Employment Fluctuations, Job Polarization and Non-Standard Work: Evidence from France and the US *

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Abstract

Using annual and quarterly labor market data from the US and France, we study the interactions between job polarization and non-standard work along the business cycle and derive four stylized facts. First, changes in aggregate hours are mainly driven by fluctuations in per-capita employment rather than hours worked per worker. Second, recessionary drops observed in aggregate hours are, to a large extent, due to the disappearance of routine work. In the US, the fall in routine standard employment accounts for most of the decline in aggregate hours, whereas in France, routine jobs losses in both standard and non-standard work matter. Third, the dynamics of routine standard employment are driven by flows from and into unemployment in both countries. Fourth, the dynamics of routine non-standard work differ across countries. In the US, fluctuations in routine non-standard employment is driven by inflows from routine standard work, while, in France, changes in routine non-standard work are accounted for by ins and outs from unemployment. Our findings support the view that within-employment reallocation, through the use of non-standard work, is an alternative margin of adjustment in the US. This is not the case in France and flexibility is achieved by adjusting hiring and separations of standard and non-standard work. In bad times, reduced stepping stones contribute to the fall in routine standard employment.

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1 Introduction

Job polarization is a common feature of developed economies. Over the last 30 years, employment growth has been fast, not only in high-paid jobs (abstract, non-routine, cognitive tasks requiring creativity, problem-solving), but also in low-paid jobs (manual, non-routine job requiring human interaction, service occupation). Employment growth has decreased significantly among middling jobs (routine, repetitive, specific activities accomplished by following well-defined instructions and procedures), and those involving tasks that can be replaced by machines (Autor & Dorn (2013); Goos et al. (2009); Goos & Salomons (2014)). Task-Biased Technological Change (TBTC) is considered as one of the main drivers for job polarization.

While it is now well understood that job polarization has far reaching consequences on the labor market in the long-run, this phenomenon has also a strong cyclical counterpart, as TBTC affects labor market adjustments at business cycle frequency. Namely, in the US, job polarization takes place mainly during downturns: Jaimovich & Siu (2018) document that the bulk of job destructions corresponds to routine job losses which mainly occurred during recessions in the US, and unlike other occupations, routine employment never goes back to its pre-crisis level. Besides, job polarization has accelerated over the last recession: in particular, Autor (2010) and Brynjolfsson & McAfee (2011) highlight that the polarization process has been accelerated by the Great Recession, as many more middle-paying jobs were shred relative to professional jobs and jobs in personal services. In addition, Foote & Ryan (2015) show that job losses during the Great Recession were mainly concentrated among middle-skill workers, the same group that has suffered the most from the disappearance of routine jobs.

In this paper, we focus on the labor market adjustments induced by job polarization in France and the US. As routine jobs are due to disappear in the long-run in both countries, firms may use several dimensions to adjust the total number of hours worked, as an alternative to creating or destroying a job: firms can vary the intensive margin (hours per worker) as well as the extensive margin (the number of workers). In a European context, firms can also use a short-term contract. More generally, firms can use different types of non-standard forms of work (part-time or short-term contract) to adjust their labor force: both enable firms to change the total number of hours worked instead of incurring the costs related to hiring and firing workers on “regular” (i.e. long-term) contracts. The comparison between France and the US allows to highlight the impact of labor market regulations on labor market adjustments in a context of job polarization. This dimension
has received little attention in the literature. The OECD (2015) points out that a greater use of ICT and structural changes in employment foster “atypical” forms of work. Growing levels of non-standard work (hereafter “NSW” or “NS”), such as part-time work or work on temporary contracts, raise policy concerns on job safety, earnings and income inequality. The OECD (2015) suggests a connection between technological changes in the prevalence of NSW. We then investigate in this paper the relationship between job polarization and NSW.

We first use yearly data (US CPS data and French Labor Force Survey) since the early 1980s to investigate the behavior of aggregate per-capita hours, defined as the product of the extensive margin (employment-to-working age population ratio) and the intensive margin (weekly hours per worker). The aggregate number of hours in the economy is decomposed into 12 components: 6 per-capita employment levels (3 tasks: abstract, routine and manual jobs, 2 types of form of employment NSW, SW within each tasks) and 6 hours per worker (weekly hours per worker in each type of task and job). Using counterfactual exercises, we study 4 recessionary episodes in the US and 5 episodes in France.

We establish that

**Fact 1:** In France and the US, in the past four decades, changes in aggregate per-capita hours has been mainly driven by changes in per-capita employment rather than by changes in weekly hours per worker. The only exceptions is the French 2011 crisis when hours per worker actually played a leading role in accounting for changes in French aggregate hours worked.

**Fact 2:** In recession, the fall in per-capita routine employment explains the bulk of the drop in aggregate hours in both countries. The 2 countries differ in the form of employment that is adjusted in bad times:

- In the US, the drop in standard routine employment is striking in recession, while employment in NSW tends to increase in recession in all task groups. As a result, in the US, the share of NSW spikes in recessions in all task groups.

- In contrast, in France, routine jobs are lost in standard and non-standard work. As a result, the cyclicality of NSW does not display any regular pattern in French recessions. The contribution of job losses in NSW has been sizable in the 1983, 2008 and 2011 recessions.

- In both countries, the main driver for changes in hours per worker lies in routine standard employment.
As routine jobs appear as a major driver for the understanding of aggregate hours, we investigate the driving forces behind per-capita routine employment using worker flows. We develop a Markov model linking workers’ transitions across labor market status to the evolution of observed per-capita employment stocks. Due to the lack of available data in France, we build quarterly worker flows from 2003Q1 to 2017Q4 and propose a variance decomposition on standard and non-standard routine employment. We then conclude that

**Fact 3:** In both countries, RS (Routine Standard) per-capita employment is mainly driven by cyclicality in transitions to/from unemployment (more job losses and less job finding in bad times). As for the within transitions,

- in recessions, RS falls in the US because more RS workers become RNS (more "downgrading")
- while, in bad times, in France, RS falls because less RNS workers become RS workers (less "stepping stone")

**Fact 4:** The countries differ along the behavior of RNS (Routine Non Standard) employment.

- In the US, RNS *increases* in recession. RNS appear to be mainly a short-term transitions to/from standard routine employment. In particular, the cyclicality of inflows from RS to RNS plays a leading in accounting for RNS fluctuations. In the 2008 recession, RNS increased in the US. The increased “downgrading” (from RS to RNS) contributed to the rise in RNS.
- In contrast, in France, RNS employment *falls* in recession. RNS is driven by the high cyclicality of job finding (40%) and to a lesser extent job losses and non participation (approx. 20% each).

Our findings support the view that within-employment reallocation, through the use of non-standard work, is an alternative margin of adjustment in the US. In bad times, more standard workers switch to NSW. In France, flexibility is achieved by adjusting hiring and separations of standard and non-standard work. Recessions are times when opportunities of stepping stones from SW to NSW are reduced.

Our paper is potentially relevant to research in macro and labor economics. The data and our stylized facts may be used as an empirical background to discipline theoretical models.
of labor market adjustment along the extensive and intensive margin across countries. The job polarization process offers an opportunity to revisit how firms proceed to this trade-off when faced with this strong technological trend. Our study of NSW also provides a first look at how firms use of this flexibility in a context of technological change.

The paper is organized as follows. We relate to the literature in section 2 and discuss the main theoretical insights related to our findings in section 3. We then present the data (section 4) and decompose the changes in hours worked for France and the US since the early 1980s in section 5. Finally, we study the dynamics of routine employment and NSW in both countries in Section 6. Section 7 concludes.

## 2 Related literature

Our paper investigates the interaction between margins of labor adjustment (extensive and intensive margins), job polarization and non-standard work in a long-run perspective as well as during cyclical swings. To our knowledge, this is the first paper that investigates all these dimensions. In doing so, our work relates to four strands of the literature.

The paper relates to the literature on the behavior of the extensive and intensive margin in the long-run (Ohanian & Raffo (2012), Van Rens (2012), Blundell et al. (2013), Langot & Pizzo (2019), among others) and along the business cycle (Kudo et al. (2019), Rogerson & Shimer (2011), among others). Facts 1 and 2 of our paper provide insight on labor market adjustments along the intensive and extensive margins in a context of polarizing employment, by taking into account NSW. Borowczyk-Martins & Lale (2019) proposes an interesting methodology of variance decomposition. We use their methodology in section 5. With respect to their paper, our originality lies in looking at the extensive and intensive margins, while their paper focuses on the intensive margin. In addition, we extend their analysis by looking at job polarization and NSW. As we need to look at per-capita employment, the economic environment becomes non-stationary. We then adapt Borowczyk-Martins & Lale (2019)’s decomposition to look at deviations from trend, which allows to identify disproportionate changes in per-capita employment with respect to trend in cyclical swings. As we focus on job polarization and NSW, which are induced by technological and institutional secular drifts, the removal of the trend is needed before performing variance analysis in recessionary episodes.

The second strand of literature studies job polarization. Cortes et al. (2017) matched individual-level CPS data to study the decline in middle-wage routine occupations during
the last 30 years. They identified workers’ transitions that contributed the most to the disappearance of routine employment. Their paper relates to section 6 of our work. Few papers look at job polarization in a short-run perspective (Jaimovich & Siu (2018), Foote & Ryan (2015), Cortes et al. (2014)). We subscribe to their view that job polarization, driven by long-run technological trends, can actually affect cyclical job losses. We contribute to this line of research by looking at the intensive margin, while previous studies looked at changes per-capita employment across task groups. Our results (Facts 1 and 2) confirm that the stress on the extensive margin is relevant in the understanding of labor market adjustments in polarized labor environment. However, Fact 2 suggests that some attention shall also be paid to adjustments in hours per worker in routine standard jobs in France, especially in recent years. In addition, these studies focus on US data, thereby discarding the issue regarding the effect of labor market institutions on job polarization. Our paper bridges this gap by looking at NSW.

