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Are Mass Layoffs Individually Costly But Socially Beneficial?*

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Highlights

- We assess both individual and aggregate effects of mass layoffs, using a unique quantitative definition of those events.
- Displaced workers suffer a long-lasting increase in the probability of being unemployed and, for those who find a job, a decrease in their salary.
- Firms that hire displaced workers exhibit lower investment rates, decreased value added, and a reduced workforce, with a higher proportion of employees on fixed-term contracts.
- Mass layoffs do not contribute to the enhancement of allocative efficiency, as the most skilled workers are less likely to be matched with the most successful establishments.
- Six years after the mass layoff event, the local unemployment rate is 12% higher in affected areas compared to unaffected regions with a diminished share of new establishment creation.

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Abstract

Relying on rich administrative data, this paper examines the adaptive capabilities of the French labor market in the aftermath of large-scale layoffs in the manufacturing sector. We assess both individual and aggregate effects of these shocks, using a unique quantitative definition of mass layoffs. We first show that displaced workers suffer a long-lasting increase in the probability of being unemployed and, for those who find a job, a decrease in their salary. While mass layoffs entail costs for displaced workers, there is a possible social benefit if they result in productive reallocation of workers to the most innovative companies and in the creation of new firms. Remarkably, our findings indicate that firms that hire displaced workers exhibit lower investment rates, decreased value added, and a reduced workforce, with a higher proportion of employees on fixed-term contracts. Additionally, mass layoffs do not contribute to the enhancement of allocative efficiency, as the most skilled workers are less likely to be matched with the most successful establishments. Furthermore, we assess the extent to which local economies adapt to these shocks, revealing that, six years after the mass layoff event, the local unemployment rate is 12% higher in comparison to unaffected regions. Lastly, the affected areas experience a diminished share of new establishment creation.

Keywords

Mass layoffs, Sorting.

JEL

J31, J42.

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RESEARCH AND EXPERTISE ON THE WORLD ECONOMY

1 Introduction

For the past forty years, most developed economies have experienced a major shift known as deindustrialization. This shift is evidenced by a substantial decline in the share of employment in the manufacturing sector, which plummeted from its peak of 22% in 1979 to 9% in 2022 in the United States, and from 21% to 10% in France. This deindustrialization process has manifested through successive waves of widespread job layoffs, primarily instigated by technological advancements such as robotization and increased import competition.[1] However, amidst this ongoing transformation, a new factor, the ecological transition, is emerging as a significant catalyst for structural change in the manufacturing sector. This sector will require profound reorganization of its production processes to meet decarbonization goals. Achieving zero net emissions will prompt the emergence of new industries while causing the decline of older ones. Consequently, this transition will require the redistribution of workers both across and within sectors, likely leading to additional episodes of mass layoffs.

Understanding how labor markets responded to past events is crucial for assessing their potential adaptability to forthcoming shocks.[2] Numerous empirical studies have consistently demonstrated the inherent weaknesses in labor market adjustments when faced with mass layoffs. This holds true even in the United States, which is widely recognized for the flexibility of its labor market. Workers who experience job loss as a consequence of mass layoffs or plant closures suffer enduring reductions in their earnings (Jacobson et al., 1993; Farber et al., 1993). The process of reallocating displaced workers to alternative sectors has proven to be imperfect, primarily due to a combination of skills mismatch and limited mobility across regions (see Azzopardi et al., 2020 and Mangum and Coate, 2019 for the United States,

[1] Applying Autor et al.'s (2013a) methodology for France, we find that the 1% of commuting zones most exposed to import competition have a probability of suffering a mass layoff that is 10pp higher than that of the 1% that are least exposed. See Section C in the Appendix for details on the methodology and results.

[2] As mentioned by Autor et al. (2021) for the US, "as the United States prepares for potentially more job loss due to the ongoing energy transformation and expected changes in oil and gas production, the failure of local labor markets to adjust successfully to the coal and China trade shocks reminds us that the adjustment process is typically slow and sclerotic, unlike the textbook model of frictionless labor market adjustment."

and Arquié and Bertin, 2023 for France).[3] The adverse effects of mass layoffs on displaced workers have been empirically demonstrated to have long-lasting consequences in numerous countries, including Germany and France (Helm et al., 2022; Brandily et al., 2022).

This paper presents novel insights into the potential trade-off associated with mass layoffs, seeking to discern whether these events might entail individual costs while simultaneously generating social benefits. It remains theoretically plausible that, while individuals affected by the layoffs may experience negative consequences, positive effects might emerge at the local economy scale, compensating for these adverse individual effects. Taking an agnostic stance toward the overall effects of mass layoffs necessitates an examination of their impacts on both levels. Addressing this research question requires the use of similar data and of a unified mass layoff definition, allowing for an exploration of effects at both the individual and aggregate levels. Our contribution lies precisely in simultaneously analyzing the impacts on both scales, using unique quantitative definitions of mass layoffs to evaluate the effects of those shocks both on displaced workers and at broader aggregate levels.

This methodology sets apart our research from the existing literature, which considers the two impacts (either individual or collective) in distinct studies using different definitions of mass layoffs. For instance, Gathmann et al. (2018) and Helm et al. (2022) investigate displacement effects in Germany. Gathmann et al. (2018) define a mass layoff as a reduction in plant size by at least *500* employees, while Helm et al. (2022) stipulate that mass layoff establishments must have between 30 and *500* employees in the year before the mass layoff event. Consequently, these two studies cannot be used to assess trade-offs associated with mass layoffs.

In our study, our focus is specifically on mass layoffs in the manufacturing sector. This choice is deliberate, as local demand shocks are less likely to be the primary determinant of

[3]It is worth noting that the decline in the manufacturing sector has resulted in an increased proportion of available jobs in the service sector. However, these service sector jobs are predominantly concentrated in urban areas as the demand for services is inherently localized. In simpler terms, regions that experience the greatest job losses in the manufacturing sector are not necessarily the ones generating new job opportunities in the service sector, as the latter requires a sufficiently dense population.

mass layoffs in manufacturing. Because goods are tradable, demand addressed to this sector does not come from local consumers but from national or international ones. Additionally, we select layoffs of a significant size to minimize concerns related to endogeneity, since it is less probable for the skills of displaced employees to be the underlying cause of the layoffs. We define a mass layoff episode as occurring when, within a particular establishment, more than 250 jobs are lost from one year to the next (absolute criteria). Alternatively, it is also defined as a situation where there's a reduction of 30% of the total number of employees (relative criteria). Moreover, our criteria consider the cumulative job losses over two consecutive years to meet one of these established thresholds.[4,5]

Our empirical approach hinges on an event study, augmented by a matching technique that pairs comparable workers or commuting zones. This approach is essential to account for potential differences between individuals who have been displaced from their jobs and those who have not, as well as the variances between the commuting zones affected by a mass layoff event and those that remain unaffected. To achieve this, we employ coarsened exact matching, a method chosen for its ability to diminish model dependency, ensuring a more robust and reliable analysis (Iacus et al., 2012).

First, our analysis focuses on the impact of mass layoffs at the individual level. We demonstrate that affected workers experience enduring challenges, encountering both a sustained rise in the likelihood of prolonged unemployment and a decrease in their earnings, especially for those who secure employment. The effects are notably pronounced for low-skilled workers, who face a 38% reduction in earnings one year after the mass layoff, and a 10% decrease persisting even six years later. In contrast, skilled employees see almost no decline in wages.

Moreover, transitioning out of the manufacturing sector carries significant financial reper-

[4]In our process of identifying mass layoff events, we adopt a two-stage procedure. First, we pinpoint potential mass layoff establishments that meet specific criteria concerning the quantity of jobs lost. We then apply additional criteria to the worker flows within these establishments. This step aims to distinguish between actual job destruction due to mass layoffs and other factors such as changes in establishment identifiers, sales of establishments, or internal firm reorganizations, which might falsely appear as job losses. See Section 2.

