

The Heterogeneous Impact of Short-Time Work: From Saved Jobs to Windfall Effects

Pierre Cahuc, Francis Kramarz, Sandra Nevoux

▶ **To cite this version:**

Pierre Cahuc, Francis Kramarz, Sandra Nevoux. The Heterogeneous Impact of Short-Time Work: From Saved Jobs to Windfall Effects. 2021. hal-03602410

HAL Id: hal-03602410

https://sciencespo.hal.science/hal-03602410

Preprint submitted on 9 Mar 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

SciencesPo
DEPARTMENT OF ECONOMICS

Discussion Paper

THE HETEROGENEOUS EFFECT OF SHORT-TIME WORK: FROM SAVED JOBS TO WINDFALL EFFECTS

Pierre Cahuc, Francis Kramarz, and Sandra Nevoux

SCIENCES PO ECONOMICS DISCUSSION PAPER

No. 2021-04

The Heterogeneous Impact of Short-Time Work: From Saved Jobs to Windfall Effects

Pierre Cahuc[*] Francis Kramarz[†] and Sandra Nevoux[‡]

Monday 17th May, 2021

Abstract

To understand which firms take-up short-time work and which workers they enroll in this program, we provide a model which shows that short-time work may save jobs in firms hit by strong negative revenue shocks, but not in less severely-hit firms, where hours worked are reduced, without saving jobs. Using detailed data on the administration of the program covering the universe of French establishments in the 2008-2009 Great Recession, we find that short-time work did indeed save jobs and increase hours of work in firms faced with large negative shocks. These firms have been able to recover rapidly in the aftermath of the Recession thanks to short-time work. We also provide evidence of large windfall effects which significantly increased the cost of the policy per job saved; yet we also find that short-time work remains more cost-efficient at saving jobs than wage subsidies.

Keywords: short-time work, employment, hours of work.
JEL codes: E24, J22, J65.[1]

[*]Sciences Po, IZA, CEPR. Email: pierre.cahuc@gmail.com.
[†]CREST(ENSAE), IPParis, CEPR. Email: kramarz@ensae.fr.
[‡]Banque de France. Email: sandranevoux@gmail.com.

[1]This paper is a fully revised version of our previous paper "When Short-Time Work Works". We thank Katharine Abraham, Joseph Altonji, Geoffrey Barrows, Russell Cooper, Xavier D'Haultfoeuille, Denis Fougère, Andrea Garnero, Alexander Hijzen, Thomas Le Barbanchon, Pedro Martins, Pedro Portugal, Arne Uhlendorff, Rune Vejlin and André Zylberberg for helpful comments. We also thank participants in seminars at Aarhus University, Aix-Marseille School of Economics (AMSE), Banque de France, Banca d'Italia, Banque Centrale du Luxembourg, the Center for Research in Economics and Statistics (CREST), the French Treasury, the French Economic Observatory (OFCE), École Polytechnique, the Institute of Labor Economics (IZA), the Organisation for Economic Co-operation and Development (OECD) and University of Louvain la Neuve. We are particularly grateful to the Statistical Department of the French Labor Ministry (DARES) and to the Secure Careers Chair (*Chaire de Sécurisation des Parcours Professionnels*), without whom this project wouldn't have been possible. Access to the confidential data, on which is based this work, has been made possible within a secure environment offered by CASD – *Centre d'Accès Sécurisé aux Données* (Ref. 10.34724/CASD).

1 Introduction

Whereas unemployment insurance is, and has been for a long time, an essential component of the Employment-Policies toolbox, short-time work is a relative newcomer in this toolbox.[2] All this changed during the recent Covid-19 crisis, which transformed short-time work into the first choice of policy makers, at least on the European side of the Atlantic.

But this new found enthusiasm should not obscure the relative lack of solid academic evaluations of the consequences of short-time work available to policy-makers as of today. This deficit is all the more troublesome in that many countries are compelled to decide how and when to make their firms transit out of short-time work in the aftermath of the Covid-19 crisis: a period when windfall effects could be significant.

French public decision-makers appear to be fully aware of these problems. After a period of increasing expenditure at the start of the Covid-19 crisis, they tried to restrict the extent of the scheme to firms "really needing short-time work". Indeed, at the end of May 2020, the short-time work take-up rate culminated at 33% in France, one of the highest levels among OECD countries. This was achieved through increased generosity of the scheme, extended eligibility, and facilitated application procedures. After May 2020, French public decision-makers have progressively limited access to short-time work by reducing its generosity, restricting its eligibility, and controlling its use.[3] However, under pressure from both employers' organizations and trade unions, improved access to short-time work was granted under "specific" conditions in July 2020.

At the time of writing, and also in the very near future, the lack of clear guidelines emerging from both theory and empirical evaluations is hampering, and will continue to hamper, attempts by the authorities to limit take-up to those "really" in dire need of the short-time work program. This problem is clearly not limited to France. Many countries throughout the world have expanded such short-time work programs in response to the two severe crises that have occurred since 2008. Following the 2008-2009 Great Recession, while the OECD average take-up rate was less than 0.2% in the fourth quarter of 2007 just before the Recession, it increased six-fold, to 1.3%, in the fourth quarter of 2009. More strikingly, in response to the Covid-19 crisis, OECD countries further increased their use of short-time work by a factor of 15 with respect to its 2008-2009 Great Recession level, to reach 21% at the end of May 2020.[4]

[2] Short-time work, also called short-time compensation, is a public program that tries to preserve jobs at firms or establishments experiencing low revenues temporarily. It provides wage subsidies to the employees the firm wishes to keep in-house, albeit with reduced work hours.

[3] By the end of June 2020, among the 3,000 short-time work applications examined by the Ministry of Labor, 850 were suspected of fraud and were subject to further investigation. The main irregularities in short-time work use appear to be engaging in teleworking while being on short-time work, and declaring higher benefits to the authorities than the amounts actually paid out to the employees.

[4] OECD (2020).

In what follows, we provide theoretical and empirical analyses of the windfall effects associated with short-time work. Our approach is set within a partial equilibrium framework. Hence, we will not provide an evaluation of the general equilibrium effects and welfare impact of short-time work. Our approach, although limited, allows us to better understand and to empirically evaluate the sources of windfall effects associated with short-time work.

The theory we develop below has three defining features that match three motivating facts. First, and rather obviously, any theory on short-time work should explain its take-up and in particular its counter-cyclical nature. Second, it should account for the heterogeneity of short-time work use across firms with positive short-time work take-up. Not all firms appear to be in need of the program. Not all workers in short-time-work firms (ones that applied and were accepted into the scheme by the public authorities) appear to be enrolled in the program. Third, it should explain how the economic situation of the firm relates to its decision to take up the scheme, the fraction of its workers enrolled, and the fraction of their hours that are subsidized by the program. Hence, we model the firm's decision to use short-time work within an inter-temporal framework in which firms are heterogeneous in their productivity, comprise workers heterogeneous in their productivity, and jobs heterogeneous in their present and (expected) value. Such a model is shown to capture our three motivating facts.

On the theoretical side, we demonstrate that short-time work may have very heterogeneous effects on employment and hours of work depending on the firm using short-time work. We show that short-time work is targeted at low-productivity jobs and that it has the potential to save them and even increase the number of hours of work *when firms face a sharp but temporary drop in their revenues*. Our analysis of the take-up decision also allows us to isolate a source of windfall effects: firms facing a limited decrease in revenues are likely to use short-time work for a fraction of their employees and, hence, reduce hours for jobs at no risk of being destroyed. In such firms, short-time work reduces the number of hours of work without saving jobs.

On the empirical side, we focus on the 2008-2009 Great Recession. We use administrative data providing remarkably detailed information about the local administration of the short-time work program during this period to construct an instrumental variables strategy for our endogenous variable, the short-time work firm-level take-up. The *département*-level[5] approval rate of short-time work applications – an expression of the local program administration efficiency – is shown to play a key role in this take-up. This local approval rate *interacted with* a local measure of the size of the shock hitting each firm generates enough variation to identify our effects of interest. In line with our model's predictions, we build quintiles of the distribution of the predicted growth of hours of work in 2009. Then, we stratify firms using these quintiles. Enrolling one additional worker in the short-time work scheme is shown to save 0.6 job in 2009 at the

[5]Metropolitan France has 95 *départements*, which are decentralized administrative units.

bottom quintile of the predicted growth of hours of work distribution (hence for firms hit by the largest – most negative – expected shock). The large employment effects at the bottom quintile imply, in line with our model's predictions, that hours of work increase. By contrast, there is no detectable short-term effect on employment at all other quintiles, even though the number of hours of work is reduced, especially at the top – most positive – quintile, still in line with the model's predictions. An additional short-time work subsidy of one percentage point of the firm's previous year payroll translates into a 20% increase in a firm's employment and a 16% increase in a firm's hours of work, always between 2008 and 2009 at the bottom quintile. And as above, at all other quintiles, there is no short-term employment effect, whereas hours of work are reduced. Mid-term effects (2008-2011) are consistent with these short-term effects. Short-time work users at the first quintile grow faster between 2008 and 2011, suggesting that short-time work helped them recover albeit with no effect of the policy on firms' survival. Firms at all other quintiles are not affected by the policy in this mid-term horizon.

All results point to the same conclusion: short-time work was very effective at saving jobs for firms hit by large negative shocks. To assess this effectiveness, we compute the cost per job saved by short-time work: 2,700€ in 2009 or 7% of the average annual labor costs, both measured for firms at the bottom quintile of the expected shock distribution. However, since short-time work does not create jobs at all other quintiles, the costs per job saved are higher. Accounting for short-time work subsidies paid in 2009 to firms at all quintiles, the cost per job saved becomes 45% of the average annual labor costs per job. Hence, windfall effects induced by the short-time work policy are quite large. Still, the short-time work policy is less costly than wage subsidies because the former allows firms to target both those employees at risk of losing their job and their non-worked hours, something impossible for the latter.

Our paper relates to previous strands of the literature, both *theoretical* and *empirical*.

On the *theoretical* side, Burdett & Wright (1989) and Audenrode (1994) have shown short-time work to be favorable to employment at the cost of distorting downwards the number of hours worked per employee; to improve welfare by mitigating those distortions caused by public unemployment insurance (Braun & Brügemann, 2014); and to be welfare-improving when firms do not fully insure employees against income shocks (Niedermayer & Tilly, 2017). Cooper et al. (2017) analyze short-time work in a random search and matching model with multi-worker firms. They show that short-time work deteriorates the allocative efficiency of the labor market, resulting in significant output losses because of a reduction in the vacancy filling rate. By introducing between firm *and* within-firm jobs heterogeneity, our model complements previous contributions by shedding light on the windfall effects associated with short-time work. This allows us to determine the circumstances in which short-time work induces firms to reduce hours for jobs at no risk of being destroyed.

On the *empirical* side, macroeconomic evaluations, using cross-country data,[6] or cross-state data in the U.S.,[7] have generally identified a positive impact on employment. Their conclusions are mostly drawn from a small number of observations, limiting their identification ability. The results of microeconomic evaluations depend heavily on the method used to correct for selection into short-time work, and yield no obvious lesson when data limitation hampers the possibility to solve selection issues: Balleer et al. (2016), Boeri et al. (2011), Niedermayer & Tilly (2017) find positive effects of short-time work on employment. Bellmann & Gerner (2011), Bellmann et al. (2015) find no effects of short-time work on employment, while Calavrezo et al. (2010) and Kruppe & Scholz (2014) find negative effects in different contexts. Tracey & Polachek (2020) find that short-time work reduces layoffs of cyclically sensitive firms but has no effects on other firms.

Two recent papers overcome the main difficulties encountered by these studies. In order to assess the impact of short-time work in Switzerland, Kopp & Siegenthaler (2021) use quarterly establishment-level data and rely on the management of the Swiss scheme by the cantonal employment agencies. Their identification strategy relies on the discretionary cantonal approval practices which entail large and persistent differences in approval rates across cantons, which are independent of establishments' characteristics. They show that short-time work increases survival of establishments and prevents dismissals of workers at low cost. Giupponi & Landais (2018) exploit exogenous eligibility rules based on firm size and industry affiliation to study employment and welfare effects of short-time work in Italy during the 2008-2009 Great Recession. They show that short-time work has positive and significant effects on firms' survival and employment and negative effect on hours worked. The Italian scheme also appears to be more prone to displacement effects by postponing rather than preventing dismissals. These reallocation issues might be due to the nature of the Italian recession itself, which was deep and long-lasting, and to the targeting of firms into the program, economic shocks being broadly defined to include a need for restructuring, bankruptcy procedures and illiquidity issues. Similar to Giupponi & Landais (2018) and Kopp & Siegenthaler (2021), the richness of our data also allows us to deal with the selection of firms into short-time work by relying on the *départemental* heterogeneity in the 2008 approval rate to identify the *causal and heterogeneous* effects of short-time work. We complement the previous contributions by documenting the very heterogeneous effects of short-time work on employment and hours of work, depending on the size of the shock faced by firms. The beneficial effects are shown to be strong for firms facing deteriorated profitability and finances, which have been able to engage in labor hoarding and recover rapidly in the aftermath of the Recession thanks to short-time work.[8] But we find large windfall effects which significantly increase the cost per job saved.

[6] Boeri et al. (2011), Brey & Hertweck (2020), Cahuc & Carcillo (2011), Hijzen & Martin (2013), Hijzen & Venn (2011), Audenrode (1994).

[7] Abraham & Houseman (1994).

[8] See Biddle (2014) for a discussion of the efficiency of labor hoarding.

The next section presents the short-time work policy. The data are detailed in Section 3. The model is presented in Section 4. The empirical strategy is explained in Section 5 and the estimation results are presented in Section 6. Lessons are drawn in Section 7, our conclusion.

2 The Policy

The regulations regarding short-time work have changed multiple times since the inception of the policy, in 1951. In the following, we present the rules prevailing in 2009.

All private establishments located in France and all their employees are eligible for short-time work. There are six potential valid motives when requesting acceptance into short-time work: (i) economic situation; (ii) modernization, restructuring and transformation; (iii) problems in the provision of raw materials and energy; (iv) accident; (v) exceptionally adverse weather conditions; (vi) other exceptional circumstances. Our paper will restrict the focus to the first such motive.

When applying for short-time work, an establishment must specify the extent of its application; i.e. either a part or the totality of the establishment; either a reduction or a temporary suspension of activity. Then, short-time work applies to hours unworked below the weekly legal duration (35 hours, or below the weekly collectively-agreed or contractual duration when it is below 35 hours). The yearly number of subsidized hours per employee and per year cannot exceed 800 (1,000 hours in the industries most severely hit by the great recession; in particular the textile and automobile industries). For any employee, periods of short-time work cannot exceed 6 consecutive months (and 6 weeks in the case of total suspension of activity). Otherwise, she becomes unemployed, even though her contract still holds.

Under short-time work, each hour worked is paid using the employee's previous gross hourly wage as a reference. The short-time work benefit amounts to 60% of this reference, with a lower limit of 6.84€, corresponding to 78% of the minimum wage. The monthly sum of the wage and of the benefit cannot be inferior to the monthly minimum wage and cannot exceed the reference wage. The benefits are paid the same way as wages are paid in France, i.e. on a monthly basis by the establishment. The establishment is then reimbursed by the State. It receives a subsidy of 3.84€ per hour and per employee in establishments within firms with 250 employees or less, and of 3.33€ per hour and per employee for establishments in firms with 251 employees or more.

To be allowed to benefit from short-time work, the establishment initiates a procedure which includes three steps: application, examination, and consumption. First, the establishment and its works council discuss the possibility of using short-time work and at the end of this consultation, the works council issues a written recommendation. The establishment fills out the short-time work application form (including the establishment identification number, industry, type, contact details, number of employees) as well as the short-time work demand (reason, area, period, number of covered employees, number of hours,

and corresponding level of subsidies). Then, the establishment sends the form with the recommendation together with a document proving its economic difficulties to the Local (*département* level) Agency in charge of Labor Relations (*DIRECCTE*), who are the public authorities in charge of managing short-time work in the *département*.

Second, the local public authority examines the short-time work application, most particularly its validity. The *DIRECCTE* may ask the labor inspection authority to examine the exact situation of this establishment. Then, it decides whether to reject or grant the application (in which case it specifies the authorization period, the number of covered employees, the number of hours, and the corresponding level of subsidies) and informs the establishment of its decision.

Third, when the application is granted, the establishment may use short-time work within the limits set by the local authority. In case it is used, the establishment sends the local authority a reimbursement form (including the number of employees and hours that effectively used short-time work during the month, and the corresponding level of short-time work subsidies). Upon receipt, the local authority checks the validity of the request and pays the establishment the corresponding sum.

The large expansion in short-time work at the start of the great recession was promoted by deliberate effort on the part of public decision-makers, who enacted laws, expanded the budget, and released circulars and directives to boost short-time work usage. In December 2008, the maximal number of short-time work hours per employee per year increased from 600 to 800; and the maximal short-time work duration in case of total suspension of activity was expanded from 4 to 6 weeks. In January 2009, the per-hour employee benefit increased from 50 to 60% of the previous gross hourly wage. Simultaneously, the subsidy received by the establishment was expanded.[9] In May 2009, *long-term short-time work* was created. An establishment was now allowed to use long-term short-time work for support from a minimum period of 3 months up to a maximum of 12 months. Under long-term short-time work, the per-hour employee benefit was set to 75% of the previous gross hourly wage. The establishment received an additional subsidy, jointly financed by the State and the unemployment insurance system.[10]

After 2009, the policy experienced no major change until 2012.[11] However, in response to a second economic slowdown and to the associated requests formulated by businesses' and workers' unions, reforms were implemented in March 2012, again expanding access to short-time work.

[9] The subsidy received by the establishment increased from 2.44 to 3.84€ for those working in firms with 250 employees or less, and from 2.13 to 3.33€ for those working in firms with 251 employees or more.

[10] On top of the "standard" subsidy, the State pays 1.90€ per hour up to the 50^{th} long-term short-time work hour of a given employee and the unemployment insurance system pays 3.90€ beyond the 50^{th} hour.

[11] The only change over this period was the increase in the maximal number of short-time work hours per employee per year from 800 to 1,000 hours, in 2010.

3 From Data to Motivating Facts

In order to understand the potential causes and effects of short-time work, we merge several data sources on French establishments. Our measures of the causes and effects of the policy are presented first. Then, we present the motivating facts that will guide our analysis, both theoretical and empirical.

3.1 Data

3.1.1 Sinapse-Chômage Partiel

To measure short-time work in all its components, *administrative and economic*, we use *Sinapse-Chômage Partiel*, a source produced by the Statistical Department of the French Labor Ministry (*DARES*) in collaboration with the Employment and Vocational Training Agency (*DGEFP*). Data were collected for the years 2007 to 2014 by the *DIRECCTE*. To accomplish this, a software called *Aglae-Chômage Partiel* creates a record for each short-time work application received from an establishment located in the *département*. The record allows information to be acquired at each step of the short-time work application process. Two data sets are then assembled out of these applications. In one, all variables generated by the application process are included: the application identification number of the establishment,[12] information on the applying establishment (identification number, name, city, commuting zone (*zone d'emploi*), *département*, *région*, industry, weekly legal and collectively-agreed work duration, number of employees); short-time work demand (reason, area, repeated use, hourly short-time work subsidy, maximum number of short-time work hours per employee and per year, works council recommendation, labor inspection recommendation, application date); short-time work authorization (decision status, decision date, authorization period, number of authorized short-time work employees in total and by occupation and work duration, number of authorized short-time work hours and the associated amount of subsidies). In the second data set, variables on monthly short-time work consumption are included: application identification number, short-time work consumption month and its sequential number relative to the first month of the authorization period, number of monthly employees effectively under short-time work, number of consumed short-time work hours and the associated amount of subsidies.

3.1.2 DADS-Établissements

The Annual Declaration of Social Data (*DADS*) is produced by the French National Institute of Statistics and Economic Studies (*INSEE*). Each establishment reports the gross wage, inclusive of employer and employee-paid payroll taxes, and net wage for each of its employee, to the tax authority. *INSEE* then processes these variables to yield various aggregates, at the individual, establishment, and firm levels. In

[12] Since information is available at the establishment level, but not at the individual level, it is not possible to identify the workers on short-time work.

what follows we use the establishment-level version which allows us to measure the industry, the city, employment, hours, and the wage bill for each establishment in our matched sample.

3.1.3 FICUS and FARE

The *INSEE*-Section "Production of Annual Firms' Statistics" (*ESANE*) produces the so-called *FICUS* (until 2007) and *FARE* (since 2008) data sets using the financial and fiscal accounts sent by all French firms to the fiscal authority. The variables are constructed using the annual tax returns and other administrative sources based on these accounts. The above data sets contain, among other things, the firm identification number and precise information about its balance sheet.

3.1.4 BODACC

The *Bulletin Officiel des Annonces Civiles et Commerciales* (*BODACC*) records information about all liquidations of firms. This administrative register allows us to identify firm destruction more precisely than with tax and social security registers, in which changes in firm identifier may be due to new owner, new address, or merger with other firms.

3.2 The Motivating Facts

Not all firms take-up short-time work. In this respect, our first motivating (but unsurprising) fact is the counter-cyclical nature of short-time work take-up. Figure 1 shows various measures of this take-up over the years. Indeed, the share of employees using short-time work at least once in the year strongly increased in 2009, reaching 4% of employees, compared to 0.5% on average in previous years. The number of non-worked hours per short-time worker increased from about 60 hours to 135 hours per year. This increase, combined with the improvement in the generosity of the scheme, multiplied the amount of subsidy per short-time worker by about 3.5 in 2009. Accordingly, the total cost of short-time work was multiplied by about 25.

The second motivating fact for our theory and our empirical analysis is presented in Figure 2. This Figure shows the extreme *heterogeneity* of short-time work use across firms with positive short-time work take-up. It shows that short-time work covers all workers in about 14% of these firms. By contrast, the share of short-time workers may well go to almost zero in other cases. Figure 2 also shows that the share of subsidized non-worked hours is very variable, but below 20% for 95% of firms. Hence, our theory should not only explain the take-up but also help us understand this large variability in short-time work use (conditional on taking-up).

