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Firing and Subcontractors? Spillover Employment Effects of Offshoring in Italy

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by

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Abstract

Using firm-level data for Italy, we address the employment consequences of international production offshoring.
We concur with previous literature that offshoring firms' individual employment performances are no worse than at matching non-offshoring firms. However, offshoring might impart negative spillover effects on subcontracting firms, and this indirect effect might be felt particularly in Italy's industrial structure (small-sized networked enterprises). To study this, we group firms within their typical subcontracting clusters, identify high-offshoring clusters and compare them with a matching low-offshoring sample. The evidence that employment performances worsen in the productive clusters with high-offshoring supports our conjecture.

JEL Classification numbers: F23, D21
Keywords: international outsourcing, multinational firms, employment effects, propensity score matching, difference-in-differences.

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1. INTRODUCTION

This paper addresses the employment effects of international production offshoring (henceforth, offshoring) building on a firm-level database compiled at ISAE on the basis of two ad-hoc surveys run in May 2003 and April 2005. First, we study the effects of offshoring directly on employment levels of offshoring firms. Next, we investigate whether offshoring has an indirect impact on employment as well via spillover effects from offshoring companies to subcontracting firms.

Previous studies investigated only the direct occupational consequences at offshoring firms per se. We make a contribution by addressing the possible spillover effects on employment exerted by offshoring. Specifically, we posit that considering only the employment performance at offshoring firms per se is incomplete, if not potentially misleading. Offshoring firms may, in fact, discontinue their commercial relations with (some) domestic subcontractors. In turn, the employees bearing the brunt might be those of subcontracting firms rather than those employed directly at offshoring firms.

While these spillover effects may be at work in any country, it could be easier to identify them in an economy like Italy, populated by a myriad of networked small and medium-sized enterprises (SMEs). The occupational impact of offshoring at large enterprises might be limited within the individual company – possibly shifting labor across different mother company's departments and/or group affiliates. On the contrary, in a system of networked SMEs, the bulk of unskilled labor intensive phases of production are already outsourced to subcontracting firms, which may be the heaviest bitten by offshoring. For this reason, our analysis tries to uncover also the occupational consequences of offshoring for entire productive clusters, including both subcontracting firms and offshoring companies per se. As we will see, our results detect a non-trivial indirect impact of offshoring on cluster-level employment levels.

In the rest of the paper, Section 2 sketches a brief survey of the relevant literature. Section 3 is devoted to illustrate our database, and display some descriptive evidence. In Section 4, we perform our econometric analyses and present the related results. Section 5 draws to a close by discussing policy implications and research avenues for the future.

2. RELEVANT LITERATURE

In the last decade, a boom in theoretical and empirical literature on the domestic effects of international production offshoring (henceforth, "offshoring") followed the political and social concerns that relocating (part of) business abroad depletes employment and worsens performance at home.

In this respect, theoretical works outlined the features, rationale and likely effects of offshoring, but their arguments are not conclusive. A very general (and popular) view states that whether firms opt for vertical or horizontal investment abroad, activities at home can be affected positively or negatively, depending on: *a)* the intensity of technological integration between the activities at home and those moved abroad (in case of vertical investments), and *b)* whether the foreign and domestic productions are complements or substitutes (in case of horizontal investments). Barba Navaretti and Venables (2004) provide a comprehensive discussion on this subject. Not surprisingly, then, economic debates are mostly on the empirical ground.

The effects of offshoring on domestic activities and performance of firms investing abroad is one of the most debated issues. For example, Tomiura (2007) finds that among

Japanese manufacturing firms, foreign outsourcers and exporters tend to be less productive than firms active in Foreign Direct Investment (FDI), but more productive than domestic firms. Other studies tackle labor market consequences. Using Italian data for 1985-1995, Mariotti *et al*. (2003) find that outward FDI reduces the labour intensity of domestic production in case of vertical investment in less developed countries, while increasing it in case of horizontal (market-seeking) investment in advanced countries. Head and Ries (2002), again on manufacturing data for Japan, show that FDI in low-income countries enhances domestic skill intensity.

In a way closer to our paper, other authors deal with the "jobs creation *vs.* depletion" issue. Brainard and Riker (1997) find only a partial substitution between employment in a firm's foreign affiliates and the parent at home, suggesting that domestic employment performance of the multinationals need not worsen after offshoring. Other studies show that a substitution relationship would emerge for affiliates in developed countries (e.g. Konings and Murphy 2006). According to Amiti and Wei (2005), offshoring led to job losses in the U.K. during the period 1995-2001 neither in manufacturing nor the services sectors. On Irish data, Görg *et al.* (2004) detect a positive effect of offshoring particularly for large firms and for those based in broader international exports.

The likely positive effects of offshoring on firm performance at home have been confirmed by an important strand of literature focusing on the construction of a proper counterfactual for the firms venturing into offshoring, to which the performance after offshoring is compared. For instance, Barba Navaretti and Castellani (2004), construct a counterfactual focusing on the Italian firms investing abroad for the first time and carry out a difference-in-difference estimate to assess the issue (see also Egger and Pfaffermayr 2003, for a similar analysis on Austrian firms, and Barba Navaretti *et al*. 2005, for the case of France). Then, they show that the net effects of outward investments on the domestic business are positive both in terms of total factor productivity and output growth, while investing abroad has no significant effect on the rate of employment growth[1].

Our paper belongs to this strand of literature, but adds a new perspective. Indeed, the mentioned studies deal with the offshoring effect on the performance of investing firms per se. However, as stated above, this cannot be the end of the story where manufacturing firms appear "networked" via close commercial links. Here, non-offshoring firms' performance may well be affected by the outward investment by other firms in the production chain.[2] In particular, the effects of offshoring on the employment of the whole productive chain may substantially differ from those measured at the offshoring firms per se.

This is a novel insight in the literature. To capture the impact of offshoring throughout the whole productive chain a firm operates in (i.e. something representing networked production more closely than the official classification of sectors), we use the 16 "clusters" classifying Italian manufacturing industries (Iuzzolino 2005). These clusters are the result of aggregating firms' activities based on the production and territorial links among them,

[1] From a different angle – i.e. focusing on the impact in host country rather than at home – Girma and Görg (2007) use the difference-in-difference propensity score matching estimators to investigate the effects of a foreign acquisition on wages in the domestic target. They show that in the UK the impact of a takeover of domestic establishment by foreign owners depends also on the nationality of the acquirer (it is more sizable if the acquirer is from the USA as opposed to the EU) and the skill group of workers (it is positive both for skilled and unskilled workers, but only if the acquirer is a US multinational).