The third one relates to the papers studying the cyclicality of worker flows in the US (Hall (2005), Shimer (2012), Elsby et al. (2010)) or European countries (Smith (2011), Le Barbanchon et al. (2015)), with non standard work (whether part-time work, as in Borowczyk-Martins & Lale (2019), Fontaine et al. (2018); or temporary contracts, as in Silva & Vazquez-Grenno (2013), Le Barbanchon et al. (2015), Limon (2017)). We extend their work by looking at job polarization in France and in the US. We thereby illustrate the impact of this long-term phenomenon on short-run employment changes, especially in a dual labor market such as in France.

Finally, our paper also relates to the literature studying the divide between standard and non standard contractual arrangements (such as, among others, Smith (2007), Caggese & Cunat (2008), Cao et al. (2010), Berton & Garibaldi (2012), Macho-Stadler et al. (2014), Cahuc et al. (2016)). To the best of our knowledge, the role of job polarization in explaining this divide has not been investigated yet. Job polarization offers an opportunity to study how firms use NSW to adjust to this major economic trend. This is also highly relevant in the policy debates on labor market reforms, especially in Europe.

3 Economic intuitions

Our paper highlights that the changes in per-capita employment are of primary importance in accounting for fluctuations in aggregate hours. Let us provide theoretical insights regarding the relationship between NSW and job polarization. This section aims at providing economic intuitions behind the link between labor market duality and job polar-
Long-term labor re-allocation. First, let us recall the long-term labor re-allocation induced by job polarization, as described in the seminal paper by Autor & Dorn (2013) and summarized in Figure 1. Due to technological progress, machines can replace routine workers, which reduces the demand for routine workers and increases the demand for abstract workers. Manual tasks cannot be replaced by machines as their job requires social interactions and manual dexterity, two dimensions in which human still outperform machines. Displaced routine workers re-allocate to manual jobs. As abstract employment expands, the demand for manual services increases (for example, the increase in female employment fuels the demand for cleaning services and child care, which as manual jobs). The relative price of manual services increases, which raises the wage in manual jobs and creates the incentive to switch from routine to manual jobs.

Recessions accelerate the process. According to Autor & Dorn (2013), this narrative describes the long-term labor re-allocation inherent to job polarization. Recessions accelerate the process. To see why, let us consider a search and matching model. In this framework, jobs are maintained as long as the expected gains from the match are
positive. Technological progress creates a downward decline in routine workers’ productivity. Figure 2 depicts the evolution of the value of a filled routine vacancy $J^R$ over time. Due to technological changes, the expected gains from a routine match are declining with time. The slope of the downward trend on $J^R$ depends on several elements such as labor market institutions, speed of technological progress and elasticities of substitution / complementarity in the production technology between machines, routine and abstract jobs.

Figure 2: Job polarization accelerates during a recession

This downward trend in $J^R$ determines the life span for the routine job. As in Mortensen & Pissarides (1998), beyond period $T$, the match is not profitable anymore. The match is dissolved. The grey area on Figure 2 illustrates the fact that there are a range of routine jobs in this situation. In the aftermath of the recession, the expected gains from all routine jobs $J^R$ shift downward, thereby accelerating the disappearance of routine jobs: jobs that were expected to disappear later actually disappear in recession. This intuition is consistent with the large swings in routine jobs during recession that we will find in the data (Figure 5). Obviously, in recession, the fall in the expected gains from a job also affect abstract and manual jobs. So, job losses also occur in abstract and manual jobs in the recession. However, the values of a filled vacancy on abstract and manual jobs are increasing over time. As a result, job losses in abstract or manual labor does not respond as much as for routine jobs that face a downward trend in $J^R$.

Notice that search and matching models are general equilibrium models. Shifts in labor demand affects worker flows across jobs. In turn, worker flows affects labor market tensions summarized as the ratio of vacancies to the pool of unemployed workers, which in turn modifies firms’ hiring decisions. As a result, job polarization effects labor stocks and
worker flows, the causality running both ways.

**Interaction between polarization and NSW in the long run.** In the economic mechanisms discussed in Figure 1, when firms adjust labor, they actually need to decide whether labor shall be adjusted with SW or NSW: Shall the cut in routine employment affect more routine in standard form of employment or in non-standard form of employment? As the standard form of employment is more costly, less flexible, we expect routine job losses to occur in SW, which in indeed the case in Figure 5, especially in routine jobs. Shall the job creation in manual jobs occur with standard contract or non standard contract? If the expected gains from manual jobs are perceived as steady (boosted in the long-run by more demand for cleaning services, beauticians, janitors, child care, ..), standard form of employment can be used (as it is the case especially in the US in Figure 1). The extent of flexibility inherent to NSW could also have feedback effects on the extent of labor re-allocations in the job polarization process. Namely, the type of contractual arrangement chosen by firms when creating new jobs differs substantially between France and the US, with France creating many more jobs in NSW than the US (Cahuc et al. (2016)). Given that routine jobs are due to disappear in the long-run, it may be optimal for firms to create such jobs using non standard rather than standard contractual arrangements, in particular in a country where it is difficult to adjust the labor force, such as France. In a more flexible, US type of environment, the incentives to create jobs in NSW are much lower: Routine jobs can thus be created using standard work as they can be destroyed at a much lower cost. Besides, those who lose their jobs have a very high chance to be offered a job in NSW rather than in NSW in France, given the very high share of NSW in job creations. Hence, the former routine workers losing their jobs in SW will most likely reallocate themselves in NSW in France vs SW in the US. Following this line of reasoning, job polarization may contribute to the rise in dualism observed in France. In this paper, we investigate this issue and study both the dynamics of Routine employment (in SW and NSW) in France and the US, and the dynamics of NSW induced by the labor market flows of each country. As a result, job polarization and NSW are deeply intertwined.

**Interaction between polarization and NSW in recession.** NSW in recessions responds to two opposite forces. On the one hand, whatever the task, NS jobs are most likely those yielding lower average expected profits compared to standard jobs. NSW are also the first displaced jobs in recession. On the other hand, NSW tends to rise during crisis. This fact may be interpreted as evidence of a strong substitution between SW and NSW during downturns.
Figure 3 illustrates the substitution effect. Figure 3 depicts the changes in total employment and in the divide between SW and NSW following a recession. In good times, for each task group, firms create jobs either in SW or NSW, depending on which one is the most profitable contractual arrangement. When a recession hits, the profitability of each type of contract is negatively impacted, leading to net job losses. On top of the net job losses by task, the frontier between SW and NSW is shifted: a substitution between SW and NSW is also at work, as some of the jobs which would have been created in SW before the beginning of the recession are now created in NSW. When this substitution effect outweighs the number of job losses, the recession may thus even lead to a rise in employment in NSW.

Notice that the converse mechanism may prevail during recoveries: the creation of each type of contract becomes more profitable and as a result, total employment rises. On top of that, the divide between SW and NSW shifts towards more SW. As a result, when the substitution effect dominates, NSW spikes in recession, then declines in the recovery.

These mechanisms are magnified in jobs that are perceived by firms as unstable, or with uncertain future profits, such as routine and manual jobs. We will see in section 6 indeed that the routine non-standard margin is used along the business cycle by French firms, especially the lower transformation of contracts from NSW to SW in bad times. US firms also use the within mobility along the business cycle, but, with spikes in “downgrading” in recession (standard workers becoming NSW workers).
4 Data and definition

4.1 Data

**French LFS.** We use the French LFS (*Enquête Emploi*) from 1983 to 2017. The survey is designed to be representative of the French population. We use the information on individual labor market status, occupation, hours worked, and labor contract (permanent vs. temporary). The survey was redesigned in 2003. Prior to 2003, the survey was annual, and individuals were surveyed each year for three years in a row. Since 2003, the survey has been quarterly and thus better suited for our purpose, i.e. the measure of flows and transitions into and out of routine employment around the Great Recession. Accordingly, we use the annual LFS from 1983 to 2017 for the analysis of aggregate hours (section 5) and the quarterly LFS from 2003Q1 to 2017Q4 for the analysis of worker flows (section 6).

**US CPS data.** The Current Population Survey (CPS) Basic Monthly Data provides information on labor market status. The survey is conducted on a monthly basis and collects data on labor status, employment and occupation. A housing unit in the CPS is interviewed for four consecutive months and then dropped out of the sample for the next eight months and is brought back in the following four months. The CPS Montly Outgoing Rotation Group (MORG) focuses on households that are about to rotate out of interviews for eight months or indefinitely. They are asked additional labor questions including respondent’s periodicity of pay, hourly wage, usual weeks worked per year at that rate, usual hours worked a week, and overtime pay. In order to have of sense of the long term trends in job polarization, we use CPS MORG data from the NBER website after pooling all months for each year and look at annual hours worked in the US between 1979 and 2017 in section 5.

We then investigate US worker flows in section 6. In order to produce US time-series that are comparable with French quarterly labor market transitions, we consider period between 2003Q1 and 2017Q4 and compute quarterly transitions as in Borowczyk-Martins & Lale (2019) using CPS basic monthly data. We compute quarterly transition probabilities by linking the 1st to the 4th (or 5th to 8th) interview of CPS respondents. We get monthly time series of quarterly transition probabilities. We then obtain quarterly time-series by taking the average of the monthly values. At the end of the process, we get quarterly time series of quarterly workers’ transition probabilities, which are comparable
4.2 Definitions

**Hours.** The sample consists of individuals aged 16 to 64. The employed population includes all workers in non-farm business sector, excluding unpaid family workers. The data provide two measures of hours: (i) hours worked during the survey’s reference week (actual hours) and (ii) usual hours worked per week, which refers to the usual workers’ week schedule, including overtime. Both questions relate to the main job. As in Borowczyk-Martins & Lale (2019), we analyse the changes in actual hours. This is also particularly relevant when looking at business cycles. We then use usual hours to determine workers’ employment status. Following the BLS, survey respondents are categorized as full-time workers if they usually work 35 hours a week or more.  

**Non-standard work (NSW).** According to the OECD (2015), NSW is defined as all employment relationships that do not conform to the “norm” of full-time, regular, open-ended employment over a long time span, with a direct relationship between employer and employee. A job is considered “non-standard” if its features differ from those of standard employment.

In our sample, such a broad definition of non-standard employment includes two partly-overlapping employment types: temporary or fixed-term contracts and part-time work. These forms of employment provide more flexible working conditions, thereby allowing firms and workers to potentially reach a more efficient use of resources. NSW could also be viewed as fostering “adjustable” or “flexible” labor allocations. We use the OECD terminology of “non-standard” employment as it is also used by other international organizations (International Labour Organisation, World Bank).

