Services Imports and Job Polarization*

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Abstract

We use newly available matched data between employers and employee to analyze the impact of trade on the wage of white- and blue-collars in France. While the traditional theories based on comparative advantage predict wage inequalities between sectors, the most recent theories that include firm heterogeneity point to a within sector impact of trade (Biscourp and Kramarz, 2007; Helpman et al., 2011) to mention few. The literature has mostly focused on trade in goods; it finds that the declining share of unskilled workers in total employment and the wage dispersion are mostly a within-industry phenomenon – and a between-firms phenomenon in the most recent study of (Helpman et al., 2012). We document that wage dispersion arises within sector. As far as it is within sector, the within component is mostly driven by wage inequality within firm. Interestingly, the within-firm component of wage inequality is much smaller in the service sector than in the manufacturing sector, and much larger among the group of multinational firms. We then show, using a translog specification that both material and service offshoring are positively correlated with the share of white-collars in the firm. Material offshoring substitutes for unskilled blue-collar workers, while service offshoring substitutes for skilled blue-collar workers. These results are robust to alternative definition of service offshoring and alternative samples of firms.

Keywords:

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1 Introduction

While traditional theories based on comparative advantage predict that trade raises wage inequalities between sectors, the most recent theories based on firm heterogeneity point to a within sector impact of trade (Biscourp and Kramarz, 2007; Helpman et al., 2011). Most of the trade literature has focused on international trade in goods. This literature finds that the declining share of unskilled workers in total employment and the wage dispersion are mostly a within-industry phenomenon. Additionally, a recent study (Helpman et al., 2012) found that it is a between-firm phenomenon. In this paper, we extend the analysis to trade in services and to trade in inputs using a very rich employer-employee dataset.

Our data has detailed information on French firm-level trade in goods, materials *and* services from 1999 to 2006. We match this data with information on the firms' balance sheets and income statements, as well as on the employment and the wage structure of each firm. First, we document that wage inequality arises within sector. As far as it is within sector, the within component is almost entirely driven by within firm wage inequalities. Then , we document that trade in services is highly concentrated among a very small number of firms.[1] The analysis we carry in this paper identifies the effect of trade in intermediate inputs, final goods and services at the firm-level on the composition of each firm's labor force. Given the dimension and the quality of the information available in the data, we can control for important factors such as technological change and sector×year specific shocks, which also account for changes in the regulatory environment. We use firm-level fixed-effects techniques to analyze the *within*-firm impact of trade.

Our paper contributes to the empirical literature on offshoring and wage inequality in several ways. To the best of our knowledge, this paper is the first to take into account the impact of trade in services at the firm-level,[2] conditioning on the firm's trade in final goods and in materials. We find that service imports complement white-collar workers and substitute for workers with intermediate skills (skilled blue-collar workers). This effect is different from the impact of material offshoring, where the substitution takes place at a lower qualification (unskilled blue-collar workers). We find that service imports are correlated with a polarized skill upgrading, while imports of materials and final goods are correlated with a general skill upgrading. This result is consistent with Levy and Murane (2004) who argue that computerisation and service offshoring can have similar effect by substituting for jobs performed by workers with an intermediate qualification. Our results remain robust after controlling for technological change and sector×year specific shocks. Using the industry classification of the firm, we report the results for the manufacturing, the wholesale-retail and the service sectors. We find a positive and significant correlation between service imports and the share of white-collar workers in the manufacturing and wholesale-retail sectors, but

[1] This fact is in line with the recent literature on trade in services at firm-level: Breinlich and Criscuolo (2011) on UK firms, Kelle (2012) on German firms, Federico and Tosti (2012) on Italian firms, Walter and Dell'mour (2010) on Austrian firms, Ariu (2012) on Belgian firms, and Gaulier et al. (2011) on French firms). Most of these studies are descriptive, and converge to a set of common stylized facts about firms engaging in international trade in services. In particular, these firms are on average larger, pay higher wages, and are more productive than their domestic counterparts.

[2] Researchers have traditionally used Input-Output tables to divide the aggregate imports of services between the different industries. The underlying "proportionality assumption" can lead to large bias in the estimation of the impact of service offshoring (Winkler, 2010; Feenstra and Jensen, 2012).

not in the service sector.

A potential drawback of our study is that we are not able to fully isolate the impact of service imports from other factors on the labor market. First, it might be that imports of services is the outcome, rather than the cause, of changes in the labor market. For example, firms may choose to outsource some activities because of pressures on the domestic labor market (changes in regulations, unions ...). This reverse causality implies that we are merely capturing a correlation, and not a causal relationship. Second, service imports may be correlated with other factors such as technology change, or the imports of goods. Failing to control for such factors would cast doubt on the causal interpretation of our results.[3] We deal with these issues in the following way. To control for changes in the regulation environment, we include industry×year dummies. To control for the potential reverse causality, we would need an instrument correlated with the service imports, and uncorrelated with the share of white-collar workers in the wage bill. We account for materials imports by controlling for the imports of both final goods and intermediate goods (Biscourp and Kramarz, 2007). We use a firm's change in share of intangible asset as the proxy for change in technology. Finally, the endogeneity issue is discussed at the end of the paper.

In the next section, we review the literature on services offshoring and job polarization, and present the data in Section 3. In Section 4, we present stylized facts linking the change in the skill composition in France with service offshoring. The theoretical framework we use to analyze our data is presented in Section 5, and results follow in Section 6. Section 7 presents robustness checks and discusses endogeneity issues. Section 8 concludes the paper.

2 Related Literature

Strictly speaking, offshoring refers to the outsourcing to a foreign country of an activity previously performed by a firm. Since data on *actual* offshoring are very hard to get, researchers have used the imports of material and services as a proxy for offshoring. In the 1990s, the focus was on trade in intermediate inputs and wage inequalities between skilled and unskilled workers, or production versus nonproduction workers (Feenstra and Hanson, 1996, 1999). It has been documented that both technological change and trade in intermediate inputs contributed to the increase in wage gap between the different type of workers. Berman et al. (1994) find that production labor-saving technical change (such as investment in computers and R&D) is the main factor behind the shift in labor demand toward skilled workers. Feenstra and Hanson (1999) find that the increasing use of computers can explain a third of the increase in the relative wage of nonproduction workers, while international outsourcing can explain about 15% (see Feenstra and Hanson, 2001, for an excellent survey).