[2] We will interchangeably use the terms "production chain" and "cluster".

which, in turn, are drawn from the input-output matrices and taking into account the distribution of employees within Italy (for more details, see Appendix I).

3. DATA AND DESCRIPTIVE EVIDENCE

3.1. The data

ISAE carries out monthly surveys on a panel of over 4,000 Italian manufacturing and extractive firms with no less than 10 employees. The ISAE sample is proportional to the universe, layered by regions, sectors, and firm size. It covers about 4% of the reference universe, that is the set of the ISTAT ASIA archive. ISAE surveys are in keeping with the European harmonized scheme.

In this context, in May 2003 and March 2005 ISAE carried out two *ad hoc* surveys on manufacturing firms' propensity to venture into offshoring (the offshoring section of the 2005 questionnaire is available on line in Costa and Ferri 2007). The sub-sample of manufacturing firms responding to both surveys drops to 3,115 observations. Moreover, to focus specifically on manufacturing and to make our model more robust, we dropped those observations relating to non-manufacturing, as well as those for which some crucial variables reported missing values. By doing so, the final sample is a balanced panel of 2,419 firms.

3.2. Descriptive evidence

Referring to 2005, offshoring regards 3.7% of our sample, in terms of number of firms, and 6.0% in terms of the domestic employee share of the sample. The noticeable difference between the two figures depends on the fact that offshoring is more widespread among lager-sized companies (Table 1 – upper panel).

[Table 1 here]

Naturally, the most interesting question is whether offshoring firms – while creating jobs abroad – shed jobs at home. We can observe this from two different angles: *a)* a "short-term angle", by looking at firms offshoring between 2003 and 2005; *b)* a "medium-term angle", by focusing on the companies which had already offshored in 2003 (and confirmed to be offshoring in 2005).

As to the short-term impact, we notice that employees in Italy of the companies which venture into offshoring between 2003 and 2005 decrease on average by 5.3% and the median increases by 0.6% (Table 1 – intermediate panel). As for the non-offshoring firms in the ISAE database, we detect a drop by 1.2% in average employment and a reduction by 4.3% in the median. Therefore, this seems to suggest that in the short term the benefits for the firm in the home country can be controversial as far as employment is concerned, and that we need further and more rigorous analyses on the subject, as we will see in Section 4 below. Regarding the medium-term impact, the descriptive results depict a similar picture: employees in Italy of the companies which were already offshoring in 2003 (and still offshore in 2005) decrease by 6.8%, while the median increases by 0.4%.

In addition, as mentioned, we cannot stop at evaluating the employment performance of offshoring firms, but we need also to investigate the possibility that offshoring companies trigger negative externalities at sub-contracting firms within the productive-chain they operate in. This "indirect" effect should not be overlooked in general and, even more so, in a productive structure like Italy's one, consisting of myriads of networked enterprises.

A first clue on the issue can be gleaned by comparing the average degree of offshoring in each cluster in 2003 (*OFFCL03*)[3] with the employment growth rate of the corresponding cluster between 2003 and 2005 (*DPEMPL*). Only in three clusters the two variables have the same sign, and in the "best performing" clusters (in terms of change in employment) the offshoring is low or nearly absent (Table 1 – lower panel).

4. The firm- and cluster-level employment impact of offshoring

In any case, the mere descriptive evidence derived from the ISAE database offers some insights on the topic in question, but does not allow us to draw with confidence any conclusion about the underlying causal links. To be able to confirm or reject those clues, we need econometric analysis, both at firm and at cluster level.

4.1. The impact of offshoring on the firm's employment

A most of the literature has already pointed out (see, among others, Brouwer *et al*. 2004, Barba Navaretti and Venables 2004, Barba Navaretti and Castellani 2005), from an analytical point of view, assessing the influence of offshoring on firm employment typically implies a counterfactual problem, namely assessing what would have happened to the employment of the firm had this not ventured into offshoring. That is, we need to compare an observable outcome – the performance of offshoring firms – with a non–observable one – the performance of the same firms had they not relocated their activity abroad. The problem is how to approximate the latter. The "natural" candidate is the performance of the non-offshoring firms in the sample, but this would not be acceptable, because the set of these firms cannot be drawn randomly (we are in a "non experimental" field). In fact, the choice as to whether or not to offshore is not random but endogenous, depending on the characteristics of each firm and the context it operates in. This is the so-called "self-selection" problem, that is usually overcome by means of matching methods.

As it is known, the rationale consists in constructing an appropriate counterfactual by matching each "offshoring" firm with a "non-offshoring" companion which had similar structural characteristics and (as a result) a similar *ex-ante* probability of investing abroad, but eventually did not. In other words, we need to identify a set of firms as similar as possible to the observable offshoring ones, apart from the fact that they did not invest abroad. This set of selected non-offshoring firms is then the counterfactual (the so-called "control" group), the performance of the "offshoring" group we have to compare to.

In line with the relevant literature on this subject (e.g. Egger and Pfaffermayr 2003, Barba Navaretti and Castellani 2004, Kraft and Ugarković 2006, Girma and Görg 2007), we applied the propensity score matching procedure.[4] In doing so, from the original sample consisting of 3.115 firms, we constructed a balanced panel of 2.419 observations to exclude missing values.[5]

[3] The mean is weighted by the employees in 2003.

[4] For a comprehensive review of the propensity score matching and its variants, from both a theoretical and practical viewpoint, see Wooldridge (2002), Blundell and Costa Dias (2002), Bryson *et al*. (2002), Dehejia and Wahba (2002), Caliendo and Kopeinig (2005), and Ichino (2006).

