# Payroll tax reductions and job flows in France

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[2013-34]

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*First draft: January, 31th 2011*
*This draft: February, 1st 2013*

## Abstract

In France, policies that aim at reducing labour cost have extended to more and more workers since the beginning of the 90s. Evaluations of the effect of payroll tax reduction often use estimations of labour demand equations. In this paper, we consider the impact of labour tax cuts on job creations and destructions through the Fillon reform (2003), by using a fixed effect instrumental variable approach and a sectoral pseudo panel dataset. Over 2002-2005, our estimates show that PTR let job flows unchanged.

## 1. Introduction

To reduce unemployment, payroll tax reductions on low wages have been implemented in many European continental countries since the beginning of the 90s. In France, economic policies have extended to more and more workers from the mandatory minimum wage within a fast-growing budget (2.9 billion € in 1992 to 29.9 billion € in 2009). Behind such policies is the view that lower labour costs increase employment. Nevertheless, on the one hand, the empirical effects on employment of payroll tax reduction are not clear. As reported in Blau and Kahn (1999) studies find small impacts on employment. Even for the literature which deals with estimating elasticities the results are rather mixed (Hamermesh, 1993; Layard *et al.*, 1991). On the other hand, when focusing on low skilled workers, results are clearer. As Neumark and Washer (2007) notice, the evidence for "disemployment" effects is strong for these workers. The employment effect of a reform that reduces the labour cost depends on several factors. If we focus on payroll tax reductions (hereafter PTR) paid by the employers, we can isolate three factors that strongly influence the efficiency of such a policy: the structure of the PTR, the elasticity of labour demand and labour supply to labour cost and the effect of PTR on wages. First, with regard to the question of the structure of PTR, the type of employees who benefit from PTR is essential; that is why we need to differentiate low skilled workers from high skilled workers. Second, the amount of PTR is important according to the elasticity of labour demand to labour costs. Third, since wages and employment are jointly determined, the duration of PTR is crucial.

Most papers focus on the net employment effect of labour costs. In our paper, we analyse the effect of Payroll Tax Reductions on job flows (hereafter JF), *i.e.* on job creation (hereafter JC) and job destruction (hereafter JD) and more generally on job reallocation (hereafter JR). Our idea is to test whether PTR increases JC or decreases JD through the

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implementation of the Fillon law (2003) in France. Indeed, some papers about job flows stipulate that job adjustment would be done through job creation in European countries whereas job adjustment would be done through job destruction in the United-States, where the labour market is supposed to be less regulated. We use concepts from the literature on gross job flows (Davis and Haltiwanger's definitions, 1990, 1992, 1999a and b) to estimate the employment effect of PTR. For this study, we merge three French administrative sources over 2002-2005 available at *Insee* (the French national statistical agency) and *Acoss-Urssaf* (the French Central Agency of Social Security Organisations). These *Insee* data enable us to run the analysis by distinguishing unskilled blue and white collar workers (hereafter the low skilled workers), skilled blue and white collar workers (hereafter the medium skilled workers) and managers, engineers, *etc.* (hereafter high skilled workers). The *Acoss-Urssaf* data allow us to get the amounts of PTR received by French establishments.

To evaluate the effect of PTR, we estimate job flows equations along with the empirical literature that deals with JC and JD determinants (Salvanes, 1997; Stiglbauer *et al.*, 2003; Gomez-Salvador *et al.*, 2004; OECD, 2009). Since we have establishment data, our first idea was to test the relationship between PTR and job flows at the individual level. However, attempting to estimate the effect of PTR on job flows implies dealing with several kinds of endogeneity or selection problems. First, for an establishment, benefiting from an amount of PTR is not exogenous because it depends on wage and employment structures, as well as the fact that wages and employment are jointly determined. Second, net creation and destruction are not observed at the same time for a given establishment. Third, not all establishments employ all types of skills of workers: for instance, an establishment with no low skilled workers has a zero probability to destroy low skilled jobs. Fourth, over 2002-2005, many firms were created and other died; to cope with these problems, we decide to use a pseudo panel data approach (Deaton, 1985 and Verbeek, 2007). We group establishment data at the 4-Digit sectoral level to be able to perform linear regressions by keeping all establishments. We build three different aggregated files: a first panel contains a balanced panel of establishments with 10 employees or more; a second panel contains an unbalanced panel of establishments with the same sectors as in the first panel; a third panel contains an unbalanced panel of establishments with all sectors. To solve the underlined problems while evaluating the impact of PTR, we then apply fixed effect (hereafter FE) regression techniques on pseudo panel data that are identical to instrumental variable (hereafter IV) estimations on individual data, where the level of aggregation is used as an instrument (Moffitt, 1993). To take account for the fact that sectors of activity are different in size, we consider FE regressions weighting each cell with the square root of the cohort size (*i.e.* the number of workers) in each cell (Deaton, 1985; Dargay, 2007). As a robustness test, and to avoid the weak instrument caveat, we also apply an IV-within estimator. We perform these regressions for overall employment, as well as for the three kinds of workers. We find no impact of PTR on job flows, whatever the skill we consider.

The paper proceeds as follows. Section 2 briefly describes the payroll tax reductions in France. Section 3 surveys literature on micro empirical evidence and motivates for a new analysis. Section 4 presents the data. In Section 5, we displays Job Flows indicators and descriptive statistics dealing with those indicators, as well as with PTR over 2002-2005. Section 6 discusses the estimation strategy. The results and discussion stand in Section 7. Section 8 concludes.

## 2. Payroll taxes in France: the Fillon law

After several reforms since 1992, payroll tax reduction programs were harmonised in 2003 (The "Fillon reform"). In particular this last reform aimed at standardizing the different measures that had existed since the decrease in the standard working time duration from 39 down to 35 hours, in 2000. The "Fillon reform" simultaneously affected several components of labour costs. The minimum wage was raised in an exceptional way, the amount and structure of the payroll tax underwent large-scale change, and the laws governing overtime quota were profoundly modified.

First, the period 2003-2005 saw the harmonisation of six coexisting minimum wages: the five monthly wage guarantees (GMR – *garanties mensuelles de rémunération*) with the level of the 39 hour-minimum wage. The French minimum wage (called *Smic*) was introduced in 1970; it includes the basic wage, fringe benefits, and all other payments having the *de facto* character of a premium. Until 2009, the level of the hourly minimum wage was revised every year on July 1st according to inflation, half of any increase in hourly blue collar wage levels and possible government extra boosts (from 2010, it is revised the first of January). When the 35-hour work week was introduced in January 2000, one of the principles enshrined in the legislation was a guarantee of the purchasing power of employees earning the minimum wage and benefiting from the working time reduction (WTR). The payment of these employees was determined on the basis of their monthly wage before WTR. So the GMRs correspond to the hourly minimum wage at the time of adoption of the 35-hour work week multiplied by 169 hours. Employees working a 35-hour work week therefore automatically earned a higher hourly wage than the hourly minimum wage for the 39-hour work week.

**Table 1.** Levels and evolutions of the GMRs and hourly minimum wage rates through the implementation of law Fillon (2003-2005).

| | Juil-01 | Juil-02 | Juil-03 | Juil-04 | Juil-05 |
|---|---|---|---|---|---|
| CPI growth rate | | 1.63% | 1.89% | 2.32% | 1.72% |
| Hourly minimum wage (*Smic*) | 6.67 | 6.83 | 7.19 | 7.61 | 8.03 |
| *Smic* growth rate : | | 2.40% | 5.27% | 5.84% | 5.52% |
| GMR1 | 1 081.21 | 1 100.67 | 1 136.15 | 1 178.54 | 1 217.88 |
| (*WTR before July 1999*) | | 1.80% | 3.22% | 3.73% | 3.34% |
| GMR2 | 1 094.65 | 1 114.35 | 1 145.54 | 1 183.40 | 1 217.88 |
| (*WTR after June 1999 and before January 2000*) | | 1.80% | 2.80% | 3.30% | 2.91% |
| GMR3 | 1 113.45 | 1 133.49 | 1 158.62 | 1 190.14 | 1 217.88 |
| (*WTR after December 1999 and before July 2001*) | | 1.80% | 2.22% | 2.72% | 2.33% |
| GMR4 | 1 127.23 | 1 147.52 | 1 168.16 | 1 195.03 | 1 217.88 |
| (*WTR after June 2001 and before July 2002*) | | 1.80% | 1.80% | 2.30% | 1.91% |
| GMR5 | | 1 154.27 | 1 172.74 | 1 197.37 | 1 217.88 |
| (*WTR after June 2002*) | | | 1.60% | 2.10% | 1.71% |

Sources: *Légifrance* and *Insee*.
Notes*:* Amounts are expressed in Euros. CPI: consumption price index.
Reading: Hourly minimum wage was increased from 6.67 to 6.83 Euros between July 2001 and June 2002; hence, over that time period, the *Smic* rose by 2,4%.