Let us now introduce the third motivating fact for both our theory and empirical analysis. Figure 3 displays how the share of short-time workers and the share of subsidized non-worked hours vary across firms

with positive short-time work take-up in relation to their economic situation. To measure this economic situation, we compute the growth rate of sales between 2008 and 2009 and plot it on the horizontal axis of Figure 3. It emerges clearly that firms which face larger drops in their sales make a more intensive use of short-time work, both by covering a larger share of employees and reducing the hours of work more drastically when the drop in sales is larger.

To conclude this section on motivating facts, we briefly present in Table 1 a selection of firm characteristics, contrasting firms using short-time work for economic reasons in 2009 with those firms which do not use short-time work in the same year. It is important to note that we restrict our attention to single-establishment firms because accounts are only available at the firm level whereas the rest of our sources are establishment-level. Hence, the theory developed below is about firms, as single entities, when they are hit by an economic shock. As shown in Table 1, firms using short-time work are older, have more employees, pay higher wages, have a lower share of temporary jobs, as well as a smaller worker turnover, a smaller employment growth rate, and a smaller revenue growth rate. Even though leverage is slightly lower in firms using short-time work, the propensity to use the policy increases with leverage, conditional on the industry and the age of the firm. Indeed, conditional on these two variables, leverage is 4.3 percentage points higher (with standard error equal to 0.002) in firms using short-time work. Table 2 shows that the short-time work take-up varies widely across industries. It is higher in manufacturing industries (6.4%) and to a lesser extent in the construction (1.1%) than in other industries.

4 Model

In this section, we use the motivating facts isolated in the previous section to construct our model of short-time work:

1. short-time work use increases in bad times;
2. short-time work use is heterogeneous both between firms and within firms (not all workers are included by their employing firm);
3. the between-firms heterogeneity in short-time work depends on sales growth within each firm: the greater the use of short-time work, the larger the drop in sales growth.

The model will generate additional predictions that we will try to test in what follows:

1. short-time work does save jobs when firms face a sharp drop in their revenues *but* firms facing a limited decrease in revenues are likely to use short-time work to reduce hours for jobs at no risk of being destroyed;

2. short-time work can increase total hours of work when firms do face a sharp drop in their revenues.

We turn now to the details of the model.

4.1 Framework

We consider a firm producing some output using labor only, within a discrete time framework. In each period, each employee produces z units of labor service per hour of work. As suggested in our motivating facts, we account for the heterogeneity of jobs (and workers) within firms by assuming that z is a match-specific random variable drawn at the start of the employment spell of each employee. The sampling cumulative distribution function of z, denoted by G, is continuously differentiable on its support $\mathbb{R}^+$. A worker who produces z units of labor service per hour of work produces $y_t = A_t z$ units of output per hour in period t, where A_t is a firm-specific productivity parameter. The evolution of this firm-specific productivity parameter is assumed to be governed by the cumulative distribution function $F(A_{t+1}|A_t)$, again continuously differentiable on its support $\mathbb{R}^+$.

This set-up allows us to capture both *within-firm across jobs productive heterogeneity* and *between-firms heterogeneity* at any moment in time. It also captures potential correlation in firm-level productivity over time.

To hire workers, firms need to post vacancies. Posting V_t vacant jobs costs $C(V_t)$ per period, where C is an increasing, convex, and twice continuously differentiable function. A vacant job generates a match with a worker (potentially employed at the firm in the next period, as will be explained below) with probability m. The preferences of workers are represented by the instantaneous utility function $c_t - \phi(h_t)$, where c_t stands for consumption, equal to the income of the current period and h_t for the number of hours worked. ϕ is an increasing, convex and twice continuously differentiable function.

Workers and firms have the same discount factor denoted by $\beta > 0$.

In line with the existing policy, short-time work allows firms and their employees to receive subsidies in order to compensate for the hours not worked when hours worked fall below a threshold, denoted $h_{stw} > 0$. Moreover, and again in line with existing policy, the short-time work subsidy depends on hours worked rather than productivity (a variable that cannot be observed by public authorities).

Subsidies per employee are equal to $\sigma \max[h_{stw} - h_t, 0]$.

In each period t, events unfold as follows:

1. The values of A_t, the firm productivity parameter and of z, the productivity parameter of each new worker, are drawn.

2. The firm posts V_t vacant jobs to hire workers in the next period.

3. The firm selects the workers it will employ in the current period: i.e. of the previously recruited employees some are dismissed and others are retained; while new workers are recruited from the new matches generated by the vacancies posted in the previous period. These decisions amount to selecting the productivity set Ω_t of jobs in the current period, meaning that jobs with productivity parameters $(A_t, z) \in \Omega_t$ are kept or created and jobs with productivity $(A_t, z) \notin \Omega_t$ are destroyed.

4. The firm bargains the wage $w(A_t, z)$ and the hours worked $h_t = h(A_t, z)$ with each worker.

5. Labor contracts are implemented. Workers who do not keep their jobs get the present discounted utility U.

In this set-up, the law of motion of employment N_t can be written as:

$$N_t = (N_{t-1} + mV_{t-1})\,\mathbf{1}\left[(A_t, z) \in \Omega_t\right] \tag{1}$$

where $\mathbf{1}[.]$ is the indicator function. This equation shows that current employment depends on past employment and on the productivity distribution of workers. The cumulative distribution function of $y_t = A_t z$ in the current period, denoted by $\tilde{F}(y_t|\eta_t)$, depends on η_t, which denotes the current and the past realizations of z and A_t.

4.2 Solutions

Profit maximization implies that firms destroy jobs that have a negative value and create vacant jobs up to the point where the marginal cost of the vacant job equals its value: the product of its matching probability with an employable worker with the value of a filled job. Thus, to define the optimal decisions, we start by computing the value of filled jobs before presenting the optimal job destruction and job creation decisions.

4.2.1 Value of filled jobs

Wages and hours of work are determined by individual bargaining in each period. Bargaining allows each worker to share the surplus of her job with her employing firm. To define the job surplus, one needs to define the job value to the firm and to the workers.

The value to the firm of a filled job with productivity parameters (A_t, z) is equal to:

$$J(A_t, z) = \max\left\{A_t z h(A_t, z) - w(A_t, z) + \sigma \max\left[h_{stw} - h(A_t, z), 0\right] + \beta\mathbb{E}\left[J(A_{t+1}, z)|A_t\right], 0\right\}$$

where $\mathbb{E}[\cdot|A_t]$ is the expectation operator conditional on A_t.

The value of a job with productivity parameters (A_t, z) to a worker is:

$$W(A_t, z) = \max\left\{w(A_t, z) - \phi(h(A_t, z)) + \beta\mathbb{E}\left[W(A_{t+1}, z)|A_t\right], U\right\}$$

By definition the surplus of a filled job with productivity parameters (A_t, z) is equal to:

$$S(A_t, z) = W(A_t, z) - U + J(A_t, z)$$

Using the previous equations, this surplus can be written as:

$$S(A_t, z) = \max[A_t z h(A_t, z) - \phi(h(A_t, z)) + \sigma \max[h_{stw} - h(A_t, z), 0] - (1-\beta)U + \beta \mathbb{E}[S(A_{t+1}, z)|A_t], 0] \quad (2)$$

Bargaining yields the share $\gamma \in [0, 1]$ of the job surplus to the worker and the complementary share to the firm. Therefore, the value to the worker and to the firm of jobs with productivity parameters (A_t, z) is defined by:

$$W(A_t, z) = \gamma S(A_t, z) + U \text{ and } J(A_t, z) = (1-\gamma) S(A_t, z) \quad (3)$$

4.2.2 Optimal number of hours of work

Since the surplus $S(A_t, z)$ does not depend on the wage but depends on hours of work (as shown by equation (2)), it is optimal for the firm and the worker to choose the number of hours of work which maximizes the surplus and then to set the wage that satisfies the surplus sharing condition (3).[13]

From equation (2), we deduce that surplus maximization with respect to the number of hours of work determines the optimal number of hours of work as a function of the output per hour of the job, $y_t = A_t z$, which is denoted by:[14]

$$h(y_t) = \begin{cases} \phi'^{-1}(y_t) & \text{if } y_t > \phi'(h_{stw}) \\ \phi'^{-1}(y_t - \sigma) & \text{otherwise} \end{cases} \quad (5)$$

This equation shows that the optimal number of hours of work for a worker equalizes her marginal dis-utility of work $\phi'(h)$ with her marginal productivity. This marginal productivity is equal to y for hours of work above the threshold number of hours h_{stw} below which non-worked hours are subsidized, and to $y - \sigma$ for hours below h_{stw}, because the marginal gain in hours of work is reduced both from the point of view of the worker and that of the firm when non-worked hours are subsidized.

The definition of the optimal number of hours of work allows us to state two important results implied by equation (5) and the convexity of function ϕ:[15]

[13] The surplus sharing rule (3) can be derived from the generalized Nash bargaining solution which is obtained by maximizing the weighted product

$$[W(A_t, z) - U]^{\gamma} [J(A_t, z)]^{1-\gamma} \quad (4)$$

with respect to the number of hours of work and to the wage. The solution to this maximization program yields the same outcome as that described here.

[14] Since the optimal number of hours depends on $y_t = A_t z$, henceforth function $h(A_t, z)$ is written $h(A_t z)$.

[15] Proofs of all results are presented in Appendix A.1.

Result 1 *The number of hours of work of each worker $h(y_t)$ increases with y_t, her output per hour of work.*

Result 2 *Workers whose specific productivity parameter z is above the threshold*

$$Z_t = \phi'(h_{stw})/A_t \tag{6}$$

are not enrolled (by their employing firm) in short-time work and those whose specific productivity parameter is below this threshold are enrolled into short-time work, if their employing firm does not lay them off.

The optimal number of hours is defined only for workers who are employable in the firm, i.e. for workers whose output per hour of work is sufficiently high, as shown in the following section.[16]

4.2.3 Job destruction

We analyze the employment decision at date t of a firm having employment N_{t-1} and mV_{t-1} new matches, both inherited from the previous period. The cumulative joint distribution function of output per hour of these workers is denoted by $\tilde{F}(y|\eta_t)$, where η_t stands for the current and the past realizations of z and A_t. The firm determines the set of workers with productivity parameters $(A_t, z) \in \Omega_t$ employed in current period t.

Firms destroy jobs with negative value. Hence, it is clear from the surplus sharing rule – equation (3) – that jobs with negative surplus will be destroyed. We now determine the reservation value of z, the job specific productivity parameter, in a firm with productivity parameter A_t, i.e. the set of jobs with current period specific productivity parameter z which are destroyed. The definition (2) of the surplus $S(A_t, z)$ implies that the surplus increases with z. Therefore, there exists a unique value of z, denoted by

$$R_t = \{z|S(A_t, z) = 0\}$$

such that jobs are destroyed if $z < R_t$. Again from (2), we deduce that R_t satisfies

$$A_t R_t h(A_t R_t) - \phi(h(A_t R_t)) + \sigma \max\left[h_{stw} - h(A_t R_t), 0\right] - (1-\beta)U + \beta \mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right] = 0 \tag{7}$$

This equation defines the reservation value of output per hour of work $A_t R_t$ below which workers cannot be employed in the firm in the current period. This implies that $\tilde{F}(A_t R_t|\eta_t)N_{-1}$ workers are dismissed and $\tilde{F}(A_t R_t|\eta_t)mV_{-1}$ new workers matched with the firm are not hired. Hence, current employment is equal to:

$$N_t = (N_{t-1} + mV_{t-1})\left[1 - \tilde{F}(A_t R_t|\eta_t)\right]$$

[16] The shape of function $h(A_t z)$ defined by equation (5) is displayed in the $(h(A_t z), z)$ plan in the bottom panel of Figure 5 which also displays the set of employable values of z defined in the following section.

4.2.4 The take-up of short-time work

Short-time work take-up is optimal only for jobs having a specific productivity parameter z below the threshold Z_t defined in equation (6) *and* above the reservation level R_t defined in equation (7).

Figure 4 displays the 3 possible situations of jobs – destruction, continuation under a short-time work policy, continuation without a short-time work policy – in the (z, A_t) plane in a context where there exist values of z and A_t for which taking-up short-time work can be profitable. All proofs are in Appendix A.1.

The left panel displays the situation of jobs when no short-time work scheme is available. In this case, the reservation value of the job-specific productivity parameter is denoted by $R_{0,t}$. Accordingly, all jobs below the $R_{0,t}$ line are destroyed. Since the $R_{0,t}$ line is decreasing, firms with a higher productivity parameter A_t keep jobs that have a lower job-specific productivity parameter z.

The right panel represents the case where a short-time work scheme is available. Taking-up short-time work is profitable for all jobs located below the Z_t line if their surplus is positive, i.e. if they are located above the R_t line which represents the reservation value of the job-specific productivity parameter when firms take up short-time work. All jobs below the R_t line are destroyed and all jobs below the Z_t line and above the R_t line use short-time work. The Figure shows that

Result 3 *Only firms having a productivity parameter below the threshold value A_{stw} which satisfies*

$$A_{stw} = \{A_t | S(A_t, Z_t) = 0\}$$

use short-time work.

It is shown in Appendix that A_{stw} has a unique value and that it is time-invariant. As a consequence, only firms facing a sufficiently negative productivity shock use short time-work.

Moreover, Figure 4 shows that:

Result 4 *The existence of short-time work decreases the value of the job-specific reservation productivity parameter; hence short-time work saves jobs at the bottom of the productivity distribution for firms using short-time work.*

Figure 4 clearly shows that the reservation productivity is lower in the presence of the short-time work scheme, even when firms do not use short-time work. The mere existence of a short-time work scheme available in the future increases the present value of its jobs to the firm and then decreases the associated reservation productivity – as shown by the term $\mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]$ in equation (7) which defines this reservation productivity. Moreover, for firms which use short-time work – i.e. those having a productivity parameter A_t below A_{stw} – the reservation productivity is further reduced, because jobs benefit from the

short-time work compensation. Comparing the job-specific reservation productivity parameter $R_{0,t}$ in the absence of a short-time work scheme, with Z_t, the threshold value of the job productivity parameter below which non-worked hours are subsidized, yields another important result:

Result 5 *In firms that take-up short-time work and have a job-specific reservation productivity $R_{0,t}$ in the absence of a short-time work scheme that is lower than the threshold value of the job-specific productivity parameter Z_t below which non-worked hours are subsidized, the short-time work compensation decreases the number of hours of work for jobs with specific productivity parameter z belonging to the interval $[R_{0,t}, Z_t]$ whereas such jobs would not have been destroyed in the absence of short-time work.*

Results 1 to 5 are illustrated in Figure 5.

The top panel displays the situation of firms which do not use short-time work because their productivity parameter A_t is larger than A_{stw}, as shown on Figure 4. Jobs with a productivity parameter z lower than R_t are destroyed and hours of work increase with z above this threshold. Since hours of work increase with the output per hour, workers work longer hours in periods when the firm productivity parameter A is larger. The short-time work scheme saves jobs with specific productivity parameter within $[R_t, R_{0,t})$, because the existence of short-time work raises the present value of jobs, even for firms which do not use short-time work (see above). However, the employment effect is likely to be very small.

The bottom panel of Figure 5 displays the case when using short-time work is optimal. The number of hours worked drops below the threshold level of hours h_{stw} under which those un-worked hours receive a subsidy. Short-time work reduces the number of hours worked for values of z within $[R_t, Z_t)$. The drop in hours worked increases with the subsidy σ. However, short-time work also diminishes the number of layoffs, since the reservation threshold R_t is lowered by the existence of the short-time work scheme.

The bottom panel of Figure 5 shows that short-time work reduces the hours of work for all jobs with a specific productivity parameter z within $[R_{0,t}, Z_t)$, *without* saving these jobs since they would have survived even in absence of a short-time work scheme.

From equation (6), the threshold value Z_t – the job-specific productivity parameter z below which non-worked hours are subsidized – depends on the comparison between the marginal dis-utility of hours of work and their marginal productivity, $A_t z$. By contrast, the reservation productivity R_t is directly impacted by the expected utility from unemployment U and by the future value of the job, as shown by equation (7). Hence, a drop in the expected utility from unemployment reduces the reservation productivity R_t, whereas Z_t remains unchanged, which fosters the short-time work take-up – $\mathrm{d}R_t/\mathrm{d}U > 0$ from equation (7). Similarly, if the future value of the job increases, the option value of keeping this job increases, reducing the reservation productivity while Z_t remains constant. Therefore, a contemporaneous negative productivity shock – implying a fall in A_t – raises the short-time work take-up when the shock is expected to be

temporary. Hence, we can state that:

Result 6 *Short-time work take-up is more likely when the expected utility from unemployment is lower and when negative productivity shocks are less persistent*

This result allows us to state the following. First, structurally weak firms, those with a low option value for their current jobs – with a high associated reservation productivity – prefer to destroy jobs rather than use short-time work. Second, short-time work take-up increases in recessions and can be close to zero in normal times. In such normal times, the relative high expected utility from unemployment may make the reservation productivity R_t larger than Z_t. By contrast, R_t can become smaller than Z_t in recessions, when the expected utility from unemployment plummets.

4.2.5 Job creation

Job creation depends on the selection of jobs described in the previous section which implies that all workers whose output per hour of work y_t is above the threshold $A_t R_t$ are employed in the current period. The cumulative distribution function of y_t, denoted by $\tilde{F}(y|\eta_t)$, depends on η_t, which denotes the current and the past realizations of z and A_t. Thus, the share $1 - \tilde{F}(A_t R_t|\eta_t)$ of employees of the previous period remain employed and the same share of new matches induced by previous period vacant jobs gives rise to hiring. The number of new matches depends on the number of vacant jobs. The optimality condition on the number of vacant jobs equalizes the marginal cost $C'(V_t)$ of vacancies with their marginal gain. Vacancies posted in the current period are matched with probability m in the current period and can yield productive jobs in the next period.

Therefore, the marginal gain is discounted by a factor β and depends on the job-specific productivity parameter z together with the expectation of the future firm specific productivity A_{t+1}:

$$C'(V_t) = \beta m \int_0^\infty \int_0^\infty \max\left[(1-\gamma)S(A_{t+1}, z), 0\right] \mathrm{d}G(z)\mathrm{d}F(A_{t+1}|A_t) \tag{8}$$

Using this set of results, we turn now to the heterogeneous effects of short-time work across firms.

4.3 Heterogeneous effects across firms

The heterogeneous employment effects of short-time work across firms are illustrated on Figures 6 and 7. We focus on the situation of firms at the onset of a recession and we describe the impact of short-time work on employment and hours of work as a function of the drop in the firm-specific productivity parameter A.

The top panel (Panel 1) of Figure 6 displays the distribution of the job-specific productivity shock z in a typical firm outside recessions, in normal times. Here, $A_{0,t}$ stands for the current value of the firm-specific productivity. In normal times, the reservation productivity R_t is above the threshold value

of productivity Z_t below which short-time work is used. Hence, $A_{0,t} > A_{stw}$ as shown on the left-panel of Figure 7 in the (z, A_t) plane as in Figure 4. In this situation, the outside option of workers is high enough to make short-time work unattractive. To put it differently, in normal times, the expected utility of unemployed workers U is high enough to ensure that both workers and employers prefer to destroy jobs. This is consistent with the low take-up of short-time work under normal circumstances.

The remaining panels of Figure 6 display four levels of firm-specific productivity, all in a recession. Recessions induce a drop in the expected utility of unemployed workers U, entailing a drop in reservation productivity R_t which becomes lower than Z_t, the threshold value of job productivity below which short-time work is profitable. In all these cases, short-time work is profitable from the firm viewpoint. However, the number of workers enrolled in short-time work depends on the within-firm distribution y_t of output per hour of work.

Panel 2 displays the situation of a firm with no productivity drop – i.e. $A_t = A_{0,t}$ as in Panel 1. Although R_t is lower than Z_t – corresponding to the situation displayed in the right hand side panel of Figure 7 – using short-time work is not worthwhile, because there is no job below Z_t .

Panel 3 shows the situation of a firm hit by a negative shock of medium size – i.e. $A_t = A_{1,t}$, inducing the firm to enroll workers in short-time work, but without saving any job, since all jobs have a productivity above the reservation productivity in the absence of a short-time work scheme $R_{0,t}$. In this case, enrollment in short-time work reduces the number of hours worked with no effect on employment.

Panel 4 displays the case of a firm hit by a large negative shock – i.e. $A_t = A_{2,t}$. In this case, a large share of jobs have a job-specific productivity below the reservation value $R_{0,t}$. Hence, absent short-time work, the firm would destroy all these jobs. Short-time work saves all jobs with a job-specific productivity $z \in [R_{0,t}, Z_t)$. It also reduces working hours of all workers having a job-specific productivity within $[R_t, Z_t)$.

Panel 5 – i.e. $A_t = A_{3,t}$ illustrates the case where the shock is very large, moving the job-specific reservation productivity $R_{0,t}$ in the absence of a short-time work scheme above the mode of the distribution of z. In this case we show that:

Result 7 *Short-time work increases the total number of hours of work in firms where $R_{0,t}$, the job-specific reservation productivity in the absence of a short-time work scheme, is higher than the mode of the z distribution (when the distribution has a single mode).*

The effect of short-time work on the number of hours worked depends on the size of the productivity shock. Short-time work can increase the total number of hours worked through its positive effect on employment when the reservation productivity, $R_{0,t}$, lies within a region of the z distribution with a negative slope.[17] For standard distributions, with a single mode, the reservation productivity $R_{0,t}$ is above

[17] See Appendix 7.

the mode – but possibly below the median and the mean, as is the case with a log-normal distribution. This case is displayed in Panel 5. It stands in stark contrast to the negative impact of short-time work on total hours in firms hit by negative productivity shocks of medium size, as displayed in Panel 3, resulting in a drop of hours worked but no job saved.

Hence, short-time work has a significant impact on employment in firms hit by large negative shocks but less so in firms hit by negative shocks of medium size. Moreover short-time work can increase the total number of hours worked in firms hit by large negative shocks while it is expected to have an impact of opposite sign in firms hit by negative shocks of medium size. We now confront the model's predictions with our data.