[5] In this respect, the most problematic variable is the share of exports in turnover, showing about 230 missing data. However, we performed the matching procedure also on the panel of 2,638 firms, in which the missing

In carrying out the procedure, we first run a probit estimation of the probability of offshoring between 2003 and 2005 (the "propensity score") on the basis of specific structural features, then we matched each offshoring firm to its nearest neighbour in terms of the propensity score, and the resulting set of neighbours is the control group.[6]

The estimate of the propensity score is performed via the following probit regression:

$$\text{Prob}\ (off0305_i=1 \mid emp03_i,\ exp03_i,\ expsq03_i,\ offsec03_j,\ offreg03_r,\ specreg03_{j,p},\ trad_i,\ scal_i,\ spec_i,\ nw_i,\ ne_i,\ ce_i) \quad (1)$$

where: $OFF0305_i$ is a dummy variable indicating whether the firm ventured into offshoring between 2003 and 2005; $EMP03_i$ is the logarithm of the number of employees in 2003 for the firm *i*; $EXP03_i$ is the share of export on firm turnover in 2003; $EXPSQ03_i$ is the square of $EXP03_i$; $OFFSEC03_j$ is the intensity of offshoring in sector *j* (i.e. the logarithm of the share of offshoring firms in the sector *j*, Ateco-3 digit); analogously, $OFFREG03_r$ indicates the intensity of the offshoring phenomenon in region *r* (i.e. the share of offshoring firms in the region); $SPECREG03_{jr}$ expresses the intensity of specialization of the region *r* in terms of employees (i.e. the share of employees of the region *r* employed in industry *j*, Ateco-3 digit); $TRAD_i$, $SCAL_i$ and $SPEC_i$ are three dummy variables following the well-known classification by Pavitt (1984);[7] and NW_i, NE_i, CE_i are three dummies expressing the Italian macro-areas the firm operates in (North-West, North-East and Centre, respectively).

The results are listed in Table 2.

[Table 2 here]

As expected, among the determinants of the choice of relocating production abroad, the firm's size, the share of exports on turnover (a proxy for the "openness" of the firm, with the linear effect prevailing throughout the sample), the intensity of offshoring in the sector all play an important role. We detect also some industry effect: with respect to high tech industries, operating in traditional sectors tends to increase the probability of offshoring. Finally, and somewhat surprisingly, our data fail to capture any significant territorial effect, with the partial exception of the North-Eastern regions, that exhibit a more positive effect on the probability of offshoring than the Southern-Island regions' one.

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values of that variable are obtained by means of a linear interpolation. The final results, for both the *psmatch2* and Becker and Ichino's algorithms (see the following note 8), are in fact reinforced. So are they in the computations of DID and SM estimators.

[6] The matching procedure has been performed using the module *psmatch2* of STATA (version 9). In light of the characteristics of our sample and the limited number of "treated" firms with respect to "untreated" ones, we decided to use the average of the three nearest neighbours with replacement (to reduce the variance of the estimates), impose a caliper of 0.005 (to exclude poor matching) and impose the belonging to a common support for treated and untreated units. Smaller calliper have been excluded because too many treated units were not matched so that the results were not longer representative of the population of the treated (see. Becker and Ichino, 2002). Moreover, for consistency purpose we also replied the analysis using the Radius matching method (which allows for all of the comparison members within the calliper, see Dehejia and Wahba, 2002, and Caliendo and Kopeinig, 2005). The results do not change qualitatively.

[7] Pavitt (1984) classifies manufacturing industries in four categories: *a)* traditional industries; *b)* scale intensive industries; *c)* specialized industries; *d)* high tech industries.

The matching technique helps to insulate the effect of offshoring on employment from these ex-ante factors. Since the counterfactual needs to be as close as possible to the group of "treated" firms, a way to test whether this requirement (the balancing property) is fulfilled consists in comparing the average firm characteristics between the groups before and after the matching. In the latter case, we should observe very smoothed differences. The comparison is shown in Table 3**,** where the characteristics of the firms and the test of the equality in means are reported.

[Table 3 here]

Before the matching, the offshoring (the "treated") firms appear larger and more export-oriented with respect to the non-offshoring ones, and operate in sectors and in regions where the offshoring strategy is more intense. After the matching, on the contrary, the differences are visibly mitigated, and no difference in means between the two groups of firms is significant.

At this point, it is possible to use the matched sample to assess the impact of offshoring on employment dynamics at firm level. To do so we used the standard matching estimator (SM) and the difference-in-difference estimator (DID).

As for the former, it is tantamount to a test for the equality of means over treated and control groups after offshoring (Barba Navaretti and Castellani 2004), and compares the post-offshoring means change in performance between the two groups. In formal terms, assuming that:

OFF_{it} is the indicator of the treatment, which takes value 1 if the firm offshores for the first time at time *t*

$\Delta Y^{1}_{i,t+1}$ is the percentage change, between *t* and *t+1*, in the number of employees in the firm *i* that offshores for the first time at time *t*;

$\Delta Y^{0}_{i,t+1}$ is the corresponding performance of the same firm if it had not offshored (i.e. the counterfactual we needed to estimate),

the SM is given by

$$\hat{\delta}_{SM} = E(\Delta Y^{1}_{t+1} - \Delta Y^{0}_{t+1} \mid OFF_{it} = 1), \tag{2}$$

and it can be estimated applying OLS in the following regression:

$$\Delta Y_i = c + \delta_{SM} T + x_i^{'} \beta + u_i, \tag{3}$$

where T is a dummy variable taking value 1 and 0 in treated and control groups, respectively, and $x^{'}$ is a vector of covariates to control for other possible sources of heterogeneity.

The DID, in turn, compares the mean change in the pre- and post- offshoring performance for the offshoring firms, with the mean change in the performance over the same period for the control group firms. In doing so, it makes it possible to control for unobserved factors that may affect the outcome. Formally, it is given by:

$$\hat{\delta}_{DID} = E(\Delta Y_{t+1}^{1} - \Delta Y_{t-1}^{1} \mid OFF_{it} = 1) - E(\Delta Y_{t+1}^{0} - \Delta Y_{t-1}^{0} \mid OFF_{it} = 0), \tag{4}$$

and it is estimated applying OLS in the following regression:

$$\Delta Y_{it} = c + \gamma_1 T + \gamma_2 P_t + \delta_{DID} PT_t + x_{it}^{'}\beta + u_{it}, \tag{5}$$

where $t = 0,1$ denotes pre- and post- offshoring period, respectively;

T is the aforementioned "treatment" dummy variable;

P is a dummy variable taking value 0 and 1 in pre- and post- offshoring period, respectively;

PT is a dummy variable taking value 1 if T=1 and P=1, and zero elsewhere;

x' is the vector of covariates expressing some structural characteristics of the firm.