[5]We ensure that the year following the mass layoff event does not show significant rehiring efforts by the firm to offset the initial layoffs. This step helps confirm the persistence and nature of the layoffs.

cussions. For instance, an individual who secures their first job after a three-year period of unemployment in the manufacturing sector earns 12% less than a comparable peer. However, if they transition to the service sectors, their salary is notably lower, with a striking 58% reduction. These findings underscore the enduring and divergent economic impacts on individuals affected by mass layoffs, particularly concerning wage disparities and sector transitions.

In our second phase of investigation into the impacts of mass layoffs on a larger scale, we delve into two crucial dimensions: the patterns of workforce reallocation and the subsequent adjustments observed within local economies following a mass layoff event. The redistribution of resources, especially the movement of workers toward the most efficient and productive companies, plays a pivotal role in influencing overall productivity growth (Hsieh and Klenow, 2009). In alignment with the principles of creative destruction,[6] mass layoffs have the potential to instigate a virtuous redistribution of workforce talent toward the most innovative and value-centric firms. While the immediate impact of such layoffs may pose individual challenges, the overall result could yield social advantages, should it foster a reallocation of workers toward firms that generate substantial value for the economy.

By leveraging the unique opportunity presented by French data to seamlessly integrate matched employer-employee data with firm performance indicators from accounting records, we explore the impact of mass layoffs on the potential for a more efficient allocation of workers.[7] Our findings reveal that firms engaging in the hiring of displaced workers exhibit a reduced investment rate. Additionally, these firms demonstrate lower added value, employ a smaller workforce, and have a higher proportion of staff on short-term contracts.

Subsequently, we categorize establishments and firms into two groups: those surpassing and those falling below the median, based on their individual fixed effects derived from an

[6]The creative destruction process can be measured at different levels (global, national, local). Simonen et al. (2020) study, for instance, the creative destruction process in the Oulu area in Finland, one of the most important technology clusters in the country (where Nokia phones were designed).

[7]Brandily et al. (2022) study job displacement in France and find that workers are reemployed by high-productivity, low labor-share firms: These "reallocations seem to provide a social good".

AKM regression (Abowd et al., 1999). A worker (firm) with a higher fixed effect is a worker (firm) with compensation higher than expected on the basis of observable characteristics included in the regression, and is therefore arguably among the best workers (firms). Our investigation into the impact of these shocks on allocative efficiency reveals a noteworthy outcome: In the aftermath of a mass layoff, there is a diminished likelihood of the most skilled workers being paired with the top-performing establishments.[8] Consequently, our analysis reveals that mass layoff events are unlikely to yield enhanced allocative efficiency.

Finally, in order to evaluate the impact of mass layoffs on a broader scale, we investigate how local economies adjust in the aftermath of these abrupt disruptions. In contrast to the extensive body of literature that examines the direct consequences of mass layoffs on displaced workers, only a limited number of studies investigate whether mass layoffs also yield indirect effects on the surrounding regions. The contributions made in this area include Gathmann et al. (2018), Jofre-Monseny et al. (2018), Vom Berge and Schmillen (2023), and Celli et al. (2023).

Indirect effects may manifest if mass layoffs in a region lead to diminished consumer demand for local goods and services, such as restaurants or retail, due to local multiplier effects. Additionally, employment in the area may decline as local firms connected to the mass layoff firm through input-output linkages experience reduced product demand. The existing literature has not reached a consensus on this matter. Jofre-Monseny et al. (2018) and Vom Berge and Schmillen (2023) did not discover evidence of spillover effects. Studying the closure of 45 manufacturing plants in Spain, Jofre-Monseny et al. (2018) indicate that the direct effects of mass layoffs are mitigated by other local establishments compensating for the initial negative labor demand shock.[9] Vom Berge and Schmillen (2023), focusing on plants with at least 100 employees, find that local spillovers significantly alleviate the direct impact of mass layoffs on municipal-level employment. Conversely, Gathmann et al. (2018) find

[8]This type of matching is desirable when the qualities of the company and the employee are complementary rather than substitutable in the production process. See Section 4.3.

[9]Specifically, for every 100 jobs lost directly in a plant closure, local employment in the affected industry declines by only 60-70 jobs.

that local spillover effects amplify the employment losses directly caused by mass layoffs. In another perspective, Celli et al. (2023) examine the long-term reaction of local labor markets to 24 mass layoffs, revealing a negative and persistent effect only on the employment of the same industry, while the rest of the local economy experiences mild effects.

We present empirical evidence in support of the existence of spillover effects. Specifically, we observe that the local unemployment rate experiences an upward trend following a mass layoff event. Six years following the occurrence of the shock, the unemployment rate registers a 12% increase compared to an unaffected commuting zone. Additionally, the proportion of temporary and short-term contracts is higher in affected areas. Furthermore, we furnish valuable insights into the process of creative destruction at the local level. While it is plausible that the decline in employment conditions at the local level could be offset by the establishment of new enterprises, our research findings do not lend support to this notion. In areas that have experienced mass layoffs, the proportion of manufacturing establishments created after the mass layoff event is significantly lower.[10]

This paper is structured as follows. Section 2 describes the construction of the data and the sample choices. Section 3 presents the empirical methodology. Section 4 provides the empirical results. We compute the mass layoffs effects on displaced workers, on firm destinations, on allocative efficiency and on the local labor markets. Section 5 discusses the implications of our results and concludes.

[10]It is worth noting that the concept of regional resilience has been employed to describe the manner in which regions or local areas respond to modifications in their economic surroundings. The resilience of a local area is contingent upon not only the adaptability of local firms or the local industrial structure, but also the capacity of workers to adapt to changing circumstances, particularly in the aftermath of mass layoffs. In economies that are globalized, local areas are affected by external shocks, and, as a result, the destructive driving forces may not manifest in endogenous construction processes within the same regions or countries. Due to the limited mobility of workers, policies need to be implemented within each region (as exemplified in the Finnish case, for instance; see Simonen et al., 2020).

2 Data and sample choices

This section provides an account of the data sources employed, offers a quantitative definition of mass layoffs, and delineates the selection of the sample. We use three primary databases for this study: the DADS-Postes and DADS-Panel for the identification of mass layoff events at the establishment level, the DADS-Panel for the measurement of labor outcomes pertaining to individual workers, and the *Elaboration des statistiques annuelles d'entreprises* (ESANE ; Fare) dataset for firm characteristics.[11]

2.1 Data sources

We use datasets known as "Déclaration annuelle de données sociales" (DADS-Postes and DADS-Panel), which are French administrative employer-employee datasets collected by INSEE (Institut National de la Statistique et des Etudes Economiques) from 1995 to 2019. Payroll declarations are mandatory for all wage-paying individuals and legal entities established in France, with the exception of those employing civil servants. DADS-Postes provides a comprehensive record of all jobs, but it does not allow for the tracking of workers over time.[12] On the other hand, DADS-Panel enables us to observe individuals born in October (representing approximately 1/12th of the population) over multiple years.

For both databases, we possess data pertaining to gender, age, nature of employment (whether it is a fixed-term contract or a permanent contract), annualized earnings, and occupation (specified at a 4-digit level). Additionally, we have knowledge of the industrial sector of the employing organization (classified at a 4-digit level) and the commuting zone of employers.

Another data source is *Elaboration des statistiques annuelles d'entreprises* (ESANE ; Fare).[13] This database provides information on firms such as sector, turnover, employment,

[11] DADS-Panel is used to ensure that the occurrence of mass layoffs is indeed indicative of genuine job destructions, rather than mere alterations in identifiers or organizational changes.

[12] DADS-Postes offers individual identifiers solely for the specific year under examination and its antecedent year. These identifiers change for every vintage of the dataset.

[13] Since 2008, FARE has replaced *Système unifié de statistique d'entreprises* (SUSE ; Ficus), collected by

and value added, based on accounting records. This information is thus not available at the establishment level.