Since the mid 1990s-early 2000s, offshoring has expanded and includes now business services.[4] Trade in commercial services has been growing faster than trade in goods over the past decades (UNCTAD, 2013), and the accompanying expansion of service offshoring has

[3] See Acemoglu (2002) and Chusseau et al. (2008) for surveys on the impact of technical change on wage inequalities, and Feenstra (2008) for the impact of trade in intermediate inputs on wages

[4] Service offshoring is considered a new phenomenon. Wilson (1995) reports anecdotal evidence that some U.S. companies were already offshoring service activities in the Caribbean or in Ireland in the 1970s and 1980s.

been referred to as the "new wave of globalization" or the "next industrial revolution" (Blinder, 2006). Amiti and Wei (2005) find no correlation between service offshoring and the employment growth in the United Kingdom between 1995 and 2001. Similarly, a report by the OECD (2006) fails at finding any significant correlation between service offshoring and employment in OECD countries between 1996 and 2003. With individual data on workers and occupations becoming more available, the focus has shifted form the traditional skilled versus unskilled worker paradigm. Crinó (2010) uses data on the occupation of the US workers and finds that service offshoring is biased toward white-collar workers, and toward workers performing non-tradable tasks. Criscuolo and Garicano (2010) show that the specific license requirement of some professions increases the costs of offshoring, within a given skill or occupation group. They give use he example of the British lawyers who have to be members of the bar to be able to practice. They find that an increase of 1% in exposure to imports of services reduces by 0.2% the wages of non-licensed occupations, and increases by 0.5% of the wages of licensed occupations. Using the CPS data, Ebenstein et al. (ming) study the impact of trade and offshoring on US workers and find a significant effect on occupation wage differentials. They also provide evidence of a costly (in terms of lower wage) reallocation of workers across industries and occupations due to globalization. Liu and Trefler (2011) provide similar evidence when looking at the impact of trade in services with China and India. Geishecker and Gorg (2011) uses data on workers in the UK and find that service offshoring reduces the wage of medium- and low-skilled workers, while increasing the wage of high-skill workers. The vast majority of these studies finds that service offshoring leads to a general skill upgrading.

An emerging literature has shifted the focus to trade in task rather than trade in physical output (Grossman and Rossi-Hansberg, 2008). The authors argue that the traditional view workers as skilled or unskilled fails at capturing the complex division of the production. Workers should be classified according to the task they perform rather than their level of education for instance. The recent technological change made the most "routine" or "codifiable" of these tasks potential candidate for offshoring. This lead to a polarization of the labor markets, where tasks performed by workers with an intermediate qualification are being offshored, thus leading to a drop in their relative wage (Goos and Manning, 2007; Autor et al., 2013). Workers at both end of the distribution experience in increase in their wage while the "middle-workers" performing routine tasks experience a wage reduction. As suggested by Levy and Murane (2004), both technological change (computers, or the automatization and codification of routine tasks) and offshoring are likely to be responsible for the change in the wage structure in the United States. Oldenski (2012) finds that communication and nonroutine tasks are more present at both end of the wage distribution than in the middle.

3 Data

We use four firm-level datasets in order to cautiously assess the link between service imports and the composition of the workforce of French firms. Each firm possess a single identification number (called *SIREN*) which allows us to merge the different datasets together.

First, we gather information on workers from the DADS dataset (Déclaration Annuelle des Salaires). This dataset provides information on the wages and the number of employees

for various occupations. Our access to this dataset is limited to three broad occupational categories: white-collar workers, skilled blue-collar workers and unskilled blue-collar workers.[5]. We know, for each firm, the number and the wages of the workers of each category.[6] Second, we use the BRN dataset (Bénéfices Réels Normaux) to obtain information on the balance sheets of firms. This dataset is provided by the fiscal authority (Département du Trésor) and focuses on firms with a turnover larger than €777,000 (€240,000 in the service sector). We use information on total sales, capital stock, stock of tangible and intangible assets, and the purchase of intermediate inputs. Third, information on firm-level exports and imports of services come from the French Central Bank. Data are collected either directly from the company itself,[7] or through banking declarations. In the latter case, the transaction must take place between a foreign and French bank account to be included in the data. This means that intra-firm trade flows may be included, as long as this condition is verified. The services recorded fall into the mode-1 classification by the GATS (i.e. cross-border trade).[8] The data are collected at the firm×service×year×country level. The classification used by the Bank of France is more aggregated and slightly different from the *Extended Balance of Payments Services Classification (EBOPS)* and identifies 21 types of services.[9] For the purpose of this study, we aggregate the import and export flows at the firm×year level. In our econometric analysis, we will distinguish between imports originating from western European countries, eastern European countries, other non-EU OECD countries, and the rest of the world. Additionally, we will also distinguish between imports originating from skilled- or unskilled-labor abundant countries. Finally, data on the imports and exports of goods are provided by the Custom office. Goods are classified according to the CN8 classification which allow us to use Rauch (1999)'s classification and differentiate between the imports of intermediate and final goods. Note that this difference is only relevant for firms in the manufacturing sector. The French Customs Office reports the total imports and exports at the firm×product×year×country level. We aggregate the import and export flows at the firm×year level. Data are available over the period 1999-2006.

Merging these four datasets together gives us information on an unbalanced panel of 92,275 firms. The sample consists of 44,342 firms registered in the manufacturing sector, 27,747 firms in the wholesale-retail sector and 23,121 firms in the service sector. Firms can change their industry classification over time, which is why the number of firm in each industry does not add-up to the number of firms in full sample. We propose some simple descriptive statistics for the last year in our sample. In 2006 we have 73,646 firms in our sample. About 5,300 firms are part of a group (either a multinational or a domestic French group). 47% are registered as manufacturing firms, 30% as wholesale-retail firms, and 23% as service firms. The manufacturing firms account for 55% of the total value added and 50% of the total employment in our sample. Wholesale-retail and service firms account for 23%

[5]See Table 7 for a description of the occupations within each category

[6]We use gross salaries as they better represent the labor cost of the firm. Gross salaries include the wage received by the worker and the taxes paid by the employer.

[7]This mainly concerns the biggest firms, the so-called *Déclarants Directs Généraux*.

[8]The GATS classifies international trade in services into four distinct modes: mode-1 is for cross-border supply of services, mode-2 refers to consumption abroad (mainly tourism), mode-3 refers to commercial presence, and mode-4 refers to the temporary movement of persons.

[9]See Table 8 for a detailed list of the Bank of France classification.

and 22% of the total value added respectively, and 25% and 24% of the total employment respectively. In 2006, 22,561 firms were importing manufacturing products (30% of the firms in our sample). More than half of them were manufacturing firms (13,517 firms), a third were in the wholesale-retail sector (7,511 firms) and the rest in the service sector (1,533 firms). The number of firms importing services was much smaller. Less than 2000 firms were importing services in 2006 (less than 3% of the firms). Among these firms importing services, about 80% were also importing manufacturing products. This overlap in import activities suggest that controlling for the imports of manufacturing products is crucial if we want to isolate the effect of service imports. Firms importing goods are larger than non-importers. These large firms account for two thirds of the employment in our sample, and 74% of the value added. Additionally, firms importing services are extremely large firms. They represent less than 3% of the firms in our sample, but account for 30% of the value added and 20% of the total employment in our sample.