The type of labor contract is not documented in the US survey: the distinction between permanent and temporary contract is not relevant in the US as firing costs are very low and independent of the type of labor contract. As a result, in the US, all part-time workers fall under “non-standard workers” and all full-timers under “standard” employment.

In contrast, in France, the distinction between permanent versus fixed-term contract is

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2In the US, we use CPS data on hours worked and usual hours from the NBER website. See Borowczyk-Martins & Lale (2019) for further analysis on survey data on hours in the US. We did not modify the data to take into account the 1994 re-design. First, Figure 8 in Appendix B does not display any visible break in 1994. Secondly, our exercise in section 5 focuses on de-trended data during recessionary episodes that occurred well before and well after the break.
crucial in the employment relationship as it determines payroll taxes, firing costs and benefits. In the French survey, we use the survey question on the type of contract (Contrat à Durée Déterminée CDD versus Contrat à Durée Indéterminée CDI) to determine workers’ status. Non-standard employment in France includes all part-timers (whether on a permanent or temporary contract) and full-timers with fixed-term contracts.

Tasks. We follow the literature by using occupational data to categorize workers into task groups (see Appendix A for further details). The occupation codes changed in 2011, when the CPS transitioned between the 2000 and 2010 classification systems. We use Cortes et al. (2017)’s mapping of each occupation code across the five occupation systems into the three task groups. Cortes et al. (2017) consider only individuals aged 16 and more. Occupations in farming, fishing, and forestry are excluded.

We repeat the US procedure on French data in order to ensure comparability across countries. As in Jaimovich & Siu (2012), we consider only individuals aged 16 and more. As for occupations, we apply the procedure used for US data. Occupations in farming, fishing, and forestry are excluded. Occupations are categorized into three groups, each corresponding to the main tasks performed on the job. We base our categorization on the two-digit occupational codes. We aim at matching the same assignment of occupations to tasks as in Jaimovich & Siu (2012).

5 Understanding the behavior of aggregate hours in recessions

5.1 Trends in annual aggregate hours per capita: driven by changes in per-capita employment

5.1.1 Measurement: per-capita employment and hours per worker

In this section, we present the methodology guiding our analysis of changes in hours and employment by task and form of employment in France and the US, using annual data since the early 1980s. To this aim, let $H_t$ be the annual per-capita aggregate hours defined as the number of total hours worked divided by the working-age population (to neutralize

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3 Harrigan et al. (2016) argue that two-digit codes used in French data are economically meaningful. Each code is the aggregation of 10 to 20 four-digit sub-occupations with stark differences in the susceptibility of jobs to automation.
changes in population size). We have \( H_t \equiv \frac{E_t}{P_t} h_t \) where \( E_t \) denotes total employment (in thousands), \( P_t \) working-age population at period \( t \) (in thousands) (16-64 years old), and \( h_t \) average number of weekly hours worked per worker. In the sequel, we are interested in the changes in \( H_t \) which may stem from (i) changes in the extensive margin in tasks Abstract, Routine and Manual (henceforth, \( A, R, M \)) and form of employment employment (\( S \) standard vs non-standard \( NS \)) and (ii) changes in the intensive margin as captured by weekly hours worked per worker in each job type. \( H_t \) can thus be decomposed by tasks and contractual arrangement as follows:

\[
H_t = \omega_{A,S} h_t^{A,S} + \omega_{R,S} h_t^{R,S} + \omega_{M,S} h_t^{M,S} + \omega_{A,NS} h_t^{A,NS} + \omega_{R,NS} h_t^{R,NS} + \omega_{M,NS} h_t^{M,NS} \tag{1}
\]

where \( \omega_{task,job} \) captures the number of workers in a specific task and type of employment, divided by working-age population \( P_t \) while \( h_{task,job} \) measures the weekly hours per workers in a specific task and type of contracts. For example, \( \omega_{R,S} \) measures per capita employment in routine jobs on standard employment contract and \( h_{R,S} \) the average weekly hours on this specific job.

5.1.2 Per capita employment drives fluctuations in aggregate hours

Counterfactuals. We use counterfactual exercises to assess the contribution of the extensive versus intensive margins to changes in aggregate hours. Let us denote \( \overline{H}_{task,job} \) per-capita aggregate hours predicted by time-varying \( x_{task,job} \), holding other elements in equation (1) fixed to their sample mean. Figure 4 plots aggregate annual hours and counterfactuals predicted by (i) time-varying per-capita employment \( \overline{H}_\omega \) and (ii) time-varying hours per worker \( \overline{H}_h \). Let us first have a look at the US data (top panel, solid line). On average, 73 % of the US working-age population is working, each of them is at work 38.9 hours per week, which yields an average \( H \) of 28.4. Aggregate hours are pro-cyclical, with a sharp drop observed during recessionary episodes. As for the US counterfactuals (dashed and dashed dotted lines), the time-series based on changes in per-capita employment \( \omega \) closely tracks observed aggregate hours, which suggests that aggregate hours are mainly driven by changes in the extensive margin.\(^4\) Hours per worker \( h \) seem to have played less significant role in driving changes in aggregate hours.

In France (Figure 4, bottom panel, solid line), observed aggregate hours display a down-

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\(^4\)One might think that our result is not consistent with Borowczyk-Martins & Lale (2019)’s result. However, their paper focuses on hours per worker (the intensive margin) while our paper looks at aggregate hours (thereby combining the extensive and the intensive margin). As a result, they lay stress on changes in the part-time employment share while we look at per-capita employment.
Figure 4: Aggregate per-capita hours $H$ and counterfactuals

Annual data. US CPS MORG (1979-2018). French LFS (1983-2017). Shaded areas indicate recessionary episodes (US NBER dates. French ECRI dates). “Data”: Aggregate per-capita hours. “Fixed hours”: Using equation (1), counterfactual aggregate hours predicted by changes in per-capita employment $\omega$ only. All hours per worker are set at their respective sample mean. “Fixed empl”: Using equation (1), counterfactual aggregate hours predicted by changes in hours per worker $h$ only. All per-capita employment levels are set at their respective sample mean.
ward sloping trend. This due to two effects: the employment rate $\frac{E}{P}$ declines from 1983 until the late 1990s combined with the fall in weekly hours per worker which accelerates after the late 1990s, in the wake of regulations on weekly working time ("35 heures" launched by Aubry regulations in 1998). As in the US, aggregate hours displays a procyclical behavior with sharp drops in aggregate hours in recession, mainly driven by changes in per-capita employment, including during recessionary episodes. Notice that, in the 2011 crisis, the sudden decline in aggregate hours is closely tracked by the counterfactual predicted by changes in hours per worker (dotted line). The last French crisis suggests a larger contribution of hours per worker, rather than per-capita employment.

**Fact 1:** In France and the US, in the past four decades, changes in aggregate per-capita hours has been mainly driven by changes in per-capita employment rather than by changes in weekly hours per worker. The only exceptions is the French 2011 crisis when hours per worker actually played a leading role in accounting for changes in French aggregate hours worked.

**Looking at the data on per-capita employment: job polarization at work** As per-capita employment appears as a major driver for changes in aggregate employment in both countries (with the exception of two recent French recessions), we now focus on employment stock data.\(^5\)

Figure 5 displays the evolution of employment per capita in both countries. Let us first focus on the graphs of the left column ($\omega^A, \omega^R, \omega^S$). In both countries, job polarization is at work: the number of abstract and manual jobs $\omega^A_t$ and $\omega^M_t$ are expanding, while the number of routine jobs $\omega^R_t$ declines over the period. The extent of the phenomenon is slightly different across countries. In the US, at the beginning of the sample, less than 20% of the working age population are employed in abstract jobs, less than 10% in manual jobs, and more than 40% in routine jobs. Routine jobs offered the vast majority of employment opportunities in the late 1970s. In 2018, routine and abstract jobs employ equal percentage of the working age population (around 30%) while per-capita employment in manual jobs expanded to reach about 13%. In France, in the early 1980s, routine jobs employ nearly half of the working-age population, while 11% are in abstract jobs and 3.5% in manual jobs. In 2017, around 40% of the working age population is in routine employment, versus less than 20% in abstract jobs, and around 5% in manual jobs. In spite of the continuing expansion in abstract jobs, employment in routine jobs in 2017 is still much larger than

\(^5\)For comments on hours per worker, see Appendix B.
in abstract jobs, which is not the case in the US in 2018 where routine and abstract jobs equally employ around 30% of the working age population.

Figure 5: Components of total hours $H : \omega$ Employment per capita, by task and job type


In terms of cyclicality, while all types of jobs disappear in hard times, US routine employment tends to display larger employment drops in recessions than abstract and manual jobs. Conclusions are similar in France.

**NSW Employment.** The middle and right panels of Figure 5 display, for each task group, the divide between standard and non-standard work. In the US, we find that the job polarization trends are similar for each type of contractual arrangement and follows the same evolution as the corresponding employment per capita: the trend is rising for
abstract and manual jobs, and falling for routine jobs. Figure 6 depicts the share of NSW within each task and provides interesting insights about the interaction between polarization and NSW. On average, over the sample period, 34% of manual workers are employed in non-standard work, which is twice larger than their routine counterpart (15%) and more than thrice larger than abstract workers (approximately 10%). While there is no trend in the share of NSW in the US for abstract and routine workers, the prevalence of NSW seem downward sloping as the expansion in manual jobs occur mainly through standard employment (bottom panel of Figure 6). This picture is consistent with Autor & Dorn (2013)’s model. With the rise in the demand for manual jobs, the relative price of manual services expands in the economy. Firms who hires manual workers expect steady future flows of profits, which leads them to hire workers employment using standard form of employment. It is also noticeable that, for all task groups, employment per worker in NSW tends to move countercyclically, and more particularly, rises markedly following the Great Recession (Figure 6). In contrast, employment per worker in SW move procyclically and decreases strongly following the Great Recession for all task groups.

