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# Globalization and the labor market : A study of tradable and non-tradable jobs in France

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**THÈSE DE DOCTORAT**

**DE L'UNIVERSITÉ PSL**

Préparée à MINES ParisTech

**Globalization and the labor market: A study of tradable  
and non-tradable jobs in France**

Soutenue par

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## Avant-propos

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Ce travail de thèse a été conduit sous la direction de Pierre-Noël Giraud, dans le cadre d'une Convention Industrielle de Formation par la Recherche (CIFRE) avec La Fabrique de l'industrie. La Fabrique de l'industrie est un laboratoire d'idées créé pour que la réflexion collective sur les enjeux industriels gagne en ampleur et en qualité. Elle est co-présidée par Louis Gallois, président du conseil de surveillance du groupe PSA, et Pierre-André de Chalendar, PDG de Saint-Gobain. Elle a été fondée en octobre 2011 par des associations d'industriels (Union des industries et des métiers de la métallurgie, Cercle de l'industrie, Groupe des fédérations industrielles, rejoints depuis par le Groupe des industries métallurgiques, et le Groupement des industries françaises aéronautiques et spatiales).

La réflexion a pour point de départ le constat que l'imbrication de l'industrie et des services est devenue si forte qu'elle rend de moins en moins pertinente cette distinction traditionnelle. Un bien manufacturé incorpore une part croissante de services nécessaires à sa production ou vendus avec lui. Symétriquement, certains services sont produits sur un mode industriel, et exigent des infrastructures et des équipements - comme les réseaux de communication - pour être délivrés. Enfin, nombre d'emplois de services sont aujourd'hui délocalisables, au même titre que les emplois industriels. Il apparaît donc pertinent d'explorer d'autres catégories d'analyse, qui tiennent compte explicitement des bouleversements induits par la mondialisation.

C'est pourquoi cette thèse étudie les évolutions structurelles de l'emploi en France en distinguant les emplois exposés à la concurrence internationale de ceux qui en sont abrités, que l'on trouve à la

fois dans l'industrie et dans les services. Les emplois exposés sont ceux qui concourent à la production de biens et services échangeables par-delà les frontières et peuvent donc être concurrencés par des emplois situés dans d'autres pays (e.g. ouvriers du textile, céréaliers, éditeurs de jeux vidéos). Par opposition, les emplois abrités (e.g. dentistes, boulangers, instituteurs, postiers, etc.) sont uniquement en concurrence avec des emplois localisés dans le même pays, voire dans la même ville.

La littérature en économie internationale est riche de travaux distinguant les secteurs exposés et abrités<sup>1</sup>. Pourtant, il existe peu d'études empiriques s'intéressant aux emplois de ces secteurs, et aucune ne porte sur la France. Dans le chapitre 1, j'étudie l'évolution et les caractéristiques (salaire, diplôme, productivité, géographie) des emplois dans les secteurs exposés et abrités en France. Parmi les principaux résultats, je trouve que l'emploi dans le secteur exposé à la concurrence internationale est minoritaire, en recul, et se tertiarise. Les salaires et la productivité du travail y sont en moyenne plus élevés et croissent plus rapidement, alors que les niveaux de qualification sont comparables. Je montre enfin que les emplois exposés sont inégalement répartis sur le territoire et exercent un effet d'entraînement sur l'emploi abrité au niveau local.

Ce chapitre a été réalisé en collaboration avec Pierre-Noël Giraud. Il fera l'objet d'une publication en décembre 2018 dans la revue *Économie et Statistique*. Des résultats préliminaires avaient déjà été publiés en septembre et novembre 2016 par La Fabrique de l'industrie dans une synthèse, *Les emplois exposés et abrités en France* (Philippe Frocrain et Pierre-Noël Giraud), et un ouvrage paru aux Presses des Mines, *Dynamique des emplois exposés et abrités en France* (Philippe Frocrain et Pierre-Noël Giraud, préface de Roger Guesnerie). On retrouve des extraits de ces publications dans le sujet de l'épreuve de Droit et Economie du Bac STMG 2018. Enfin, j'ai présenté ces travaux lors de conférences académiques et grand public, dont le 66ème Congrès de l'Association Française de Sciences Économique à Nice; la 22ème conférence Dynamics, Economic Growth and International Trade (DEGIT) à Paris, la 19ème conférence du European Trade Study Group (ETSG) à Florence; Le Printemps

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<sup>1</sup>Elle y fait parfois référence sous les termes échangeables et non-échangeables, ou nomades et sédentaires (Giraud).

de l'économie 2017 à Paris; et la 28e convention nationale de l'Assemblée des Communautés de France (AdCF) à Nantes.

Dans le chapitre 2, j'adopte une approche microéconomique en examinant le processus de retour à l'emploi de salariés français licenciés à cause de la fermeture d'un site de production, selon qu'ils proviennent d'un secteur exposé ou abrité. De manière intéressante, on trouve que les salariés du secteur exposé n'ont pas plus de risque d'être licenciés (suite à la fermeture d'un site de production) que ceux du secteur abrité. Néanmoins, les perspectives de retour à l'emploi sont significativement moins bonnes pour les salariés licenciés du secteur manufacturier, par rapport à ceux des services exposés et du secteur abrité. À partir d'une méthode de double différence, je montre que les pertes salariales imputables au licenciement sont en outre plus élevées pour ces salariés manufacturiers licenciés. Les résultats suggèrent que ces difficultés pourraient s'expliquer par l'importance des compétences spécifiques dans l'industrie manufacturière, secteur en déclin et concentré géographiquement.

Ce chapitre a été réalisé conjointement avec Eugénie Tenezakis. Des résultats préliminaires ont été publiés en décembre 2017 et juin 2018 par La Fabrique de l'industrie dans une synthèse, *Que deviennent les salariés qui perdent leur emploi ?* (Philippe Frocrain et Eugénie Tenezakis), et un ouvrage paru aux Presses des Mines, *Parcours de travailleurs dans une économie mondialisée* (Philippe Frocrain et Eugénie Tenezakis, préface de Pierre Méhaignerie). Ces travaux ont fait l'objet de présentations lors du Conseil d'orientation de La Fabrique de l'industrie à Paris, Les Rendez-vous de l'histoire 2018 à Blois, et sur le plateau de Xerfi Canal.



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# CHAPTER 1

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## The evolution of tradable and non-tradable employment

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### Résumé

Le développement des technologies de l'information et de la communication, la diminution des coûts de transport, et la baisse des barrières tarifaires, ont élargi l'éventail des biens et services échangeables internationalement. En termes d'emploi, ces changements sont porteurs d'opportunités et de risques. Ce premier chapitre étudie l'évolution de l'emploi dans les secteurs exposés et abrités en France, sur la période 1999-2015. Nous reprenons la méthodologie de [Jensen and Kletzer \(2005\)](#), étendue par [Barlet et al. \(2010\)](#), afin de construire un indicateur de la concentration géographique de l'offre et distinguer ainsi les activités exposées à la concurrence internationale des activités abritées (86 activités). Selon notre classification, l'emploi exposé est minoritaire et en recul, passant de 27.5% à 23.6% de l'emploi total sur la période étudiée. Nous montrons que ce déclin s'est accompagné d'une tertiarisation de l'emploi exposé : le nombre d'emplois dans les services exposés a nettement progressé, pour devenir la composante majoritaire au sein du secteur exposé, devant les emplois manufacturiers et du secteur primaire. On constate également que les emplois exposés sont plus productifs et mieux rémunérés. Enfin, nous examinons la répartition spatiale de l'emploi exposé, et les conséquences de son évolution sur les emplois abrités. Nous utilisons l'approche économétrique développée par [Moretti \(2010\)](#) pour estimer le nombre d'emplois abrités créés dans une zone donnée à la suite de l'apparition

d'un nouvel emploi exposé dans cette même zone. Nos estimations montrent que lorsque 100 emplois exposés apparaissent dans une zone d'emploi de France métropolitaine, environ 80 emplois abrités supplémentaires sont créés au sein de la même zone d'emploi.

## Abstract

Technological advances in information, communication, and transportation, coupled with lower formal trade barriers, have enlarged the number of goods and services that can be traded internationally. This has generated both employment opportunities and risks. The objective of this paper is to investigate the evolution of employment in the tradable and non-tradable sectors in France over 1999-2015. Using the methodology provided by [Jensen and Kletzer \(2005\)](#) and extended by [Barlet et al. \(2010\)](#), based on the geographical concentration of supply, we first establish a distinction between tradable and non-tradable industries (86 industries). According to our classification, tradable employment makes up the minority of French employment and has decreased significantly as a proportion of total employment, dropping from 27.5% to 23.6%. We show that there has been significant restructuring within the sector: tradable services jobs now make up the majority of tradable jobs in France and have grown sharply, while employment has declined in the rest of the tradable sector (manufacturing, agricultural and mining industries). We also identify a large wage and labour productivity gap between tradable and non-tradable sectors. Finally, we examine how tradable jobs are distributed across French local labor markets and how their development impacts non-tradable employment locally. Using the local multiplier approach developed by [Moretti \(2010\)](#), we find that for every 100 tradable jobs created in an employment area in metropolitan France between 2008 and 2016, 80 additional non-tradable jobs were created within the same area.



## 1.1 Introduction

The distinction between primary, secondary and tertiary sectors, initially made by Fisher (1935), forms the basis of classification of economic activities. Nevertheless, it has lost some of its relevance due to the blurring of the line between industrial activities and service activities. Manufactured goods involve a growing share of services that are required to produce them or sold with them (Crozet and Milet, 2014). Symmetrically, some services are produced on an “industrial mode” (Fontagné et al., 2014) and require infrastructures and equipment, such as communication networks, to be delivered. On the other hand, the sharp growth in international trade in recent decades has made it increasingly necessary to make a distinction between activities exposed to international competition and those not exposed to it, found in primary, secondary and tertiary sectors. This distinction between the tradable and non-tradable sectors has been widely used in international economics, with special relevance for, inter alia, the effects of devaluation, the purchasing-power-parity theory of exchange rates, the determination of inflation in open economies, and the specification and estimation of international trade flows (Goldstein and Officer, 1979). To date, the vast majority of empirical studies associate the tradable sector with the primary and secondary sectors, implicitly assuming that services are not tradable (Gervais and Jensen, 2015). Yet recent advances in information and communication technologies have increased the tradability of a great number of products and especially services, providing employment opportunities and risks. Surprisingly, only a very few studies - Jensen and Kletzer (2005); Hlatshwayo and Spence (2014) for the United States, and Eliasson et al. (2012); Eliasson and Hansson (2016) for Sweden - have made a detailed study of tradable and non-tradable employment. We contribute to this recent literature and to the debate on the effects of increased globalization on the employment structure of our economies by analyzing employment, wages, skills, and labor productivity patterns across tradable and non-tradable industries in France from 1999 to 2015.

The distinction between tradable and non-tradable jobs stems from the division of a country’s



economy into two parts. The tradable sector produces goods and services that can be produced in one country and consumed in another - in the specific case of tourism, it is foreign consumers that do the moving. The non-tradable sector produces to satisfy exclusively domestic demand. Jobs in the tradable sector, which are usually called *tradable jobs*, compete with jobs in other countries. This does not just involve jobs in the manufacturing and agricultural sectors, but also all jobs engaged in producing remotely deliverable services. Thus, we can expect the tradable sector to include, e.g., automobile workers, call centre employees, milk producers, and software engineers. It also includes jobs in tourism, which are partly supported by the movement of foreign consumers. International tourists clearly consume in the territory where production takes place. But in choosing between several destinations, they put jobs located in different countries into competition. Regarding jobs in the non-tradable sector, referred to as *non-tradable jobs*, they only directly compete with jobs in the same country, and often even in the same town. High tariffs can explain why some jobs are sheltered from international competition. Others are sheltered for reglementary or institutional reasons, e.g. soldiers and politicians. However, most often it is transport costs that constitute a barrier to international trade, in particular for activities that require physical proximity between consumers and producers. A typical example is hairdressing, which is not yet automated or remotely controllable, and for which international differences in price and quality do not justify cross-border movement of consumers. This observation is also valid for other non-tradable jobs like bakers and physiotherapists.

In practice it is not easy to precisely identify tradable and non-tradable jobs. This distinction is not made in national accounts and no consensual method has emerged in the academic literature. Moreover, the boundary between the two categories is not fixed because of technical and regulatory changes. We identify three main, not mutually exclusive, methods to classify tradable and non-tradable jobs. A large body of literature ([De Gregorio et al., 1994](#); [Dwyer, 1992](#); [Dixon et al., 2004](#); [Amador and Soares, 2017](#)) uses trade statistics to classify as tradable industries that produce goods and services of which a sufficient portion are traded. For instance, Amador and Soares (2017) identify tradable

and non-tradable industries based on Portuguese firm-level data: industries that report an export-to-sales ratio above 15% are included in the tradable sector. Using this criterion, they find that almost one quarter of non-manufacturing employment is tradable. A second approach (Bardhan and Kroll, 2003; Blinder, 2009; Blinder and Krueger, 2013; Jensen and Kletzer, 2010) determines *offshorability*<sup>1</sup> based on the task content of occupations. The idea is that tasks involving little face-to-face customer contact or having high information content are likely to be offshorable. As an example, computer programming meets the criteria, unlike childcare which requires close physical proximity. An important limitation, as shown by Lanz et al. (2011), is that workers performing tasks considered tradable also tend to perform non-tradable tasks. In addition, different offshorability measures coexist, even among authors using the same database (Püschel, 2013). In this paper we choose a third approach, using geographic concentration indexes as an indicator of tradability.

In a stimulating contribution, Jensen and Kletzer (2005) compute geographic concentration indexes for industries and occupations to estimate the number of tradable jobs in the United States, paying particular attention to the tradability of services. Industries that produce tradable goods and services need to be geographically concentrated in order to take advantage of increasing returns to scale and agglomeration economies, or access to transportation nodes and natural resources. Conversely, non-tradable activities are more spatially dispersed, as they tend to follow the geographical distribution of population and income. Indeed, trade costs are so high for non-tradable industries that supply and demand tend to converge domestically. For instance, bakeries tend to be highly dispersed, as they almost exclusively serve local customers, while car manufacturers are more concentrated, as the tradability of their output allows them to take advantage of concentration. Helpman and Krugman (1985) demonstrated this intuition in a formal model, while Krugman (1991) computed locational Gini coefficients for 106 three-digit US manufacturing industries.<sup>2</sup> From a methodological

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<sup>1</sup>It should be noted that the concept of offshorability, i.e. the ability to perform work from abroad, differs slightly from our definition of tradability as it does not include jobs in tourism, which cannot strictly be offshored but depend partly on foreign demand.

<sup>2</sup>More recently, Gervais and Jensen (2015) proposed a theoretical framework formalizing the idea that the disparity between local supply and local demand is an indicator of the extent of trade in an industry.

standpoint, the approach of [Jensen and Kletzer \(2005\)](#) differs in the sense that they do not study pure geographical concentration of supply as in [Krugman \(1991\)](#), but rather geographical concentration of supply relative to local demand. A few studies have since used this approach to classify industries and occupations. [Eliasson et al. \(2012\)](#) and [Barlet et al. \(2010\)](#) focus on the tradability of services in the case of Sweden and France respectively. [Hlatshwayo and Spence \(2014\)](#) study the evolution of the tradable and non-tradable sectors in the United States. Our work differs from [Barlet et al. \(2010\)](#) in the sense that they focus on the tradability of services, while we are interested in the evolution of all tradable and non-tradable jobs in the French economy and analyze not only employment but also wages, skills, labor productivity, geography, and the local employment multiplier effect of tradable jobs on non-tradable jobs.

According to our classification of tradable and non-tradable industries, tradable employment is still the minority in France. And increasingly so: its share of total employment has significantly decreased, from 27.5% in 1999 to 23.6% in 2015. In the space of sixteen years, non-tradable employment increased by 2.78 million, while tradable employment dropped by 400,000. Interestingly, tradable employment has become more tertiary, which is consistent with the growing importance of services in world trade and global value chains. Jobs in tradable service activities now represent almost half of tradable jobs, and have experienced a higher employment growth rate than jobs in non-tradable services. This has not however been sufficient to compensate for the decline in the manufacturing, agricultural and mining industries. The fall in tradable employment has also been accompanied by a widening productivity gap between the two groups: labor productivity gains are much more dynamic in tradable than non-tradable sectors. In 2015, the annual gross wage for tradable workers was on average 27% higher than for non-tradable workers, and the gap does not seem to reflect a difference in the skill structure, which is remarkably similar in the two sectors.

We also analyze how employment evolved at the local labor market level (French employment

areas) between 2008 and 2016. Since tradable industries are concentrated in certain areas, we observe disparities in regional exposure to foreign competition. Strikingly, we observe that the employment areas in which tradable employment has shrunk the most have often also been affected by the destruction of non-tradable jobs, and vice versa. To identify a causal relationship, we follow the econometric approach proposed by [Moretti \(2010\)](#) to estimate *local multipliers*, i.e. the impacts of employment changes in the tradable sector on employment in the non-tradable sector. Our results confirm the significant local multiplier effect of tradable employment. From 2008-2016, for every 100 additional jobs created in the tradable sector in an employment zone in mainland France, 80 jobs were also generated in the non-tradable sector within the same area.

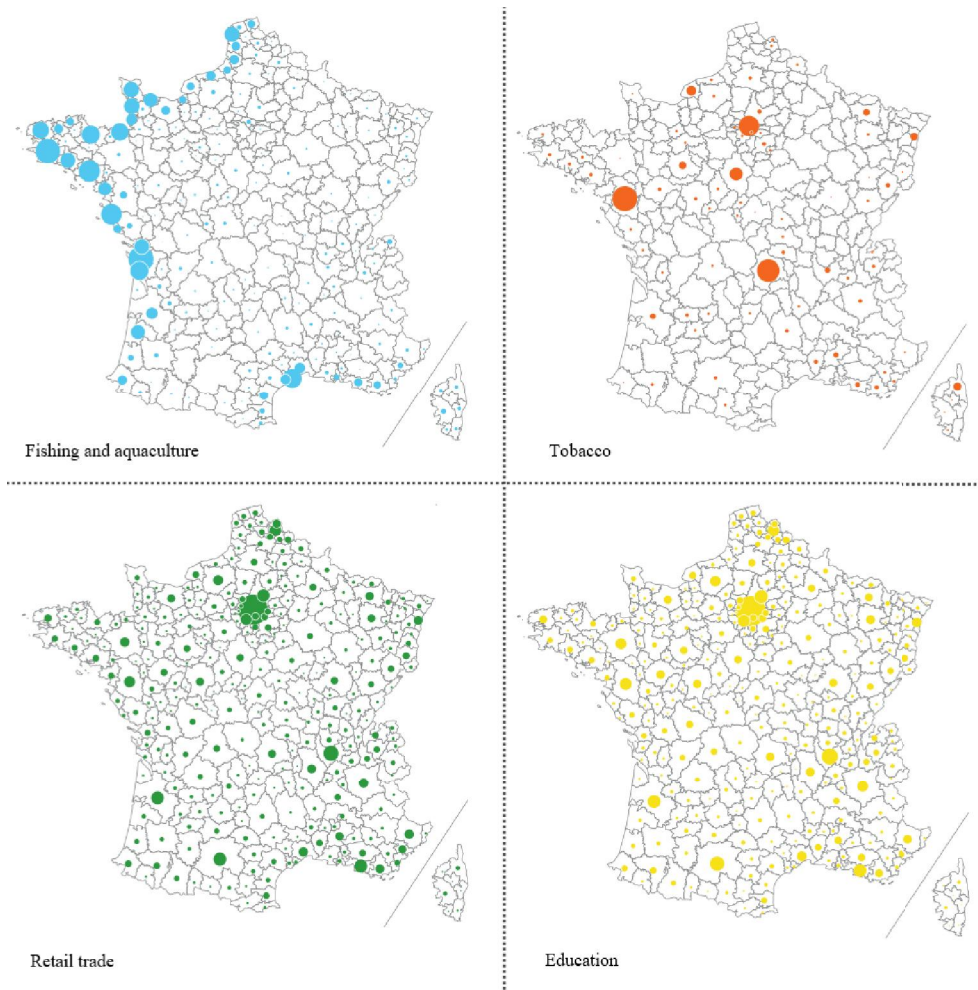
The remainder of this paper is organized as follows. Section 2 presents the classification used in this article and the methodology from which it is derived. In section 3 we analyze employment trends and workers' characteristics in tradable and non-tradable sectors. Section 4 provides an estimate of local multipliers based on our classification of tradable and non-tradable jobs. Section 5 concludes.

## 1.2 Classification of tradable and non-tradable industries

### 1.2.1 Data and methodology

Figure 2.1 depicts the distribution of employment across French employment areas for four industries. It illustrates the significant heterogeneity in the geographic concentration of production. Fishing and aquaculture jobs are concentrated in coastal areas, yet fish are consumed throughout France and even abroad. Although the presence of natural resources is determined by geography, these jobs are exposed to foreign competition if other countries propose similar or substitutable products. Similarly, 58% of jobs in "Tobacco products" are concentrated in three areas (Nantes, Clermont-Ferrand and Paris). In contrast, and as expected, jobs in "Retail trade" and "Education" are much more evenly distributed throughout France.

Figure 1.1: Spatial distribution of employment, 2012



Source : Insee, population census 2012. Produced using Philcarto : <http://philcarto.free.fr>

To measure geographic concentration, we compute Gini coefficients following the methodology of Barlet et al. (2010) based on the approach developed by Jensen and Kletzer (2005). Note that we use a different database. Our database includes more services (46 versus 36) than in Barlet et al. (2010), due to a change in the French classification of economic activities (NAF). Moreover, the number of employment areas have changed since their publication. In the rest of the paper we indicate the NAF code in parentheses when referring to a particular industry.

We compute geographic concentration indexes to determine whether or not employment - a proxy for supply - in industry  $i$  is more concentrated than the demand it faces at the local level. If supply

exceeds demand in a given area, then part of the production will necessarily be consumed outside the area, i.e. the output is tradable. Following [Jensen and Kletzer \(2005\)](#) and [Barlet et al. \(2010\)](#) we first compute the share of demand addressed to each industry in each employment area. Local demand for a given industry will vary depending on the amount of local household income and intermediate consumption from other industries.

All data come from INSEE (French National Institute for Statistics and Economic Studies). We use 2012 census data on local employment at the two-digit level (88 industries<sup>3</sup>) - the most disaggregated level for computing Gini coefficients and tracking the long-term evolution of employment - for 304 employment areas<sup>4</sup>, and data on local population and median income for 2009<sup>5</sup>. We also use 2012 national Input-Output Supply and Use tables.<sup>6</sup> The demand share for industry  $i$  in employment area  $ea$  ( $IDS_{i,ea}$ ) is calculated as follows:

$$IDS_{i,ea} = \sum_{j=1}^J \left( \frac{IC_{i,j}}{D_i} \cdot \frac{EMP_{j,ea}}{EMP_j} \right) + \frac{HC_i}{D_i} \cdot \frac{MInc_{ea}}{MInc_{tot}} \cdot \frac{Pop_{ea}}{Pop_{tot}} \quad (1.1)$$

- $IC_{i,j}$ : output of industry  $i$  used by sector  $j$  (intermediate consumption),  $i \neq j$ ,

- $D_i$ : demand for industry  $i$ 's products (final and intermediate consumptions, exports),

- $EMP_{j,ea}$ : industry  $j$  employment in employment area  $ea$ ,

- $EMP_j$ : total employment in industry  $j$ ,

- $HC_i$ : total household consumption of industry  $i$  products<sup>7</sup>,

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<sup>3</sup>Due to data availability we drop two industries from the initial 88 industries defined at this level of aggregation. The two industries not covered in national accounts are: "Undifferentiated goods and services producing activities of private households for own use" (NAF code 98) and "Activities of extraterritorial organizations and bodies (NAF code 99)", which are very small in terms of employment so that their omission should not have a significant impact on results.

<sup>4</sup>An employment area is a geographic area within which most of the labor force resides and works and in which employers can find most of the labor needed to fill available jobs. Due to data availability we consider only metropolitan France, that is, 304 employment areas out of 322.

<sup>5</sup>Data are taken from the *Atlas des zones d'emploi 2010* (Dares, Insee, Datar, 2012).

<sup>6</sup>We thank INSEE for giving us access to this detailed data

<sup>7</sup>Total household consumption is the sum of household final consumption plus individual general government consumption expenditure in the supply and use table. We use public national account data on households' actual final

- $MInc_{ea}$ : median income per consumption unit in employment area  $ea$ ,

- $MInc_{tot}$ : median income in metropolitan France,

- $Pop_{ea}$ : population in employment area  $ea$ ,

- $Pop_{tot}$ : population in metropolitan France.

The first term represents local demand for intermediate consumption. Importantly, with this term we take into account the fact that some non-tradable input suppliers might be concentrated *because* the downstream industry is itself concentrated. The second term is local household demand, which is assumed to be proportional to the employment area's population and median income. The higher the demand of employment area  $ea$  for industry  $i$ 's products, the higher the value of  $IDS_{i,ea}$ . Note that using this methodology we make three implicit assumptions, namely: (i) as input-output tables are only available at the national level, there are no local variations in the sectoral intermediate consumption structure, (ii) output per worker is similar for local workers and national workers, and (iii) income elasticity of final consumption is equal to 1.