In particular, the role of x is to allow to control for factors which can affect the employment other than that of interest. We then run two symmetric pairs of regressions (3) and (5), respectively excluding and including the vector of covariates x. In both cases, bootstrapped standard errors with 500 replications have been computed. The robust estimates are shown in Table 4 below.

[Table 4 here]

These results suggest some considerations. Firstly, both the SM and DID estimators point out that offshoring has a negative effect on firms' occupational performance; the effect of offshoring on firm employment slightly drops in the case of SM but remains unchanged if measured by DID. Moreover, as expected, in the regressions none of the covariates is significant at all. Thus, these results would induces us to conclude that, on the sole basis of the ISAE sample data, in the Italian manufacturing sector the choice to venture into offshoring tends to deplete the employment dynamics at firm level. In 2003, the newly offshoring firms in our sample employed 14,259 employees; therefore, other things being equal, the choice of relocating production abroad is estimated having (directly) involved about 1,000 individuals.

These findings are not strictly in line with current literature, which usually finds a positive impact (see e.g. Görg, Hanley and Strobl 2004) or absence of significant effects (see e.g. Amiti and Wei 2005; Barba Navaretti and Castellani 2004). However, it should be borne in mind that our analysis, taking into account only one offshoring period, essentially focuses on the *short term* occupational effects, and in this case it is possible that the two "conflicting" results are complement rather than substitute for each other. Furthermore, three additional considerations suggest to be prudent: (i) the scarce significance of the DID; (ii) the fact that in both the SM and the DID estimates the significance of the model drops dramatically when we introduce the covariates; (iii) the limited number of "treated" firms (only 55). All in all, we deem this aspect deserves further investigation in the future.

In addition, in spite of all the attention devoted to the employment consequences of offshoring, what the literature may have (so far) neglected is that this issue has not one but two dimensions: the direct impact (just addressed) but also an indirect impact. In other words, as stated above, manufacturing companies are generally tightly linked to a network of subcontracting firms. Hence, the possibility is concrete that, from an occupational point of view, offshoring could heavily affect also the productive chain at large where the offshoring firm belongs. Furthermore, in theory, offshoring could even deliver a "not-so-negative" direct impact at the firm *per se*, helping it to limit job losses, while, at the same time, exerting a negative indirect impact on the firm's productive chain, because of the termination of close trade relationships linking firms' businesses, such as subcontracting and so on.

4.2. The impact of offshoring on the cluster employment

In order to obtain reliable results assessing the *indirect* occupational effect of offshoring, we carried out a new causal analysis. In this respect it is helpful to apply once again the propensity score matching methodology. To more precisely address the question at stake, we focused on the impact in the region-by-cluster employment. Therefore we considered a new dataset broken down by 16 clusters and 19 regions,[8] consisting of 273 observations (31 region-by-cluster cells are empty). The visible drop in the number of observations depends on the fact that now the observation unit of our analysis is no longer the firm but the cluster, and we are interested in studying how the employment dynamics varies among the production chains, also allowing for some territorial effect.

In this way, the first step of the new matching procedure is the following probit regression, estimating the probability of observing newly offshoring firms in a given region and within a given cluster (i.e. the variable $OFF0305_{jr}$):[9]

$$\text{Prob}\ (\text{OFF0305}_{cr}=1\ |\ \text{EMP01}_{cr}, \text{OFFCL03}_{cr}, \text{EXP03}_{cr}, \text{SPECL}_{cr}, \text{NW}_{cr}, \text{NE}_{cr}, \text{CE}_{cr}) \qquad (6)$$

where: $EMP01_{cr}$ is the logarithm of the average number of employees in cluster c and region r in 2001;[10] $OFFCL03_{cr}$ is the intensity of offshoring in cluster c and region r (i.e. the average number of offhoring firms weighted by employee in the same cell) in 2003; $EXP03_{cr}$ is the average of the turnover share of exports in cluster j and region r in 2003; $SPECL03_{cr}$ is the logarithm of the "intensity of specialization" of the region r in cluster c, that is the share of employees of the region r employed in cluster c in 2003; NW_i, NE_j and CE_j are the aforementioned territorial dummy variables.

The results are all listed in Table 5 below.

[Table 5 here]

It appears that also in this "region-by-cluster" case, the probability of observing firms investing abroad for the first time between 2003 and 2005 is higher the higher: *i)* the average size of the cluster/region in terms of employees; *ii)* the past intensity of offshoring

[8] Clusters are constructed as stated in section 2 (for more details see Iuzzolino, 2005). As for regions, the ISAE sample groups Piemonte and Val d'Aosta together (due to the small size of the latter), therefore we have 19 regions instead of 20.

[9] The matching procedure has been performed again by means of the module *psmatch2* of STATA (version 9), using the average of the three nearest neighbours with replacement and imposing a calliper of 0.05 and the belonging to a common support for treated and untreated units. Smaller calliper have been excluded because too many treated units were not matched. Similar analysis using the Radius matching method generated consistent results, as well as further estimates, using the Becker and Ichino's *attnd* and *attr* algorithms, did.

[10] Controlling for specialization in terms of firms (as opposed to employees), does not change the results.

in the cluster/region; *iii)* the export propensity; *iv)* the weight of a given cluster within its region. In this context we detect some territorial effects, showing that compared to Italy's Southern regions, the Northwestern and Northeastern ones tend to have a higher propensity to offshore in the period considered.

Here too, moreover, the tests of the equality in means show that before the matching the 37 treated units out of 41 offshoring[11] have (on average) larger size and higher degree of past offshoring, exports' share on turnover and degree of specialization in a given production chain, while after the matching all these differences are no longer significant (see Table 6).

[Table 6 here]

Again, to assess the causal effect of offshoring on employment dynamics – this time at the region-by-cluster level – it is worth using the standard matching estimator (SM) and the difference-in-difference estimator (DID), in the same vein as we have done in the firm-level analysis (see section 4.1.). Now:

t is the offshoring time;

$\Delta Y^{1}_{c,t+1}$ is the percentage change, between *t* and *t+1*, in the number of employees in cluster *c* where the offshoring took place for the first time at time *t*;

$\Delta Y^{0}_{c,t+1}$ is the corresponding performance of the same cluster if offshoring had not occurred,

and the equivalent expressions for the regressions (3) and (5) are respectively:

$$\Delta Y_c = c + \delta_{SM} T + u_c \qquad (7)$$

for the SM, and

$$\Delta Y_c = c + \gamma_1 T + \gamma_2 P + \delta_{DID} PT + u_c \qquad (8)$$

for the DID, where *T*, *P* and *PT* are the dummy variables illustrated above.