5 Empirical Strategy

We evaluate the impact of short-time work on firm i in 2009 by estimating the following regression:

$$y_{it} = \alpha_0 + \alpha_1 STW_{it} + \alpha_2 x_{it} + \eta_i + \eta_t + \varepsilon_{it} \tag{9}$$

where the dependent variable, y_{it}, is an outcome variable for firm i in year t, typically (an indicator for) firm i's death, the logarithm of employment, the logarithm of the total number of hours of work or the logarithm of the number of hours of work per employee. STW_{it} is an indicator function equal to one if firm i takes up short-time work in year t; x_{it} is a vector of covariates that comprise a measure of the shock to the revenue of the firm, as well as, depending on the specification, the logarithm of firm i's employment in $t-1$, the logarithm of firm i's total number of hours of work in $t-1$, the logarithm of firm i's number of hours of work per employee in $t-1$, firm i's leverage in $t-1$, firm i's return on assets in $t-1$, or firm i's age. η_i is a time-invariant fixed-effect for firm i; η_t is a year fixed-effect, and ε_{it} is an error term. A measure that we will repeatedly use to capture the size of the shock to the firm's revenue is the leave-one-out growth rate of sales in the sector $\times$ commuting zone of firm i in year t.

To capture short-time work take-up, we construct other measures based on the intensive margin of its use: *i)* the number of short-time work hours of the firm divided by its total number of hours worked in the previous year; *ii)* the short-time work subsidy of the firm divided by its total labor cost in the previous year; *iii)* the number of short-time workers in the firm divided by its total number of workers in previous year.

Because confounding variables may simultaneously impact the dependent variable and the short-time work take up, STW_{it} is likely to be correlated with the error term ε_{it}. More precisely, firms have more incentives to use short-time work if it is more costly to store production or to find productive replacement activities for incumbent workers when demand drops. If firms using short-time work more intensively are

also those more likely to adjust employment downwards when their revenue drops, the OLS estimates for short-time work in equation (9) should be biased downwards.[18] Indeed, as will be shown below, we constantly find that the OLS estimates for α_1 are negative and statistically significant.

To consistently estimate the causal impact of short-time work from equation (9), we use an IV strategy. The instrument should affect the short-time work take-up but not employment, except through this take-up variable. To construct such an instrument, we first note that firms apply for short-time work only if the expected gain of applying is larger than the cost of doing so. The expected gain will depend on the expected local approval rate of a short-time work application as well as on the size of the shock to the firm's revenue – i.e. a drop in demand for instance. Conditional on being granted access to short-time work, we denote the firm i's gain from the program as γ_{it}, an increasing function of the absolute value of the shock, when negative, to the firm's revenue. Now, denoting the expected approval rate of firm i's application by p_{it}, the expected gain from the application is equal to $p_{it} \times \gamma_{it}$. The comparison of this expected gain with the application cost c_i implies that firm i applies to short-time work only if $p_{it} \times \gamma_{it} > c_i$. To go further, we assume that the expected approval rate of firm i's application, p_{it}, depends on the past *départemental* approval rate. We provide evidence which supports this assumption below. To approximate the shock to the firm's revenue, we compute the leave-one-out growth rate of sales in firm i's industry and commuting zone. This leave-one-out growth rate, specific to each firm, should be correlated to the firm-specific shock faced by i but exogenous to this firm. Hence, this interaction term $p_{it} \times \gamma_{it}$ measures the gain of taking up short-time work, conditional on these two variables, each one also included in the regression.

More precisely, the short-time work take-up of firm i in department j in year t is modelled using the following equation:

$$STW_{i(j)t} = \beta_0 + \beta_1 ap_{jt-1} + \beta_2 g_{it} \times ap_{jt-1} + \beta_3 x_{it} + \phi_i + \phi_t + \nu_{it} \tag{10}$$

where ap_{jt-1} is the approval rate in department j in year $t-1$, g_{it} is the leave-one-out growth rate of sales in the sector $\times$ commuting zone of firm i in year t (also included in the vector of covariates x_{it} as in equation 9). ϕ_i is a time-invariant fixed-effect for firm i; ϕ_t is a year fixed-effect, and ν_{it} is an error term.

We now explain how this firm-specific instrument operates. First, consider two firms, faced with the same leave-one-out shock in two departments with different approval rates. The firm in the department with the highest rate is more likely to take up short-time work. Now, if we consider two firms in the same department, hence with the same approval rate, the one with the lowest leave-one-out growth rate of sales is more likely to take-up short time work.[19]

[18] Bellmann et al. (2015) (p. 196) finds that firms which use short-time work tend to adjust employment more strongly when output falls than firms which do not use short-time work.

[19] Recall that the equation contains, as separate controls, the leave-one-out growth rate of sales and the approval probability.

In order to show the relevance of this instrument, we begin by documenting the heterogeneity of the approval rates across departments and its relationship with the efficiency indicators of departmental administrations, according to which a more efficient administration has a higher approval rate.

Then, we will show how the interactions between the approval rate and demand shocks impact the take-up rate.

Approval rate heterogeneity across départments

The *DIRECCTE* – the *département* level agencies in charge of Labor Relations – play a key role in administering the implementation of short-time work regulations. They are in charge of processing the applications and the payment of short-time work subsidies. The decentralized administration of short-time work induces a heterogeneity in the approval rate of short-time work applications across *départements*. Figure 8 displays the cross-sectional (across *départements*) variation in the 2008 approval rate of short-time work applications, even though short-time work was barely in use then. Approval rates range from 45 to 100 percent in 2008.[20]

Although several ministerial circulars and directives were sent to local authorities, calling for easier access to the policy in 2009, Figure 9 shows that the *départements* where the approval rate was higher in 2008 are also those that had a higher approval rate in 2009. Therefore, firms could anticipate that, even during the Great Recession, accessing short-time work in some specific and identifiable *départements* would be difficult when in others it was relatively easy.

Approval rate and the quality of management

As we show now, a low approval rate appears to be a signal of bad administrative management. We measure the quality of management using an indicator of administrative inconsistency in 2007-2008. Indeed, a fraction of firms had their applications rejected in a first step but approved at a later stage. We measure the number of such cases and include it in some of our regressions. We also measure management quality by the response time to short-time work applications. Given the distribution of this response time, we characterize bad quality as having an average response time above 14 workdays (two full weeks). As can be seen on Figure 10 and Table 3, the approval rate is negatively associated with the average number of short-time work application refusals that are subsequently reversed, and with the proportion of short-time work applications to which the response time is greater than 14 workdays. In other words, the longer the administrative delay, the higher the number of times an establishment needs to apply for short-time work (and be rejected) on average in a given *département* before being accepted into the program, and the more cumbersome and poorly managed the procedure is: the lower the approval rate will be.[21]

[20] Since there is a large share of approval rates between 80 and 100 percent, we proceed to robustness exercises in Section A.2 to check that our results hold when the four *départements* whose approval rate is below 80 percent in 2008 are excluded.

[21] Note that we use the approval rate differently from Kopp & Siegenthaler (2021) who compare establishments that applied for short-time work and had their applications approved (the treatment group), and establishments that had their application

Table 3 shows that the approval rate is also positively correlated with the average age of the administrative employees in charge, *inter alia*, of the management of short-time work in 2008. The age of the administrative workforce in the *région* can be seen as a proxy for its experience and level of human capital. This suggests that an older and ipso facto more experienced administrative workforce is more efficient in managing the short-time work scheme, which appears to result in a shorter administrative delay and a greater probability of being accepted into the program.

Approval rate and short-time work take-up

The left hand-side panel of Figure 11 clearly shows that there existed a positive correlation between the approval rate of the *départemental* administration and the short-time work take-up before the Great Recession, in 2008. This relation holds even controlling for the average sector × commuting zone growth rate of sales and the average sector × commuting zone employment growth to ensure that this relation is not driven by congestion effects induced by differences in "sector × commuting zone" employment growth. The right hand-side panel of Figure 11 displays a strong positive relation between the short-time work take-up rate *in 2009* and the approval rate of the *départemental* administration *in 2008*. The short-time work take-up rate in 2009 is about five times larger in the *départements* at the 95^{th} centile of our measure of approval rate in 2008 than in those at the 5^{th} centile.

These facts suggest that in *départements* with less efficient administrative staff assigned to examine short-time work applications, the procedures directly affecting the approval decision are more ineffective and take longer. This reduces approval rates and hence the short-time work take-up. Therefore, we will use the interaction between shocks to firms' revenues and the approval rate in the previous year as an instrument for the short-time work take-up variable. More precisely, equations (9) and (10) are estimated in difference for 2009, meaning that we estimate the following equation for firm i, located in *département* $j(i)$, in year t:

$$\Delta y_{it} = \alpha_1 \Delta STW_{it} + \alpha_2 \Delta x_{it} + \Delta \eta_t + \Delta \varepsilon_{it} \tag{11}$$

where firm i's decision to take-up short-time work in year t, STW_{it}, is instrumented using:

$$\Delta STW_{it} = \beta_1 \Delta ap_{j(i)t-1} + \beta_2 (\Delta g_{it} \times ap_{j(i)t-1} + g_{it} \times \Delta ap_{j(i)t-1}) + \beta_3 \Delta x_{it} + \Delta \eta_t + \Delta \nu_{it} \tag{12}$$

where Δ denotes the first-difference operator: $\Delta z_t = z_t - z_{t-1}$.

To summarize, our instruments comprise the change in the past authorization rate (Δap_{jt-1}) and the sum of two interaction terms: *i)* ($\Delta g_{it} \times ap_{jt-1}$), the interaction between the change in the leave-one-out revenue growth rate of the industry × commuting zone cell of firm i, and the past *départemental*

denied (the control group), since many establishments with a denied application in our context are eventually approved after a second round of application.

authorization rate; *ii)* $(g_{it} \times \Delta ap_{jt-1})$, the interaction between the change in the past (i.e. between 2007 and 2008) *départemental* authorization rate and the leave-one-out revenue growth rate of the industry × commuting zone cell. Since there is virtually no change in the past *départemental* authorization rate between 2007 and 2008, the results are driven by the interaction between the change in the leave-one-out revenue growth rate of the industry × commuting zone cell of firm i and the past *départemental* authorization rate – i.e. the term $(\Delta g_{it} \times ap_{jt-1})$.

Remark: Our instruments for the take-up of short-time work, the extensive margin of the policy, are also clearly valid when applied at the intensive margin of the policy, i.e. the number of hours used by the firm or the number of employees enrolled by their employing establishment. Indeed, a model of the extensive margin and a (separately estimated) model of the intensive margin could be fitted into a latent variables framework based on a unique, identical index. And the larger the index, the larger the probability of take-up, and the larger the associated number of hours or number of workers enrolled in the program. Hence, when these instruments are valid for the extensive margin they are also valid for the intensive margin.

6 Empirical Results

We start by analyzing the firm-level impact of the short-time work take-up on the entire set of firms before looking at its heterogeneous effects across firms. The heterogeneity is captured using the size of the fall in firms' revenues during the Great Recession, as suggested by our model.

6.1 Global Effects

6.1.1 Short-Term Effects

Tables 4 and 5 report the OLS estimates of the relation between our different measures of short-time work take-up and firms' outcomes described by equation (11). Table 4 shows that short-time work use is negatively correlated with employment growth, growth in total hours of work, and growth in hours per worker. Table 5 shows that firms using short-time work in 2009 are more likely to be liquidated by 2010 than other firms.[22] More precisely, firms using short-time work have 11% lower employment growth than other firms in 2009 and are 3% more likely to be dead by 2010. Our IV approach shows that these correlations likely arise from the selection into short-time work of firms facing negative shocks.

Table 6 displays the first-stage estimates of the two-stage least squares estimation of equations (11) and (12). The *interaction* between the change in the leave-one-out revenue growth rate of the industry ×

[22] We look here at liquidations by 2010 – i.e, an indicator variable equal to one if a firm with positive employment on 31 December 2008 has been liquidated by the end of 2010. Results are similar for year 2009 but it is more relevant to look at liquidations with a one year lag to gauge the death of firms due to the length of liquidation procedures.

commuting zone cell of firm i and the past *départemental* authorization rate is negatively and significantly related to short-time work use, implying that a drop in the leave-one-out revenue growth rate of the industry $\times$ commuting zone cell of firm i has a lower effect on the short-time work take-up in *départements* where the past authorization rate is lower – controlling for the change in the leave-one-out revenue growth rate of the industry $\times$ commuting zone cell. F statistics are above 20 for all specifications.

Tables 7 and 8 report the results for the second stage of our IV estimation. Compared with the OLS estimates, results are markedly different. Although we still see a negative relation between the short-time work take-up and the growth rate of hours of work, the relation disappears for both employment growth and firm death.

We will see that the absence of a significant employment effect of short-time work in the above analysis masks a tremendous across-firms heterogeneity of the effect of short-time work on firms' outcomes when results are made conditional on the size of the (negative) shock.

6.1.2 Mid-Term Effects

Two stories about short-time work can be told. In the first, the policy helps firms with limited access to financial markets, hit by transitory negative shocks, to recover and grow in the following years. In the second, however, short-time work helps structurally weak firms, without recovery potential, to keep jobs alive that will soon be destroyed. In order to assess which story is more credible, we analyze the impact of the take-up of short-time work *in 2009* on firms' outcomes at the end of 2011. We analyze the impact of short-time work beyond year 2009 until the end of 2011 because France was again hit by a recession and the French short-time work scheme experienced subsequent reforms in 2012. We estimate the same model as before, using changes spanning the period from 2008 to 2011 rather than from 2008 to 2009.

Tables 9 and 10 report the OLS estimates of the relation between our different measures of short-time work take-up and firms' outcomes by 2011. They show that short-time work use is negatively correlated with employment growth, growth in total hours of work, and growth in hours per worker but positively correlated with the probability of liquidation at this longer-term horizon.

Tables 11 and 12 report the results for the second stage of our IV estimation. As was the case for the 2009 horizon, results are very different from the OLS estimates. There is still a negative relation between short-time work take-up and the growth rate of hours of work, but the relation between STW and firm deaths disappears[23] and a positive correlation (significant at 90% confidence level) with employment growth arises. This suggests that short-time work is effective at saving jobs in the medium-long run and has no effect on firm survival in the medium run. The next section will probe this issue further by analyzing the heterogeneous effects of short-time work across firms.

[23] We look here at liquidations by 2012.

6.2 Heterogeneous Effects

Guided by our model's predictions – short-time work has heterogeneous effects across firms depending on the magnitude of the shock that hits them – we stratify firms according to their predicted growth rate of hours of work in 2009. More precisely, for each firm, we predict the growth rate of hours of work in 2009 from a leave-one-out regression[24] which includes the covariates of equation (11) excluding the indicator for short-time work use, STW. Then, we build quintiles for firms taking up short-time work. We then allocate all other (non-user) firms within these quintiles according to the same predicted growth rate of hours of work. This allows us to construct quintiles including a balanced number of firms taking up short-time work, each quintile including both STW users and non-users.

6.2.1 Short-Term Heterogeneous Effects

We first present some descriptive statistics on firms at each quintile before showing a first set of results on the effects of short-time work on employment and hours of work, again at each quintile. These results will be shown to be fully in line with the predictions of our theoretical model. We then analyze the exact quantitative impact of short-time work at each quintile together with an evaluation of the cost per saved job in 2009.

Descriptive statistics

Table 13 shows that the predicted growth rate of hours of work for firms using short-time work in 2009 varies quite a lot: it goes from -12% at the bottom quintile to 2.6% at the highest one. Short-time work is concentrated in bottom quintiles of firms. The take-up at the first quintile is 3 times larger than at the fifth. Among firms with a positive take-up, those at the bottom quintiles are larger, less productive, and receive larger amounts of short-time work subsidies than firms at the top quintiles (see Table 14).

Qualitative effects

We now analyze the IV estimates of the impact of short-time work at the different quintiles. The first-stage estimates, reported in Table B1, show that the instruments are significant at every quintile and that the F statistics are above 12, again at every quintile.

Figure 12 provides a visual assessment of the fit of the theoretical model with our IV estimates. These estimates – also reported in Table 15 – are significantly different from zero for the employment growth variable *only at the lowest quintile of revenue shock distribution*. At all other quintiles, the estimates are never significantly different from zero. Furthermore, their magnitude decreases when the predicted revenue shock gets more positive (less negative). This clearly illustrates the absence of a causal employment effect of short-time work for those firms hit by small negative shocks (or even positive), as predicted by our theoretical model.

[24] As shown by Abadie et al. (2018), this procedure avoids bias induced by endogenous stratification.

Furthermore, short-time work increases the total number of hours of work at the bottom quintile of predicted growth rate of hours of work distribution (see the bottom panel of Figure 12). By contrast, the *impact declines and becomes negative at the top quintiles* (the precise estimates are reported in Table 15). Again, our model predicts (Result 7) this differentiated effect: the short-time work policy may increase the total number of hours worked at firms hit by very large negative shocks when the policy allows the firm to save many of its jobs. By contrast, almost no jobs are saved in firms hit by smaller shocks, even though firms reduce the total number of hours worked for those employees they enroll in short-time work.

In addition, short-time work does not seem to have either increased the firm's survival rate or favored the temporary survival of firms intended or destined to be liquidated in the short term (see Table 16). Indeed, firms that were short-time work users in 2009 are as likely to be liquidated by 2010 as non-users at every quintile.

Strikingly, the above results hold for all our measures (at the intensive margin) of short-time work take-up: *i)* the ratio of the firm's short-time work hours to the total number of hours worked in the previous year (Tables B3 and B4); *ii)* the ratio of the firm's short-time work subsidy to its total labor costs in the previous year (Tables B6 and B7); *iii)* the ratio of the firm's number of short-time workers to its employment in the previous year (Tables B9 and B10).

Quantitative effects

The magnitude of the coefficients clearly shows a very strong impact of short-time work on employment for firms hit by large negative revenue shocks. Short-time work increases employment growth by about 42% in the first quintile – Table 15, Column 1, Row 1. This magnitude corresponds to 1.5 times the employment growth standard deviation within this quintile. As firms belonging to this first quintile are larger than other firms, short-time work saved about 11% (with a 95% confidence interval equal to $[2\%, 19\%]$) of jobs for short-time work users *assuming*, in line with results reported in Table 15, that short-time work did not save jobs *outside* the bottom quintile.

When one percent of the firm's work hours enter into short-time work scheme, employment increases by approximately 5.7% at the bottom quintile (Table B3). The associated increase in total worked hours equals 4.5% of worked hours at this quintile (see Column Q_1, Row 3 of Table B3). By contrast, short-time work reduces hours worked at all other quintiles, with a strong negative impact at the top quintile where hours of work drop by 7.3%. Assuming, in line with these results, that short-time work has no significant impact on total hours of work outside the bottom and top quintiles, we conclude that short-time work has virtually no impact on total hours worked – the number of hours of work in each quintile being reported in Table 14.

Enrolling one additional worker in the short-time work scheme therefore saves 0.6 job at the bottom quintile of the predicted growth of hours of work distribution (Table B9, Column Q_1). Hence, workers who

keep their jobs thanks to their enrollment in the short-time work scheme crowd out 0.4 (other) workers (through a reduction in hires, non-renewal of temporary jobs, or non-conversion of temporary jobs into permanent jobs). Table B9, Column Q_1 also shows that enrolling one additional percent of workers in short-time work increases the number of hours of work by 0.5 percent at the bottom quintile. By contrast, there is no detectable effect on employment at all other quintiles (see Columns Q_2 to Q_5 of the same Table B9) but the number of hours of work is reduced, especially at the top quintile.

An additional short-time work subsidy of one percentage point of the firm's previous year payroll translates into a 20% increase in a firm's employment and a 16% increase in a firm's hours of work, always at the bottom quintile (Table B6). And similar to what was found above, at all other quintiles, there is no employment effect whereas hours of work are reduced, with a strong 27% drop at the top quintile.

The theoretical model allows us to understand the large employment effects at the bottom quintile. Indeed, the impact of the subsidy is amplified by the downward adjustment of wages for those workers who have their work hours reduced. Hence, when enrolling workers in short-time work, firms benefit both from the subsidy – shared with workers through wage bargaining – and reduced payments to workers because of the reduced work hours.

Cost per job saved

All the above results point to the same conclusion: short-time work was very effective at saving jobs for firms hit by large negative shocks. Using our estimate of the number of jobs created – from Table 15 – together with the size of the received subsidy – from Table 14 –, we can compute the cost per job saved. This cost equals 2700€ in 2009; 7% of the average annual labor costs at the bottom quintile (with a 95% confidence interval equal to $[4\%, 27\%]$).

7% is extremely small compared to the costs (per job created) of wage subsidies, typically estimated to lie between 100% and 200% of annual labor costs.[25] However, since short-time work did not create jobs at all quintiles but only at the bottom, the cost per job saved is higher. Accounting for all short-time work subsidies paid in 2009 to firms belonging to all quintiles, the cost per job saved becomes 45% of the average annual labor costs per job (with a 95% confidence interval equal to $[25\%, 175\%]$). Hence, windfalls effects induced by the short-time work policy are quite large, but it does appear to be more effective than wage subsidies at saving jobs in the short-run. As shown by our theory, the specific strength of the short-time work scheme is its targeting of both employees at risk of losing their job and their non-worked hours in firms where the marginal productivity of these employees and their hours fall below their marginal labor cost. Wage subsidies on the other hand are usually given to all a firm's employees (who belong to some targeted category based on age or past labor market experience, for instance) and all their hours, even

[25] The cost per job created of a permanent wage subsidy amounts to the labor cost divided by the absolute value of the elasticity of labor demand with respect to labor cost (Cahuc et al., 2019). Assuming that this elasticity lies between -1 and -0.5 (Hamermesh, 2014), the cost per job created of a wage subsidy amounts to between 100% and 200% of the labor cost.

when their marginal productivity is actually well above their marginal labor cost.

6.2.2 Mid-Term Heterogeneous Effects

We now analyze the impact of short-time work beyond year 2009, until the end of 2011.