We then compute a Gini coefficient ( $G_i$ ) to determine whether or not an industry is more concentrated than the demand it faces. To compute the Ginis we first need to sort employment areas by increasing order of local employment to local demand ratio,  $\lambda_{i,ea}/IDS_{i,ea}$ , with  $\lambda_{i,ea} = EMP_{i,ea}/EMP_i$ . Then we define the cumulative share of employment in industry  $i$  as

$$\lambda_{i,ea(n)} = \sum_{ea=1}^n \lambda_{i,ea}$$

and the cumulative industry demand share as

$$IDS_{i,ea(n)} = \sum_{ea=1}^n IDS_{i,ea}$$

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consumption to complete the database when information is missing. Due to the lack of data on retail trade, except for motor vehicles and motorcycles, we assume that demand for this industry comes exclusively from households.



The Ginis can be written as

$$G_i = 1 - \sum_{n=1}^{EA} [IDS_{i,ea(n)} - IDS_{i,ea(n-1)}][\lambda_{i,ea(n)} + \lambda_{i,ea(n-1)}] \quad (1.2)$$

with  $\lambda_{i,ea(0)} = IDS_{i,ea(0)} = 0$ . Compared to a standard Gini coefficient, the baseline is the distribution of demand and not the uniform distribution of employment. In the case where employment in industry  $i$  strictly follows the spatial distribution of demand, the value of  $G_i$  is 0. On the contrary, a Gini coefficient equal to one corresponds to a situation where employment in industry  $i$  is concentrated in a single employment area while demand comes from other employment areas.

However, this methodology has some shortcomings that we should mention. First, the calculated indexes may vary depending on the geographic unit used. This modifiable areal unit problem (MAUP), however, has only a limited impact in the case of France according to [Barlet et al. \(2010\)](#), who use three different geographic units. A second limitation when calculating Ginis for only one period is that we assume static tradability over time. Third, production can be tradable and dispersed when not in an increasing return activity. Fourth, as pointed out by [Collins \(2010\)](#), domestic tradability does not necessarily imply international tradability as transportation and transaction costs may differ domestically versus internationally. In particular, differences in language and legal frameworks are significant barriers to trade. Lastly, it is difficult to draw comparisons between countries, as detailed sectoral breakdown data are not available at the level of local labor markets for a panel of countries.

### 1.2.2 Choice of tradability threshold

The Gini coefficients inform us on an industry's degree of geographic concentration, but we still need to determine a threshold that separates the tradable and non-tradable sectors. This necessarily involves a degree of subjectivity. [Jensen and Kletzer \(2005\)](#) for instance consider that any activity with a Gini coefficient of over 0.1 is tradable. However, this threshold seems fairly irrelevant to our case since only 3 of the 86 sectors studied are situated below this figure. In other words, the levels of concentration



measured are on average higher in our estimations. This can be explained by the different sizes of the geographic units selected. The geographic division employed by [Jensen and Kletzer \(2005\)](#) for the United States (Metropolitan State Areas) corresponds to much larger areas. Yet the Gini coefficient tends to decrease as the size of the geographic unit increases ([Barlet et al., 2008](#)). The tradability threshold of [Barlet et al. \(2010\)](#), which involves taking a threshold value corresponding to the Gini coefficient of the wholesale trade sector, is also unsuitable. It would lead us to include industries like “Public administration and defense” (84) and “Human health” (86) in the tradable sector. Since the tradability of the manufacturing sector has been clearly identified in the empirical literature, the threshold value we select is the Gini coefficient of the least concentrated industry in that sector, i.e. “Repair and installation of machinery and equipment” (33). Therefore, industries with a Gini coefficient greater than or equal to 0.25 are considered as tradable. When the coefficient is below 0.25, jobs in the industry are non-tradable. This way of establishing the threshold value is similar to that used by [Eliasson et al. \(2012\)](#) for Sweden.

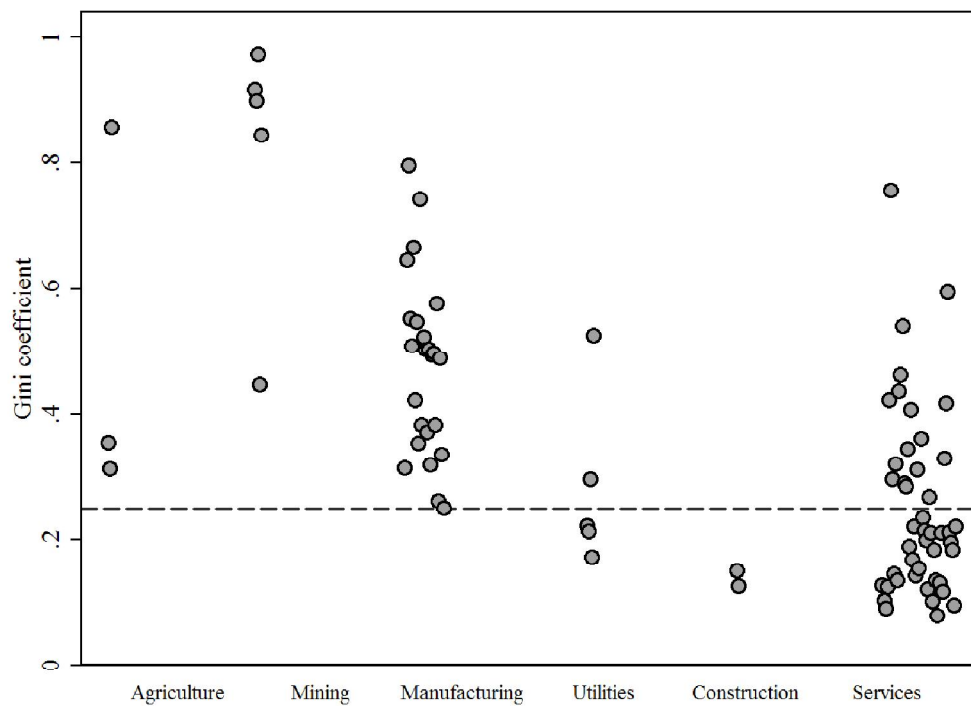
As expected, a high relative concentration of supply does not only concern the primary and secondary sectors. Some service industries also have very high Gini coefficients (Figure 1.2), in particular “Air transport” (51), “Gambling and betting activities” (92), “Programming and broadcasting activities” (60), “Insurance” (65), and “Publishing activities” (58).<sup>8</sup> Other industries are located close to their clients or users. Industries with a Gini coefficient lower than 0.25 include notably “Education” (85), “Human health activities” (86), “Retail trade” (47), “Public administration and defense” (84), “Other personal service activities” (dry cleaning-laundering, hairdressing, funeral services, etc., 96), or “Services to buildings and landscape activities” (81). Obviously, a significant share of non-tradable employment corresponds to core services provided by the government throughout the country. Con-

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<sup>8</sup>We classify “Scientific research and development” (72) in the tradable sector without reporting a Gini coefficient. Since 2010, R&D has no longer been considered as intermediate consumption expenditure, but as investment expenditure. Given that households do not consume this service, the demand measured at local level by the equation (2.1) is zero, as is the Gini coefficient given by equation (2.2). [Barlet et al. \(2010\)](#) have nevertheless shown that, with a Gini coefficient of 0.59 (well above our 0.25 threshold), this is one of the most concentrated sectors. The same problem arises for “Construction of buildings” (41). We consider this sector’s employment, which is highly dispersed over the territory, as non-tradable.

sequently, in what follows we sometimes break down non-tradable employment into a non-market component, grouping codes 84 to 88 of the NAF, and a market component, grouping all of the other divisions in the non-tradable sector. A complete list of the 86 industries and their classification can be found in the Appendix I.

Figure 1.2: Gini coefficients, 2012



Note: The X-axis corresponds to the NAF code of each industry but we report only six broad sectors.

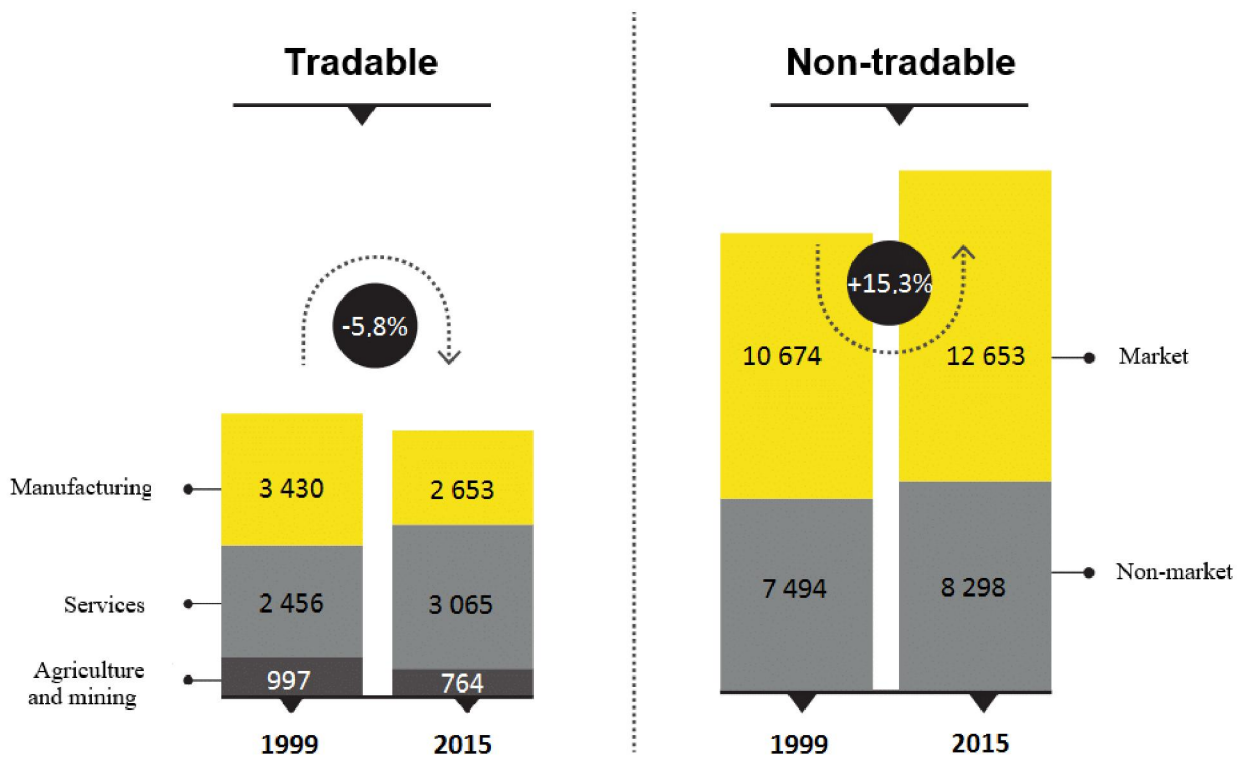
## 1.3 Tradable and non-tradable employment in France

### 1.3.1 National employment trends

To study the evolution of tradable and non-tradable employment in France, we use national accounts data (Insee) on total employment by industry. We assume that the classification of industries established for 2012 does not vary throughout the period 1999-2015. Due to a change in the French classification system in 2008, it would be impossible for us to compare the Gini coefficients calculated for 1999 with those of 2012. Our results indicate that the share of tradable jobs significantly decreased

between 1999 and 2015, dropping from 27.5% to 23.6% of total employment. This drop was very sharp from 2001 up to the financial crisis (2009-2010), and then less pronounced. In volume, the tradable sector lost around 400,000 jobs, while the non-tradable sector increased by 2.78 million (Figure 1.3) .

Figure 1.3: Employment changes in tradable and non-tradable sectors (thousands), 1999-2015



Source : Insee, National accounts. Authors' calculations.

Perhaps more interesting is the increasingly tertiary nature of tradable jobs. Currently, almost one tradable job in two (47.3%) is in services, compared to 35.7% in 1999. While manufacturing, agriculture and the mining industry saw a considerable drop in their workforce, tradable services created a total of 610,000 jobs. Job creations in tradable services accelerated sharply from 2006 and slowed down very little during the crisis. Moreover, from 1999 to 2015, they increased much faster than non-tradable services and the non-tradable market sector (+24.8% compared to +14.5% and +18.5%). The most dynamic tradable services were “Activities of head offices, management consultancy activities” (70), +195,000; “Computer programming, consultancy and related activities” (62), +141,000; “Scientific research and development” (72), +81,000; as well as activities connected to tourism: “Creative, artis-

tic and performance activities” (90), +69,000, and “Accommodation” (55), +47,000. While concerns have been raised about the recent increased tradability of services, our results suggest that this has not led to massive offshoring. The growth in tradable service jobs has not, however, compensated for the drop in other parts of the tradable sector. “Crop and animal production, hunting and related services” (1) dropped the most (-206,000), followed by traditional industries such as “Manufacture of wearing apparel” (14), -89,000, and “Manufacture of textiles” (13), -61,000, while industries like “Manufacture of motor vehicles, trailers and semi-trailers” (29) and “Manufacture of computer, electronic and optical products” (26) also contracted considerably (respectively -69,000 and -60,000). The drop in manufacturing employment, which explains three-quarters of of jobs losses in the tradable sector, results from a combination of factors, i.e. a much faster productivity growth in industry than in services, combined with consumers’ reduced sensitivity to price reductions of manufactured goods (low price elasticity of demand for manufactured goods); a change in the structure of household expenditure, which comprises an increasingly large amount of services; outsourcing of some activities to specialized companies in the tertiary sector; and lastly, international competition, in particular from emerging countries. While in the 1990s there was a broad consensus that job losses were mostly attributable to technology, the surge in Chinese imports, coupled with a new focus in the literature on offshoring based on “trade in tasks” ([Grossman and Rossi-Hansberg, 2008](#)) have reopened the debate on the role of international trade in manufacturing employment decline. For instance, Chinese import competition could explain 13% of the recent decline in French manufacturing employment ([Malgouyres, 2017](#)), and around 25% in the case of the US ([Autor et al., 2013](#)). According to [Acemoglu et al. \(2016\)](#) almost half of these job losses are concentrated in upstream industries, impacted through inter-industry linkages.<sup>9</sup>

In the non-tradable sector, the greatest increases in employment were recorded in “Human health activities” (86), +364,000, the construction sector (41-43), +347,000, “Residential care activities”

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<sup>9</sup>The respective impacts of technological change and trade on the decline in manufacturing employment are still under debate. See [Demmou \(2010\)](#) for an evaluation of the significance of these structural determinants in the decline of industrial employment in France from 1980 to 2007.

(87), +277,000, and “Food and beverage service activities” (56), 243,000. “Activities of membership organizations” (94) and “Public administration and defense”(84) are the two non-tradable industries that destroyed the most jobs (respectively -184,000 and -114,000). The non-tradable market sector, with 1.98 million jobs created (+18.5%), was overall more dynamic than the non-market non-tradable sector, where employment increased by 804,000 (+10.7%).

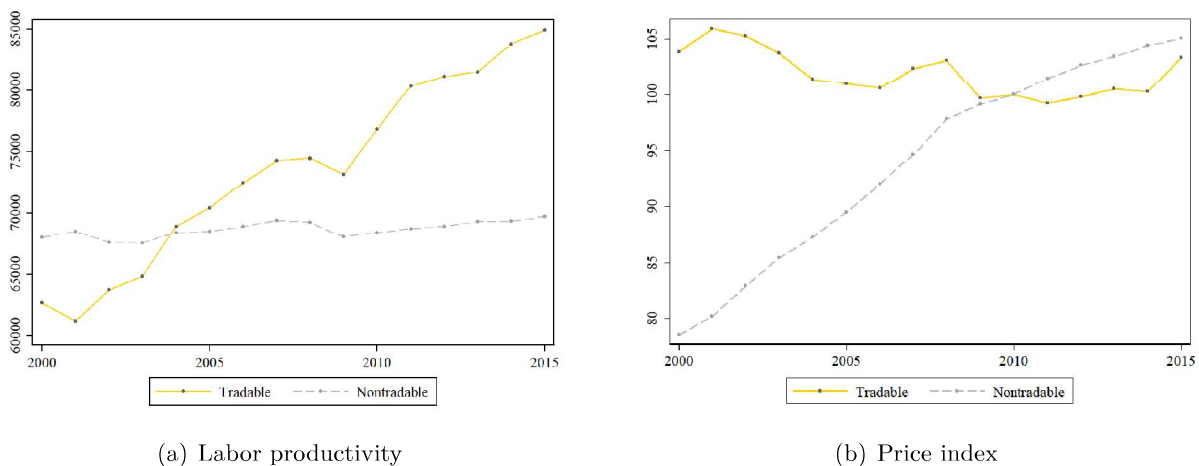
The evolution of the structure of employment in France is remarkably similar to that observed in the United States. During the same period, [Hlathwayo and Spence \(2014\)](#) estimate that US tradable employment went from 30% to 26.3% of total employment, and decreased in volume (-3.4 million units). Like in France, the drop in manufacturing and agricultural employment was not compensated by more jobs in the tradable service sector, while the number of non-tradable jobs increased dramatically. [Eliasson and Hansson \(2016\)](#) find a much larger share of tradable jobs in the case of Sweden (almost 40% of total employment in 2010). Between 1990 and 2005 they do not identify a significant change in employment, either in the tradable sector or in the non-tradable sector. However, the period also saw a shift towards tradable service activities within the Swedish tradable sector. Appendix IV proposes a brief analysis of the evolution of tradable and non-tradable employment in Europe based on our classification of industries.

### 1.3.2 Labor productivity, wages and skills

The distinction between tradables and non-tradables reveals significant differences in labor productivity, defined here as real value added per worker in full-time equivalent. We observe much larger productivity growth in the tradable sector (Figure 1.4a) between 2000 and 2015. The productivity differential may be explained by a rationalization effect of international trade: in Meltitz-type models ([Melitz, 2003](#)) with heterogeneous firms, trade leads to the intra-sectoral reallocation of resources. Put simply, foreign competition pushes the least productive domestic firms out of the market, and allows the most productive ones to extend their market shares. In addition, [Timmer et al. \(2014\)](#) showed

that, within global value chains, advanced nations increasingly specialize in high value added activities. Another explanation may be that the shrinking tradable sector shed the least able workers (Young, 2014) and keeps the most productive ones. Perhaps as important in our opinion, this productivity gap may largely reflect the fact that numerous non-tradable service activities are still difficult to automate because they involve a high degree of social interaction (home carers, psychiatrists, beauticians, etc.) or precision (hairdressers, cooks, decorators).

Figure 1.4: Price and labor productivity in tradable and non-tradable sectors, 2000-2013



Notes: Labor productivity at time  $t$  in sector  $S = \{T, NT\}$  is  $\varphi_t^S = \sum_{i \in S} \frac{VA_{i,t}}{PVA_{i,t}} / \sum_{i \in S} L_{i,t}$ , where  $VA_{i,t}$  is gross value added at current prices for each industry in sector  $S$ ,  $PVA_{i,t}$  is the price index of gross value added at time  $t$  for each industry in sector  $S$  (using 2010 as base year), and  $L_{i,t}$  is full-time employment at time  $t$  in each industry in sector  $S$ .

The price index at time  $t$  in sector  $S$  is  $P_t^S = \sum_{i \in S} \omega_{i,t} PVA_{i,t}$ , where  $\omega_{i,t} = VA_{i,t} / VA_t^S$ .

Source : Insee, National accounts. Authors' calculations.

There is also a significant wage gap between tradable and non-tradable workers. In 2015, the gross annual wage of workers (full-time equivalent) in the tradable sector was on average 27% higher, i.e. an annual difference of 9,156 euro.<sup>10</sup> Workers are paid more in tradable services, with an average annual gross wage of 48,279 euro compared to 40,633 euro in manufacturing industries (Table 1). This result is in line with Jensen and Kletzer (2005) and Eliasson et al. (2012) for the United States and Sweden, respectively.

<sup>10</sup>In the absence of detailed industry-level data for the self-employed (2.5 million people in France) at this level of sectoral disaggregation, we cannot generalize this result to all workers.

Perhaps surprisingly, this wage gap does not reflect a difference in workers' educational attainment. Table 1 shows that tradable and non-tradable sectors have a very similar skill structure.<sup>11</sup> In the tradable sector, college graduates are principally employed in services. In the non-tradable sector, the share of college graduates is higher in non-market industries (46%), and particularly concentrated in health, education and administration, while the majority of workers in residential social-medical and social institutions and non-residential social action do not have a high school diploma. The skill structure of the market non-tradable sector is similar to the manufacturing sector, with fewer than one-third of college graduates. A higher wage in tradable industries is however consistent with the literature showing that exporters pay higher wages than non-exporters (Bernard and Jensen, 1995, 1997). Recent studies using matched employer-employee data find significant exporter wage premia, even after controlling for observable and unobservable individual characteristics (Schank et al., 2007). The main usual explanation for the exporter wage premium is the higher productivity of exporting firms. Higher wages in the tradable sector are thus consistent with the productivity gap we observe between the two sectors.

Interestingly, although significant productivity gains in the tradable sector may explain part of the wage differential, they have largely benefited non-tradable workers. The wage gap between tradable and non-tradable employees has in fact grown at a much slower pace than the productivity differential. From 2010 to 2015, the productivity ratio between tradable and non-tradable activities went up by 9.4 percentage points, while the wage ratio only increased by 1.6 percentage points.<sup>12</sup> A classic "Balassa-Samuelson" effect (Balassa, 1964; Samuelson, 1964) can explain this phenomenon. According to this effect, greater productivity growth in tradable industries translates into a rise in the relative price of non-tradable goods and services. Indeed, when the productivity of the tradable sector increases, the wages of tradable workers go up because prices for tradables are set in international markets.

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<sup>11</sup>Note that the structure is similar even when broken down into 11 education levels.

<sup>12</sup>Two mining industries, "Mining of coal and lignite" (05) and "Mining of metal ores" (07), for which value added was nil for several years are excluded from the calculation of tradable sector productivity and price index.



Therefore firms in the non-tradable sector also have to increase wages to prevent their employees from looking for work in the tradable sector where wages are higher. These wage increases for non-tradable workers can only be achieved through price increases, since productivity has remained the same in the non-tradable sector. As shown by Figure 1.4b, prices in the non-tradable sector did in fact increase sharply while they went down slightly in the tradable sector. The impact of a productivity shock in the tradable sector on relative prices is closely dependent on labor mobility. When intersectoral mobility is high, non-tradable firms have to significantly increase their prices to align their wages with those of the tradable sector. Consumer preferences for non-tradable goods and services are also important. If consumers have strong preferences for non-tradable products, then the additional income generated by the increased productivity in the tradable sector will disproportionately benefit the non-tradable sector, pushing the price of these products even higher. The dynamics of relative prices may also be explained by the intensity of competition in the non-tradable sector. Due to greater protection of non-tradable markets, companies are freer to fix their prices and therefore tend to set them high. [Bénassy-Quéré and Coulibaly \(2014\)](#) show for instance that the divergence of relative prices within the European Union is explained in part by differences in the degree of regulation of product and labor markets. Lastly, a drop in real interest rates can trigger a faster increase in the prices of non-tradable goods and services. [Piton \(2016a\)](#) identifies three mechanisms: (i) a higher demand for non-tradable products, following a drop in interest rates, cannot be satisfied by imports ([Dornbusch, 1983](#)); (ii) the non-tradable sector is often more dependent on bank loans, especially in real estate ([Reis, 2013](#)); (iii) the non-tradable sector may be more labor-intensive than the tradable sector and therefore benefit less from the drop in the cost of capital ([Piton, 2016b](#)).

Strikingly, net destructions of jobs between 2010 and 2014 only concerned “low-skilled” workers, while the number of “high-skilled” workers increased in both tradable and non-tradable activities. This evolution is in line with that reported by [Jensen and Kletzer \(2005\)](#) who indicate – but for 1998-2002 – a general drop in “low-skilled” employment in the U.S. and a steep rise in “skilled” employment in



tradable services and the non-tradable sector. Interestingly, the erosion of “low-skilled” employment appears to be less pronounced in the non-tradable sector. While the number of workers without a high school diploma is rapidly declining in a large number of tradable sectors due to automation and competition from countries with low labor costs, some non-tradable industries have been relatively spared. For instance, services to buildings and landscape activities (81), along with residential care activities and social work activities without accommodation (87-88), are a kind of refuge for low-skilled workers.

Table 1.1: Mean wage and education attainment in the tradable and non-tradable sectors

Tradable	€/ %	Variation (%)	Non-tradable	€/ %	Variation (%)
<u>All</u>			<u>All</u>		
Mean yearly wage (€)	43,258	8.8	Mean yearly wage (€)	34,103	7.4
With no high school diploma	40.6	-14.2	With no high school diploma	41.9	-7.4
With high school diploma	18.8	-1.6	With high school diploma	20.4	4.8
With college diploma	40.5	9.3	With college diploma	37.7	10.3
<u>Manufacturing</u>			<u>Market</u>		
Mean yearly wage (€)	40,633	8.1	Mean yearly wage (€)	35,953	7.5
With no high school diploma	50.6	-16.6	With no high school diploma	46.5	-9.0
With high school diploma	18.3	-1.8	With high school diploma	21.8	3.6
With college diploma	31.1	5.6	With college diploma	31.7	13.8
<u>Tradable services</u>			<u>Non-market</u>		
Mean yearly wage (€)	48,279	9.1	Mean yearly wage (€)	31,497	7.4
With no high school diploma	24.5	-8.8	With no high school diploma	35.5	-4.5
With high school diploma	17.7	-3.0	With high school diploma	18.5	6.7
With college diploma	57.9	11.1	With college diploma	46.0	7.1

Notes: Yearly mean gross wage per worker in full-time equivalent in thousands of euros for the year 2015. Variation between 2010 and 2015. Skill structure in percentage for the year 2014. Variation rate in the number of workers for each category between 2010 and 2014. Census data provide information on the number of workers by education level for each industry. We aggregate the eleven educational levels into three categories: with no high school diploma, with high school diploma, with college diploma.

Source: Insee, national accounts, population census (2010-2014).