2.2 Mass layoff definition

We narrow our focus to mass layoffs within the manufacturing sector to address concerns related to endogeneity. This deliberate choice serves a twofold purpose. First, the termination of employment during a period marked by widespread job cuts, such as a mass layoff, cannot be attributed to the skills and abilities of an individual; this is an essential consideration to allow for our investigation conducted at the individual level to identify a causal effect of mass layoffs. Secondly, the probability of mass layoffs in the manufacturing sector being influenced by local demand shocks is notably lower. This is important in order to be able to isolate a causal effect of layoffs on local economies, for our study conducted at the level of commuting zones. Notably, the demand for tradable goods exhibits a more national or even international nature. In contrast, layoffs within the service sector are significantly more contingent on local demand.

The identification of mass layoff events is conducted through a two-stage procedure. Initially, we identify potential mass layoff establishments by establishing certain criteria related to the number of jobs that have been destroyed. Subsequently, we apply additional criteria to the flows of workers entering and exiting these establishments in order to eliminate instances where changes in establishment identifiers, sales of establishments, or reorganizations within a firm may falsely appear as job destructions.

First stage. Our initial phase comprises two criteria. First, an establishment qualifies as a potential mass layoff establishment if there is a destruction of more than 250 jobs from one year to another (according to the absolute criteria); alternatively, if 30% of the total number of employees are eliminated (as per the relative criteria). Additionally, we ascertain

INSEE between 1995 and 2007.

that the sum of job destruction over two consecutive years also adheres to one of these two criteria. Furthermore, we verify that the firm did not rehire in the year following the mass layoff to compensate for the initial layoff. To accomplish this, we use DADS-Postes, which provides data at the establishment level. Specifically, we use the variable "*effectifs 3112*", which represents the number of jobs declared by the firm as of December 31 of each year. This variable is chosen as it facilitates the delimitation of the event date.

Second stage. The second stage involves the elimination of events that were erroneously classified as mass layoffs. This is achieved by using individual-level data in DADS Panel and examining the outflow of workers from the potential mass layoff (MLO) establishment. We employ the criteria outlined in Royer (2011) to identify and remove the following potential mass layoff establishments: (i) establishments where more than 70% of workers go to the same three establishments, with each of these receiving firms accounting for at least 10% of all workers from the potential MLO firm, (ii) establishments where more than 30% of workers go to a single establishment, or (iii) establishments where more than 50% of workers in the receiving firm originate from the potential mass layoff establishment.

Number of mass layoffs. In the manufacturing sector, over the period 1995-2019, a total of 507 mass layoff events were identified. The subsample of individuals that we are able to track in DADS Panel consists of 9,900 workers affected by one of these mass layoffs events. It has been duly verified that these individuals indeed transitioned to a different firm identifier, as it may be the case that they remained employed within the same establishment that underwent a mass layoff. Out of the initial cohort of 9,900 workers, we retain only those who have experienced a solitary instance of mass layoff, resulting in a final count of 7,200 workers. Indeed, the impact of a mass layoff may become less discernible when a worker endures multiple instances of such terminations.

Finally, the average magnitude of a mass layoff in our sample stands at 260 workers.

2.3 Sample choice

Only full-time jobs of individuals aged between 25 and 56 that are not classified as "annex" by INSEE are retained. The definition of a "non annex" job is based on two criteria. First, yearly earnings must exceed three times the monthly minimum wage. Secondly, the duration of employment must be greater than 30 days and 120 hours, with a ratio of hours to days exceeding 1.5. Our decision to exclusively focus on full-time, "non annex" employment is driven by the desire to concentrate on positions that exhibit greater stability. Moreover, this approach ensures that the observations can be compared in terms of yearly salary. Additionally, the selected age range aims to limit the sample to individuals who are neither retired nor enrolled in school.

We define skills categories using the "Professions et Categories socioprofessionnelles" occupation code. We construct two main categories corresponding to low-skilled and high-skilled workers.[14]

3 Empirical strategy

We quantify the effects of mass layoffs at both the individual and local area level. Our empirical approach is based on an event study that we supplement by matching workers (or commuting zones) to account for the possibility that individuals (or commuting zones) affected by a mass layoff event may differ on average from workers (or commuting zones) that were not affected. Variables are stacked over a 10-year period.[15] In the regressions conducted at the individual level, we compare some labor outcomes of a worker who was laid off to a similar (matched) worker who was not, d years after the mass layoff event. Similarly, at the

[14]We use the "PCS 2003" classification (INSEE, 2022). Low-skilled workers correspond to the following categories: unskilled industrial (66, 67), unskilled manual (68, 69), services workers (54, 55, 56, 64). For high-skilled workers, we use the following categories: engineers and technical managers (38), managers (36, 37), creative professionals (35), scientific professionals (34), heads of business (23), liberal professions (31). See also Harrigan et al. (2021).

[15]For each worker, or each commuting zone, we have four lines for variables before the mass layoff and six lines for variables after the mass layoffs.

commuting zone level, we compare some labor outcomes of a local area hit by a mass layoff event to a comparable (matched) local area which was not, d years after the mass layoff.

3.1 Matching procedure

We match workers using coarsened exact matching, as this method reduces model dependency (Iacus et al., 2012). In particular, instead of guaranteeing the sample size *ex ante*, the method aims at *ex ante* ensuring a sufficient balance, i.e. making the empirical distribution of covariates more similar (reducing bias), so that, after pruning some observations (reducing precision), the sample size is an *ex post* outcome of the procedure.

This matching procedure creates cells in which displaced and non-displaced workers (or commuting zones) possess the (exact) same coarsened characteristics within each cell. Subsequently, we randomly designate one non-displaced worker (or commuting zone) as a control for every displaced worker (or each commuting zone affected by a mass layoff). As a consequence, a one-to-one matching is established.

Matching workers. We match workers in a given two-digit sector and occupation based on firm size, pay and work experience. Following Helm et al. (2022), we use these characteristics measured two years prior to the mass layoff instead of one year, as workers who got laid off might have experienced wage loss in the year prior to the layoff compared to the workers who remained employed, by means of smaller number of hours worked or lesser wage increase.

Matching commuting zones. We match commuting zone using a coarsened exact matching technique. The matching characteristics are the unemployment rate and the sectoral composition of the labor force.

3.2 Estimation regressions

3.2.1 Equation at the individual level

For our study at the individual level, we estimate the following model:

$$Y_{icdt} = \sum_{d=-5}^{6} \beta_d \times \mathbb{1}\left\{t_i^D + d = t\right\} \times \mathbb{1}\left\{D_i = 1\right\} + \sum_{d=-5}^{6} \delta_d \times \mathbb{1}\left\{t_i^D + d = t\right\} + \alpha_i + \sigma_{c,d} + \epsilon_{icdt} \quad (1)$$

where d denotes the number of years that occurred either before (with a minus sign) or after (with a plus sign) the mass layoff event, t_i^D is the displacement (D) year for individual i and c is a given cell in a calendar year t.[16] The variables from the year before the mass layoff are indexed by the subscript $d = 0$.

Y_{icdt} is either i) some labor outcome of worker i at time t, d years before or after the mass layoff (for instance, the likelihood of employment, the log wage or a dummy equal to 1 if the worker has a full-time, non-annex job) or ii) some characteristics of the establishment where the worker is employed at that time (expressed in log). $\mathbb{1}\left\{t_i^D + d = t\right\}$ is an indicator variable equal to 1 in period $t_i^D + d$ and $\mathbb{1}\left\{D_i = 1\right\}$ is an indicator variable with a value of 1 if worker i was displaced in year t_i^D. We control for individual fixed effect, α_i, and for cell-by-period fixed effects, $\sigma_{c,d}$ (where cells correspond to our matched pairs, as explained in Section 3.1).[17]

3.2.2 Equation at the commuting zone level

For the commuting zone level study, we estimate the following model:

$$Y_{zdt} = \sum_{d=-5}^{6} \beta_d \times \mathbb{1}\left\{t_z^D + d = t\right\} \times \mathbb{1}\left\{D_i = 1\right\} + \sum_{d=-5}^{6} \delta_d \times \mathbb{1}\left\{t_z^D + d = t\right\} + \alpha_z + \sigma_{t_z^D} + \epsilon_{zdt_z^D} \quad (2)$$

[16] See Section 3.1 for details on how cells for matching are created.