The five "generations" of GMR applied to employees moving towards the 35-hour work week before July 1st 1999, 2000, 2001, 2002 and 2003. Table 1 displays the levels and evolutions of the five GMR, as well as of the French minimum wage, over 2001-2005.

Second, the Fillon law aims at merging 2 PTR devices. Indeed, at the beginning of 2003, two programs of payroll tax reductions existed. Indeed, since June 1996, but before June 1998 and the implementation of the French 35 hours work week, there was a unique device that aimed

at reducing employer payroll tax for low wage workers (the low wage payroll tax cut device; hereafter LWPTR). For each worker, every French establishment could benefit from this payroll tax that amounts to 18.6% of the wage at the *Smic* level and then decreases linearly towards 0 Euros for a wage that was larger than 1.3 times the minimum wage. In 1998 and 2000, Aubry 1 and 2 laws were adopted to reduce the standard working week from 39 to 35 hours - starting on 1 January 2000 for companies employing more than 20 people, and on 1 January 2002 for all other firms. The aim was to promote job creation and reduce unemployment by introducing work sharing. The Aubry laws did not oblige firms to adopt a 35-hour working week: firms can choose to reduce effective working time or pay overtime. These laws were an incentive for firms to implement a working time reduction: they diminished the payroll taxes of employers, who reduced the working hours of their employees. To benefit from these payroll tax cuts, firms had to sign agreements with unions to determine the size of the effective hours of work reductions, the increase in hourly wage rates (level of wage compensation) and the number of new jobs that would be created or preserved. For employees whose hours of work were cut, the working time reduction payroll tax reduction (WTRPTR) amounts to 26% times the wage at the GMR level (see supra), then decreasing linearly until 1.7 times the GMR. Hence, firms that decreased the effective working time of their workers benefited from a more generous system of payroll tax reductions to compensate additional costs of working time reduction. This last device replaces the previous of firms that decrease the working time of their workers. Table 2 displays the four steps through which the 'Fillon reform' merges these two devices, between July 2003 and July 2005.

**Table 2.** Changes in PTR devices through the adoption of the Fillon law (2003-2005).

<table>
<tr><th></th><th>Working Time Reduction<br>Payroll Tax Reduction</th><th>Low Wage Payroll Tax Reduction</th></tr>
<tr><td>Before July 2003</td><td>1. Maximum reduction: 26% of the gross wage (at the GMR1 level). Linearly decreasing with gross wage until 1.7 times the GMR1, Then stable at 600 Euros.</td><td>2. Maximum reduction: 18.6% of the gross wage. Linearly decreasing with it towards 0 Euros at a wage that is greater than 1.3 times the gross Smic.</td></tr>
<tr><td>Between July 2003 and June 2004</td><td rowspan="2">3. Maximum reduction: 26% of the gross wage (at the GMR level). Linearly decreasing with it towards 0 Euros at 1.7 times the GMR2 (1 January 2000).</td><td>4. Maximum reduction: 20.8% of the gross wage. Decreasing with it towards 0 Euros at 1.5 times the Smic.</td></tr>
<tr><td>Between July 2004 and December 2004</td><td rowspan="2">5. Maximum reduction: 23.4% of the gross minimum wage. Decreasing towards 0 Euros at 1.6 times the Smic.</td></tr>
<tr><td>Between January 2005 and June 2005</td><td>6. Maximum reduction: 26% of the gross wage. Decreasing towards 0 Euros at 1.6 times the GMR2.</td></tr>
<tr><td>Starting on 1 July 2005</td><td colspan="2">7. Maximum reduction: 26% of the gross wage.<br>Decreasing towards 0 at 1.6 times the Smic</td></tr>
</table>

Sources: *Légifrance* and *Insee*.

Overall, in France, PTR represents 29.9 billion Euros (Table 3) and 10.3 % of total payroll tax in 2009. 91 % of PTR are paid with state budget. 70% of PTR correspond to PTR on low wages. Since the beginning of the 90's, PTR has grown from 1.9 million in 1992 to 29.9 millions in 2009. In particular, they sharply rose during the implementation of the French 35 hours work week, between 1998 and 2001 (+7.2 percentage points). Although PTR decrease for WTRPTR establishments and increase for LWPTR establishments while implementing the Fillon reform, the whole amount PTR grew over 2001-2007. As well, the share of PTR in total PT, *i.e.* the ratio of PTR to PT, decreases over 2001-2007.

**Table 3.** Evolution of payroll tax reduction in France (1992-2009).

| | 1992 | 1995 | 1998 | 2001 | 2004 | 2007 | 2009 |
|---|---|---|---|---|---|---|---|
| Billion € | 1.9 | 6.2 | 11 | 18.2 | 20.1 | 27.2 | 29.9 |
| Share in total Payroll Tax | 1.4% | 4.1% | 6.3% | 8.8% | 8.9% | 10.2% | 10.3% |

Source: Social Security Organism (Prévot, 2010).

Taking into account the fact that the "Fillon reform" simultaneously affected several components of labour costs, we want to evaluate to what extent PTR impact job flows, *ie*. job creation, job destruction and more generally job reallocation.

In this paper, we evaluate empirically the impact of the Fillon reform on job flows, hence considering a different approach to those of Bunel *et al.* (2010) or Simmonet and Terracol (2010).

## 3. Impact of PTR on employment: micro empirical evidence and motivations

### 3.1 Effect of PTR on employment

The first study using micro data that analyses the effect of PTR on employment is Hamermesh's (1979). Using the Panel Study of Income Dynamics over the 1968-1974 period of time, the author shows that an increase of payroll tax affects both employment and wages. He finds that an increase of 1% in payroll tax decreases wages by 0.3%. With the same methodology, Gruber (1997) shows that the 1981 reform of the social security system in Chile which reduced payroll tax had no effect on manufacturing employment, but on wages. The PTR only affected wages. Johansen and Klette (1997) analyse the effect on wages of a payroll tax cut for the Norwegian manufacturing industry over 1983-1993. They find that, on average, a reduction of 1% in the labour costs increases the hourly wages by 0.4%. Benmarker, Mellander and Ockert (2009) use a panel of Swedish firms over the 2001-2004 period of time to evaluate a modification of the payroll tax legislation that differentiate regions in 2002. They analyse separately continuing firms and firms that enter or exit of the sample. First, they find no employment effect and a positive effect on wages for continuing firms. Second, when they add entries and exits, they find a positive effect on firm entry (an elasticity of around 0.1) and no effect on firm exit. Overall, and very interestingly, if there is a positive effect of payroll tax cut it is through firm entry. Korkeamaki and Uusitalo (2009) use a panel of Finnish firms between 2001 and 2003 as well to evaluate a modification of the payroll tax legislation. They evaluate the employment and wage effects of PTR for firms which benefit from the payroll tax cut. As in Benmarker *et al.* (2009), the employment effect is only due to firm entry. Cruces *et al*. (2010) use firm administrative data for Argentina to evaluate the relation between payroll tax, wages and employment. They find that changes in payroll affects partially the wages but have no significant effect on employment. As reported in Blau and Kahn (1999) studies find substantial impacts on wages but small impacts on employment.

For France, some previous studies investigate the relationship between PTR and employment. Crépon and Desplatz (2001) analyse the effect of the reduction in labour cost of low wage workers during the 90s. They use an employer-employee dataset and show that employment increases by almost 500,000 employees between 1994 and 1997 because of payroll tax reduction. Kramarz and Philippon (2001) use the French labour Force surveys over the 1990-1998 period of time and show that an increase in labour cost leads to an increase in the probability of losing jobs (the estimated elasticity is 1.5). Bunel, Gilles and L'Horty (2010) analyse the effect on employment and wages of the Fillon law (2003) by

merging two administrative data sources between 2002 and 2005. The Fillon reform enabled to standardize the different measures that had existed since the decrease of the legal working time duration from 39 to 35 hours (1998-2000). They show that the impact of the reform is slightly negative for the 35 hours-firms and slightly positive for the 39-hours firms. At the end, the effect is ambiguous. Moreover, they show a positive effect on wages for both types of firms. Simmonet and Terracol (2010) estimate the effect of the same reform on transitions from unemployment to employment by distinguishing the two types of firms. Their idea is to measure the labour demand as the increase or the decrease in transitions. They show that the Fillon reform decreases transitions for the 35-hours firms and has no effect for the 39-hours firms.

