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SERVICE OFFSHORING AND WAGES: WORKER-LEVEL EVIDENCE FROM ITALY*[1]

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Abstract

We study the effects of service offshoring on the wages of Italian workers. To this purpose, we build up a novel data set combining information from two different sources: (1) matched employer-employee data based on administrative records from the Italian National Social Security Institute; and (2) industry-level indicators of service offshoring based on Import Matrices released by the Italian Statistical Office. We estimate worker-level wage regressions controlling for a number of employee, firm and industry characteristics. In line with previous studies, we find that service offshoring does not cause significant reductions in workers' wages. We also find, however, that service offshoring contributes to widening the wage gap between more and less skilled employees. Finally, we document heterogeneity in the effects of service offshoring depending on the type of activities relocated abroad. Specifically, our results show that offshoring of business services exerts moderately negative effects on workers' wages, whereas offshoring of other services has virtually no impact on individual earnings.

1. Introduction

Recent developments in Information and Communication Technology (ICT) have drastically reduced the cost of trading services internationally (Freund and Weinhold, 2002; Head et al., 2009), thereby allowing firms to transfer a wider range of service activities to foreign countries (UNCTAD, 2004; OECD, 2007b). The consequences of this new phenomenon - known as *service offshoring* [2] for the labor markets of developed countries have received increasing attention by media and politicians (Bhagwati et al., 2004; Amiti and Wei, 2005; Trefler, 2005; Mankiw and Swagel, 2006) and have become the object of a growing number of empirical studies. Due to data constraints, however, most of the empirical literature has focused on industries or firms. As a result, we still know very little about the effects of service offshoring on the economic fortunes of individual employees.

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In this paper, we fill this gap by studying how service offshoring affects the wages of Italian workers. To perform our analysis, we construct a novel data set merging information from two different sources. The first consists of matched employer-employee data based on administrative records from the Italian National Social Security Institute (INPS). We observe a representative sample of workers including all individuals born in four different dates, and with at least one contract registered at INPS in a given year. The data set contains a wealth of information about the workers. Moreover, for each worker, it reports the firm identifier and is thus a matched employer-employee data set. Our final sample consists of roughly 100,000 workers and 60,000 firms per year, and spans the period 1998-2002.

We combine these data with information on the intensity of service offshoring in the industry of each firm. Following the literature (in particular, Amiti and Wei, 2005, 2006, 2009; and Crinò, 2010b, 2012a,b), we measure service offshoring as the share of imported private services in the industry's total purchases of intermediate inputs. To construct this indicator, we use the Import Matrices released by the Italian Statistical Office (ISTAT). These matrices contain official information on the imports of different services in each industry. By using them, we can relax some of the restrictions implied by alternative methodologies for constructing the offshoring proxies, which are based on the adoption of Input-Output tables combined with economy-wide service imports (see Feenstra and Jensen, 2009, for a discussion on this point). Moreover, we can calculate separate offshoring indicators for different types of services, which allows us to explore heterogeneity in the effects of service offshoring across different activities.

Following Hummels et al. (2011), we base our empirical analysis on the estimation of worker-level wage regressions controlling for many characteristics of the individual, the firm and the industry. We augment these specifications with our industry-specific proxies for service offshoring. Importantly, we always control for job spell (i.e., worker-firm) fixed-effects, thereby focusing on workers employed in the same firm for at least two consecutive years. These workers constitute the bulk of individuals in our sample.

We start by estimating the model with an aggregate indicator of service offshoring. The results show that service offshoring does not cause significant reductions in workers' wages. While the wage elasticity of service offshoring is consistently negative across specifications, it is also small and imprecisely estimated. Overall, these results corroborate and generalize those of previous studies based on firm- or industry-level data, according to which the labor market effects of service offshoring have so far been moderate in many developed countries.

Then, we move a step ahead and explore heterogeneity across workers with different skill levels. Specifically, we distinguish the wage effects of service offshoring across high-skill and low-skill employees. To this purpose, we extend the model by including an interaction term

between the service offshoring proxy and a dummy for non-production workers. This interaction term turns out to be positive across a large number of specifications. At the same time, the linear term of service offshoring always turns out to be negative. This suggests that service offshoring may contribute to widening the wage gap between more and less skilled employees. Nevertheless, the magnitude of this effect is fairly small in our sample.

Finally, we study how the effects of offshoring differ depending on the types of services relocated abroad. To this purpose, we replace the aggregate proxy for service offshoring with disaggregate indicators for four different services: finance and insurance, R&D, computing and information, and business services. We find virtually no effect for the former three categories: the estimated coefficients are always small and generally insignificant. We instead find stronger effects for business services, which represent the bulk of service offshoring in Italy. Specifically, our results imply that business services offshoring reduces workers' wages within the firm. Also in this case, however, the economic magnitude of the effect is not large.

The paper is organized as follows. Section 2 provides a brief overview of the existing literature. Section 3 describes the data and reports some stylized facts. Section 4 explains the empirical model and the estimation strategy. Section 5 discusses the results. Finally, Section 6 concludes.

2. Related Literature

Before turning to the empirical analysis, we place the paper in context by providing an overview of the existing evidence on service offshoring and labor markets. Due to space constraints, and given the empirical nature of this paper, we focus on empirical contributions. For theoretical studies on the productivity, wage and welfare effects of offshoring, the interested reader can refer to Bhagwati et al. (2004), Samuelson (2004), Deardorff (2005), Markusen (2005), Antras et al. (2006), Baldwin (2006), Markusen and Strand (2008), Grossman and Rossi-Hansberg (2008), Baldwin and Robert-Nicoud (2010) and Rodriguez Clare (2010). More detailed and comprehensive surveys of the literature can instead be found in Feenstra and Hanson (2003), Hijzen (2005), Crinò (2009) and Feenstra (2010).