The results of the two (robust) estimates, here too performed also computing bootstrapped standard errors with 500 replications, are shown in the following Table 7.

[Table 7 here]

We find a negative effect of offshoring on employment dynamics within the cluster/region: the more intense was the phenomenon in the past in the cluster and the region, the lower the employment growth rate. Even though the significance is limited to 95%, this result appears to be quite robust: not only are the effects estimated by SM and DID virtually the same, but they do not change at all when covariates – none of which turns out to be significant – are introduced. Secondly, as far as the DID is concerned, also the significance of those effects is unchanged. Thirdly, differently from the results relating to

[11] This reduction is due to the fact that 4 units are off the common support.

the firm-level employment effects of offshoring, here the significance of the DID model specification is robust to the introduction of the covariates.

All this, therefore, suggests that considering the cluster and the regional area, in the short-medium term the employment dynamics tends to be poorer the more intense the offshoring phenomenon in the area and in the production chain. More precisely, the region-by-cluster contexts in which firms decided to offshore for the first time between 2003 and 2005 suffered from an employment reduction of about 2%. In absolute terms, this affected about 5,500 employees in our sample. Therefore, these results seem to confirm that offshoring may actually shed jobs, especially when – correctly – accounting for its spill-over effects throughout the production chain.

Some insights of the distributional impact across the production chains – i.e. our cluster/region observation units – emerge when we introduce cluster dummies into the DID regression. The results are reported in Table 8, where the dummy excluded refers to the Paper-and-printing cluster (see Iuzzolino 2005). The coefficients of these dummies add up on the constant, and express the additional occupational effects detected for the offshoring observation units within each cluster. Thus, all other elements being unchanged: *a)* the reduction in employment is throughout smaller than in the omitted cluster, with the exception of the Leather and Footwear cluster (i.e. Textiles, clothing, leather products and footwear-4), which shows no significant difference; *b)* besides the latter and Paper-and-printing, other clusters with noteworthy (negative) employment effects are Motor vehicles and Meat products (Food, beverage and tobacco-2); *c)* only the Knitting cluster (i.e. Textiles, clothing, leather products and footwear-3) exhibits a positive occupational impact.

[Table 8 here]

Finally, it is possible to show that the indirect employment effect is even more relevant than the direct one. In order to do so, let us notice that the former effect plus the latter one add aup to the total employment effect. Since the two effects are each other related, we need to disentangle them. To this end, we compute the difference between the two, weighting the direct effect through the share of the employees of newly offshoring firms on the overall employment of the sample: $-0.023 - (-0.07*14{,}259/238{,}756) \approx -0.019$

Therefore, in our sample, the firm-level effect of offshoring accounts for only 18% of the impact on the overall Italian manufacturing employment. The remaining 82% of the total employment impact is due to the *net indirect occupational effect*, which is still negative and involves about 4,500 employees in our sample.

5. CONCLUSIONS

This paper aimed to investigate the employment consequences of international production offshoring by Italian manufacturing companies. To accomplish this task, we availed ourselves of a highly representative firm-level database developed at ISAE building on two ad-hoc surveys run in May 2003 and March 2005.

Besides concurring with previous literature on the occupational impact at offshoring firms per se, we extend the analysis to the possible *indirect* (i.e. cluster-level) employment effects. In particular, our analysis suggests that, independently from the firm level effects, offshoring may have negative spillover effects on suppliers, especially in contexts where networked firm situations prevail. Our evidence that employment performances worsen in the productive clusters with strongest offshoring supports this conjecture.

Further analyses – perhaps using richer datasets – may be needed to confirm the existence and to establish the economic significance of the indirect employment effects of offshoring. Nevertheless, these results may start feeding the policy debate. The negative spillover effects of offshoring on the domestic job market provide a negative externality on the firms in business relation with those investing abroad. In view of the fact that offshoring generally induce a shift from unskilled to skilled labor demand, public programs could be needed to support job retraining and favor mobility in the areas with intense offshoring.

Appendix I
The Iuzzolino's (2005) method for the detection of productive chains

In order to single out the productive relationships which link the firms in a given sector and a given area, the Iuzzolino's (2005) algorithm relies on the input-output (I/O) matrices and ISTAT census data on Italian manufacturing firms.

The procedure firstly detects 7 macro-sectors that can be deemed homogeneous from a productive-chain point of view, that is sectors with an internal trade accounting for no less than 2/3 of the manufacturing goods used in the production process. To this end, aggregating across the 49 branches of the I/O matrices takes into account both horizontal and vertical relationships, as they are carried out whithin the same Ateco subsections and include in each macro-sector all the branches producing the intermediate goods used in the same sector.

Secondly, the territorial complementarities have been approximated, through a "data driven" procedure that selects the sector clusters on the basis of the correlation degree in the distribution of employees. In this respect, for every macro-sector a geographical location matrix is computed including, for each component sector, the share of employees located in each one of the 8,000 Italian municipalities. Then, a cluster analysis is carried out on the seven matrices in order to aggregate the component sectors. The 16 clusters used in this paper are the result of the algorithm.