With sectoral data, Jamet (2005) analyses the consequences of PTR on low skilled employment between 1993 and 1997. She finds a positive employment effect on low skilled workers: about 150,000 jobs created or saved. Gafsi, L'Horty and Mihoubi (2005) also find that 150,000 low skilled jobs were created or saved during the 90's and find a negative effect on high skilled jobs. On the whole, the effect on whole employment is small.

### 3.2 Effect of PTR on job flows

Since the mid-80 and the beginning of the 1990s, a lot of papers distinguish job creation and job destruction among net employment variation. In particular, instead of simply considering the net variation in employment, those papers aim at studying job creations and job destructions along with the business cycle. Early papers include those of Leonard (1987), Davis and Haltiwanger (1990; 1992) or Blanchard and Diamond (1991) for the US, Boeri and Cramer (1991) for Germany, or Conti and Revelli (1998) for Italy.

From a theoretical point of view and along with this empirical literature, Mortensen and Pissarides (1994) develop job search and matching models to propose a new way to model labor market, including JC and JD to model unemployment changes. Within this framework, a lot of papers study the consequences of labour market policy aiming at reducing labour cost through PTR (in particular) on job flows.

Mortensen and Pissarides (1999) analyze the effect of taxation. The authors consider a job search economy, as well as Nash bargaining on wages and endogenous destruction rates. Studying the impact of changing alternative labor market institutions (unemployment benefit, firing cost, hiring subsidy or PTR), they show that a decrease in PT leads to a decrease in unemployment mainly through a reduction in JD rate. Using the same framework, Sinko (2007) study the impact of PT and tax progression considering different types of wage determination (monopoly union, Nash bargaining or efficiency wages). Under MU, her analytical results are ambiguous. Numerical simulations show that PTR induce an increase in JC (through an increase of the surplus of a match), and a decrease in JD (through a fall in the reservation probability). Combining tax credit and proportional tax in a revenue neutral manner, she shows that tax progression may improve employment if wages are set in a bargaining framework; moreover, tax progression promotes the emergence of less productive jobs and thus lowers average job productivity. This result is confirmed by Pierrard (2005) who considers a similar framework, considering an intertemporal general equilibrium model and two types of workers. The author shows that diminishing employer social contribution impacts positively employment, but this goes more through reducing JD than increasing JC; moreover, PTR targeted at minimum wage increase much more net employment that if it was targeted at other wages. Within a general equilibrium model with three skill levels, but considering exogenous job destruction, Batyra et Sneessens (2010) get the same result through a direct link between JC and minimum wage. Including job competition does not reverse their results but sharply reduces the welfare gains of high skilled. The authors thus

recommend combining large PTR for low skilled workers, smaller PTR for medium skilled jobs and no rebate at all for high skilled jobs.
Hence, these papers show that PTR should *(i)* increase JC and decrease JD *(ii)* be more efficient if they are more targeted on low skilled (or on low wage) workers.

From an empirical point of view, a recent strand of literature focuses on workers or on job flows magnitude (Job Reallocation, hereafter JR; JC or JD). In fact, Contini and Rivelli (1997), Davis and Haltiwanger (1999), Stiglbauer *et al.* (2003), Bassanini and Marianna (2009), Fuchs and Weyh (2010) or the recent OECD survey (OECD, 2009) aims at studying job flows determinants. Within the same framework, some recent papers (Salvanes, 1997; Gomez-Salvador *et al.*, 2004; OECD, 2010) tried to evaluate the impact of labor market institutions on job flows. Indeed, studying the effect of labour market rigidities on job turnover for seven countries (Norway, Denmark, Netherlands, Germany, Italy, Canada and the US), Salvanes (1997) shows that job flows tend to decrease through employment protection, whereas it tends to grow through an employment subsidy that increases job creation. As well, using panel data over 1995-2000 for 13 European countries, Gomez-Salvador *et al.* (2004) look at the role of labor market institutional features in the dynamics of job creation and destruction. Their results confirm (negative correlation between employment protection legislation and JF) or complete (negative impact of an employment subsidy on JD, consistent with Leonard and Van Audenrode (1993)) those of Salvanes (1997). They moreover show that the tax wedge (the difference between the labor cost paid by the firm and the consumption wage received by workers, *i.e.* the sum of worker wage and employer payroll taxes) lowers JR through JC.

In this paper, we evaluate empirically the impact of the Fillon reform on job flows, hence considering a different approach to those of Bunel et al (2010) or Simmonet and Terracol (2010).

## 4. The data

### 4.1 The data sources

We use data from two different administrative sources available at *Insee* (the French national statistical agency) and three at *Acoss-Urssaf* (the French Central Agency of Social Security Organisations). From *Insee*, the first data source is the DADS (*Déclarations Annuelles de Données sociales*), which is a matched employer-employee longitudinal data source, constructed from firm reports to the tax authority. The second source is another administrative source called FICUS (*FiChiers Unifiés de Suse*), which gives us measures of employment, value-added and other economic outcomes for most French firms. From *Acoss-Urssaf*, we use three databases called AROME (*Application du Recouvrement pour l'Observation et la Mesure des Encaissements*), ORME (*Observation du Recouvrement sur les Mesures d'Emploi*) and SEQUOIA (*Système pour l 'Etude QUantitative et l'ObservatIon des Assiettes*). They report information about establishments that benefited from payroll tax reductions.

The *DADS* data source includes data on all workers employed in private and semi public establishments. *Insee* has been receiving information from the tax authority since 1950 in order to elaborate statistics about employment and wages in France. Two files now exist based on this data source: *(i)* a panel (available from 1967) in which all workers born in

October of an even[3] year can be followed across time and firms; *(ii)* the "exhaustive data" available from 1993 in which all workers and establishments are followed by couple of years. In both files, individual wages, employment periods, age, sex, and the skill level of the workers are extremely precisely measured. In particular, these enable us to run the analysis by distinguishing unskilled blue and white collar workers (hereafter the low skilled workers), skilled blue and white collar workers (hereafter the medium skilled workers) and managers, engineers, *etc.* (hereafter high skilled workers), following the classification of Burnod and Chenu (2001). The firm or establishment identifiers are also known for each observation, where an observation in both files corresponds to a person-establishment-year triplet. There is one main difference between the two files. In the panel, workers are followed across time. On the contrary, in the exhaustive file, legal restrictions prevent us from connecting information on individual workers between couples of years. In this article, we use the exhaustive data – aggregated by establishments – for the years 2002 to 2005. For each year, we have a sample of approximately 1,500,000 establishments.

*The FICUS* dataset give information about the firms to which establishments belong to. This information is available for all firms that are subject to the two major tax regimes. These regimes cover virtually the entire productive system, representing roughly 95 percent of taxable firms in terms of sales. The data were kept for the period 2000-2005. For each year, we have a sample of approximately 2,500,000 firms. They mostly contain various economic situation indicators: value-added, capital investment, firm's profits, *etc.*

We also need information about the nature of the PTR in every firm. For this, we use the *ORME* database provided by *Acoss* (*Agence Centrale des Organismes de Sécurité Sociale* – Central Agency of Social Security Organisations). This database allows us to identify different categories of establishments that benefited from PTR over 1999-2005 and to get the precise amount of money the establishment receive as PTR. This chiefly concerns the low wage rebate, the aids associated with Aubry 1 and 2 laws on the reduction of working time, as well as the two sections of the Fillon reform of 2003 – that affecting establishments that have adopted the 35-hours work week and that affecting other firms.

To get a precise idea of the magnitude of PTR relatively to the wage bill, we have to compute the usual indicator that is the share of PTR out of the total labour cost (including the PTR). For that purpose, we also need information on the whole wage bill, as well as on employers' taxes that are effectively reported by firms. These are provided by two other *Acoss-Urssaf* datasets, *AROME* (for employers' social contributions) and *SEQUOIA* (for wage bill, workforce numbers).

Hence, these three *Acoss-Urssaf* datasets contain aggregate data at the level of each establishment, including the wage bill, workforce numbers, PTR, the payroll taxes due to establishments affiliated to the general social security regime.

### 4.2 The final datasets

Public establishments have been excluded from the final sample, as have the establishments of firms with no right to PTR under the Fillon reform[4]. Firms benefiting simultaneously from two types of aid or discontinuously, holding firms, domestic service firms, temporary employment agencies and public firms have all been excluded. Firms in which the growth rate of employment, production and labour costs are characterised by extreme values, and those in which the average gross hourly wage is lower than the minimum wage have been excluded.