As mentioned in the Introduction, most of the existing studies use aggregate data at the industry- or firm-level. Some of these contributions count the number of service jobs that can be potentially relocated abroad, and are thus directly exposed to service offshoring. To this purpose, these studies compute the number of individuals employed in so called 'tradable occupations', namely, occupations that require little face-to-face contact with final consumers, depend substantially on ICT, and perform routine tasks (Autor et al., 2003; Levy and Murname, 2004; Blinder, 2006). These attributes imply that the cost of performing these jobs from remote

locations is relatively low. The main conclusion of these studies is that the fraction of jobs potentially at risk of offshoring is quite large. In particular, roughly 25% of workers in the U.S., Europe, and other industrialized countries are employed in tradable occupations. See Bhardan and Kroll (2003), Dossani and Kenney (2004), Garner (2004), Van Welsum and Reif (2005), Van Welsum and Vickery (2005), Jensen and Kletzer (2005, 2008), Blinder (2006, 2009), Kroll (2007), Moncarz et al. (2008), Blinder and Krueger (2009) and Kletzer (2009).

While these figures are large, additional evidence suggests that the actual impact of service offshoring on the labor market has so far been moderate in many developed countries. During the first half of the past decade, offshoring has accounted for only 2-4% of the job separations in the U.S. and for similar shares in the EU and Japan. See Bhagwati et al. (2004), Mankiw and Swagel (2006) and Kirkegaard (2007). Moreover, U.S. employment in tradable occupations has actually increased, and job growth has been particularly sustained in high-skill intensive, high-wage, jobs. See Mann (2003), Kirkegaard (2004), Jensen and Kletzer (2005) and Moncarz et al. (2008).

Perhaps more importantly, econometric studies based on industry- or firm-level data show that until now service offshoring has had moderate effects on domestic employment. In some cases, the effects have been found to be even positive, suggesting that service offshoring may actually raise employment by boosting productivity and expanding the scale of firms' operations. These contributions include Amiti and Wei (2006), Blinder and Krueger (2009) and Liu and Trefler (2011) for the U.S.; Amiti and Wei (2005) and Hijzen et al. (2011) for the U.K.; Hijzen and Swaim (2007), OECD (2007a,b) and Crinò (2012a) for different groups of industrialized economies; Görg and Hanley (2005) for Ireland; and Jensen et al. (2006) for Denmark.

Existing work confirms these findings also for Italy. In particular, both Falzoni and Tajoli (2011) - using industry-level data - and Crinò (2010a) - using firm-level data - find that service offshoring has not caused significant reductions in domestic employment over the last two decades. We depart from these two studies in a number of important directions. First, instead of studying employment effects, we analyze wage effects, which have been overlooked so far due to lack of data. Second, and most importantly, we use rich micro-level data instead of aggregate information for industries or firms.

A smaller set of contributions study how service offshoring affects the skill and occupational composition of labor demand. These works show that service offshoring shifts the composition of labor demand toward high-skill labor. The reason is that imported services complement with high-skill workers and substitute for low-skill workers. Some of these studies also find that

service offshoring tends to change the occupational composition of labor demand at given educational level, by penalizing tradable occupations and favoring less tradable jobs.

Evidence on the U.S. is provided by Crinò (2010b), who uses industry-level data on employment and wages for more than 100 occupations. Crinò (2012a) finds similar results for a number of European countries, and Crinò (2010a) reports consistent evidence for Italian firms. Our work is perhaps more closely related to Geishecker and Görg (2012) who show, using individual-level wage data for the U.K., that service offshoring tends to raise the skill premium. Our adoption of matched employer-employee data constitutes an important departure from that paper, for two main reasons. First, it allows us to control for firm characteristics besides the standard worker-level covariates. Second, it allows us to focus on job stayers by controlling for job spell fixed-effects.

Finally, our paper is also related (though more tangentially) to the vast literature on material offshoring and labor markets. Starting with the seminal papers by Feenstra and Hanson (1996, 1999, 2003), this literature finds that material offshoring contributes to increasing wage inequality between high-skill and low-skill workers. The effect was stronger during the 1980s than it is nowadays, perhaps because material offshoring is no longer growing as fast as it did in the past. More recent contributions add to this literature by using matched employer-employee data. In particular, Hummels et al. (2011) confirm that material offshoring raises the skill premium using rich matched employer-employee data for Denmark. Our empirical approach is borrowed from Hummels et al. (2011). Unlike that paper, however, we study service offshoring instead of material offshoring. Moreover we focus on Italy, a country for which micro-level evidence is still very limited.[3]

3. Data and Stylized Facts

In this section, we describe the data and provide some stylized facts. We start with the matched employer-employee data (Section 3.1) and then turn to the offshoring indicators (Section 3.2).

3.1 Matched Employer-Employee Data

We use a matched employer-employee data set based on administrative records from the Italian National Social Security Institute (INPS). The data were provided to us by the *Fondazione Rodolfo DeBenedetti*. We merge two data archives containing information on employees and firms, respectively.

From the first archive, we gather information on demographic characteristics (age and province of work), occupations (executives, managers and white-collars, blue-collars, apprentices, other) and daily wages (annual earnings divided by the number of worked days) for a representative sample of workers. The latter consists of all individuals born in four different dates (10th of March, June, September and December) with at least one contract registered at INPS in a given year. We restrict our analysis to full-time workers aged 16 to 65.

The archive contains one observation for each contract registered at INPS in a given year. Hence, for some individuals we observe more than one record in the same time period. In these cases we proceed as follows. When a worker has a plurality of positions within the same firm-occupation-province cell, we aggregate these contracts and use total earnings across all positions to construct the wage variable. When instead a worker has a plurality of positions in the same firm, but in different occupations and/or provinces, we use total earnings across all positions and consider the occupation/province of the longest job. Finally, for workers employed in more than one firm, we consider the longest job. If two positions have equal duration, we consider the one in which the worker has earned the highest wage.

From the second archive, we gather information on the characteristics of the firms in which these workers are employed. In particular, we source data on size (number of employees), organizational structure (single firm, parent firm, subsidiary) and industry of activity. After merging the two archives, we are left with about 100,000 individuals and 60,000 firms per year. The time span of the data is 1998-2002. Table 1 shows the available number of individuals and firms in each period, both for the whole sample and for the manufacturing and services sectors separately.