[17] As in Helm et al. (2022), controlling for cell-by-period fixed effect is equivalent to controlling for cell-by-calendar year fixed effects, because cells are defined separately for each layoff year.

where z denotes a commuting zone. Y_{zdt} corresponds to some characteristics, at time $t_z^D + d$, of the commuting zone hit by a mass layoff at time t_z^D, expressed in log. We control for commuting zone fixed effect α_z and a mass layoff year fixed effect $\sigma_{t_z^D}$.

4 Results

4.1 Individual effects

We start with the analysis of the effects of mass layoffs on displaced workers. Results in this section are presented for the whole sample and by skills, to explore the heterogeneity of the effect of mass layoffs, contingent upon the specific occupation and, thus, the respective skills required. Prior skill levels are taken into consideration before the occurrence of the mass layoff to account for the possibility that displaced workers may be compelled to transition into alternative occupations.

4.1.1 Heterogeneous effects on employment probability

Table 3 shows estimates of regression 1 for the impact of displacement on the log odds ratio of being employed in a stable (full-time, non-annex) job, based on a logit regression. A displaced worker has a 21 points lower probability of having a stable job one year after the mass layoff, and still 17 points lower 6 years after.[18]

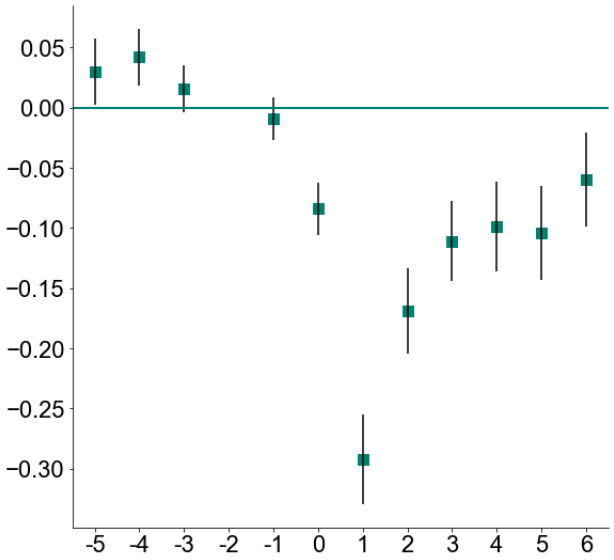
The impact is substantially smaller for highly skilled workers, with a decrease of 0.08 points after one year and 0.04 points after six years. In contrast, low-skilled workers are much more affected, experiencing a 33-point decrease in the probability of having a stable job one year after the layoff, and a 20-point decrease after six years.

[18]These figures represent the marginal effects derived from the logit regression.

4.1.2 Heterogeneous effects on wages

Figure 1 displays estimates of regression 1 with the wages of displaced workers in the overall sample as the dependent variable. Conditional on having a non-annex job, the wage is 25% lower in the first year following the mass layoff and remains 6% lower after six years. The total accumulated losses over a span of six years average at €21,845 for each displaced worker who secured a stable job after the layoff. In other words, even for workers who have the most favorable trajectory after being laid off, namely those who find employment, the individual cost of displacement is substantial.

Figure 1: Effect of mass layoffs on wages

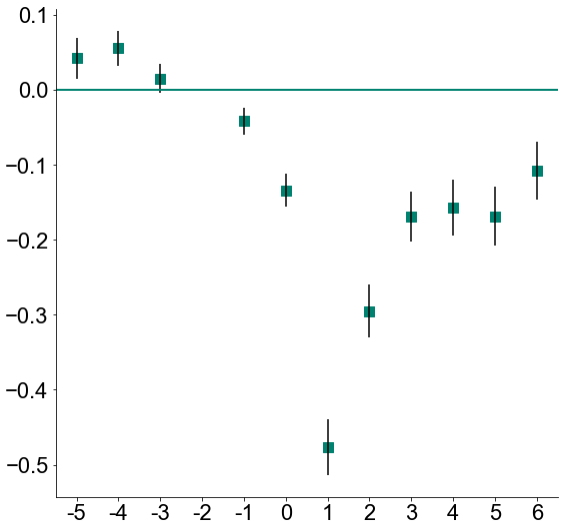


Note: The figure reports estimates of the effects of mass layoffs on wages of displaced workers based on equation 1. The dependent variable is the log of annualized earnings. See Section A.2 for a detailed description of the variables. We include individual fixed effects and cell-by-period fixed effects. Standard errors are clustered at the cell level (pair of matched workers). Regression estimates for all workers. Bars indicate significance at the 5% level. The X-axis corresponds to the years before and after the mass layoff.

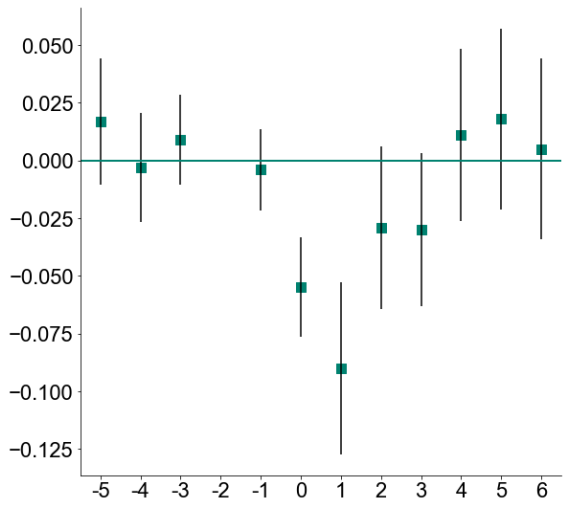
Figure 2 shows the heterogeneous effects of mass layoffs on wages depending on skills. Effects are much larger for low-skilled workers (Figure 2a). Low-skilled workers who found a stable job suffer a loss of 37% of their annual wage the first year and 10% the sixth year after the mass layoff. By contrast, high-skilled workers' losses are statistically significant for

Figure 2: Effect of mass layoffs on wages: low-skilled vs. high-skilled workers

(a) Low-skilled workers



(b) High-skilled workers



Note: These figures compare the effects of mass layoffs on wages for low-skilled workers (a) and high-skilled workers (b). The dependent variable is the log of annualized earnings. See Section A.2 for a detailed description of the variables. We include individual fixed effects and cell-by-period fixed effects. Standard errors are clustered at the cell level. Regression estimates for all workers. Bars indicate significance at the 5% level. The X-axis corresponds to the years before and after the mass layoff.

the first year only, with a loss of 8.6% (Figure 2b).

4.1.3 Effect on wages after a period of unemployment

We will now examine the impact on wages of the initial employment opportunity subsequent to a mass layoff, following a period of either one to four years without stable employment. Table 4 displays estimations that pertain to the specific effect on the first job undertaken by a displaced worker, rather than an overall average effect (which may already encompass some degree of catch-up). Consequently, the adverse impact on wages is more pronounced.

We differentiate between cases where the first job is in the manufacturing sector and those where it is not. In instances where the initial job falls within manufacturing, the wage is reduced by 33% if the worker has been without stable employment for a full year, and by 45% if the worker has been without stable employment for two years (column 2). On the other hand, if the first job is outside of the manufacturing sector, the effects are more substantial:

a 57% decrease after one year without stable employment and a 46% decrease after four years (column 1).