Tab. A1 – Sector clusters in the Italian manufacturing industries:

Macro -sector	N° cluster	Cluster		Main production	Component sectors	Sectors 3-digit
I	1	Food products, beverages and tobacco	1	Beverage	Dairy products and ice cream	155
			1		Grain mill products, starches and starch products	156
			1		Other food products	158
			1		Beverages	159
			1		*Tobacco products*	*160*
	2	Food products, beverages and tobacco	2	meat products	Processed and preserved fish and fish products	152
			2		Processed and preserved fruit and vegetables	153
			2		Animal and vegetable oils and fats	154
			2		Meat and meat products	151
			2		Prepared animal feeds	157
			2		*Machinery for food, beverage and tobacco processing*	*2953*
II	3	Textiles, clothing, leather products and footwear	1	Textile products	Textile yarn and thread	171

			1		Textile fabrics	172
			1		Textile finishing services	173
			1		Other textiles	175
			1		*Machinery for preparing, spinning, weaving and knitting textiles*	*29541*
	4	Textiles, clothing, leather products and footwear	2	Wearing	Leather clothes	181
			2		Other wearing apparel and accessories	182
			2		Furs; articles of fur	183
			2		Luggage, handbags and the like; saddlery and harness	192
			2		*Chemical products for textiles*	*24666*
			2		Man-made fibres	2470
	5	Textiles, clothing, leather products and footwear	3	Knitting	Made-up textile articles, except apparel	174
			3		Knitted or crocheted fabrics	176
			3		Knitted and crocheted articles	177
	6	Textiles, clothing, leather products and footwear	4	Leather and shoes	Leather	191
			4		Footwear	193
			4		*Other machinery for textile and apparel production, including sewing machines*	*29542*
III	7	Paper and printing	1	Paper and printing	Pulp, paper and paperboard	211
			1		Articles of paper and paperboard	212
			1		Books, newspapers and other printed matter and recorded media	221
			1		Printing services and services related to printing	222
			1		Reproduction services of recorded media	223
			1		*Prepared unrecorded media*	*2465*
			1		*Machinery for paper and paperboard production*	*2955*
IV	8	Wood, Furniture, Non-metallic mineral products, other manufacturing	1	Glass and glass products	Wooden containers	204
			1		Glass and glass products	261
			1		Cement, lime and plaster	265
			1		Articles of concrete, plaster and cement	266
			1		Sports goods	364
			1		*Waste oil*	*23204*
	9	Wood, Furniture, Non-metallic mineral products, other manufacturing	2	Furniture	Wood, sawn, planed or impregnated	201
			2		Veneer sheets; plywood, laminboard; particle board, fibre board and other panels and boards	202
			2		Builders' joinery and carpentry, of wood	203
			2		Other products of wood; articles of cork, straw and plating materials	205
			2		Bricks, tiles and construction products, in baked clay	264
			2		Furniture	361
			2		*Machinery for wood products*	*29564*
	10	Wood, Furniture, Non-metallic mineral products, other manufacturing	3	Jewellery	Jewellery and related articles	362
			3		Musical instruments	363
			3		Games and toys	365
			3		Miscellaneous manufactured goods n.e.c.	366
			3		*Precious metals*	*2741*
	11	Wood, Furniture, Non-metallic mineral products, other manufacturing	4	Ceramic tiles and building products	Non-refractory ceramics goods other than for construction purposes; refractory ceramic products	262
			4		Ceramic tiles and flags	263
			4		Cut, shaped and finished ornamental and building stone and articles thereof	267
			4		Other non-metallic mineral products	268
			4		*Machinery for mining, quarrying and construction*	*2952*
V	12	Petrolchemicals, rubber and plastic products	1	Pharmaceuticals and refining	Coke oven products	231
			1		Refined petroleum products	232
			1		Basic chemicals	241
			1		Pesticides and other agro-chemical products	242
			1		Paints, varnishes and similar coatings, printing ink and mastics	243
			1		Pharmaceuticals, medicinal chemicals and botanical products	244

			1		Glycerol; soap and detergents, cleaning and polishing preparations; perfumes and toilet preparations	245
			1		Other chemical products	246
			1		*Printing and book-binding machinery and parts thereof*	*29561*
			1		Non-metal secondary raw materials	3720
	13	Petrolchemicals, rubber and plastic products	2	Rubber and plastic products	Nuclear fuel	233
			2		Rubber products	251
			2		Plastic products	252
			2		*Miscellaneous special purpose machinery and parts thereof*	*29562*
VI	14	Metal and mechanical industry	1	Electronics	Basic precious metals and other non-ferrous metals	274
			1		Structural metal products	281
			1		Other general purposes machinery	292
			1		Office machinery and computers	300
			1		Electric motors, generators and transformers	311
			1		Electricity distribution and control apparatus	312
			1		Insulated wire and cable	313
			1		Accumulators, primary cells and primary batteries	314
			1		Lighting equipment and electric lamps	315
			1		Electrical equipment n.e.c.	316
			1		Electronic valves and tubes and other electronic components	321
			1		Television and radio transmitters; apparatus for line telephony and telegraphy	322
			1		Medical and surgical equipment and orthopaedic appliances	331
			1		Instruments and appliances for measuring, checking, testing, navigating and other purposes	332
			1		Industrial process control equipment	333
			1		Optical instruments and photographic equipment	334
			1		Watches and clocks	335
	15	Metal and mechanical industry	2	Iron and steel	Basic iron and steel and ferro-alloys	271
			2		Tubes	272
			2		Other first processed iron and steel	273
			2		Foundry work services	275
			2		Tanks, reservoirs and containers of metal; central heating radiators and boilers	282
			2		Steam generators, except central heating hot water boilers	283
			2		Forging, pressing, stamping and roll forming services of metal; powder metallurgy	284
			2		Treatment and coating services of metal; general mechanical engineering services	285
			2		Cutlery, tools and general hardware	286
			2		Other fabricated metal products	287
			2		Machinery for the production and use of mechanical power, except aircraft, vehicle and cycle engines	291
			2		Agricultural and forestry machinery	293
			2		Machine tools	294
			2		Other special purpose machinery	295
			2		Weapons and ammunitions	296
			2		Domestic appliances n.e.c.	297
			2		Television and radio receivers; sound or video recording or reproducing apparatus and associated goods	323
			2		Metal secondary raw materials	3710
VII	16	Motor vehicles and other transport equipment	1	Motor vehicles and aircraft	Motor vehicles	341
			1		Bodies (coachwork) for motor vehicles; trailers and semi-trailers	342
			1		Parts and accessories for motor vehicles and their engines	343
			1		Ships and boats	351
			1		Railway and tramway locomotives and rollig-stock	352
			1		Aircraft and spacecraft	353
			1		Motorcycles and bicycles	354
			1		Other transport equipments n.e.c.	355
			1		*New and used rubber tyres and tubes*	*2511*
			1		*Electrical equipment for engines and vehicles n.e.c.*	*3161*
			1		*Engines*	*29111*

Source: Iuzzolino (2005). The items in italics are not considered in our paper (where only Ateco up to 3 digit are taken into accout).