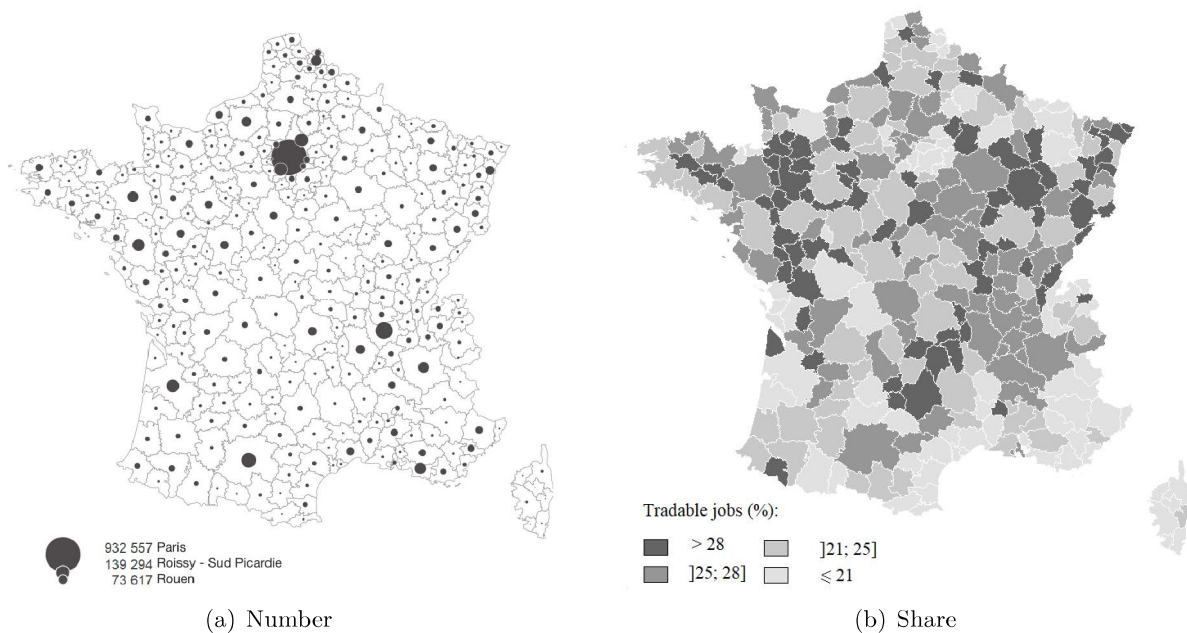
### 1.3.3 Geography

As a reminder, non-tradable jobs more or less follow the geographic distribution of their clients, unlike tradable jobs, which can produce far from the final consumer and therefore tend to be concentrated. The employment areas that feature the greatest number of tradable jobs are urban zones corresponding to the main French metropolitan areas, i.e. Paris, Lyon, Toulouse, Bordeaux, Nantes, Marseille, etc. (Figure 1.5a). The leading ten zones thus concentrate one third of French tradable employment. On the other hand, in relative terms, most tradable jobs are found in employment areas with few inhabitants. These are located in western France (Figure 1.5b), on a long strip of land going from Cognac (Charente), which specializes in producing brandy, to Vire (Calvados) in the northeast, which specializes in dairy processing, and in Auvergne and the Midi-Pyrenees. These zones are usually characterized by a high share of manufacturing jobs.

The Mediterranean coast is, on the contrary, the area in which tradable jobs represent the lowest shares of total employment. In this area, tradable sector employment is mainly composed of jobs in tradable services (Figure 1.6). Along with services linked to tourism, numerous of workers are engaged in activities with higher added value (digital, R&D, corporate headquarters, etc.) in employment areas like Aix-en-Provence, Cannes-Antibes, and Marseille-Aubagne. However, this is insufficient to counterbalance the proportion of non-tradable jobs in the region.

Tradable services nationally represent almost one tradable job in two, but they are the majority component in tradable employment in only 41 of the 304 employment areas (Figure 1.6). They are concentrated around some of the major French cities and tourist areas. These 41 employment areas (37% of national tradable employment) account for 60% of national employment in tradable services. Agricultural employment only dominates tradable employment in a handful of rural employment areas, mostly located in the south of France. In the rest of the country, i.e. in 80% of employment areas,

Figure 1.5: Number and share of tradable jobs, employment areas (2012)



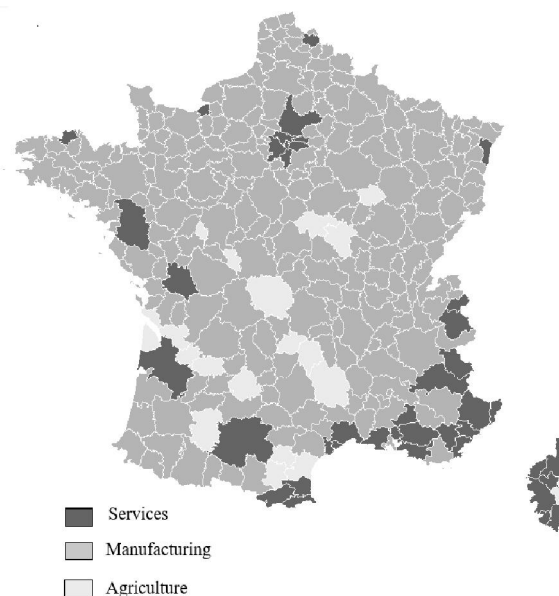
Source : Insee, population census 2012. Authors' calculations. Produced with Philcarto : <http://philcarto.free.fr>

the manufacturing industry (41% of tradable employment) dominates the tradable sector.

This suggests that the continued drop in manufacturing employment, and to a lesser extent agricultural employment, is likely to destabilize a great number of local labor markets. Conversely, the growth of tradable services is likely to mostly benefit a smaller number of employment areas, and especially large metropolitan areas. Indeed, this is what we observe from 2008 to 2016 (see figures 10 and 11, Appendix III).<sup>13</sup> Only 30 out of 304 employment areas saw an increase in manufacturing employment during that time. These zones of industrial resistance include for example Toulouse (aerospace), Figeac (aerospace), and Saint-Nazaire (shipbuilding). Deindustrialization is thus affecting most employment areas. Unsurprisingly, the traditional French industrial regions (Hauts-de-France, Grand-Est, and Ile-de-France) are undergoing the most deep-seated reorganization, while industrial employment is resisting better in the west and the south. A non-negligible number of these areas are also experiencing a drop in employment in tradable services. In other areas, employment in tradable

<sup>13</sup>We use the Acooss (*Agence centrale des organismes de sécurité sociale*) database to study the spatial distribution of jobs from 2008 to 2016. Note that it only concerns payroll employment, and exclude agricultural employees, households employing domestic personnel, and employees of public bodies.

Figure 1.6: Major industry within tradable employment, employment areas (2012)



Source : Insee, population census 2012. Authors' calculations. Produced using Philcarto : <http://philcarto.free.fr>

services is sufficiently dynamic to compensate for deindustrialization. This mainly includes several major metropolitan areas : Toulouse, Nantes, Paris, Bordeaux, Montpellier, Lille, and Lyon together account for 72% of net tradable employment gains. Overall, only 14% of employment areas experienced an increase in tradable jobs from 2008 to 2016 (see Figure 8 in the Appendix III). Finally, a small number of areas have seen an increase in both manufacturing and tradable services employment (Toulouse, Saint-Nazaire, Saint-Malo, Vitré, Chinon, Mont-Blanc, Salon-de-Provence, Les Sables d'Olonne, Ambert, and Corsica). This finding is in line with [Bouba-Olga and Grossetti \(2018\)](#) who argue that there is no robust evidence of a link between territorial density and territorial competitiveness.

The growth of non-tradable employment is more widespread, concerning around half of employment areas (see Figure 9 in the Appendix III). However, the gains are highly concentrated: almost 60% of the non-tradable employment growth is concentrated in ten large metropolitan areas. Strikingly, the employment areas where non-tradable employment has dropped sharply (Centre, Bourgogne, Champagne-Ardenne, Lorraine) are often also areas that have been subject to a significant destruction of tradable jobs, and vice versa. This relation may be causal. Indeed, non-tradable jobs are

highly dependent on the evolution of aggregated local income because their clients are mostly local, unlike tradable jobs which satisfy scattered demand. We look at this issue in the next section.

## 1.4 The local multiplier effect of tradable employment in France

[Moretti \(2010, 2011\)](#) has developed an econometric approach for estimating local employment multipliers, i.e. the number of non-tradable jobs created in a given area following an exogenous increase in the number of tradable jobs within the area. He finds a multiplier of 1.6 for U.S. cities between 1980 and 2000, including only manufacturing industries in the tradable sector. We contribute to this recent literature by estimating the local employment multiplier effect for French employment areas between 2008 and 2016. The theoretical basis of Moretti's empirical approach builds upon the Rosen-Roback spatial general equilibrium model ([Rosen, 1979](#); [Roback, 1982](#)) and is briefly outlined below.

### 1.4.1 Conceptual framework

We assume that each employment area is a competitive economy that uses labor to produce tradable and non-tradable goods and services. Prices for tradables are set in international markets, whereas prices for non-tradables are determined locally. Workers are perfectly mobile across industries within an employment area, so that marginal product and wages are equalized locally in the long run. Workers' indirect utility depends on the local wage net of living costs and on idiosyncratic preferences for location. Idiosyncratic preferences for location hamper labor mobility across areas, implying a finite elasticity of local labor supply (upward-sloping local labor supply curve). The elasticity of local labor supply is also affected by local unemployment rates. Therefore, if local unemployment and geographical mobility of labor are low, then an increase in local labor demand mostly results in higher local wages and not in higher employment. Finally, the local housing supply is not fixed and depends on geography and land use regulations. Assuming upward-sloping local labor and housing supply curves,

Moretti (2010, 2011) departs from the Rosen-Roback framework in which any shocks to local labor markets are fully capitalized in the price of land.

Let us consider the case of a permanent increase in tradable industry  $j$  labor demand in employment area  $ea$ . This could occur e.g. if the local economy manages to attract a new firm or if the labor productivity of a pre-existing firm increases. With these new tradable workers, the number of local jobs increases (direct effect). Therefore, the local aggregate income has to increase, triggering additional demand for tradable and non-tradable goods and services (indirect effect). It also pushes up local prices as local labor and housing supply curves are upward sloping (general equilibrium effects). The multiplier effect on non-tradable employment is unambiguously positive and translates into a lower local unemployment rate and/or labor migration from other employment areas. The magnitude of the multiplier depends on several factors. First, if households have strong preferences for non-tradable goods and services they will spend a large fraction of additional income on those products. Second, it depends on technology in the non-tradable sector. Labor-intensive technology implies that additional demand is met principally by hiring new workers. Third, the magnitude of the local employment multiplier is also affected by the type of new jobs created in the tradable sector. For a given number of tradable job creations, local aggregate income increases more when high-paying jobs are created. Fourth, it depends on the offsetting general equilibrium effects induced by changes in local prices. Higher wages and housing costs will increase production costs, reducing the supply of non-tradable products. Low elasticities of local housing and labor supplies imply large offsetting general equilibrium effects and hence a low multiplier. But since labor and housing supply are not perfectly inelastic, negative general equilibrium effects only partially undo the first positive income effect. The increase in labor costs also negatively impacts tradable employment in firms that are not directly affected by the increase in demand. Indeed, they cannot increase their prices to compensate for higher labor costs as tradable prices are set in international markets. This lowers their competitiveness, unless agglomeration economies are sufficiently large to compensate for the increase in factor

prices. Of course, tradable intermediate input suppliers may benefit from an increase in tradable industry  $j$ 's production. However, these suppliers are not necessarily located in the same employment area. Therefore, the local multiplier effect on tradable employment should be quantitatively smaller than the local multiplier effect on non-tradable employment.

### 1.4.2 Econometric approach

Following [Moretti \(2010\)](#), we estimate the elasticity of non-tradable local employment with respect to tradable local employment using the following model (Model 1) :

$$\Delta NT_{ea,t} = \alpha_1 + \beta_1 \Delta T_{ea,t} + \gamma_1 d_t + \varepsilon_{ea,t} \quad (1.3)$$

where  $\Delta NT_{ea,t}$  and  $\Delta T_{ea,t}$  are, respectively, the change over time in the log number of jobs in the non-tradable and tradable sector in employment area  $ea$ . The period covered in this paper runs from 2008 to 2016. For each employment area we have two observations, corresponding to two time intervals 2008-2012 and 2012-2016. We introduce an indicator  $d_t$  for the second period, and an error term  $\varepsilon_{ea,t}$ . The  $\beta_1$  coefficient is the elasticity of non-tradable to tradable employment.

A one percent increase in the number of tradable jobs is associated with a  $\beta$  percent increase in non-tradable employment. To obtain the value of the local multiplier, we simply multiply the estimated  $\beta_1$  in equation (5.1) by the relative size of the non-tradable sector over our two periods, i.e. the number of non-tradable jobs for each tradable job:

$$Multiplier = \hat{\beta}_1 \times \left( \frac{NT_{2008} + NT_{2012}}{T_{2008} + T_{2012}} \right)$$

The local multiplier gives the number of jobs created in the non-tradable sector for one additional job in the tradable sector. Alternative specifications are estimated. The effect of tradables on other



tradables (Model 2) is estimated by randomly splitting tradable industries into two parts:

$$\Delta T_{ea,t}^1 = \alpha_2 + \beta_2 \Delta T_{ea,t}^2 + \gamma_2 d_t + \varepsilon_{ea,t} \quad (1.4)$$

Unlike other studies we estimate separate elasticities for the market and non-market non-tradable sectors (Model 3). Indeed we anticipate that the multiplier effect of tradable jobs is lower on non-market non-tradable jobs than on market non-tradable jobs because part of the non-market non-tradable sector is funded from national taxation, and therefore less sensitive to local income variations.

OLS estimation will likely lead to inconsistent estimates if there are unobserved time-varying local shocks affecting employment growth in both sectors. As pointed out by [Moretti and Thulin \(2013\)](#), shocks to the labor supply of an employment area due for instance to changes in crime rates, schools air quality, public services, or taxes, may induce bias. The sign of the bias can be either positive or negative, depending on whether the shock is correlated positively or negatively with changes in tradable employment. For instance, improvements in the quality of infrastructures in an employment area will attract new tradable activities while at the same time facilitating workers' migration to the area, thus increasing demand for non-tradable products and employment in the non-tradable sector. This would result in an upward bias in the OLS estimator of the elasticity of non-tradable to tradable employment. Conversely, the estimate would be biased downward if a local government reacted to the decline in non-tradable jobs in the area by encouraging employment creation in the tradable sector through subsidies. Another potential concern is that of reverse causality. For instance, the creation of a new university campus in a given employment area may induce some tradable firms to move to this area to benefit from a pool of skilled workers and local knowledge spillovers. To estimate the causal effect of tradable employment growth on non-tradable employment growth, we need to isolate exogenous shifts in demand for tradable workers. Following [Moretti and Thulin \(2013\)](#) we use a classic "Bartik- instrument" ([Bartik, 1991](#)). The idea is to isolate local variations in tradable employment

caused by national shocks from the variations resulting from local specificities. The instrumental variable for Model 1 is constructed as

$$\sum_{j \in J} \left\{ \frac{T_{ea,t}^j}{T_{ea,t}^J} \left[ \ln \left( \sum_{ea' \in EA} T_{ea',t+4}^j \right) - \ln \left( \sum_{ea' \in EA} T_{ea',t}^j \right) \right] \right\} \quad (1.5)$$

where  $\frac{T_{ea,t}^j}{T_{ea,t}^J}$  denotes the share of tradable industry  $j$  in total tradable employment of employment area  $ea$  at period  $t$ . The term in brackets is the nationwide change in employment between  $t$  and  $t + 4$  in tradable industry  $j$  (excluding employment area  $ea$  itself). Thus an employment area is affected by national trends in proportion to its initial industry mix. Arguably, as long as national changes are not driven by specific economic conditions in a given employment area, the instrument captures exogenous changes in local labor demand.

As pointed out by [Van Dijk \(2018\)](#), the Regress-M method ([Détang-Dessendre et al., 2016](#)) represents a valuable alternative to the Bartik-instrument. Instead of instrumenting local employment growth in the tradable sector based on employment changes at the national level, the regression instrument involves a regression across all employment areas (excluding employment area  $ea$  itself). So for each period we regress local tradable employment variations on local tradable industry employment shares at the beginning of the period (excluding employment area  $ea$  itself):

$$\Delta T_{ea',t} = \sum_{j \in J} \left( b_{ea,t}^j \frac{T_{ea',t}^j}{T_{ea',t}^J} \right) + \epsilon_{ea',t} \quad (1.6)$$

and the instrument corresponds to the predicted employment growth based on employment area  $ea$  industry composition:

$$RM_{ea,t} = \sum_{j \in J} \left( \hat{b}_{ea,t}^j \frac{T_{ea,t}^j}{T_{ea,t}^J} \right) \quad (1.7)$$

This regression based measure addresses the issue of restricted multipliers as it allows different

multiplier effects across tradable industries, *i.e.* it predicts higher tradable employment growth in employment areas composed of tradable industries having large  $b_{ea,t}^j$ .<sup>14</sup>

### 1.4.3 Data and results

We use Acooss (*Agence centrale des organismes de sécurité sociale*) data on payroll employment for the period 2008-2016. Data are available at the two-digit industry and employment area level. However, agricultural employees, households that employ domestic personnel, and employees of public bodies are not covered by our database. Each of the 304 employment areas of mainland France is observed over two four-year time intervals, so that our database contains 608 observations.

Table 2 displays the results for the local multiplier in France between 2008 and 2016. Columns (1) and (2) present OLS estimates. In column (2), we control for other covariates - local unemployment rates, total local labour force, and the share of local non-tradable employment at the beginning of each period - and introduce regional fixed effects. In both columns the elasticity is positive and significant. However, as explained in 4.2, OLS estimates are likely to suffer from reverse causality or omitted variable bias so that instrumental variable estimates are preferred. Our estimate obtained with the Bartik-instrument in column (5) indicates that, over the period, for every 100 tradable jobs created in an employment area in mainland France, 80 additional non-tradable jobs were created within the same area (*i.e.* a local multiplier of 0.8). This result is robust to the inclusion of additional controls (regression coefficients are reported in Table 4, Appendix II) and regional fixed effects, with a point estimate of 0.88 (column 6). A comparison of OLS and IV results reveals that IV estimates provide significantly higher coefficients, suggesting that OLS estimates are biased downward.

We find a significant but lower multiplier effect of tradable jobs on other tradable jobs (0.39). This result is consistent with Moretti's theoretical framework. Firstly, demand (intermediate consumption

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<sup>14</sup>See [Broxterman and Larson \(2018\)](#) for a discussion on measures identifying shocks in demand to regional economies.

and final household demand) for tradable goods and services mainly comes from firms and households located in other areas in France or abroad. Secondly, employment growth in part of the tradable sector pushes up local prices and may cause firms in the rest of the tradable sector to relocate or even disappear. As expected, the local multiplier is lower on non-market non-tradable jobs (0.1) than on market non-tradable jobs (0.74), and even lower than multiplier on tradable jobs. This arguably reflects the fact that non-market non-tradable jobs partly depend on state subsidies or social security contributions and are therefore less affected by local aggregate income variations.

Results obtained with our baseline specification are robust to a different instrument, the Regress-M instrument (see Table 5, Appendix II), with a local multiplier effect of tradable jobs on non-tradable jobs of 0.81 (versus 0.80 with the Bartik-instrument). However, all coefficients become insignificant when we include controls and region fixed effects. The small F-statistics, below 5, suggest that those estimation results are not very reliable, and overall, the Bartik-instrument is much stronger.

Our local multiplier of tradable on non-tradable jobs is half the size of that estimated by [Moretti \(2010\)](#) in the case of the United States. But as shown by [Van Dijk \(2018\)](#), Moretti's multiplier is likely to be overestimated. When [Van Dijk \(2018\)](#) includes additional controls, location fixed effects, or splits industries into tradable and non-tradable sectors based on their geographical concentration, the size of the multiplier is reduced. He finds a multiplier of 1.0 with a classification of industries allowing for tradable services. This result is in line with the multiplier we find in the case of France. [Gerolimetto and Magrini \(2015\)](#), who extend the analysis to the period 2000-2010, consider tradable services and spatial interdependencies, find a lower local multiplier of 0.53 for the US. By including only manufacturing jobs in the tradable sector, [Malgouyres \(2017\)](#) finds a local multiplier of 1.46 in the case of France for the period 1995-2007. Altogether, our two studies identify a fairly large local multiplier for France, i.e. larger than in other studies including e.g. [Moretti and Thulin \(2013\)](#) in the case of Sweden, [Wang and Chanda \(2017\)](#) using Chinese data, and [de Blasio and Menon \(2011\)](#) for

the case of Italy. These results suggest that trade shocks have large negative effects on French local employment, not only for jobs directly exposed to foreign competition but also for non-tradable jobs.

Admittedly, we need to remain cautious about the exact value of the multiplier. Our database covers only payroll employment and not total employment or total hours worked. As the majority of French self-employed workers are in the non-tradable sector (personal services, health and social action, construction)<sup>15</sup>, we may be underestimating the value of the local multiplier. On the other hand, we may be overlooking some long-term effects since we are studying four-year intervals. This could potentially reduce the size of the multiplier if crowding out effects take time to occur.

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<sup>15</sup>See [Omalek and Rioux \(2015\)](#)

Table 1.2: Summary of estimated local multipliers for French employment areas between 2008 and 2016

	OLS			IV (Bartik)		Multiplier	
	(1)	(2)	(3)	(4)	(5)	(6)	(6)
<u>Model 1</u>							
Tradable on non-tradable	0.140*** (0.029)	0.085*** (0.029)	0.327*** (0.062) [69.21]	0.361*** (0.126) [24.57]	0.80	0.88	0.88
<u>Model 2</u>							
Tradable on other tradable	0.212*** (0.049)	0.110** (0.054)	0.430*** (0.146) [38.32]	0.441* (0.244) [14.10]	0.39	0.40	0.40
<u>Model 3</u>							
Tradable on market non-tradable	0.161*** (0.032)	0.090*** (0.031)	0.367*** (0.068) [69.21]	0.344** (0.148) [17.93]	0.74	0.70	0.70
Tradable on non-market non-tradable	0.055 (0.046)	0.027 (0.047)	0.231** (0.103) [69.21]	0.320* (0.167) [27.71]	0.1	0.13	0.13
Year FE	Y	Y	Y	Y	Y	Y	Y
Region FE	N	Y	N	Y	N	Y	Y
Controls	N	Y	N	Y	N	N	Y

Notes: Robust standard errors clustered by employment area reported in parentheses. Kleibergen-Paap Wald rk F statistic in brackets. The multiplier in column 5 (6) is calculated using the IV estimator (Bartik-instrument) in column 3 (4). Control variables include: local unemployment rates, local total labour force, and the share of local non-tradable employment at the beginning of each period. Location fixed effects correspond to dummy variables for 22 regions of metropolitan France. \*Significance at the 10% level; \*\*significance at the 5% level and \*\*\*significance at the 1% level.

## 1.5 Conclusion

In this paper, we first examine the evolution and characteristics of tradable and non-tradable jobs in France over the period 1999-2015. We establish a classification of 86 industries, based on their degree of geographic concentration. We show that tradable jobs are in the minority and decreasing. They make significant productivity gains and receive on average higher wages than non-tradable jobs. Non-tradable jobs, however, constitute the vast majority of jobs and are growing. These jobs have to date experienced lower productivity gains though they are not less skilled than tradable jobs. We also show that there has been significant restructuring within the sector: tradable services jobs now make up the majority of tradable jobs in France while manufacturing is declining. Since employment areas tends to specialize in different tradable activities, they have evolved in different ways. We note in particular that the areas where non-tradable employment has decreased have, for the most part, also destroyed a high number of tradable jobs, and vice versa. Using an econometric approach developed by [Moretti \(2010\)](#), we show that tradable jobs do appear to have a significant local multiplier effect on non-tradable jobs. According to our estimations, from 2008-2016, for every 100 additional jobs created in the tradable sector in an employment zone in mainland France, 80 jobs were also generated in the non-tradable sector within the same area. This result may explain why local governments grant numerous subsidies to attract or simply maintain tradable activities in their territory. It also suggests that trade shocks spill over beyond jobs directly exposed to foreign competition.