The empirical literature has formulated two definitions for service offshoring. Amiti and Wei (2005) consider the imports of telecommunications, computer services, and other business services as the narrow definition, and overall service imports as the broad definition. For our narrow definition of service offshoring, we select the imports of communication, license and patents, IT, and other business services. These imports categories accounted for 77% of the total imports of services in 2006.[10] We follow the exiting literature and scale the imports of intermediate inputs and services by the production cost of the firm.[11] Firm production cost includes the wage bill, the purchase of intermediate inputs and other variable operating costs. Considering the sub-sample of firms that were importing services in 2006, we find that on average, service imports accounted for slightly less than 5% of the total cost of the firm. The ratio is close to 12% if we look at the imports of intermediate goods over total cost. It is noteworthy that very few firms import services, and that the import values are small compare to the imports of goods.

4 Stylized facts

Here we present some simple stylized fact on the extent of skill upgrading in the manufacturing, wholesale-retail and service sector. Figure 1 shows the change in the share of each type of worker in the industry wage bill along with the change in service imports between 1999 and 2006 in the manufacturing sector. As will become clear in the rest of the paper, most of the skill upgrading and effect of trade takes place in the manufacturing sector. In the appendix, we present the corresponding figures for the wholesale-retail and the service sector. In Panel (a), we look at the change in the share of white-collar workers. We see a positive (and statistically significant) correlation. Industries where the labor demand shifted towards white-collar workers are also industries where service imports increased between 1999 and 2006. This correlation is negative and statistically significant in Panel (b) where we look at the share of skilled blue-collar workers,i.e. workers with an intermediate qualification. The

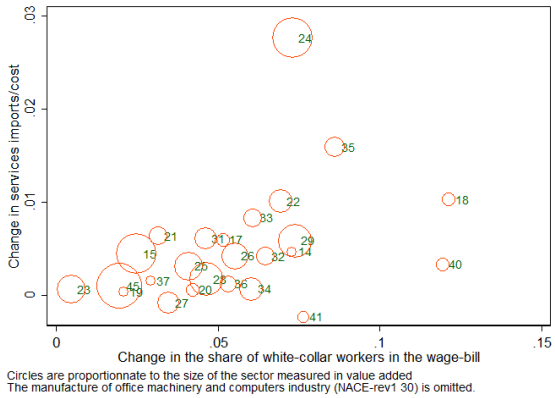
[10] For the same year, they accounted for 68% of the imports of services by manufacturing firms.

[11] Feenstra and Hanson (1996) scale the import of intermediate inputs by the total purchases of non-energy materials. Biscourp and Kramarz (2007) scale the imports of intermediate and final goods by total sales. Our results remain similar if we use this method instead

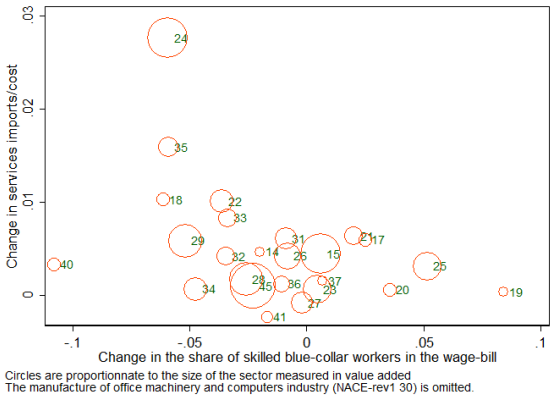
correlation becomes insignificant in Panel (c), i.e. for unskilled blue-collar workers. Figure 1 suggests that service imports are correlated with a polarization effect of the labor demand in manufacturing industries. The corresponding figure for the wholesale-retail and service sectors show no correlation between white-collar, skilled blue-collar or unskilled blue-collar workers and service imports.

Figure 1: Change between 1999 and 2006 in the share of each type of worker in the wage bill and change in the service imports – Manufacturing sector

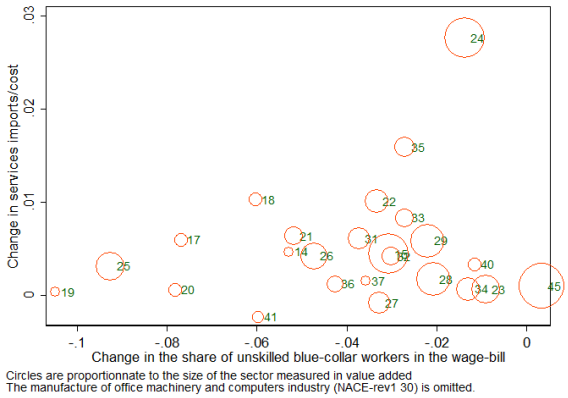
(a) White-collar workers



(b) Skilled blue-collar workers



(c) Unskilled blue-collar workers



We now take a closer look at the change in the share of white-collar workers in the wage bill. Figure 1 suggests that the change in labor demand is taking place in each industry. To get a broad view of these changes, we decompose the total variation into a between-industry and a within-industry component. The between-industry component captures how much of the total variation in the share of white-collar workers is due to the differences in growth rates of each industry. As is usually done in this kind of analysis, we use the following decomposition:

$$\Delta P = \sum_s \Delta S_s \overline{P}_s + \sum_s \Delta P_s \overline{S}_s,$$

where $s = 1, ..., N$ denotes industries. ΔP denotes the aggregate change in the share of white-collar workers in the wage bill. ΔS_s is the change in the relative size of industry s. $\overline{P}_s$ represents the average share of white-collar workers in industry s over the period. This first term is the between-industry component. ΔS_s is the change in the share of white-collar workers in industry s, and $\overline{S}_s$ is the average size of industry s over the period. This term is the within-industry component. Since we are using firm-level data, we can further decompose the within-industry change into between- and within-firm components, using the same decomposition.

$$\Delta P_s = \sum_i \Delta S_{i,s} \overline{P}_{i,s} + \sum_i \Delta P_{i,s} \overline{S}_{i,s},$$

where $i = 1, ..., I$ denotes firms. Averaging over all industries, the total within effect is:

$$\Delta P^{within} = \sum_s \overline{S}_s \sum_i \Delta S_{i,s} \overline{P}_{i,s} + \sum_s \overline{S}_s \sum_i \Delta P_{i,s} \overline{S}_{i,s},$$