4.2 Destination firms

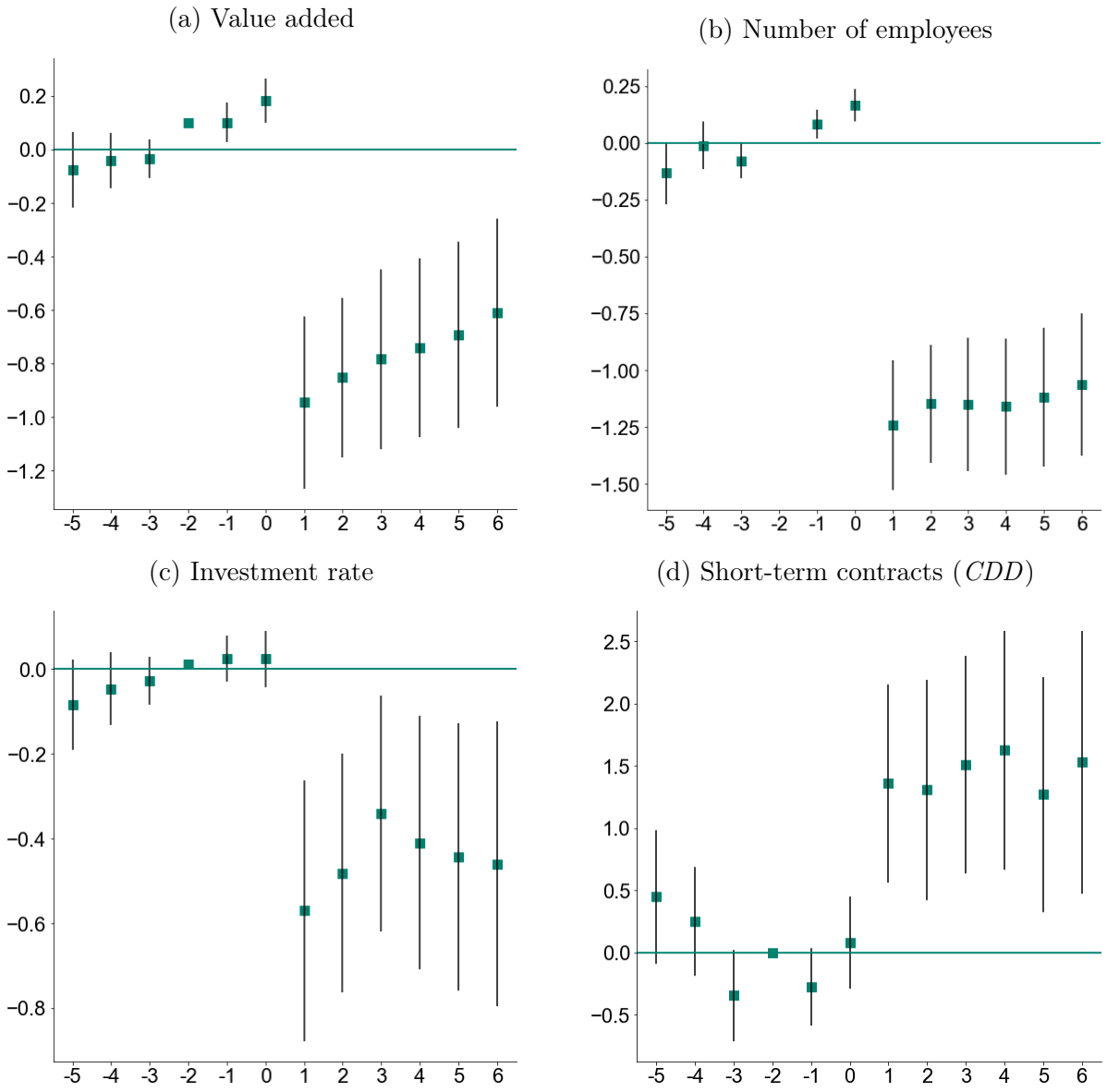
We now compare the type of establishments where redundant employees find new jobs with the establishments where their paired peers work. In order to conduct a relevant comparison between these two establishments, it is essential to have characteristics at the establishment level. In particular, characteristics at the plant level should be considered for companies with multiple production sites. This is because the performance of different establishments within the same firm is likely to vary. However, the availability of balance sheets is limited to the firm level, which does not allow for the consideration of differences between establishments within the same firm. To ensure that the performance of a specific establishment is measured rather than an average of multiple establishments, this study focuses solely on single establishments.[19]

A successful reallocation would occur if dismissed employees were to find employment in a better-performing establishment. In such cases, the redundancy plan would have facilitated the hiring of dismissed employees in establishments considered "better." In that case, mass layoffs would have favored a better allocation of resources and could be beneficial for growth.

However, our analysis does not support this notion. Figure 3 displays estimates of a regression model with various outcomes of the establishment (alternatively value added, investment rate, share of fixed-term contracts) as the dependent variable. Establishments where laid-off employees find new stable jobs have lower value added and employ fewer staff. Consequently, these establishments tend to be smaller in size. Additionally, they have a higher proportion of fixed-term contracts among their staff. Importantly, the investment rate in these establishments is, on average, 36% lower six years after the mass layoff compared

[19]The selected sample primarily consists of smaller companies, although the results remain robust even when the analysis is replicated at the company level, assuming that each plant performs as well as the entire company as a whole.

Figure 3: Destination firms



Note: Following equation 1, we compare establishments hiring displaced workers with the one in which their twin works. The dependent variable is the value added of the establishment (a), the number of employees (b), the investment rate (c), and the share of short-term contracts (d). All variables are expressed in log terms. See Section A.2 for a detailed description of the variables. We include individual fixed effects and cell-by-period fixed effects. Standard errors are clustered at the cell level. Bars indicate significance at the 5% level. The X-axis corresponds to the years before and after the mass layoff.

to establishments of the paired worker. This indicates that these firms not only have smaller size but also invest less. The reduced investment today may lead to lower growth in the future.

Despite the lower value-added and employment levels in these firms, they may have higher apparent labor productivity if the reduction in value added is relatively smaller compared to the reduction in employment. This is indeed what Brandily et al. (2022) find. This paradoxical result could be attributed to the fact that the companies recruiting employees after a redundancy plan are more reliant on temporary work. This could explain why the ratio of value added to employment appears high due to artificially low employment levels in data that do not include temporary contracts. Indeed, the increased reliance on temporary work affects the measurement of value added and employment, resulting in an overestimation of productivity (see Gonzalez and Mihoubi, 2002). In the data used (DADS), employment in companies using temporary contracts is underestimated as temporary workers are associated with their temporary employment agencies rather than the user companies themselves.

4.3 Effect on allocative efficiency

We now shift our attention to examining the impact of mass layoffs on the efficient allocation of resources, specifically in terms of the matching of workers to establishments. Our objective is to determine whether such events present an opportunity for a more optimal distribution of workers across different establishments. In order to do this, we focus on a specific metric: the probability of matching certain types of workers and certain types of establishments, which will be ranked based on their fixed effects obtained from an AKM regression.

To carry out our analysis, we run an AKM regression on the DADS-panel dataset for the period 2009-2019. This dataset allows us to track a representative subsample of workers over time. Measuring conjointly worker and firm quality as a worker's fixed effect and a firm's fixed effect of an AKM regression hinges on the assumption that workers have a sufficient number of employers. This assumption is crucial in order to differentiate between the quality of

workers and the quality of the firms they belong to. However, it is important to acknowledge the potential presence of a well-known limited mobility bias (Andrews et al., 2008). But this bias is mitigated in our dataset as 47% of the individuals in our sample had at least two distinct employers at the firm level during the 2009-2019 period.