## 1.6 Appendices

### I. Industry classification

Table 1.3: Gini coefficients, classification, and employment by industry

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Tradable / Non-tradable</i>	<i>Employment 2015</i>
01	Crop and animal production, hunting and related service activities	0,35	T	708,56
02	Forestry and logging	0,31	T	29,80
03	Fishing and aquaculture	0,86	T	18,22
05	Mining of coal and lignite	0,92	T	0,02
06	Extraction of crude petroleum and natural gas	0,90	T	0,25
07	Mining of metal ores	0,97	T	0,55
08	Other mining and quarrying	0,45	T	18,11
09	Mining support service activities	0,84	T	0,17
10	Manufacture of food products	0,31	T	593,37
11	Manufacture of beverages	0,64	T	30,63
12	Manufacture of tobacco products	0,80	T	1,32
13	Manufacture of textiles	0,55	T	43,15
14	Manufacture of wearing apparel	0,51	T	44,13
15	Manufacture of leather and related products	0,67	T	23,63
16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0,42	T	66,15
17	Manufacture of paper and paper products	0,55	T	61,59
18	Printing and reproduction of recorded media	0,35	T	75,45
19	Manufacture of coke and refined petroleum products	0,74	T	8,80
20	Manufacture of chemicals and chemical products	0,38	T	119,68
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	0,52	T	46,43
22	Manufacture of rubber and plastic products	0,50	T	162,66
23	Manufacture of other non-metallic mineral products	0,37	T	106,08
24	Manufacture of basic metals	0,50	T	85,69
25	Manufacture of fabricated metal products, except machinery and equipment	0,32	T	314,24
26	Manufacture of computer, electronic and optical products	0,49	T	82,50
27	Manufacture of electrical equipment	0,50	T	83,49
28	Manufacture of machinery and equipment n.e.c.	0,38	T	164,04
29	Manufacture of motor vehicles, trailers and semi-trailers	0,58	T	123,17



Table 1.3: Gini coefficients, classification, and employment by industry

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Tradable / Non-tradable</i>	<i>Employment 2015</i>
30	Manufacture of other transport equipment	0,26	T	80,57
31	Manufacture of furniture	0,49	T	53,12
32	Other manufacturing	0,33	T	75,44
33	Repair and installation of machinery and equipment	0,25	T	280,63
35	Electricity, gas, steam and air conditioning supply	0,22	N	137,12
36	Water collection, treatment and supply	0,21	N	19,37
37	Sewerage	0,30	T	25,83
38	Waste collection, treatment and disposal activities; materials recovery	0,17	N	107,94
39	Remediation activities and other waste management services	0,53	T	4,62
41	Construction of buildings	-	N	168,20
42	Civil engineering	0,15	N	181,85
43	Specialized construction activities	0,13	N	1488,23
45	Wholesale and retail trade and repair of motor vehicles and motorcycles	0,13	N	483,17
46	Wholesale trade, except of motor vehicles and motorcycles	0,10	N	1109,67
47	Retail trade, except of motor vehicles and motorcycles	0,09	N	2093,05
49	Land transport and transport via pipelines	0,13	N	791,46
50	Water transport	0,42	T	15,20
51	Air transport	0,76	T	66,81
52	Warehousing and support activities for transportation	0,30	T	260,94
53	Postal and courier activities	0,15	N	237,50
55	Accommodation	0,32	T	237,69
56	Food and beverage service activities	0,14	N	905,76
58	Publishing activities	0,44	T	119,19
59	Motion picture, video and television program production, sound recording and music publishing activities	0,46	T	58,10
60	Programming and broadcasting activities	0,54	T	35,06
61	Telecommunications	0,29	T	137,08
62	Computer programming, consultancy and related activities	0,28	T	403,44
63	Information service activities	0,34	T	70,16
64	Financial service activities, except insurance and pension funding	0,19	N	422,06
65	Insurance, reinsurance and pension funding, except compulsory social security	0,41	T	180,89
66	Activities auxiliary to financial services and insurance activities	0,17	N	177,93
68	Real estate activities	0,22	N	351,18
69	Legal and accounting activities	0,14	N	331,38

Table 1.3: Gini coefficients, classification, and employment by industry

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Tradable / Non-tradable</i>	<i>Employment 2015</i>
70	Activities of head offices; management consultancy activities	0,31	T	447,26
71	Architectural and engineering activities; technical testing and analysis	0,15	N	387,87
72	Scientific research and development	-	T	446,90
73	Advertising and market research	0,36	T	168,55
74	Other professional, scientific and technical activities	0,23	N	92,94
75	Veterinary activities	0,21	N	25,95
77	Rental and leasing activities	0,20	N	139,23
78	Employment activities	0,12	N	801,38
79	Travel agency, tour operator and other reservation service and related activities	0,27	T	55,08
80	Security and investigation activities	0,21	N	166,70
81	Services to buildings and landscape activities	0,10	N	462,31
82	Office administrative, office support and other business support activities	0,18	N	382,08
84	Public administration and defense; compulsory social security	0,14	N	2392,57
85	Education	0,08	N	1825,31
86	Human health activities	0,13	N	1824,16
87	Residential care activities	0,21	N	782,69
88	Social work activities without accommodation	0,12	N	1168,88
90	Creative, arts and entertainment activities	0,33	T	224,19
91	Libraries, archives, museums and other cultural activities	0,42	T	55,90
92	Gambling and betting activities	0,60	T	24,18
93	Sports activities and amusement and recreation activities	0,21	N	272,37
94	Activities of membership organizations	0,20	N	314,93
95	Repair of computers and personal and household goods	0,18	N	83,85
96	Other personal service activities	0,10	N	374,15
97	Activities of households as employers of domestic personnel	0,22	N	155,16

## II. Supplementary tables

Table 1.4: Full regression results.

	OLS				IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Elasticity	0.085 *** (0.029)	0.110 *** (0.054)	0.090 *** (0.031)	0.027 (0.047)	0.361 *** (0.126)	0.440* (0.244)	0.344 *** (0.148)	0.319* (0.167)
Unemployment	-0.219 *** (0.104)	-0.091 (0.277)	-0.371 *** (0.110)	0.252 (0.164)	-0.094 (0.130)	0.080 (0.302)	-0.247* (0.141)	0.382 *** (0.170)
Total labor force	0.000 (0.000)	0.000 *** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 ** (0.000)	0.000 (0.000)	0.000 ** (0.000)
Share non-tradable	-0.004 (0.026)	0.041 (0.060)	0.046 *** (0.035)	-0.324 *** (0.059)	-0.023 (0.032)	0.010 (0.062)	0.006 (0.049)	-0.288 *** (0.066)

Notes: Robust standard errors clustered by employment area reported in parentheses. Columns (1) and (5) correspond to model 1, (2) and (6) to model 2. The dependent variable in (3) and (7) is the log variation of market non-tradable employment, while it is the log variation of non-market non-tradable employment in columns (4) and (8). All regressions include location fixed effects. Location fixed effects correspond to dummy variables for 22 regions of metropolitan France. \*Significance at the 10% level; \*\*significance at the 5% level and \*\*\*significance at the 1% level.

Table 1.5: Summary of estimated local multipliers, alternative instrument

	OLS		IV (Regress-M)		Multiplier	
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Model 1</u>						
Tradable on non-tradable	0.140*** (0.029)	0.085*** (0.029)	0.331*** (0.129) [13.151]	0.458 (0.505) [1.406]	0.81	-
<u>Model 2</u>						
Tradable on other tradable	0.212*** (0.049)	0.110** (0.054)	0.954*** (0.333) [6.161]	4.161 (10.823) [0.127]	0.86	-
<u>Model 3</u>						
Tradable on market non-tradable	0.161*** (0.032)	0.090*** (0.031)	0.334** (0.140) [13.151]	0.199 (0.572) [0.789]	0.67	-
Tradable on non-market non-tradable	0.055 (0.046)	0.027 (0.047)	0.366* (0.204) [13.151]	0.937 (0.740) [2.249]	0.15	-
Year FE	Y	Y	Y	Y	Y	Y
Region FE	N	Y	N	Y	N	Y
Controls	N	Y	N	Y	N	Y

Notes: Robust standard errors clustered by employment area reported in parentheses. Kleibergen-Paap Wald rk F statistic in brackets. The multiplier in column 5 (6) is calculated using the IV estimator (Regress-M instrument) in column 3 (4). As we only modify the instrumental variable, OLS results are unchanged compared with Table 2. Control variables include: local unemployment rates, local total labour force, and the share of local non-tradable employment at the beginning of each period. Location fixed effects correspond to dummy variables for 22 regions of metropolitan France. \*Significance at the 10% level; \*\*significance at the 5% level and \*\*\*significance at the 1% level.

### III. Supplementary figures

Figure 1.7: French employment areas

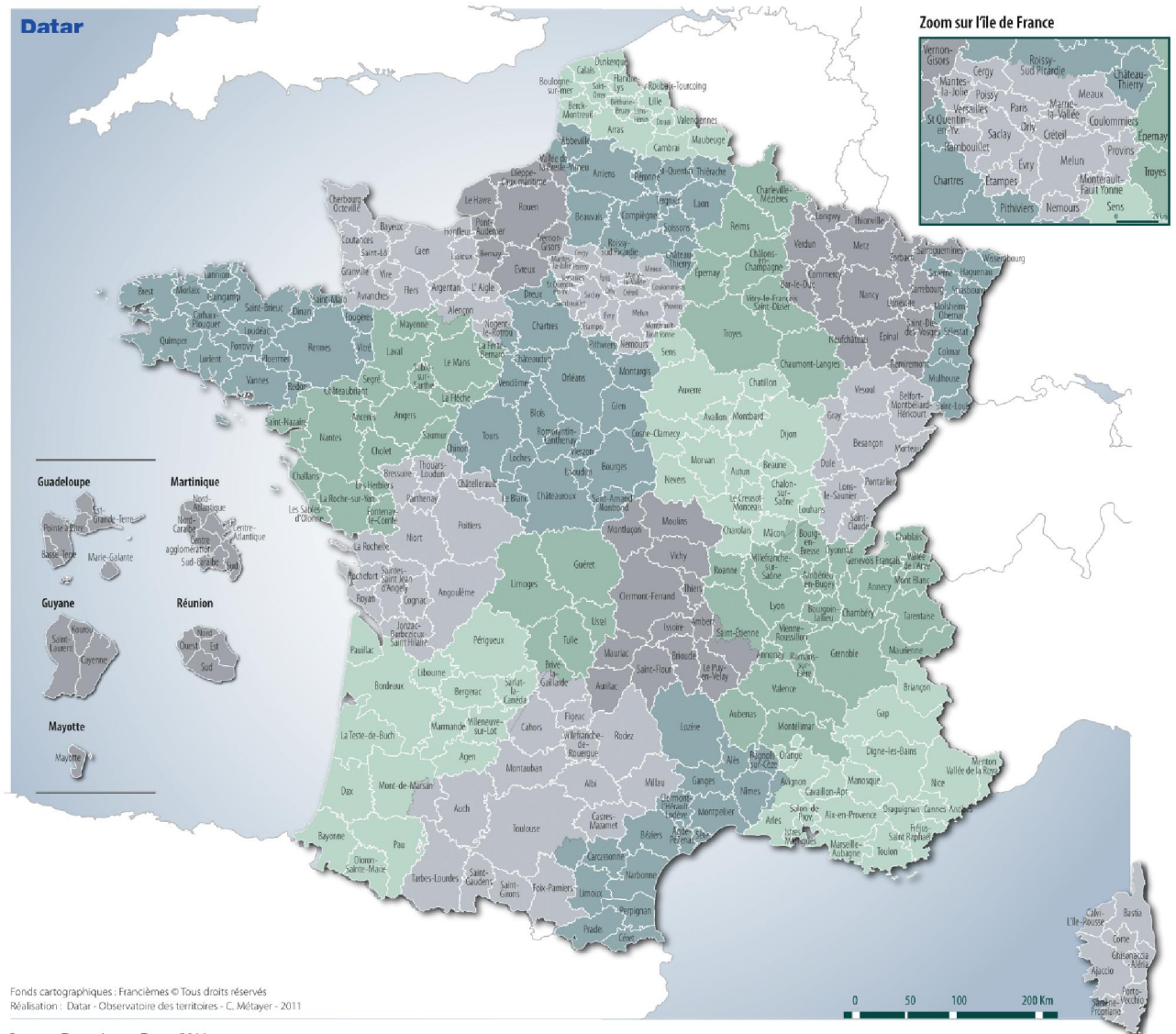
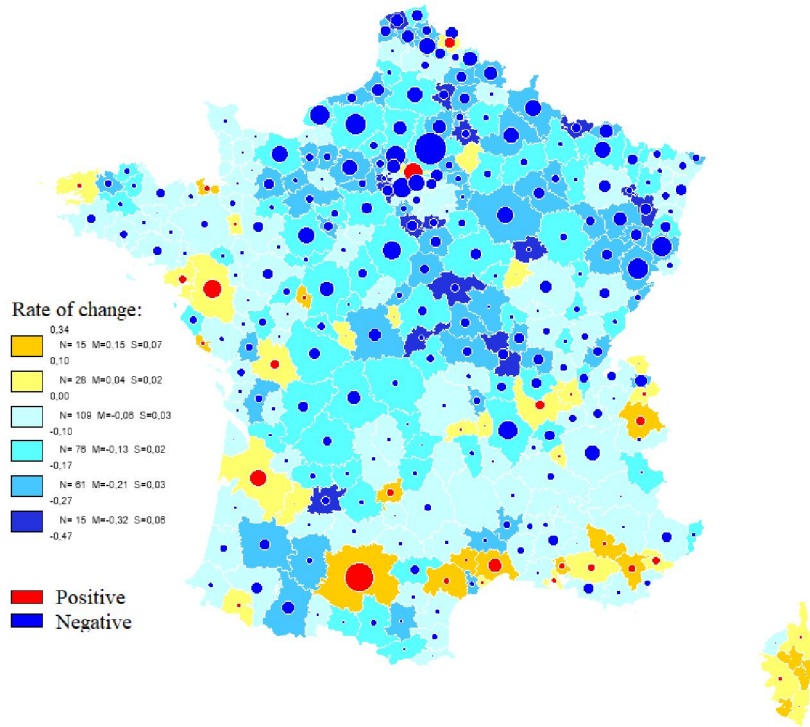
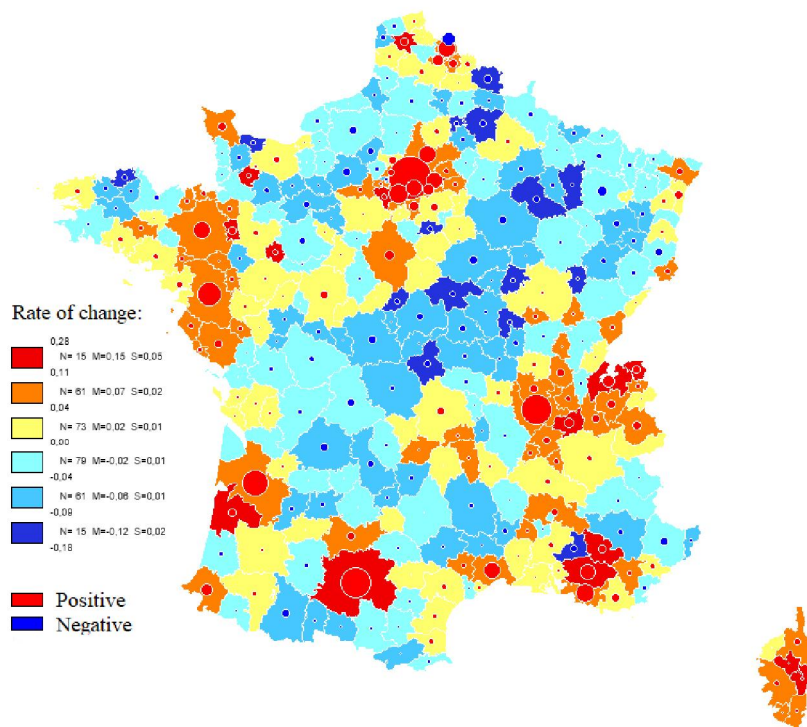


Figure 1.8: Change in tradable payroll employment, 2008-2016



Source: Acoess. Produced using Philcarto : <http://philcarto.free.fr>

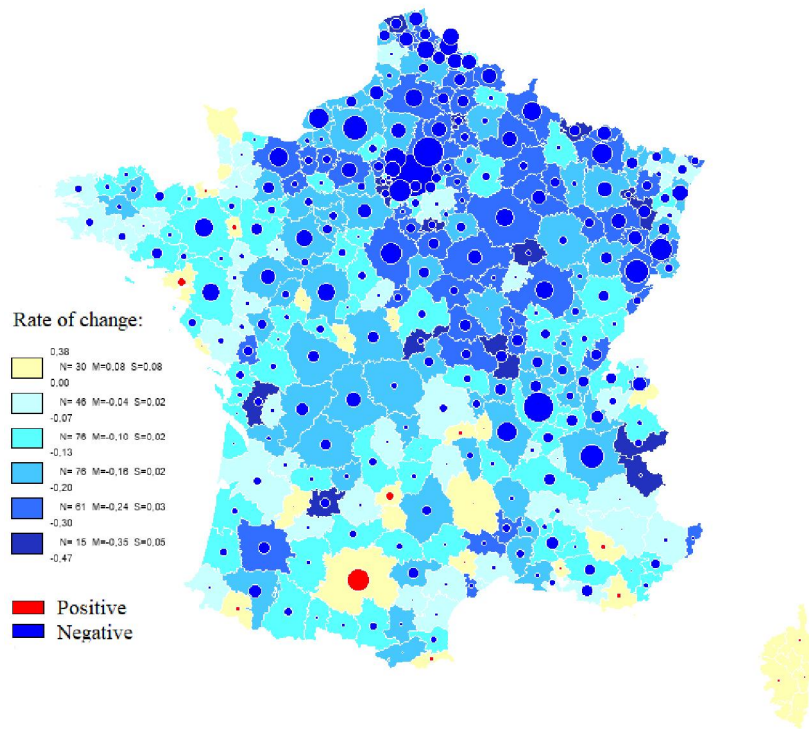
Figure 1.9: Change in non-tradable payroll employment, 2008-2016



Source: Acoess. Produced using Philcarto : <http://philcarto.free.fr>

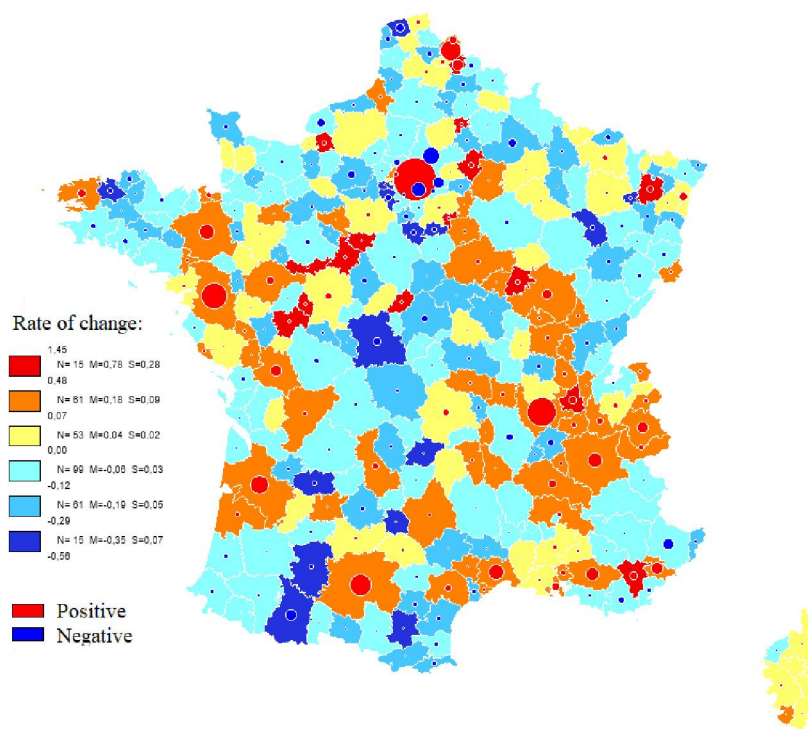


Figure 1.10: Change in manufacturing payroll employment, 2008-2016



Source: Acoess. Produced using Philcarto : <http://philcarto.free.fr>

Figure 1.11: Change in tradable services payroll employment, 2008-2016

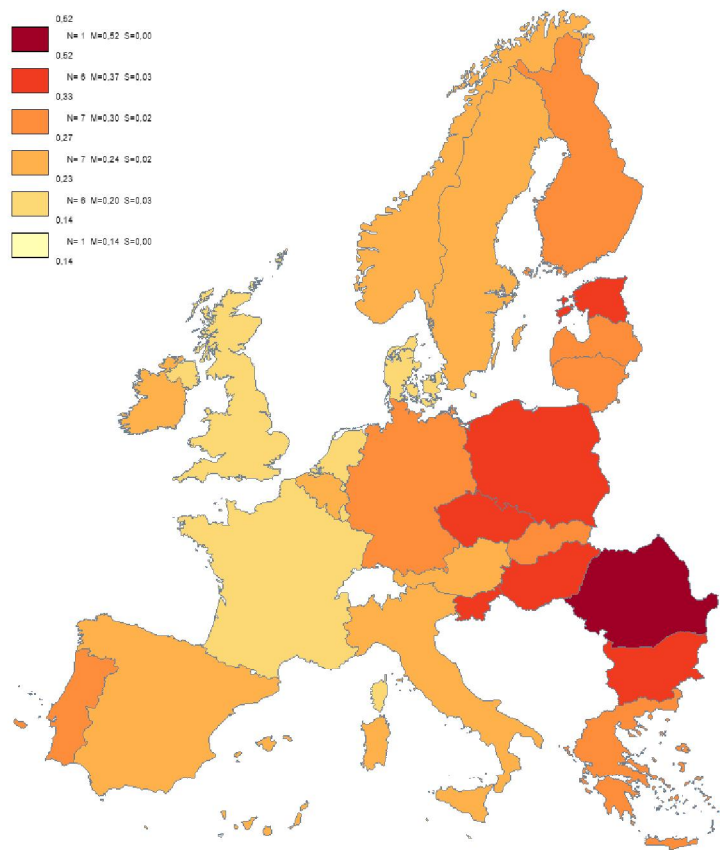


Source: Insee. Produced using Philcarto : <http://philcarto.free.fr>

#### IV. The evolution of tradable and non-tradable employment in Europe

We use our classification of industries to analyze the evolution of tradable and non-tradable employment in 28 European countries. Eurostat data on employment by industry are slightly more aggregated, with a breakdown into 64 (NACE rev2 A\*64) industries versus 88 for France using national account data. Fortunately, tradable and non-tradable industries are grouped in only three cases. In one case, “Legal and accounting activities; activities of head offices; management consultancy activities”, we consider that half of employment is tradable and the other half is non-tradable. In the two other cases<sup>16</sup>, French data suggest that the non-tradable component is much bigger so we allocate the entire industry to the non-tradable sector. Table 6 details the classification of industries.

Figure 1.12: Share of tradable employment in 28 European countries, 2013



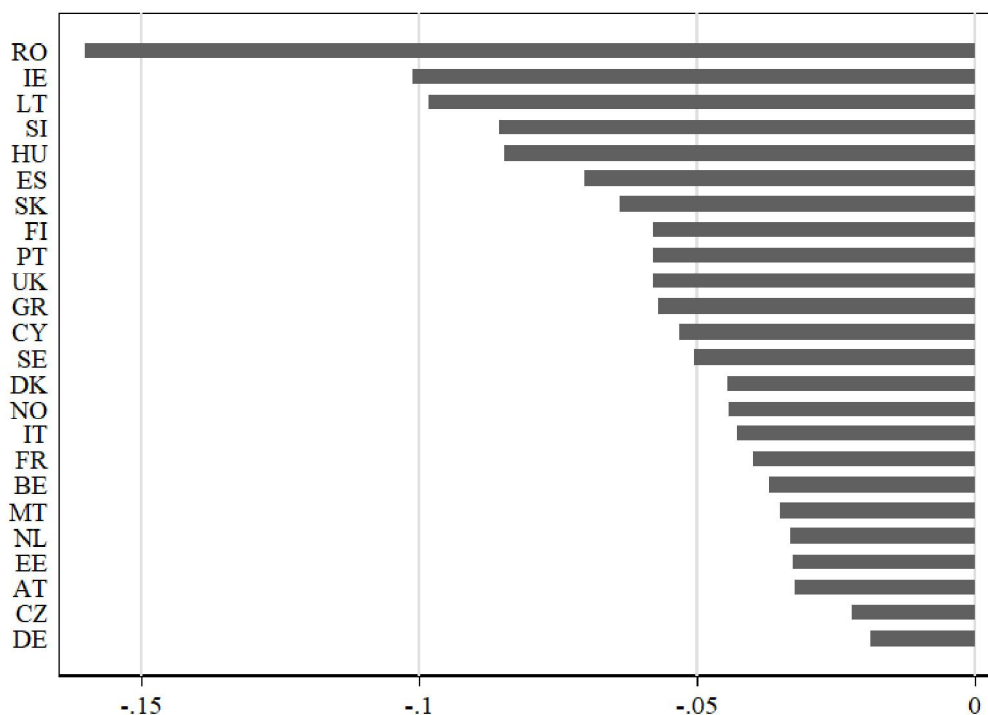
Source: Eurostat. Produced using Philcarto : <http://philcarto.free.fr>

<sup>16</sup>“Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services”, “Accommodation; food and beverage service activities”.



Figure 1.12 reveals significant cross-country differences in the proportion of tradable jobs. Yet, tradable jobs are everywhere in the minority, with the exception of Romania (52% of tradable jobs) where a large share of the population works in agriculture (Figure 1.14). Our results also show that the decline in tradable employment is pervasive: the share of tradable jobs has declined in the 24 European countries for which we have data for the period 1999-2013. In volume, tradable employment has decreased everywhere but in Germany, Austria and Malta. Germany, the largest European economy, has seen the lowest reduction in the share of tradable jobs over 1999-2013. The reason is that Germany managed to maintain a strong manufacturing basis, while also developing tradable services, and created a total of 168,000 tradable jobs. Austria and Czech Republic has also maintained a large share of manufacturing jobs and contained the relative decline of tradable employment.