Results are displayed in Table 1. The first row shows the aggregate change in the share of white-collar workers in the wage bill for the whole sample of firms. We have to restrict ourselves to firms that are continuously present over the period, and who do not change industry classification. On average, the share of white-collar workers in the wage bill increased by almost 4 percentage points between 1999 and 2006. This change is almost entirely a within-industry change. On average, in each industry, the share of white-collar workers increased by 3.4 percentage points. The within-industry change is in turn almost entirely driven by within-firm changes. The previous figures suggest that the phenomenon is within industries, but the magnitude of the effect varies between industries. The next rows of Table 1 indicate that the change in the skill composition is much more pronounced in the manufacturing sectors than in the wholesale-retail or in the service sectors. In the manufacturing sector, the share of white-collar workers increased by 5 percentage points, while it increased by only 1 percentage point in the wholesale-retail sector, and by 1.5 percentage points in the service sector. Again, in each sector the change takes place within industries, and within-firms. An important factor we need to take into account in our data is the presence of firms belonging to a group. One can imagine a situation where the group's headquarters decides to reorganize the production between its different plants (or firms), therefore leading to a relocation of workers across plants. The change in the skill composition induced by this decision may not be correlated with the decision to import goods or services. To account for this, we split our sample between independent firms and firms belonging to a group. We find that the change in the share of white-collar workers is more pronounced in firms that are part of a group (+5.4 percentage points) than in independent firms (+2.8 percentage points). Next, we look at whether the average change in the share of white-collar workers depends on the size of the firm.[12] We consider two categories of firms: firms with less than 50 employees, and those with 50 or more employees.[13] In the French system, firms with more than 50 employees

[12]Epifani and Gancia (2006) develop a theoretical model where output expansion is biased in favor of skilled workers. They find that as firms grow larger, they employ relatively more skilled workers.

[13]We take the average employment over the period 1999-2006 as the threshold of 50 employees.

face considerably more regulations than firms with less than 50 employees (Gourio and Roys, 2012; Garicano et al., 2013), and this can affect a firm's skill composition. We find that in firms with less than 50 employees, the share of white-collar workers has increased on average by 2.8 percentage points, while it increased by 3.6 percentage points in firms with more than 50 employees. As a robustness check in our econometric analysis, we will use this threshold again. Finally, we look at whether firms importing goods or services have increased their share of white-collar workers more than other firms. On average, firms importing services have increased by 5.2 percentage points their share of white-collar workers. This is more than the average change (+3.5 percentage points). It is important to note that, with this sample, only 2,710 firm are importing services over the period. They represent less than 5% of this panel of firms. Firms importing intermediate inputs have increased their share of white-collar workers by 5.6 percentage points. The augmentation is less for firms importing final products (+4.2 percentage points). As already mentioned, many firms are importing both intermediate inputs and final goods, or both services and goods. These figures give a broad view of the extent of skill upgrading in our dataset. In the econometric analysis, we will control for the import and export activity of each firm to make sure that we are carefully assessing the impact of service and material imports on the share of white-collar workers.

Table 1: Changes in the share of white-collar workers in the wage bill

		Total	B. Ind	W. Ind		
Sample	Firms			Tot	B. firms	W. firms
All	45,226	0.035	0.000	0.035	-0.001	0.035
Manufacturing	22,659	0.051	0.002	0.049	-0.001	0.049
Wholesale-Retail	12,661	0.011	-0.004	0.015	0.000	0.015
Service	9,906	0.015	0.001	0.014	-0.001	0.015
Independent	42,528	0.028	0.000	0.028	0.001	0.027
Group	2,698	0.052	0.006	0.047	-0.003	0.049
less than 50 emp.	35,647	0.028	-0.000	0.028	0.001	0.027
more than 50 emp.	9,579	0.036	0.000	0.036	-0.002	0.037
Imp. Services	2,710	0.052	0.004	0.047	-0.001	0.049
Imp. II	11,937	0.056	0.005	0.051	-0.001	0.052
Imp. FG	15,613	0.042	0.004	0.037	-0.001	0.038

Figures measure changes in the share of white-collar workers in the total wage bill. Group consists of firms belonging to a group, which can be multinational or not. Imp. II and Imp. FG stand for imports of intermediate inputs and imports of final goods respectively.

5 Econometric Specification

We follow the existing literature and use a translog specification to study the link between international trade and the skill structure of labor demand. This methodology, first intro-

duced by Berman et al. (1994) has been widely used in the empirical literature on trade and wage inequalities. We assume the short-run cost function of the firm can be approximated by a translog function, twice differentiable and linearly homogeneous in factor prices. As usual in this framework, we treat the imports of goods and services as a shift-factor, which means that the firm chooses optimally its employment composition for a given level of imports. The translog form of the short-run cost function is given by:

$$\begin{aligned} lnC_{SR} = \gamma_0 &+ \sum_c \gamma_c lnW^c + \gamma_Y lnY + \gamma_K lnK + \sum_z \gamma_z Z \\ &+ \frac{1}{2}\Big[\sum_c \sum_{c'} \gamma_{cc'} lnW^c lnW^{c'} + \gamma_{YY}(lnY)^2 + \gamma_{KK}(lnY)^2 + \sum_z \sum_{z'} \gamma_{zz'} ZZ'\Big] \\ &+ \sum_c \gamma_{cY} lnW^c lnY + \sum_c \gamma_{cK} lnW^c lnK + \sum_c \gamma_{cZ} lnW^c Z \\ &+ \gamma_{YK} lnY lnK + \sum_{zY} \gamma_z Z lnY + \sum_z \gamma_{zK} Z lnK, \end{aligned} \tag{1}$$

where the index c is for the different kind of worker (white-collar, skilled blue-collar and unskilled blue-collar workers). lnW^c is the log-wage of workers c, Y is output, K is capital, and Z is the set of cost-shifters. In Z, we include services and materials imports, along with a proxy for technological change, and a dummy for whether the firm belongs to a group. This expression can be simplified by imposing linear price homogeneity and symmetry. These restrictions apply to the following coefficients:

$$\sum_c \gamma_c = 1; \ \sum_c \gamma_{cc'} = \sum_{c'} \gamma_{c'c} = \sum_c \gamma_{cY} = \sum_c \gamma_{cK} = \sum_c \gamma_{cZ} = 0, \gamma_{cc'} = \gamma_{c'c}, \ \gamma_{zz'} = \gamma_{z'z}. \tag{2}$$

We then apply Shephard's lemma, and get the following system of relative labor demand functions:

$$S^c = \gamma_c + \sum_{c'} \gamma_{cc'} lnW^{c'} + \gamma_{cY} lnY + \gamma_{cK} lnK + \sum_z \gamma_{cz} Z, \quad c \in (H, M, L). \tag{3}$$