Figure 6: Share of non-standard work by task

Figure 5 reveals that, in France, NSW is not as countercyclical as in the US. In particu-
lar, we do not find any sharp increase in NSW during French recessionary episodes and especially the Great Recession. Overall, the cyclicality of NSW in France is less clear-cut while in the US non-standard forms of employment exhibit spikes during recessions. With respect to section 3, such a pattern suggests strong substitution effects in the US in recessions. Another striking difference with the US labor market is the upward trend followed by NSW in France. Such a secular evolution is common to all task groups, and at the end of our sample period, NSW represents 30% of total employment in France versus 13% in the early 1980s. The prevalence of NSW in each task group is however the same as in the US: the share of NSW in manual occupations in France is on average larger (56.7%) than in abstract and routine jobs (18.2% and 21.7% respectively).

5.2 Analyzing recessionary episodes since the early 1980s

The analysis of section 5.1.2 highlights that variations in aggregate hours are largely explained by changes in per-capita employment (Fact 1). This section provides more insight on this claim by quantifying the contribution of fluctuations in per-capita employment by task and labor contract during recessionary episodes covered by our sample. This lead us to Fact 2.

5.2.1 Methodology

Counterfactuals. We use counterfactual exercises to assess the contribution of the extensive versus intensive margin to changes in aggregate hours in the spirit of Borowczyk-Martins & Lale (2019). As we have 12 time-varying elements in equation (1) (six $\omega$ and six $h$), we compute 12 counterfactual aggregate hours that are the predicted fictitious time-series of aggregate hours when only 1 element is allowed to vary over-time, holding the other 11 elements fixed to their sample mean. Let us denote $H^{\omega,job}_{task}$ the per-capita aggregate hours driven by element $x^{\omega,job}_{task}$ in equation (1).

Deviation from trends. Job polarization and drifts in labor market institutions (especially in France) generate trends in employment per capita $\omega^{job}_{task}$. The French regulation

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$H^{R,S}_{task} = \omega^A_S h^A_m + \omega^R_S h^R_m + \omega^M_S h^M_m + \omega^A_NS h^A_NS + \omega^R_NS h^R_NS + \omega^M_NS h^M_NS$

where “m” refers to the sample mean.

---

6For instance, $H^{R,S}_{task}$ is the counterfactual times series of per-capita aggregate hours predicted by time-varying routine per-capita employment in standard jobs, such that
on working time also affects weekly hours per worker. As we are interested in business cycle changes in aggregate hours, we HP-filter $H_t$ and the 12 counterfactuals using the recommended smoothing parameter for annual data (6.25). We then analyze disproportionate changes in hours per worker and employment per capita, with respect to long-term trends.\footnote{Notice that we focus on employment per capita such that $\sum \sum \omega_{t,job}^{task,job} = \frac{E_t}{P_t} \cdot \omega_{t,job}^{task,job}$. We do not look at employment share (employment for each type of jobs in total employment). In doing so, we differ from Borowczyk-Martins & Lale (2019) and job polarization papers such asAutor & Dorn (2013). Indeed, as pointed out by Albertini et al. (2017), focusing on employment share could be misleading, especially when total employment goes down. Employment shares for a given task could increase just because aggregate employment declines. For instance,Albertini et al. (2017) point out that the expansion in manual jobs, measured as employment share, in France in the late 1980s is partly driven by the fall in aggregate employment. A lower change in manual jobs is actually observed when measured as employment per capita. In our view, the analysis of employment per capita, rather than employment share, allows to properly capture changes in the extensive margin for each type of job. Cortes et al. (2014) and Cortes et al. (2017) also focus on changes in employment per capita.}

Quantifying the contribution of changes in per-capita employment and hours per worker. In order to decompose changes in per-capita employment, we compute changes in per-capita hours around recessions. The cumulative change is per-capita total hours between period $s$ and $t$ is captured as

$$\Delta H^C_{s,t} = \Delta H^C_t - \Delta H^C_s$$

where $H^C$ refers to the HP-filtered $H_t$. We can then write $\Delta H^C_{s,t}$ as driven by the sums of changes in HP-filtered counterfactuals. We quantify the contribution of each element to changes in per-capita total hours between period $s$ and period $t$ as

$$\gamma_{s,t}^{x,task,job} = \frac{\overline{H}_t^{C,x,task,job} - \overline{H}_s^{C,x,task,job}}{\Delta H^C_{s,t}}$$

where $\overline{H}_t^{C,x,task,job}$ denotes the HP-filtered counterfactuals hours predicted by changes in $x^{task,job}$. For example, $\overline{H}_t^{C,\omega,R,S}$ denotes the HP-filtered counterfactual aggregate hours predicted by changes in per-capita employment in routine standard employment alone, the other elements are kept at their sample mean.\footnote{We check that $\sum \sum \gamma_{s,t}^{x,task,job} = 1$. In recession, per-capita total hours decline: $\Delta H^C_{s,t} < 0$. If element $x^{task,job}$ also drives a fall in per-capita total hours, then, we expect $\overline{H}_t^{C,x,task,job} - \overline{H}_s^{C,x,task,job} < 0$, such that $\gamma_{s,t}^{x,task,job} > 0$. $\gamma_{s,t}^{x,task,job} > 0$ measures the contribution of $x^{task,job}$ to changes in cyclical per-capita aggregate hours. Notice that $\gamma_{s,t}^{x,task,job}$ can be negative, thereby showing that changes in $x^{task,job}$ would predict increases in $H^C$ while the recession reduces $H^C$: $x^{task,job}$ does not contribute at all to changes
5.2.2 Fluctuations in aggregate hours during recessionary episodes

The US. Our US sample covers four recessions. Panel (b) in Table 1 presents changes in cyclical components of aggregate hours $\Delta H^C_t$, in percentage points as well as % of the sample mean of aggregate hours, over each recessionary episode (panel (a))\(^9\). Panel (c) in Table 1 reports the contributions of the changes in per-capita employment (by task and contract type), while panel (d) corresponds to the contribution of the changes in weekly hours worked per worker to the changes in aggregate hours. Panel (e) then summarizes the respective contributions of changes in aggregate employment per capita, $\gamma_\omega$, changes in the average number of weekly hours worked, $\gamma_h$. The last part of the Table splits $\gamma_\omega$ by task group and then by contractual arrangement.

The changes in aggregate hours are negative over the four recessionary episodes, which is consistent with the cyclicality we found in Figure 4. The most severe cyclical swing was the 2008 recession, with a 5.24% drop in aggregate hours, which is twice larger than the fall observed in the 1981 crisis (2.66%).

The comparison between $\gamma_h$ and $\gamma_\omega$ (panel (e)) shows that, on average, drops in per-capita employment account for more than 70% of the fall in aggregate hours in US recessions, except for the 2001 crisis which is exclusively explained by the extensive margin. Among the changes in per-capita employment, changes in routine employment - and more precisely routine standard employment $\omega^{R,S}$ - is by far the main contributor (panel (c)). Employment in NSW plays only a minor role compared to SW (panel (e), $\gamma_\omega^{NSW}$). Specifically, the sign of $\gamma_\omega^{NSW}$ is always negative. This is consistent with our theoretical insights of section 3, suggesting a strong substitution between NSW and SW during recessions which leads to an increase in NSW. This is particularly true for manual jobs since all contributions of $\omega^{M,NS}$ are negative (see panel (c) of Table 1.

Falls in hours per worker account for less than 30% of the decline in aggregate hours ($\gamma_h$, panel (e)). The contribution of the intensive margin is mainly due to a fall in weekly hours worked in routine standard jobs ($h^{R,S}$, panel (d)).\(^{10}\) In line with Jaimovich & Siu (2018), our decomposition exercise confirms that fluctuations in routine labor are central in cyclical aggregate hours $H^C$. As the sum of $\gamma$ equals 1, when one $\gamma$ is negative, we might also have some $\gamma > 1$ in absolute value.

\(^9\)For the US, we take the same NBER dates as in Borowczyk-Martins & Lale (2019) and follow their analysis by focusing on a 2 year-window. For France, we consider the dates of recession by ECRI. We focus on a 1-year window as the fall in aggregate per-capita hours is the steepest in the first year of the recession. In 2011, for the last French recession, we use a 2-year window as the changes in aggregate hours was actually very small in France in 2012.

\(^{10}\)We provide the graphical illustration of such results in Appendix C.
Table 1: Decomposition of changes in aggregate hours in recessions

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th></th>
<th></th>
<th></th>
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<td>-0.22</td>
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<tr>
<td>$\gamma_\omega^{NSW}$</td>
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<td>0.28</td>
<td>-0.27</td>
<td>-0.84</td>
<td>1.03</td>
<td>0.17</td>
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</tbody>
</table>

US CPS MORG, annual data, 1979-2018. French LFS, annual data, 1983-2017. In panel (a), “$\Delta H^C$ in %”, changes in cyclical aggregate hours as a % of the sample mean of aggregate hours. In panel (e), $\gamma_h = \sum_{r,t} \gamma^{A,job}_{r,t} \gamma_{r,t} \gamma^{M,job}_{r,t}$, $\gamma_\omega = \sum_{r,t} \gamma^{task,job}_{r,t} \gamma^{R,job}_{r,t}$, $\gamma_\omega_R = \sum_{r,t} \gamma^{R,job}_{r,t}$, $\gamma_\omega_A = \sum_{r,t} \gamma^{A,job}_{r,t}$, $\gamma_\omega_M = \sum_{r,t} \gamma^{M,job}_{r,t}$, $\gamma_\omega^{task,S} = \sum_{r,t} \gamma^{task,S}_{r,t}$, $\gamma_\omega^{NSW} = \sum_{r,t} \gamma^{NSW}_{r,t}$. Numbers in bold are commented in the text.
in the fall in aggregate hours observed during busts. Our approach however complements theirs as we show that routine employment, and especially routine standard employment, accounts for cyclical fluctuations at the extensive and the intensive margins, the former being by far dominant.

**France.** The right part of Table 1 presents decomposition results based on French data. As in the US, we observe that changes in aggregate hours are negative over the five French recessionary episodes. The most severe recession occurred in the early 1980s with a 2% fall in aggregate hours, closely followed by the recent 2011 crisis (1.84%). In contrast to the US economy, the 2008 crisis, with a -0.87% change in aggregate hours, was not the largest cyclical swing in France.