Figure 1.13: Variation of the tradable employment share (percentage points), 24 European countries, 1999-2013

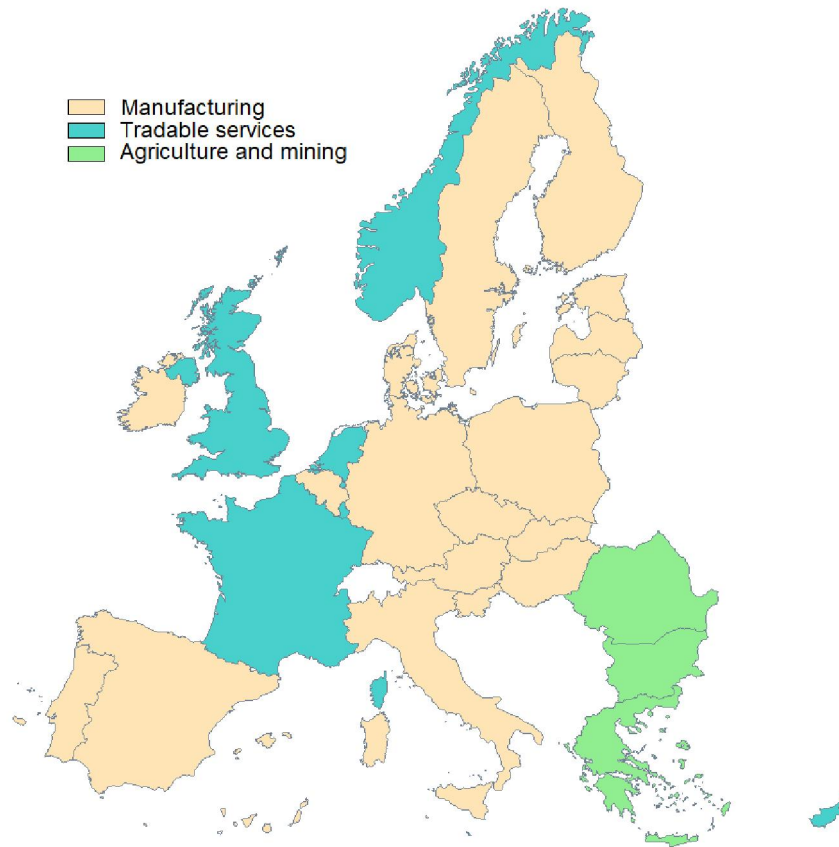


Source: Eurostat. Produced using Philcarto : <http://philcarto.free.fr>

On the contrary, tradable services tend to dominate tradable employment in Western Europe (Luxembourg, France, the United Kingdom and the Netherlands, see Figure 1.14), with a rapid decline

in manufacturing employment, in particular in France and the United Kingdom. These countries are among those which present the lowest share of tradable employment in total employment (Figure 1.12).

Figure 1.14: Major industry within tradable employment, 28 European countries, 2013



Source: Eurostat. Produced using Philcarto : <http://philcarto.free.fr>

Table 1.6: Classification of industries, NACE A\*64

NACE code	Industry	T / N
A01	Crop and animal production, hunting and related service activities	T
A02	Forestry and logging	T
A03	Fishing and aquaculture	T
B	Mining and quarrying	T
C10-C12	Manufacture of food products; beverages and tobacco products	T
C13-C15	Manufacture of textiles, wearing apparel, leather and related products	T
C16	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	T
C17	Manufacture of paper and paper products	T
C18	Printing and reproduction of recorded media	T
C19	Manufacture of coke and refined petroleum products	T
C20	Manufacture of chemicals and chemical products	T
C21	Manufacture of basic pharmaceutical products and pharmaceutical preparations	T
C22	Manufacture of rubber and plastic products	T
C23	Manufacture of other non-metallic mineral products	T
C24	Manufacture of basic metals	T
C25	Manufacture of fabricated metal products, except machinery and equipment	T
C26	Manufacture of computer, electronic and optical products	T
C27	Manufacture of electrical equipment	T
C28	Manufacture of machinery and equipment n.e.c.	T
C29	Manufacture of motor vehicles, trailers and semi-trailers	T
C30	Manufacture of other transport equipment	T
C31-C32	Manufacture of furniture; other manufacturing	T
C33	Repair and installation of machinery and equipment	T
D	Electricity, gas, steam and air conditioning supply	N
E36	Water collection, treatment and supply	N
E37-C39	Sewerage, waste management, remediation activities	N
F	Construction	N
G45	Wholesale and retail trade and repair of motor vehicles and motorcycles	N
G46	Wholesale trade, except of motor vehicles and motorcycles	N
G47	Retail trade, except of motor vehicles and motorcycles	N
H49	Land transport and transport via pipelines	N
H50	Water transport	T

Table 1.6: Classification of industries, NACE A\*64

NACE code	Industry	T / N
H51	Air transport	T
H52	Warehousing and support activities for transportation	T
H53	Postal and courier activities	N
I	Accommodation and food service activities	N
J58	Publishing activities	T
J59-J60	Motion picture, video, television programme production; programming and broadcasting activities	T
J61	Telecommunications	T
J62-J63	Computer programming, consultancy, and information service activities	T
K64	Financial service activities, except insurance and pension funding	N
K65	Insurance, reinsurance and pension funding, except compulsory social security	T
K66	Activities auxiliary to financial services and insurance activities	N
L	Real estate activities	N
M69-M70	Legal and accounting activities; activities of head offices; management consultancy activities	N/T
M71	Architectural and engineering activities; technical testing and analysis	N
M72	Scientific research and development	T
M73	Advertising and market research	T
M74-M75	Other professional, scientific and technical activities; veterinary activities	N
N77	Rental and leasing activities	N
N78	Employment activities	N
N79	Travel agency, tour operator reservation service and related activities	T
N80-82	Security and investigation, service and landscape, office administrative and support activities	N
O	Public administration and defence; compulsory social security	N
P	Education	N
Q86	Human health activities	N
Q87-Q88	Residential care activities and social work activities without accommodation	N
R90-R92	Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	T
R93	Sports activities and amusement and recreation activities	N

Table 1.6: Classification of industries, NACE A\*64

NACE code	Industry	T / N
S94	Activities of membership organisations	N
S95	Repair of computers and personal and household goods	N
S96	Other personal service activities	N
T	Activities of households as employers; undifferentiated goods- and services	N
U	Activities of extraterritorial organisations and bodies	N





## CHAPTER 2

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### Job displacement costs in tradable and non-tradable industries

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#### Résumé

En France, les fermetures d'entreprises exposées à la concurrence internationale ravivent régulièrement le débat, déjà très ancien, sur les conséquences de la mondialisation. Il existe un large consensus dans la littérature économique autour de l'idée que l'ouverture commerciale des économies est un processus globalement gagnant. Les économistes admettent cependant que celle-ci crée des perdants dans tous les pays. Dans ce deuxième chapitre nous tentons de déterminer si le risque de licenciement suite à la fermeture d'un site de production, et les coûts qui lui sont associés, sont plus élevés dans les activités exposées à la concurrence internationale, i.e. l'industrie manufacturière et les services exposés, que dans le secteur abrité. En utilisant un panel apparié employeur-employé sur la période 1998-2010, nous trouvons que le risque de perte d'emploi consécutif à la fermeture d'un site de production, en contrôlant pour les facteurs influençant le licenciement, est moindre dans le secteur exposé et en particulier dans l'industrie manufacturière. Néanmoins, les perspectives de retour à l'emploi sont significativement moins bonnes pour les salariés licenciés du secteur manufacturier par rapport à ceux des services exposés et du secteur abrité. À partir d'une méthode de double différence, nous montrons que les pertes salariales imputables au licenciement sont en outre plus élevées pour ces salariés manufacturiers licenciés. Les résultats suggèrent que ces difficultés pourraient s'expliquer par l'importance des compétences spécifiques dans l'industrie manufacturière, secteur en déclin et concentré géographiquement.



## Abstract

In France, the closure of firms exposed to foreign competition regularly revives the public debate on the consequences of globalization. The economic literature broadly agrees that nations gain from trade. However, economists also agree that free trade can have disruptive effects on workers. In this chapter we investigate whether job displacement risks and costs are higher in tradable industries, i.e. the manufacturing sector and tradable services, than in non-tradable industries. Job displacement is defined as involuntary job loss due to firm closure. Using matched employer-employee panel data from 1998 to 2010, we find that the risk of displacement, controlling for factors that influence displacement, is lower in the tradable sector, particularly in (tradable) manufacturing. However, re-employment opportunities are significantly reduced for displaced manufacturing workers. Using difference-in-differences techniques, we also find larger income losses for these manufacturing workers. Results suggest that skill specificity may be a major factor explaining lower re-employment and larger wage losses in this declining and geographically concentrated sector.



## 2.1 Introduction

The impact of free trade on employment was debated intensely during the runup to the French presidential elections in 2017. The climax of the campaign was probably the highly mediatized confrontation between the two candidates who qualified for the second round (Marine Le Pen and Emmanuel Macron) in the presence of workers at a clothes dryer factory (Whirlpool) about to be relocated to Poland. Political parties opposed to free trade interpreted the event as a symbol of the negative effects of globalization, echoing the concerns of a large share of the French population<sup>1</sup>. More generally, the closure of firms exposed to foreign competition<sup>2</sup>, sometimes for relocation, regularly revives the long-standing public debate on how globalization impacts jobs and wages.

Most economists argue that globalization has a positive impact on the aggregate wellbeing of a country (Crozet et al., 2017) thanks to gains from traditional comparative advantages, increased product variety, economies of scale, and technological spillovers. Numerous studies thus underline the positive repercussions of trade on GDP and productivity (Frankel and Romer, 1999; Frankel and Rose, 2002). Empirical studies that attempt to establish a link between international trade and changes in the overall number of jobs or the aggregated unemployment rate are however less clear-cut (Schwarzer, 2015). One of the problems of evaluations is that it is very difficult to dissociate the impacts of globalization from the influence of the specific characteristics of economies, i.e. the degree of labor market flexibility, effectiveness of education and vocational training systems, taxation, etc. It is also difficult to distinguish the effects of technical progress from those of international competition, since these phenomena tend to reinforce each other (Reshef and Toubal, 2017)<sup>3</sup>.

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<sup>1</sup>According to a recent poll, only 26% of French people view globalization as an opportunity for their country, compared to an average of 42% for people in the 22 countries questioned. Ipsos (2017), Protectionnisme ou libéralisme?, www.ipsos.com.

<sup>2</sup>Recent examples in France include Whirlpool in Amiens, GM&S in La Souterraine, Tupperware in Joué-lès-Tours, La Seita (subsidiary of Imperial Tobacco) in Riom, and Ford in Blanquefort.

<sup>3</sup>On the one hand, the international fragmentation of firms' production is largely the result of technical change, e.g. container transportation and coordination of activities by internet. On the other hand, globalization has a dynamic impact on technical change: firms exposed to foreign competition are more likely to adopt new technologies to resist global competitive pressures.

Economists also agree that free trade generates winners and losers. Both traditional and modern theories of international trade predict distributive effects of trade liberalization. Globalization reallocates resources between sectors, firms, occupations, and tasks. Stolper and Samuelson showed back in 1941, in an extension of the HOS model, how gains from trade are accompanied by a change in income distribution within countries. For countries well endowed with skilled labor, the model predicts that, through international specialization, the opening-up of trade will increase wage inequality between low-skill (LS) and high-skill (HS) workers. However, the rising inequalities in developed countries since the 1980s are not entirely consistent with the Stolper-Samuelson analysis. First, unlike the predictions made by Stolper and Samuelson, inequalities between LS and HS workers have also grown in numerous *developing* countries (Goldberg and Pavcnik, 2007). Second, the rise in demand for skilled workers in rich countries is not so much due to the dynamism of the industries intensive in high-skill workers, as to increased demand for this type of workers *within* industries. Lastly, the higher wages earned by HS workers cannot be explained by an increase in the relative price of goods that are intensive in HS workers (Lawrence et al., 1993). Based on the observation of an acceleration in the international fragmentation of production, and in particular the development of investments by US multinationals in Mexico, Feenstra and Hanson (1997) put forward the following explanation of the growing inequalities: when a US firm relocates a new stage of production to Mexico, it concerns the activity that is the least intensive in high-skill tasks. Yet, from the Mexican point of view, this new activity is more skill-intensive than the tasks previously carried out. As a result, demand for HS workers rises in Mexico while demand for LS workers drops in the United States: inequalities widen in both countries and within sectors. Recently, for the case of France, Carluccio et al. (2017) show that outsourcing tends to increase average wages within the firm, but that the wages of LS workers are negatively impacted.

LS workers therefore turn out to be particularly vulnerable to the effects of globalization. This

observation calls for three clarifications. First, technical progress, just like trade with developing countries, tends to reduce the demand for LS workers, so that it is difficult to separate their respective impacts. Second, a series of recent studies have highlighted the phenomenon of a polarization of the labor market, both in the United States ([Autor et al., 2006](#); [Autor and Dorn, 2013](#)) and several European countries ([Goos et al., 2009](#)) including France ([Harrigan et al., 2016](#); [Malgouyres, 2017](#); [Charnoz et al., 2017](#)). In developed countries, the share of LS and HS workers is increasing, while the share of medium-skill workers is going down as a consequence of technical progress and the outsourcing of routine tasks. Third, studies on firm heterogeneity show that trade is associated with an increase in wage inequalities between workers with the same qualification level working in firms with different productivity levels ([Helpman et al., 2017](#)).

Increasing competitive pressures also have heterogeneous effects on local labor markets, due to the geographic concentration of activities exposed to international competition. A recent and influential strand of the literature analyzing the regional dimension of import penetration shows that trade's costs and benefits are unevenly distributed geographically. The growth of import competition has a negative impact on wages and employment in most exposed local labor markets. Examples of this literature include [Autor et al. \(2013, 2015\)](#) for the US, [Dauth et al. \(2014\)](#) for Germany, [Topalova \(2010\)](#) for India, [Dix-Carneiro and Kovak \(2017b\)](#) for Brazil, and [Malgouyres \(2017\)](#) for France. The surge in unemployment rates in areas facing competition from imports suggests that the reallocation of laid-off workers towards expanding sectors is a long and costly process. Another recent and growing area of the literature studying the worker-level effects of trade ([Autor et al., 2014](#); [Dix-Carneiro and Kovak, 2017a](#); [Dauth et al., 2018](#)), confirms that workers in import-competing sectors may incur substantial adjustment costs. For instance, [Dix-Carneiro and Kovak \(2017a\)](#) find that the workers most exposed to a rise in import competition are more likely to transition into low-paying service industries. The existence of trade-related adjustment costs helps explain the concerns generated by the closure of firms exposed to international competition, especially when they involve industries and regions that

offer few re-employment perspectives for displaced workers.

In this chapter, we analyze the impact of firm closures on the careers of French displaced workers. A large body of research has shown that job displacement deteriorates labor market outcomes (Podgursky and Swaim, 1987; Jacobson et al., 1993; Couch and Placzek, 2010; Hijzen et al., 2010) and has a negative impact on psychological and physical well-being (Sullivan and Von Wachter, 2009; Browning et al., 2006). We contribute to this literature by proposing the first analysis of the costs of job displacement, in terms of wage losses and unemployment, across French tradable and non-tradable industries. By comparing postdisplacement outcomes of workers displaced from tradable industries with similar workers in non-tradable industries, we also complement the aforementioned literature on worker-level analysis of trade adjustment costs. Unlike these studies, though, we do not restrict the tradable sector to manufacturing, but also include tradable services. The only similar study we were able to find was carried out by Eliasson and Hansson (2016) on Swedish data.

In the absence of detailed data on trade in services, we classify industries as tradable or non-tradable based on their geographical clustering. This procedure enables us to identify tradable services at the 3-digit level. We use a large administrative dataset to follow hundreds of thousands of French workers over the period 1998-2010. The analysis of displacement risks and re-employment probabilities is based on probit regression models. To preview the results, we find that the likelihood of displacement due to firm closure is actually lower in the tradable sector than in the non-tradable sector. Interestingly, the risk of displacement is lowest in the manufacturing sector. However, workers displaced from the manufacturing sector face poorer re-employment prospects. We also quantify the causal effect of displacement on postdisplacement wages. Combining propensity score matching with difference-in-differences to account for potential sources of selection bias, we find larger wage losses for displaced manufacturing workers. This result may explain why the public seems to pay disproportionate attention to manufacturing plant closures.

In Section 2 we start by describing the data, and the methodologies used to identify displacement and tradable and non-tradable industries. Section 3 provides descriptive statistics on displacement and re-employment. Section 4 features our results on displacement risks and re-employment opportunities. Section 5 shows the effects of job displacement on future wages. Section 6 discusses the results and Section 7 concludes.

## 2.2 Identification of displacement and classification of industries

### 2.2.1 Data and identification of displacement

Data for this study are extracted from a rich employer-employee dataset, the DADS (Déclaration Annuelle des Données Sociales). This dataset features information about non-agricultural French workers that all employers must report yearly to social security authorities and the tax administration. The data set includes, for each year, all periods of work for each employee, the gross and net wage corresponding to each period of work, and socio-demographic characteristics of employees such as their gender, age and occupation. In addition, the data set provides the industry classification code of each establishment or firm at the 4-digit NAF (rev.1) level, as well as their geographical location. From these reports, the French National Institute for Statistics and Economic Studies (INSEE) constructs a comprehensive annual dataset, the DADS postes, and a matched employer-employee panel, called Panel DADS, containing a 1/12th sample of the comprehensive dataset.<sup>4</sup>

The DADS do not specify the reason why an individual has changed of employer or disappeared from the database. The challenge is thus to distinguish job displacement from separations for other reasons, e.g. voluntary resignation, job mismatch, or poor performance. Job displacement is defined as involuntary job loss due to exogenous shocks such as economic turmoil or structural change ([Quintini](#)

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<sup>4</sup>The DADS panel is composed of data on employees born in the month of October in even-numbered years from 1976 until 2001, forming a sample of 1/25th of the total worker population, and of employees born in October in all years from 2002 to 2010, forming a sample of 1/12th of all workers covered by the DADS source.

and Venn, 2013). To identify displaced workers, we identify firm closures between 1999 and 2009 in the DADS postes (exhaustive) database. More specifically, closure is established based on the disappearance of a “local unit” identifier from the database. A local unit is composed of all establishments of a given firm located in a given local labor market. We therefore construct a local unit identifier by concatenating the firm identifier (SIREN code) with the local labor market identifier (employment area code<sup>5</sup>). We focus on local units instead of establishment closures, as in Royer (2011), because the DADS panel does not provide *establishment* identifiers, but only *firm* identifiers. Displaced workers are workers belonging to local units that have closed.

One drawback is that the firm identifier can be somewhat unstable over time, meaning that a firm may disappear from the database due to administrative reasons, a change of activity, a merge, or a takeover (Royer, 2011). At the level of a local unit, when an establishment relocates to another employment area this may result in the disappearance of the local unit from the database without real closure. Drawing on (Margolis, 2002), we attempt to control for these false local unit deaths by tracking worker flows across local units between year  $t$  and  $t + 1$ . Using the DADS panel we compute the share of workers from local unit  $j$ , which disappeared in  $t$ , that move to another local unit  $k$  in  $t + 1$ . If more than 50% of the total workforce of the local unit  $j$ , observed in  $t$ , move to the same local unit  $k$  in  $t + 1$ , we consider that there is an economic continuity between local units  $j$  and  $k$ , implying that workers of  $j$  have not been displaced in  $t$ . This correction only makes sense if there is a sufficient number of employees to follow in the local unit. Accordingly, this correction concerns only local units for which at least three employees are observed in the panel at the date of the unit’s disappearance<sup>6</sup>.

In the next step, we restrict the panel of displaced and non-displaced workers to the period from 1998 and 2010 (the last year available). This period is of particular interest for the analysis of glob-

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<sup>5</sup>Metropolitan France is divided into 348 employment areas.

<sup>6</sup>Since the exhaustive dataset contains over 20 million employees a year, we track only worker flows within a region (22 regions in Metropolitan France) to reduce the computational burden.



alization's impact on the labor market as it covers the introduction of the euro (1999), China's entry into the World Trade Organization (2001), the financial crisis and the Great Recession (2007-2010).

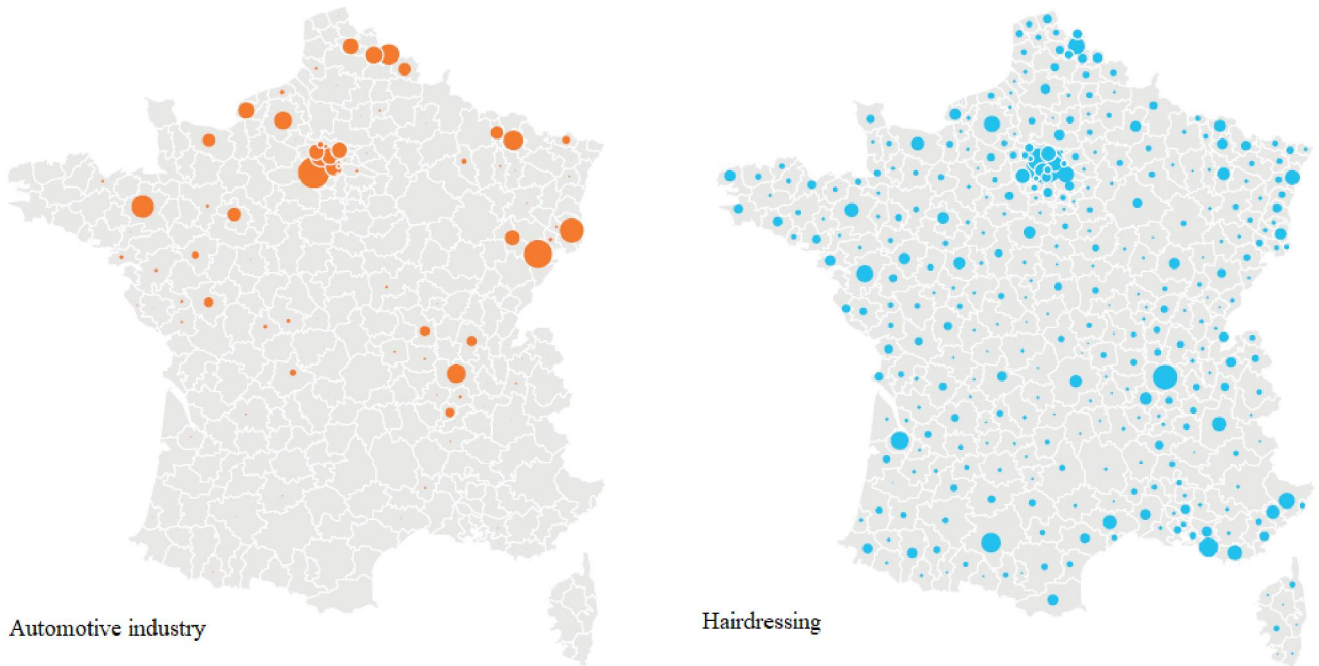
We keep only "non-annex" workstations (*postes non annexes*) in Metropolitan France. A workstation is said to be "non-annex" if its volume of work and the level of earnings are sufficient according to INSEE's definition. In practice, "non-annex" workstations are workstations with an annual wage at least three times higher than the monthly minimum wage and a yearly job duration of more than 30 days and 120 hours, combined with a ratio between hours worked and job duration greater than 1.5. We focus on the private sector, including state-owned industrial and commercial establishments, and exclude the public sector where job displacement is negligible. We also restrict the sample to individuals aged between 20 and 60 in order to avoid complications related to the discontinued entry of young workers on the job market and early retirement, which could be confounded with displacement. Lastly, we drop extreme outliers in the database, i.e. individuals with an annual net salary above 1,000,000 euros. These restrictions leave us with a sample of around 10.7 million observations.

### 2.2.2 Identification of tradable and non-tradable industries

We split industries into tradable and non-tradable using an index of geographic concentration. It is based on the observation that tradable producers tend to be geographically separated from consumers, while trade costs are so high for non-tradable producers (e.g. dentists, civil servants, gardeners) that they have to locate close to the final demand, i.e. non-tradable suppliers tend to follow the spatial distribution of the population. Figure 2.1 depicts the heterogeneous distribution of employment across French employment areas for two industries of equivalent size. While employment in the automotive industry is clustered around a few major centers (Île-de-France, Nord-Pas-de-Calais, Franche-Comté, Rhône-Alpes), hairdressers are much more evenly distributed on the French territory.

A commonly used indicator of production concentration is the so-called locational Gini coefficient

Figure 2.1: Spatial distribution of employment, 2007



Source : Insee, Clap. Made with Philcarto : <http://philcarto.free.fr>

(Krugman, 1991). This coefficient describes concentration at the regional level. When an industry's employment is highly concentrated in a given area, part of the production is consumed outside that area; and when the output is traded regionally it has the potential to be traded internationally. Of course we would prefer to rely on actual trade data to classify industries, however, such data are not available at a detailed level for services.

We use the CLAP database<sup>7</sup>, which provides local data on payroll employment by industry for 2007. Industries are defined at the 4-digit NAF (rév.1) level for the 348 employment areas in metropolitan France. We aggregate industries at the 3-digit level, otherwise too many industries contain a very small number of workers. Then we exclude industries with fewer than 100 workers, as well as the public and agricultural sectors, which are not well covered by the database. For each employment area  $ea$  we first compute the local employment share in industry  $i$ ,  $\lambda_{i,ea} = E_{i,ea}/E_i$ , and the employment area's share in total French payroll employment,  $X_{ea} = E_{ea}/E_{Fra}$ . Employment areas are then sorted by

<sup>7</sup>Connaissance Locale de l'Appareil Productif (CLAP) : Tabulation sur mesure, version PSM - (INSEE). The database was provided by Réseau Quêtelet and follow the NAF rév. 1.

increasing order of the ratio  $R_{i,ea} = \lambda_{i,ea}/X_{ea}$ . The locational Ginis can then be calculated as:

$$G_i = 1 - \sum_{n=1}^{EA} [X_{ea(n)} - X_{ea(n-1)}][\lambda_{i,ea(n)} + \lambda_{i,ea(n-1)}] \quad (2.1)$$

where  $X_{ea(n)}$  is the cumulative share of industry  $i$ 's employment in employment area  $ea$ , with  $X_{ea(0)} = 0$  and  $X_{ea(EA)} = 1$ , and  $X_{ea(n-1)}$  the cumulative share of industry  $i$  employment in employment area  $(n-1)$  with the next lowest share of industry employment. The Gini coefficients inform us on an industry's degree of geographic concentration, a high index reflecting high tradability. Choosing a cut-off value to separate tradable and non-tradable industries involves some degree of arbitrariness and will remain open to criticism. Here we choose a threshold that includes the maximum number of manufacturing industries while excluding all retail trade industries. Therefore, industries with a Gini coefficient equal to or above 0.5 are considered as tradable. Arguably, Tables 2.1 and 2.2 suggest that this threshold is appropriate to classify industries, at least as a first-order approximation. In addition to manufacturing industries, the tradable sector comprises mining industries and a large number of service activities, such as insurance, IT systems consultancy, and software publishing. In what follows, we often breakdown the tradable sector into tradable manufacturing and tradable services, as these sub-sectors followed opposite employment trends over the period and present differences in the skill composition of their workforce (see Chapter 1). The non-tradable sector features mostly local services (e.g. restaurants, retail trade, bank branches, cleaning activities), but also construction industries and a handful of manufacturing industries. Table 8 (Appendix II) provides a complete list of industries and their classification.