To keep the notation as simple as possible, we denote the different kind of workers by he following index: H is for white-collar workers, M is for skilled blue-collar workers and L is for unskilled blue-collar workers. On the left hand side, we have the share of each worker in the wage bill. The complete system of labor demand is estimated using Zellner's method for seemingly unrelated regressions (SUR). Given that we use the exact same set of regressors in each equation of the system, this method simply accounts for the cross-equation correlation in the error terms. Because of the restrictions imposed on the coefficients, we cannot estimate the full system at once, and need to drop an equation. The results are not affected by the choice of the equation dropped. Without loss of generality, we decide to drop the equation for unskilled blue-collar workers. We estimate the following system of equations:

$$Wsh^H = \gamma_W + \gamma_{H,H} ln(\frac{W^H}{W^L}) + \gamma_{H,M} ln(\frac{W^M}{W^L}) + \gamma_{H,Y} lnY + \gamma_{H,K} lnK + \sum_{z \in Z} \gamma_{H,z} Z + u^H \tag{4}$$

$$Wsh^M = \gamma_M + \gamma_{M,H} ln(\frac{W^H}{W^L}) + \gamma_{M,M} ln(\frac{W^M}{W^L}) + \gamma_{M,Y} lnY + \gamma_{M,K} lnK + \sum_{z \in Z} \gamma_{M,z} Z + u^M, \quad (5)$$

where Wsh^H and Wsh^M are the shares of white-collar workers and skilled blue-collar workers in the wage bill, respectively. u^H and u^M are the error terms. To wipe out time-invariant firm heterogeneity, all variables are deviated from firm averages, and standard errors are adjusted to account for the loss of degrees of freedom. We retrieve the coefficient $\gamma_{H,L}$ and $\gamma_{M,L}$ in Equations (4) and (5) and the coefficients for the unskilled blue-collar worker equation by applying the set of restrictions described in (2). If service imports are correlated with a skill upgrading, we would expect $\gamma_{H,Service\ Imports} > 0$, as it would shift outward the demand for white-collar workers. If service imports were correlated with a polarized skill upgrading, we would expect the coefficient $\gamma_{M,Service\ Imports}$ to be negative, and $\gamma_{H,Service\ Imports}$ and $\gamma_{L,Service\ Imports}$ either positive or null.

6 Results

Table 2 presents the estimation of Equation (4) using the full sample of firms. The upper part of the table displays the different cost shifters, and the lower part reports the translog variables. Since our study is first motivated by the link between service imports and the share of white-collar workers, we report in Columns (1)-(3) the coefficients for the white-collar workers equation, where we add one by one the different cost shifters. In Columns (4)-(6), all the cost shifters are included, and we also control for industry×year specific shock. Columns (4), (5) and (6) reports the results for the white-collar, skilled blue-collar and unskilled blue collar workers respectively. The coefficients on output, capital and individual wages are always significant and estimated with the expected signs (although quite puzzlingly the coefficient on capital turns negative and the coefficient on output turns non-significant in the last specification when we include industry×year dummies). Column (1) reports the results from the simplest specification, where the service imports are the only cost shifter. The results suggest that the imports of services are positively correlated with the share of white-collar workers in the wage bill. In Columns (2), we control for the imports of intermediate inputs and final goods. As describe in the previous section, most of the firms that are importing services are also importing goods. The results suggest that the import of manufacturing products (either final or intermediate goods) is also positively correlated with the share of white-collar workers. Note that the coefficient on service imports is very little affected by this additional control. Controlling for the imports of goods, we still find a positive and highly significant coefficient for service imports. In Column (3), we control for technical change using the share of intangible assets, and control for the ownership of the firm. Being part of a group could bias our results, as the change in skill-intensity within the firm could be decided at the firm's headquarter and be, to some extent, uncorrelated with the imports of services. Our results remain statistically unchanged by the inclusion of these two controls. Technical progress and the group dummy are both associated with an greater skill-intensity, but the coefficients on services and goods imports remain positive and statistically significant. The change in the share of white-collar workers could also be driven

by some external factors such as measures of deregulations at the industry level. Since we do not have data on the various changes in the regulatory environment in each industry, we use industry×year dummies to control for this. The results are presented in Column (4) and constitute our preferred specification. This additional control seems quite important as it changes a lot the magnitude of our coefficients, but not their significance level. Services and materials imports are still positively correlated with the share of white-collar workers in the wage bill. The effect is about twice as small as in the previous specification without industry×year controls. However, we are more confident in these last results as we control for a lot of potential omitted factors. In this last specification, the imports of final goods have a stronger correlation on the share of white-collar workers than the imports of intermediate inputs. This is in line with the results by Biscourp and Kramarz (2007) who find a strong negative correlation between the change in the share of unskilled production workers and an increase in the imports of final products. The results suggest that service imports and the imports of final products have a similar effect on the share of white-collar workers. In Columns (5) and (6) we report the coefficients for skilled blue-collar and unskilled blue-collar workers. Taken together, the last three columns constitute the whole labor demand system. Results suggest that service imports are negatively correlated with the share of *skilled* blue-collar workers, i.e. those with an intermediate qualification. This strongly contrasts with the imports of goods which are both negatively correlated with *unskilled* blue-collar workers. While trade in goods is correlated with a *general* skill-upgrading, the imports of services are correlated with a *polarized* skill-upgrading. Note that the correlation is silent on whether workers gain or lose on average with the imports of goods or services. First, our results only describe a correlation, and not a causal relationship. Second, we cannot say anything about whether the change in the composition of the firms' labor force happens through entries or exits (or both) of workers. Because our results are based on cost-share estimations, they are silent about the number of white-collar, skilled blue-collar or unskilled blue-collar workers actually employed by firms. The results only suggest that service imports are correlated with changes in the occupation-mix of the firm, and that this change is biased toward a greater of white-collar workers and a lower share of skilled blue-collar workers.

As suggested in Table 1, the change in the share of white-collar workers varies strongly between the manufacturing, the wholesale-retail, and the service sector. We now split our sample according to these three broad sectors and replicate the results from our preferred specification for each sector (Columns (4)-(6) in Table 2). Results are displayed in Tables 3 for the manufacturing sector and in Table 4 for the wholesale-retail and service sectors. Table 3 uses the sample of manufacturing firms, which consists of 44,342 firms. Our results suggest that the average effect from the previous table is mostly driven by manufacturing firms. Regarding the different cost-shifters, the results are qualitatively unchanged but the point estimates are larger. We find that service imports are associated with a polarized skill upgrading. They are positively correlated with the share of white-collar workers and negatively correlated with the share of skilled blue-collar workers. Interestingly, the share of unskilled blue-collar workers is uncorrelated with service imports. We interpret this as evidence of a polarization of the labor demand by manufacturing firms. Workers with an intermediate qualification substitute for service imports. We find that a one percentage point increase in the service imports is associated with a 0.057 percentage point increase in the share of white-collar workers. This coefficient is twice as large as the one obtained in the