[3] Since 2006 it has been containing all workers born in October.

[4] France Telecom, Orange, La Poste, RFF, EDF, GDF, ADP, SNCF, Banque de France, RATP, SEITA.

With these establishment data, we build three different aggregated files at the 4-Digit sectoral level over 2002-2005. A first panel, called Panel 1, is a balanced panel of 97,424 establishments with 10 employees or more (4.8 million employees) over 2002-2005. A second panel, called Panel 2, is an unbalanced panel of establishments over 2002-2005 with the same sectors as in Panel 1. A third panel, called Panel 3, is an unbalanced panel of establishments over the 2002-2005 period of time with all sectors including those that are found in Panel 1. Panel 2 and Panel 3 contain 735,102 establishments (7.7 million employees) and 796,168 establishments (8 million employees) respectively[5]. It may seem important to distinguish between the 3 types of panels. Indeed, the literature that deals with job flows show that a large part in job creation and destruction is due to firm creation or destruction (Davis and Haltiwanger, 1999 and Section 2). Hence, considering Panels 2 and 3 and not only Panel 1 will help us in taking account for establishment's demography.

Table 4 reports the establishment and employment distribution in each of the 3 Panels. Looking at average establishment size classes, we see that Panels 2 and 3 are composed by a larger part of small establishments than Panel 1. Moreover, the main part of workers is employed in smaller establishments. It is not surprising because, contrary to Panels 2 and 3, Panel 1 contains only establishments that can be followed over the whole 2002-2005 time period, and that are the biggest ones. Indeed, smaller establishments go easier to bankruptcy and a lot of establishments were created over2002-2005. Otherwise, there are large differences between the three panels across broad business groups: for instance, in Panel 1, there are much more establishments that come from equipment or intermediate goods business sectors and far fewer that come from the trade or personal services sectors. The same hold for the number of workers.

[5] The three panels must contain more than 30 observations each sector*year.

**Table 4.** Distribution of firms and employment: average size classes and business sectors.

| Establoshment size classes | | | Broad business sectors (French NES16) | | |
|---|---|---|---|---|---|
| | Establishment share (%) | Employment share (%) | | Establishment share (%) | Employment share (%) |
| | | | Panel 1. | | |
| Employment < 10 | 0 | 0 | Agricultural and food industries | 3.2 | 4.5 |
| 10 <= Employment < 20 | 2.8 | 1.0 | Consumption goods | 4.4 | 6.2 |
| 20 <= Employment < 50 | 67.8 | 45.2 | Car industries | 0.6 | 1.9 |
| 50 <= Employment < 100 | 22.6 | 31.2 | Equipment goods | 5.7 | 7.7 |
| 100 <= Employment < 250 | 6.3 | 18.9 | Intermediate goods | 12.0 | 15.3 |
| 250 <= Employment < 500 | 0.4 | 3.1 | Energy | 0.6 | 0.8 |
| 500 <= Employment < 1000 | 0.04 | 0.5 | Construction | 12.6 | 8.2 |
| 1000 <= Employment < 2500 | 0 | 0 | Trade | 24.4 | 20.2 |
| Employment >= 2500 | 0 | 0 | Transport | 7.0 | 7.2 |
| | | | Finance | 2.9 | 4.1 |
| | | | Housing | 1.3 | 1.3 |
| | | | Business services | 11.8 | 12.6 |
| | | | Personal services | 9.0 | 5.5 |
| | | | Education and social services | 4.4 | 4.3 |
| | | | Panel 2. | | |
| Employment < 10 | 74.8 | 36.0 | Agricultural and food industries | 4.5 | 4.2 |
| 10 <= Employment < 20 | 12.9 | 18.2 | Consumption goods | 2.4 | 5.0 |
| 20 <= Employment < 50 | 10.7 | 29.6 | Car industries | 0.2 | 1.5 |
| 50 <= Employment < 100 | 0.9 | 5.9 | Equipment goods | 2.6 | 6.2 |
| 100 <= Employment < 250 | 0.6 | 9.3 | Intermediate goods | 4.4 | 11.9 |
| 250 <= Employment < 500 | 0.03 | 0.9 | Energy | 0.1 | 0.7 |
| 500 <= Employment < 1000 | 0 | 0 | Construction | 15.6 | 10.3 |
| 1000 <= Employment < 2500 | 0 | 0 | Trade | 29.7 | 22.6 |
| Employment >= 2500 | 0 | 0 | Transport | 3.9 | 6.6 |
| | | | Finance | 3.0 | 4.4 |
| | | | Housing | 2.0 | 1.4 |
| | | | Business services | 10.1 | 13.6 |
| | | | Personal services | 17.1 | 7.8 |
| | | | Education and social services | 4.3 | 3.9 |
| | | | Panel 3. | | |
| Employment < 10 | 76.0 | 35.8 | Agricultural and food industries | 4.4 | 4.4 |
| 10 <= Employment < 20 | 12.2 | 17.8 | Consumption goods | 2.6 | 5.0 |
| 20 <= Employment < 50 | 10.1 | 28.9 | Car industries | 0.2 | 1.4 |
| 50 <= Employment < 100 | 0.9 | 6.2 | Equipment goods | 2.5 | 6.4 |
| 100 <= Employment < 250 | 0.6 | 9.4 | Intermediate goods | 4.3 | 12.5 |
| 250 <= Employment < 500 | 0.05 | 1.7 | Energy | 0.1 | 0.7 |
| 500 <= Employment < 1000 | 0.002 | 0.2 | Construction | 14.4 | 9.9 |
| 1000 <= Employment < 2500 | 0.001 | 0.1 | Trade | 29.8 | 22.1 |
| Employment >= 2500 | 0 | 0 | Transport | 3.7 | 7.0 |
| | | | Finance | 2.8 | 4.2 |
| | | | Housing | 2.0 | 1.4 |
| | | | Business services | 9.8 | 13.1 |
| | | | Personal services | 17.4 | 7.8 |
| | | | Education and social services | 5.8 | 4.0 |

Source: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers or more and coming from the private non-farm business and semi-public sectors over 2002-2005.

Table 5 gives further information over all three panels. In particular, it confirms findings of Table 4 (see "*Establishment features*"). Moreover, it shows that there are smaller variations in employment, and larger labour productivity or capital intensity levels on average in Panels 2 and 3 than in Panel 1. Otherwise, concerning the worker composition, panels 2 and 3 exhibits larger part of workers aged fewer than 30 and a larger part of women. As to skills on the contrary, all three panels show one quarter of low skilled workers and about one third of high skilled workers.

Hence, even if it may seem to be more convenient to follow the same establishments across time to study the impact of the PTR on job flows, we may suffer from a lack of information considering only Panel 1 instead of Panels 2 or 3. That's why we will work with all three panels.

**Table 5.** Sample characteristics. Means or sums over 2002-2005.

| Variables / Samples | Panel 1 | Panel 2 | Panel 3 |
|---|---|---|---|
| *Number of establishments:* | 97,424 | 735,102 | 796,468 |
| *Total number of workers:*[a] | 4,777 | 7,656 | 8,049 |
| *Establishment features:* | | | |
| Average number of workers in an establishment | 49.0 | 10.4 | 10.1 |
| Small estab. (< 20 workers)[b] | 39.9% | 90.4% | 90.9% |
| Firms with more than one establishment | 40.8% | 24.7% | 24.1% |
| *Variation in employment:* | 144.1 | 104.1 | 96.1 |
| *Performance indicators:* | | | |
| Lagged establishment profit ratio | 16.9% | 17.3% | 16.9% |
| Value added growth rate | 16.1% | 26.3% | 26.5% |
| Labor productivity | 14167 | 148236 | 141066 |
| *Capital intensity:* | 1990 | 4241 | 4228 |
| *Workers:* | | | |
| Part of low skilled workers | 24.4% | 25.1% | 24.9% |
| Part of medium skilled workers | 39.8% | 39.9% | 39.9% |
| Part of high skilled workers | 35.8% | 35.0% | 35.2% |
| Part of women | 41.2% | 44.6% | 44.7% |
| Part of workers aged less than 30 years old | 28.8% | 31.4% | 31.0% |
| *Wages:*[c] | | | |
| All workers | 189265 | 286608 | 220834 |
| Low skilled workers | 102788 | 148917 | 115089 |
| Medium skilled workers | 140370 | 207494 | 159564 |
| High skilled workers | 286592 | 400577 | 306602 |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers or more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Notes: [a]Thousands of workers; [b]Percentage of establishments that employ fewer than 20 workers. [c]Euros a year.