Note that the indicator we use to classify industries differs slightly from the one used in Chapter 1 as it is based on a less precise proxy of local industry demand. It reflects a trade-off between index precision and sectoral disaggregation. Indeed, input-output tables used to compute industry demand shares are available only at the 2-digit level. We favoured sectoral disaggregation because part of the

analysis focuses on the between-industry mobility of displaced workers. Finally, with our current classification and the restrictions imposed in the previous subsection, our sample contains 22% of tradable jobs over the period covered, which is in line with previous estimates (Chapter 1). This classification allows us to distinguish workers displaced from tradable industries from workers displaced from non-tradable industries. However and importantly, we do not presume that all - or even most - workers displaced from tradable industries are displaced due to foreign competition. There are of course other causes of job losses in tradable industries, e.g. shifts in consumer preferences, technological change, and restructuring.

Table 2.1: The 10 largest tradable industries, 2007

<i>Industry</i>	<i>Employment (thousands)</i>	<i>Gini</i>
Insurance	166,580	0,51
Manufacture of plastic products	148,675	0,59
IT systems consultancy	145,554	0,62
Meat industry	141,332	0,68
Manufacture of motor vehicles	140,750	0,88
Treatment of metals; general mechanical engineering	136,208	0,52
Software publishing	134,504	0,57
Manufacture of air and spacecraft	93,886	0,86
Manufacture of pharmaceuticals	92,428	0,65
Publishing activities	89,871	0,56

Table 2.2: The 10 largest non-tradable industries, 2007

<i>Industry</i>	<i>Employment (thousands)</i>	<i>Gini</i>
Other retail sale in non-specialised stores	664,191	0,15
Building of complete constructions or parts thereof; civil engineering	643,971	0,21
Retail sale in non-specialised stores	623,160	0,19
Legal, accounting, and management consultancy activities	606,945	0,33
Urban and road transports	549,956	0,19
Restaurants	457,273	0,24
Monetary intermediation	376,145	0,33
Building completion and finishing	353,266	0,23
Construction installation	352,941	0,17
Cleaning activities	327,464	0,30

## 2.3 Descriptive statistics

### 2.3.1 Displacement rates

Figure 2.2 shows that at the aggregate level from 2000 to 2008, job displacement affected on average 3.2% of French employees. While this percentage may appear low, it implies that a worker has a 70% chance of being affected by one or several displacements over the course of a 40-year career, assuming that displacement risk in each year is distributed as an independent and identically distributed random variable (Publishing, 2018). The report by Quintini and Venn (2013), which covers seven other countries, put the French displacement rate in perspective, and ranks France in an intermediate position.<sup>8</sup> Over this period, displacement affected between 1.5% and 5.5% of workers each year. Displacement rates are high in the United Kingdom and the United States, probably because employment protection is relatively minimal, and low in Germany and Sweden. The large increase of displacement rates in most countries in 2009-2010 suggest that the evolution of job displacement is highly influenced by cyclical movements.

Interestingly, we find that the share of displaced workers is lower in the sector directly exposed to foreign competition (2.8%) than in the non-tradable sector (3.3%).<sup>9</sup> Perhaps even more surprisingly, this result is driven by the much lower share of laid-off workers in the tradable manufacturing sector (2.3%), while tradable services and the non-tradable sector display similar displacement rates. Decomposing by gender, age, and qualification<sup>10</sup>, we see that displacement rates are much lower for all types of manufacturing worker except for high-skilled manufacturing workers compared to high-skilled workers of the non-tradable sector (Figure 2.3). This result goes against the idea that manufacturing

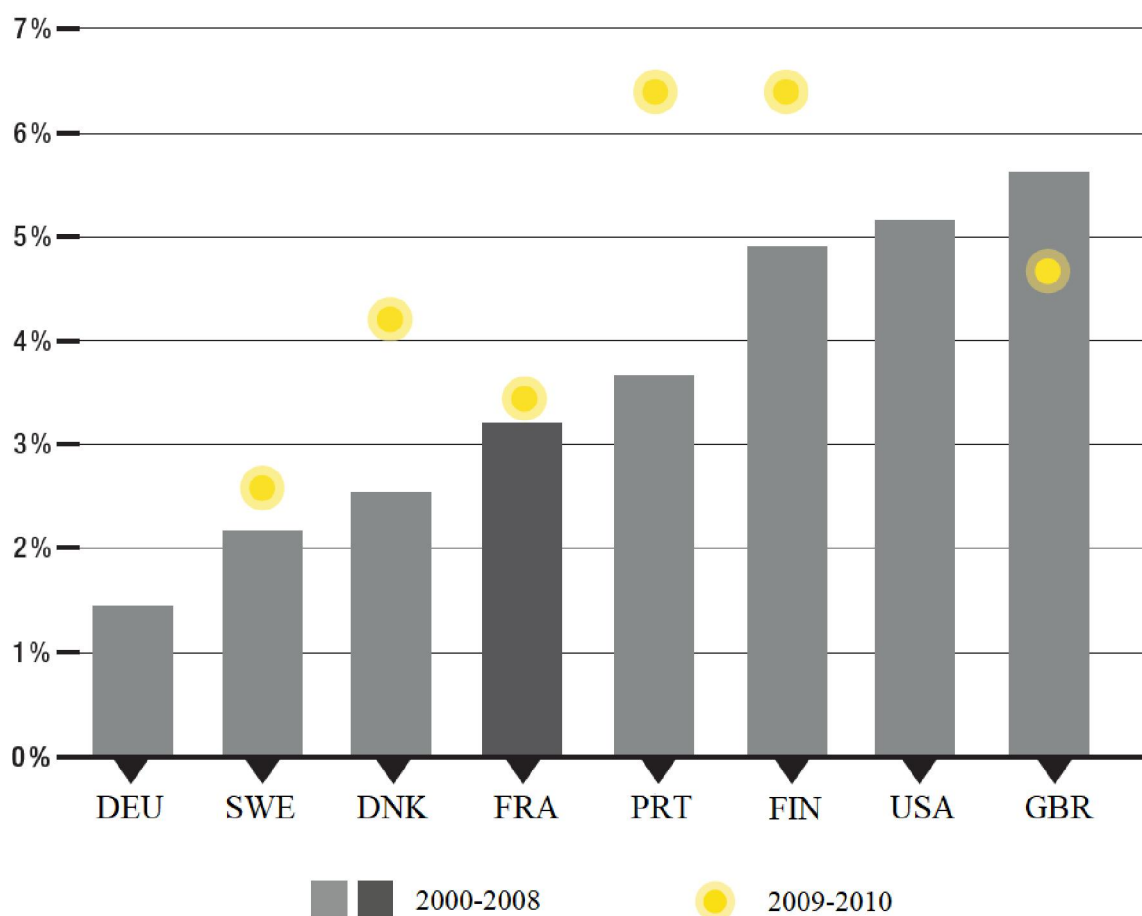
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<sup>8</sup>Quintini and Venn (2013) indicate that despite the efforts made to ensure that consistent definitions and methods were used for every country it remains some doubt about the cross-country comparability of estimates of displacement rates.

<sup>9</sup>The displacement rate is higher in the non-tradable sector for all years between 1999 and 2009 except for 2002 (Figure 10, Appendix I).

<sup>10</sup>Every job in the panel DADS has a 2-digit PCS occupation code (29 occupations). We (somewhat subjectively) attribute each occupation with a skill level (low, medium, high). A complete list of occupations with corresponding skill levels is provided in Table 9 (Appendix III).

Figure 2.2: Displacement rates in eight countries, 2000-2010



Source : [Quintini and Venn \(2013\)](#); Displacement for France (until 2009): Insee, Panel DADS, authors' calculations.

workers are more vulnerable as a whole, at least with respect to local unit closure. More frequent voluntary separations, stronger worker unions, or high fixed production costs, are possible explanations of a lower share of displaced manufacturing workers. Lastly, while distressed manufacturing firms receive considerable attention in the media, this finding suggests that deindustrialization is not driven by a disproportionate number of manufacturing plant closures.

### 2.3.2 Re-employment rates

Figure 2.4 shows that only 40% of French workers displaced in year  $t$  are re-employed in year  $t + 1$ , with an increase of only 8 percentage points two years after dismissal. France ranks fairly average in international comparisons: Germany, Denmark, United States, Finland and Sweden have much

Figure 2.3: Displacement rates by gender, age and skill level, 2000-2009

	Full sample	Tradable manufacturing	Tradable services	Non-tradable
<i>Gender</i>				
Men	<b>3,5</b>	2,2	3,6	3,8
Women	2,9	<b>2,6</b>	3,0	2,9
<i>Age</i>				
20-25	<b>3,7</b>	2,4	3,4	3,8
26-30	<b>3,5</b>	2,2	3,7	3,7
31-35	3,4	2,2	3,5	3,6
36-40	3,2	2,2	3,3	3,3
41-45	3,0	2,3	3,1	3,0
46-50	2,8	2,3	3,1	2,8
51-55	2,7	2,2	2,9	2,8
56-60	3,1	<b>2,7</b>	3,0	3,2
<i>Skill level</i>				
High skilled	2,3	2,1	3,4	2,0
Medium skilled	3,5	2,2	3,4	3,9
Low skilled	3,4	<b>2,6</b>	2,9	3,5

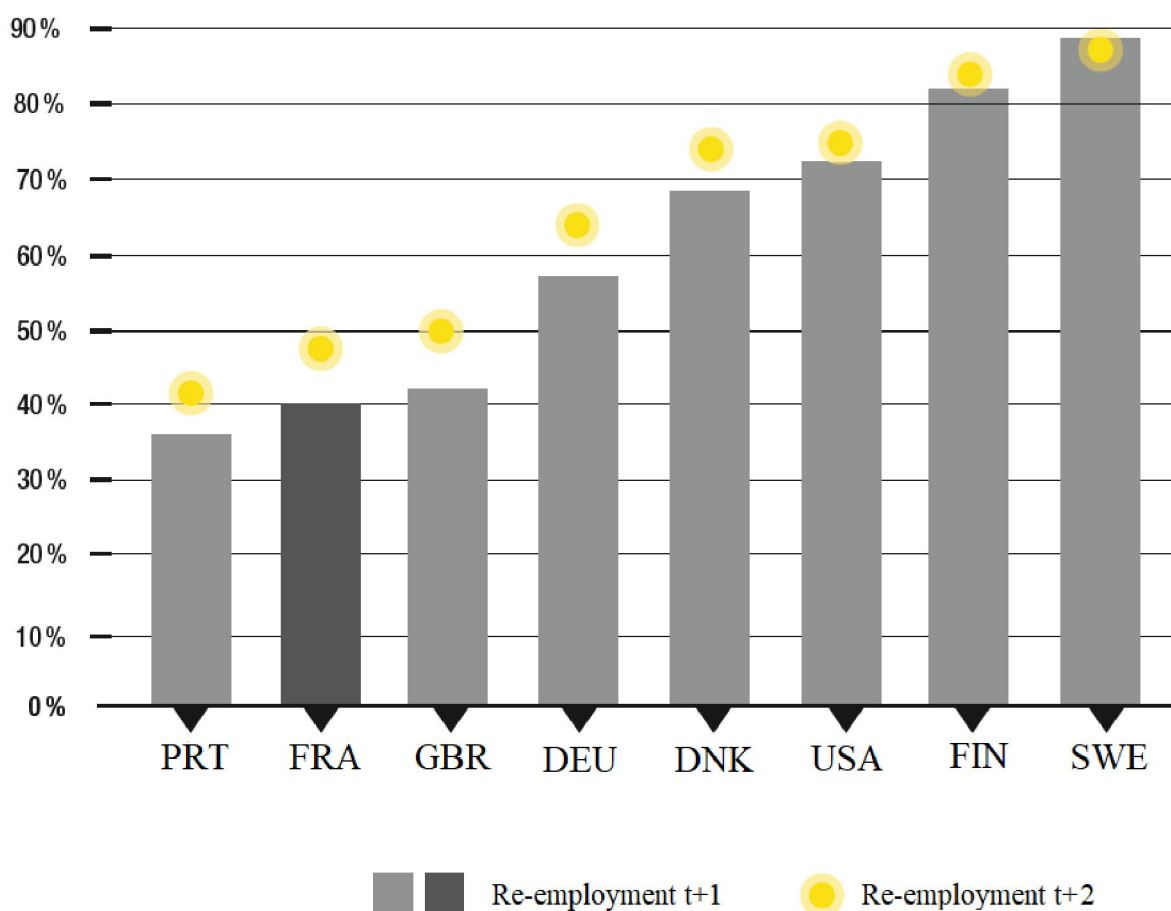
Source :Insee, Panel DADS.

higher re-employment rates, while Portugal and the United Kingdom show comparable rates. Note that Sweden, often presented as a model country in terms of labor market outcomes, combines a re-employment rate above of 80% in the year following the dismissal with a low displacement rate.

However, the aggregate re-employment rate hides clear heterogeneity. Figure 2.5 shows the share of displaced workers re-employed one year, two years, and three years after displacement, for each sector of origin. It appears that workers displaced from tradable manufacturing industries experience more difficulties finding work than workers in tradable services and the non-tradable sector. In the third year following displacement, only 47% of displaced manufacturing workers have found a new job, against 54% in the non-tradable sector and 62% in tradable services. Again, our descriptive statistics do not support the hypothesis of a higher vulnerability of tradable jobs as a whole. They nevertheless indicate that workers displaced from manufacturing industries on average face poorer



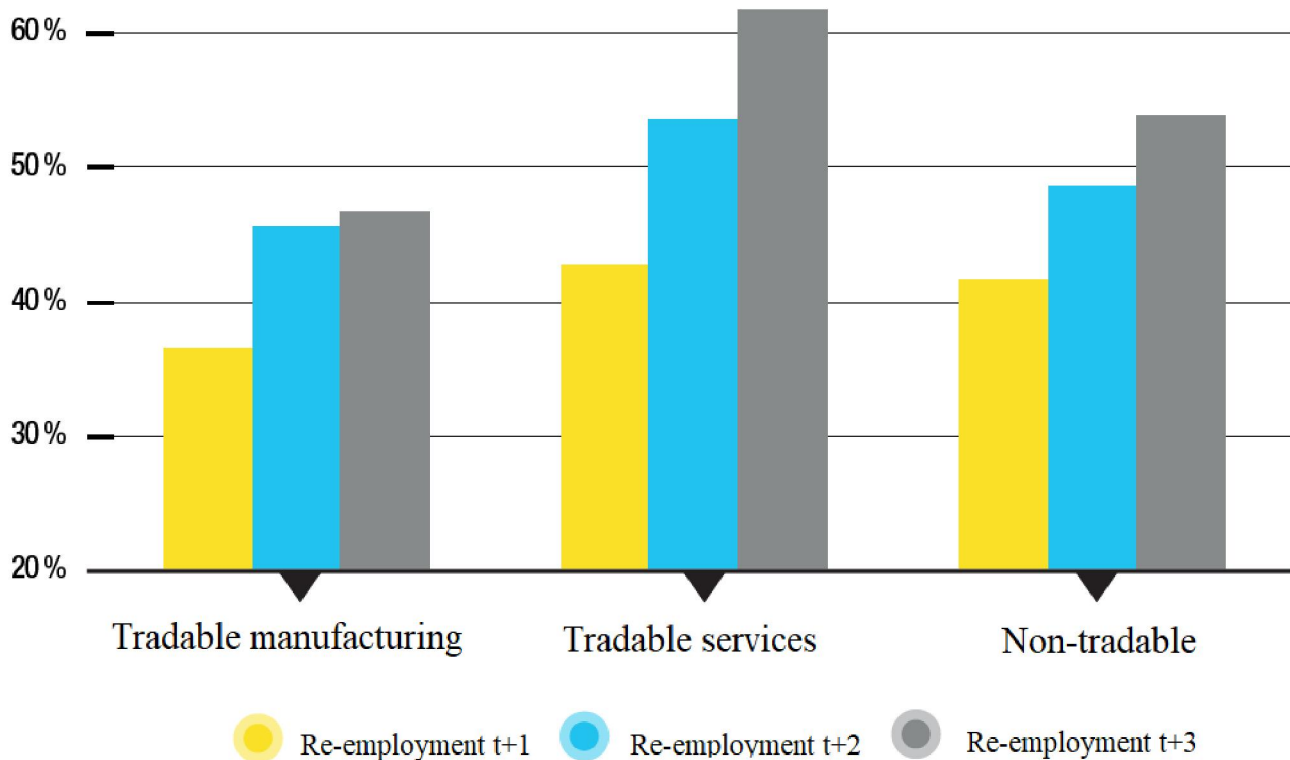
Figure 2.4: Re-employment rates in eight countries, 2000-2008



Source : Quintini and Venn (2013); France: Insee, Panel DADS, authors' calculations.

re-employment prospects. This is consistent with the fact that employment in tradable services has increased sharply, while the decline in manufacturing employment may have reduced the chances for laid-off manufacturing workers to find re-employment. Differences in sectoral displacement risks and employment opportunities may also be explained by sectoral differences in the composition of the labor force (tenure, occupation, employment contract, etc.) and local labor market characteristics. Moreover, this may be due to the role of industry-specific human capital of workers in each sector, and to the geographical distance separating declining and expanding production facilities, which limits within-industry labor reallocation when the geographical mobility of workers is low.

Figure 2.5: Re-employment rates by sector of origin, 2000-2010



Source : Insee, Panel DADS, authors' calculations.

## 2.4 Econometric analysis of displacement and re-employment probabilities

The descriptive statistics presented in the previous section indicate some interesting differences between tradable services, tradable manufacturing, and the non-tradable sector in terms of displacement and re-employment rates. Perhaps surprisingly, displacement rates are higher for workers in tradable services and the non-tradable sector than for workers in the manufacturing sector. On the other hand, re-employment rates are on average lower for workers displaced from the manufacturing sector. In this section we explore these aspects further by studying how individual, firm and sectoral factors affect displacement risk and re-employment probability based on an econometric analysis. The analysis of displacement probability is based on a panel of workers displaced or non-displaced between 1999 and 2009. To reduce the computational burden, we draw a 10% random sample of observations from our initial sample. We end up with a pooled sample of about 921,000 observations. Turning to the

estimation of re-employment probabilities, we use the full sample of displaced workers, and make two additional restrictions. First, we focus on displacement up to 2007 in order to study re-employment for the three years following the event of displacement. Second, we omit workers with short tenure, i.e. workers not present in the local unit at least one year before displacement, to limit the risk of poor job matching. The sample used to study re-employment probabilities contains around 94,000 observations.

Table 3 presents estimates of the displacement and re-employment probit models. An individual displaced in  $t$  is re-employed if she finds a job in another local unit in  $t + 1$ ,  $t + 2$ , or  $t + 3$ . Table 4 (Appendix I) presents separate estimates for each period following displacement.

Consistent with previous empirical studies on job displacement (e.g., Quintini and Venn, 2013), we find that older workers (between 56 and 60 years old) face a higher risk of job loss. We also see that the tenure effect on job displacement is nonlinear. Job tenure protects workers against job loss up to a point where the probability of displacement increases slightly with tenure. In addition, older, long-tenure workers seem to encounter significant difficulties following displacement. Being in the age group 56-60 decreases the probability of re-employment by almost 31 percentage points, all other things being equal. This probably reflects the fact that early retirement becomes an option for some job losers, especially when they have accumulated (and lost) a significant amount of firm-specific human capital. Again, the effect of tenure is nonlinear, its positive influence decreasing marginally. Not surprisingly, the probability of displacement decreases with the size of the local unit, and younger workers face lower chances of re-employment. Having a permanent contract significantly decreases the risk of displacement and increases the likelihood of re-employment.

We are particularly interested in the effect of being employed in one of the two tradable sectors compared to the reference category, the non-tradable sector. Workers in the (tradable) manufacturing sector and tradable services are less likely to be displaced than workers in the non-tradable sector, even

after controlling for other personal, firm and job characteristics. However, re-employment opportunities are significantly reduced for manufacturing workers only.<sup>11</sup> Manufacturing workers face the lowest chances of re-employment, and this effect is relatively large in magnitude: being displaced from the manufacturing sector decreases by 4.6 percentage points the probability of being re-employed in the three years following displacement, *ceteris paribus*. We propose an explanation for this sector-specific effect in section 6.

Strikingly, our findings differ substantially from those of [Eliasson and Hansson \(2016\)](#) in the case of Sweden. First, they find a *larger* risk of displacement for individuals working in manufacturing and tradable services. Second, the probability of re-employment is higher for workers formerly belonging to tradable services in comparison to non-tradable industries and manufacturing, while we find only better re-employment perspectives in comparison to manufacturing.

To summarize, the likelihood of displacement and re-employment varies considerably across demographic groups. Lower re-employment probabilities and higher displacement risks typically concern older workers, with short or very long tenures, employed at small (tradable) local manufacturing units.

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<sup>11</sup>Table 4 (Appendix I) indicates that workers displaced from tradable services are significantly less likely to be re-employed the year following displacement, compared to non-tradable workers. However, the magnitude of the effect is very small, and the coefficient is not significant two and three years following displacement.

Table 2.3: Probit estimates of displacement and re-employment

	Displacement		Re-employment	
	Marginal effect	SE	Marginal effect	SE
<i>Sector</i>				
Manufacturing	-0.0089**	0.0005	-0.0464**	0.0047
Tradable services	-0.0015*	0.0007	-0.0094	0.0059
(Ref: non-tradable sector)				
<i>Age</i>				
20-25	-0.0065**	0.0007	-0.0826**	0.0066
26-30	-0.0034**	0.0007	-0.0410**	0.0059
31-35	-0.0005	0.0007	-0.0082	0.0057
41-45	0.0004	0.0007	-0.0114	0.0059
46-50	0.0005	0.0008	-0.0212**	0.0061
51-55	0.0013	0.0008	-0.0903**	0.0063
56-60	0.0073**	0.0010	-0.3079**	0.0069
(Ref: 36-40)				
<i>Other individual characteristics</i>				
Male	0.0028**	0.0004	0.0064	0.0038
(Ref: female)				
Tenure	-0.0052**	0.0001	0.0102**	0.0008
Tenure squared	0.0001**	0.0000	-0.0004**	0.0000
Full-time	-0.0065**	0.0005	0.0849**	0.0045
Homeworker	-0.0022	0.0020	0.0249	0.0390
Interim	0.0374**	0.0023	-0.0579**	0.0109
(Ref: part-time)				
<i>Local unit</i>				
Size	-3.08e-06**	1.03e-07	-7.63e-06**	8.22e-07
Year FE	Y		Y	
Region FE	Y		Y	
Occupation FE	Y		Y	
Log likelihood	-121,496.14		-61,033.36	
LR $\chi^2$ (82)	16,790.30		5,675.30	
Prob $>\chi^2$	0.0000		0.0000	
# obs.	921,172		94,078	

Interpretation: Being a male increases the probability of displacement by 0.0028, with all other regressors set to their current values.

Occupation fixed effects correspond to dummy variables for 35 PCS ("Professions et Catégories Socioprofessionnelles") occupations.

Significance: \*\*\*1%; \*\*5%.

## 2.5 Econometric analysis of the effects of displacement on earnings

The previous section showed that a large share of workers has trouble securing a new job after displacement. Unemployment is clearly a major displacement cost borne by displaced workers. This section examines another crucial economic consequence of firm closure, i.e. the effect of displacement on future flows of earnings.

### 2.5.1 Estimation strategy

We are interested in the evolution of earnings after displacement compared to a hypothetical situation in which workers would not have been laid off. The challenge of causal inference is to find a credible counter-factual to the displacement situation, as each individual is observed in only one of these two states (displaced or non-displaced) at a given point in time. In order to estimate the effects of displacement on earnings, we combine propensity score matching with difference-in-differences (DID).

DID is one of the many econometric methods used for impact evaluation, the canonical model being introduced by Rubin (1974). This model evaluates the causal effect of a “treatment” on a given outcome by comparing the group of treated individuals with a group of individuals who did not receive the treatment, the control group. Here the treatment group is made up of displaced workers, while workers who have not been displaced form the control group. We are interested in how, on average, the wage of displaced workers would have evolved if they had not been displaced (the average treatment effect on the treated). The problem is that comparing the group of displaced workers with the group of non-displaced workers may be misleading, as it is rather unlikely that both groups will have similar pre-displacement characteristics. One could expect, for instance, low-skilled workers to be significantly more affected by displacement<sup>12</sup>. This will be problematic for instance if those workers

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<sup>12</sup>We do not assume that dismissals are correlated with workers characteristics. Employers cannot choose which employee to lay off since all workers lose their jobs following the closure of a local unit. However, it is likely that local units intensive in low-skill or routine jobs tend to be more impacted by trade and technological shocks.

have lower wage growth prospects independently from the treatment. In such a case we could seriously misestimate the true causal effect of displacement.