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Table 1 – Two links: offshoring-firm size nexus and offshoring-employment dynamics by cluster

Average and median employees at offshoring vs. non-offshoring companies (2005)		
	Average	Median
Offshoring	275.2	99.5
Non-offshoring	81.6	23
Average and median employees at firms offshoring between 2003 and 2005 (Italy vs. the World)		
	Average	Median
Italy – 2003	241.3	79.0
Italy – 2005	228.5	79.5
Italy – 2006	223.2	83.2
World - 2005	277.3	115.0
Offshoring intensity and cluster employment dynamics (2003-2005 period)		
	Offshoring intensity offshore (% of cluster's firms that offshore)	Employment dynamics (var. % of cluster's employees in the period)
T1	0.15	-0.08
M2	0.11	-0.03
MT1	0.09	0.01
P1	0.09	-0.01
T2	0.08	-0.05
T4	0.08	-0.07
M1	0.08	-0.03
W3	0.07	-0.01
T3	0.06	-0.11
P2	0.03	0.05
W1	0.03	0.02
W2	0.03	0.01
F1	0.03	0.04
F2	0.03	-0.02
PP1	0.02	-0.03
W4	0.01	0.05

Note: F= Food products, beverages and tobacco; M=Metal and mechanical industry; MT=Motor vehicles and other transport equipments; P= Petrochemicals, rubber and plastic products ; PP=Paper and printing; T= Textiles, clothing, leather products and footwear; W= Wood, Furniture, Non-metallic mineral products other manufacturing. See also Appendix I.

Table 2 – Probit regression for the probability of offshoring between 2003 and 2005

Variable	coefficient	Variable	coefficient	
emp03	0.215***	Ce	0.127	
exp03	2.092***	Trad	0.540*	
expsq03	-1.974**	Scal	0.095	
Offsec03	0.501***	Spec	0.285	
Offreg03	-2.276	_cons	-2.050***	
Specreg03	-0.796	Number of obs.		2418
Nw	0.219	Prob > chi2		0.000
Ne	0.397*	Pseudo R2		0.1511

Legend: * p<0.1; ** p<0.05; *** p<0.01.

Note: $OFF0305_i$ is a dummy variable indicating whether firm i ventured into offshoring between 2003 and 2005; $EMP03_i$ is the logarithm of its number of employees in 2003; $EXP03_i$ is the share of export on firm turnover in 2003; $EXPSQ03_i$ is the square of $EXP03$; $OFFSEC03_j$ is the intensity of offshoring in sector j (i.e. the logarithm of the share of offshoring firms in sector j, Ateco-3 digit); analogously, $OFFREG03_r$ measures the intensity of the offshoring phenomenon in region r (i.e. the share of offshoring firms in the region); $SPECREG03_{jr}$ is the intensity of specialization of region r in industry j in terms of employees (i.e. the share of employees of the region r employed in industry j, Ateco-3 digit); $TRAD_i$, $SCAL_i$ and $SPEC_i$ are three dummy variables following the well-known classification by Pavitt (1984); and NW_i, NE_i, CE_i are three dummies capturing the Italian macro-areas the firm operates in (North-West, North-East and Centre, respectively).

Table 3 – average value of structural characteristics of the firms in treated and control group, before and after matching

		Mean		% reduct		t-test	
Variable	Sample	Treated	Control	% bias	bias	t	p>t
emp03	Unmatched	4.580	3.476	81.9		6.48	0.000
	Matched	4.580	4.696	-8.6	89.5	-0.42	0.673
exp03	Unmatched	0.380	0.177	74.7		5.7	0.000
	Matched	0.380	0.364	5.8	92.3	0.3	0.765
expsq03	Unmatched	0.223	0.099	53.7		4.45	0.000
	Matched	0.223	0.200	10	81.4	0.5	0.617
offsec03	Unmatched	-2.832	-3.243	68.5		4.49	0.000
	Matched	-2.832	-2.902	11.6	83.1	0.67	0.504
offreg03	Unmatched	0.056	0.049	32.4		2.21	0.027
	Matched	0.056	0.056	-0.4	98.9	-0.02	0.983
specreg03	Unmatched	0.045	0.037	14.9		1.08	0.280
	Matched	0.045	0.051	-13.3	11.1	-0.63	0.531
trad	Unmatched	0.564	0.584	-4		-0.3	0.767
	Matched	0.564	0.545	3.7	8.8	0.19	0.850
scal	Unmatched	0.164	0.253	-22.1		-1.51	0.131
	Matched	0.164	0.170	-1.5	93.2	-0.08	0.933
spec	Unmatched	0.218	0.128	23.8		1.96	0.050
	Matched	0.218	0.224	-1.6	93.3	-0.08	0.940
nw	Unmatched	0.218	0.196	5.5		0.41	0.682
	Matched	0.218	0.188	7.4	-36.2	0.39	0.697
ne	Unmatched	0.473	0.296	36.7		2.83	0.005
	Matched	0.473	0.509	-7.6	79.4	-0.38	0.707
ce	Unmatched	0.218	0.254	-8.4		-0.6	0.547
	Matched	0.218	0.236	-4.3	49.1	-0.22	0.823

Note: $EMP03_i$ is the logarithm of the number of employees in 2003 for the firm *i*; $EXP03_i$ is the share of export on firm turnover in 2003; $EXPSQ03_i$ is the square of $EXP03_i$; $OFFSEC03_j$ is the intensity of offshoring in sector *j* (i.e. the logarithm of the share of offshoring firms in the sector *j*, Ateco-3 digit); analogously, $OFFREG03_r$ measures the intensity of the offshoring phenomenon in region *r* (i.e. the share of offshoring firms in the region); $SPECREG03_{jr}$ is the intensity of specialization of region *r* in industry *j* in terms of employees (i.e. the share of employees of the region *r* employed in industry *j*, Ateco-3 digit); $TRAD_i$, $SCAL_i$ and $SPEC_i$ are three dummy variables following the well-known classification by Pavitt (1984); and NW_i, NE_i, CE_i are three dummies expressing the Italian macro-areas the firm operates in (North-West, North-East and Centre, respectively).