Table 17 reports the results of the instrumental variable estimation of equation (11) in which the growth rate of the dependent variable is computed over the December 2008 to December 2011 period (or a firm's death indicator for the same period). Our measure of short-time work is for year 2009.

Our methodology is essentially identical to the one used for our short-term analyses. We classify firms into quintiles of their predicted growth rate of hours of work for the year 2009. Then, we examine the mid-term outcomes, at each quintile.

Firms at the first (i.e. bottom) quintile, for which short-time work had positive effects on employment and hours of work in 2009, also grow faster from 2008 to 2011, suggesting that short-time work helped them recover, potentially because the scheme helped these firms retain their workforce despite the negative shock. However, we find no effect of the policy on firms' survival (Table 18). Hence, short-time work does not appear to help particularly fragile firms survive. Firms at all other quintiles are not affected by the policy in this mid-term horizon (Tables 17 and 18). These results are robust to using our alternative measures of short-time work take-up (Tables B11 to B16).

To recap our findings, short-time work appears to be used by firms faced with a temporary negative shock rather than by firms hit by permanent shocks whose jobs are condemned to be destroyed in the medium term. Indeed, this view is confirmed by Figure 13 in which we report the evolution of the profitability and the financial situation of short-time work users relative to non-user firms over 2008-2011. Short-time work users have lower return on assets, lower return on equity, lower coverage and higher debt ratio than non-users, in 2008, before the recession. Moreover, the profitability and the financial situation of short-time work users were much more hurt, in 2009, than those of non-users. However, users' finances improved more rapidly than those of the non-users, coming back to their pre-2009 level as early as 2011. These estimates are consistent with our model's result 6: short-time work should be used by low-productivity firms hit by temporary shocks whereas firms hit by large permanent shocks prefer to destroy jobs.[26]

[26] This is also consistent with Giroud & Mueller (2017)'s interpretation of the role played by short-time work: the scheme helps firms hoard labor when faced with large (but temporary) drops in revenue inducing stringent financial constraints. Unfortunately, the lack of access to data does not allow us to analyze the role of financial constraints and this analysis is left for future research. This is also in line with the findings of Kopp & Siegenthaler (2021) who find that short-time work saved low-profit jobs at greater risk of being destroyed during the 2009 recession in Switzerland, but which were profitable when the recession ended.

7 Conclusion

Based on our motivating facts, we develop a model to analyze the heterogeneous effects of short-time work on firms. Our empirical results, on France during the 2008-2009 Great Recession, fully confirm the extent of firms' heterogeneous responses to this policy. Short-time work has been very effective at saving jobs and increasing total hours of work at firms hit by strong negative revenue shocks. These firms have been able to recover rapidly in the aftermath of the Recession. However, our estimates also point to large windfall effects, to the extent that firms facing a limited decrease in revenues also use short-time work to reduce hours of work for jobs at no risk of being destroyed. Hence, in these firms, short-time work reduced the number of hours of work without saving jobs. Still, short-time work policies remain more cost-efficient at saving jobs than wage subsidies because the former allow firms to select themselves into the program by enrolling those employees at risk of losing their job as well as their number of hours worked, something impossible for a subsidy policy.

All in all, our analysis suggests that short-time work had desirable properties when the Great Recession hit. But the size of windfall effects evaluated in our paper indicates that its effectiveness significantly hinges on its design. From this perspective, our results suggest ways to optimize short-time work schemes.

First, the scheme should be targeted at firms facing large drops in their revenues. A way to screen firms might be to subsidize short-time work for a sufficiently large number of non-worked hours per employee rather than subsidizing non-worked hour below the usual contractual number of hours worked from the outset, as was the case in France in the Great Recession, since employees whose hours worked are reduced by small amounts are less at risk of seeing their jobs destroyed.

Second, introducing experience rating should reduce the windfall effects, as stressed by Burdett & Wright (1989). When financial markets are imperfect, short-time work may be useful to firms in temporary distress. However, if firms can use short-time work at no cost, some firms may decide to make the policy their usual tool when faced with certain repetitive shocks rather than search for other ways to overcome such temporary but recurring difficulties.

Finally, as stressed by Cooper et al. (2017), extending the short-time work policy is likely to decrease allocative efficiency on the labor market, resulting in significant output losses. This suggests that short-time work schemes should only be implemented cautiously outside recessions.

References

Abadie, A., Chingos, M. M., & West, M. R. (2018). Endogenous stratification in randomized experiments. *The Review of Economics and Statistics*, *C*(4), 567–580.

Abraham, K. G., & Houseman, S. N. (1994). *Does Employment Protection Inhibit Labor Market Flexibility? Lessons from Germany, France and Belgium*, (pp. 59–93). 4390. University of Chicago Press.

Audenrode, M. A. V. (1994). Short-time compensation, job security, and employment contracts: Evidence from selected oecd countries. *Journal of Political Economy*, *102*(1), 76–102.

Balleer, A., Gehrke, B., Lechthaler, W., & Merkl, C. (2016). Does short-time work save jobs? a business cycle analysis. *European Economic Review*, *84*, 99–122.

Bellmann, L., & Gerner, H.-D. (2011). Reversed roles? wage and employment effects of the current crisis. In H. Immervoll, A. Peichl, & K. Tatsiramos (Eds.) *Who Loses in the Downturn? Economic Crisis, Employment and Income Distribution*, vol. 32 of *Research in Labor Economics*, (pp. 181–206). Emerald Publishing Ltd.

Bellmann, L., Gerner, H.-D., & Upward, R. (2015). The response of german establishments to the 2008-2009 economic crisis. In I. Kubin, P. Commendatore, & S. Kayam (Eds.) *Complexity and Geographical Economics: Topics and Tools*, vol. 19 of *Dynamic Modeling and Econometrics in Economics and Finance*, (pp. 165–307). Emerald Publishing Ltd.

Biddle, J. E. (2014). Retrospectives: The cyclical behavior of labor productivity and the emergence of the labor hoarding concept. *The Journal of Economic Perspectives*, *28*(2), 197–211.

Boeri, T., Bruecker, H., Fuchs-Schündein, N., & Mayer, T. (2011). Short-time work benefits revisited: Some lessons from the great recession. *Economic Policy*, *26*(68), 697–765.

Braun, H., & Brügemann, B. (2014). Welfare effects of short-time compensation. IZA Discussion Paper 8597, Institute of Labor Economics (IZA).

Brey, B., & Hertweck, M. S. (2020). The extension of short-time work schemes during the great recession: A story of success? *Macroeconomic Dynamics*, *24*(2), 360–402.

Burdett, K., & Wright, R. (1989). Unemployment insurance and short-time compensation: The effects on layoffs, hours per worker,and wages. *Journal of Political Economy*, *97*(6), 1479–1496.

Cahuc, P., & Carcillo, S. (2011). Is short-time work a good method to keep unemployment down? *Nordic Economic Policy Review*, *1*(1), 133–164.

Cahuc, P., Carcillo, S., & Barbanchon, T. L. (2019). The effectiveness of hiring credits. *The Review of Economic Studies*, *86*(2), 593–626.

Calavrezo, O., Duhautois, R., & Walkowiak, E. (2010). Short-time compensation and establishment exit: An empirical analysis with french data. IZA Discussion Paper 4989, Institute of Labor Economics (IZA).

Cooper, R., Meyer, M., & Schott, I. (2017). The employment and output effects of short-time work in germany. NBER Working Paper 23688, National Bureau of Economic Research (NBER).

Giroud, X., & Mueller, H. M. (2017). Firm leverage, consumer demand, and employment losses during the great recession. *The Quarterly Journal of Economics*, *132*(1), 271–316.

Giupponi, G., & Landais, C. (2018). Subsidizing labor hoarding in recessions: The employment and welfare effects of short time work. CEPR Discussion Paper 13310, Centre for Economic Policy Research (CEPR).

Hamermesh, D. S. (2014). Do labor costs affect companies demand for labor? IZA World of Labor 3, Institute of Labor Economics (IZA).

Hijzen, A., & Martin, S. (2013). The role of short-time work schemes during the global financial crisis and early recovery: A cross-country analysis. IZA Discussion Paper 7291, Institute of Labor Economics (IZA).

Hijzen, A., & Venn, D. (2011). The role of short-time work schemes during the 2008-2009 recession. OECD Social, Employment and Migration Working Paper 115, Organization for Economic Cooperation and Development (OECD).

Kopp, D., & Siegenthaler, M. (2021). Short-time work and unemployment in and after the great recession. *Journal of the European Economic Association, forthcoming*.

Kruppe, T., & Scholz, T. (2014). Labour hoarding in germany: Employment effects of short-time work during the crises. IAB Discussion Paper 17/2014, Institute for Employment Research (IAB).

Niedermayer, K., & Tilly, J. (2017). Employment and welfare effects of short-time work. Tech. rep., Mimeo.

OECD (2020). Oecd employment outlook 2020: Worker security and the covid-19 crisis. Tech. rep., Organisation for Economic Co-operation and Development (OECD).

Tracey, M. R., & Polachek, S. W. (2020). Heterogeneous layoff effects of the us short-time compensation program. *LABOUR*, *34*(4), 399–426.

8 Figures

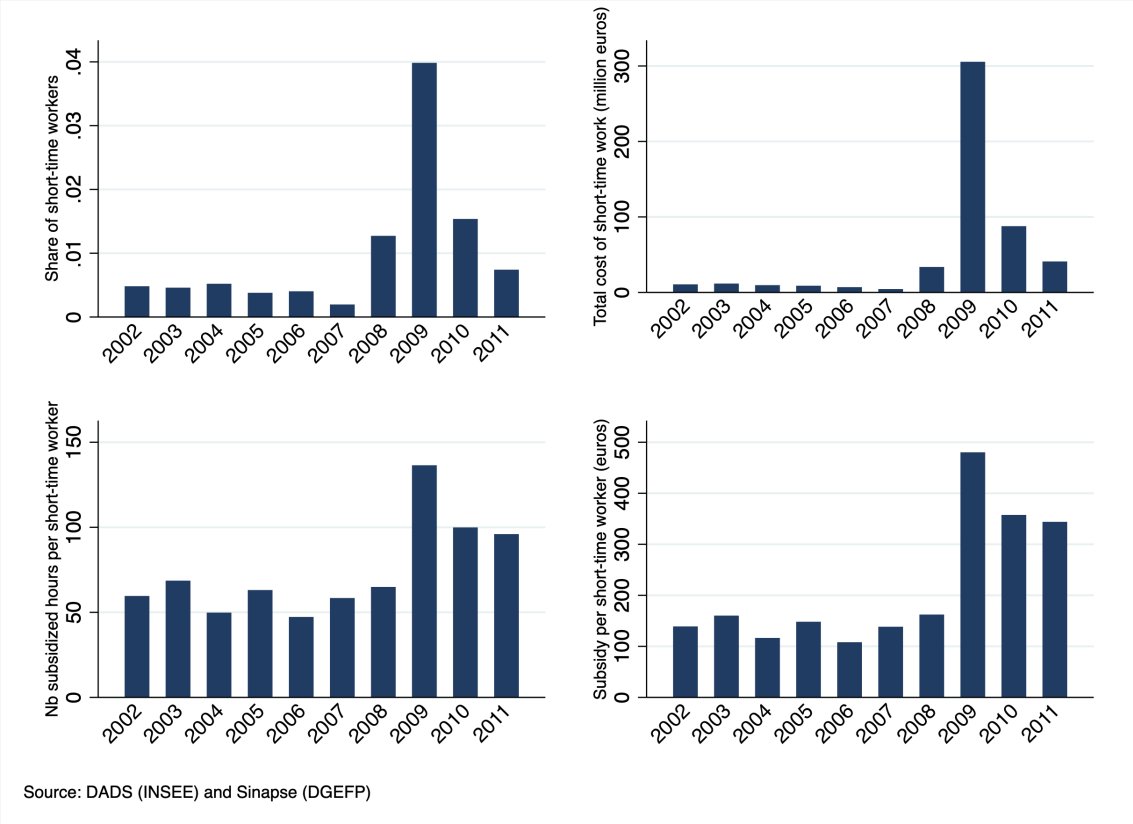


Figure 1 – Share of short-time workers (top left), total cost of short-time work (top right), number of subsidized non-worked hours per short-time worker (bottom left) and subsidy per short-time worker (bottom right)

Sources: *DADS* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Establishments using short-time work for economic reasons. **Note:** The share of short-time workers is equal to the number of employees on short-time work at least once during the year divided by the average number of employees in the year; the total cost of short-time work is equal to the sum of short-time work subsidies paid in the year; the number of subsidized non-worked hours per short-time worker is equal to the number of subsidized non-worked hours in the year divided by the number of short-time workers in the year; the subsidy per short-time worker is equal to the sum of short-time work subsidies paid in the year divided by the number of short-time workers in the year.

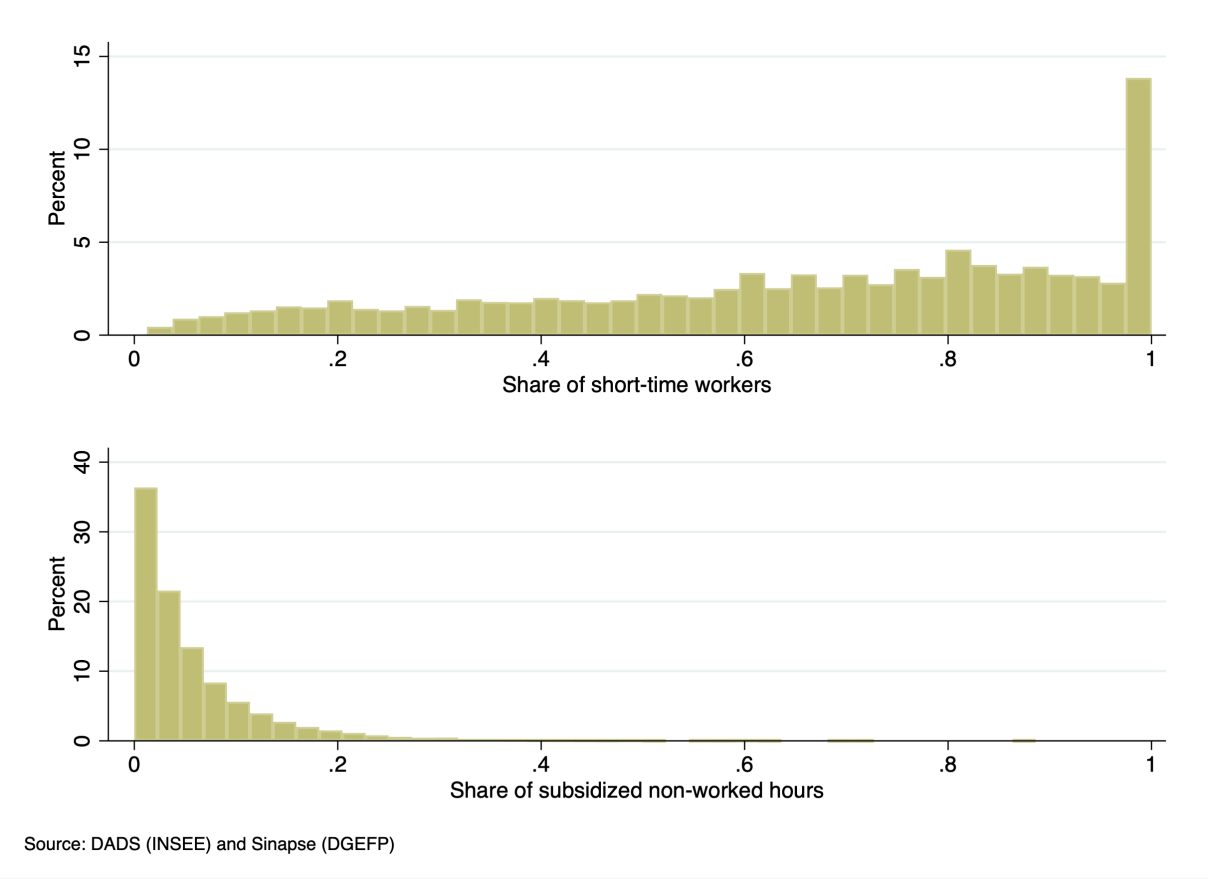


Figure 2 – Histogram of share of short-time workers (top panel) and histogram of share of subsidized non-worked hours (bottom panel) among firms with positive short-time work take-up

Sources: *DADS* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Establishments using short-time work for economic reasons. **Note:** In every firm, the share of short-time workers is equal to the number of employees on short-time work at least once in the year divided by the average number of employees in the year; the share of subsidized non-worked hours is equal to the number of subsidized non-worked hours in the year divided by the number of hours worked in the year.

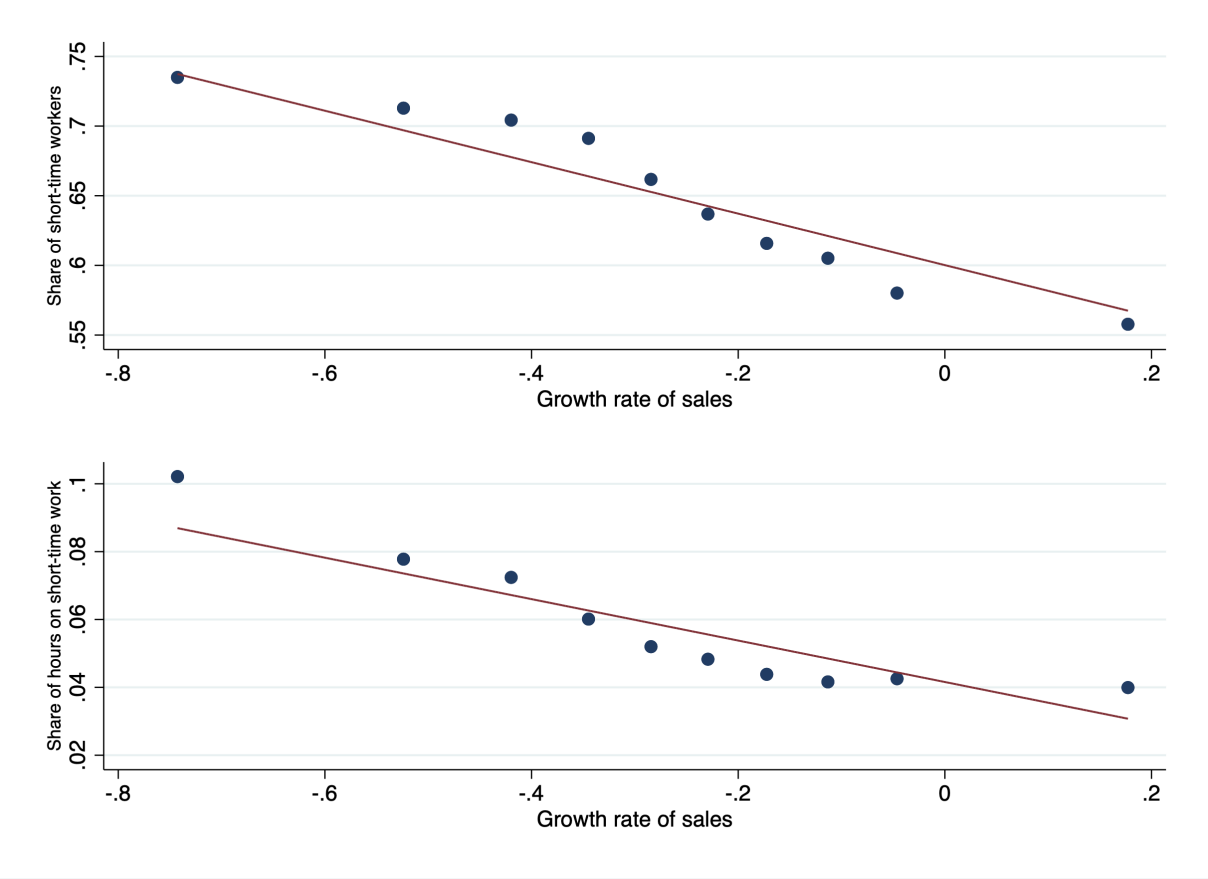


Figure 3 – Sales growth rate (horizontal axis) and share of short-time workers (top panel) or share of subsidized non-worked hours (bottom panel) among firms with positive short-time work take-up
Sources: *DADS* (*INSEE*) *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Establishments using short-time work for economic reasons. **Note:** In every firm, the share of short-time workers is equal to the number of employees on short-time work at least once in the year divided by the average number of employees in the year; the share of subsidized non-worked hours is equal to the number of subsidized non-worked hours in the year divided by the number of hours worked in the year.