Table 2 reports summary statistics on the variables used in our analysis. Panel a) contains information on worker characteristics. On average, workers are 36-year old, with individuals employed in the services sector or in white-collar occupations being slightly older. The average daily wage is 74 Euro, with substantial variation across skill groups and sectors: as expected, wages are higher for white-collar occupations (99 Euro) and for services jobs (77 Euro). As for gender, 37% of workers are female. Women are more prevalent in the services sector (42%) and in white-collar occupations (47%) . Regarding the occupational and sectorial composition of the sample, roughly 40% of individuals are employed in white-collar jobs and 54% in the services sector. Turning to the firm characteristics, panel b) shows that the average firm has 71 employees. About half of the firms are in services, and their average size is slightly greater than that of manufacturing enterprises (74 vs. 67 employees). Finally, 80% of the firms are single-plant (i.e., they do not belong to any group); out of the remaining firms, 12% are parent companies and 8% subsidiaries.

3.2 Offshoring Indicators

We combine the matched employer-employee data with industry-specific indicators of service offshoring. The two data sets can be merged at the level of 17 broad industries, defined according to the ATECO81 classification. As shown in Table A1, these industries span the entire manufacturing and private services sectors in Italy.

Following Amiti and Wei (2005, 2006, 2009) and Crinò (2010b, 2012a,b), we proxy for service offshoring using the share of imported private services in total input purchases. The intuition behind this indicator is the following: the output of offshored services needs to be imported in Italy to be combined with other inputs in production; accordingly, this indicator is higher the higher is the intensity of service offshoring. The lack of service import data at the industry-level has typically complicated the construction of this variable. Amiti and Wei (2005, 2006, 2009) have therefore proposed to use estimates based on Input-Output tables and data on service imports at the economy-wide level. However, ISTAT has recently released detailed Import Matrices containing official information on the imports of individual services in each industry. We exploit these matrices to build up the offshoring measures used in our analysis.

For each industry in our sample, the Import Matrices report imports of four different services: finance and insurance, computing and information, R&D, and business services. We denote these imports by M_{sht}, where s indicates one of the four services, h indexes industries, and t denotes years. Summing imports across the four services, we obtain total service imports at the industry-level:

$$MS_{ht} = \sum_{s=1}^{4} M_{sht}.$$

Finally, we normalize MS by the total purchases of intermediate inputs in each industry - denoted by I - which we source from the Use Matrices of the Input-Output accounts. This yields our aggregate proxy for service offshoring:

$$SOS_{ht} = \frac{MS_{ht}}{I_{ht}}.$$

To study heterogeneity across types of services, we complement this variable with four disaggregate indicators of offshoring, each corresponding to one of the services covered by the Import Matrices. In particular, we construct the following variables:

$$SOS\_FI_{ht} = \frac{M_{FI,ht}}{I_{ht}}, \quad SOS\_CI_{ht} = \frac{M_{CI,ht}}{I_{ht}},$$

$$SOS\_RD_{ht} = \frac{M_{RD,ht}}{I_{ht}}, \; SOS\_BS_{ht} = \frac{M_{BS,ht}}{I_{ht}},$$

where FI, CI, RD and BS stand for finance and insurance, computer and information, R&D, and business services, respectively.

In some of the regressions, we also control for material offshoring, defined as the foreign relocation of production activities. Following Feenstra and Hanson (1996, 1999, 2003), we measure material offshoring using the share of imported intermediates in total input purchases. To construct this variable - labeled MOS - we use the same approach as above. Also in this case, we draw information on industry-level imports from the Import Matrices and on total intermediate inputs from the Use Tables.

Table 3 contains summary statistics on the offshoring variables. Panel a) reports figures for the manufacturing sector and panel b) figures for the services sector. Each panel contains information on the aggregate offshoring proxy (SOS), on the disaggregate offshoring indicators (SOS_FI, SOS_CI, SOS_RD and SOS_BS) and on the material offshoring variable (MOS). The first two columns contain the mean and standard deviation of each indicator for both sectors. The three remaining columns show the change in each variable (on average for each sector) between the endpoints of our sample.

Service offshoring is still a limited phenomenon in Italy: on average, it accounts for 1.6% of total input purchases between 1998 and 2002. Not surprisingly, figures are higher for the services sector (1.9%) than for the manufacturing sector (1.5%). In comparison, material offshoring is quantitatively more important: it accounts for 22% of total input purchases on average, 26% in manufacturing and 3% in services. This pattern is similar to that documented for the U.S. and other European countries (Crinò, 2010b, 2012a,b). Our sample period is also characterized by limited growth in offshoring. Specifically, service offshoring has remained fairly constant both in manufacturing and in services. Material offshoring has instead increased slightly in manufacturing and remained stable in services.

The aggregate figures mask substantial heterogeneity across individual services. The bulk of offshoring consists of business services: they account for more than half of total service offshoring both in the manufacturing and in the services sector. The second most important categories are financial services and information services, which jointly make 40% of service offshoring in manufacturing and 35% in services. R&D offshoring is instead more limited, accounting for 6% of service offshoring in manufacturing and for 2% in the services sector.

Table 4 - sourced from Crinò (2012a) - provides information on the geographical origin of service imports. In particular, the table reports the shares of intra-EU27 and extra-EU27

imports, based on data from Eurostat. The geographical data are available only for recent years, so the table refers to 2007. The group 'All services' includes total service imports. The majority of import flows come from other European economies. Specifically, 63% of imports originate in the EU27. Moreover, most of the imports originating outside the region come from other European countries. North America and Asia account for smaller, yet non-negligible, shares (9% and 8%, respectively). The picture is similar across the individual services, although the share of North America is noticeably higher for R&D and information services.