Propensity-score matching (PSM) offers a potent way to minimize this potential selection bias, by dealing with *observable* heterogeneity in pre-treatment characteristics. PSM consists in matching workers on the basis of their ex-ante probability of being displaced, conditionally on a set of observable characteristics (Rosenbaum and Rubin, 1983). Our matching strategy follows the conventional procedure in the literature on worker displacement. First, for each individual of the restricted sample, we estimate the probability of displacement (the propensity score) with a probit model including the following observed covariates: gender, age, sector, broad occupational status (PCS), type of contract (full-time, part-time, home-working or interim), local unit location (region in 22 categories), the level of the pre-displacement wage and the wage growth between 4 and 2 years before displacement. Then we match each displaced worker with a non-displaced individual on the basis of the propensity score. Different algorithms allow to constitute pairs of workers with similar scores, and we use nearest neighbor one-to-one matching as matching algorithm. The balancing indicators indicate that the matching was successful in reducing differences between the two groups in terms of their observable characteristics (see Table 5 and Figure 11 in Appendix I). The mean standardized bias is reduced by a factor of four.

Finally we apply difference-in-differences (DID) to the the sample of matched pairs. Matching is complementary to the DID method, which allows to difference out the potential bias due to unobserved permanent differences between displaced and non-displaced workers. In the DID model, the impact of displacement on earnings is estimated by subtracting change in post-displacement earnings of displaced workers from the change in earnings of non-displaced workers over the same period. In practice, we estimate the following equation:

$$y_{it} = \sum_{k=-2}^4 \beta_1^k T_{it}^k + \sum_{k=-2}^4 \beta_2^k T_{it}^k D_{it} + X_{it} \beta_3 + \alpha_i + \gamma_t + \epsilon_{it} \quad (2.2)$$

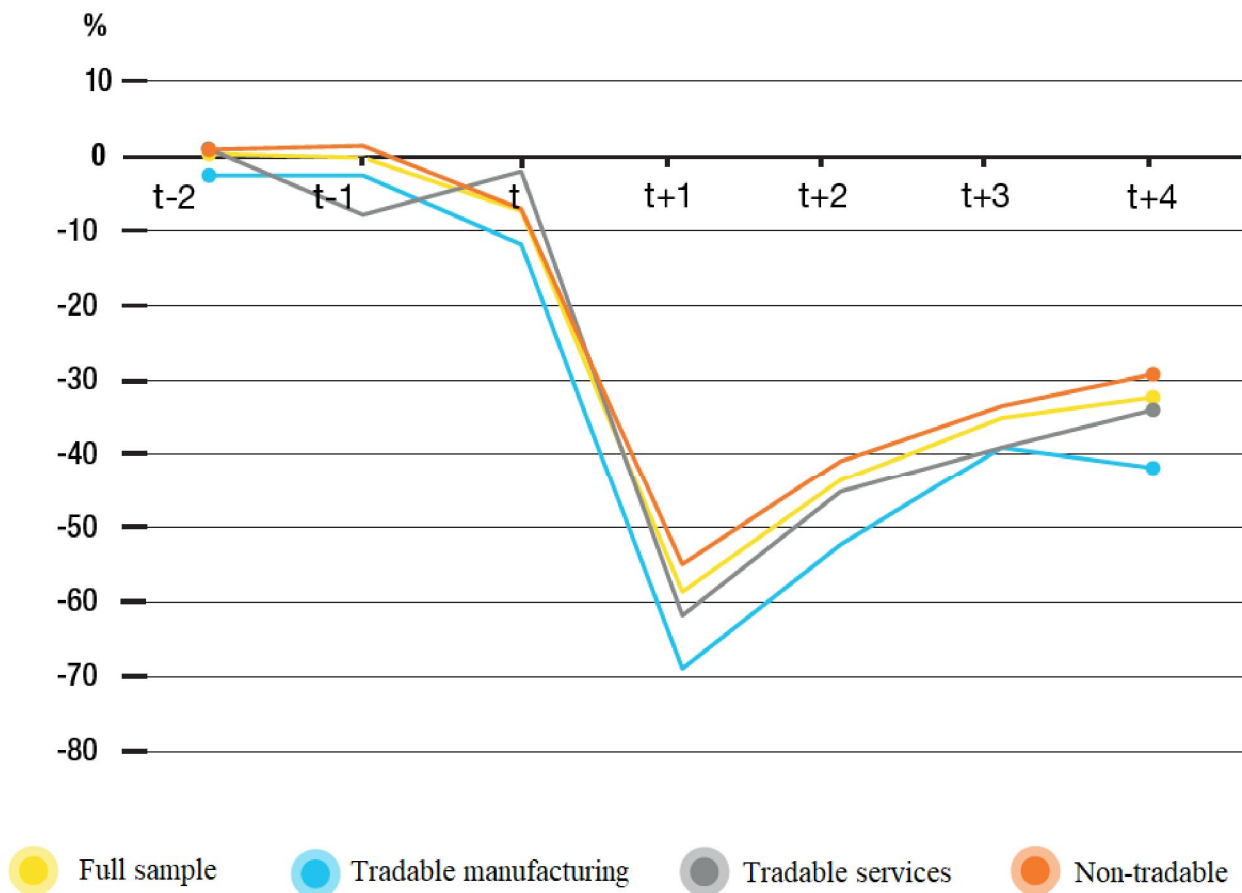
where the outcome variable  $y_{it}$  represent the annual net wage.  $T_{it}^k$  is a dummy variable that takes the value one in post-displacement years,  $\alpha_i$  and  $\gamma_t$  are respectively worker and time fixed effects, the vector  $X_{it}$  contains a worker's age and age-squared, and  $\delta^k$  captures the causal effect of job displacement on earnings. The superscript  $k$  indicates the period relative to displacement. We focus on displacements that occur between 2002 and 2006 and their effect on earnings in the two years before and four years after displacement. Thus we have five cohorts with, in each year, a control and a treatment group. For instance, the 2004 cohort contains a group of workers displaced in 2004 and a group of workers non-displaced in 2004, and data on their earnings for the period 2002-2008. The cohorts are pooled to increase the sample size. Note that a crucial assumption of this model, the so-called parallel trend assumption, requires that in the absence of displacement the difference between the displaced and non-displaced group is constant over time. Although matching and taking the difference in outcomes over time reinforce the credibility of this assumption, a bias may remain as the identification strategy does not account for potential unobserved, time-varying heterogeneity.

### 2.5.2 Findings

Figure 2.7 shows the estimated average annual wage losses caused by job displacement, up to 4 years after displacement. Wage losses are considerable the year following dismissal ( $t + 1$ ). The average post-displacement wage loss corresponds to almost 60% of the average wage the year prior to displacement. This negative effect of displacement on wages is long-lasting. Four years after displacement, the average annual wage loss directly imputable to displacement still represents 30% of predisplacement wages. Workers laid off from the manufacturing sector suffer much larger losses in  $t + 1$  (-69%) than workers displaced from the non-tradable sector (-55%, in  $t + 1$ ), while those displaced from tradable services are in an intermediate position, with a wage loss of 62%.



Figure 2.6: Estimates of the effect of displacement on annual net wages, by sector

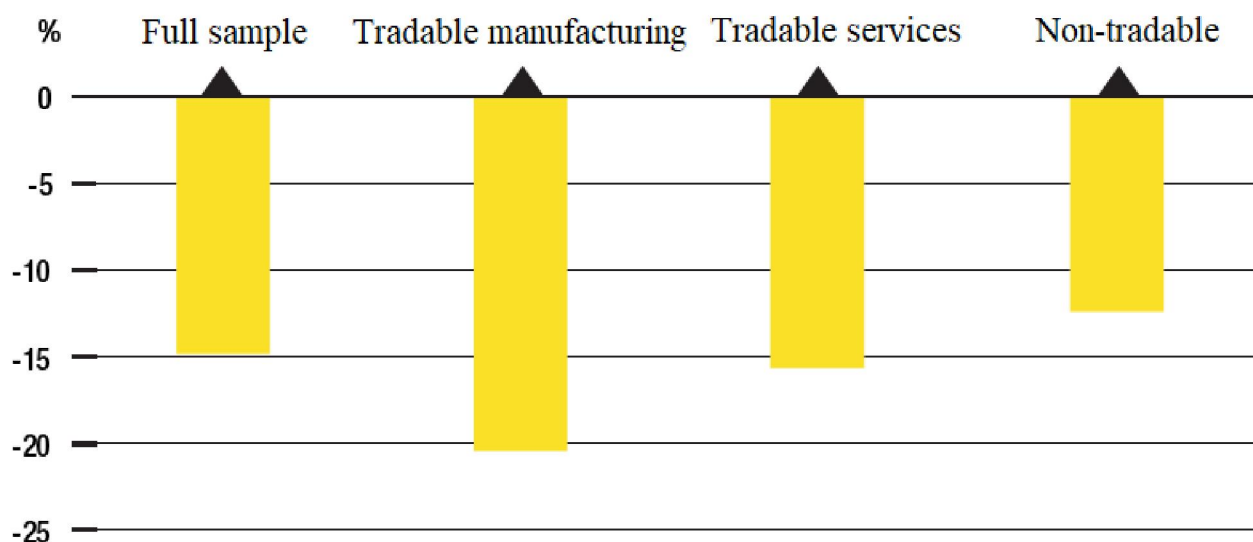


The graph reports the difference-in-differences estimates using equation 6.1 and presented in Table 5 (Appendix I). Percentage effects are calculated as estimate divided by average annual wages in the year prior to displacement.

Importantly, we do not examine *income* losses, due to lack of information on unemployment benefits and reduced taxation that constitute income support for dislocated workers. By construction, a worker has a wage equal to 0 when she does not work. This could explain why wage losses appear so considerable, and why workers displaced from manufacturing suffer from more severe and durable wage losses. Indeed, as shown by Figure 2.5, manufacturing workers are less rapidly and less frequently re-employed. We circumvent this issue by focusing on wage losses in the year of re-employment, re-employment occurring in  $t + 1$ ,  $t + 2$ ,  $t + 3$  or  $t + 4$ . Cancelling out spells of unemployment drastically reduces estimated wage losses, but does not invalidate previous conclusions on sectoral differences. In the year of re-employment, wage losses imputable to the event of displacement represent 20%, 16% and 12% of the pre-displacement wage in the manufacturing sector, tradable services, and non-tradable sector, respectively. Similarly, Figure 2.8 shows that the share of workers for whom the post-displacement

wage is at least 10% lower than the pre-displacement level is much larger for individuals displaced from the manufacturing sector (35%, versus 26% in the non-tradable sector).

Figure 2.7: Annual wage losses estimates by sector, the year of re-employment



Percentage effects are calculated as estimate divided by average annual wages in the year prior to displacement. Difference-in-differences estimates are presented in Table 6 (Appendix I).

Figure 2.8: Wage variation the year of re-employment, by sector

Wage variation	Full sample	Tradable manufacturing	Tradable services	Non-tradable
$\geq 10\%$	30	24	28	31
$\leq 10\%$	28	35	25	26
$[-10\%, 10\%]$	43	41	46	43

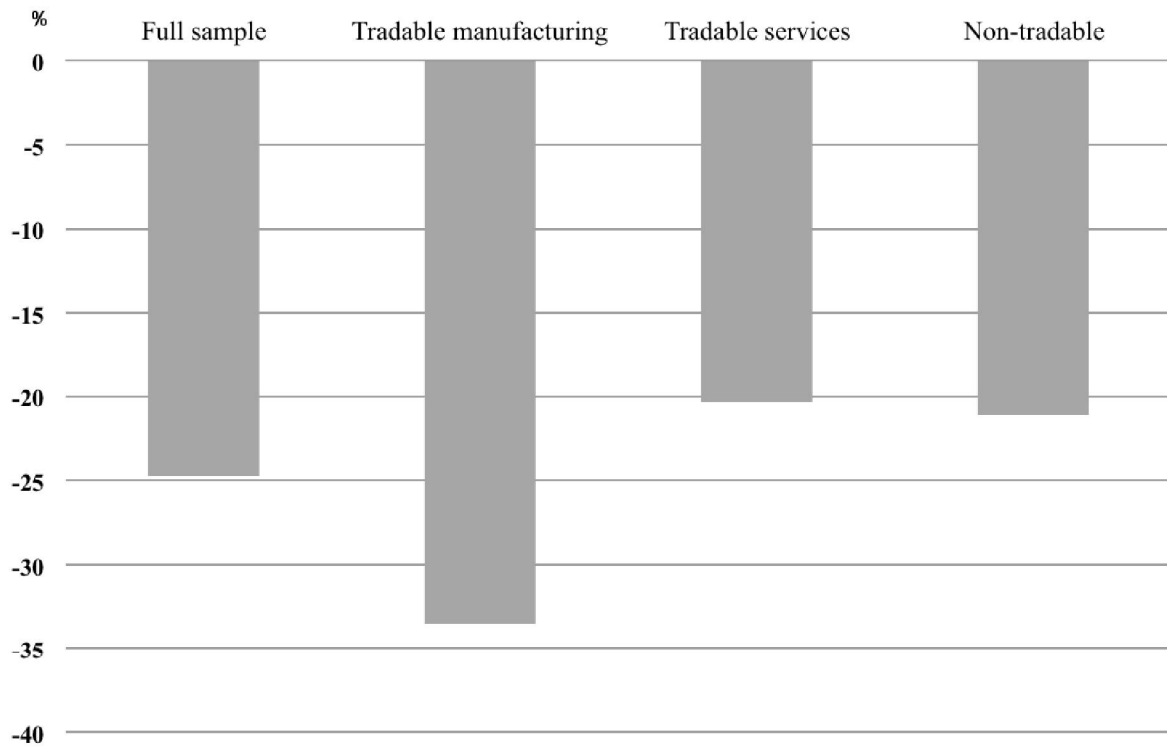
Percentage effects are calculated as wage the year of re-employment divided by average annual wages in the year prior to displacement

Restricting the sample to industry switchers<sup>13</sup> (Figure 2.9), we find much higher wage losses: on average for the full sample, losses increase by 10 percentage points. This result suggests that industry switching acts as one of the main drivers of wage losses. Industry switching seems more damaging for workers displaced from manufacturing industries (13 percentage points increases), followed by workers displaced from non-tradable industries (9 percentage points increase) and tradable services (5

<sup>13</sup>We study between-industry mobility of displaced workers at the 3-digit NAF (rév.1) level.

percentage points increase).

Figure 2.9: Annual wage losses estimates by sector, for industry switchers, the year of re-employment



Percentage effects are calculated as estimate divided by average annual wages in the year prior to displacement. Difference-in-differences estimates are presented in the appendix, Table 7.

## 2.6 Discussion

In the previous sections, we find lower chances of re-employment for displaced manufacturing workers, and larger negative wage impacts once re-employed. We argue that this may be explained by a combination of geographic concentration of manufacturing production, industry/occupation-specific human capital, and an aggregate decline in the demand for manufacturing workers. The idea is the following. As tradable production is geographically concentrated, dismissed manufacturing workers are likely to have to change employment area if they want to find another job in the same industry. However, relocation involves mobility costs, both monetary and non-monetary, that may outweigh the cost of unemployment or the costs associated with the loss of industry-specific human capital. Basically, the worker has two options: (i) incur the mobility cost induced by moving area to find a job within the same industry and keep the benefits of its specific human capital, or (ii) remain in the

same employment area and change industry, which involves a loss of human capital specific to the industry. Sometimes, workers may have no choice but to move from their employment area or face unemployment because local employers cannot absorb the whole labor force displaced by the distressed tradable firms. Similarly, a trade shock may transfer the entire industry abroad, as was recently the case with the closure of the last cigarette plant in mainland France<sup>14</sup>, compelling workers to move to another country to find a job in the same industry. When a worker decides to switch industry, she necessarily loses her industry-specific human capital, whether she moves to a new employment area or not.<sup>15</sup> Anecdotal evidence suggests that this dilemma is common, especially for long-tenured and low-skilled workers displaced from declining industries<sup>16</sup>.

Conversely, non-tradable producers are more widely spread over the territory, their location following the spatial distribution of non-tradable goods and services demand. Hence, displaced non-tradable workers are *a priori* more likely to find a job within the same industry and employment area, thus avoiding mobility costs and loss of industry-specific human capital. Strikingly, displaced manufacturing workers are much more likely to switch industry when re-employed (57%) than workers displaced from non-tradable industries (36%). This is quite problematic since, as suggested by Figure 2.9, industry-specific human capital is greater in the manufacturing sector (industry switchers incur larger wage losses)<sup>17</sup>. One might argue that a worker could switch industry without switching occupation,

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<sup>14</sup>Vincent, F. (2017). Le "baroud d'honneur" des salariés de la Seita, la dernière usine de cigarettes.

<sup>15</sup>More formally, think of an economy consisting of  $J$  local labor markets (LLM), each inhabited by a mass of identical individuals. At the beginning of the period, households are distributed across LLM in a given way, with a higher concentration of tradable jobs. Households work in the LLM they live in and moving across LLMs is costly. If they want to switch LLM while remaining within the same industry, they incur a utility cost that decreases with the number of producing regions, reflecting the fact that households prefer to have large relocation choices. There is also an industry-switching cost (e.g. cost of retraining), which increases with the significance of industry-specific human capital. In an extreme case, when the number of producing regions falls to zero, workers are forced to incur the industry-switching cost. Workers' decisions following a shock to a given industry in a given area will depend on the significance of LLM and industry-switching costs. A worker may favor unemployment when these costs outweigh unemployment benefits. When switching industry, the worker will incur a wage cut corresponding to the amount of human capital not valued in the new job (the industry-switching cost).

<sup>16</sup>Garnier, J. (2018). Mim, Pimkie, Jules, Brice... La détresse des salariées de l'habillement. Le Monde.fr. Le Monde.fr. Caffin, P (2018). Beauvais : le choc des salariés après l'annonce de la fermeture de Froneri (ex-Nestlé). Le Parisien.fr. Freyssenet, E. (2018). Mobilité et travail, l'histoire d'un couple infernal. Les Echos.fr.

<sup>17</sup>Many researchers attribute wage losses after displacement to the loss of industry-specific or occupation-specific human capital. This explanation is consistent with the fact that wage losses are greater for workers that switch industry and/or occupation after displacement. On the role of industry-specific human capital see Neal (1995) and Parent (2000).

thus limiting human capital losses. Yet, occupational mobility is higher among displaced manufacturing workers (49% switch occupation versus 37% in tradable services and non-tradable industries). Of course, the sectoral and occupational mobility dilemma is accentuated by the fact that manufacturing employment declined sharply over the period. One might also argue that, like tradable manufacturing industries, tradable services are geographically concentrated, but workers displaced from tradable services incur lower displacement costs. Our explanation is as follows: *(i)* It is easier to be re-employed in tradable services since employment in that sector is expanding (see Chapter 1); and *(ii)* Figure 2.9 suggests that the human capital of these workers is more transferable since industry-switching is less damaging in tradable services than in manufacturing.

The decision to change industry, move to another area, or stay unemployed, also crucially depends on the industry mix of the local labor market. Skills are differently transferable across industries and occupations. It would therefore be interesting to construct a measure of the similarity of different industries' human capital or skill requirements, to explore how job-seekers arbitrate between geographical and skill distance, as in [Neffke et al. \(2018\)](#).

## 2.7 Conclusion

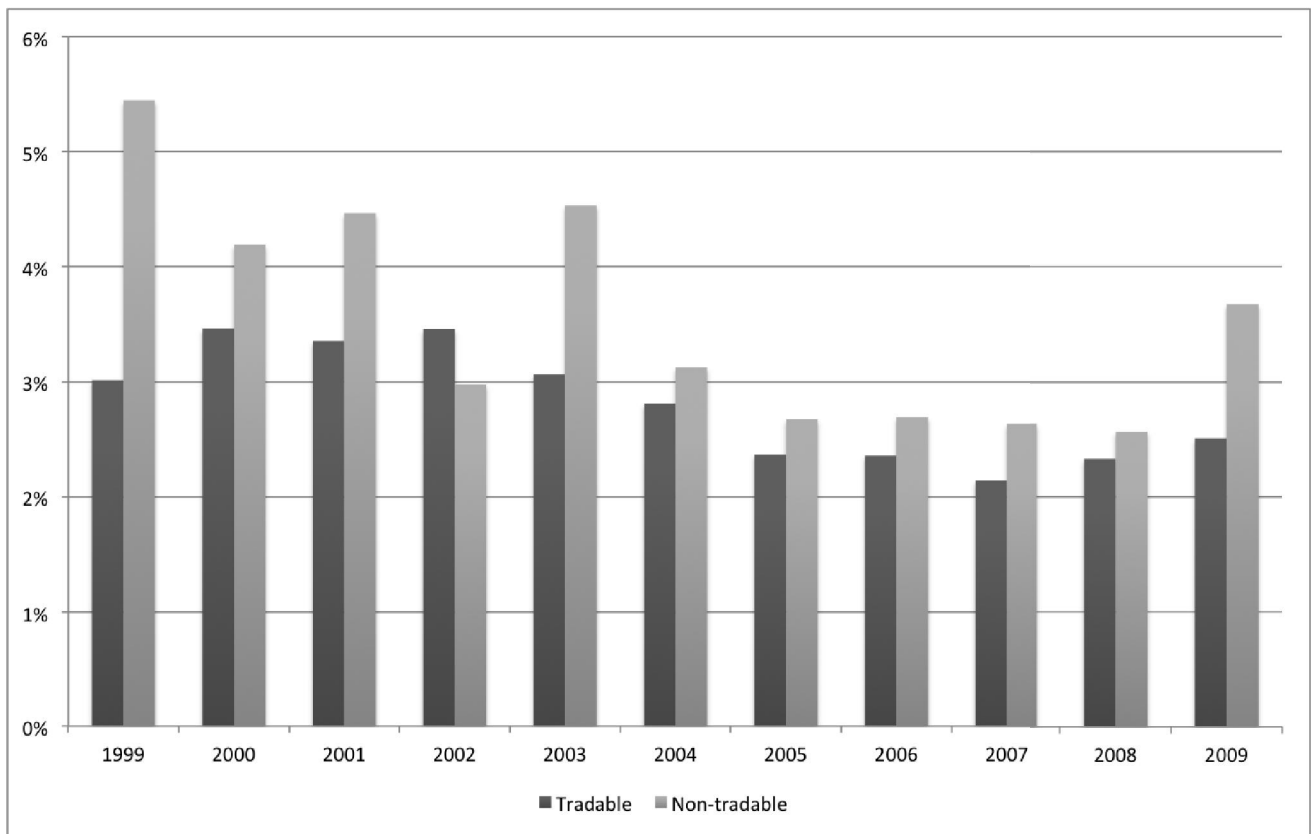
In this chapter we examine the costs associated with job displacement in the French tradable and non-tradable sectors from 1998 to 2010. The lack of literature studying the tradable sector as a whole opens up the way to investigate differences between tradable manufacturing and tradable services. We find that, despite intense media coverage of tradable firm closures, the probability of displacement is lower in the tradable sector. Overall, though, we show that the reallocation of French workers towards expanding sectors is far from automatic. Workers displaced from the tradable manufacturing sector face lower re-employment prospects than those displaced from the non-tradable sector. In addition, they are more likely to change industry or occupation when re-employed, and suffer from larger wage losses. Finally, our results indicate that workers displaced from tradable services face displacement costs broadly similar to the one incurred by displaced non-tradable workers.

Adjustment costs are still rarely taken into account in the literature on the gains from trade. The standard assumption is that labor relocates to expanding industries/occupations smoothly and at no cost (WTO, 2017). Yet adjustment costs reduce the net gains from trade and the acceptance of trade reforms (Francois et al., 2011). It turns out that the gains from trade are still much greater than the adjustment cost (Davidson and Matusz, 2009; Kambourov, 2009; Dix-Carneiro, 2014). For instance, Dix-Carneiro (2014) finds that adjustment costs range between 11 and 26 percent of the gains from trade in Brazil. In theory, it is therefore possible to compensate the losers using only a fraction of these large aggregate gains from trade. Our results on displacement costs in tradable services indicate that adjustment costs might even be lower when including tradable services. It is likely, though, that part of the backlash against international trade comes from policy-makers' difficulties to compensate for trade-related adjustment costs. More generally, the low re-employment rates we find in the case of France (54% three years after displacement) suggest that there is room for improving the assistance that labor market programs provide to displaced workers.

## 2.8 Appendices

### I. Supplementary figures and tables

Figure 2.10: Evolution of displacement rates in tradable and non-tradable sectors, 1999-2009.



Source : Insee, Panel DADS, authors' calculations.

