Backward linkages and the export performance of business services. Evidence from a sample of Italian firms

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Abstract

We provide evidence on backward linkages between downstream manufacturing sectors and the export performance of Italian business service firms. Combining input-output coefficients from the National Accounts with region-level information on the international involvement and market thickness of downstream manufacturing sectors, we build some measures of local spillovers and we test them as determinants of the business service firms' export status. Our results show that the export activity of downstream manufacturing sectors is positively related to the services firms' probability of exporting to the same foreign market. Also downstream market thickness bears the same positive effect, even if the latter turns to be non-significant for KIBS sectors. Finally, our evidence confirms that the scope of export spillovers is essentially local.

JEL:*L80, L25, F14, D22*

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1 Introduction

In the recent decades employment and production have moved from manufacturing to services which nowadays account for the most of high-income countries' GDP. The increasing role of services is related to different phenomena. First of all, during the last 30 years the traditional manufacturing production system has undergone a first shift towards the domestic outsourcing of some production phases to local providers of components and/or specific services. As a consequence, a rapid increase in the number of business service firms performing activities for the manufacturing ones has followed. A second change has concerned and still concerns today the outsourcing of phases of production abroad (offshoring) taking advantage of a deeper trade integration with low labour cost countries and of high technologies from advanced economies. Finally, the ICT revolution has stimulated trade in services - traditionally considered as *non-tradable* - and this process further promotes the international specialisation according to comparative advantages.

Services, then, face international competition, as manufacturing goods do, and the outcome on export specialisation can matter for long run growth and welfare. Especially, Knowledge Intensive Business Services (KIBS) represent a large part of Business Services (BS) and may play a significant role in this specialisation process[1](Jensen, 2008). At the same time, the linkages between operators in services and the ones in manufacturing extend, and these ties are important for the efficiency and the dynamism of the economic system. Manufacturing and services firms do not carry on two separate and locked sets of activities, instead their interactions and complementarities contribute to determine the overall performance of the economy. As a consequence, the success of service firms in exporting is strictly related to the initial local conditions. If services are naturally born local, then their penetration in foreign markets may represent a difficult task and may be somehow related to the export experience of their customers. The involvement of downstream firms in foreign markets may reduce the fixed costs of exporting - naturally higher in services - increasing the available information on the export activities and on destination countries. Also, the presence of a large number of firms in the downstream manufacturing sectors fosters the exploitation of the static and dynamic scale economies enriching the services firms' market experience. These features very often are reported in business studies but a systematic analysis is still missing due to data limitations. However, while some studies exist on services firms' internationalisation, to the

[1]According to the definition adopted by the European Union, KIBS refer to the NACE Divisions 72, 73 and to the professional activities included in the NACE division 74. See the Appendix for more detail.

best of our knowledge, no previous research has focussed the attention on the nexus between the export performance of service firms and the performance of downstream manufacturing sectors. In this respect we believe this research topic is fundamental for understanding a country's overall potential for long run growth. Then, we mean to address the relationship between market thickness and export openness in local downstream manufacturing sectors and the export performance of business service firms. We expect that the export openness in downstream manufacturing sectors helps service firms to reduce the cost of acquiring information on the foreign market. Also, we expect that large and competitive downstream sectors allow service firms to enlarge their experience and to gain from the *learning-by-interacting* process.

We test these hypotheses on a sample of Italian business service firms from the 2001-2003 CAPITALIA survey building some measures of backward linkages based on the national Input-Output coefficients in order to capture the extent of market thickness and openness in downstream manufacturing sectors.

The study of spillovers from services to manufacturing can be considered of particular interest for Italy, a country marked by severe regional disparities and still in search for a new development agenda for the "Mezzogiorno". Most of this area seems to be doomed to lag behind and to be confined to local and stagnant economic circuits. Shedding light on the manufacturing-services nexus can help in tailoring more effective policies for these areas and enhancing the efficiency and the international activities of firms located in more advanced regions too. On the other hand, the Italian experience represented in our study can also give a general insight on what are the key local conditions for internationalisation in services.

The work is structured as follows: section 2 presents the literature review, section 3 presents the survey and the evidence on internationalisation of services firms in our sample, sections 4 and 5 respectively present the model and the results and section 6 summarizes the findings and concludes.