## 5. Job Flows and PTR over 2002-2005

In the first part of this section, we present concepts from the literature on gross job flows to estimate the employment effect of PTR. We use the Davis and Haltiwanger's definitions (1999). These definitions are well-known but it is always useful and practical to remember them. In the second part of this Section, we display descriptive statistics dealing with job flows and PTR.

### 5.1 Job flows measures

Gross job creation in $t$ is measured by the difference in the jobs created between $t-1$ and $t$ for an establishment which increases employment. For the sector $s$ in $t$ :

$$C_{st} = \sum_{e \in S^+} \Delta EMP_{est}$$

where $S^+$ is the sub-set of establishments $e$ that increase employment between $t-1$ and $t$ and $\Delta EMP_{est} = EMP_{est} - EMP_{est-1}$ is the employment variation between *t-1* and *t* within a given establishment *e*.

Conversely, gross job destruction in $t$ is measured by the difference in the jobs destroyed between $t-1$ and $t$ for an establishment that reduces employment. For the sector $s$ in $t$ :

$$D_{st} = \sum_{e \in S^-} \left| \Delta EMP_{est} \right|$$

where $S^-$ is the sub-set of establishments $e$ that reduce employment between $t-1$ and $t$ .

*Gross job reallocation* in $t$ is measured by the sum of job creation and job destruction between $t-1$ and $t$ :

$$R_{st} = \sum_{e \in S} \left| \Delta EMP_{est} \right| = C_{st} + D_{st}$$

In order to express the previous measures as rates, we need the sector size. We take its average size between $t-1$ and $t$ :

$$Z_{st} = 0.5\left(EMP_{st} + EMP_{st-1}\right)$$

Hence, creation, destruction and reallocation rates the sector $s$ are written:

$$JCR_{st} = \frac{C_{st}}{Z_{st}},\ JDR_{st} = \frac{D_{st}}{Z_{st}},\ JRR_{st} = \frac{R_{st}}{Z_{st}} \qquad (1)$$

As well, we can define job flows measures for each skill. Indeed, we can show that we have:

$$\sum_{e \in Q^+} \Delta EMP^q_{est} = \sum_{e \in S^+ \cap Q^+} \Delta EMP^q_{est} + \sum_{e \in S^- \cap Q^+} \Delta EMP^q_{est}$$

for each skill $q=L$ (low), $M$ (medium) or $H$ (high) worker with $q \in Q$ and for each establishment that create employment within the category of $q$-skilled workers ($e \in Q^+$).
As above for all workers, we consider the average number of the $q$-skilled workers employed in $t-1$ and $t$ to get the sector $s$ gross job creation rate for the $q$-skilled workers:

$$JCR^q_{st} = \frac{\sum_{e \in q^+} \Delta EMP^q_{est}}{Z^q_{st}}$$

In a similar way, we calculate $JDR^q_{st}$ and $JRR^q_{st}$.

### 5.2 Linking the magnitude of job flows with PTR

Table 6 displays usual descriptive statistics on job flows for all workers[6]. As usual, they show that job reallocation rates decrease with the average size of the firm; nevertheless, this relation is mainly due to that of job creation rates with average firm size. Moreover, job reallocation rates are larger among services than among manufacturing industries. These conclusions hold for all three panels.

[6] The same statistics are also available for any type of workers (according to skill groups).

**Table 6.** Job flows, average firm size and business sectors.

| Sample | Panel 1 | | | Panel 2 | | | Panel 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| Type of reallocation | JRR | JCR | JDR | JRR | JCR | JDR | JRR | JCR | JDR |
| *By sector of operation*: | | | | | | | | | |
| Manufacturing: | | | | | | | | | |
| Agricultural and food industries | 7.2[a] | 3.6 | 3.6 | 9.5[a] | 4.3 | 5.3 | 9.4[a] | 4.2 | 5.2 |
| Consumption goods | 8.1 | 3.0 | 5.1 | 9.7 | 3.5 | 6.2 | 9.8 | 3.6 | 6.3 |
| Car industries | 6.5 | 2.5 | 4.0 | 8.1 | 2.7 | 5.4 | 8.1 | 2.8 | 5.3 |
| Equipment goods | 7.4 | 3.2 | 4.2 | 8.9 | 3.7 | 5.2 | 9.0 | 3.6 | 5.4 |
| Intermediate goods | 7.4 | 2.7 | 4.6 | 8.7 | 3.1 | 5.6 | 8.6 | 3.0 | 5.6 |
| Energy | 6.0 | 3.5 | 2.5 | 6.3 | 3.5 | 2.8 | 5.8 | 2.9 | 2.9 |
| Services: | | | | | | | | | |
| Construction | 8.3 | 4.6 | 3.7 | 11.5 | 5.8 | 5.7 | 11.5 | 5.8 | 5.7 |
| Trade | 7.1 | 4.0 | 3.1 | 10.0 | 4.8 | 5.2 | 10.1 | 4.8 | 5.3 |
| Transport | 8.7 | 4.4 | 4.3 | 11.1 | 5.0 | 6.1 | 10.4 | 4.7 | 5.8 |
| Finance | 12.3 | 4.3 | 7.9 | 12.8 | 4.6 | 8.2 | 12.8 | 4.6 | 8.2 |
| Housing | 7.1 | 3.9 | 3.1 | 10.9 | 5.5 | 5.4 | 11.0 | 5.6 | 5.4 |
| Business services | 11.2 | 6.0 | 5.1 | 13.0 | 6.3 | 6.8 | 13.0 | 6.3 | 6.8 |
| Personal services | 7.8 | 3.7 | 4.1 | 12.1 | 5.4 | 6.7 | 12.3 | 5.5 | 6.8 |
| Education and social services | 6.4 | 4.1 | 2.2 | 8.4 | 4.9 | 3.4 | 8.6 | 5.0 | 3.6 |
| *By sectoral average firm size:* | | | | | | | | | |
| Employment < 10 | -0.0 | -0.0 | -0.0 | 12.0 | 5.6 | 6.4 | 12.1 | 5.7 | 6.4 |
| 20 <= Employment < 50 | 8.2 | 4.3 | 3.8 | 11.2 | 4.9 | 6.3 | 11.2 | 4.9 | 6.3 |
| 50 <= Employment < 100 | 8.4 | 4.4 | 4.1 | 10.3 | 4.6 | 5.7 | 10.3 | 4.7 | 5.7 |
| 100 <= Employment < 250 | 9.0 | 4.3 | 4.7 | 8.6 | 3.3 | 5.3 | 8.7 | 3.2 | 5.5 |
| 250 <= Employment < 500 | 6.7 | 2.8 | 3.9 | 6.1 | 2.7 | 3.4 | 6.1 | 2.7 | 3.4 |
| 500 <= Employment < 1000 | 5.7 | 2.6 | 3.2 | 6.2 | 1.8 | 4.4 | 5.3 | 1.5 | 3.8 |
| 1000 <= Employment < 2500 | 5.2 | 2.1 | 3.1 | -0.0 | -0.0 | -0.0 | 6.6 | 1.2 | 5.4 |
| Employment >= 2500 | -0.0 | -0.0 | 0.0 | -0.0 | -0.0 | -0.0 | 4.5 | 0.6 | 3.9 |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers or more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Note: [a]Percentage of the average employment rate computed over *t* and *t-1*.

Looking at the evolution of job flows over 2002-2005 (Table 7), we have to remember that this time period corresponds to a recession or at least to a period characterized by low output growth rate, which may explain why job creations decrease or job destruction rate increase. However, if we look at what happens at every skill level, we see that job destruction decreases for low and medium skilled workers, whereas job creation decreases for high skilled workers. Hence, job reallocation rates fall for all workers. These facts hold for all types of panels, except that the figures are mechanically higher in Panels 2 and 3 than in Panel

1 because the formers take into account the smallest establishments as well as establishments' demography. These results hold for each skill groups. JCR and JDR are higher for low skilled workers as the result of more mobility for these workers.