4. Empirical Model

Our empirical model is borrowed from recent work of Hummels et al. (2011). Inspired by that paper, we estimate several variants of the following wage regression:

$$\ln w_{ijht} = \alpha_{ij} + \alpha_t + \beta_1 \Gamma_{ht} + \theta' \mathbf{\Theta}_{it} + \omega' \mathbf{\Omega}_{jt} + \lambda' \mathbf{\Lambda}_{ht} + \varepsilon_{ijht}, \qquad (1)$$

where i indexes individuals, j firms, h industries and t years. w denotes daily wages.[4] α_t are year fixed-effects. Γ_{ht} is one of our measures of service offshoring. $\mathbf{\Theta}_{it}$ is a vector of individual characteristics including age, age squared and a full set of occupation dummies (executives, managers and white-collar, blue-collar, apprentices and other occupations). $\mathbf{\Omega}_{jt}$ is a vector of firm characteristics including size (log number of employees) and a full set of dummies for Italian administrative regions. $\mathbf{\Lambda}_{ht}$ is a vector of industry characteristics whose content varies across specifications (see below). Importantly, the specifications always include worker-firm fixed-effects, α_{ij}. Hence, the coefficient β_1 measures the effect of service offshoring within job spells, i.e. for workers employed in the same firm for two or more years.[5]

We start by estimating the model with $\Gamma_{ht} = SOS_{ht}$. This benchmark specification yields the average effect of service offshoring on workers' wages. Next, we interact Γ_{ht} with a dummy for non-production workers (i.e., executives plus managers and white-collar employees), in order to study how service offshoring affects individuals with high and low skill levels. Finally, we let Γ be a vector containing the four disaggregate indicators of service offshoring, in order to investigate whether the foreign relocation of different services has different effects on workers' wages. Since offshoring varies at the industry-level while wages are defined at the worker-level, we correct the standard errors for clustering within industries (Moulton, 1990).

5. Results

This section presents the estimation results. We start by discussing the findings obtained with the aggregate indicator of service offshoring (Section 5.1). Then, we present the results obtained by distinguishing workers in two categories of high-skill and low-skill employees (Section 5.2). Finally, we discuss the findings obtained by disaggregating the offshoring variable in separate indicators for individual services (Section 5.3).

5.1 Service Offshoring and Workers' Wages

Table 5 reports the first set of results. To begin with, we estimate eq. (1) including only job spell and year fixed-effects. The results of this benchmark specification are reported in column (1). The coefficient on service offshoring is negative but imprecisely estimated. Since the dependent variable is expressed in logarithms while service offshoring is measured in percentages, the parameter β_1 gives the semielasticity of wages with respect to service offshoring. Hence, the point estimate in column (1) implies that a 1 percentage point (p.p.) increase in SOS lowers individual wages by 0.04%. Given that service offshoring is less than 2% in our sample and has remained fairly constant between 1998 and 2002, the economic magnitude of this effect is quite small, let alone statistically insignificant.

In column (2), we enrich the specification by adding the controls for individual characteristics, $\mathbf{\Theta}_{it}$. The age coefficients suggest that the earning profile of Italian workers is increasing and concave in age. The occupational dummies also have the expected sign, as they suggest that all occupational groups have lower wages than the executives, our reference category. More importantly, controlling for individual characteristics leaves the results for service offshoring essentially unchanged. The coefficient β_1 is still negative, but is also imprecisely estimated and small in size.

Next, we include the vector of controls for firm characteristics, $\mathbf{\Omega}_{jt}$. The results are reported in column (3). The coefficient on log employment is positive but statistically insignificant, suggesting workers' wages to be weakly increasing in firm size. Also in this case, the main evidence on service offshoring remains largely unaffected: neither the sign nor the size of β_1 show noteworthy changes. Column (4) controls for material offshoring, which may be correlated with SOS and independently affect workers' wages. The coefficient on MOS is negative and precisely estimated, and the estimate of β_1 is now even smaller than in previous specifications.

In column (5), we add the controls for other industry characteristics, $\mathbf{\Lambda}_{ht}$. These include: log output, log number of (full-time equivalent) employees, log capital intensity (gross fixed capital formation divided by employment) and log material intensity (purchases of intermediate inputs per worker); all these variables are sourced from the "STAN Database for Industrial Analysis" (OECD). The results suggest that wages are weakly increasing in industry size, although none of the coefficients on the size indicators is precisely estimated. The results also suggest that higher capital and material intensity are both associated with lower wages, although significantly so only in the case of capital intensity. This is broadly consistent with capital and materials being substitutes for labor in production. Anyway, adding controls for industry characteristics does not cause any noteworthy change in our coefficient of interest, β_1.

The last three columns add proxies for an industry's exposure to international trade. In particular, column (6) controls for log openness, defined as log imports plus exports over output. Column (7) controls for import penetration - defined as log imports over apparent consumption (production plus imports minus exports) - which is likely to be a better proxy for competition from low-wage countries. Finally, column (8) includes log exports and log imports as separate regressors, in order to account for the possibility that different types of trade flows have different effects on individual wages. The results suggest that higher exposure to international trade is detrimental for workers' earnings. Note, indeed, that all of the trade variables enter with the negative sign and that their coefficients are precisely estimated, although only marginally so in the case of exports. Nevertheless, the coefficient β_1 does not change in any appreciable way compared to previous columns.

This first set of results suggests that service offshoring does not exert large negative effects on individual wages. This evidence is in line with that provided by studies using industry- or firm-level data, according to which the labor market effects of service offshoring has so far been moderate in many industrialized economies.

5.2 Service Offshoring and the Skill Premium

Our next step is to study how service offshoring affects the skill premium within firms. To this purpose, we extend eq. (1) by adding an interaction term between SOS and a dummy for non-production workers. The results are reported in Table 6. We start, in column (1), with the benchmark specification without controls (except for job spell and year fixed-effects). Both offshoring terms are negative, and the interaction of SOS with the non-production workers dummy is also precisely estimated. As we show below, however, this latter result is extremely fragile.

In column (2), we add the controls for individual characteristics. The coefficients on these variables are similar to those reported in Table 5, both in terms of sign and in terms of size. More importantly, controlling for individual characteristics substantially changes some of the results for service offshoring. In particular, the interaction term switches sign - from negative to positive - and is now imprecisely estimated. The linear term remains instead negative and insignificant. The point estimates imply that a 1 p.p. increase in service offshoring is associated with a fall of about 0.048% in low-skill wages and about 0.038% in high-skill wages.

Column (3) adds the vector of controls for firm characteristics. The results for firm size are similar to those reported in Table 5. At the same time, the coefficients on service offshoring maintain the same sign as in the previous column, i.e. negative for the linear term and positive for the interaction term, and are also of roughly the same size as before. Both coefficients are again estimated with little precision.