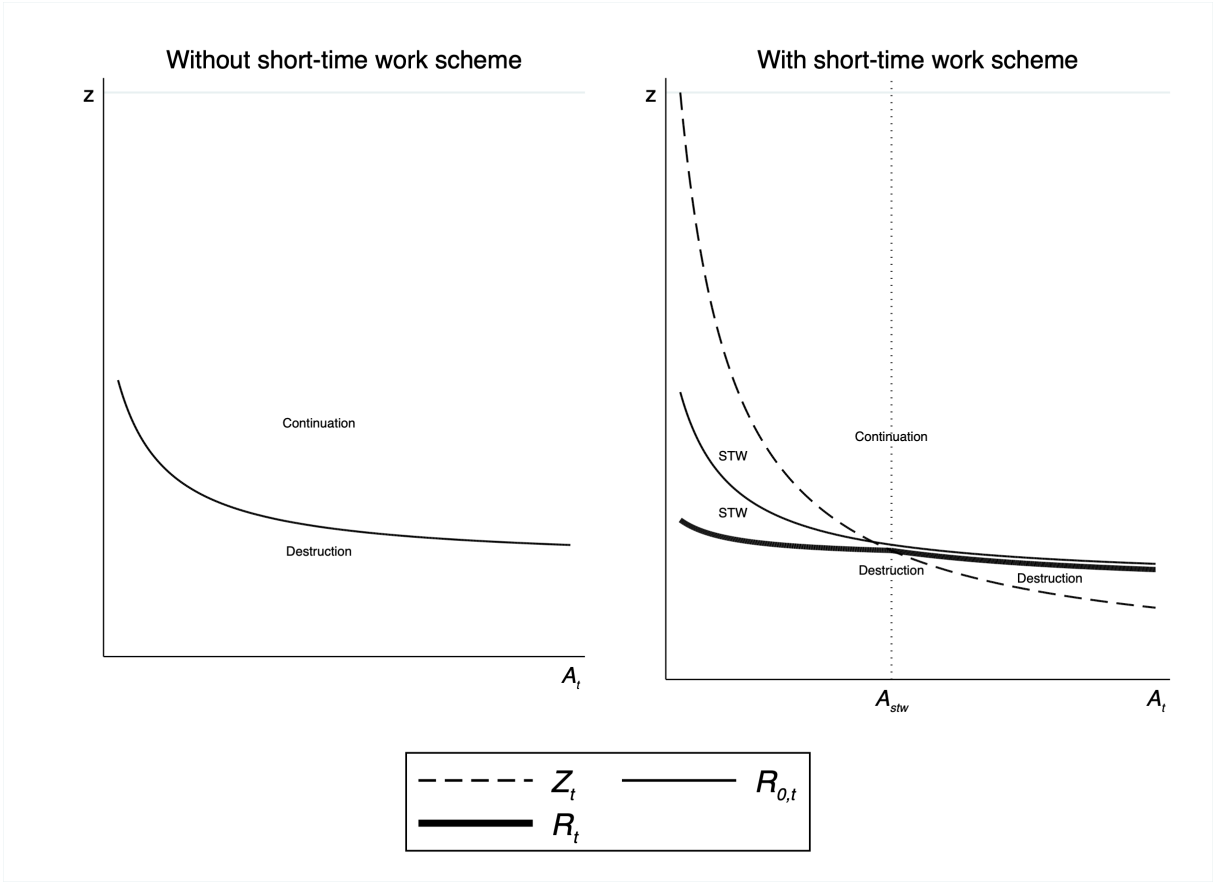


Figure 4 – Job destruction and short-time work take-up in the (z, A_t) plane without short-time work scheme (left panel) and with short-time work scheme (right panel)

Notes: $\diamond$ Z_t stands for the threshold level of job specific productivity parameter z below which short-time work is used if the job is not destroyed. $\diamond$ $R_{0,t}$ stands for the job specific reservation productivity z below which jobs are destroyed absent short-time work scheme. $\diamond$ R_t stands for the job specific reservation productivity z in the presence of short-time work scheme.

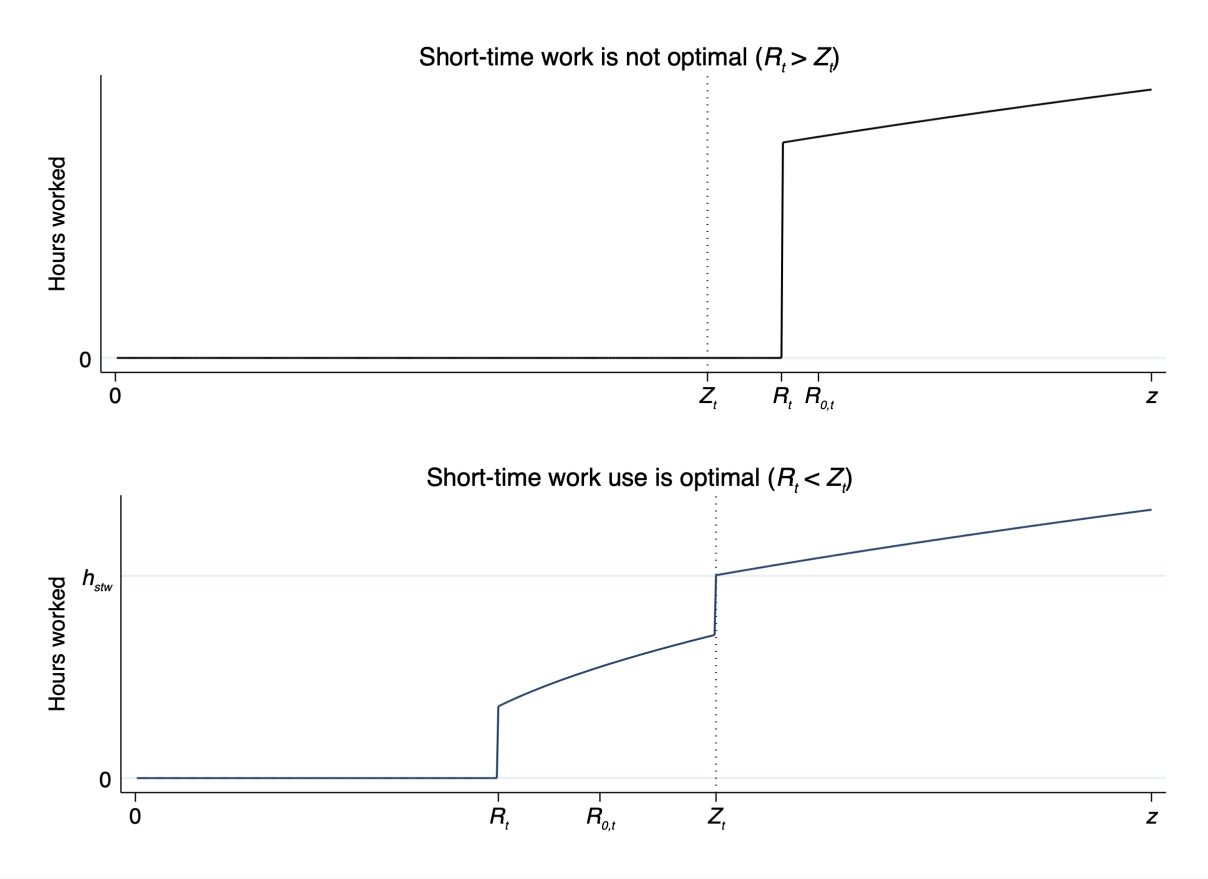


Figure 5 – Hours of work and job destruction without (top panel) and with (bottom panel) short-time work take-up

Notes: $\diamond$ Z_t stands for the threshold level of job specific productivity parameter z below which short-time work is used if the job is not destroyed. $\diamond$ $R_{0,t}$ stands for the job specific reservation productivity below which jobs are destroyed absent short-time work scheme. $\diamond$ R_t stands for the job specific reservation productivity in the presence short-time work scheme.

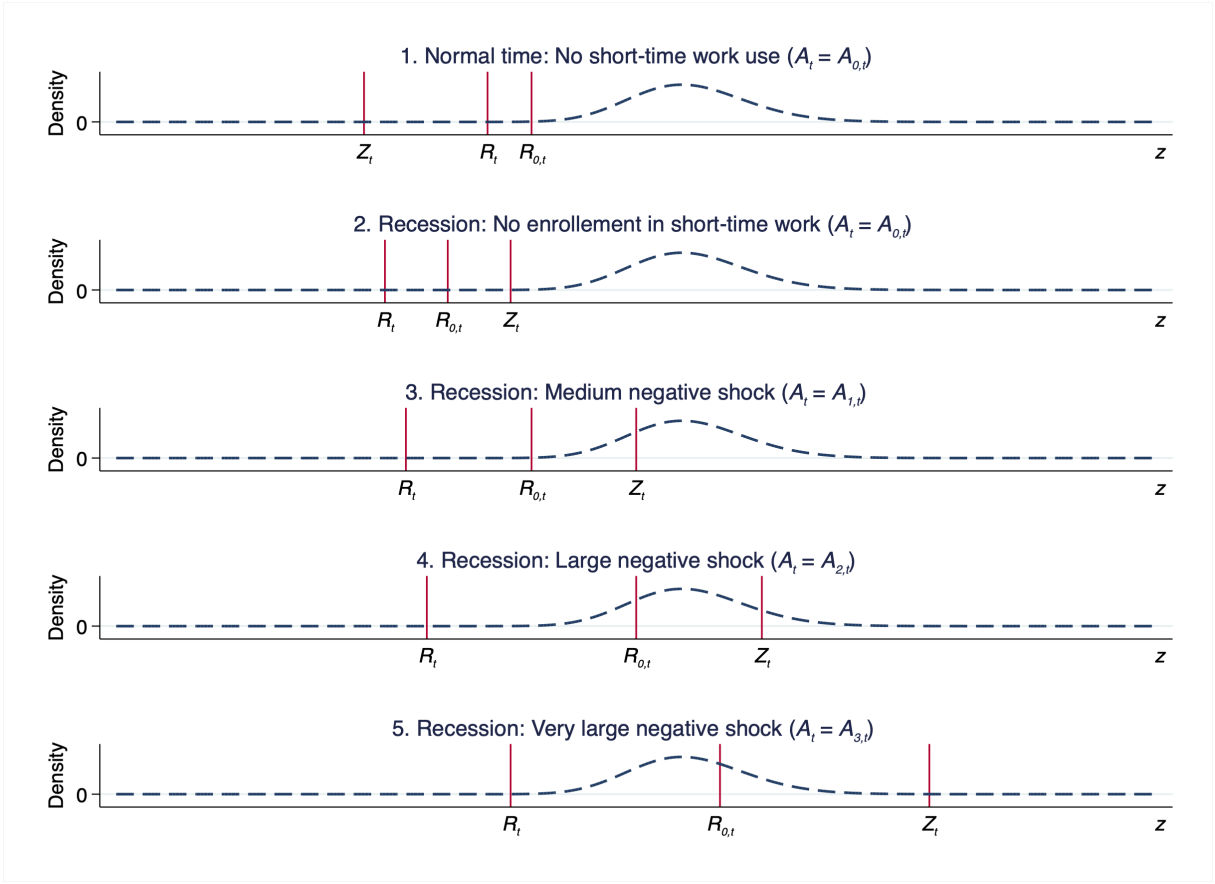


Figure 6 – The effects of short-time work according to the firm productivity shock

Notes: This figure displays the job specific productivity distribution z of jobs within firms together with the reservations productivity. All jobs with productivity parameter z below $R_{0,t}$ are destroyed in the absence of short-time work scheme. All jobs with productivity parameter z below R_t are destroyed in the presence of short-time work scheme. All jobs with productivity parameter z below Z_t and above R_t use short-time work in the presence of short-time work scheme. All jobs with productivity parameter z above Z_t continue without using short-time work. Panel 1: firm in normal time; Panel 2: firm in recession not hit by negative productivity shock (i.e. no shock on A); Panel 3: firm in recession hit by negative productivity shock of medium size (i.e. medium drop in A); Panel 4: firm in recession hit by large negative productivity shock (i.e. large drop in A); Panel 5: firm in recession hit by very large negative productivity shock (i.e. very large drop in A). z has a log-normal distribution with parameters $(1, 0.1)$.

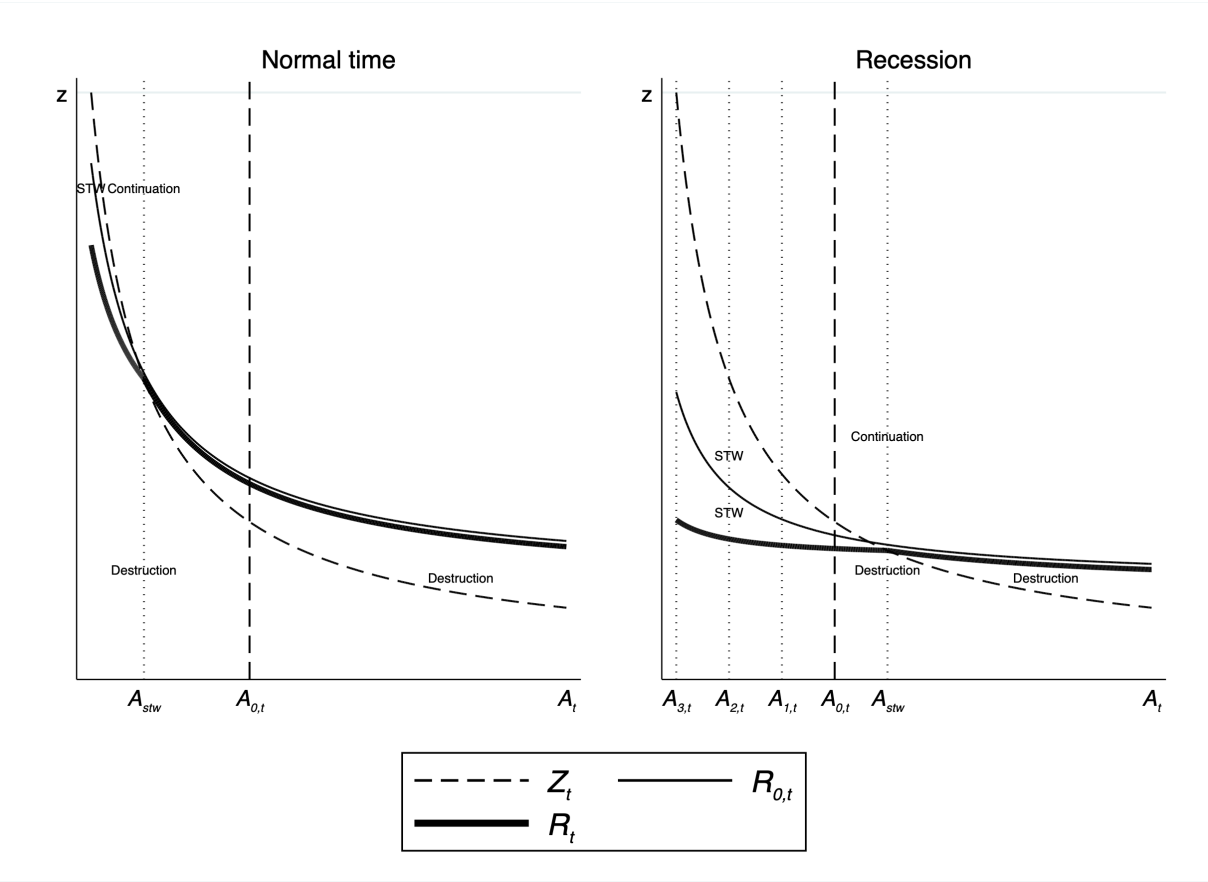


Figure 7 – Job destruction and short-time work take-up in the (z, A_t) plane in normal time (left panel) and in recessions (right panel)

Notes: ⋄ Z_t stands for the threshold level of job specific productivity parameter z below which short-time work is used if the job is not destroyed. ⋄ $R_{0,t}$ stands for the job specific reservation productivity z below which jobs are destroyed absent short-time work scheme. ⋄ R_t stands for the job specific reservation productivity z in the presence of short-time work scheme. ⋄ $R_{0,t}$ Values $A_{i,t}$, $i = 0, .., 4$, correspond to the values reported in the different panels of Figure 6.

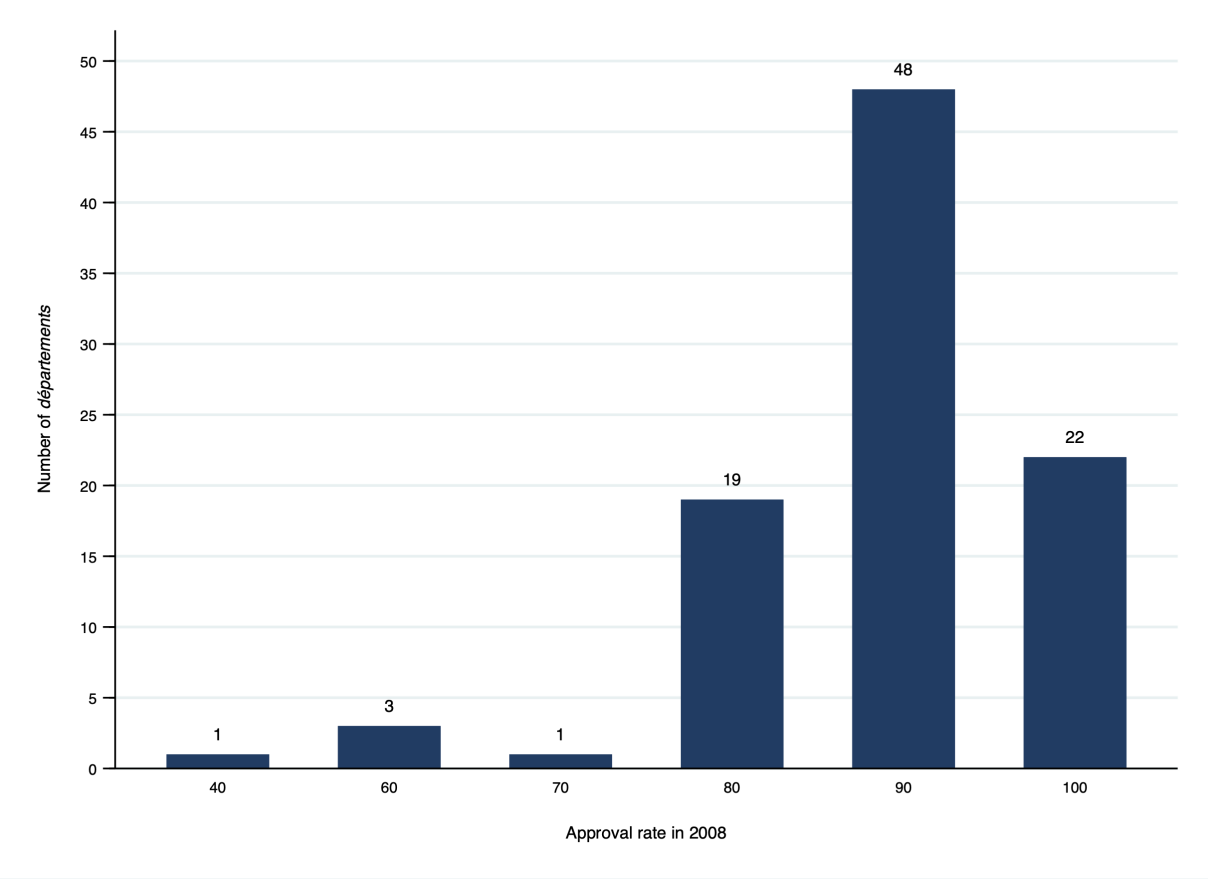


Figure 8 – Number of *départements* (vertical axis) and approval rate in 2008 (horizontal axis)
Source: *Sinapse* (*DGEFP*).
Scope: ◇ Mainland France excluding Corsica. ◇ Market sectors excluding agriculture. ◇ Establishments using short-time work.
Definition: Approval rate is defined as the number of accepted short-time work applications divided by the total number of applications.
Reading: 48 *départements* had approval rates between 90% and 100% in 2008.

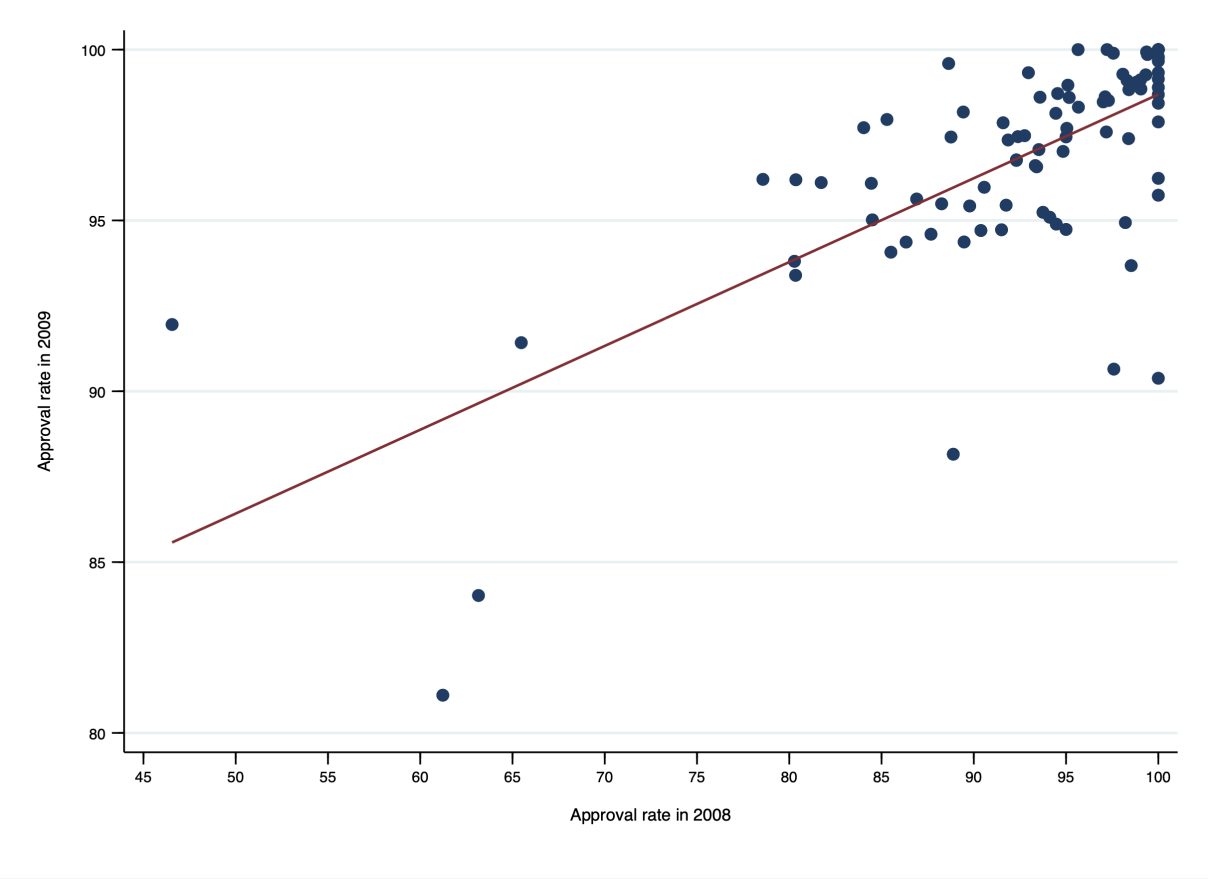


Figure 9 – Approval rates in 2009 (vertical axis) and in 2008 (horizontal axis)
Source: *Sinapse* (*DGEFP*).
Scope: ◇ Mainland France excluding Corsica. ◇ Market sectors excluding agriculture. ◇ Establishments using short-time work.
Definition: Approval rate is defined as the number of accepted short-time work applications divided by the total number of applications.
Notes: ◇ The approval rate is computed at the *département* level. ◇ The equation corresponding to the linear regression is: $y_i = \underset{(5.358528)}{74.152368} + \underset{(.0565378)}{.24537992} x_i$, $AdjR^2 = .4751$ and $N = 94$ where i denotes the *département*, y_i denotes the approval rate in 2009 and x_i denotes the approval rate in 2008.

