed persons in pool i, the optimal strategy for the entrepreneurs present in this pool consists of offering, at each date t, a non renegotiable constant wage

$w_{i,t}$. The problem of the firm, which takes W_u as given, can be written:

$$\max_{\{V_{i,t},w_{i,t}\}_{t=1,\ldots,\infty}} \sum_{t=1}^{\infty} \beta^t \Bigg[AR(L_{i,t}) - \prod_{\tau=1}^{t} (1-q_{\tau-1})^t L_{i,0} w_{i,0} - \sum_{\tau=0}^{t-1} w_{i,t-\tau} m(\theta_{i,t-\tau}) V_{i,t-\tau} \prod_{x=0}^{\tau} (1-q_{t-x}) - c_V V_{i,t} \Bigg]$$

s.t. $L_{i,t} = \prod_{\tau=0}^{t}(1-q_\tau)L_{i,0} + \sum_{\tau=0}^{t-1} m(\theta_{i,t-\tau})V_{i,t-\tau}\prod_{x=0}^{\tau}(1-q_{t-x})$ and $\dfrac{\partial \theta_{i,t}}{\partial w_{i,t}} = \dfrac{-\theta_{i,t}}{(1-\mu)\left(w_{i,t}-(1-\beta)W_{u,t}\right)}$

The first order conditions with respect to $V_{i,t}$ and $w_{i,t}$, around the steady state (θ_i and q constant across periods), are respectively

$$-c_V + m(\theta_i) \sum_{\tau=0}^{\infty} \beta^\tau (1-q)^\tau \left[AR_L(L_{i,t+\tau}) - w_{i,t} \right] = 0 \tag{A24}$$

$$m'(\theta_i) \frac{\partial \theta_i}{\partial w_{i,t}} \sum_{\tau=0}^{\infty} \beta^\tau (1-q)^\tau \left[AR_L(L_{t+\tau}) - w_{i,t} \right] - m(\theta_i) \sum_{\tau=0}^{\infty} \beta^\tau (1-q)^\tau = 0 \tag{A25}$$

From these two equations we obtain the steady state value of the wage which is identical in all labor pools, in the symmetric equilibrium:

$$w = \mu AR_L(L) + (1-\mu)(1-\beta)W_u$$

From (A21), (A22), (A23), (A24) and (A25) we get

$$W_u(1-\beta) = b + \beta \frac{\mu}{(1-\mu)} \theta c_V$$

so that the wage equation is

$$w = \mu \left[AR_L(L) - b + \beta \theta c_V \right] + b$$

Using the labor demand equation

$$AR_L(L) = w + \frac{c_V \left[1 - \beta(1-q)\right]}{m(\theta)}$$

we can determine the wage:

$$w = b + \frac{\mu}{1-\mu} c_V \left(\frac{\left[1-\beta(1-q)\right]}{m(\theta)} + \beta\theta \right)$$

and the employment level

$$AR_L(L) = b + \frac{1}{1-\mu} \frac{c_V \left[1-\beta(1-q)\right]}{m(\theta)} + \beta\theta c_V \frac{\mu}{1-\mu}$$

A.8.2 Temporary hiring credit

Now, let us assume that there is a non-anticipated temporary hiring subsidy in period t in the neighborhood of steady state. Employers post wages, which are constant and non renegotiable as assumed above, and a bonus $z_{i,t}$ for the current period. This bonus enables the employer and the employee to share the supplementary surplus provided by the hiring credit. In this context, the current labor earnings in period t, denoted by $\omega_{i,t}$, are the sum of the stationary wage w and of the bonus $z_{i,t}$. We still have

$$\frac{\partial \theta_{i,t}}{\partial W_{ei,t}} = \frac{-\theta_{i,t}}{(1-\mu)\left(W_{ei,t} - W_{u,t}\right)}$$