We regress the log of the annual wage $S_{i,e,z,j,t}$ of full-time worker i working in establishment e, in commuting zone z, in occupation j at time t on worker fixed effect γ_i, firm fixed effect α_e, a vector of observable time varying individual characteristics of worker i, $X_{i,t}$:

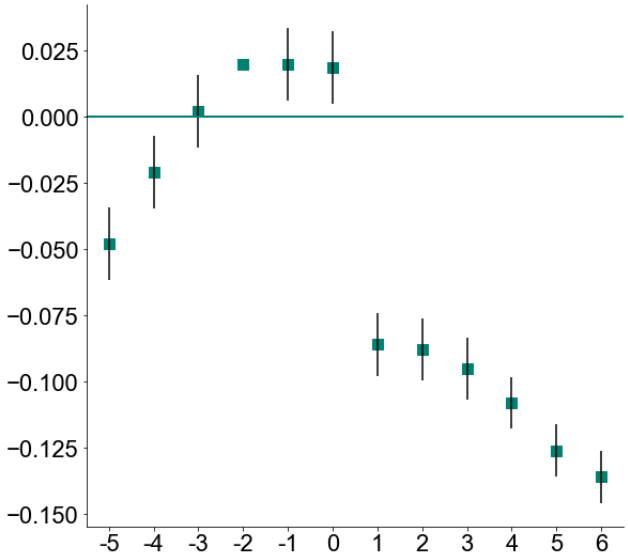
$$\log(S_{i,e,z,j,t}) = \alpha_e + \gamma_i + X_{i,t}$$

Following the approach taken by Orefice and Peri (2020), the vector $X_{t,i}$ includes a quartic polynomial in experience, a dummy variable for the *Ile de France* region (which represents the wealthiest region in France), the 4-digit occupation code, and gender interacted with experience, *Ile de France*, and year dummies. We define "good" workers as those whose fixed effect, within a given occupation, is above the median for that group. Similarly, we define "good" establishments as those whose fixed effect, within a given sector, is above the median for that group.

Next, we explore the impact of mass layoffs on the probability of "good" workers being matched with "good" establishments. Indeed, in an efficient local labor market, the best workers should ideally be able to join the best companies, similar to how the best players in a sports competition would join the best teams or how NASA aims to attract the best engineers. This phenomenon helps to explain the higher productivity observed in large cities in the United States (Andersson et al., 2007). This type of matching is desirable when the qualities of the company and the employee are complementary rather than substitutable in the production process. For example, a highly competent employee in a poorly managed working environment with inadequate equipment would not be able to compensate for the company's shortcomings and would therefore perform less effectively.

Mass layoffs could potentially serve as an opportunity to reallocate the workforce, allowing

Figure 4: Effect on probability of good workers being matched with good firms



Note: This figure shows the probability of good workers being matched with good establishments (see Section 4.3 for the methodology). Six years after the mass layoff, the probability that a good worker works for a good establishment is 14 points lower than for its twin. Bars indicate significance at the 5% level. The X-axis corresponds to the years before and after the mass layoff.

the most competent workers to join the best companies. The results, as shown in Figure 4, indicate that, six years after the mass layoff, the probability of a "good" worker being employed by a "good" establishment is 14 percentage points lower compared to their matched counterpart. This suggests a form of "deskilling" for these employees.

Overall, our analysis in Sections 4.2 and 4.3 leads to conclude that mass layoffs do not lead to a more efficient allocation of the workforce.

4.4 Effects at the commuting zone level

We ultimately assess the consequences of mass layoffs at the level of commuting zones (CZs). By focusing exclusively on mass layoffs in the manufacturing industry, we are able to minimize the possibility that their occurrence is associated with local economic conditions, specifically demand shocks. This allows us to isolate the impact of mass layoffs. What occurs within the commuting zone following a mass layoff?

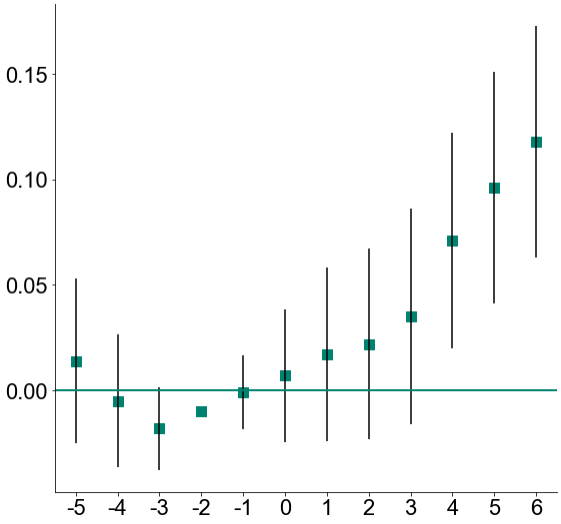
The results obtained from a regression based on equation 2 are depicted in Figure 5. Six years following the mass layoff, the unemployment rate exhibits a 12% increase in comparison to a comparable area that remained unaffected (Figure 5a).[20] Our findings align with the concept of local multiplier effects (Moretti, 2010): When a facility shuts down or significantly reduces its size, the operations of subcontractors and all associated services are jeopardized. These (de)multiplier effects gradually materialize, which accounts for the delayed and deteriorating impact of mass layoffs on the unemployment rate in the area. Additionally, we discover that the proportion of short-term contracts (CDD - *Contrat à durée déterminée*) and temporary work (Intérim - *Contrat d'intérim*) in total employment is respectively 21% and 47% higher six years following the mass layoff (Figures 5b and 5c).

In the context of the concept of creative destruction, this deterioration in local employment conditions might be counteracted by the establishment of new businesses. However, our findings do not support this notion. In local regions where mass layoffs have been implemented, the proportion of manufacturing establishments created is 14% lower one year after the mass layoff, and even 22% lower six years later (Table 5). The situation worsens over time and extends to other sectors. The impact on the creation of new establishments, across all sectors combined, is negative and statistically significant five years after the mass layoff (column 5 in Table 5).

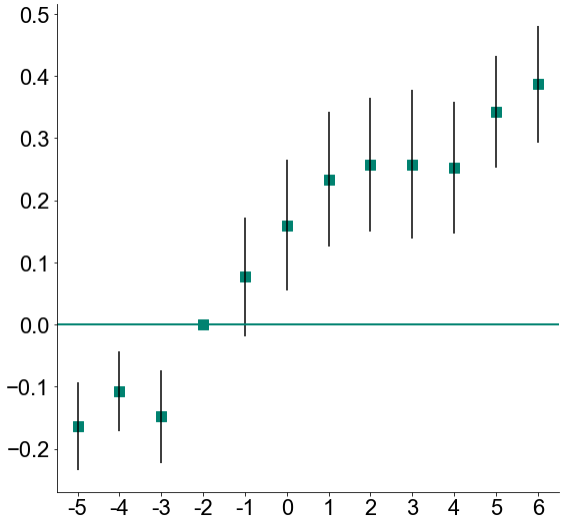
[20]The approximation of the unemployment rate at the commuting zone level is derived by relating the number of individuals seeking employment to an estimation of the active population, which is equal to the sum of jobseekers and employed workers.

Figure 5: Commuting zone level effects

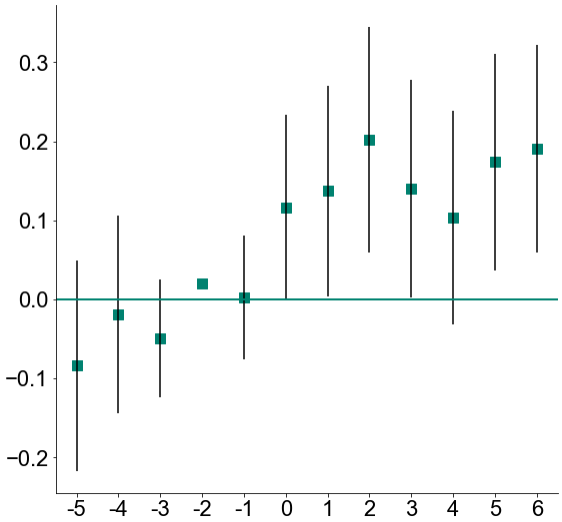
(a) Unemployment rate



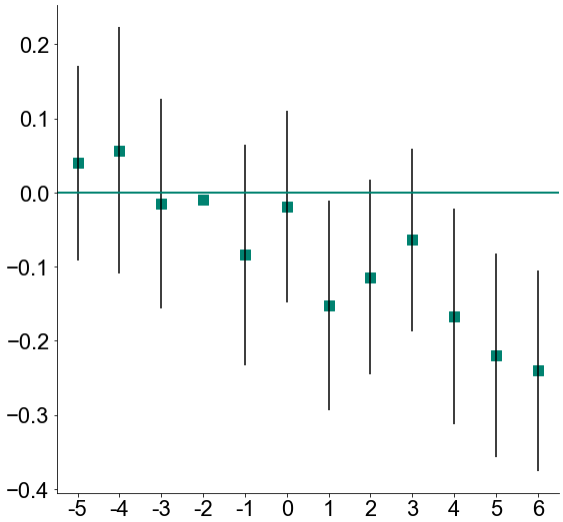
(b) Share of short-term contracts (CDD)



(c) Temporary work (Intérim)



(d) Share of new manufacturing establishments



Note: Following equation 2, these figures show the effects of mass layoffs at the commuting zone level. The dependent variables are the unemployment rate at the commuting zone level (a), the share of short-term contracts (CDD) (b), the share of temporary work (Intérim) (c), the share of new manufacturing establishments (d). All variables are expressed in log terms. See Section A.2 for a detailed description of the variables. Bars indicate significance at the 5% level. The X-axis corresponds to the years before and after the mass layoff.