In column (4), we add the proxy for material offshoring. The coefficient on MOS is negative and similar in size to that reported in Table 5. Regarding service offshoring, the coefficients on the linear and interaction terms still have the opposite sign and are statistically insignificant. In column (5), we further extend the specification by including the controls for other industry characteristics. The proxies for industry size enter with positive coefficients, although none of them is precisely estimated. The proxies for material and capital intensity enter instead with negative coefficients, although only that on capital intensity is statistically significant. Controlling for industry characteristics potentially correlated with service offshoring does not change the signs of the coefficients on SOS. Now, however, the interaction term is precisely estimated at conventional significance levels.

The remaining columns include controls for international trade: trade openness in column (6), import penetration in column (7), export and import flows in column (8). Similarly to Table 5, all of these variables enter with negative coefficients and the estimates are also statistically significant. This confirms the previous result that an industry's exposure to foreign competition may cause some reductions in individual earnings. The coefficients on service offshoring still have the opposite sign. Moreover, the parameter associated with the interaction term is precisely estimated also in this case.

Overall, this second set of results suggests that service offshoring may contribute to increasing the wage gap between high-skill and low-skill workers. Nevertheless, the economic magnitude of the effect is not large. This confirms the evidence emerging from previous studies on service offshoring and the skill composition of labor demand (Crinò, 2010a,b, 2012a,b; Geishecker and Görg, 2012). In keeping with those studies, our results suggest that imported services tend to substitute for less skilled workers and to complement with more skilled

workers, thereby resulting in a widening of the wage gap within firms. Also in our case, this effect turns out to be quite moderate.

5.3 Offshoring of Individual Services and Workers' Wages

Our last step is to investigate how the foreign relocation of specific services affects workers' wages. To this purpose, in Table 7 we modify eq. (1) by replacing SOS with the four disaggregate indicators explained in Section 3.2. Column (1) contains a baseline specification including only the year and job spell fixed-effects. The coefficients on SOS_FI, SOS_CI and SOS_RD are all small and imprecisely estimated. On the contrary, the coefficient on SOS_BS is negative and marginally significant (at the 10.6% level). The point estimate implies that a 1 p.p. increase in business services offshoring reduces workers' wages by about 0.13%. Hence, the effects of service offshoring are heterogeneous across activities, and the largest impact is exerted by offshoring of business services, which constitutes the bulk of service offshoring in Italy.

Column (2) includes the controls for individual characteristics. These variable behave similarly to previous tables, and their inclusion does not change the results on service offshoring. In particular, the coefficient on SOS_BS is negative and statistically significant, while those on the other indicators are small and estimated with little precision. In column (3), we control for firm characteristics. In line with our previous results, firm size is positively (though insignificantly) associated with workers' wages. Adding controls for firm characteristics does not affect our coefficients of interests in any appreciable way. Indeed, the results still imply business services offshoring to be associated with lower wages and the other types of offshoring to be largely uncorrelated with individual earnings.

In column (4), we control for material offshoring. As in previous tables, the coefficient on MOS is negative. Its inclusion causes a slight drop in the coefficient on SOS_BS and an increase in the coefficient on SOS_CI. Overall, however, controlling for material offshoring does not substantially alter the qualitative pattern of our results. Column (5) adds the remaining industry characteristics. Also in this case, industry output is weakly positively associated with workers' wages, whereas the factor intensities are weakly negatively correlated with individual earnings. The results for service offshoring are largely unchanged also in this very demanding specification. In particular, we still find business services offshoring to be associated with lower wages within the firm, and the other types of service offshoring to be largely orthogonal to workers' earnings.

Finally, columns (6)-(8) add the controls for international trade. The results for these variables are broadly consistent with those reported in the previous tables, although the estimates are somewhat less precise. Also in this case, greater exposure of an industry to international trade is associated with lower wages. As for service offshoring, the coefficients are unchanged, both in terms of sign and in terms of size. Hence, controlling for other variables related to trade openness and foreign competition does not overturn our previous findings, according to which business services offshoring leads to some reduction in workers' wages, whereas the foreign relocation of other services has essentially no impact on individual earnings.

6. Conclusion

In this paper, we have studied how service offshoring affects workers' wages in Italy. To this purpose, we have constructed a novel data set combining information from two different sources: (1) matched employer-employee data released by INPS; and (2) industry-level indicators of service offshoring based on Import Matrices released by ISTAT. Using this data set, we have estimated worker-level wage regressions controlling for a wealth of characteristics of the individual, the firm and the industry.

In keeping with a growing literature using aggregate data for individual industries or firms, we have found that service offshoring does not cause significant reductions in workers' wages. We have also found, however, that service offshoring may contribute to widening the wage gap between more and less skilled employees, although this effect tends to be small as well. Finally, we have documented that the effects of service offshoring are heterogeneous depending on the type of activities relocated abroad. In particular, we have found that offshoring of business services exerts moderately negative effects on workers' wages, whereas offshoring of other services has virtually no impact on individual earnings.

Overall, our results corroborate the main message of existing studies, according to which the 'fear of service offshoring' (Amiti and Wei, 2005) is largely exaggerated. They also suggest, however, that specific government policies may help mitigate the adjustment costs faced by specific groups of workers. In particular, strengthening on-the-job training and favoring access to higher education may reduce the potentially negative consequences of service offshoring for low-skill individuals.

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Appendix – tables

Table 1 - Workers and Firms in the Sample

Year	All sample		Manufacturing		Services	
	Workers	*Firms*	*Workers*	*Firms*	*Workers*	*Firms*
1998	94.792	58.197	44.691	28.740	50.101	29.457
1999	94.447	60.227	45.038	29.107	49.409	31.120
2000	100.370	63.317	46.454	29.977	53.916	33.340
2001	102.734	65.022	46.568	30.056	56.166	34.966
2002	104.798	66.017	46.496	30.104	58.302	35.913
Average 1998-2002	99.428	62.556	45.849	29.597	53.579	32.959

Source: Administrative records from INPS.