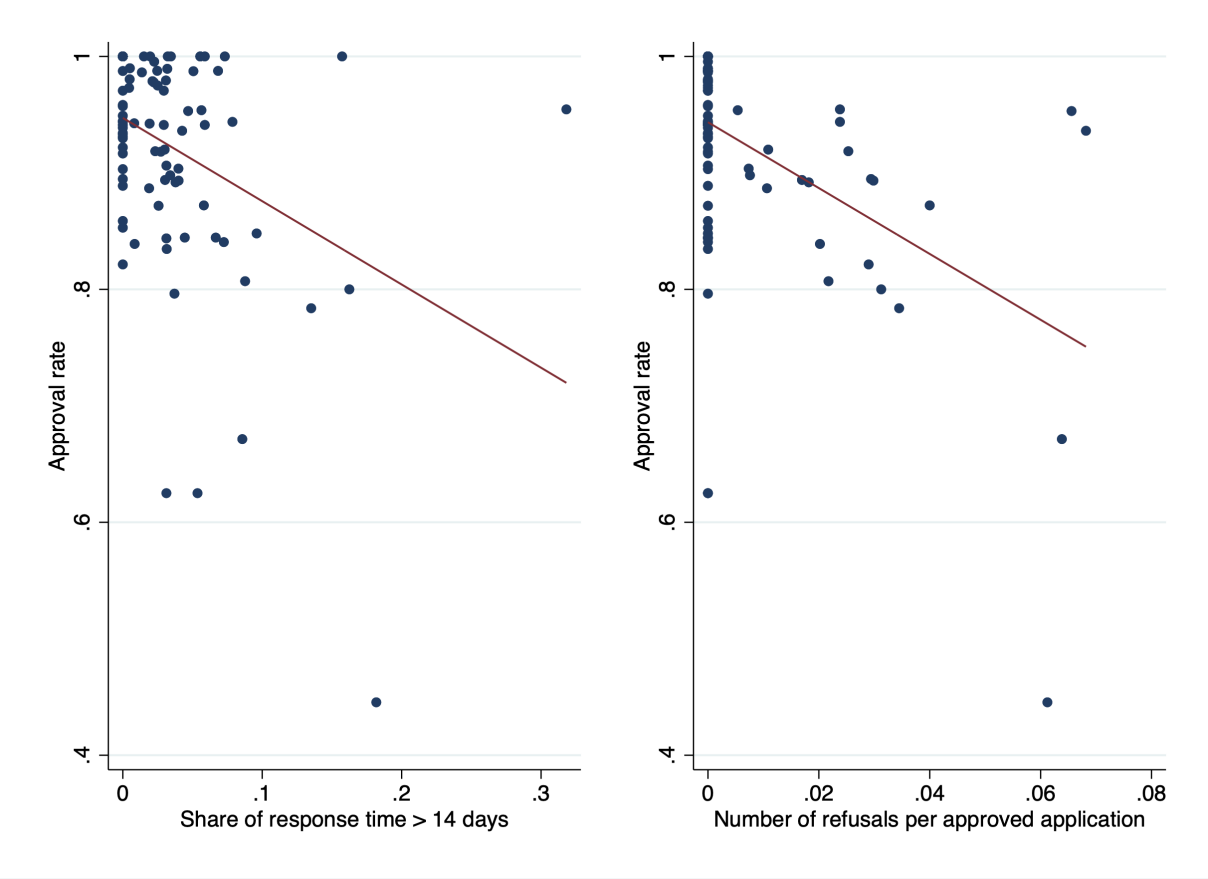


Figure 10 – Short-time work authorization rate in 2008, number of refusals per approved application (left panel), and share of response time longer than 14 days (left panel)
Source: *Sinapse* (*DGEFP*).
Scope: ⋄ Mainland France excluding Corsica. ⋄ Market sectors excluding agriculture.
Notes: ⋄ These figures are scatter plots of the average *départemental* approval rate, number of refusals per approved application and share of response time longer than 14 days. Approval rate is defined as the number of approved short-time work applications divided by the total number of short-time work applications.

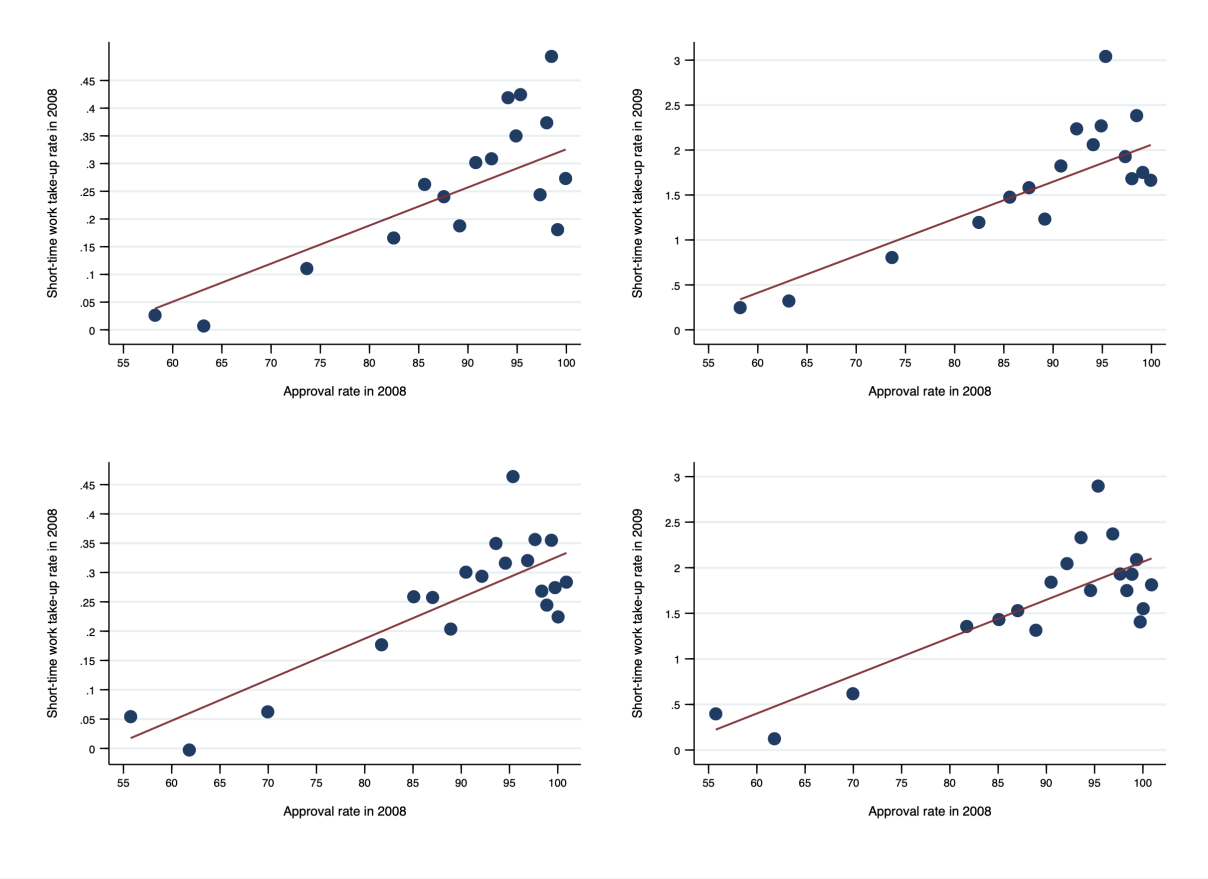


Figure 11 – Proportion of short-time work establishments in 2008 (left) and in 2009 (right) (vertical axis) and approval rate in 2008 (horizontal axis)

Source: *Sinapse* (*DGEFP*).

Scope: ◇ Mainland France excluding Corsica. ◇ Market sectors excluding agriculture.

Notes: ◇ Each graph represents a binscatter which groups the variable on the horizontal axis into equal-sized bins, computes the mean of the variables on the horizontal and vertical axes within each bin, and creates a scatterplot of these data points. ◇ Top graphs report the mean of the short-time work take-up rates whereas the bottom graphs report the mean conditional on the commuting zone and sector revenue growth rate and the commuting zone and sector employment growth.

Definitions: ◇ Approval rate is defined as the number of accepted short-time work applications divided by the total number of short-time work applications. ◇ The commuting zone and sector revenue and employment growth rates are defined in a symmetric way.

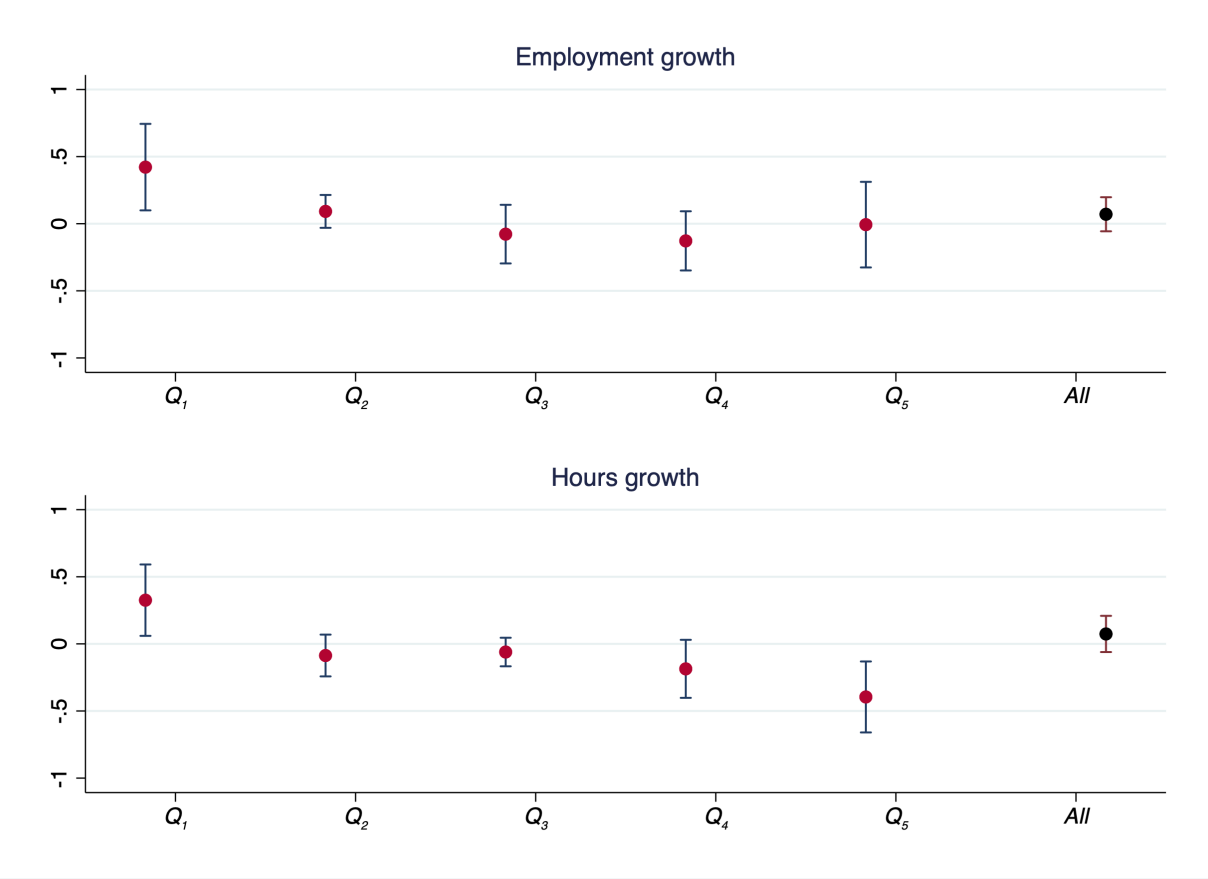


Figure 12 – Second stage IV estimates of the impact of short-time work take-up in 2009 on employment and hours of work.

Notes: This figure reports the second stage estimates and the 95% interval confidence of the impact of short-time work take-up in 2009 on the employment growth rate (top panel) and the growth rate of hours of work (bottom panel) by quintile of predicted growth rate of hours of work in 2009 (from Q_1 to Q_5) and for all firms (*All*). The I-bars report the 95 percent confidence interval. Estimates are reported in Tables 7 and 15 where more details are provided.



Figure 13 – Profitability and financial situation over 2008-2011 of firms using short-time work in 2009 relative to other firms

Sources: *DADS, FARE* (*INSEE*) and *Sinapse* (*DGEFP*).

Scope: ⋄ Mainland France excluding Corsica. ⋄ Market sectors excluding agriculture.

Notes: ⋄ ROE: return on equity equal to EBITDA/Total Equity ⋄ ROA: return on assets, equal to EBITDA/Total Assets ⋄ Coverage: EBTIDA/Interest expense ⋄ Leverage: Total debt / Total Assets; ⋄ Each graph displays the difference in the value of the corresponding index between firms using short-time work in 2009 and other firms, conditional on sector and firm age. The I-bars report the 95 percent confidence interval. Standard errors are clustered at the *département* level.

9 Tables

Table 1 – Characteristics of firms with and without short-time work in 2009.

	$STW = 1$	$STW = 0$
Revenue growth rate	−.17 (.00)	.05 (.00)
Leverage rate	.25 (.00)	.27 (.00)
Employment growth rate	−.14 (.00)	−.05 (.00)
Hourly gross wage	14.21 (.05)	13.81 (.07)
Hours worked per worker	1687.16 (3.42)	1617.36 (1.08)
Turnover rate	1.33 (.01)	1.67 (.00)
Share of temporary jobs	.11 (.00)	.20 (.00)
Number of employees	20.32 (.54)	6.95 (.03)
Age	18.5 (.15)	13.49 (.01)
Observations	11,313	757,030

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms. **Definitions:** The revenue growth rate is defined as the difference in the revenue between 2009 and 2008, divided by the revenue in 2008. The leverage rate is defined as the level of debt divided by the level of assets The employment growth rate is defined as the difference in the number of employees between the 31^{st} of December 2009 and the 31^{st} of December 2008, divided by the number of employees on the 31^{st} of December 2008. The hourly gross wage is defined as the total labor cost divided by the total number of hours worked. The number of hours worked per worker is defined as the total number of hours worked divided by the average number of employees. The turnover rate is defined as the total number of employees present at least one hour in the firm during the year divided by the average number of employees. The share of temporary jobs is defined as the number of employees under non-permanent contracts divided by the total number of employees. The number of employees is defined as the number of employees on the 31^{st} of December 2008. The age is defined as the difference between 2009 and the year of creation of the firm. **Notes:** $STW = 1$ stands for the firms using short-time work for economic reasons in 2009; $STW = 0$ stands for the firms not using short-time work in 2009. Standard errors of the means are reported in parentheses.

Table 2 – Short-time work take-up rate by industry in 2009.

	STW take-up	Number of firms
Construction	.012 (.000)	206,705
Finance, insurance and real estate	.005 (.000)	45,800
Information and communication	.006 (.000)	27,040
Manufacturing and extractive industries	.064 (.001)	115,101
Specialized, scientific and technical services	.010 (.000)	111,375
Wholesale and retail trade, transport	.006 (.000)	439,034

Sources: *DADS* and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms. Standard errors of the means are reported in parentheses.

Table 3 – Correlation between the proportion of short-time work applications whose response time is longer than 14 workdays in 2008, the average number of short-time work refusals in 2007-2008 preceding an authorization in 2008, the approval rate of short-time work applications in 2008 and the average age of the administrative employees in 2008

Variables	% response time > 14 days	Nb of refusals before acceptance	Approval rate	Age of employees
% time >14 days	1.000			
Nb of refusals before acceptance	0.291^{***}	1.000		
Approval rate	-0.465^{***}	-0.518^{***}	1.000	
Age of employees	-0.233^{**}	-0.313^{***}	0.268^{***}	1.000

Sources: Data on the characteristics of the administrative workforce at the local level (*DARES*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. **Definitions:** Response time is defined as the number of workdays elapsed between the receipt date and the decision date regarding the short-time work application and its proportion is computed at the *département* level in 2008. The number of short-time work refusals in 2007-2008 preceding an authorization in 2008 is the number of times an establishment needs to apply for this scheme and is rejected in 2007-2008 prior to its final acceptance in 2008, and the average of this number is computed at the *département* level. Approval rate is defined as the number of accepted short-time work applications divided by the total number of short-time work applications and is computed at the *département* level in 2008. The age of the administrative employees in charge, *inter alia*, of the management of short-time work, is averaged at the *région* level in 2008. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 4 – Short-time work take-up, employment and hours of work in 2008-2009 using ordinary least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Employment growth	-0.107***	-0.008***	-0.039***	-0.000
	(0.003)	(0.001)	(0.003)	(0.000)
Growth in total	-0.150***	-0.018***	-0.088***	-0.000
hours	(0.004)	(0.003)	(0.005)	(0.000)
Growth in hours per	-0.092***	-0.015***	-0.070***	-0.000*
capita	(0.003)	(0.002)	(0.003)	(0.000)
N	257,324	257,324	257,324	257,324

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** The dependent variable is either employment growth, growth in total hours or growth in hours per capita, defined as the log-difference between 2009 and 2008. The explanatory endogenous variable is either ΔSTW, ΔH_{STW}, ΔS_{STW} or ΔL_{STW}. Δ is the difference operator. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. H_{STW} is the number of short-time work hours of the firm divided by its total number of hours worked in previous year. S_{STW} is the short-time work subsidy of the firm divided by its total labor cost in previous year. L_{STW} is number of workers placed under short-time work of the firm divided by its total number of workers in previous year. ap_{jt-1} is the authorization rate of the *département* j of firm i in year $t-1$. g_{it} is the leave-one-out revenue Haltiwanger growth rate of the industry $\times$ commuting zone cell of firm i. gl_{it-1} is the employment Haltiwanger growth rate of firm i. Covariates include: firm size in previous year (indicator variables for size: 1-10, 11-50, 51-250, 251-1000, >1000 employees); the past leverage of the firm, defined as total borrowings divided by total assets; a dummy variable equal to 1 if the firm is older than 5 years and to 0 otherwise. **Notes:** This table displays the α_1 coefficient of the OLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 5 – Short-time work take-up and death in 2008-2009 using ordinary least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Death	0.026***	0.003***	0.012***	0.000
	(0.002)	(0.000)	(0.002)	(0.000)
N	272,934	272,934	272,934	272,934
F	53.221	48.259	51.438	44.402
R^2	0.006	0.005	0.006	0.005

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** The dependent variable is death, equal to 1 if the firm is liquidated by 2010 and to 0 otherwise. The explanatory endogenous variable is either ΔSTW, ΔH_{STW}, ΔS_{STW} or ΔL_{STW}. Δ is the difference operator. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. H_{STW} is the number of short-time work hours of the firm divided by its total number of hours worked in previous year. S_{STW} is the short-time work subsidy of the firm divided by its total labor cost in previous year. L_{STW} is number of workers placed under short-time work of the firm divided by its total number of workers in previous year. ap_{jt-1} is the authorization rate of the *département* j of firm i in year $t-1$. g_{it} is the leave-one-out revenue Haltiwanger growth rate of the industry $\times$ commuting zone cell of firm i. gl_{it-1} is the employment Haltiwanger growth rate of firm i. Covariates include: firm size in previous year (indicator variables for size: 1-10, 11-50, 51-250, 251-1000, >1000 employees); the past leverage of the firm, defined as total borrowings divided by total assets; a dummy variable equal to 1 if the firm is older than 5 years and to 0 otherwise. **Notes:** This table displays the α_1 coefficient of the OLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 6 – First stage estimates in 2008-2009

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Δap_{jt-1}	0.008	0.093	0.012	0.340
	(0.015)	(0.109)	(0.029)	(1.138)
Δg_{it}	-0.036***	-0.200***	-0.056***	-2.351***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.005)	(0.031)	(0.009)	(0.383)
Δg_{it}	0.096***	0.642***	0.171***	6.919***
	(0.011)	(0.084)	(0.020)	(0.871)
g_{it}	-0.247***	-1.695***	-0.440***	-18.066***
	(0.029)	(0.226)	(0.054)	(2.250)
gl_{it-1}	-0.016***	-0.096***	-0.027***	-0.853***
	(0.002)	(0.017)	(0.005)	(0.149)
N	257,324	257,324	257,324	257,324
F	26.229	20.762	20.843	20.224
R^2	0.036	0.022	0.024	0.008

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** The dependent variable is either ΔSTW, ΔH_{STW}, ΔS_{STW} or ΔL_{STW}. Δ is the difference operator. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. H_{STW} is the number of short-time work hours of the firm divided by its total number of hours worked in previous year. S_{STW} is the short-time work subsidy of the firm divided by its total labor cost in previous year. L_{STW} is number of workers placed under short-time work of the firm divided by its total number of workers in previous year. ap_{jt-1} is the authorization rate of the *département* j of firm i in year $t-1$. g_{it} is the leave-one-out revenue Haltiwanger growth rate of the industry $\times$ commuting zone cell of firm i. gl_{it-1} is the employment Haltiwanger growth rate of firm i. Covariates include: firm size in previous year (indicator variables for size: 1-10, 11-50, 51-250, 251-1000, >1000 employees); the past leverage of the firm, defined as total borrowings divided by total assets; a dummy variable equal to 1 if the firm is older than 5 years and to 0 otherwise. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12). Each column displays the results of this regression for each dependent variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 7 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Employment growth	0.080	0.013	0.052	0.001
	(0.064)	(0.011)	(0.042)	(0.001)
Growth in total	-0.191***	-0.035***	-0.124***	-0.003***
hours	(0.061)	(0.011)	(0.038)	(0.001)
Growth in hours per	-0.277***	-0.050***	-0.178***	-0.004***
capita	(0.028)	(0.005)	(0.017)	(0.000)
N	257,324	257,324	257,324	257,324