Table 1 suggests two types of labor market adjustments in French recessions. The first one occurred in the 1983, 1992 and 2008 recessions and is in line with US labor adjustments. During those recessions, labor market adjustments are mainly driven by drops in per-capita employment (in panel (e), $\gamma_\omega > \gamma_h$). As in the US, the fall in per-capita employment is explained by important changes in routine work. A look at the values of $\omega_{R,S}$ and $\omega_{R,NS}$ shows that both types of routine jobs are important. In particular, the contribution of routine SW is of first importance during the first two French recessions, while the one of routine NSW is dominant during the Great Recession. The second type of French labor market adjustments attribute a predominant role to variations in weekly hours per worker, especially in the 2011 recessions (panel (e), $\gamma_h > \gamma_\omega$). In 2002, the contribution of both margins is balanced with a dominant influence for the intensive margin ($\gamma_h = 0.54$). In 2011, variations in the intensive margin would actually predict a higher decrease in cyclical hours than the one we actually observe ($\gamma_h = 1.08 > 1$), while changes in per-capita employment ($\gamma_\omega = -0.08$) would actually predict a rise in aggregate hours, which is counterfactual. An analysis of the detailed contributions shows some common feature among adjustments occurring during in 2002 and 2011 recessions.

In particular, the fall in the intensive margin mainly comes from changes in weekly hours spent in routine standard work ($\gamma_{h,R,S}$, panel(d)). Our decomposition exercises also indicate that variations in abstract standard and routine non-standard work (for the 2011 recession) are also important in explaining cyclical changes along the intensive margin. The sizeable contribution of hours per worker in the 2011 French crisis is consistent with Fontaine et al. (2018)’s results. They show that cyclical changes in hours per worker has played a major role in accounting for fluctuations in French aggregate hours since 2003.

The response of NSW does not display any regularity in its sign (panel (e), $\gamma_{\omega,NSW}$). The
fall of NSW contributes to the understanding of the fall in aggregate hours in 1983, 2008 and 2011, but not in 1992 and 2002. This is consistent with Figure 6 showing any strong cyclicality in the share of NSW in France. With respect to our discussion in section 3, this suggests that the substitution effect does not always prevail in France.

**A focus on the Great Recession.** To fix ideas, we now examine in details labor adjustments in the Great Recession (columns (5) and (9) in Table 1). In both countries, the fall observed in aggregate hours was largely explained by job losses in routine per-capita employment.

In the US economy, cyclical changes of job losses in routine standard alone accounted for nearly 65% of the fall in aggregate hours while the contribution of routine non-standard was negligible. In contrast, in France, both forms of contractual arrangement mattered. The contribution of the changes in routine non-standard employment was even dominant ($\omega^{R,NS} = 0.82 > \omega^{R,S} = 0.50$).

Overall, the fall in non-standard work, whatever the task, was a good proxy for the recessionary decline in aggregate hours observed during the Great Recession in France ($\gamma_{\omega,NSW} = 1.03$). In contrast, in the US, variations in non-standard work would actually predict an *increase* in aggregate hours in the crisis. With a large drop in standard employment and an increase in non-standard work, the share of NSW in the US economy spikes in recession, which is consistent with Figure 6.

**Fact 2:** In recession, the fall in per-capita routine employment explains the bulk of the drop in aggregate hours in both countries. The 2 countries differ in the form of employment that is adjusted in bad times. In the US, the drop in standard routine employment is striking in recession, while employment in NSW tends to increase in recession in all task groups. As a result, in the US, the share of NSW spikes in recessions in all task groups. In contrast, in France, routine jobs are lost in standard and non-standard work. As a result, the cyclicality of NSW does not display any regular pattern in French recessions. The contribution of job losses in NSW has been sizable in the 1983, 2008 and 2011 recessions. In both countries, the main driver for changes in hours per worker lies in routine standard employment.
6 The dynamics of per capita employment

In this section, we look at the dynamics of job polarization and labor market duality using worker flows. We focus on the recent period 2003Q1-2017Q4 as worker flows as available only after 2003 in the French LFS.

6.1 Measuring worker flows by task and form of employment

We consider three labor market statuses: employment, unemployment (measured according to the ILO definition) and non-participation. When looking at employed individuals, their occupations are categorized into three groups, each corresponding to the main task performed on the job: abstract, routine or manual. The US data does not record any past occupation for non-participants. As a result, all US individuals categorized as non-participant are not assigned any task. We then treat French inactive individuals in the same way. In addition, for unemployed workers, even though French and US data provide information on their occupation in their most recent job, we decide to consider only one unemployment category, without distinguishing unemployment of workers with past occupation as abstract, routine or manual. We make this choice for 2 reasons: (i) past-occupation is not a 100% predictor of the occupation after re-employment (Sahin et al. (2014)), (ii) this choice reduces the size of the dynamic system which makes the interpretation of results more straightforward. In a nutshell, we classify individuals in each quarter into one of 8 mutually exclusive categories: SW employment in one of the 3 occupation groups (denoted A, R, M for non-routine Abstract, Routine, and non-routine Manual occupations, respectively); NSW employment in one of the tasks; unemployed (U); or not in the labor force (N).

We rely on a 8-state Markov model of labor market adjustments: “A” abstract employment, “R” routine employment, “M” manual employment, “U” unemployed and “N” not in the labor force. “S” and “NS” refers to standard and non-standard employment, respectively. Let us denote the corresponding stocks as

\[ X_t = (A_t, S_t, A_t, NS_t, R_t, S_t, R_t, NS_t, M_t, S_t, M_t, NS_t, U_t, N_t). \]

Hence, stocks evolve as

\[ X_t = \ell_t X_{t-1} \quad (2) \]

where \( \ell_t \) denotes a square matrix of size 8, whose elements \( \ell_{ij} \) capture the probability of transition from labor status \( i \) to labor status \( j \). Using quarter-to-quarter matched data, we compute gross flows across employment states. We then adjust the data along three dimensions. We first seasonally adjust gross flows using x12. As in Elsby et al.
(2015), we then compute transition probabilities that are consistent with the observed changes in stocks \((A, R, M, U, N)\) (correction for margin error). Finally, as gross flows provide transition probabilities observed at discrete points of time, in order to correct these measures for possible transitions occurring between consecutive surveys, we correct gross flows for time aggregation bias (Shimer (2012)). We then get instantaneous transition rates.

6.2 Average quarterly transition rates

Tables 2 and 3 report average quarterly transition rates for France and the US respectively.

Table 2: US: Average quarterly transition probabilities

<table>
<thead>
<tr>
<th>From:</th>
<th>A,S</th>
<th>A,NS</th>
<th>R,S</th>
<th>R,NS</th>
<th>M,S</th>
<th>M,NS</th>
<th>U</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,S</td>
<td>89.4</td>
<td>3.9</td>
<td>3.1</td>
<td>0.1</td>
<td>0.8</td>
<td>0</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>A,NS</td>
<td>28.3</td>
<td>51.6</td>
<td>0.5</td>
<td>3.2</td>
<td>0.4</td>
<td>1.9</td>
<td>4.3</td>
<td>10</td>
</tr>
<tr>
<td>R,S</td>
<td>2.9</td>
<td>0</td>
<td>84.9</td>
<td>5.2</td>
<td>1.2</td>
<td>0</td>
<td>3.6</td>
<td>2.1</td>
</tr>
<tr>
<td>R,NS</td>
<td>0.5</td>
<td>2</td>
<td>26</td>
<td>49.1</td>
<td>0.7</td>
<td>2.9</td>
<td>7</td>
<td>11.8</td>
</tr>
<tr>
<td>M,S</td>
<td>2.3</td>
<td>0.2</td>
<td>4.2</td>
<td>0.3</td>
<td>74</td>
<td>12.4</td>
<td>3.1</td>
<td>3.5</td>
</tr>
<tr>
<td>M,NS</td>
<td>0.3</td>
<td>1.5</td>
<td>0.6</td>
<td>3.9</td>
<td>22</td>
<td>52.7</td>
<td>6.6</td>
<td>12.4</td>
</tr>
<tr>
<td>U</td>
<td>6.1</td>
<td>3.3</td>
<td>17.4</td>
<td>10.6</td>
<td>5</td>
<td>7.9</td>
<td>16.2</td>
<td>33.5</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>1.2</td>
<td>1.6</td>
<td>2.8</td>
<td>0.9</td>
<td>2.4</td>
<td>7.4</td>
<td>82.7</td>
</tr>
</tbody>
</table>

“A,S” : abstract standard work; “A,NS” : abstract NSW; “R,S” routine standard work, “R,NS” : routine NSW, ... “U” : unemployed; “N” : non participation. (a): each quarter, 28.3% of non standard workers in abstract jobs become standard workers in the US. To help with the reading of the table, diagonal elements within each task are in bold.

Table 3: France : Average quarterly transition probabilities

<table>
<thead>
<tr>
<th>From:</th>
<th>A,S</th>
<th>A,NS</th>
<th>R,S</th>
<th>R,NS</th>
<th>M,S</th>
<th>M,NS</th>
<th>U</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,S</td>
<td>97.5</td>
<td>0.8</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td>A,NS</td>
<td>3.9</td>
<td>88.1</td>
<td>0.1</td>
<td>0.5</td>
<td>0.4</td>
<td>0.1</td>
<td>3.8</td>
<td>3.3</td>
</tr>
<tr>
<td>R,S</td>
<td>0.2</td>
<td>0.0</td>
<td>97.0</td>
<td>0.8</td>
<td>0.0</td>
<td>0.0</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>R,NS</td>
<td>0.1</td>
<td>0.2</td>
<td>4.6</td>
<td>82.0</td>
<td>0.0</td>
<td>0.2</td>
<td>8.5</td>
<td>4.4</td>
</tr>
<tr>
<td>M,S</td>
<td>0.3</td>
<td>0.1</td>
<td>0.3</td>
<td>0.1</td>
<td>93.9</td>
<td>2.3</td>
<td>1.4</td>
<td>1.5</td>
</tr>
<tr>
<td>M,NS</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
<td>1.1</td>
<td>2.3</td>
<td>86.7</td>
<td>5.0</td>
<td>4.5</td>
</tr>
<tr>
<td>U</td>
<td>0.8</td>
<td>2.3</td>
<td>2.7</td>
<td>15.5</td>
<td>0.4</td>
<td>2.7</td>
<td>55.9</td>
<td>19.7</td>
</tr>
<tr>
<td>N</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>1.6</td>
<td>0.1</td>
<td>0.4</td>
<td>6.0</td>
<td>91.0</td>
</tr>
</tbody>
</table>

“A,S” : abstract standard work; “A,NS” : abstract NSW; “R,S” routine standard work, “R,NS” : routine NSW, ... “U” : unemployed; “N” : non participation. (a): each quarter, 3.9% of non standard workers in abstract jobs become standard workers in France. To help with the reading of the table, diagonal elements within each task are in bold.