Table 2: Baseline Specification: Full Sample

	White-collar workers			White	Sk. Blue	Unsk. Blue
	(1)	(2)	(3)	(4)	(5)	(6)
Service Imports	0.052^a	0.049^a	0.048^a	0.028^a	-0.024^a	0.004
	(5.513)	(4.950)	(5.854)	(2.841)	(-2.761)	(0.435)
II Imports		0.068^a	0.067^a	0.013^a	-0.002	-0.011^b
		(17.539)	(17.191)	(3.149)	(-0.480)	(-2.134)
FG Imports		0.034^a	0.034^a	0.023^a	-0.007	-0.016^a
		(5.679)	(5.692)	(3.993)	(-1.343)	(-3.164)
Intang. Assets (%)			0.010^a	0.008^a	-0.004	-0.004
			(3.208)	(2.611)	(-1.478)	(-1.398)
group			0.009^a	0.003^a	-0.000	-0.003^b
			(6.849)	(2.794)	(-0.013)	(-2.711)
Ln Output	0.004^a	0.004^a	0.004^a	0.001	-0.004^a	0.002^a
	(4.798)	(4.414)	(4.471)	(1.493)	(-4.705)	(3.075)
Ln Capital	0.004^a	0.004^a	0.003^a	-0.004^a	0.002^a	0.002^a
	(6.001)	(5.428)	(4.877)	(-6.351)	(3.235)	(3.688)
Ln W^{White}	0.049^a	0.049^a	0.049^a	0.045^a	-0.016^a	-0.029^a
	(40.625)	(43.573)	(40.616)	(37.192)	(-14.265)	(-29.176)
Ln W$^{Skilled\ Blue}$	-0.034^a	-0.034^a	-0.034^a	-0.039^a	0.067^a	-0.028^a
	(-25.991)	(-25.948)	(-25.983)	(-30.108)	(52.264)	(-23.824)
Ln W$^{Unskilled\ Blue}$	-0.015^a	-0.015^a	-0.015^a	-0.006^a	-0.051^a	0.057^a
	(-17.622)	(-17.636)	(-19.030)	(-7.173)	(-51.013)	(68.371)
Observations	657,609					
Number of Firms	92,275					
Firm f.e.	YES					
Industry×Year f. e.	NO	NO	NO	YES	YES	YES

Significance levels: ^{c} $p < 0.1$, ^{b} $p < 0.05$, ^{a} $p < 0.01$. Robust standard errors clustered at the firm level. t-statistics between parenthesis.

baseline regression but remains quantitatively small. We do not find evidence in favor of the "fear of offshoring" argument which has fulled the debate on service offshoring in the recent years Blinder (2006); Bhagwati and Blinder (2009). This argument underlines the fact that because services are on average skill-intensive, workers with a high qualification would lose from service offshoring. Our result suggest that it is workers with an intermediate level of qualification who substitute for service imports, not workers performing high-end tasks. This result contrasts with the correlation we find regarding the imports of intermediate and final goods. We find that importing goods is correlated with a general skill upgrading. Unskilled blue-collar workers are substitutes for this kind of trade, and white-collar workers are complements to it. This result is in line with what Biscourp and Kramarz (2007) find for the period 1986-1992 using similar data. Results for wholesale-retail and service firms are presented in Table 4. We find that service imports is correlated with the white-collar workers in the wholesale-retail sector, but not in the service sector. Furthermore, the imports of goods are not statistically significant in any of these regressions. In the rest of the paper, we perform robustness checks on manufacturing firms as this is where the correlation

is statistically significant. Moreover, this makes our results comparable with the existing literature on services and goods offshoring.

Table 3: Manufacturing sector: results by type of workers

	White	Sk. Blue	Unsk. Blue
	(1)	(2)	(3)
Service imports	0.057^b	-0.055^b	-0.001
	(2.560)	(-2.511)	(-0.081)
II imports	0.015^a	-0.004	-0.011^b
	(3.483)	(-0.642)	(-2.176)
FG imports	0.047^a	-0.012	-0.035^a
	(5.094)	(-1.188)	(-3.342)
Intangible Assets (%)	0.015^a	-0.007	-0.008^c
	(2.992)	(-1.162)	(-1.713)
group	0.004^b	0.003	-0.006^a
	(2.484)	(1.265)	(-3.493)
Ln Output	-0.002	-0.002	0.003^a
	(-1.392)	(-1.209)	(2.847)
Ln Capital	-0.004^a	0.004^a	-0.001
	(-3.799)	(3.825)	(-0.812)
Ln W^{White}	0.055^a	-0.015^a	-0.04^a
	(31.209)	(-7.762)	(-24.743)
Ln W$^{Skilled\ Blue}$	-0.058^a	0.068^a	-0.01^a
	(-30.438)	(28.967)	(-5.126)
Ln W$^{Unskilled\ Blue}$	0.003^a	-0.053^a	0.05^a
	(3.276)	(-34.233)	(41.692)
Observations	311,890		
Number of firms	44,342		
Fixed Effects	Firm, Industry×Year		

Significance levels: ^{c} $p < 0.1$, ^{b} $p < 0.05$, ^{a} $p < 0.01$. Robust standard errors clustered at the firm level. t-statistics between parenthesis.

7 Robustness Checks and Endogeneity Issues

We now perform a series of robustness check to assess the validity of our results. We focus on the manufacturing sector, and only report the coefficient on the service imports variable for each type of worker.[14]

First, instead of using the aggregate service imports, we focus on what other authors have labelled the narrow definition of service offshoring. It includes the imports of communication, license and patents, IT, and other business services.[15] Results are shown in the first raw

[14]The remaining coefficients are very similar from the baseline specification. The full results, not shown here, are available upon request.