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 8 – Short-time work take-up and death in 2008-2009 using two stage least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Death	0.005	0.003	0.004	0.000
	(0.080)	(0.014)	(0.052)	(0.001)
N	270,011	270,011	270,011	270,011

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 9 – Short-time work take-up, employment and hours of work in 2008-2011 using ordinary least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Employment growth	-0.123***	-0.010***	-0.050***	-0.000
	(0.005)	(0.002)	(0.004)	(0.000)
Growth in total	-0.143***	-0.010***	-0.058***	-0.000
hours	(0.006)	(0.003)	(0.005)	(0.000)
Growth in hours per	-0.018***	-0.001	-0.009***	-0.000
capita	(0.002)	(0.001)	(0.001)	(0.000)
N	215,760	215,760	215,760	215,760

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** The dependent variable is either employment growth, growth in total hours or growth in hours per capita, defined as the log-difference between 2011 and 2008. The explanatory endogenous variable is either ΔSTW, ΔH_{STW}, ΔS_{STW} or ΔL_{STW}. Δ is the difference operator. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. H_{STW} is the number of short-time work hours of the firm divided by its total number of hours worked in previous year. S_{STW} is the short-time work subsidy of the firm divided by its total labor cost in previous year. L_{STW} is number of workers placed under short-time work of the firm divided by its total number of workers in previous year. ap_{jt-1} is the authorization rate of the *département* j of firm i in year $t-1$. g_{it} is the leave-one-out revenue Haltiwanger growth rate of the industry $\times$ commuting zone cell of firm i. gl_{it-1} is the employment Haltiwanger growth rate of firm i. Covariates include: firm size in previous year (indicator variables for size: 1-10, 11-50, 51-250, 251-1000, >1000 employees); the past leverage of the firm, defined as total borrowings divided by total assets; a dummy variable equal to 1 if the firm is older than 5 years and to 0 otherwise. **Notes:** This table displays the α_1 coefficient of the OLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 10 – Short-time work take-up and death in 2008-2011 using ordinary least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Death	0.053***	0.005***	0.025***	0.000
	(0.004)	(0.001)	(0.002)	(0.000)
N	270,011	270,011	270,011	270,011
F	86.452	76.758	79.813	76.470
R^2	0.011	0.011	0.011	0.010

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** The dependent variable is death, equal to 1 if the firm is liquidated by 2012 and to 0 otherwise. The explanatory endogenous variable is either ΔSTW, ΔH_{STW}, ΔS_{STW} or ΔL_{STW}. Δ is the difference operator. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. H_{STW} is the number of short-time work hours of the firm divided by its total number of hours worked in previous year. S_{STW} is the short-time work subsidy of the firm divided by its total labor cost in previous year. L_{STW} is number of workers placed under short-time work of the firm divided by its total number of workers in previous year. ap_{jt-1} is the authorization rate of the *département* j of firm i in year $t-1$. g_{it} is the leave-one-out revenue Haltiwanger growth rate of the industry $\times$ commuting zone cell of firm i. gl_{it-1} is the employment Haltiwanger growth rate of firm i. Covariates include: firm size in previous year (indicator variables for size: 1-10, 11-50, 51-250, 251-1000, >1000 employees); the past leverage of the firm, defined as total borrowings divided by total assets; a dummy variable equal to 1 if the firm is older than 5 years and to 0 otherwise. **Notes:** This table displays the α_1 coefficient of the OLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 11 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Employment growth	0.314*	0.056*	0.212*	0.005*
	(0.169)	(0.032)	(0.120)	(0.003)
Growth in total	-0.023	-0.007	-0.014	-0.000
hours	(0.162)	(0.029)	(0.109)	(0.003)
Growth in hours per	-0.190***	-0.036***	-0.127***	-0.003***
capita	(0.030)	(0.006)	(0.021)	(0.000)
N	215,760	215,760	215,760	215,760

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 12 – Short-time work take-up and death in 2008-2011 using two stage least squares.

	ΔSTW	ΔH_{STW}	ΔS_{STW}	ΔL_{STW}
Death	0.050	0.014	0.035	0.001
	(0.143)	(0.024)	(0.092)	(0.002)
N	270,011	270,011	270,011	270,011

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12). Each column displays the results of this regression for each explanatory endogenous variable considered: ΔSTW, ΔH_{STW}, ΔS_{STW} and ΔL_{STW}. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 13 – Characteristics of firms in 2009 by quintile of predicted growth rate of hours of work

	Number of firms	Short-time work rate	Predicted hours' growth rate	
			$STW = 0$	$STW = 1$
Q_1	32362	.0539213	-.1233521	-.1226278
		(.0012555)	(.0002617)	(.0009336)
Q_2	26575	.0656632	-.0763497	-.0762959
		(.0015194)	(.0000405)	(.0001523)
Q_3	40589	.0430166	-.0557907	-.0566606
		(.0010071)	(.0000264)	(.0001253)
Q_4	58040	.0300655	-.0356493	-.0356684
		(.0007088)	(.0000335)	(.0001879)
Q_5	99758	.0176026	.0434239	.0267018
		(.0004164)	(.0037786)	(.0014615)

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. Predicted hours' growth rate of the firm is the hours' growth rate, defined as the log-difference in the hours between 2008 and 2007, as predicted by equation (11). Standard error of the mean in parentheses.

Table 14 – Characteristics of firms using short-time work in 2009 by quintile of predicted growth rate of hours of work

	Number of firms	Number of employees	Number of hours	Value added per employee	Short-time work subsidy
Q_1	1745	55.5788	106078.1	42.44463	55335.24
		(4.655511)	(8571.909)	(.6909723)	(4790.174)
Q_2	1745	45.80287	84533.27	48.23589	47879.84
		(1.845634)	(3363.518)	(.6084186)	(2171.073)
Q_3	1746	40.89233	74350.23	52.9308	46598.31
		(1.590337)	(2851.988)	(.7546771)	(2431.985)
Q_4	1745	36.41146	65077.45	52.23537	38394.8
		(1.416902)	(2530.21)	(.5795473)	(2066.981)
Q_5	1756	24.96982	41436.85	50.8624	22890.73
		(1.245398)	(2112.331)	(.6761735)	(1671.174)

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. Standard error of the mean in parentheses.

Table 15 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.423***	0.096	-0.060	-0.077	-0.032
	(0.160)	(0.068)	(0.117)	(0.107)	(0.160)
Growth in total	0.338**	-0.087	-0.057	-0.178	-0.349***
hours	(0.135)	(0.082)	(0.053)	(0.113)	(0.131)
Growth in hours per	-0.149***	-0.183***	-0.306***	-0.299***	-0.380***
capita	(0.042)	(0.040)	(0.043)	(0.034)	(0.065)
N	32,362	26,575	40,589	58,040	99,758

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 16 – Short-time work take-up and death in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.144	-0.044	-0.110	0.087*	0.061
	(0.098)	(0.097)	(0.111)	(0.045)	(0.118)
N	34,886	29,617	45,555	52,049	107,904

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 17 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.696***	0.025	0.194	0.183*	0.324
	(0.213)	(0.165)	(0.214)	(0.107)	(0.432)
Growth in total	0.665**	0.029	0.187	0.003	-0.192
hours	(0.260)	(0.154)	(0.259)	(0.131)	(0.375)
Growth in hours per	-0.045	-0.044	-0.213**	-0.105	-0.415***
capita	(0.094)	(0.057)	(0.088)	(0.078)	(0.078)
N	27,647	22,569	34,431	47,847	83,266

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 18 – Short-time work take-up and death in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.202	0.015	-0.152	-0.041	0.381*
	(0.150)	(0.110)	(0.179)	(0.128)	(0.215)
N	34,924	29,670	45,403	52,111	107,903

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table 19 – Profitability and financial situation over 2008-2011 of firms using short-time work in 2009 and belonging to the lowest quintile of the predicted revenue growth in 2009

Quintile	2008	2009	2010	2011
Return on assets	$-.024^{***}$ (.002)	$-.065^{***}$ (.003)	$-.037^{***}$ (.003)	$-.020^{***}$ (.002)
Return on equity	$-.033^{***}$ (.004)	$-.125^{***}$ (.006)	$-.061^{***}$ (.006)	$-.026^{***}$ (.005)
Interest coverage	-10.658^{***} (1.415)	-29.261^{***} (1.847)	-20.092^{***} (2.118)	-10.462^{***} (2.249)
Leverage	$.004^{*}$ (.002)	$.011^{***}$ (.002)	$.005^{***}$ (.002)	.001 (.002)
Nb of observations	153,594	153,594	153,594	153,594

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture.**Definitions:** Return on equity is equal to EBITDA/Total Equity Return on assets is equal to EBITDA/Total Assets Coverage is equal to EBTIDA/Interest expense. Leverage is equal to Total debt / Total Assets. **Notes:** The table reports the difference in the value of the corresponding index between firms using short-time work in 2009 and other firms, conditional on sector and firm age Standard errors clustered at the sector × *département* level are reported between parentheses: * p<0.10, ** p<0.05, *** p<0.01.

A Appendix

A.1 Model Solutions

A.1.1 Proof of Result 1:

Differentiation of equation (5) yields

$$h'(y_t) = \begin{cases} 1/\phi''(y_t) & \text{if } y_t > \phi'(h_{stw}) \\ 1/\phi''(y_t - \sigma) & \text{if } y_t < \phi'(h_{stw}) \end{cases}$$

and if $y_t = \phi'(h_{stw})$, the right derivative of $h(y_t)$ is equal to $1/\phi''(y_t)$, and the left derivative of $h(y_t)$ is equal to $1/\phi''(y_t - \sigma)$. Since function ϕ is convex, $h'(y_t) > 0$.

A.1.2 Proof of Result 2:

According to the definition of the optimal number of hours of work $h(y_t)$ provided by equation (5) and to Result 1, it is profitable to enroll workers in short-time work if $y_t = A_t z < \phi'(h_{stw})$. Therefore, in every period t, there exits a single value of z, denoted by $Z_t = \phi'(h_{stw})/A_t$, such that it is profitable to enroll workers in short-time work if $z < Z_t$ provided that they are employable.

A.1.3 Proof of Result 3:

From the definition (2) of the surplus and the definition of $Z_t = \phi'(h_{stw})/A_t$, we get:

$$S(A_t, Z_t) = \max[\phi'(h_{stw})h(A_t, \phi'(h_{stw})/A_t) - \phi(h(A_t, \phi'(h_{stw})/A_t)) + \sigma \max\left[h_{stw} - h(A_t, \phi'(h_{stw})/A_t), 0\right] - (1-\beta)U + \beta\mathbb{E}\left[S(A_{t+1}, \phi'(h_{stw})/A_t)|A_t\right], 0] \quad \text{(A1)}$$

Since the surplus increases with A_t, condition $S(A_t, Z_t) = 0$ defines a unique value of A_t – provided its existence – denoted by A_{stw}.

A.1.4 Proof of Result 4:

Equation (7) implies that the job specific reservation productivity R_t decreases with the short-time work subsidy. Differentiation of equation (7) yields:

$$\frac{\mathrm{d}R_t}{\mathrm{d}\sigma} = -\frac{\max\left[h_{stw} - h(A_t R_t), 0\right] + \beta\partial\mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]/\partial\sigma}{A_t h(A_t R_t) + \beta\partial\mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]/\partial R_t} < 0 \quad \text{(A2)}$$

The denominator is positive. The term $h_{stw} - h(A_t R_t)$ of the numerator is strictly positive for firms which use short-time work. The other term of the numerator, equal to $\beta\partial\mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]/\partial\sigma$, is positive because the expected value of the surplus increases with the short-time work subsidy. It is clear that this term is positive for all firms when there is a short-time work scheme, even for firms which do not enroll workers in short-time work during the current period.

A.1.5 Construction of Figure 4 and proofs of Results 5 and 6:

This appendix defines the shape of functions R_t, Z_t and $R_{0,t}$ in the (z, A_t) plane. These functions define frontiers of areas of values of (z, A_t) in which firms decide whether they keep or destroy jobs and whether they enroll workers in short-time work.

- Let us first define the shape of frontier Z_t in the (z, A_t) plane. From the definition of $Z_t = \phi'(h_{stw})/A_t$ which corresponds to the threshold value of the job specific productivity z below which short-time work use can be profitable, we know that short-time work is not used above this frontier and can be used below. Moreover this frontier is decreasing in the (z, A_t) plane.

- Let us define the shape of frontier R_t in the (z, A_t) plane. From the definition of R_t we know that jobs are destroyed if their job specific productivity z is below the frontier and continue if it is above. Differentiation of condition (7), which defines the value of R_t, implies that:

$$\frac{\mathrm{d}R_t}{\mathrm{d}A_t} = -\frac{R_t h(A_t R_t) + \beta \partial \mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]/\partial A_t}{A_t h(A_t R_t) + \beta \partial \mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]/\partial R_t} < 0$$

- Let us compare the slopes of R_t and Z_t. From the definition of $Z_t = \phi'(h_{stw})/A_t$ and equation (7), we get:

$$\frac{\mathrm{d}Z_t}{\mathrm{d}A_t} = -\frac{\phi'(h_{stw})}{A_t^2} = -\frac{Z_t}{A_t} \tag{A3}$$

$$\left.\frac{\mathrm{d}R_t}{\mathrm{d}A_t}\right|_{R_t=Z_t} = -\frac{h(A_t R_t)R_t + \beta \frac{\partial \mathbb{E}[S(A_{t+1},R_t)|A_t]}{\partial A_t}}{h(A_t R_t)A_t + \beta \frac{\partial \mathbb{E}[S(A_{t+1},R_t)|A_t]}{\partial R_t}} = -\frac{Z_t}{A_t}\left(\frac{1 + \frac{\beta}{h(A_t R_t)Z_t}\frac{\partial \mathbb{E}[S(A_{t+1},R_t)|A_t]}{\partial A_t}}{1 + \frac{\beta}{h(A_t R_t)A_t}\frac{\partial \mathbb{E}[S(A_{t+1},R_t)|A_t]}{\partial R_t}}\right) \tag{A4}$$

  Since z is a permanent component of $y_t = A_t z$ and A_t is a transitory component, we have

$$\left.\frac{\partial \mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]}{Z_t \partial R_t}\right|_{R_t=Z_t} > \left.\frac{\partial \mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]}{A_t \partial A_t}\right|_{R_t=Z_t} > 0$$

  Therefore, the ratio in parentheses in the right hand side of equation (A4) is smaller than one. This implies that the slope of R_t is smaller, in absolute value, than the slope of Z_t when $R_t = Z_t$. Since R_t and Z_t are continuous functions of A_t, this implies that R_t and Z_t cross only once on an intercept where the absolute value of the slope of R_t is smaller than that of Z_t, as displayed on Figure 4.

- The shape of $R_{0,t}$, the job specific reservation productivity without short-time work scheme, is deduced from equation (7), as for the shape of R_t. The only difference between $R_{0,t}$ and R_t arises from the positive value of σ for R_t, while $\sigma = 0$ for $R_{0,t}$. According to equation (A2), R_t drops with σ implying that R_t is lower than $R_{0,t}$. Remark that $R_t < R_{0,t}$ even for firms which do not use short-time work when a short-time work scheme exists, because equation (A2) shows that the presence of a short-time work scheme raises the expected value of future job surplus – i.e the term $\partial \mathbb{E}\left[S(A_{t+1}, R_t)|A_t\right]/\partial R_t$ at the numerator of (A2).

A.1.6 Proof of Result 7:

We compute the impact of the short-time work compensation σ on the total number of hours worked in the neighborhood of $\sigma = 0$. We consider a firm in period t with N_{t-1} employees inherited from period $t-1$ and mV_{t-1} matches arising for job vacancies posted in period $t-1$. We exhibit sufficient conditions under which raising σ increases the total number of hours of work in the firm in the current period. For the sake of clarity, we consider the case where $\beta \to 0$ to the extent that the presence of short-time work scheme in the future reduces the reservation productivity, and then increases employment and the total number of hours of work in the current period.

The firm keeps workers whose output per hour of work y is above the reservation level equal to $A_t R_t$ in the presence of a short-time work scheme ($\sigma > 0$) and to $A_t R_{0,t}$ in the absence of a short-time work scheme ($\sigma = 0$). Thus, in the absence of a short-time work scheme, the total number of hours of work in the firm in period t can be written as:

$$H_t = (N_{t-1} + mV_{t-1}) \int_{A_t R_{0,t}}^{\infty} h(y)\tilde{f}(y|\eta_t)\mathrm{d}y$$

where $\tilde{f}$ is the density of the current distribution of y in period t, the CDF of which is denoted by $\tilde{F}(y|\eta_t)$. $h(y)$ is defined by equation (5).

Now, let us analyze the effects of increases in the short-time work subsidy σ in the neighborhood of $\sigma = 0$ and let us assume that Z_t, the threshold value of job specific productivity below which it is profitable to use short-time work, is above the job specific reservation productivity R_t. In this case, among employed workers, those whose output per hour of work is below $A_t Z_t$ are enrolled in short-time work and those whose productivity is above $A_t Z_t$ are not. Therefore, the total number of hours of work in the firm in period t can be written as:

$$H_t = (N_{t-1} + mV_{t-1}) \left[\int_{A_t R_t}^{A_t Z_t} h(y) \tilde{f}(y|\eta_t) \mathrm{d}y + \int_{A_t Z_t}^{\infty} h(y) \tilde{f}(y|\eta_t) \mathrm{d}y \right]$$

From this definition and the fact that $\mathrm{d}h(y)/\mathrm{d}\sigma = 0$ if $y \geq A_t Z_t$, we get:

$$\frac{\mathrm{d}H_t}{\mathrm{d}\sigma} \frac{1}{(N_{t-1} + mV_{t-1})} = -\frac{\mathrm{d}R_t}{\mathrm{d}\sigma} A_t h(A_t R_t) \tilde{f}(A_t R_t|\eta_t) + \int_{A_t R_t}^{A_t Z_t} \frac{\mathrm{d}h(y)}{\mathrm{d}\sigma} \tilde{f}(y|\eta_t) \mathrm{d}y$$

From equation (5), we get $\mathrm{d}h(y)/\mathrm{d}\sigma = -\mathrm{d}h(y)/\mathrm{d}y$, and from equation (7) we have:

$$\frac{\mathrm{d}R_t}{\mathrm{d}\sigma} = -\frac{\max\left[h_{stw} - h(A_t R_t), 0\right]}{A_t h(A_t R_t)} \text{ when } h(y) \leq h_{stw}$$

This implies that:

$$\frac{\mathrm{d}H_t}{\mathrm{d}\sigma} \frac{1}{(N_{t-1} + mV_{t-1})} = \left[h_{stw} - h(A_t R_t)\right] \tilde{f}(A_t R_t|\eta_t) - \int_{A_t R_t}^{A_t Z_t} \frac{\mathrm{d}h(y)}{\mathrm{d}y} \tilde{f}(y|\eta_t) \mathrm{d}y$$

Integration by parts of the integral yields:

$$\int_{A_t R_t}^{A_t Z_t} \frac{\mathrm{d}h(y)}{\mathrm{d}y} \tilde{f}(y|\eta_t) \mathrm{d}y = h_{stw} \tilde{f}(A_t Z_t|\eta_t) - h(A_t R_t) \tilde{f}(A_t R_t|\eta_t) - \int_{A_t R_t}^{A_t Z_t} h(y) \tilde{f}'(y|\eta_t) \mathrm{d}y$$

Therefore, substitution of this expression of the integral in the previous equation yields, in the neighborhood of $R_t = R_{0,t}$:

$$\frac{\mathrm{d}H_t}{\mathrm{d}\sigma} \frac{1}{(N_{t-1} + mV_{t-1})} = -\int_{A_t R_{0,t}}^{A_t Z_t} \left[h_{stw} - h(y)\right] \tilde{f}'(y|\eta_t) \mathrm{d}y$$

This term is positive if $\tilde{f}'(y|\eta_t)$ is negative for values of $y \in [A_t R_{0,t}, A_t Z_t]$.

A.2 Robustness

This appendix presents two robustness checks. First, it shows that the heterogeneous effects of short-time work hold consistently when the population of firms using short-time work is stratified by tercile instead of quintile of the drop in the predicted number of hours of work in 2009. Second, it reports the results for firms located outside the three *départements* with very low approval rate of short-time work applications.

A.2.1 Stratification by tercile

In order to assess how robust the heterogeneous effects of short-time work are, Tables B17 to B38 report descriptive statistics on terciles of firms and the results when the distribution of firms is stratified in terciles rather than in quintiles. These tables show that short-time work has a positive impact on employment and hours of work in the bottom tercile only. There are no employment effects in the other terciles and total hours of work drop in firms of the top tercile which use short-time work. These results are totally consistent with those obtained when firms are stratified in quintiles.

A comparison of the IV estimates of the impact of short-time work on employment growth in Tables B20 and 15 indicates that the coefficient is significantly larger in the bottom quintile than in the bottom tercile. This confirms that short-time work saves more jobs in firms hit by larger negative shocks since the average predicted drop in hours of work is larger in the bottom quintile than in the bottom tercile as shown by Tables 13 and B17.

Table B20 reports a point estimate of the effect of short-time work use (variable ΔSTW) on employment equal to 0.37 in the bottom tercile. Accounting for the number of employees in firms in the bottom tercile – see Table B18 – this point estimate corresponds to an increase of 15% in the total number of jobs in firms that used short-time work. This is consistent with the result obtained when firms were stratified in quintiles, equal to 11%, with a 95% confidence interval equal to $[2\%, 19\%]$.