General picture. As found in Elsby et al. (2013), the US labor market is characterized by a higher turnover than its French counterpart. Indeed, when looking at the persistence
of each labor market status, namely the diagonal elements in Tables 2 and 3, all US numbers are lower than their French counterparts. For instance, the average quarterly probability of remaining unemployed amounts to 55.9% in France against 16.2% in the US. Let us now focus on the job finding by unemployed workers by paying attention to line “U”. The average duration of unemployment is larger in France than in the US. As French unemployment workers face a 24.4% quarterly probability of finding a job\textsuperscript{11}, the average length of unemployment spell is 1 year\textsuperscript{12}, versus less than 6 months in the US\textsuperscript{13}. As regards to job stability (column “U” in Tables 2 and 3) probabilities of losing a job (whether abstract, routine or manual) are higher in the US than in France. Our findings are consistent with previous evidence on US and French worker flows (Shimer (2012), Elsby et al. (2015), Le Barbanchon et al. (2015) or Fontaine (2016)).

Tasks. Our originality lies in documenting ins-and-outs of task groups. Routine jobs account for the vast majority of job findings : 75% of job findings are in routine jobs in France\textsuperscript{14} and 56% in the US\textsuperscript{15}. As regards to mobility across employed workers, our estimates of transition probabilities suggest that there are virtually no transitions from routine employment to manual employment or to abstract employment. This implies that career changes from one task to the other implies an unemployment spell in France. In contrast, in the US, we observe more employment mobility between abstract and routine employment ($R, S \rightarrow A, S = 2.9\%$, $A, S \rightarrow R, S = 3.1\%$ per quarter), as well as Manual and routine employment ($R, S \rightarrow M, S = 1.2\%$, $M, S \rightarrow R, S = 4.2\%$ per quarter).

In both countries, abstract jobs are the most stable ones, with the lowest separation probability and the lowest probability of transition to non-participation. Manual employment lies at the other end of the distribution with the highest probability of exiting manual employment (with respect to abstract and routine jobs), higher probability of exiting to unemployment or non participation. Therefore, one consequence of job polarization may be that, while employment stability will remains globally unchanged at the aggregate level, as the former routine workers reallocate to abstract (more stable) or manual (less stable) jobs, job stability may decrease at the individual level for the former routine workers reallocating to manual/less stable jobs.

\textsuperscript{11}(100-55.9-19.7)
\textsuperscript{12}1\textsuperscript{0.244} quarters
\textsuperscript{13}1\textsuperscript{1.162-3.35} quarters
\textsuperscript{14}(2.7+15.5)/(0.8+2.3+2.7+15.5+0.4+2.7)
\textsuperscript{15}(17.4+10.6)/(6.1+3.3+17.4+10.6+5+7.9)
**NSW.** We investigate further this topic by looking at the relationship between job polarization and non standard forms of work. When examining the diagonal elements in Tables 2 and 3, in all task groups, NSW is characterized by less persistence than SW, especially in the US. All non-standard workers are more likely to switch labor market status next quarter than their counterparts with standard contract.

In France (Table 3), non-standard workers are three to ten times as likely as standard workers to lose their job within the next three months. Nonstandard workers in routine jobs are characterized by the highest job finding rate and job separations. Such findings are suggestive that holding a non-standard contractual arrangement increases the risk of dropping out of the labor market (column “N” in each table).

As for the so-called stepping stone effect, we actually observe little transformation of non-standard to standard work in France: Each quarter, only 3.9% of non standard workers in abstract job become standard workers (4.6% in Routine jobs ; 2.3% in Manual jobs). In each task, in France, 70% to 80% of job findings are in NSW. Standard work appears as a “protected” labor market status as “downgrading” from standard to non-standard work is rare within each task group: transitions from A,S to A,NS, R,S to R,NS are marginal each quarter. The exception is the manual segment of employment: worker transitions equally go both ways (M,S to M,NS and vice versa) at the rate of 2.3% per quarter, which suggests that manual jobs in France are of lower quality than abstract and routine jobs. Furthermore, manual workers face a lower stepping stone probability (from M,NS to M,S) and more likelihood of “downgrading” (from M,S to M,NS). Table 3 suggests that French workers with standard form of employment enjoy a favorable economic environment, which contributes to the French labor market duality.

In the US (Table 2), the job finding rate (transition from U to employment) is actually larger in standard work than in non-standard work for abstract and routine jobs. In contrast, for manual jobs, workers find a job in non standard work (with probability 7.9% per quarter) easier than in standard work (with probability 5% quarterly). Stepping stones are larger in the US than in France: each quarter, on average, 25% of workers of part-timers get a full-time job within their occupational group. The probability of transformation from non-standard work to standard work is 28.3% in abstract jobs, 26% in US routine jobs, 22% in manual jobs, each quarter. The flexibility of the US labor market can also be seen on the “downgrading” of workers on standard contract to non-standard work. Each quarter, 3.9% of full-time abstract workers switch to part-time. This mobility goes up to 5.2% for standard routine workers and 12.4% for standard manual workers. Summary statistics of Tables 2 and 3 could be seen as a first piece of evidence
indicating that within-employment reallocation, namely transitions involving standard and non-standard work at the same task group, is much larger in the US than in France.\textsuperscript{16}

6.3 $\beta$ Variance decomposition of employment

6.3.1 Computing $\beta$

With estimates of transition rates in hand, our goal is now to decompose cyclical fluctuations in employment rate into contributions attributable to each of the flow hazards. To do so, we adapt the dynamic decomposition of Elsby et al. (2015) to our empirical model. The main advantage of this method relies on the fact that it is not based on a steady-state approximation. Given the relatively low level of worker flows on the French labor market, a non-steady state decomposition becomes even more relevant.

We obtain the following $\beta$ statistic indicating the share of employment variance that is accounted for by the hazard rate from $i$ to $j$:

$$\beta_{ij} = \frac{\text{Cov}(\Delta e_{t-1,t}, \Delta \tilde{e}_{ij}^{t-1,t})}{\text{Var}(\Delta e_{t-1,t})}$$

where, $\Delta$ is the first difference operator and $\tilde{e}_{ij}^{t-1,t}$ the counterfactual employment rate obtained when only one worker flow fluctuates. In order to compute $\tilde{e}_{ij}^{t-1,t}$, we proceed as follows. First, we compute labor market stock changes that are driven by contemporaneous but also past changes in transition rates. This recursive formulation of stock variations is at the heart of the non-steady state decomposition. Second, we express the variance of any given labor market stock as the sum of its covariance with any counterfactual obtained in the previous step.

\textsuperscript{16}We did not check whether transitions across employment categories are accompanied with a change in employer or not. When we look at the change in employer, using CPS monthly data after 1994, we find change in employer occurs with a probability lying between 3.13% and 4.87% for occupational stayers (no career change, the worker remains in her task group) who switch between SW and NSW. This is consistent with Borowczyk-Martins & Lale (2019)’s view that the switch between SW and NSW (whatever the direction of the change) is primarily done with the same employer. We show that this is true within each task group. When looking at occupational moves (change in task group), the change in employer is more likely. The likelihood of change of employer in case of a change in task group, without change in form of employment, rise to approximately 35% to 55%, which echoes Moscarini & Thomson (2007)’s findings that 60% of occupational movers in the US change employer. If the change in task group is also combined with a change in form of employment (SW, NSW), the probability of change in employer rises to approximately 70%. The results for French data are qualitatively consistent with these findings. Results are available upon request.
### 6.3.2 Results

Table 4: β decomposition of RS and RNS - 2003Q1-2017Q3

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th></th>
<th>France</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>R, S</td>
<td>R, NS</td>
<td>R, S</td>
<td>R, NS</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>(a) Job separation from employment to unemployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_{R,S-U}$</td>
<td>34.5</td>
<td>2.3</td>
<td>21.6</td>
<td>1.6</td>
</tr>
<tr>
<td>$\beta_{R,NS-U}$</td>
<td>1.6</td>
<td>-8.4</td>
<td>0.8</td>
<td>24.4</td>
</tr>
<tr>
<td>Total job separation to $U$</td>
<td>36.1</td>
<td>-6.1</td>
<td>22.4</td>
<td>26.0</td>
</tr>
<tr>
<td>(b) Job finding from unemployment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_{U-R,S}$</td>
<td>35.9</td>
<td>4.3</td>
<td>17.6</td>
<td>0.3</td>
</tr>
<tr>
<td>$\beta_{U-R,NS}$</td>
<td>3.2</td>
<td>-44.4</td>
<td>0.5</td>
<td>41.4</td>
</tr>
<tr>
<td>Total job finding from $U$</td>
<td>39.1</td>
<td>-40.1</td>
<td>18.1</td>
<td>41.7</td>
</tr>
<tr>
<td>(c) Within: to/from NSW</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\beta_{R,S-R,NS}$</td>
<td>20.3</td>
<td>91.3</td>
<td>2.3</td>
<td>-0.2</td>
</tr>
<tr>
<td>$\beta_{R,NS-R,S}$</td>
<td>2.6</td>
<td>4.7</td>
<td>26.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Total within</td>
<td>22.9</td>
<td>96.0</td>
<td>28.5</td>
<td>1.3</td>
</tr>
<tr>
<td>(d) to/from Non-participation</td>
<td>-3</td>
<td>18.2</td>
<td>13.8</td>
<td>22.3</td>
</tr>
</tbody>
</table>

US CPS basic monthly. French LFS. 20013Q1-2017Q4 in both countries. (a): 20.3% of the variance in changes in per capita routine standard employment in the US is explained by transition from routine standard to routine non-standard work. $\beta^N$ sum of all $\beta$s involving non-participation. Numbers in bold are commented in the text.