Table 2 - Descriptive Statistics on the Matched Employer-Employee Data

	All sample		Manufacturing		Services		White-Collar		Blue-Collar	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
a) Workers										
Age	35,9	10,54	35,72	10,56	36,08	10,52	37,4	9,71	34,92	10,93
Daily wage	73,6	429,17	69,56	226,41	77,03	545,81	99,6	623,93	56,39	218,28
Gender: Female	0,37	0,48	0,31	0,46	0,42	0,49	0,47	0,50	0,30	0,46
Occupation: Executives	0,01	0,11	0,01	0,12	0,01	0,10	0,03	0,17	-	-
Occupation: Managers & white-collar	0,39	0,49	0,26	0,44	0,50	0,50	0,97	0,17	-	-
Occupation: Blue-collar	0,54	0,50	0,66	0,48	0,43	0,50	-	-	0,89	0,31
Occupation: Apprentices	0,06	0,24	0,07	0,25	0,05	0,22	-	-	0,10	0,30
Industry: Services	0,54	0,50	-	-	-	-	0,69	0,46	0,44	0,50
b) Firms										
Size (employees)	71,1	591,61	67,5	353,12	74,3	743,18				
Organization: Single firm	0,80	0,40	0,85	0,36	0,76	0,42				
Organization: Parent firm	0,12	0,33	0,10	0,31	0,14	0,35				
Organization: Subsidiary	0,07	0,26	0,05	0,22	0,09	0,29				
Industry: Services	0,53	0,50	-	-	-	-				

Source: Administrative records from INPS.

Table 3 - Descriptive Statistics on the Offshoring Indicators

	Mean	St. dev	1998	2002	change %
a) Manufacturing					
SOS	1,50	1,527	1,51	1,53	0,02
SOS_FI	0,29	0,271	0,30	0,32	0,01
SOS_CI	0,31	0,801	0,28	0,30	0,02
SOS_RD	0,10	0,107	0,11	0,10	-0,01
SOS_BS	0,80	0,518	0,81	0,81	0,00
MOS	26,30	11,572	24,65	26,09	1,44
b) Services					
SOS	1,90	1,437	2,09	1,85	-0,23
SOS_FI	0,46	0,309	0,53	0,50	-0,03
SOS_CI	0,19	0,146	0,18	0,18	0,00
SOS_RD	0,03	0,033	0,04	0,03	-0,01
SOS_BS	1,21	0,989	1,34	1,14	-0,20
MOS	2,84	0,967	2,93	2,66	-0,26

SOS: service offshoring, aggregate; SOS_FI: Finance and insurance; SOS_CI: computer and information; SOS_RD: R&D; SOS_BS: business services; MOS: Material offshoring. Source: ISTAT.

Table 4 - Origin of Service Imports

	Intra-EU27	Extra-EU27	of which:	Other Europe	North America	Latin America	Asia	Africa	Oceania
All Services	62,5	37,5		13,7	8,8	2,4	7,7	4,3	0,6
Other Business Services	71,3	28,7		10,5	7,8	0,7	4,5	4,9	0,3
Computer	82,4	17,6		4,1	10,3	0,1	2,4	0,1	0,6
Finance and Insurance	83,1	16,9		8,0	6,3	0,3	1,7	0,7	0,0
Research and Development	75,0	25,0		10,1	11,5	0,0	3,4	0,0	0,0

Reported figures are the share of each region (indicated in columns) in the total imports of each service category (indicated in rows). *All services* includes imports of all types of services. *Extra-EU27* is computed as total imports minus intra-EU27 imports. *Other Europe* is computed as Extra-EU27 imports minus the sum of imports from the other regions. Data refer to the year 2007. Source: Crinò (2012a).

Table 5 - The Effect of Service Offshoring on Wages

	Benchmark (1)	**Individual Charact.** (2)	**Firm Charact.** (3)	**Material Offsh.** (4)	**Industry Charact.** (5)	**Openness** (6)	**Import Penetration** (7)	**Exports & Imports** (8)
SOS	-0.042	-0.044	-0.043	-0.022	-0.065	-0.052	-0.061	-0.046
	[0.031]	[0.029]	[0.029]	[0.029]	[0.040]	[0.038]	[0.042]	[0.041]
age		0.085***	0.084***	0.085***	0.084***	0.084***	0.085***	0.085***
		[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]
age2		-0.001***	-0.000***	-0.000***	-0.001***	-0.001***	-0.001***	-0.001***
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Occup: Managers		-0.126**	-0.126**	-0.125**	-0.105**	-0.105**	-0.105**	-0.105**
		[0.053]	[0.053]	[0.053]	[0.043]	[0.043]	[0.043]	[0.043]
Occup: Blue coll.		-0.165**	-0.165**	-0.164**	-0.140**	-0.140**	-0.140**	-0.140**
		[0.060]	[0.060]	[0.060]	[0.047]	[0.047]	[0.047]	[0.047]
Occup: Apprentices		-0.238***	-0.239***	-0.239***	-0.214***	-0.214***	-0.214***	-0.214***
		[0.052]	[0.053]	[0.053]	[0.036]	[0.036]	[0.036]	[0.036]
Occup: Others		-0.041	-0.037	-0.036	-0.009	-0.009	-0.009	-0.009
		[0.085]	[0.083]	[0.083]	[0.072]	[0.072]	[0.072]	[0.072]
Employees			0.005	0.004	0.003	0.003	0.003	0.003
			[0.004]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]
MOS				-0.002**	-0.001	-0.001	-0.001	-0.001
				[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Production					0,083	0,084	0,096	0,123
					[0.167]	[0.137]	[0.150]	[0.136]
Full-time equivalent					0.047	-0.037	-0.024	-0.075
					[0.135]	[0.146]	[0.134]	[0.146]
Capital intensity					-0.024***	-0.024***	-0.022***	-0.023***
					[0.006]	[0.007]	[0.006]	[0.007]
Material intensity					-0.106	-0.118	-0.141	-0.135
					[0.115]	[0.113]	[0.120]	[0.121]
Openness						-0.028**		
						[0.011]		
Import penetration							-0.031***	
							[0.010]	
Exports								-0.022*
								[0.011]
Imports								-0.026***
								[0.008]
Observations	497,141	497,141	496,024	496,024	417,016	417,016	417,016	417,016
R-squared	0.070	0.075	0.075	0.075	0.079	0.079	0.079	0.079
Groups	208,814	208,814	208,249	208,249	176,335	176,335	176,335	176,335

The dependent variable is log daily wages. All specifications control for worker-firm and year fixed effects. Standard errors reported in round brackets are corrected for clustering within industry. ***, ** and * denote significance at the 1, 5 and 10 percent level, respectively.