**Table 7.** Job flows for the different population of workers under consideration.

| Population | All workers | | | Low skilled workers | | | Medium skilled workers | | | High skilled workers | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of reallocation | JRR | JCR | JDR | JRR | JCR | JDR | JRR | JCR | JDR | JRR | JCR | JDR |
| Panel 1. Balanced panel of establishments | | | | | | | | | | | | |
| 2003 | 8.3[a] | 4.3 | 3.9 | 20.4 | 9.9 | 10.4 | 16.2 | 8.0 | 8.2 | 15.0 | 8.6 | 6.9 |
| 2004 | 7.5 | 3.7 | 3.8 | 17.1 | 8.0 | 9.0 | 14.6 | 6.9 | 7.7 | 13.8 | 7.3 | 6.0 |
| 2005 | 8.8 | 3.9 | 4.9 | 17.6 | 8.6 | 8.9 | 15.2 | 6.8 | 8.4 | 16.2 | 7.0 | 7.8 |
| Panel 2. Unbalanced panel of establishments with the same sectors as in Panel 1 | | | | | | | | | | | | |
| 2003 | 10.6 | 4.8 | 5.8 | 24.4 | 11.4 | 13.0 | 19.9 | 9.2 | 10.7 | 19.1 | 9.5 | 9.6 |
| 2004 | 10.3 | 4.6 | 5.7 | 22.5 | 10.2 | 12.3 | 19.1 | 8.5 | 10.6 | 17.2 | 8.9 | 8.2 |
| 2005 | 10.8 | 4.9 | 5.8 | 22.4 | 10.9 | 11.5 | 19.2 | 9.2 | 10.1 | 18.2 | 8.5 | 7.7 |
| Panel 3. Unbalanced panel of establishments with all sectors | | | | | | | | | | | | |
| 2003 | 10.5 | 4.7 | 5.8 | 24.6 | 11.6 | 13.1 | 19.9 | 9.1 | 10.8 | 18.8 | 9.3 | 9.5 |
| 2004 | 10.3 | 4.5 | 5.7 | 22.6 | 10.2 | 12.4 | 19.1 | 8.5 | 10.6 | 17.0 | 8.8 | 8.2 |
| 2005 | 10.8 | 4.9 | 5.8 | 22.8 | 11.2 | 11.6 | 19.2 | 9.1 | 10.1 | 18.1 | 8.4 | 9.7 |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers or more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Note: [a]Percentage.

**Table 8.** Payroll tax cuts: overall amounts and tax cuts rates 2003-2005.

| Year / PTR | Overall amounts[a] | Tax cuts rates[b] |
|---|---|---|
| Panel 1. Balanced panel of establishments | | |
| 2003 | 5,616 | 4.13 |
| 2004 | 5,769 | 4.18 |
| 2005 | 5,770 | 4.14 |
| Panel 2. Unbalanced panel of establishments with the same sectors as in Panel 1 | | |
| 2003 | 9,065 | 4.39 |
| 2004 | 9,708 | 4.59 |
| 2005 | 10,376 | 4.71 |
| Panel 3. Unbalanced panel of establishments with all sectors | | |
| 2003 | 9,467 | 4.33 |
| 2004 | 10,109 | 4.52 |
| 2005 | 10,784 | 4.62 |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers and more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Notes: [a]Millions of Euros; [b]Percentage.

Section 3 showed that the overall amounts of PTR given to firms rose over 2002-2005 considering the whole economy. According to our three panels, the same conclusions hold.

Indeed (Table 8), whatever the panel we consider, both the amount of PTR and the PTR ratio to labour cost rise over 2002-2005.

The question we ask next is whether the decrease in job destruction for low and medium skill workers, as well as the decrease in the job creation rate of high skill workers reflects an impact of PTR.

## 6. The econometric strategy

To evaluate the impact of varying PTR on job creation and destruction using establishments panel data, we want to estimate separately 3 job flows equations of the type (Gomez-Salvador (2004)):

$$JFR_{it} = X_{it}\beta + \Delta PTR_{it}\gamma + \varepsilon_{it} \quad (1)$$

for $JFR_{it}$=$JCR_{it}$, $JDR_{it}$ or $JRR_{it}$ that are our outcome variables. Subscripts *i* and *t* denote establishment and time respectively. As in Bunel and L'Horty (2012), $\Delta PTR_{it}$ represents our variable of treatment and is the variation between *t-1* and *t* in the ratio of the payroll tax reduction to the wage bill; $X_{it}$ refers to a multidimensional vector of control variables; and $\varepsilon_{it} = \mu_i + \delta_{it}$ is a composite error term, where $\mu_i$ is an unobserved establishment effect.

Estimating (1) directly using establishments *i* data over 2002-2005 is very difficult for many reasons.

There are selection and endogeneity problems. First, $X_{it}$ is often supposed to be correlated with $\mu_i$. If genuine panel data are available, using a within estimator solve the problem. This is the case of Panel 1, where several observations are observed for the same establishment, but not that of Panels 2 and 3. However, Panel 1 suffers from large attrition because of firm demography (Section 4); considering only this panel may be misleading. Moreover, even for Panel 1, a given establishment cannot create and destroy jobs at the same time. Thus, there will be many zeros for each dependent variable while estimating (1) using establishments observations directly. A similar problem appears if we perform regressions on different skill groups: to be able to compare the effect of varying PTR according to different skills of workers, we have to work on the same establishments and consequently to impose that the establishment employs all types of skills; hence we may introduce a selection bias.

Second, the variable of treatment ($\Delta PTR_{it}$) is endogenous. Indeed, as mentioned in Section 3, PTR for a given worker depends on her gross wage level; thus PTR should be correlated to the average wage level at the establishment. Besides, a given skill (either low, medium or high) group of workers is a function of certain professional categories and thus of wages (see supra, Section 4). In particular, as shown in Table 5, the establishment average wage of high skilled workers is larger than that of medium skilled workers, and that of medium skilled workers is larger than that of low skilled workers. Since any PTR amount decreases with wage level whatever the device we consider, PTR (and thus $\Delta PTR_{it}$) should be correlated with the given skill wage [, even if it is difficult to prove it through any computation because the *Acoss-Urssaf* dataset only gives us the whole amount of PTR]. Otherwise, wages were proved to determine job flows (Davis and Haltiwanger, 1999). Wages are thus part of the $X_{it}$

vector. Since wages and employment are jointly determined, wages are endogenous. Moreover, wages may also depend on minimum wages. In fact, the French minimum wage, as well as the five monthly wage guarantees were revised every year over 2002-2005 on July 1st so that hourly minimum wages go to a unique value on July 2005 (see Table 1, Section 3). As often demonstrated in the literature (CSERC, 1996; Koubi and Lhommeau, 2006; Cette *et al.* 2012), increases in minimum wages should spread to the wages distribution.

For all these reasons, we decide to use a pseudo panel data approach (Deaton, 1985; Verbeek, 2007). We aggregate the individual data at the 4-Digit sectoral level (see Section 4 for the aggregation of establishment data) and consider the following equation:

$$JFR_{st} = X_{st}\beta + \Delta PTR_{st}\gamma + \varepsilon_{st} \quad (2)$$

where $JFR_{st}$ (respectively $X_{st}$ and $PTR_{st}$) is the average value computed of all observed $JFR_{it}$'s (respectively $X_{it}$'s and $PTR_{it}$'s) in business sector *s* at time *t*. Finally $\varepsilon_{st} = \mu_{st} + \delta_{st}$. Here, sector aggregations are based on a large number of establishments, the number *S* of sectors is fixed, whereas the number of establishment $n_s$ per sector tends to infinity. We can treat $\mu_{st}$ as fixed unknown parameters ($\mu_{st} = \mu_s$) so that we use the within estimator on the pseudo panel. In this case, indeed, Moffitt (1993) shows that grouping can be viewed as an instrumental variable (IV*)* procedure. Each $\mu_i$ of equations (1) is decomposed into a sector effect $\mu_s$ and establishment *i*'s deviation from this effect. If we note $z_{si}$ a dummy variable that is equal to 1 if establishment *i* is in sector *s*, we can write:

$$\mu_i = \sum_s \mu_s z_{si} + \upsilon_i \quad (3)$$

Substituting (3) into (1) and defining $Z_i = (z_{1i}, ....., z_{Si})$ and $\mu = (\mu_1, ....., \mu_S)'$ we obtain:

$$JFR_{it} = X_{it}\beta + \Delta PTR_{it}\gamma + Z_i\mu + \upsilon_i + \delta_{it} \quad (4)$$

If $\Delta PTR_{it}$ or $X_{it}$ are correlated with $\mu_i$, we can expect that they are correlated with $\upsilon_i$. In equations (4), only an instrumental variables estimator will be consistent for $\beta, \gamma$ and $\mu$. Cohort dummies $Z_i$ interacted with time dummies provide valid instruments for all explanatory variables in the model (including the full set of cohort dummies - Deaton (1985)) ). In other words, to be in a sector is an appropriate instrument because it is correlated with $\Delta PTR_{it}$ or $X_{it}$ but not with $\upsilon_i + \delta_{it}$. Moffitt (1993) shows that the within estimator on the pseudo panel (equation (2)) is identical to *IV* estimators on the individual panel dataset (equation (4)).