A.2.2 Regressions without the *départements* with low approval rate in 2009

To check that our results about the heterogeneous impact of short-time work are not driven by *départements* with particularly low short-time work approval rate, we run our regressions excluding the three *départements* with approval rate below 90% in 2009 (see Figure 9). These *départements* are Hautes-Alpes (05), Paris (75) and Hauts-de-Seine (92). Since the dispersion in approval rate is reduced, instruments become weaker. Accordingly, we proceed to these robustness checks with a stratification of firms in two groups, below and above the median of the (leave-one-out) predicted growth rate of hours of work in 2009. Tables B39 to B42 show that the results are consistent with those obtained when these *départements* are included.

B Supplementary Tables

Table B1 – First stage estimates in 2008-2009 by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3	Q_4	Q_5
Δap_{jt-1}	0.005	0.013	0.017	0.004	0.005
	(0.023)	(0.027)	(0.021)	(0.017)	(0.008)
Δg_{it}	-0.043***	-0.059***	-0.041***	-0.036***	-0.023***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.009)	(0.010)	(0.006)	(0.006)	(0.003)
Δg_{it}	0.117***	0.164***	0.109***	0.092***	0.049***
	(0.016)	(0.023)	(0.012)	(0.009)	(0.007)
g_{it}	-0.228***	-0.333***	-0.294***	-0.272***	-0.123***
	(0.028)	(0.046)	(0.030)	(0.030)	(0.020)
gl_{it-1}	0.041***	0.063***	0.017	-0.019	-0.007***
	(0.008)	(0.021)	(0.018)	(0.014)	(0.002)
N	32,362	26,575	40,589	58,040	99,758
F	12.867	15.035	23.130	.	17.190
R^2	0.039	0.064	0.046	0.034	0.012

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔSTW. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B2 – First stage estimates in 2008-2009 by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Δap_{jt-1}	0.033	0.261	0.156	-0.021	0.103
	(0.171)	(0.236)	(0.158)	(0.104)	(0.065)
Δg_{it}	-0.323***	-0.312***	-0.238***	-0.182***	-0.113***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.054)	(0.070)	(0.033)	(0.038)	(0.014)
Δg_{it}	0.880***	1.094***	0.730***	0.534***	0.341***
	(0.120)	(0.188)	(0.095)	(0.065)	(0.080)
g_{it}	-1.729***	-2.404***	-1.944***	-1.641***	-0.810***
	(0.245)	(0.410)	(0.265)	(0.225)	(0.137)
gl_{it-1}	0.336***	0.759***	0.093	-0.210*	-0.025
	(0.060)	(0.174)	(0.135)	(0.110)	(0.022)
N	32,362	26,575	40,589	58,040	99,758
F	11.312	13.464	13.997	.	15.763
R^2	0.029	0.048	0.031	0.020	0.005

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔH_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B3 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.057***	0.015	-0.013	-0.014	-0.007
	(0.020)	(0.012)	(0.020)	(0.022)	(0.028)
Growth in total	0.046**	-0.016	-0.011	-0.037	-0.072***
hours	(0.019)	(0.016)	(0.009)	(0.024)	(0.026)
Growth in hours per	-0.020***	-0.033***	-0.053***	-0.058***	-0.082***
capita	(0.006)	(0.009)	(0.007)	(0.009)	(0.012)
N	32,362	26,575	40,589	58,040	99,758

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B4 – Short-time work take-up and death in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.019	-0.005	-0.016	0.016*	0.021
	(0.014)	(0.017)	(0.017)	(0.009)	(0.021)
N	34,886	29,617	45,555	52,049	107,904

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B5 – First stage estimates in 2008-2009 by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Δap_{jt-1}	-0.007	0.040	0.039	-0.017	0.016
	(0.046)	(0.063)	(0.041)	(0.028)	(0.017)
Δg_{it}	-0.095***	-0.086***	-0.066***	-0.050***	-0.031***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.016)	(0.021)	(0.010)	(0.011)	(0.004)
Δg_{it}	0.259***	0.296***	0.201***	0.144***	0.076***
	(0.033)	(0.046)	(0.024)	(0.017)	(0.011)
g_{it}	-0.473***	-0.607***	-0.497***	-0.415***	-0.199***
	(0.059)	(0.094)	(0.061)	(0.057)	(0.031)
gl_{it-1}	0.087***	0.215***	0.058	-0.040	-0.003
	(0.015)	(0.049)	(0.040)	(0.031)	(0.006)
N	32,362	26,575	40,589	58,040	99,758
F	14.709	12.565	13.794	.	17.219
R^2	0.034	0.045	0.027	0.019	0.007

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔS_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B6 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.200***	0.062	-0.043	-0.047	-0.026
	(0.069)	(0.047)	(0.072)	(0.082)	(0.113)
Growth in total	0.159**	-0.060	-0.040	-0.137*	-0.265***
hours	(0.065)	(0.060)	(0.032)	(0.083)	(0.096)
Growth in hours per	-0.065***	-0.125***	-0.191***	-0.206***	-0.295***
capita	(0.022)	(0.035)	(0.027)	(0.031)	(0.045)
N	32,362	26,575	40,589	58,040	99,758

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B7 – Short-time work take-up and death in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.057	-0.023	-0.061	0.054	0.064
	(0.050)	(0.066)	(0.062)	(0.038)	(0.084)
N	34,886	29,617	45,555	52,049	107,904

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B8 – First stage estimates in 2008-2009 by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Δap_{jt-1}	0.348	1.238	1.843	-1.276	0.362
	(1.489)	(2.033)	(1.454)	(2.179)	(0.601)
Δg_{it}	-3.095***	-3.310***	-2.675***	-2.315***	-1.578***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.602)	(0.797)	(0.344)	(0.539)	(0.215)
Δg_{it}	8.051***	10.745***	7.870***	7.662***	3.403***
	(1.030)	(1.647)	(0.895)	(1.735)	(0.470)
g_{it}	-15.822***	-24.172***	-20.625***	-22.847***	-8.794***
	(1.975)	(3.751)	(2.196)	(5.190)	(1.441)
gl_{it-1}	3.052***	5.310***	1.815	-2.707**	-0.367**
	(0.655)	(1.754)	(1.546)	(1.083)	(0.166)
N	32,362	26,575	40,589	58,040	99,758
F	12.978	14.662	20.295	.	15.064
R^2	0.023	0.035	0.033	0.003	0.005

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔL_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B9 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.006***	0.002	-0.001	-0.001	-0.000
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Growth in total	0.005**	-0.002	-0.001	-0.003*	-0.005***
hours	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Growth in hours per	-0.002***	-0.003***	-0.005***	-0.004***	-0.006***
capita	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	32,362	26,575	40,589	58,040	99,758

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B10 – Short-time work take-up and death in 2008-2009 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.002	-0.001	-0.002	0.001	0.001
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)
N	34,886	29,617	45,555	52,049	107,904

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B11 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.328***	0.016	0.093	0.140	0.250
	(0.103)	(0.117)	(0.121)	(0.095)	(0.338)
Growth in total	0.323***	0.020	0.087	0.011	-0.153
hours	(0.122)	(0.110)	(0.148)	(0.102)	(0.287)
Growth in hours per	-0.010	-0.033	-0.136**	-0.080	-0.324***
capita	(0.045)	(0.039)	(0.057)	(0.060)	(0.069)
N	27,647	22,569	34,431	47,847	83,266

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B12 – Short-time work take-up and death in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.026	0.013	-0.021	-0.009	0.096**
	(0.022)	(0.017)	(0.028)	(0.026)	(0.039)
N	34,924	29,670	45,403	52,111	107,903

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B13 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.328***	0.016	0.093	0.140	0.250
	(0.103)	(0.117)	(0.121)	(0.095)	(0.338)
Growth in total	0.323***	0.020	0.087	0.011	-0.153
hours	(0.122)	(0.110)	(0.148)	(0.102)	(0.287)
Growth in hours per	-0.010	-0.033	-0.136**	-0.080	-0.324***
capita	(0.045)	(0.039)	(0.057)	(0.060)	(0.069)
N	27,647	22,569	34,431	47,847	83,266

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B14 – Short-time work take-up and death in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.073	0.037	-0.085	-0.042	0.329**
	(0.078)	(0.066)	(0.101)	(0.097)	(0.152)
N	34,924	29,670	45,403	52,111	107,903

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B15 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Employment growth	0.009***	0.000	0.002	0.002	0.005
	(0.003)	(0.003)	(0.003)	(0.002)	(0.007)
Growth in total	0.009**	0.000	0.002	0.000	-0.003
hours	(0.004)	(0.003)	(0.004)	(0.002)	(0.006)
Growth in hours per	-0.000	-0.001	-0.003**	-0.001	-0.007***
capita	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
N	27,647	22,569	34,431	47,847	83,266

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B16 – Short-time work take-up and death in 2008-2011 using two stage least squares, by quintile of predicted growth rate of hours of work and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3	Q_4	Q_5
Death	0.003	0.001	-0.002	-0.001	0.006*
	(0.002)	(0.002)	(0.003)	(0.002)	(0.003)
N	34,924	29,670	45,403	52,111	107,903

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} quintile of predicted growth rate of hours of work, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by quintile of predicted growth rate of hours of work and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each quintile considered: Q_1, Q_2, Q_3, Q_4 and Q_5. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B17 – Characteristics of firms in 2009 by tercile of the revenue shock.

	Number of firms	Short-time work rate	Predicted hours' growth rate	
			$STW = 0$	$STW = 1$
Q_1	50067	.0580422	-.108127	-.1055574
		(.001045)	(.0001952)	(.0006839)
Q_2	69105	.0420519	-.0541408	-.056717
		(.0007635)	(.0000338)	(.0001655)
Q_3	138152	.0211723	.0227567	.0033956
		(.0003873)	(.0027342)	(.0010244)

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. STW is equal to 1 if the firm uses short-time work for economic reasons in 2009 and to 0 otherwise. Predicted growth rate of hours of the firm is the growth rate of hours, defined as the log-difference in the hours between 2008 and 2007, as predicted by equation (11).

Table B18 – Characteristics of firms using short-time work in 2009 by tercile of the revenue shock.

	Number of firms	Number of employees	Number of hours	Value added per employee	Short-time work subsidy
Q_1	2906	52.58741	99131.78	44.44527	52740.96
		(2.96202)	(5449.087)	(.4985987)	(3060.597)
Q_2	2906	41.05747	74717.97	52.12383	45920.03
		(1.231618)	(2204.638)	(.5465254)	(1890.31)
Q_3	2925	28.56821	49076.28	51.44957	28019.55
		(.9735935)	(1699.423)	(.5010218)	(1310.173)

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance.

Table B19 – First stage estimates in 2008-2009 by tercile of the revenue shock and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3
Δap_{jt-1}	0.012	0.010	0.005
	(0.024)	(0.019)	(0.011)
Δg_{it}	-0.049***	-0.041***	-0.027***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.009)	(0.006)	(0.004)
Δg_{it}	0.134***	0.111***	0.063***
	(0.019)	(0.012)	(0.007)
g_{it}	-0.267***	-0.309***	-0.162***
	(0.033)	(0.032)	(0.022)
gl_{it-1}	0.051***	-0.007	-0.010***
	(0.009)	(0.013)	(0.002)
N	50,067	69,105	138,152
F	14.980	28.365	22.585
R^2	0.050	0.048	0.018

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory variable ΔSTW. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B20 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3
Employment growth	0.370**	-0.049	-0.042
	(0.154)	(0.119)	(0.116)
Growth in total	0.257**	-0.089	-0.386***
hours	(0.109)	(0.064)	(0.116)
Growth in hours per	-0.151***	-0.314***	-0.338***
capita	(0.025)	(0.038)	(0.045)
N	50,067	69,105	138,152

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B21 – Short-time work take-up and death in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3
Death	0.060	-0.061	0.068
	(0.080)	(0.087)	(0.089)
N	54,143	73,088	142,780

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B22 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3
Employment growth	0.436***	0.243*	0.267
	(0.142)	(0.138)	(0.304)
Growth in total	0.477**	0.191	-0.244
hours	(0.186)	(0.128)	(0.259)
Growth in hours per	-0.036	-0.146***	-0.315***
capita	(0.064)	(0.038)	(0.068)
N	42,333	58,512	114,915

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each tercile Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B23 – Short-time work take-up and death in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔSTW.

	Q_1	Q_2	Q_3
Death	0.150	-0.162	0.240
	(0.108)	(0.144)	(0.178)
N	54,110	73,077	142,824

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B24 – First stage estimates in 2008-2009 by tercile of the revenue shock and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3
Δap_{jt-1}	0.097	0.148	0.067
	(0.188)	(0.143)	(0.073)
Δg_{it}	-0.321***	-0.233***	-0.130***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.058)	(0.036)	(0.019)
Δg_{it}	0.973***	0.725***	0.403***
	(0.143)	(0.093)	(0.066)
g_{it}	-2.024***	-2.076***	-1.002***
	(0.291)	(0.260)	(0.154)
gl_{it-1}	0.389***	-0.094	-0.048**
	(0.066)	(0.107)	(0.020)
N	50,067	69,105	138,152
F	14.695	15.750	17.192
R^2	0.037	0.031	0.008

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory variable ΔH_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B25 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3
Employment growth	0.056**	-0.012	-0.009
	(0.023)	(0.019)	(0.023)
Growth in total	0.039**	-0.016	-0.081***
hours	(0.017)	(0.012)	(0.026)
Growth in hours per	-0.023***	-0.055***	-0.073***
capita	(0.004)	(0.008)	(0.010)
N	50,067	69,105	138,152

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B26 – Short-time work take-up and death in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3
Death	0.010	-0.008	0.018
	(0.012)	(0.015)	(0.017)
N	54,143	73,088	142,780

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B27 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3
Employment growth	0.069***	0.034	0.057
	(0.023)	(0.023)	(0.065)
Growth in total	0.076***	0.027	-0.054
hours	(0.029)	(0.023)	(0.054)
Growth in hours per	-0.007	-0.028***	-0.067***
capita	(0.010)	(0.007)	(0.017)
N	42,333	58,512	114,915

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B28 – Short-time work take-up and death in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2	Q_3
Death	0.024	-0.024	0.058*
	(0.017)	(0.024)	(0.034)
N	54,110	73,077	142,824

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B29 – First stage estimates in 2008-2009 by tercile of the revenue shock and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3
Δap_{jt-1}	0.004	0.032	0.007
	(0.051)	(0.038)	(0.020)
Δg_{it}	-0.092***	-0.065***	-0.036***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.017)	(0.010)	(0.006)
Δg_{it}	0.277***	0.197***	0.098***
	(0.037)	(0.023)	(0.012)
g_{it}	-0.538***	-0.527***	-0.252***
	(0.067)	(0.062)	(0.037)
gl_{it-1}	0.099***	0.004	-0.011**
	(0.016)	(0.031)	(0.005)
N	50,067	69,105	138,152
F	17.013	16.184	18.572
R^2	0.039	0.029	0.010

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory variable ΔS_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B30 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3
Employment growth	0.206**	-0.039	-0.032
	(0.083)	(0.073)	(0.088)
Growth in total	0.143**	-0.058	-0.293***
hours	(0.060)	(0.042)	(0.093)
Growth in hours per	-0.078***	-0.199***	-0.257***
capita	(0.013)	(0.025)	(0.035)
N	50,067	69,105	138,152

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B31 – Short-time work take-up and death in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3
Death	0.026	-0.033	0.058
	(0.045)	(0.054)	(0.067)
N	54,143	73,088	142,780

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B32 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3
Employment growth	0.256***	0.136	0.204
	(0.081)	(0.088)	(0.242)
Growth in total	0.284***	0.106	-0.185
hours	(0.106)	(0.083)	(0.204)
Growth in hours per	-0.015	-0.100***	-0.240***
capita	(0.038)	(0.025)	(0.055)
N	42,333	58,512	114,915

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B33 – Short-time work take-up and death in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2	Q_3
Death	0.064	-0.093	0.196
	(0.064)	(0.089)	(0.134)
N	54,110	73,077	142,824

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B34 – First stage estimates in 2008-2009 by tercile of the revenue shock and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3
Δap_{jt-1}	0.863	1.300	-0.302
	(1.525)	(1.396)	(1.116)
Δg_{it}	-3.203***	-2.601***	-1.833***
$\times ap_{jt-1} + g_{it} \times \Delta ap_{jt-1}$	(0.611)	(0.399)	(0.317)
Δg_{it}	8.921***	7.950***	5.067***
	(1.189)	(0.881)	(1.035)
g_{it}	-18.855***	-21.890***	-13.215***
	(2.428)	(2.309)	(2.851)
gl_{it-1}	3.809***	-0.528	-0.692***
	(0.685)	(1.052)	(0.189)
N	50,067	69,105	138,152
F	13.525	23.361	17.778
R^2	0.026	0.036	0.002

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 6. **Notes:** This table displays the first stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory variable ΔL_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B35 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3
Employment growth	0.006**	-0.001	-0.001
	(0.002)	(0.002)	(0.002)
Growth in total	0.004**	-0.001	-0.006***
hours	(0.002)	(0.001)	(0.002)
Growth in hours per	-0.002***	-0.005***	-0.005***
capita	(0.000)	(0.001)	(0.001)
N	50,067	69,105	138,152

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B36 – Short-time work take-up and death in 2008-2009 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3
Death	0.001	-0.001	0.001
	(0.001)	(0.001)	(0.001)
N	54,143	73,088	142,780

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 5. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B37 – Short-time work take-up, employment and hours of work in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3
Employment growth	0.007***	0.003	0.004
	(0.002)	(0.002)	(0.005)
Growth in total	0.007**	0.003	-0.003
hours	(0.003)	(0.002)	(0.004)
Growth in hours per	-0.001	-0.002***	-0.004***
capita	(0.001)	(0.001)	(0.001)
N	42,333	58,512	114,915

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 9. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B38 – Short-time work take-up and death in 2008-2011 using two stage least squares, by tercile of the revenue shock and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2	Q_3
Death	0.002	-0.002	0.003
	(0.002)	(0.002)	(0.003)
N	54,110	73,077	142,824

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_x is the x^{th} tercile of the revenue shock, by ascending order of importance. See Table 10. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by tercile of the revenue shock and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each tercile considered: Q_1, Q_2 and Q_3. Δgl_{it-1} is winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B39 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, excluding the *départements* whose authorization rate is below 90% in 2009, by 2-quantile of the revenue shock and considering as explanatory variable ΔSTW.

	Q_1	Q_2
Employment growth	0.437***	-0.020
	(0.162)	(0.175)
Growth in total	0.168	-0.438***
hours	(0.183)	(0.156)
Growth in hours per	-0.103	-0.224***
capita	(0.075)	(0.050)
N	69,014	159,786

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_1 (respectively Q_2) is the group of firms below (above) the median in terms of the revenue shock. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by 2-quantile of the revenue shock and considering as explanatory endogenous variable ΔSTW. Each column displays the results of this regression for each group considered: Q_1 and Q_2. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. The *départements* whose authorization rate is below 90% in 2009 are excluded: 05, 75, 92. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B40 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, excluding the *départements* whose authorization rate is below 90% in 2009, by 2-quantile of the revenue shock and considering as explanatory variable ΔH_{STW}.

	Q_1	Q_2
Employment growth	0.069*	-0.008
	(0.036)	(0.036)
Growth in total	0.016	-0.093**
hours	(0.038)	(0.037)
Growth in hours per	-0.024*	-0.051***
capita	(0.013)	(0.011)
N	69,014	159,786

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_1 (respectively Q_2) is the group of firms below (above) the median in terms of the revenue shock. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by 2-quantile of the revenue shock and considering as explanatory endogenous variable ΔH_{STW}. Each column displays the results of this regression for each group considered: Q_1 and Q_2. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. The *départements* whose authorization rate is below 90% in 2009 are excluded: 05, 75, 92. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B41 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, excluding the *départements* whose authorization rate is below 90% in 2009, by 2-quantile of the revenue shock and considering as explanatory variable ΔS_{STW}.

	Q_1	Q_2
Employment growth	0.260**	-0.015
	(0.111)	(0.120)
Growth in total	0.100	-0.303***
hours	(0.121)	(0.108)
Growth in hours per	-0.062	-0.156***
capita	(0.042)	(0.035)
N	69,014	159,786

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_1 (respectively Q_2) is the group of firms below (above) the median in terms of the revenue shock. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by 2-quantile of the revenue shock and considering as explanatory endogenous variable ΔS_{STW}. Each column displays the results of this regression for each group considered: Q_1 and Q_2. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. The *départements* whose authorization rate is below 90% in 2009 are excluded: 05, 75, 92. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.

Table B42 – Short-time work take-up, employment and hours of work in 2008-2009 using two stage least squares, excluding the *départements* whose authorization rate is below 90% in 2009, by 2-quantile of the revenue shock and considering as explanatory variable ΔL_{STW}.

	Q_1	Q_2
Employment growth	0.007**	0.000
	(0.003)	(0.003)
Growth in total	0.003	-0.006***
hours	(0.003)	(0.002)
Growth in hours per	-0.002	-0.003***
capita	(0.001)	(0.001)
N	69,014	159,786

Sources: *DADS*, *FICUS* and *FARE* (*INSEE*) and *Sinapse* (*DGEFP*). **Scope:** Mainland France excluding Corsica. Market sectors excluding agriculture. Single-establishment firms with employment in 2008 greater than 4. Firms not using short-time work at all in 2009 or using it in 2009 for economic reasons only. **Definitions:** Q_1 (respectively Q_2) is the group of firms below (above) the median in terms of the revenue shock. See Table 4. **Notes:** This table displays the α_1 coefficient of the second stage of the 2 SLS estimation of equations (11) and (12) by 2-quantile of the revenue shock and considering as explanatory endogenous variable ΔL_{STW}. Each column displays the results of this regression for each group considered: Q_1 and Q_2. Each line displays the results of this regression for each dependent variable considered: employment growth, growth in total hours and growth in hours per capita. The *départements* whose authorization rate is below 90% in 2009 are excluded: 05, 75, 92. Δgl_{it-1}, Δgh_{it-1} and $\Delta ghtete_{it-1}$ are winsorized at the 0.01 level. Robust standard errors are clustered at the *département* level. p-values: * p<0.1, ** p<0.05, *** p<0.01.