For each employment stock, we can compute a β decomposition driven by 56 non-diagonal elements in the $(8 \times 8)$ Markov matrix of equation (2). Table 4 shows the quantitative contribution of selected transition probabilities to the variance of routine standard and routine non-standard per-capita employment for the US and France. For the sake of brevity, we report complete decomposition results along with unemployment variance decomposition in Appendix D. For comparison purpose, we restrict our analysis to a period for which worker flows is available in both countries, namely the 2003Q1-2017Q4 period.

**Fluctuations in $R, S$ employment** Let us have a look at fluctuations in routine standard employment in both countries (columns (1) and (3)). The first drivers of RS changes are transitions involving unemployment (panels (a) and (b)). In the US, both job separations and job findings to routine standard jobs account for 70.4% of the observed variation in routine standard employment per capita. Among this set, the relative contribution of both transition rates are balanced (around 35% for routine job losses and job finding respectively). The qualitative pattern is similar in France even if it is lower of an order of magnitude ($\beta_{R,S-U} + \beta_{U-R,S} = 39.2\%$). This could be explained by a higher influence of transitions involving non-participation (13.8% in France, versus -3% in the US).
Panel (c) of Table 4 looks at “within” reallocations, meaning transitions between standard and non-standard work in the routine task group. In the two countries, transitions between standard and non-standard work explain approximately 25% of the variance of RS. However, a look at the disaggregate contribution of within transitions shows a striking difference across countries. In the US, changes in “downgrading” from $R, S$ to $R, NS$ matters while, in France, it is the cyclicality of the reverse transition (namely stepping stone effect from $R, NS$ to $R, S$) that affects RS fluctuations. Thus, transition from RS to RNS alone accounts for 20.3% of the variance of RS work in the US versus only 2.3% in France. In France, transitions from RNS to RS explain the vast majority ($\beta_{R,NS-R,S} = 26.2\%$) of within-employment reallocation.

**Fluctuations in $R, NS$ employment.** Columns (2) and (4) in Table 4 display the decomposition results of variations in routine non-standard work for the US and France respectively. Again, there are important differences between both labor markets. In the US, over the 2003Q1-2017Q3, variations in RNS are overwhelmingly explained by within-employment reallocation. Within reallocation, namely those implying only routine jobs, explain 96% of this variance. The transformation of routine standard jobs to non-standard jobs, namely the “downgrading” effect, is by far the main driver for RNS variance ($\beta_{R,S-R,NS} = 91.3\%$). In France, the picture is different along several dimensions. First, within transition probabilities have a negligible influence in accounting for the variance of routine NSW. Second, most of the variability in $R, NS$, about 65%, is due to transitions implying unemployment. In particular, routine non-standard job separations explain 24.4% of changes in $R, NS$ while the contribution of job finding rate is of 41.4%. A look at the latter contribution for the US case points to another striking difference between France: in the US, unemployment exit to routine non-standard have a negative contribution of -44.4% to RNS variance. This indicates that fluctuations in $U - R, NS$ plays in the opposite direction than cyclical fluctuations in RNS.

**Illustration: the 2008 crisis.** To illustrate our results, we display in Figure 7 the evolution of worker transition probabilities. At the early stage of the Great Recession, in both countries, RS employment falls (Figure 5) as RS workers face a steeper probability of job losses ($R, S \to U$) while job finding to routine standard falls ($U \to R, S$).

In the US, the probability at which routine standard workers switch to routine non-standard work increased of about 2 percentage points. This increased “downgrading” effect contributed to the job losses in RS employment. This finding echoes Borowczyk-
Martins & Lale (2019)'s results on the spikes of part-time employment in recessions. US firms use within-employment reallocation to adjust labor in bad times.

In France, during the 2008 crisis, French RNS worker faced a lower probability to get a RS job. The steep drop in the $RNS \rightarrow RS$ transition (less stepping stone) contributed to the fall in RS jobs. More specifically, for a routine non-standard worker the probability of “upgrading” to routine standard work fell from 5.5% to 3.5%.

**Fact 3:** In both countries, RS (Routine Standard) per-capita employment is mainly driven by cyclicality in transitions to/from unemployment (job losses and job finding). As for the within transitions, in recessions, RS falls in the US because more RS workers become RNS (increased "downgrading"); while, in France, RS falls because less RNS workers become RS workers (less ”stepping stone”).

As for RNS jobs, RNS increases in the US in the Great Recession (Figure 5), boosted by increased inflows from RS workers (increased "downgrading" in recession). Notice that US unemployed workers have a harder time finding a RNS job, which would tend to lower
RNS employment. However, as RNS employment actually increased in the data, the drop in the RNS job finding rate does not appear as a driver for RNS employment: $\beta_{U \rightarrow RNS} < 0$ in Table 4.

In contrast, in France, RNS fell in the 2008 crisis (Figure 5), due to spikes in job losses ($RN, S \rightarrow U$) and steep fall in job finding ($U \rightarrow R, NS$).

**Fact 4:** The countries differ along the behavior of RNS (Routine Non Standard) employment. In the US, RNS increases in recession. RNS appear to be mainly a short-term transitions to/from standard routine employment. In particular, the cyclicity of inflows from RS to RNS plays a leading in accounting for RNS fluctuations. In the 2008 recession, RNS increased in the US. The increased “downgrading” (from RS to RNS) contributed to the rise in RNS. In contrast, in France, RNS employment falls in recession. RNS is driven by the high cyclicity of job finding (40%) and to a lesser extent job losses and non participation (approx. (20% each).

Our findings support the view that within-employment reallocation, through the use of non-standard work, is an alternative margin of adjustment in the US. In bad times, more standard workers switch to NSW. In France, flexibility is achieved by adjusting hiring and separations of standard and non-standard work. Recessions are times when opportunities of steeping stones from SW to NSW are reduced.

### 6.3.3 Policy implications and lessons for economic modelling

We discuss here implications of our findings in terms of policy and economic modelling.

**Long-run implications.** First, when modelling labor market adjustments, we show that the focus on the extensive margin in the job polarization literature is relevant when one looks at US data. However, on French data, the understanding of both margins of labor is relevant in the recent recession.

Secondly, job polarization refers to the growth of ”lousy” (manual) and ”lovely” (abstract) jobs as Goos et al. (2009). Our result adds NSW to this analysis by stressing that, in the US, standard as well as non-standard routine work have been lost over the past decades (Figure 5). In the US, mainly standard jobs have contributed to an increase in jobs in ”lovely” and ”lousy” jobs, so that the US does not display any upward trends in the share
of NSW in the economy (Figure 6). In particular, US manual jobs expansion mainly occurs using SW, rather than NSW. The share on NSW in manual jobs is actually falling over time in the US. In contrast, in France, while standard routine jobs have been lost over the past decades, non-standard forms of employment expanded in all task segments of the labor market. In particular, over the past decades, French manual jobs expansion has mainly occurred using NSW, rather than SW, which is unlike the US. The OECD (2015) voiced concerns about the growth of NSW as non-standard jobs tend to pay lower wages than standard jobs, especially at the bottom of the earnings distribution, thereby raising earnings inequality. Our analysis suggests that this concern is particularly relevant for the French labor market.

Thirdly, our results help understand the career changes and labor market mobility in both countries. In France, task changes mainly go through unemployment (Table 3). Direct mobility without any unemployment spell is marginal. Policy in France shall be targeted at non-employed workers. In addition, in terms of modelling, the simple model of occupational choice in Autor & Dorn (2013), with direct occupational switch, without unemployment, would not be relevant in France. In the US (Table 2), in contrast, 3 to 4% of employed workers operate a change in task group from one quarter to the next. This fraction is significant but remains quite low in view of the massive job losses in routine employment over the last decades. The US labor reallocation cannot go through only employment-to-employment task reallocation, as in Autor & Dorn (2013)’s model. Our result is consistent with Cortes et al. (2014)’s findings that inflows into routine employment from unemployed and non-participants drive the disappearance of routine jobs. Modelling job polarization also requires in the US the understanding of worker flows ins and outs of non-employment.

**Business cycle implications.** Our findings support the view that within-employment reallocation, through the use of non-standard work, is an alternative margin of adjustment in the US. In bad times, more standard workers switch to NSW. The substitution effect of NSW discussed in section 3 prevails such that NSW spikes in recession. In France, flexibility is achieved by adjusting hiring and separations of both standard and non-standard work. Recessions are times when opportunities of stepping stones from SW to NSW are reduced. NSW appears as a labor status “at the margin” of labor: a gateway to employment for unemployed workers and non-participants, hired in unstable jobs.

Finally, our paper has also implications on the costs of the business cycles. Lucas (1987) argues that the welfare costs of business cycles are negligible, which implies that business
cycle research and counter-cyclical stabilization policy are irrelevant. In contrast, Krebs (2007) argues that business cycle costs are sizeable when displaced workers face income losses that persist even after the displaced worker is re-employed. Our results suggest that Krebs (2007)’s findings are particularly relevant in the context of job polarization and NSW. In recession, routine jobs are lost. In France, the highest job finding rate lie in non-standard routine employment, which offers less job security than standard routine jobs. In addition, in French recessions, NSW workers face lower opportunities to reach standard form of employment (lower stepping stones in bad times). Our results suggest that the persistent income loss might indeed be relevant in the wake of recessions, in a context of job polarization and NSW.

7 Conclusion

Using annual and quarterly labor market data from the US and France, we study the interactions between job polarization and non-standard work along the business cycle and derive four stylized facts. First, changes in aggregate hours are mainly driven by fluctuations in per-capita employment rather than hours worked per worker. Second, recessionary drops observed in aggregate hours are, to a large extent, due to the disappearance of routine work. In the US, the fall in routine standard employment accounts for most of the decline in aggregate hours, whereas in France, routine jobs losses in both standard and non-standard work matter. Third, the dynamics of routine standard employment are driven by flows from and into unemployment in both countries. Fourth, the dynamics of routine non-standard work differ across countries. In the US, fluctuations in routine non-standard employment is driven by inflows from routine standard work, while, in France, changes in routine non-standard work are accounted for by ins and outs from unemployment. Our findings support the view that within-employment reallocation, through the use of non-standard work, is an alternative margin of adjustment in the US. This is not the case in France and flexibility is achieved by adjusting hiring and separations of standard and non-standard work. In bad times, reduced stepping stones contribute to the fall in routine standard employment.