## 7. Results and discussion

Since we estimate JF equations, we first focus on JF determinants. Then, we display results.

### 7.1 Usual determinants for JF

Within the strand of literature that analyzes the determinants of JF, several factors have been put in evidence (Salvanes (1997), Contini and Revelli (1998), Davis and Haltiwanger (1999), Stiglbauer *et al.* (2003), Gomez-Salvador *et al.* (2004), Fuchs and Weyh (2010) or OECD (2009)). **Tables 9a to c in appendix** contain the corresponding correlations for JF when

measured for all workers independently of their skill level for all three panels. In particular, Job Flows:
- are smaller in bigger establishments. Average firm size is negatively correlated with the magnitude of JF. On the contrary, being a small French firm (*ie.* employing fewer than 20 workers) is positively correlated with it. Besides, for an establishment, belonging to a firm with more than one establishment should be negatively correlated with large JF, which is only the case for Panels 2 and 3;
- are related with economic situation; positively with JC and negatively with JD for Panel 1. Different results are found for Panels 2 and 3;
- should be negatively correlated with capital intensity;
- are correlated with net employment variation: positively correlated with JC, but negatively correlated with JD;
- are correlated with workers features within a firm: JF are bigger in firms where there are more workers that are younger than 30 years old; as well, a firm employing more women is characterized by larger JF;
- are significantly related to wages: JF for a given population of workers is a priori negatively correlated to the average wage of the corresponding category of workers.

### 7.2 Results

We estimate the links between PTR and job creation or PTR and job destruction for total employees and for the three different workers' skill groups (low skilled, medium skilled and high skilled workers). For each skill group, we estimate the effect of the share of payroll tax reductions in the sector wage bill on job creation, job destruction and job reallocation controlling for a set of control variables presented in the previous sub-section. First, we use sector characteristics: the size of the given sector with total employment; the employment variation between *t-1* and *t* to control for the "structural" growth of the sector; the share of multi-establishment firms and the share of small establishments (with fewer than 20 employees). Second, we use workers characteristics: the share of women and the share of young workers (fewer than 30 years-old); wages for each skill. Third, we use an economic and financial performance indicator: the growth rate of sectoral value-added between *t-1* and *t*. Fourth, we consider the capital intensity ratio. All these variables vary with time enough to be introduced in the FE regressions applied to (pseudo) Panels 1, 2 and 3. These control variables are not always significant for each regression.

**Table 10.** Effect of payroll tax reduction on job flows.

Estimating job flows equations on pseudo panel data using a within estimator.

| Population / Sample | Panel 1 | Panel 2 | Panel 3 |
|---|---|---|---|
| Job reallocation rate | | | |
| *All workers* | -0.237 | 0.131 | 0.093 |
| | (0.357) | (0.295) | (0.257) |
| *By skill level:* | | | |
| Low skilled workers | -1.610 | -0.736 | -0.896 |
| | (1.126) | (0.824) | (0.754) |
| Medium skilled workers | 0.429 | 0.187 | -0.205 |
| | (0.750) | (0.629) | (0.521) |
| High skilled workers | -0.151 | -0.284 | 0.130 |
| | (0.616) | (0.540) | (0.450) |
| Job creation rate | | | |
| *All workers* | 0.143 | 0.198 | 0.139 |
| | (0.186) | (0.202) | (0.200) |
| *By skill level:* | | | |
| Low skilled workers | -0.449 | -0.172 | -0.492 |
| | (1.015) | (0.749) | (0.657) |
| Medium skilled workers | 1.142* | 0.606 | 0.494 |
| | (0.606) | (0.442) | (0.381) |
| High skilled workers | 0.066 | -0.073 | 0.041 |
| | (0.541) | (0.491) | (0.413) |
| Job destruction rate | | | |
| *All workers* | -0.380 | -0.067 | -0.046 |
| | (0.331) | (0.371) | (0.318) |
| *By skill level:* | | | |
| Low skilled workers | -1.161 | -0.564 | -0.404 |
| | (0.811) | (0.520) | (0.458) |
| Medium skilled workers | -0.712 | -0.419 | -0.700 |
| | (0.644) | (0.703) | (0.569) |
| High skilled workers | -0.217 | -0.211 | 0.089 |
| | (0.781) | (0.656) | (0.553) |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).

Field: Firms employing 10 workers and more and coming from the private non-farm business and semi-public sectors over 2002-2005.

Notes: Standard errors are robust to heteroscedasticity, serial correlation and sectoral clustering. *Standard error* within parentheses. *** (respectively ** and *) stands for significance at a 1% (respectively 5 or 10%) level.

We estimate the relationship between PTR and gross flows by skill groups considering equations of type (2) as such. However, sizes of the sectoral cohorts are rather different; which may induce heteroscedasticity. Hence, it is recommended to run regressions reweigthing by the square root of the size of each cohort, *ie.* of the employment level for the considered category of workers (Deaton (1985) ; Devereux (2007) ; Stiglbauer *et al.* (2003)). Moreover, standard errors are also corrected for serial correlation, heteroscedasticity and for sectoral clustering. Table 10 contains corresponding results. It shows that PTR let job reallocation rates unchanged, either considering job creation or job destruction rates. These results hold for any of the skill groups and all three panels.

**Table 11.** Effect of payroll tax reduction on job flows.

Estimating job flows equations on pseudo panel data using an IV-within estimator.

| Population / Sample | Panel 1 | Panel 2 | Panel 3 |
|---|---|---|---|
| *All workers* | -0.937 | -0.632 | 0.181 |
| | (0.897) | (0.823) | (0.806) |
| *By skill level:* | | | |
| Low skilled workers | -1.283 | -0.585 | -0.879 |
| | (2.853) | (1.827) | (1.841) |
| Medium skilled workers | -1.424 | -1.422 | -1.139 |
| | (1.851) | (1.545) | (1.411) |
| High skilled workers | -1.289 | -1.928 | -0.690 |
| | (1.554) | (1.297) | (1.371) |
| Job creation rate | | | |
| *All workers* | 0.322 | -0.429 | -0.156 |
| | (0.351) | (0.446) | (0.440) |
| *By skill level:* | | | |
| Low skilled workers | 3.832 | 1.140 | 0.310 |
| | (3.044) | (1.785) | (1.713) |
| Medium skilled workers | 0.725 | -0.823 | -0.669 |
| | (1.445) | (1.082) | (0.993) |
| High skilled workers | 0.107 | -0.140 | 0.408 |
| | (1.675) | (1.113) | (1.001) |
| *All workers* | -1.259 | -0.203 | 0.338 |
| | (0.817) | (0.999) | (0.898) |
| *By skill level:* | | | |
| Low skilled workers | -2.549 | -1.725 | -1.189 |
| | (2.009) | (1.352) | (1.245) |
| Medium skilled workers | -2.149 | -0.599 | -0.470 |
| | (1.962) | (1.716) | (1.539) |
| High skilled workers | -1.397 | -1.798 | -1.097 |
| | (1.403) | (1.546) | (1.464) |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).

Field: Firms employing 10 workers and more and coming from the private non-farm business and semi-public sectors over 2002-2005.

Notes: Standard errors are robust to heteroscedasticity, serial correlation and sectoral clustering. *Standard error* within parentheses. *** (respectively ** and *) stands for significance at a 1% (respectively 5 or 10%) level.

However, estimation techniques based on grouping individual data into cohorts are identical to instrumental variables approaches where the group indicators are used as instruments. Consequently, the sectoral dummies variables should satisfy the appropriate conditions for an instrumental variables estimator to be consistent. In particular, this requires that the instruments are relevant, *i.e.* appropriately correlated to the explanatory variables in the model. If this not the case, we may face weak instruments problem (Bound, Jaeger and Baker, 1995) and estimates of the impact of PTR may be highly biased. To avoid such a caveat, we implement the within estimation of (2), instrumenting $\Delta PTR_{it}$ by its (first) lagged value $\Delta PTR_{it-1}$. Results are reported the three last columns of Table 10. The p-value (equal to 0) associated to the *F*-test for weak instruments show the computed *F*-statistics is (largely)

greater than the critical value (16.38) tabulated by Stock and Yogo (2005) ; hence our instrument is not weak. Our findings show that PTR definitely did not affect at all job reallocation rates[7] (Table 11).

## 8. Concluding remarks

To reduce unemployment, payroll tax reductions on low wages have been implemented in many European continental countries since the beginning of the 90s. In France, economic policies have extended to more and more workers from the mandatory minimum wage within a fast-growing budget.