Table 4 – The effect of offshoring on firm's employment growth

	SM	DID	SM	DID
Effect of Offshoring (p-value)	-0.077*** (0.001)	-0.070* (0.052)	-0.071*** (0.005)	-0.070* (0.058)
Constant	0.025***	0.010	0.023	0.000
Presence of covariates (a)	NO	NO	YES	YES
No. of significant covariates (b)	-	-	none	None
No. of obs.	2418	4836	2417	4835
Replications	500	500	500	500
Prob > chi2	0.001	0.009	0.197	0.076
R-squared	0.001	0.001	0.003	0.001

(a) Covariates include: share of exports on turnover (in quadratic form; in linear form the results are the same); percentage of region employees employed in a given sector; sector and macro-region dummies.
(b) At 0.1, 0.05 or 0.01 level.
Legend: * p<0.1; ** p<0.05; *** p<0.01.

Table 5 – Probit regression for the probability of offshoring in clusters-by-regions cells between 2003 and 2005

Variable	coefficient
emp01	0.010*
offcl03	6.560**
exp03	1.647***
specl03	0.302***
Nw	0.777**
Ne	0.753**
Ce	0.501
_cons.	-1.531***
No. of obs.	273
Prob. > chi2	0.000
Pseudo-R2	0.282

Legend: * p<0.1; ** p<0.05; *** p<0.01.
Note: $EMP01_{cr}$ is the logarithm of the average number of employees in cluster *c* and region *r* in 2001; $OFFCL03_{cr}$ is the intensity of offshoring in cluster *c* and region *r* (i.e. the average number of offhoring firms weighted by employee in the same cell) in 2003; $EXP03_{cr}$ is the average of the turnover share of exports in cluster *j* and region *r* in 2003; $SPECL03_{cr}$ is the logarithm of the "intensity of specialization" of the region *r* in cluster *c*, that is the share of employees of the region *r* employed in cluster *c* in 2003; NW_i, NE_j and CE_j are the aforementioned territorial dummy variables.

Table 6 – Average value of structural characteristics in cluster *j* and region *r* in treated and control group, before and after matching

		Mean		% reduct		t-test	
Variable	Sample	Treated	Control	% bias	bias	t	p>t
Emp01	Unmatched	18.644	8.581	36.3		3.61	0.000
	Matched	9.856	13.065	-11.6	68.1	-1.43	0.158
Offcl03	Unmatched	0.085	0.056	77.8		4.38	0.000
	Matched	0.070	0.079	-26.2	66.3	-0.91	0.369
Exp03	Unmatched	0.359	0.160	111.7		6.69	0.000
	Matched	0.297	0.261	20	82.1	0.81	0.425
Specl03	Unmatched	-2.584	-3.610	81.8		4.58	0.000
	Matched	-2.880	-2.968	7	91.4	0.31	0.761
Nw	Unmatched	0.268	0.151	28.9		1.86	0.064
	Matched	0.200	0.273	-18.1	37.6	-0.6	0.551
Ne	Unmatched	0.341	0.194	33.5		2.13	0.034
	Matched	0.360	0.207	34.8	-4	1.2	0.238
Ce	Unmatched	0.244	0.203	9.9		0.6	0.550
	Matched	0.240	0.333	-22.3	-125.9	-0.72	0.476

Note: $EMP01_{cr}$ is the logarithm of the average number of employees in cluster *c* and region *r* in 2001; $OFFCL03_{cr}$ is the intensity of offshoring in cluster *c* and region *r* (i.e. the average number of offhoring firms weighted by employee in the same cell) in 2003; $EXP03_{cr}$ is the average of the turnover share of exports in cluster *j* and region *r* in 2003; $SPECL03_{cr}$ is the logarithm of the "intensity of specialization" of the region *r* in cluster *c*, that is the share of employees of the region *r* employed in cluster *c* in 2003; NW_i, NE_j and CE_j are the aforementioned territorial dummy variables.

Tab 7 – The effect of offshoring on the sector employment growth

	Estimator (a)			
	SM	DID	SM	DID
Effect of Offshoring (p-value)	-0.024** (0.017)	-0.023** (0.041)	-0.024** (0.041)	-0.023** (0.043)
Constant	0.016***	-0.039***	0.191**	-0.038***
Presence of Covariates (b)	NO	NO	YES	YES
No. of significant covariates (c)	-	-	none	none
No. of obs.	273	546	273	546
Replications	500	500	500	500
Prob. > chi2	0.017	0.000	0.296	0.000
R-squared	0.015	0.168	0.021	0.170

(a) SM = standard matching estimator; DID = difference-in-difference estimator.
(b) Covariates include: the size (overall employment) of the cell; the average share of exports on turnover; the percentage of region employees employed in a given cluster; 16 cluster dummies.
(c) At 0.01, 0.05 or 0.01 level.
Legend: * p<0.1; ** p<0.05; *** p<0.01.

Tab 8 – The effect of offshoring on the sector employment growth: cluster effects

	DID
Effect of Offshoring	-0.023***
Constant	-0.110***
Presence of Covariates (a)	YES
Significant covariates (b)	none
Food products, beverages and tobacco – 1	0.109***
Food products, beverages and tobacco – 2	0.038***
Textiles, clothing, leather products and footwear – 1	0.059***
Textiles, clothing, leather products and footwear – 2	0.058***
Textiles, clothing, leather products and footwear – 3	0.205***
Textiles, clothing, leather products and footwear– 4	-0.019
Wood, Furniture, Non-metallic mineral products other manufacturing – 1	0.074***
Wood, Furniture, Non-metallic mineral products other manufacturing – 2	0.070***
Wood, Forniture, Non-metallic mineral products other manufacturing – 3	0.093***
Wood, Forniture, Non-metallic mineral products other manufacturing – 4	0.096***
Petrochemicals, rubber and plastic products – 1	0.072***
Petrochemicals, rubber and plastic products – 2	0.091***
Metal and mechanical industry	0.075***
Metal and mechanical industry	0.068***
Motor vehicles and other transport equipment	0.019**
Number of obs.	546
Replications	500
Prob > chi2	0.000
R-squared	0.658

(a) Other than the cluster dummies. Covariates include: the size (overall employment) of the cell; the average share of exports on turnover; the percentage of region employees employed in a given cluster.
(b) Other than the cluster dummies. Significance at 0.1, 0.05 or 0.01 level.
Legend: * p<0.1; ** p<0.05; *** p<0.01. Running the same regression excluding the covariates but keeping the dummies leads to the same result.