Table 2.4: Probit estimates of re-employment, one, two and three years following displacement

	T+1		T+2		T+3	
	Marg. effect	SE	Marg. effect	SE	Marg. effect	SE
<i>Sector</i>						
Manufacturing	-0.0720**	0.0047	-0.0226**		-0.0462**	0.0047
Tradable services (Ref: non-tradable sector)	-0.0128*	0.0059	-0.0045	0.0031	-0.0094	0.0058
<i>Age</i>						
20-25	-0.0600**	0.0067	-0.01356**	0.0036	-0.0826**	0.0066
26-30	-0.0338**	0.0061	-0.0074*	0.0034	-0.0410**	0.0059
31-35	-0.0057	0.0059	-0.0044	0.0034	-0.0083	0.0057
41-45	-0.0141*	0.0061	0.0056	0.0036	-0.0114	0.0059
46-50	-0.0243**	0.0063	0.0048	0.0036	-0.0212**	0.0061
51-55	-0.0720**	0.0064	-0.0092**	0.0036	-0.0903**	0.0063
56-60 (Ref: 36-40)	-0.2247**	0.0068	-0.0526**	0.0033	-0.3079**	0.0069
<i>Other individual characteristics</i>						
Male (Ref: female)	0.0188**	0.0039	-0.0041	0.0022	0.0064	0.0038
Tenure	0.0076**	0.0009	0.0011*	0.0005	0.0102**	0.0008
Tenure squared	-0.0003**	0.0000	-0.0001**	0.0000	-0.0004**	0.0000
Full-time	0.0906**	0.0045	0.0055*	0.0025	0.0849**	0.0045
Homeworker	-0.0061	0.0398	0.0021	0.0213	0.0249	0.5240
Interim (Ref: part-time)	-0.0310**	0.0105	-0.0150*	0.0060	-0.0579**	0.0109
<i>Local unit</i>						
Size	-2.87e-06**	8.47e-07	-7.23e-06**	8.02e-07	-7.63e-06**	8.22e-07
Year FE	Y		Y		Y	
Region FE	Y		Y		Y	
Occupation FE	Y		Y		Y	
Log likelihood	-62,958.32		-26,192.82		-61,033.36	
LR $\chi^2$ (79)	3,850.06		1,354.56		5,675.39	
Prob $>\chi^2$	0.0000		0.0000		0.0000	
# obs.	94,078		94,078		94,078	

Interpretation: Being a male increases the probability of being re-employed in the year following displacement (t+1) by 0.0188, with all other regressors set to their current values.

Occupation fixed effects correspond to dummy variables for 35 PCS ("Professions et Catégories Socioprofessionnelles") occupations.

Significance: \*\*\*1%; \*\*5%.



Table 2.5: Difference-in-differences estimates of the effect of displacement on annual net wages

	Full sample		Tradable manufacturing		Tradable services		Non tradable	
	Euro	%	Euro	%	Euro	%	Euro	%
$t-2$	-33.74 (164.9)	0.2	-412.5 (352.5)	-2.5	231.4 (710.6)	1.4	118.9 (193.1)	0.9
$t-1$	28.34 (164.9)	-0.2	-427.6 (352.5)	-2.6	-1,315* (710.6)	-7.9	168.0 (193.1)	1.3
$t$	-995.3** (164.9)	-7.2	-1,935** (352.6)	-11.8	-343.6 (710.8)	-2.1	-934.8** (193.1)	-7.2
$t+1$	-8,070** (164.9)	-58.7	-11,268** (352.8)	-69.0	-10,231** (710.9)	-61.8	-7,164** (193.1)	-55.1
$t+2$	-6,007** (164.9)	-43.7	-8,564** (353.0)	-52.4	-7,483** (711.2)	-45.2	-5,316** (193.1)	-40.9
$t+3$	-4,841** (164.9)	-35.2	-6,391** (353.2)	-39.1	-6,489** (711.4)	-39.2	-4,355** (193.1)	-33.45
$t+4$	-4,444** (164.9)	-32.3	-6,871** (353.5)	-42.1	-5,585** (711.8)	-33.7	-3,794** (193.1)	-29.12
# obs.	209,856		36,608		16,832		156,416	
<i>Balancing indicators</i>								
Mean bias before	6.2							
Mean bias after	1.6							
Pseudo R2 before	0.052							
Pseudo R2 after	0.005							

The estimated parameters are based on a difference-in-differences model using equation (6.1). Treated and untreated individuals are matched by means of propensity-score matching (using single nearest neighbor). All regressions include controls for age, age<sup>2</sup>, year and worker fixed effects. Percentage effects are calculated as estimate divided average wages in the year prior to displacement. Significance: \*\*1%; \*5%.

Figure 2.11: Histograms of standardized bias across covariates for matched and unmatched samples, 2002 cohort.

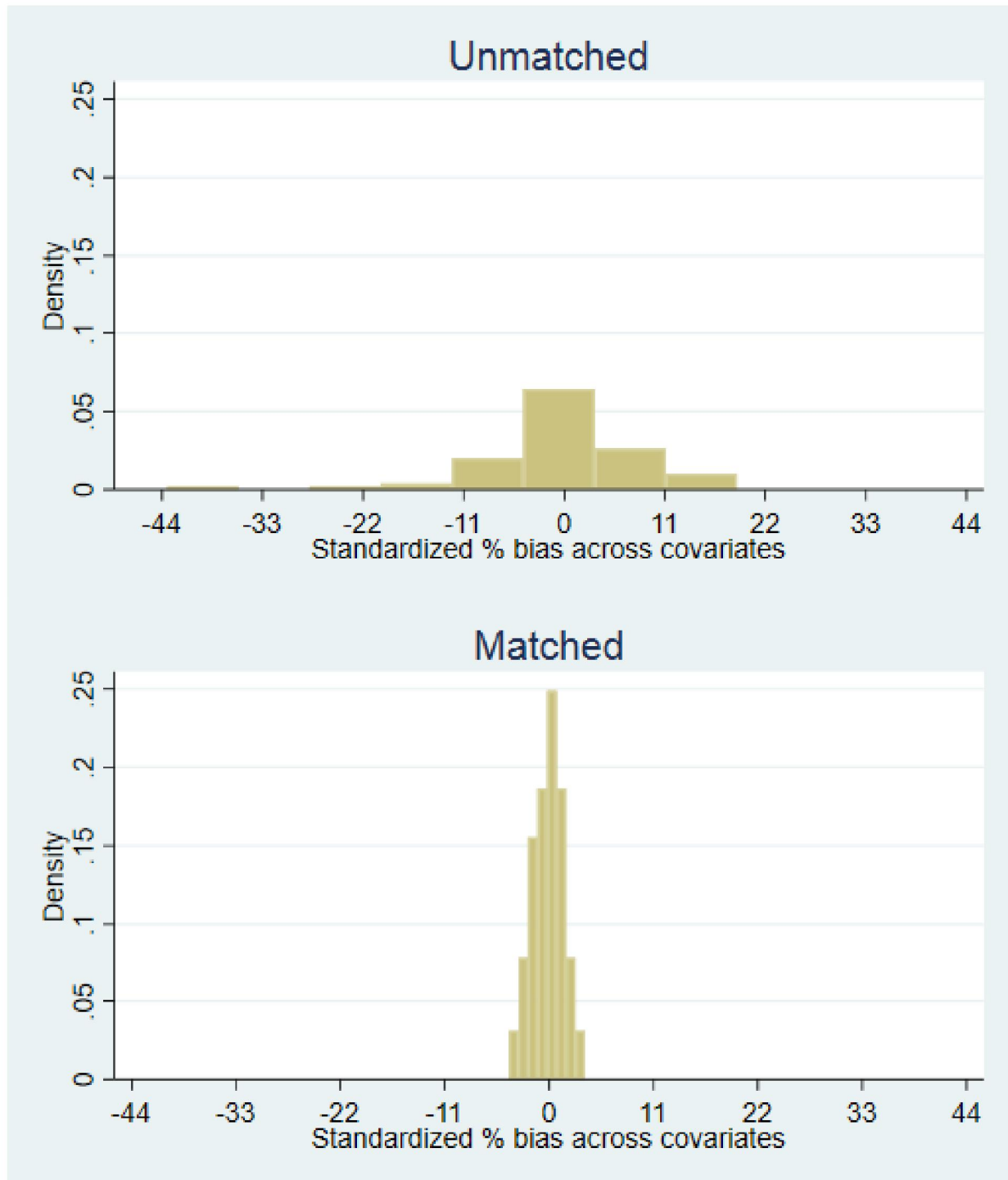


Table 2.6: Difference-in-differences estimates of the effect of displacement on annual net wages the year of re-employment

	Full sample		Tradable manufacturing		Tradable services		Non tradable	
	Euro	%	Euro	%	Euro	%	Euro	%
$T_{it}D_{it}$	-2,936** (406.9)	-14,8	-4,179** (746.0)	-20,4	-3,984** (1,454)	-15,6	-2,335** (511.6)	-12,4
# obs.	29,128		6,932		2,512		19,496	
Balancing indicators								
Mean bias before	6,9							
Mean bias after	1,8							
Pseudo R2 before	0,0412							
Pseudo R2 after	0,0064							

The estimated parameters are based on a difference-in-differences model using a variant equation (6.1) where there is only one post-displacement period. Treated and untreated individuals are matched by means of propensity-score matching (using single nearest neighbor). All regressions include controls for age, age<sup>2</sup>, year dummies. Percentage effects are calculated as estimate divided average wages in the year prior to displacement. Significance: \*\*1%; \*5%.

Table 2.7: Difference-in-differences estimates of the effect of displacement on annual net wages the year of re-employment, for industry-switchers

	Full sample		Tradable manufacturing		Tradable services		Non tradable	
	Euro	%	Euro	%	Euro	%	Euro	%
$T_{it}D_{it}$	-4,806**	-24,7	-6,521**	-33,5	-4,848*	-20,3	-3,953**	-21,1
	(725,4)		(1,088)		(1,894)		(1,039)	
# obs.	12,156		3,428		1,324		7,288	
Balancing indicators								
Mean bias before	7,1							
Mean bias after	1,9							
Pseudo R2 before	0,0474							
Pseudo R2 after	0,0066							

We study between-industry mobility of displaced workers at the 3-digit NAF (rév.1) level. The estimated parameters are based on a difference-in-differences model using a variant equation (6.1) where there is only one post-displacement period. Treated and untreated individuals are matched by means of propensity-score matching (using single nearest neighbor). All regressions include controls for age, age<sup>2</sup>, year dummies. Percentage effects are calculated as estimate divided average wages in the year prior to displacement. Significance: \*\*1%; \*5%.

## II. Gini coefficients, classification, and total employment

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Employment, 2007</i>
<i>Tradable industries</i>			
120	Extraction de minerais d'uranium	1,00	101
231	Cokéfaction	1,00	150
101	Extraction et agglomération de la houille	1,00	1 491
623	Transports spatiaux	0,99	243
233	Elaboration et transformation de matières nucléaires	0,99	10 944
247	Fabrication de fibres artificielles ou synthétiques	0,98	1 739
355	Fabrication de matériels de transport nca	0,98	1 157
144	Production de sel	0,97	1 183
145	Activités extractives nca	0,97	651
111	Extraction d'hydrocarbures	0,97	1 364
103	Extraction et agglomération de la tourbe	0,97	240
191	Apprêt et tannage des cuirs	0,96	1 978
296	Fabrication d'armes et de munitions	0,96	9 394
143	Extraction de minéraux pour l'industrie chimique et d'engrais naturels	0,96	334
176	Fabrication d'étoffes à maille	0,95	1 289
112	Services annexes à l'extraction d'hydrocarbures	0,95	119
335	Horlogerie	0,95	3 241
263	Fabrication de carreaux en céramique	0,95	2 037
352	Construction de matériel ferroviaire roulant	0,95	11 242
354	Fabrication de motocycles et de bicyclettes	0,95	4 459
271	Sidérurgie	0,94	34 682
314	Fabrication d'accumulateurs et de piles électriques	0,94	4 598
272	Fabrication de tubes	0,94	12 373
202	Fabrication de panneaux de bois	0,94	8 302
172	Tissage	0,93	10 920
611	Transports maritimes et côtiers	0,93	12 790
171	Filature	0,93	7 582
621	Transports aériens réguliers	0,92	72 039
193	Fabrication de chaussures	0,92	10 063
223	Reproduction d'enregistrements	0,92	2 000
177	Fabrication d'articles à maille	0,92	8 597
232	Raffinage de pétrole	0,92	11 283
152	Industrie du poisson	0,91	14 316
351	Construction navale	0,90	26 955
160	Industrie du tabac	0,90	2 641
181	Fabrication de vêtements en cuir	0,89	643
211	Fabrication de pâte à papier, de papier et de carton	0,89	22 406

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Employment, 2007</i>
183	Industrie des fourrures	0,89	559
273	Autres opérations de première transformation de l'acier	0,88	5 416
297	Fabrication d'appareils domestiques	0,88	14 020
341	Construction de véhicules automobiles	0,88	140 750
264	Fabrication de tuiles et briques en terre cuite	0,88	5 881
265	Fabrication de ciment, chaux et plâtre	0,88	6 137
262	Fabrication de produits céramiques	0,88	12 125
242	Fabrication de produits agrochimiques	0,87	5 782
282	Fabrication de réservoirs métalliques et de chaudières pour le chauffage central	0,87	10 227
173	Ennoblement textile	0,87	7 372
313	Fabrication de fils et câbles isolés	0,87	13 392
154	Industrie des corps gras	0,87	2 792
751	Administration générale, économique et sociale	0,87	793
274	Production de métaux non ferreux	0,86	18 004
353	Construction aéronautique et spatiale	0,86	93 886
363	Fabrication d'instruments de musique	0,86	2 241
365	Fabrication de jeux et jouets	0,86	3 769
364	Fabrication d'articles de sport	0,86	6 378
153	Industrie des fruits et légumes	0,86	21 250
275	Fonderie	0,85	32 221
251	Industrie du caoutchouc	0,84	53 536
175	Autres industries textiles	0,84	21 915
612	Transports fluviaux	0,84	2 782
323	Fabrication d'appareils de réception, enregistrement ou reproduction du son et de l'image	0,84	5 703
261	Fabrication de verre et d'articles en verre	0,84	42 465
157	Fabrication d'aliments pour animaux	0,84	18 521
622	Transports aériens non réguliers	0,83	3 600
732	Recherche-développement en sciences humaines et sociales	0,82	597
192	Fabrication d'articles de voyage et de maroquinerie	0,81	16 084
924	Agences de presse	0,81	5 986
334	Fabrication de matériels optique et photographique	0,81	12 196
343	Fabrication d'équipements automobiles	0,79	82 669
300	Fabrication de machines de bureau et de matériel informatique	0,79	18 820
726	Autres activités rattachées à l'informatique	0,78	384
243	Fabrication de peintures et vernis	0,78	15 643
268	Fabrication de produits minéraux divers	0,78	8 896
156	Travail des grains ; fabrication de produits amylicés	0,77	13 908
141	Extraction de pierres	0,76	6 210
155	Industrie laitière	0,76	56 525

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Employment, 2007</i>
294	Fabrication de machines-outils	0,76	12 516
159	Industrie des boissons	0,76	41 297
293	Fabrication de machines agricoles	0,76	26 275
922	Activités de radio et de télévision	0,75	34 664
205	Fabrication d'objets divers en bois, liège ou vannerie	0,75	6 268
312	Fabrication de matériel de distribution et de commande électrique	0,75	54 315
362	Bijouterie	0,75	9 108
321	Fabrication de composants électroniques	0,74	55 247
315	Fabrication de lampes et d'appareils d'éclairage	0,74	12 444
286	Fabrication de coutellerie, d'outillage et de quincaillerie	0,74	28 597
246	Fabrication d'autres produits chimiques	0,74	27 190
316	Fabrication d'autres matériels électriques	0,74	30 156
241	Industrie chimique de base	0,74	52 035
455	Location avec opérateur de matériel de construction	0,73	4 036
201	Sciage, rabotage, imprégnation du bois	0,73	20 502
284	Forge, emboutissage, estampage ; métallurgie des poudres	0,72	44 199
311	Fabrication de moteurs, génératrices et transformateurs électriques	0,72	25 792
925	Autres activités culturelles	0,72	5 345
342	Fabrication de carrosseries et remorques	0,71	29 908
603	Transports par conduites	0,71	3 803
322	Fabrication d'appareils d'émission et de transmission	0,70	37 489
724	Activités de banques de données	0,70	7 226
245	Fabrication de savons, de parfums et de produits d'entretien	0,70	49 754
174	Fabrication d'articles textiles	0,69	13 474
203	Fabrication de charpentes et de menuiseries	0,69	28 266
366	Autres industries diverses	0,68	14 325
204	Fabrication d'emballages en bois	0,68	15 914
151	Industrie des viandes	0,68	141 332
552	Autres moyens d'hébergement de courte durée	0,68	29 726
291	Fabrication d'équipements mécaniques	0,67	62 324
731	Recherche-développement en sciences physiques et naturelles	0,66	45 962
332	Fabrication d'instruments de mesure et de contrôle	0,66	56 871
212	Fabrication d'articles en papier ou en carton	0,65	50 971
244	Industrie pharmaceutique	0,65	92 428
671	Auxiliaires financiers	0,64	30 924
923	Autres activités artistiques et de spectacle	0,64	45 056
287	Fabrication d'autres ouvrages en métaux	0,64	54 283
402	Production et distribution de combustibles gazeux	0,63	11 206
632	Gestion d'infrastructures de transports	0,63	56 101

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Employment, 2007</i>
721	Conseil en systèmes informatiques	0,62	145 554
652	Autres intermédiations financières	0,62	46 817
182	Fabrication de vêtements en textile	0,61	46 458
921	Activités cinématographiques et vidéo	0,61	34 627
295	Fabrication d'autres machines d'usage spécifique	0,60	55 270
361	Fabrication de meubles	0,60	77 283
142	Extraction de sables et d'argiles	0,60	17 217
252	Transformation des matières plastiques	0,59	148 675
333	Fabrication d'équipements de contrôle des processus industriels	0,59	18 761
267	Taille, façonnage et finissage de pierres ornementales et de construction	0,58	11 889
512	Commerce de gros de produits agricoles bruts	0,58	45 490
927	Activités récréatives	0,58	24 850
372	Récupération de matières non métalliques recyclables	0,57	15 311
722	Réalisation de logiciels	0,57	134 504
221	Edition	0,56	89 871
723	Traitement de données	0,55	45 391
725	Entretien et réparation de machines de bureau et de matériel informatique	0,55	15 371
283	Chaudronnerie	0,55	70 945
403	Production et distribution de chaleur	0,55	22 685
631	Manutention et entreposage	0,52	88 570
285	Traitement des métaux ; mécanique générale	0,52	136 208
660	Assurance	0,51	166 580
281	Fabrication d'éléments en métal pour la construction	0,51	56 667
<i>Non-tradable industries</i>			
526	Commerce de détail hors magasin	0,48	65 428
266	Fabrication d'ouvrages en béton ou en plâtre	0,48	37 069
634	Organisation du transport de fret	0,46	109 179
331	Fabrication de matériel médico-chirurgical et d'orthopédie	0,46	41 672
633	Agences de voyage	0,46	40 953
371	Récupération de matières métalliques recyclables	0,46	14 747
712	Location d'autres matériels de transport	0,46	6 170
714	Location de biens personnels et domestiques	0,45	29 619
711	Location de véhicules automobiles	0,43	14 589
519	Autres commerces de gros	0,43	19 125
601	Transports ferroviaires	0,42	160 009
525	Commerce de détail de biens d'occasion	0,42	7 269
292	Fabrication de machines d'usage général	0,41	105 095



<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Employment, 2007</i>
511	Intermédiaires du commerce de gros	0,41	66 833
401	Production et distribution d'électricité	0,40	130 092
744	Publicité	0,40	114 374
642	Télécommunications	0,40	166 332
746	Enquêtes et sécurité	0,39	147 514
551	Hôtels	0,39	183 132
513	Commerce de gros de produits alimentaires	0,38	174 173
222	Imprimerie	0,38	85 984
743	Activités de contrôle et analyses techniques	0,37	55 747
514	Commerce de gros de biens de consommation non alimentaires	0,36	194 805
451	Préparation des sites	0,36	89 944
853	Action sociale	0,36	179 924
713	Location de machines et équipements	0,35	32 049
742	Activités d'architecture et d'ingénierie	0,35	260 327
505	Commerce de détail de carburants	0,34	22 028
926	Activités liées au sport	0,33	31 730
741	Activités juridiques, comptables et de conseil de gestion	0,33	606 945
410	Captage, traitement et distribution d'eau	0,33	44 745
701	Activités immobilières pour compte propre	0,33	38 664
651	Intermédiation monétaire	0,33	376 145
852	Activités vétérinaires	0,32	14 598
527	Réparation d'articles personnels et domestiques	0,32	20 127
503	Commerce d'équipements automobiles	0,30	62 733
518	Commerce de gros d'équipements industriels	0,30	292 163
747	Activités de nettoyage	0,30	327 464
555	Cantines et traiteurs	0,30	105 165
554	Cafés	0,30	45 016
900	Assainissement, voirie et gestion des déchets	0,29	87 314
702	Location de biens immobiliers	0,29	108 858
158	Autres industries alimentaires	0,29	243 569
804	Formation permanente et autres activités d'enseignement	0,28	72 302
504	Commerce et réparation de motocycles	0,28	13 592
502	Entretien et réparation de véhicules automobiles	0,27	108 932
748	Services divers fournis principalement aux entreprises	0,27	248 466
672	Auxiliaires d'assurance	0,27	69 633
745	Sélection et fourniture de personnel	0,26	67 740
703	Activités immobilières pour compte de tiers	0,25	138 053
553	Restaurants	0,24	457 273
454	Travaux de finition	0,23	353 266
522	Commerce de détail alimentaire en magasin spécialisé	0,22	81 063
851	Activités pour la santé humaine	0,22	332 169

<i>NAF code</i>	<i>Industry</i>	<i>Gini</i>	<i>Employment, 2007</i>
501	Commerce de véhicules automobiles	0,22	204 646
515	Commerce de gros de produits intermédiaires non agricoles	0,22	218 642
452	Construction d'ouvrages de bâtiment ou de génie civil	0,21	643 971
521	Commerce de détail en magasin non spécialisé	0,19	623 160
602	Transports urbains et routiers	0,19	549 956
641	Activités de poste et de courrier	0,18	286 368
453	Travaux d'installation	0,17	352 941
523	Commerce de détail de produits pharmaceutiques et de parfumerie	0,17	154 615
524	Autres commerces de détail en magasin spécialisé	0,15	664 191
930	Services personnels	0,13	178 102

### III. Classification of PCS

Table 2.9: PCS 2003, skill level

Code	Libellé	Skill level
10	Agriculteurs (salariés de leur exploitation)	Low
21	Artisans (salariés de leur entreprise)	Low
22	Commerçants et assimilés (salariés de leur entreprise)	Low
23	Chefs d'entreprise de 10 salariés ou plus (salariés de leur entreprise)	High
31	Professions libérales (exercées sous statut de salarié)	High
33	Cadres de la fonction publique	High
34	Professeurs, professions scientifiques	High
35	Professions de l'information, des arts et des spectacles	High
37	Cadres administratifs et commerciaux d'entreprises	High
38	Ingénieurs et cadres techniques d'entreprises	High
42	Professeurs des écoles, instituteurs et professions assimilées	High
43	Professions intermédiaires de la santé et du travail social	High
44	Clergé, religieux	High
45	Professions intermédiaires administratives de la fonction publique	Medium
46	Professions intermédiaires administratives et commerciales des entreprises	Medium
47	Techniciens (sauf techniciens tertiaires)	Medium
48	Contremaîtres, agents de maîtrise (maîtrise administrative exclue)	Medium
52	Employés civils et agents de service de la fonction publique	Low
53	Agents de surveillance	Low
54	Employés administratifs d'entreprise	Medium
55	Employés de commerce	Low
56	Personnels des services directs aux particuliers	Low
62	Ouvriers qualifiés de type industriel	Medium
63	Ouvriers qualifiés de type artisanal	Medium
64	Chauffeurs	Low
65	Ouvriers qualifiés de la manutention, du magasinage et du transport	Medium
67	Ouvriers non qualifiés de type industriel	Low
68	Ouvriers non qualifiés de type artisanal	Low
69	Ouvriers agricoles et assimilés	Low

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## RÉSUMÉ

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On oppose traditionnellement les emplois industriels et les emplois de services. L'interpénétration croissante de l'industrie et des services rend cependant cette distinction de plus en plus inopérante. À l'heure de la globalisation, il apparaît en revanche pertinent de distinguer les emplois exposés à la concurrence internationale de ceux qui en sont abrités, que l'on trouve à la fois dans l'industrie et dans les services. Cette thèse analyse dans un premier temps les évolutions et les caractéristiques des emplois exposés et abrités en France. Quels sont les emplois exposés et abrités ? Se distinguent-ils en termes de qualifications, salaires, évolutions de la productivité ? Comment sont-ils répartis sur le territoire ? Elle étudie ensuite les interdépendances entre ces deux catégories d'emplois, en évaluant empiriquement l'effet d'entraînement de l'emploi exposé sur l'emploi abrité au niveau des zones d'emploi de France métropolitaine. L'étude s'intéresse enfin à un échantillon de salariés licenciés suite à la fermeture d'un site de production. Elle tente de déterminer si le risque de licenciement, et les coûts qui lui sont associés, sont plus élevés dans le secteur exposé que dans le secteur abrité.

## MOTS CLÉS

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Exposé ; Abrité ; Mondialisation ; Multiplicateur ; Licenciement ; Structure de l'emploi en France

## ABSTRACT

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The distinction between manufacturing and service jobs has lost some of its relevance due to the growing interpenetration between industrial and service activities. On the other hand, globalization has made it increasingly necessary to distinguish between jobs exposed to international competition (tradable jobs) and those not exposed to it (non-tradable jobs), found in primary, secondary and tertiary sectors. This thesis begins by analyzing the developments and characteristics of tradable and non-tradable employment in France. Which jobs are tradable and which are non-tradable? Are they different in terms of skills, wages, and productivity? How are they distributed around the country? It then studies the interdependencies between these two categories of employment, making an empirical evaluation of the local multiplier effect of tradable jobs on non-tradable jobs in French local labor markets. Lastly, the thesis focuses on workers laid off due to firm closure. It sets out to determine whether the risk of job displacement, and the associated costs, are higher in the tradable sector than in the non-tradable sector.

## KEYWORDS

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Tradable ; Non-tradable ; Globalization ; Local multiplier ; Displacement ; French employment structure