Most papers that analyse the impact of PTR on employment focus on the net employment effect of labour costs. In this paper, we examine to what extent Payroll Tax Reductions increases job creation or decreases job destruction separately.

To proceed, we first use concepts from the literature on gross job flows (Davis and Haltiwanger's definitions, 1990, 1992, 1999a and 1999b) to estimate the employment effect of PTR. For this study, we merge three different administrative sources over 2002-2005 that are available at *Insee* and *Acoss-Urssaf*. These data enable us to run the analysis by distinguishing unskilled blue and white collar workers (hereafter the low skilled workers), skilled blue and white collar workers (hereafter the medium skilled workers) and managers, engineers (hereafter high skilled workers).

To analyze the impact of PTR on job creation and destruction, we have to cope with four main problems. In fact, a firm that benefits from PTR is not exogenous for many reasons and in particular the fact that wages and employment are jointly determined. Moreover, considering job creation and destruction at the establishment level, we have to face the fact that there are many zeros for each dependant variable because an establishment cannot create and destroy jobs at the same time. As well, when we work with individual data, we have to impose that the establishment employs all types of skills – because, for instance, an establishment with no low skilled workers has a zero probability to destroy low skilled jobs – so we may introduce a selection bias in our estimation. Finally, a lot of establishments were created or die over 2002-2005; hence, considering a genuine panel over our period of study may be misleading. For these reasons, we use a pseudo panel data approach (Deaton, 1985 and Verbeek, 2007) at the 4-Digit sectoral level to be able to perform linear regressions by keeping most of the establishments over the 2002-2005 period of time. Indeed, estimation techniques based on pseudo panel data are identical to IV estimations where the level of aggregation is used as an instrument (Moffitt, 1993). To avoid the weak instrument's caveat that may also occur through applying the within estimator to pseudo panel data, we also use a within-IV estimator. Our results are the following. Whatever the dataset we consider, the model we estimate, there is no impact of PTR on job flows, even with regards to any of the skill groups.

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[7] All estimations were run using the xtivreg2 procedure.

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**Appendices**

**Table 9a.** Job flows and its determinants. Pearson's correlation coefficients.
Panel 1 for 'All workers'.

| Variables / Type of reallocation | JRR | JCR | JDR |
|---|---|---|---|
| *Establishment features:* | | | |
| Average number of workers in an establishment | -0.144*** (<.001) | -0.225*** (<.001) | -0.001 (0.979) |
| Small estab. (< 20 workers) | 0.108*** (<.001) | 0.200*** (<.001) | -0.022 (0.427) |
| Firms with more than one establishment | 0.059** (0.035) | 0.041 (0.147) | 0.078*** (0.006) |
| *Performance indicators:* | | | |
| **Lagged establishment profit ratio** | **0.063** (0.026)** | **0.022 (0.439)** | **0.055** (0.049)** |
| Value added growth rate | -0.051* (0.071) | 0.092*** (0.001) | -0.129*** (<.001) |
| **Labor productivity** | **0.013 (0.632)** | **0.014 (0.627)** | **0.005 (0.855)** |
| *Capital intensity:* | 0.024 (0.396) | -0.049* (0.082) | 0.065** (0.021) |
| *Variation in employment* | -0.171*** (<.001) | 0.331*** (<.001) | -0.435*** (<.001) |
| *Employment:* | | | |
| Part of women | 0.085*** (0.002) | 0.113*** (<.001) | 0.015 (0.602) |
| Part of workers aged less than 30 | 0.110*** (<.001) | 0.274*** (<.001) | -0.073*** (0.009) |
| *Wages:* | | | |
| All workers | -0.027 (0.330) | 0.017 (0.550) | -0.043 (0.123) |
| Low skilled workers | -0.131*** (<.001) | -0.053* (0.058) | -0.110*** (<.001) |
| Medium skilled workers | -0.073*** (0.009) | -0.016 (0.558) | -0.072** (0.011) |
| High skilled workers | -0.027 (0.343) | 0.051* (0.073) | -0.067** (0.017) |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers and more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Notes: *P value*s within parentheses. *** (respectively ** and *) stands for significance at a 1% (respectively 5 or 10%) level.

**Table 9b.** Job flows and its determinants. Pearson's correlation coefficients.
Panel 2 for 'All workers'.

| Variables / Type of reallocation | JRR | JCR | JDR |
|---|---|---|---|
| *Establishment features:* | | | |
| Average number of workers in an establishment | -0.382*** (<.001) | -0.375*** (<.001) | -0.204*** (<.001) |
| Small estab. (< 20 workers) | 0.481*** (<.001) | 0.449*** (<.001) | 0.273 (<.001) |
| Firms with more than one establishment | -0.081*** (0.004) | -0.070** (0.012) | -0.050* (0.076) |
| *Performance indicators:* | | | |
| **Lagged establishment profit ratio** | **0.102*** (<.001)** | **0.083*** (0.003)** | **0.067** (0.017)** |
| Value added growth rate | 0.075*** (0.008) | 0.042 (0.137) | 0.063** (0.026) |
| **Labor productivity** | **0.009 (0.742)** | **0.007 (0.802)** | **0.006 (0.821)** |
| *Capital intensity:* | 0.101*** (<.001) | -0.007 (0.082) | 0.128*** (0.021) |
| *Variation in employment* | -0.042 (0.138) | 0.259*** (<.001) | -0.234*** (<.001) |
| *Employment:* | | | |
| Part of women | 0.165*** (<.001) | 0.162*** (<.001) | 0.088** (0.017) |
| Part of workers aged less than 30 | 0.337*** (<.001) | 0.423*** (<.001) | 0.115*** (<.001) |
| *Wages:* | | | |
| All workers | 0.011 (0.698) | 0.078*** (0.006) | -0.042 (0.139) |
| Low skilled workers | -0.088*** (0.002) | 0.004 (0.873) | -0.111*** (<.001) |
| Medium skilled workers | -0.039 (0.163) | 0.046 (0.106) | -0.080*** (0.004) |
| High skilled workers | -0.028 (0.328) | 0.066** (0.019) | -0.080*** (0.004) |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers and more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Notes: *P value*s within parentheses. *** (respectively ** and *) stands for significance at a 1% (respectively 5 or 10%) level.

**Table 9c.** Job flows and its determinants. Pearson's correlation coefficients.
Panel 3 for 'All workers'.

| Variables / Type of reallocation | JRR | JCR | JDR |
|---|---|---|---|
| *Establishment features:* | | | |
| Average number of workers in an establishment | -0.327*** (<.001) | -0.309*** (<.001) | -0.167*** (<.001) |
| Small estab. (< 20 workers) | 0.454*** (<.001) | 0.398*** (<.001) | 0.255*** (<.001) |
| Firms with more than one establishment | -0.181*** (<.001) | -0.115*** (<.001) | -0.135*** (<.001) |
| *Performance indicators:* | | | |
| **Lagged establishment profit ratio** | **0.074*** (0.002)** | **0.060** (0.012)** | **0.046* (0.058)** |
| Value added growth rate | 0.048** (0.046) | 0.026 (0.278) | 0.039* (0.100) |
| **Labor productivity** | **0.004 (0.857)** | **0.004 (0.854)** | **0.002 (0.934)** |
| *Capital intensity:* | 0.056** (0.020) | -0.001 (0.956) | 0.070*** (0.004) |
| *Variation in employment* | -0.038 (0.118) | 0.214*** (<.001) | -0.209*** (<.001) |
| *Employment:* | | | |
| Part of women | 0.240*** (<.001) | 0.237*** (<.001) | 0.115*** (<.001) |
| Part of workers aged less than 30 | 0.330*** (<.001) | 0.425*** (<.001) | 0.082*** (<.001) |
| *Wages:* | | | |
| All workers | -0.044* (0.068) | 0.028 (0.248) | -0.075*** (0.002) |
| Low skilled workers | -0.111*** (<.001) | -0.020* (0.407) | -0.121*** (<.001) |
| Medium skilled workers | -0.081*** (0.007) | -0.005 (0.846) | -0.103*** (<.001) |
| High skilled workers | -0.062*** (0.009) | 0.025 (0.303) | -0.096*** (<.001) |

Sources: AROME, ORME and SEQUOIA (*Acoss-Urssaf*) databases, DADS and FICUS (*Insee*).
Field: Firms employing 10 workers and more and coming from the private non-farm business and semi-public sectors over 2002-2005.
Notes: *P value*s within parentheses. *** (respectively ** and *) stands for significance at a 1% (respectively 5 or 10%) level.

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