The economy is in the neighborhood of steady state at date t. Thus, q_t, $W_{u,t+1}$, $W_{ei,t+1}$ and $\theta_{i,t+1}$ are at their steady state value. Accordingly, we have from equations (A20) and (A21):

$$W_{ei,t} - W_{u,t} = \omega_{i,t} - b + \beta(1 - \theta m(\theta) - q)\left(W_e - W_u\right) \tag{A26}$$

and, therefore,

$$\frac{\partial \theta_{i,t}}{\partial z_{i,t}} = \frac{\partial \theta_{i,t}}{\partial W_{ei,t}} \frac{\partial W_{ei,t}}{\partial z_{i,t}} = \frac{-\theta_{i,t}}{(1-\mu)\left(W_{ei,t} - W_{u,t}\right)}$$

The problem of the firm is to choose the bonus and the number of job vacancies that maximize its profits:

$$\Pi(Z, L) = \max_{(V_{i,t}, z_{i,t})} AR(L_{i,t}) - wL_{i,t} + (\sigma_t - z_{i,t}) m(\theta_{i,t}) V_{i,t} - c_V V_{i,t} + \beta \Pi(Z, L_{i,t})$$

where $Z = (A, w, q)$ subject to the law of motion of employment:

$$L_{i,t} = (1-q)L + m(\theta_{i,t})V_{i,t} \text{ and } \frac{\partial \theta_{i,t}}{\partial z_{i,t}} = \frac{-\theta_{i,t}}{(1-\mu)\left(W_{ei,t} - W_{u,t}\right)} \tag{A27}$$

The first order conditions with respect to $V_{i,t}$ and $z_{i,t}$ can be written

$$AR_L(L_{i,t}) - \omega_{i,t} + \sigma_t + \beta \Pi_L(Z, L_{i,t}) = \frac{c_V}{m(\theta_{i,t})} \tag{A28}$$

$$\frac{\mu}{(1-\mu)}\left[AR_L(L_t) - \omega_{i,t} + \sigma_t + \beta \Pi_L(Z, L_{i,t})\right] = W_{ei,t} - W_{u,t} \tag{A29}$$

From equations (A28) and (A29) we get

$$W_{ei,t} - W_{u,t} = \frac{\mu}{(1-\mu)} \frac{c_V}{m(\theta_{i,t})}. \tag{A30}$$

This equation shows that the hiring subsidy σ_t has no direct impact on the utility, and therefore on the remuneration obtained by the employee. The subsidy has an impact only through congestion effects associated with the labor market tightness that changes the average recruitment costs $c_V/m(\theta_{i,t})$ and the reservation utility $W_{u,t}$. Looking at equation (A28) we see that firms increase the number of job vacancies up to the point where the marginal discounted net revenue of employment equals the average recruitment costs $c_V/m(\theta_{i,t})$. Hence, choosing the number of vacancies when the marginal revenue of labor is decreasing allows the firm to avoid sharing the hiring subsidy with the worker. More generally, this mechanism, which has been highlighted by Stole and Zwiebel (1996) and examined further in a search and matching model by Cahuc et al. (2008), arises when there are decreasing marginal returns to labor and when firms can commit on employment either at the same time as they set the wage offer or before they bargain the wage.

Using equations (A26), (A28) and (A29), together with the steady state value of $(W_e - W_u)$, we obtain:

$$\omega_{i,t} = b + c_V \frac{\mu}{(1-\mu)} \left(\frac{1}{m(\theta_{i,t})} - \beta \frac{[1 - \theta m(\theta) - q]}{m(\theta)} \right)$$

Substituting in equation (A29) and using (A28), we get in symmetric equilibrium in period t

$$\omega_t = b + \mu \left[A_t R_L(L_t) + \sigma_t + \beta \theta c_V - b \right] \tag{A31}$$

So that (7) and (8) can be written for period t :

$$A_t R_L(L_t) = b - \sigma_t + \frac{c_V}{(1-\mu)} \left[\frac{1}{m(\theta_t)} - \frac{\beta(1-q)}{m(\theta)} \right] + \frac{\mu}{1-\mu} \beta \theta c_V \tag{A32}$$

$$1 - L_t = u_{t-1} + q(1 - u_{t-1}) - m(\theta_t) u_{t-1} \tag{A33}$$

Differentiation of these equations provides the macro elasticity of contemporaneous employment with respect to labor costs when there is a temporary change in labor costs induced by a temporary hiring credit in a context where the wage is endogenous:

$$\varepsilon_\sigma(\text{macro,temp,endo}) = \frac{1}{\eta\alpha \left[1 + \frac{c_V}{m(\theta) w} \left([1 - \beta(1-q)] - \frac{\mu}{q\alpha(1-\mu)^2} \right) \right]} \tag{A34}$$

where $\eta = H/L$ and $\alpha = L R_{LL}(L)/R_L(L) < 0$.