5 Conclusion

This paper presents novel insights into the adjustment capabilities of the French labor market following mass layoffs in the manufacturing sector. We examine the effects of mass layoffs on both displaced workers and on a more aggregate level. Our findings indicate that, while individual costs are significant and enduring, there appears to be a lack of evidence of any tangible social benefits in terms of worker reallocation or creative destruction at the local level. Firms that hire displaced workers tend to be smaller in terms of number of employees, exhibit a lower investment rate, and have a higher proportion of employees on fixed-term contracts. In terms of local economies, the unemployment rate in affected areas is 12% higher six years after the mass layoff compared to unaffected areas. Furthermore, these areas also experience a reduced share of new establishments following such a shock.

Examining the labor market's capacity to adapt is crucial in anticipating the challenges of the ecological transition. According to the European Union Commission (2023), between 35% and 40% of all jobs will be affected by this transition. The manufacturing sector, in particular, faces substantial challenges due to changes in production methods and intense global competition in green industries. This transformation will result in the reallocation of workers both across and within sectors, and will generate trade shocks through a shift in international specialization caused by the emergence of new sectors. Implementing the energy transition without adversely affecting workers is thus a major challenge. Hanson and Stock (2023) argue that "applying the lessons from prior economic upheavals can smooth the green power transition for workers".

Further research is necessary to model and quantify the effects on the labor market of sectoral reallocations induced by the ecological transition. This includes examining the impact of various policies aimed at initiating the transition, such as the introduction of a carbon tax.

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A Summary statistics and description of variables

A.1 Summary statistics

Table 1: Descriptive statistics: mass layoffs

	(1) Number	(2) Av. Size	(3) Number of individuals
Mass layoffs	507*	260	7200**

Note: *: This number corresponds to the mass layoff identified with the methodology described in Section 2.2. **: These are the individuals we can follow with the representative sampling of the DADS-panel (see Section 2.2). In total, 132,000 individuals are affected by the 507 layoffs.

Table 2: Displaced vs. Non-Displaced Workers

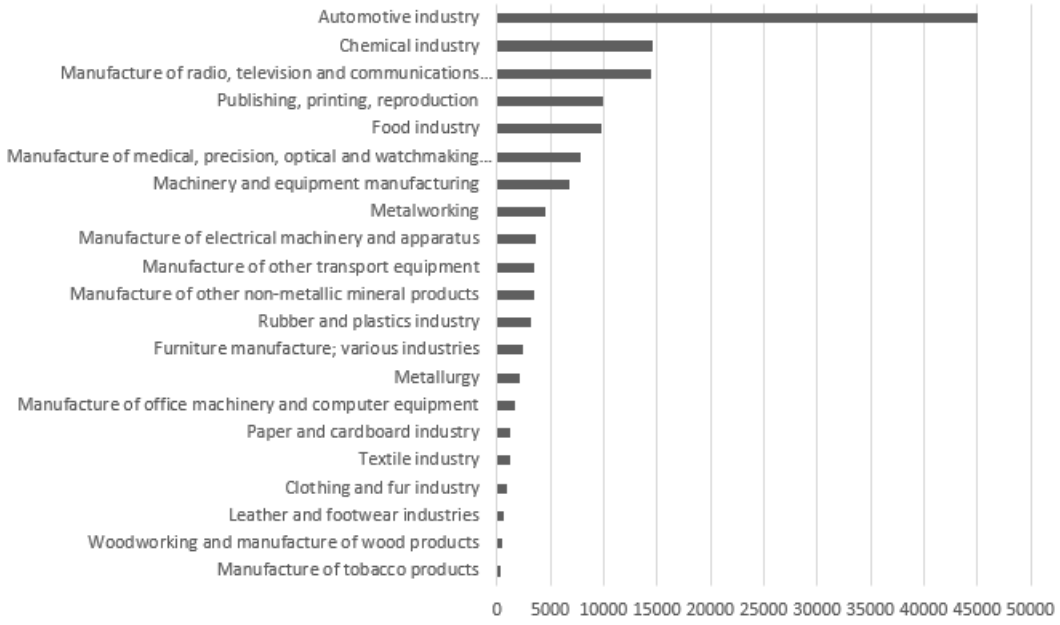
	(1) Displaced workers (Treatment)	(2) Non-Displaced (Matched Control)
Annual earnings	28046	28550
Age	41.5	41.3
Seniority	5.1	5.1
Number of employees per establishment*	1619	1506

Note: We show the averages. Annual earnings, seniority and the number of employees per establishment are measured two years before the mass layoff. *: This is the number of employees declared by the company (which also includes non-annexed jobs).

A.2 Description of variables

- **Mass layoffs**: We focus on mass layoffs in the manufacturing sector. An establishment qualifies as a potential mass layoff establishment if more than 250 jobs are destroyed from one year to another (absolute criteria), or 30% of the total number of employees (relative criteria), and if the sum of jobs destruction in two consecutive years also respects one of those two criteria. For a precise description of the construction of this variable, see Section 2.2.

Figure 6: Number of individuals affected by mass layoffs by sectors



Note: This figure shows the number of individuals affected by mass layoffs by sector. The numbers correspond to the whole sample (132,000 individuals) and not to the representative sampling (DADS-panel) used in the regressions.

A.2.1 At the individual level (for Sections 4.1, 4.2, 4.3)

- **Wage**: annualized earnings expressed in log terms. Source: DADS-Panel (INSEE).
- **Low-skilled workers**: We define skills categories using the "Professions et catégories socioprofessionnelles" occupation code ("PCS 2003" classification, see INSEE (2022)). Low-skilled workers correspond to the following categories: unskilled industrial (66, 67), unskilled manual (68, 69), services workers (54, 55, 56, 64).
- **High-skilled workers**: We define skills categories using the "Professions et catégories socioprofessionnelles" occupation code ("PCS 2003" classification, see INSEE (2022)). We use the following categories: engineers and technical managers (38), managers (36, 37), creative professionals (35), scientific professionals (34), heads of business (23), liberal professions (31).
- **Value added**: value added of the firm expressed in log terms. Source: FICUS-FARE.

- **Number of employees**: number of employees of the firm expressed in log terms. Source: DADS-Postes (INSEE).
- **Investment rate**: deflated tangible investment divided by deflated value added. Source: FICUS-FARE.
- **Short-term contracts**: share of short-term employees (CDD) of the total number of employees. Source: DADS-Postes (INSEE).