Table 6 - The Effect of Service Offshoring on the Skill Premium

	Benchmark	Individual Charact.	Firm Charact.	Material Offsh.	Industry Charact.	Openness	Import Penetration	Exports & Imports
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SOS	-0.031	-0.048	-0.047	-0.026	-0.069	-0.056	-0.065	-0.050
	[0.028]	[0.030]	[0.030]	[0.030]	[0.041]	[0.039]	[0.043]	[0.041]
SOS×wc	-0.025***	0.010	0.010	0.009	0.014*	0.014*	0.013*	0.013*
	[0.007]	[0.008]	[0.008]	[0.008]	[0.007]	[0.007]	[0.006]	[0.006]
age		0.085***	0.084***	0.085***	0.084***	0.084***	0.085***	0.085***
		[0.004]	[0.004]	[0.004]	[0.003]	[0.004]	[0.003]	[0.004]
age2		-0.001***	-0.000***	-0.000***	-0.001***	-0.001***	-0.001***	-0.001***
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Occup: Managers		-0.126**	-0.126**	-0.126**	-0.105**	-0.105**	-0.105**	-0.105**
		[0.053]	[0.053]	[0.053]	[0.043]	[0.043]	[0.043]	[0.043]
Occup: Blue coll.		-0.179***	-0.178***	-0.176***	-0.160***	-0.160***	-0.158***	-0.159***
		[0.059]	[0.059]	[0.059]	[0.039]	[0.039]	[0.039]	[0.039]
Occup: Apprentices		-0.251***	-0.253***	-0.251***	-0.234***	-0.234***	-0.233***	-0.233***
		[0.052]	[0.053]	[0.053]	[0.028]	[0.028]	[0.029]	[0.029]
Occup: Others		-0.053	-0.049	-0.047	-0.027	-0.026	-0.025	-0.026
		[0.083]	[0.081]	[0.081]	[0.064]	[0.063]	[0.064]	[0.064]
Employees			0.005	0.005	0.003	0.003	0.003	0.003
			[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]
MOS				-0.002**	-0.001	-0.001	-0.001	-0.001
				[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Production					0.118	0.120	0.137	0.174
					[0.167]	[0.138]	[0.151]	[0.136]
Full-time equivalent					0.053	-0.032	-0.017	-0.068
					[0.134]	[0.146]	[0.134]	[0.145]
Capital intensity					-0.024***	-0.024***	-0.022***	-0.023***
					[0.007]	[0.007]	[0.006]	[0.007]
Material intensity					-0.101	-0.112	-0.135	-0.129
					[0.114]	[0.112]	[0.118]	[0.119]
Openness						-0.028**		
						[0.011]		
Import penetration							-0.030**	
							[0.010]	
Exports								-0.022*
								[0.011]
Imports								-0.024***
								[0.008]
Observations	497,141	497,141	496,024	496,024	417,016	417,016	417,016	417,016
R-squared	0.071	0.075	0.075	0.075	0.079	0.079	0.079	0.079
Number of groups	208,814	208,814	208,249	208,249	176,335	176,335	176,335	176,335

The dependent variable is log daily wages. All specifications control for worker-firm and year fixed effects. Standard errors reported in round brackets are corrected for clustering within industry. ***, ** and * denote significance at the 1, 5 and 10 percent level, respectively.

Table 7 - The Effect of Service Offshoring on Wages: Disaggregate Indicators of Service Offshoring

	Benchmark	**Individual Charact.**	**Firm Charact.**	**Material Offsh.**	**Industry Charact.**	**Openness**	**Import Penetration**	**Exports & Imports**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
SOS_FI	0.017	0.023	0.022	0.005	-0.061	-0.040	-0.061	-0.042
	[0.066]	[0.053]	[0.052]	[0.047]	[0.074]	[0.074]	[0.075]	[0.074]
SOS_RD	0.041	0.045	0.053	0.056	-0.031	-0.058	-0.037	-0.068
	[0.113]	[0.100]	[0.100]	[0.087]	[0.086]	[0.098]	[0.093]	[0.101]
SOS_CI	0.026	0.036*	0.036*	0.094***	0.007	0.008	0.006	0.007
	[0.020]	[0.020]	[0.019]	[0.027]	[0.028]	[0.028]	[0.026]	[0.029]
SOS_BS	-0.133	-0.150*	-0.148*	-0.112	-0.257**	-0.233**	-0.254**	-0.220**
	[0.078]	[0.075]	[0.074]	[0.069]	[0.085]	[0.080]	[0.087]	[0.080]
age		0.083***	0.083***	0.084***	0.088***	0.088***	0.088***	0.088***
		[0.003]	[0.003]	[0.003]	[0.005]	[0.005]	[0.005]	[0.005]
age2		-0.001***	-0.000***	-0.000***	-0.001***	-0.001***	-0.001***	-0.001***
		[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Occup: Managers		-0.126**	-0.126**	-0.125**	-0.104**	-0.104**	-0.104**	-0.104**
		[0.053]	[0.053]	[0.053]	[0.042]	[0.042]	[0.042]	[0.042]
Occup: Blue coll.		-0.165**	-0.164**	-0.164**	-0.139**	-0.139**	-0.139**	-0.139**
		[0.060]	[0.060]	[0.060]	[0.046]	[0.046]	[0.046]	[0.046]
Occup: Apprentices		-0.238***	-0.240***	-0.239***	-0.214***	-0.214***	-0.214***	-0.214***
		[0.052]	[0.053]	[0.053]	[0.036]	[0.036]	[0.036]	[0.036]
Occup: Others		-0.041	-0.037	-0.037	-0.008	-0.008	-0.008	-0.008
		[0.085]	[0.083]	[0.083]	[0.071]	[0.071]	[0.071]	[0.071]
Employees			0.004	0.004	0.003	0.003	0.003	0.003
			[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]
MOS				-0.003***	-0.002*	-0.001*	-0.002**	-0.001**
				[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Production					0.104	0.106	0.105	0.131
					[0.142]	[0.126]	[0.140]	[0.128]
Full-time equivalent					-0.095	-0.140	-0.098	-0.138
					[0.182]	[0.183]	[0.180]	[0.181]
Capital intensity					-0.023***	-0.023***	-0.023***	-0.022***
					[0.005]	[0.006]	[0.006]	[0.006]
Material intensity					-0.194	-0.198	-0.196	-0.197
					[0.171]	[0.168]	[0.170]	[0.167]
Openness						-0.019**		
						[0.008]		
Import penetration							-0.002	
							[0.012]	
Exports								-0.014*
								[0.007]
Imports								-0.009
								[0.010]
Observations	497,141	497,141	496,024	496,024	417,016	417,016	417,016	417,016
R-squared	0.071	0.075	0.076	0.076	0.079	0.079	0.079	0.079
Number of groups	208,814	208,814	208,249	208,249	176,335	176,335	176,335	176,335