A.8.3 Permanent hiring credit

Let us analyze the consequence of a permanent hiring credit on steady state employment. Assuming that the hiring subsidy σ is permanent, and then acts as a mere wage subsidy, we get in steady state, from the first order conditions of the maximization problem of the firm:

$$\frac{A R_L(L) - w}{1 - \beta(1-q)} + \sigma = \frac{c_V}{m(\theta)} \tag{A35}$$

$$\frac{\mu}{(1-\mu)} \left[A R_L(L) - w + [1 - \beta(1-q)] \, \sigma \right] = W_e - W_u \tag{A36}$$

In this equation, the term $w - [1 - \beta(1-q)] \, \sigma$ represents the instantaneous labor cost per employee, equal to the wage minus the flow of benefits of the hiring credit spread out on the duration of the job. Proceeding as in the previous subsection, it is easily shown that these two equations imply

$$w = b + \mu(A R_L(L) + \sigma [1 - \beta(1-q)] + \beta \theta c_V - b) \tag{A37}$$

This wage equation is similar to equation (A31) except that σ is now multiplied by the factor $[1 - \beta(1-q)]$. It is worth stressing, however, that a permanent hiring credit has a different effect on wages than a temporary hiring credit because the steady state labor market tightness θ

which appears in the wage equation reacts to a permanent hiring credit, but not to a temporary hiring credit. This implies that a permanent hiring credit has a stronger effect on wages than a temporary hiring credit. This effect comes through the impact of the labor market tightness on the expected value of unemployed workers, which can be written, using equations (A21) and (A30):

$$W_{u,t} = \frac{b}{1-\beta} + \frac{\mu}{1-\mu} c_V \sum_{\tau=1}^{\infty} \beta^{\tau} \theta_{t+\tau} \tag{A38}$$

assuming that the transversality condition $\lim_{t\to\infty} \beta^t W_{u,t} = 0$ is fulfilled. This expression for $W_{u,t}$ shows that a temporary increase in labor market tightness has a lower impact on $W_{u,t}$, and therefore on wages, than a permanent increase.

Using the same method as in the previous subsection, we get, from the differentiation of equations (A35), (A36) and (A37), the macro elasticity of employment with respect to labor cost when the change in labor cost stems from a permanent hiring credit in a context where the wage is endogenous:

$$\varepsilon_{\sigma}(\text{macro,perm,endo}) = \frac{1}{\alpha\left[1 + \frac{c_V[1-\beta(1-q)]}{wm(\theta)}\right] - \frac{c_V[1-\beta(1-q)]}{wm(\theta)} \frac{\mu}{(1-\mu)^2 u} - \frac{q(1-u)\mu c_V}{w(1-\mu)^2 u^2 m(\theta)}}$$

A.9 Supplementary Tables

Table 10: The situation of workers hired with zéro charges, immediately before recruitment

	Employed	Registered unemployed	Unregistered unemployed	Training	Education	Other Inactive
Less than 26 years old	29%	36%	5%	5%	18%	7%
26 years old or more	42%	39%	5%	4%	4%	8%

Source : Pole Emploi.

Table 11: Number of eligible/ ineligible firms and employees in the sample in 2008

	Number of firms		Number of employees (in 2008)	
Number of employees (firm level)	below 10	above 10	below 10	above 10
all	832,910	146,811	3,892,725	11,381,920
+ excluding temp. help agencies, associations & agriculture	654,047	123,177	2,882,882	9,364,554
+ trimming extreme values	647,230	120,075	2,793,922	9,285,739
+ keeping 6-10 and 10-14 employees only	71,391	31,163	649,825	433,702
+ excluding missing control variables	70,998	30,912	646,717	430,109

Source : DADS (Insee). Note: The number of employees is the average number of employees per firm in 2008 (average of monthly full-time equivalent employees between 1 January and 30 November 2008).