[15]Both measures are actually strongly correlated, with a coefficient of correlation of 0.73

Table 4: Wholesale-retail sector: regression by type of worker

	Wholesale-retail firms			Service firms		
	White	Sk. Blue	Unsk. Blue	White	Sk. Blue	Unsk. Blue
	(1)	(2)	(3)			
Service imports	0.036^{b}	-0.021	-0.014	0.011	-0.013	0.002
	(2.008)	(-1.556)	(-0.912)	(0.819)	(-0.908)	(0.216)
FG imports	0.005	-0.002	-0.002	0.016	-0.006	-0.006
	(0.591)	(-0.362)	(-0.366)	(0.819)	(-0.321)	(-0.321)
Intangible Assets (%)	0.005	-0.001	-0.004	0.001	0.000	-0.001
	(0.887)	(-0.130)	(-0.856)	(0.129)	(0.036)	(-0.204)
group	0.003	-0.000	-0.003	0.002	-0.006^{b}	0.004^{c}
	(1.104)	(-0.073)	(-1.281)	(0.590)	(-2.07)	(1.648)
Ln Output	0.008^{a}	-0.008^{a}	-0.001	0.001	-0.006^{a}	0.004^{a}
	(4.552)	(-5.030)	(-0.336)	(0.765)	(-3.54)	(2.964)
Ln Capital	-0.008^{a}	0.002	0.006^{a}	0.000	-0.002	0.001
	(-6.394)	(1.632)	(5.680)	(0.258)	(-1.387)	(1.286)
Ln W^{White}	0.039^{a}	-0.015^{a}	-0.023^{a}	0.034^{a}	-0.016^{a}	-0.018^{a}
	(16.994)	(-8.086)	(-12.645)	(13.46)	(-6.949)	(-9.452)
Ln W$^{Skilled\ Blue}$	-0.009^{a}	0.064^{a}	-0.055^{a}	-0.047^{a}	0.068^{a}	-0.022^{a}
	(-3.637)	(29.418)	(-26.391)	(-17.751)	(25.682)	(-10.085)
Ln W$^{Unskilled\ Blue}$	-0.030^{a}	-0.048^{a}	0.078^{a}	0.012^{a}	-0.052^{a}	0.040^{a}
	(-17.970)	(-31.152)	(54.842)	(5.729)	(-21.971)	(22.105)
Observations	189,723			155,996		
Number of Firms	27,747			23,121		
Fixed Effects	Firm, Industry×Year					

Significance levels: ^{c} $p < 0.1$, ^{b} $p < 0.05$, ^{a} $p < 0.01$. Robust standard errors clustered at the firm level. t-statistics between parenthesis.

of Table 5. This alternative definition does not quantitatively change much our results. The coefficient on service imports turns slightly nonsignificant in the white-collar worker equation (The p-value is actually 10.06), and is not statistically different from the baseline estimate. We still find the negative correlation between the imports of services and the share of skilled blue-collar workers in the wage bill.

Next, we control for the export activity of the firms. Bernard and Jensen (1997) argue that exporters account for most of the increase in the wage gap between high- and low-skilled workers in the United States during the 1980s. We include the exports of goods and services (scaled by total sales) in the regression. The inclusion of these two additional variables does not change the coefficient on service imports. Interestingly (results not shown here but available upon request), we find that the exports of services are negatively correlated with the share of white-collar workers, and positively correlated with the skilled blue-collar workers. This brings additional support for the substitutability between skilled blue-collar workers and service imports.

In the third row of Table 5, we use the share of workers in employment rather than in

the wage bill as our dependent variable. In the presence of rigidities in the labor market, wages may not immediately respond to shifts in relative labor demand. Our results remain similar when we use the employment share as the dependent variable.[16] The results remain qualitatively similar, suggesting that they do not hinge on the specificities of the French labor market.

In the next four rows, we look at whether the import origin of services matters. Biscourp and Kramarz (2007) find that the imports of goods from non-EU OECD countries have the strongest impact on production workers in the French manufacturing firms between 1986 and 1992. We distinguish between four different geographic regions: Western Europe, Eastern Europe, the non-EU OECD countries, and the rest of the world (RoW). The results suggest that our baseline results are driven by the imports from Western European countries, and from non-EU OECD countries. The coefficients are precisely estimated and similar to the baseline results. The imports from Eastern European countries and from the rest of the world (mainly developing economies), are not correlated with the labor demand of any type of worker. This result highlights the fact that trade in services is mostly taking place between developed economies. The competition from China or India, often mentioned as providers of services at low costs (Liu and Trefler, 2011), does not seem to be correlated with the relative labor demand by French manufacturing firms. When it comes to the imports of services by French firms, the competition is more likely to come from OECD countries than from developing economies. This result is confirmed in the last rows of the table, where we decompose countries based on their skill abundance. We use the World Development Indicator database from the World Bank and classify countries based on the share of their population with a tertiary education.[17]

We now look at whether the imports of services have a different impact for small versus large firms, and for independent firms versus firms belonging to a group. We first look at firms with different sizes. According to the French labor laws, firms have to face heavier regulation when they reach the threshold of 50 employees. Garicano et al. (2013) and Gourio and Roys (2012) find that this has a strong effect on the distribution of firms' size and productivity. We look at whether our baseline results hold for these two categories of firms. The results are presented in the first two rows of Table 6. The baseline results are partly driven by the small firms in our sample. The coefficients on service imports are not significant in the sample of firms with more than 50 employees. The coefficients on service imports in the small firms sample are larger (at a slightly lower significance level) than in the baseline. This could suggest that smaller firms adjust faster their skill composition. Alternatively, this could be due the simple statistical fact that when small firms add a worker for instance, this extra worker can change significantly the relative shares of the workers in the firm. This in turn would mean that there is more variance to be captured by our set of regressors in small firms than in larger firms. In the third row of Table 6, we focus on domestic independent firms. We find that the polarization effect vanishes, suggesting that the correlations are partially driven by the firms members of a group. A quick look at the data reveals that among firms

[16] Crinó (2012) and Davies (2013) use the same theoretical framework to study the effect of service offshoring and greenfield FDI respectively on the relative labor demand using a panel of OECD countries. They do not find any significant difference in their result when using the employment share as dependent variable.

[17] For each year, we split in tiers the distribution of the share of the population with tertiary education. Countries in the top tier, i.e. countries with the highest share, are classified as high-skill countries.

Table 5: Robustness Checks. Sample: Manufacturing firms

	White-collar	Skilled Blue-collar	Unskilled Blue-collar
	(1)	(2)	(3)
Narrow Definition	0.056	-0.064**	0.008
	(1.617)	(-1.967)	(0.428)
Control for Export/sales	0.064***	-0.061***	-0.003
	(2.900)	(-2.720)	(-0.185)
Share in Employment	0.068***	-0.065***	-0.003
	(2.860)	(-2.536)	(-0.180)
Imports from Eastern EU	0.069	0.120	-0.189
	(0.621)	(0.931)	(-1.602)
Imports from Western EU	0.063***	-0.061**	-0.002
	(2.483)	(-2.256)	(-0.121)
Imports from non-EU OECD	0.083	-0.111**	0.029
	(1.244)	(-1.997)	(1.239)
Imports from the RoW	-0.004	0.036	-0.031
	(-0.046)	(0.404)	(-0.508)
Imports from high-skill countries	0.071***	-0.065***	-0.006
	(2.685)	(-2.567)	(-0.349)
Imports from middle-skill countries	-0.060	-0.001	0.060
	(-0.437)	(-0.004)	(0.351)
Imports from low-skill countries	0.054	-0.012	-0.042
	(0.391)	(-0.097)	(-0.711)
Observations	311,890		
Number of firms	44,342		
Fixed Effects	Firm, Industry×Year		

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the firm level. t-statistics between parenthesis. The last estimation is carried on 276,528 observations and 39,527 firms.

importing services, 70% a part of a group. Dropping them leaves us with very few importers of services and therefore a possible weaker correlation. However, it is noteworthy that the coefficient on service imports in the white-collar worker equations is twice as large as in the baseline regression for manufacturing firms (table 3).