A.2.2 At the commuting zone level (for Section 4.4)

- **Commuting zones**: We define commuting zones using the "Zones d'emploi 2010" (INSEE, 2020): this is a geographical area within which most of the working population lives and works, and in which establishments can find most of the manpower needed to fill the jobs on offer.
- **Unemployment rate**: The unemployment rate is approximated by relating the number of jobseekers to an approximation of the active population equal to jobseekers plus employed workers. Source: INSEE ("Taux de chômage localisés par zone d'emploi").
- **Share of short-term contracts**: share of employed workers with short-term contracts ("CDD") over the total number of employed workers. Source: DADS-Postes (INSEE).
- **Temporary work**: share of temporary workers (Intérim) over the total number of employees. Source: DADS-Postes (INSEE).
- **Share of new manufacturing establishments**: share of new manufacturing establishments of the total number of establishments in the commuting zone. Source: Data on new establishments come from the REE "Répertoire des entreprises et des établissements" supplied by INSEE (2023). Only establishments with more than 10 employees at the time of creation are included here.

- **Share of new establishments**: share of new establishments of the total number of establishments in the commuting zone. Source: Data on new establishments come from the REE "Répertoire des entreprises et des établissements" supplied by INSEE (2023). Only establishments with more than 10 employees at the time of creation are included here.

B Tables

Table 3: Effect of mass layoffs on log odds ratio of the probability of being employed

	(1) All	(2) High-skilled	(3) Low-skilled
$year: +1$	-1.904***	-1.063***	-2.699***
	(0.051)	(0.132)	(0.111)
$year: +2$	-1.478***	-0.228*	-2.024***
	(0.053)	(0.138)	(0.116)
$year: +3$	-1.352***	-0.736***	-1.856***
	(0.053)	(0.117)	(0.118)
$year: +4$	-1.451***	-1.275***	-1.700***
	(0.053)	(0.114)	(0.122)
$year: +5$	-1.311***	-0.742***	-1.430***
	(0.055)	(0.122)	(0.129)
$year: +6$	-1.614***	-0.648***	-1.793***
	(0.055)	(0.128)	(0.129)
Worker FE	Yes	Yes	Yes
Stratum Year FE	Yes	Yes	Yes
Obs	62,056	13,946	10,920

Note: This table reports estimates of the effects of mass layoffs on the log odds ratio of the probability of being employed for the whole sample (column 1), for high-skilled workers (column 2), for low-skilled workers (column 3), based on a logit regression. See Section A.2 for a detailed description of the variables. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 4: Effect of mass layoffs on the wage of the first job depending on the sector

	(1) Wages	(2) Wages
Outside Manuf: $year + 1$	-0.849***	
	(0.075)	
Outside Manuf: $year + 2$	-0.748***	
	(0.105)	
Outside Manuf: $year + 3$	-0.887***	
	(0.187)	
Outside Manuf: $year + 4$	-0.627**	
	(0.239)	
In Manuf: $year + 1$		-0.410***
		(0.103)
In Manuf: $year + 2$		-0.652***
		(0.153)
In Manuf: $year + 3$		-0.128
		(0.110)
In Manuf: $year + 4$		0.101
		(0.268)
Worker FE	Yes	Yes
Stratum Year FE	Yes	Yes
Obs	50,603	50,603
Adjusted R-squared	0.689	0.683

Note: This table reports estimates of the effects of mass layoffs on the wage of the first job - we distinguish whether this first job is in the manufacturing sector (column 2) or outside the manufacturing sector (column 1). Wages are measured in log terms. See Section A.2 for a detailed description of the variables. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01

Table 5: Effect of mass layoffs on commuting zones

	(1) Temporary work	(2) ST contracts	(3) Unemp.	(4) New manuf. estab.	(5) New estab.
$year: -5$	-0.085	-0.164***	0.014	0.040	0.032
	(0.069)	(0.037)	(0.021)	(0.067)	(0.041)
$year: -4$	-0.019	-0.108***	-0.006	0.058	0.011
	(0.065)	(0.034)	(0.016)	(0.086)	(0.046)
$year: -3$	-0.053	-0.149***	-0.019*	-0.015	-0.031
	(0.039)	(0.038)	(0.010)	(0.072)	(0.048)
$year: -1$	0.003	0.077	-0.002	-0.085	-0.050
	(0.040)	(0.050)	(0.010)	(0.077)	(0.045)
MLO year	0.117*	0.161***	0.007	-0.020	-0.026
	(0.061)	(0.054)	(0.016)	(0.066)	(0.041)
$year: +1$	0.138**	0.234***	0.017	-0.152**	-0.053
	(0.068)	(0.055)	(0.021)	(0.072)	(0.042)
$year: +2$	0.202***	0.258***	0.023	-0.114*	-0.032
	(0.074)	(0.056)	(0.024)	(0.068)	(0.049)
$year: +3$	0.141**	0.259***	0.035	-0.064	-0.064
	(0.070)	(0.061)	(0.026)	(0.064)	(0.047)
$year: +4$	0.104	0.253***	0.071***	-0.168**	-0.110*
	(0.069)	(0.055)	(0.026)	(0.075)	(0.059)
$year: +5$	0.175**	0.344***	0.097***	-0.221***	-0.136**
	(0.071)	(0.046)	(0.028)	(0.070)	(0.060)
$year: +6$	0.192***	0.387***	0.119***	-0.241***	-0.136***
	(0.068)	(0.049)	(0.029)	(0.069)	(0.048)
CZ FE	Yes	Yes	Yes	Yes	Yes
CZ * MLO year FE	Yes	Yes	Yes	Yes	Yes
Obs	1,164	615	1,313	1,167	1,271

Note: Following equation 2, this table reports estimates of the effects of mass layoffs on commuting zones. $year: -2$ is dropped as it is the reference year. "Temporary work" stands for the share of temporary workers; "ST contracts" = the share of short-term contracts; "Unemp." = the unemployment rate; "New manuf. estab." = the share of new manufacturing establishments; "New estab." = the share of new establishments. See Section A.2 for a detailed description of the variables. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01

C Mass layoffs and import competition

We follow the methodology laid out in Autor et al. (2016) and developed initially in Autor et al. (2013a) and Autor et al. (2013b). Import competition is measured for each commuting zone as the weighted average exposure in each industry to imports from China to France, where national imports are allocated to each commuting zone depending on its share of national industry employment before the rise of Chinese imports, divided by the number of workers employed in the commuting zone, as shown in equation 3.

$$IPW_{it}^{CF} = \frac{1}{L_{i,1995}} \sum_{k} \frac{L_{i,k,1995}}{L_{k,1995}} M_{it}^{CF} \tag{3}$$

A simple OLS might be biased as imports from China could reflect a change in demand and not only a change in Chinese competitors' productivity. Therefore, the measure of exposure, IPW_{it}^{CF}, is instrumented by a measure constructed in a similar way, IPW_{it}^{CO}, but using the imports from China to some other countries, M_{it}^{CO}, instead of imports from China to France, M_{it}^{CF}. These other countries are high-income countries similar to France but whose business cycle should be rather independent from the French one. The list of countries is as in Malgouyres (2017) and includes the following countries: Argentina, Australia, Canada, Chile, Denmark, Japan, New Zealand, Norway, Singapore, Sweden and South Korea.

Another concern is that employment levels used to construct shares and to normalize imports are likely to depend on anticipated imports from China; for instance, employers who are more exposed to Chinese imports in a given period decrease employment in response to this increased competition. Therefore,for both measures, IPW_{it}^{CF} and its instrument IPW_{it}^{CO}, lagged employment levels are used to reduce simultaneity bias concerns as in Autor et al. (2013a). Employment levels in 1995, hence at the beginning of our period, are chosen as shown in equations 3 and 4.

$$IPW_{it}^{CO} = \frac{1}{L_{i,1995}} \sum_{k} \frac{L_{i,k,1995}}{L_{k,1995}} M_{it}^{CO} \tag{4}$$

As shown in Table 6, import penetration has a positive effect on the probability of a commuting zone suffering a mass layoff (MLO). This effect is significant at the 1% level.

Table 6: Effect of import penetration on the probability of MLO

	(1)
	Probability of a MLO
Trade Shock	0.0203***
	0.0050
CZ*Year FE	Yes
Obs	7,600

Note: Import penetration from China to France is instrumented by imports from China to similar high-income countries, as described in the text. Imports are taken in log. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01. Data source: BACI, CEPII.