The dependent variable is log daily wages. All specifications control for worker-firm and year fixed effects. Standard errors reported in round brackets are corrected for clustering within industry. ***, ** and * denote significance at the 1, 5 and 10 percent level, respectively.

Table A1 - Industries Used in the Analysis

Code	Description
15-16	Food, beverage and tobacco
17-19	Textiles, apparel, leather, leather prod.
20,36	Wood and cork
21-22	Pulp, paper, publishing
23-24	Chemicals
25	Rubber and plastics
28	Fabricated metal products
29	Machinery
30	Office machinery and computers
31	Electrical machinery and apparatus nec
32-33	Communication equipment, medical, precision and optical instruments
34	Motor vehicles
35	Other transport equipment
37	Manufacturing, nec
50-52, 70-72, 74	Wholesale and retail trade, real estate, business activities
60-63	Transport and storage
64	Post and telecommunication

Notes

[1] We thank *Fondazione Rodolfo DeBenedetti* for generously providing us with the worker-level data used in this paper. The usual disclaimer applies.

[2] Service offshoring refers to the foreign relocation of service activities through either foreign direct investment or arm's length contracts with unaffiliated foreign suppliers (Helpman, 2006).

[3] A few other papers have used the same worker-level data employed in this study to analyze the effects of trade openness on individual wages (see e.g. Falzoni et al., 2011). Our focus in not on trade in final goods but on service offshoring, a less studied phenomenon in the Italian context.

[4] Daily wages are the ratio of yearly wages (including bonuses) over the number of worked days. Results using yearly wages are qualitatively similar. Weekly and hourly wages cannot be computed using our data, as the number of weeks reported in social security registers is not completely reliable and the number of hours is not recorded.

[5] Worker-firm observations lasting only one year are excluded from the sample.

Sommario

Il paper analizza gli effetti dell'*offshoring* di servizi sui salari dei lavoratori italiani. L'analisi si basa su un nuovo dataset costruito combinando due differenti fonti di informazioni: dati amministrativi rilasciati dall'Istituto Nazionale di Previdenza Sociale (INPS), che permettono di collegare i lavoratori ai rispettivi datori di lavoro (linked employer-employee data), e indicatori settoriali di *offhsoring* derivati dalle matrici Input-Output pubblicate dall'Istituto Nazionale di Statistica (ISTAT).

L'analisi empirica si propone di valutare l'effetto dell'*offshoring* di servizi sui salari dei lavoratori italiani, controllando opportunamente per le caratteristiche rilevanti dei lavoratori, delle imprese e dei settori di appartenenza. L'analisi mostra che l'*offshoring* di servizi non ha causato riduzioni significative dei salari. Tuttavia, esso contribuisce ad ampliare la disuguaglianza salariale tra lavoratori maggiormente qualificati e lavoratori meno qualificati. Infine, si riscontrano effetti diversi secondo il tipo di servizi delocalizzati all'estero: l'*offshoring* di servizi professionali ha infatti effetti moderatamente negativi sui salari dei lavoratori, mentre l'esternalizzazione di altre tipologie di servizi mostra un impatto trascurabile.

Abstract

We study the effects of service offshoring on the wages of Italian workers. To this purpose, we build up a novel data set combining information from two different sources: (1) matched employer-employee data based on administrative records from the Italian National Social Security Institute; and (2) industry-level indicators of service offshoring based on Import Matrices released by the Italian Statistical Office. We estimate worker-level wage regressions controlling for a number of employee, firm and industry characteristics. In line with previous studies, we find that service offshoring does not cause significant reductions in workers' wages. We also find, however, that service offshoring contributes to widening the wage gap between more and less skilled employees. Finally, we document heterogeneity in the effects of service offshoring depending on the type of activities relocated abroad. Specifically, our results show that offshoring of business services exerts moderately negative effects on workers' wages, whereas offshoring of other services has virtually no impact on individual earnings.

Nota biografica sugli autori

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Elisa Borghi è assegnista di ricerca presso l'Università Carlo Cattaneo – LIUC. Ha conseguito il Dottorato di Ricerca in Scienze Economiche presso l'Università degli Studi di Milano e la laurea quadriennale in Economia delle Istituzioni e dei Mercati Finanziari presso l'Università Commerciale L. Bocconi. La sua ricerca si concentra principalmente sugli effetti della globalizzazione sul mercato del lavoro, con particolare interesse per le conseguenze di riallocazione del lavoro, di disoccupazione e sugli effetti di benessere. Un altro campo di ricerca riguarda gli effetti della qualità istituzionale sulla performance delle imprese.

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Biographical sketch

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Elisa Borghi is post-doc fellow at Università Carlo Cattaneo – LIUC. She holds a Ph.D. in Economics from the University of Milan, and a B.A. in Economics and Finance from Bocconi University. Her research deals mainly with the effects of globalisation on labour markets, with a focus on job reallocation, unemployment and welfare outcomes. Another field of research is the role of institution quality in determining firms' performance.

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