Our paper is potentially relevant to research in macro and labor economics. The data and our stylized facts may be used as an empirical background to discipline theoretical models of labor market adjustment along the extensive and intensive margin across countries. The job polarization process offers an opportunity to revisit how firms proceed to this trade-off when faced with this strong technological trend. Our study of NSW also provides a first
look at how firms use of this flexibility in a context of technological change. Developing a dynamic labor market model including these dimensions is left for future research.

References


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A Definition of tasks

US. Abstract jobs (creative, problem-solving, and coordination tasks) include non-routine cognitive workers (Management, business, and financial operations occupations. Professional and related occupations).

Routine employment (repetitive, codifiable job tasks) include sales and related occupations, office and administrative support occupations, production occupations, transportation and material moving occupations, construction and extraction occupations, and installation, maintenance, and repair occupations.

Manual jobs (assisting or taking care of others requiring physical dexterity and flexible interpersonal communication) are service occupations such as Ushers, Lobby Attendants, and Ticket Takers, Amusement and Recreation Attendants, Embalmers, Funeral Attendants, Morticians, Undertakers, and Funeral Directors, Barbers, Hairdressers, Hairstylists, and Cosmetologists, Makeup Artists, Theatrical and Performance, Manicurists and Pedicurists, Shampooers, Skincare Specialists, Baggage Porters and Bellhops, Concierges, Travel Guides, Child-care Workers, Personal Care Aides, Fitness Trainers and Aerobics Instructors, Recreation Workers, Residential Advisors, Personal Care and Service Workers, All Other.

France. Abstract jobs are management, business, science, and arts occupations; this includes occupation codes 23 large business heads, 31 licensed professionals, 33 civil servant, executives, 34 scientific professional, 35 creative professional, 37 top managers and professionals, 38 technical manager, engineers, 42 teacher, and 43 health workers.\(^{17}\)

Routine jobs are sales and office occupations; construction and maintenance occupations, and production, transportation, and material moving occupations; this includes occupation codes 45 mid-level professionals in the public sector, office worker, 46 mid-level professionals in the corporate sector, office workers, 47 technician, 48 foremen, supervisors, 52 civil servants, office workers, mid-level and low level, 53 security workers, 54 office

\(^{17}\)One could argue that occupation 43 could also be considered to be part of manual non-routine jobs. We choose to consider them in the abstract group, as Charnoz & Orand (2015). These authors consider the same group of occupations in the abstract group and checked that these jobs are indeed characterized by abstract-intensive tasks. In addition, Jaimovich & Siu (2012) also consider medical occupations as part of non-routine cognitive jobs.
workers in the corporate sector, 55 retail worker, 62 skilled industrial workers, 63 skilled manual laborers, 64 drivers, 65 skilled distribution worker (dispatch, dockers, warehousemen, ...), 67 low skill workers, in manufacturing, food industries, press, ... 68 low skill laborers, craftsmen.

Manual jobs are service occupations. This includes occupation codes 56 Personal service workers and 22 heads of small businesses (selling food, tobacco, services, and other items).

**B  Looking at the data: hours per worker**

**B.1  US**

Let us look at the evolution of weekly hours per worker, the other component of aggregate hours. Figure 8 shows that each abstract worker is at work on average 41.4 hours a week, which is larger than routine workers (38.8 hours a week) and manual workers (34.2 hours a week). The low average hours per week in manual occupations is due to (i) the larger share of part-timers in manual work (Figure 6) and (ii) to the difference in hours per worker in non-standard work: part-timers in manual jobs work 20.4 hours a week versus approximately 21.3 hours in abstract and routine part-time jobs.

Figure 8 suggests that there is no strong trends in hours per worker in standard employment for abstract and routine jobs, while, in all tasks, the number of hours per worker in NSW steadily increases over the period. Notice that weekly hours on manual jobs with full-time contracts also tend to decline.

Notice that for each task group, hours are procyclical for standard work $h_{A,S}, h_{R,S}, h_{M,S}$ with a particularly sharp drop following the Great Recession, whereas NSW hours per worker does not seem to respond to recession.

**B.2  France**

Let us turn to weekly hours of work depicted in Figure 9. On average, abstract workers at work 38 hours a week, versus 36.5 hours for routine workers and 31 hours for manual workers. As in the US, manual workers work less because the share of NSW is dominant in this task group (Figure 6) and weekly hours per worker in NWS is lower in this task group (22 hours per week on average versus 27 hours for abstract workers and 29 hours for routine workers).
Globally, the trend in hours of work is decreasing for Routine and Manual jobs, and rather increasing for Abstract jobs. One also sees that the evolutions are different when decomposing by contract type: while weekly hours have decreased sharply at the end of the 1990s for all task groups, they increased in NSW during the same period. Weekly hours did not necessarily decrease (and not by much) following the beginning of the Great Recession in 2008, but they decreased substantially in Abstract SW, Routine and Manual NSW following the second recessionary episode following the Great Recession in 2011. Thus, weekly hours are not necessarily procyclical, depending on the type of contract and task, and which recession is considered.
Figure 9: France: Components of total hours $H$ : $h$ weekly hours per worker, by task and job type

French LFS, annual data, 1983-2017. Shaded areas indicate ECRI recessionary episodes. $h^A$ average weekly hours in abstract jobs. Similar definition applies to Routine and Manual jobs. Horizontal red line “average” is average value over the sample period.

C Total hours $H$ by task/job type and counterfactuals over the business cycle

Figure 10 illustrates the main properties discussed in section 5.2.2. It represents the total variation of aggregate hours over the business cycle, and the variations implied by changes in routine standard employment, abstract standard employment, hours worked on routine standard and abstract standard jobs respectively. Figure 11 depicts the same exercise for France.

Figure 11 depicts the total variation of aggregate hours over the business cycle, and the variations implied by main contributor to such changes :
Figure 10: US: Total hours $H$ by task/job type and counterfactuals: cyclical component

US CPS MORG, annual data, 1979-2018. HP filtering with smoothing parameter of 6.25. “Data”: HP-filtered per-capita aggregate hours $H^C$. “Based on R,S empl” : counterfactual HP-filtered per-capita aggregate hours predicted only by changes in routine standard per-capita employment $\omega^{RS}$. Similar definition applies to the other lines.
Figure 11: France: Total hours $H$ by task/job type and counterfactuals: cyclical component

French LFS, annual data, 1979-2018. HP filtering with smoothing parameter of 6.25. “Data”: HP-filtered per-capita aggregate hours $H^C$. “Based on R,S empl”: counterfactual HP-filtered per-capita aggregate hours predicted only by changes in routine standard per-capita employment $\omega^{RS}$. Similar definition applies to the other lines.
Columns (1), (2), (4) and (5) in Table 5 reports the full variance decomposition of Table 4. Columns (3) and (6) of Table 5 reports the variance decomposition of unemployment fluctuations in the US and France respectively. The major forces behind French unemployment changes lie in changes in the job finding rate of routine NSW that account for more than 20% of unemployment variance. The second biggest contribution lies in routine job losses in routine standard employment \((\beta_{R,S}^R - U) = 12\%\). Job losses and findings in routine non standard work alone account for nearly a third of fluctuations in French unemployment. These results clearly suggests that fluctuations in NSW play a key role in short run changes in French unemployment. Interestingly, the contribution of routine employment losses in standard work \((\beta_{R,S}^R - U) = 12\%\) is larger than that of job finding in this type of job \((\beta_{U}^U - R_S = 9.2\%)\), thereby suggesting that, along the business cycle, job losses are sharp in routine standard jobs, while job finding does not respond as much, especially during expansions.

In each occupational group, regarding job losses in France, the contribution of employment exits from standard jobs \((\beta_{A,S}^A - U, \beta_{R,S}^R - U, \beta_{M,S}^M - U)\) is larger than job losses in non standard work \((\beta_{A,NS}^A - U, \beta_{R,NS}^R - U, \beta_{M,NS}^M - U)\). This may relate to the legal constraints on temporary work contract in France. As long as the term of the contract is not reached, separations from temporary contracts are not common (Cahuc et al., 2016). They occur without any penalty at the term of the contract. There are also legal constraints in the renewal procedure: temporary contracts can only be renewed once and the maximum duration of a temporary job spell cannot exceed two years. The increased prevalence of temporary contracts can then reduce the fluctuations in the separation rate through a standard compositional effect, as the cyclicality of the separation rate is very heterogenous across temporary and permanent contracts. In addition, NSW also includes part-timers with permanent contracts.

The picture that emerges from the decomposition of US unemployment variance is different from the French one. First, the total contribution of NSW to unemployment fluctuations is of a lower order of magnitude. Indeed, when NSW accounts for 24% of US unemployment rate changes, the same statistic is around 38% in France. Second, the two countries differ with respect to the contribution of the job finding. Unemployment exits to standard employment generate around 30\% \((\beta_{U}^U - A_S + \beta_{U}^U - R_S + \beta_{U}^U - M_S)\) of US unemployment changes while, in France, they account for barely 12\%. Unambiguously, such patterns suggest that NSW is not a primary driver shaping US unemployment whereas
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it is in the French case. In both countries, entries and exits from routine jobs explain more than 40% of unemployment dynamics. The novelty of our approach is to underline that the cyclicality of the job polarization process does not involve the same forms of employment on both sides of the Atlantic, especially as the job finding rate is concerned.

Third, with respect to job separations, the overall contribution of job losses is the same in both countries (around 24%), particularly with respect to employment exits from routine standard work (around $\beta_{R,S-U}$ = 13% in both countries).

Finally, in Table 5, the total contribution of changes in workers’ transitions involving manual jobs to unemployment variance is far larger in the US than in France. Table 5 suggests that this is due to US job finding of manual standard jobs ($\beta_{U-M,S}$) and separation from manual non standard employment ($\beta_{M,NS-U}$), that are more responsive to the business cycle than in France.