Table 12: Difference-in-differences estimates of the impact of the hiring credit on various labor market outcomes in 2009 for surviving firms

Cohorts	2006-2009	2006-2009	2008-2009
Covariates	No	Yes	Yes
Employment growth	.009***	.008***	.009***
	(.002)	(.002)	(.002)
Hours growth	.010***	.009***	.009***
	(.002)	(.002)	(.002)
Hiring rate	.014***	.012***	.019***
	(.005)	(.004)	(.005)
Separation rate	.005	.004	.010*
	(.005)	(.004)	(.005)
Nb. Observations	399,412	399,412	203,889

Source : DADS (Insee). Note : this Table presents our difference-in-differences estimates for different outcomes (rows) and different specifications (columns) for surviving firms. The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 December to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 December to 30 November). We consider as outcomes the growth rate of employment between 30 November of year t and year t-1; the growth rate of the number of hours worked between November of year t and November of year t-1; the number of hires from 1 December of year t-1 to 30 november of year t divided by employment on 30 November of year t-1; the number of separations from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; and the number of excess reallocation from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1. As covariates, we include year, sector and regions dummies, as well as their interactions; we also include dummies for firm age, firms with sales below 2 millions euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 13: Difference-in-differences estimates of the impact of the hiring credit on various labor market outcomes in 2009 with weighted observations

Cohorts	2006-2009	2006-2009	2008-2009
Covariates	No	Yes	Yes
Employment growth	.009***	.008***	.008***
	(.002)	(.002)	(.002)
Hours growth	.010***	.009***	.008***
	(.002)	(.002)	(.002)
Hiring rate	.014***	.0121***	.018***
	(.005)	(.004)	(.005)
Separation rate	.004	.003	.010*
	(.005)	(.004)	(.005)
Survival rate	.000	.000	.000
	(.001)	(.001)	(.001)
Nb. Observations	405, 376	405, 376	206, 845

Source : DADS (Insee). Note : this Table presents our difference-in-differences estimates for different outcomes (rows) and different specifications (columns) when firms are weighted according to their size as measured by the number of full time equivalent employees in the previous year. The treatment group comprises firms of size between 6 (included) and 10 (excluded) full time equivalent employees in the previous year (average from 1 December to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 December to 30 November). We consider as outcomes the growth rate of employment between 30 November of year t-1 and year t; the growth rate of the number of hours worked between November of year t-1 and November of year t; the number of hires from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; the number of separations from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; As covariates, we include year, sector and regions dummies, as well as their interactions; we also include dummies for firm age, firms with sales below 2 million euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 14: Difference-in-differences estimates of the impact of the hiring credit on employment and hours worked in 2009 based on employment pool x sector units

Cohorts	2006-2009	2006-2009	2008-2009
Covariates	No	Yes	Yes
Employment growth	$.008^{***}$ (.002)	$.007^{***}$ (.002)	$.008^{***}$ (.002)
Hours growth	$.008^{***}$ (.002)	$.008^{***}$ (.002)	$.008^{***}$ (.002)
Nb. Observations	13,544	13,544	6,787

Source : DADS (Insee). Note : this table presents our difference-in-differences estimates for different outcomes (rows) and different specifications (columns) based on averaged labor market outcomes for 5 different sectors in 348 employments pools. Within each employment pool x sector unit the treatment group comprises firms of size between 6 (included) and 10 (excluded) full time equivalent employees in the previous year (average from 1 January to 30 November). For each year, we only consider units for which we have observations in our treatment or our control groups. The control group comprises firms of size between 10 (included) and 14 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). We consider as outcomes the growth rate of employment between 30 November of year t-1 and year t; the growth rate of the number of hours worked between November of year t-1 and November of year t. As covariates, we include year dummies, sector dummies, region dummies and their interactions. We also include dummies for distribution of firms' age, the share of firms with sales below 2 million euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers), lagged employment growth, lagged hiring rate and lagged separation rate. Weights are used: for each employment pool x sector unit the weight equals total employment among firms with less than 14 full-time equivalent employees in the previous year. Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 15: Difference-in-differences estimates of the impact of the hiring credit on wages in 2009