One last concern that may arise is the case where there is a reverse causality between the share of white-collar workers and the imports of services. Instrumental variables are typically used to handle this kind of endogeneity. We would need an instrument that is correlated with the imports of services variable but uncorrelated with the share of white-collar workers. A two step procedure using an strictly exogenous variable as instrument would ensure that we are capturing a causal link and not a simple correlation. Our econometric analysis is using firms that import services as well as firms that do not. We would need an instrument that applies to all the firms in our sample, importers and non-importers alike. Therefore, we cannot use the strategy used in Hummels et al. (2014) as they only rely on firms that are always importing, thus focusing on the effect of offshoring at the intensive margin. We

Table 6: Manufacturing sector: Size category and origin of the imports of service

	White-collar	Skilled Blue-collar	Unskilled Blue-collar
	(1)	(2)	(3)
Less than 50 employees	0.093**	-0.074*	-0.019
	(2.345)	(-1.925)	(-0.823)
More than 50 employees	0.027	-0.033	0.006
	(1.247)	(-1.395)	(0.398)
Independent firms only	0.111**	-0.068	-0.042
	(2.432)	(-1.524)	(-1.439)
Observations	311,890		
Number of firms	44,342		
Fixed Effects	Firm, Industry×Year		

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Robust standard errors clustered at the firm level. t-statistics between parenthesis.

are aware that any firm-level variable from the firm's balance sheet is going to be correlated with both the share of white-collar workers and the imports of services. Abramovsky and Griffith (2006) use the share of workers in the IT department of the firm as an instrument for service offshoring. IT workers can lower the search cost and find foreign suppliers more easily. However, we believe this would be correlated with the share of white-collar workers, as IT workers are classified as white-collar workers in our dataset. Moreover, any firm-level variable from the firm's balance sheet is likely to be correlated with both service offshoring and the share of white-collar workers in the wage bill. Variables that exploit the country×service dimension of the trade in services data, such as the variables used in the gravity framework for instance, are very good candidates, but they only apply to firms that are importing services, not to non-importers.

8 Conclusion

Trade in services is growing, and importing services is becoming increasingly feasible. The debate over the impact of service imports on the labor market is fueled by the fear that high-skilled jobs are going to be lost. While the trade in intermediate inputs is of great concern for low-skilled workers, service imports are seen as a possible threat for skilled workers. Concerns arise as to whether this "new wave of globalization" is going to weaken the comparative advantage of developed economies. Due to the lack of data, little is still known about the impact of service imports on employment. We contribute to fill this gap by using very detailed data on individual imports of services by French firms, along with information on the skill composition of its labor force. We first look at the data and find that between 1999 and 2006, the share of white-collar workers in the wage bill increased by 3.5 percentage points on average. This increase is much more pronounced in the manufacturing sector (+5.2 percentage points) than in the other sectors of the economy. We then use a translog short-run cost function to estimate the link between service and material imports on the share of white-collar workers in the wage bill. Our results suggest that imported services

are positively correlated with the share of white-collar workers, and negatively correlated with the share of skilled blue-collar workers. This is consistent with a polarization of the workforce in the manufacturing firms, correlated with service imports. Conversely, material imports is correlated with a general skill upgrading. These results hold for manufacturing firms, especially firms with less than 50 employees, and for imports originating from skill-abundant countries such as in Western Europe and other non-EU OECD countries. Our empirical results suggest that the "fear" over service imports among white-collar workers is ill-placed, as we find that they complement service imports. Our results hold after controlling for technical change and industry×year characteristics such as changes in the regulatory environment.

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9 Appendix

Table 7: Classification of Occupations

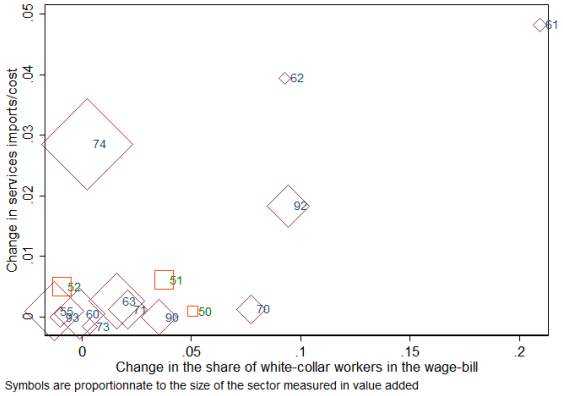
occupation	type of worker
Chief executive	White-collar
Health professional, and Lawyer	White-collar
Executive civil Servant	White-collar
Professors, scientific profession	White-collar
Occupation in Information, art and entertainment	White-collar
Administrative executives, sales representatives	White-collar
Engineers and executive technicians	White-collar
Teachers	White-collar
Occupation Health and Social Work technicians	White-collar
Religious activities	White-collar
Administrative civil servants	White-collar
Administrative occupation	White-collar
Technicians	White-collar
Foreman, supervisor	White-collar
Administrative employee	Skilled blue-collar
Skilled worker	Skilled blue-collar
Drivers	Skilled blue-collar
Skilled workers in transport, handling, stockage	Skilled blue-collar
Unskilled worker	Unskilled blue-collar
Farm worker	Unskilled blue-collar
Civil service agents	Unskilled blue-collar
Security guards	Unskilled blue-collar
Worker in small businesses	Unskilled blue-collar
Personal services worker	Unskilled blue-collar

Table 8: Service data

Communication	Telecommunication and post
Construction	Foreign merchandise designated for major works Major works
Insurance	Insurance on merchandises bonus and service charge Bonuses, other insurance: bonus and service charges Reinsurance
Financial	Service charge and banking or financial charges from banking sector Service charge and banking or financial charges from non-banking and private sector
Computer and Information	Computer Services
Royalties, Licenses, Patents	Royalties on Patents, trade in know-how Sales of licences, property rights, author's rights
Other Business Services	Leasing of mobile and immobile goods (other than ships) Studies, Research and Technical Assistance Overheads, management costs Other labour remuneration Subscriptions, advertising
Personal and cultural services	Audiovisual other services
Public Administration	Other payments from the French government Military expenditures

Figure 2: Change in the share of each type of worker in the wage bill and change in the service import intensity in the wholesale-retail and service sector

(a) White-collar workers



(b) Skilled blue-collar workers

(c) Unskilled blue-collar workers