Cohorts	2006-2009	2006-2009	2008-2009
Covariates	No	Yes	Yes
All wages	.000 (.001)	−.001 (.001)	.000 (.002)
Low wage incumbents	.000 (.001)	−.001 (.001)	.000 (.001)
Eligible entrants	.000 (.002)	.000 (.002)	−.001 (.002)
Nb. Observations	210,553	210,553	105,277

Source : DADS (Insee). Note : this Table presents our difference-in-differences estimates for different outcomes (rows) and different specifications (columns). The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). We consider as outcomes the differences in log hourly wages between 30 November of year t-1 and year t; "All wages" stands for the wages of all workers present in the firm on 30 November of year t. "Low wage incumbents" stands for the wages below 1.6 times the minimum wage of workers present in the firm from 30 November of year t-1 to 30 November of year t. 'Eligible entrants" stands for the wages below 1.6 times the minimum wage of workers present in the firm on 30 November of year t but not present in the firm on 30 November of year t-1 and who have been working at least one month in the firm. As covariates, we include year, sector and regions dummies, as well as their interactions; we also include dummies for firm age, firms with sales below 2 million euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 16: Difference-in-differences estimates of the impact of the hiring credit in 2009 on various labour market outcome with a varying bandwidth.

Size bandwidth	7-13	6-14	5-15	[5,8]-[13,16]
Employment growth	.005*** (.002)	.008*** (.002)	.011*** (.002)	.015*** (.002)
Hours growth	.006*** (.002)	.009*** (.002)	.012*** (.002)	.016*** (.002)
Hiring rate	.012** (.005)	.012*** (.004)	.015*** (.004)	.015*** (.005)
Separation rate	.007 (.005)	.004 (.004)	.003 (.004)	.000 (.005)
Survival rate	.000 (.001)	.000 (.001)	.000 (.001)	.000 (.001)
Nb. Observations	283,737	405,376	549,022	363,101

Source : DADS (Insee). Note : this Table displays the DID estimates varying the bandwidth (in colums). The sample contains all available cohorts (2006-2009), and we include covariates presented in table 2. The 2nd column is identical to column (2) of table 2 We consider as outcomes the growth rate of employment between 30 November of year t and year t-1; the growth rate of the number of hours worked between November of year t and November of year t-1; Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.

Table 17: Difference-in-differences estimates for various labor market outcomes in placebo years

Placebo	December 2006	December 2007
Cohorts	2006-2007	2006-2008
Covariates	Yes	Yes
Employment growth	$-.001$	$.001$
	(.002)	(.002)
Hours growth	$-.001$	$.001$
	(.003)	(.002)
Hiring rate	$.001$	$-.004$
	(.003)	(.003)
Separation rate	$.002$	$-.005^{*}$
	(.003)	(.003)
Survival rate	$.000$	$.001$
	(.001)	(.001)
Nb. Observations	178,603	270,593

Source : DADS (Insee). Note : this Table presents our difference-in-differences estimates for different outcomes (rows) and different placebo years (columns, 12 months starting from December 2006 or 2007, instead of 2009). The treatment group comprises firms of size between 6 (included) and 10 (excluded) full-time equivalent employees in the previous year (average from 1 January to 30 November). The control group comprises firms of size between 10 (included) and 14 (excluded) full time equivalent employees in the previous year (average from 1 January to 30 November). We consider as outcomes the growth rate of employment between 30 November of year t and year t-1; the growth rate of the number of hours worked between November of year t and November of year t-1; the number of hires from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; the number of separations from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1; and the number of excess reallocation from 1 December of year t-1 to 30 November of year t divided by employment on 30 November of year t-1. As covariates, we include year, sector and regions dummies, as well as their interactions; we also include dummies for firm age, firms with sales below 2 millions euros in the previous year, the share of low-wage and part-time workers in the previous year and the shares of female or male workers with different occupations (managers, white-collar or blue-collar workers). Robust standard deviations in parentheses. * significant at 10 percent, ** significant at 5 percent, *** significant at 1 percent.