2 Literature Review

After Melitz's (2003) seminal work on heterogeneous firms, the basic idea is that the restructuring brought about by international trade leads to a rise in the average sector TFP due to the reallocation of resources from the less productive firms exiting the market to the most productive ones. As the evidence shows (Mayer and Ottaviano, 2008), then, a country's comparative advantage is positively correlated with the performance of the firms, thus micro level analysis can give important insights about the country speciali-

sation and efficiency. As in standard trade theory, the nature of trade and production specialisation has no sign here. However, different specialisation patterns can convey different long run growth rates and, in particular, the idea that production of knowledge is central for long run growth is an unquestionable fact clearly stated by the endogenous growth literature (Lucas, 1988; Romer, 1990; Grossman and Helpman 1991). The picture of dynamic increasing returns led by accumulation of knowledge represents an important message for society and policy makers. However, the theoretical possibility that the free flow of knowledge could produce higher long run growth rates for all of the countries integrated into the world economy is not supported by the evidence. In other words, local conditions matter, as implied by the New Economic Geography literature (Fujita et al., 2001). Gathering the notions of external scale economies, cumulative causation and of backward and forward linkages, this strand of literature has shown that, following trade liberalisation, development can well be a very slow path of diffusion of economic activities from the center to the periphery (Puga and Venables, 1996). Also, Martin and Ottaviano (1998) show positive feedbacks from agglomeration to the growth rate of a location and for its future specialisation[2].

Summing up, knowledge, trade specialisation and local conditions can be quite important in determining the performance of the firms in a sector and, through these channels, a country's long run economic growth. Also, the availability of efficient services enhances the efficiency of downstream firms, helps to attract foreign investments and stimulates domestic growth, in particular, these positive effects seem to be out of question for KIBS.

Furthermore, being services the prominent and most dynamic sector in advanced economies, the future world leadership may play on it and, even if nowadays trade in services is circumscribed, its weight in the world trade flows is likely to grow thanks to newer ICT technologies and firms' internationalisation strategies. As a consequence, both the domestic and foreign performance of services firms will contribute to govern the country's path of specialisation and the future pattern of comparative advantage.

However, as the evidence shows the export activity in services is a difficult task and the relationship with internationalised manufacturing customers can ease the flow of the necessary information to become an exporter. Also, some agglomeration economies may be at work: local thick downstream markets may increase the experience and stimulate the learning process of service firms regardless of the international involvement of their customers.

Up to now, the scant empirical literature on the internationalisation of

[2]In their model, through an agglomeration process, one location specialises in innovation and industry and the other in the traditional production.

services has just focussed on the main determinants of the export performance [3] and the role of linkages from local downstream manufacturing firms has been neglected. The research conducted on manufacturing firms, instead, has explored the role of spillovers in determining the firms' export status and intensity. Especially, the extent of spillovers from other exporting firms or MNEs has been investigated. Externalities of this form can be related to a decrease in the cost of access to foreign markets. The proximity of exporters or MNEs would reduce these costs (Aitken et al., 1997), furthermore the presence of other exporters can lower the cost of production by increasing the availability of specialized capital and labor inputs (Bernard and Jensen, 2004). For the UK, Greenaway et al. (2004) find that MNEs' exports have a positive effect on domestic firms' probability of being exporters but they don't affect the export ratio of domestic firms. On the other hand, R&D spillovers from MNEs have a positive and significant impact on both the decision of domestic firms' to export and their choice of export ratio. Barrios et al. (2003) examine the effect of spillovers emanating from domestic exporters and MNEs for the export status and intensity of foreign and domestic firms operating in the Spanish manufacturing and they provide evidence for significant differences between the two firm types. They also consider different export destinations, and their results show that Spanish exporters benefit more from spillovers when exporting to more advanced countries than to less technologically advanced countries or, indeed, selling locally. Taymaz and Yilmaz (2009) find a positive externality from export activities of other firms in the same industry in the Turkish manufacturing. Sjoholm (2003) stresses the importance of being in a foreign network: in a sample of Indonesian firms, foreign ownership and importing intermediates make exporting more likely while FDI in the region is not really significant for the firm's export behavior. Following Clerides et al. (1998) who find weak support for both regional and sectoral spillovers in Colombia, Bernard and Jensen (2004) test region-specific, industry-specific, and local (industry and region) export spillovers disclosing that the latter are negligible. For France Koenig (2009) shows that the number of exporters in the same local market generates destination-specific positive externalities and Koenig et al. (2010) find that the product-specific nature of export spillovers also matters, even if the strongest effect emerges from the neighbouring exporters of the same product to the same market.

Finally, closer to our research line, Nefussi and Schwellnus (2010) find a significant interdependence between the location choices of French services

[3] See Love and Mansury (2009) for the U.S.A., Gourlay et al. (2005) for the U.K., Eickelpasch and Vogel (2009) for Germany and Conti et al. (2010) for Italy.

multinationals and the location of downstream French manufacturing affiliates. Making use of National Input-Output tables they build an indicator capturing the potential demand of French affiliates for each foreign country and their empirical evidence supports the existence of a complementarity in location choices between manufacturing and services[4]. They prove that the internationalisation in services and manufacturing are strictly linked, even if their focus, on FDI in opposite to export activity (being the target of the present work), and the mechanisms behind this relationship are different from the ones we stress. They emphasize the importance of the geographical proximity in the services provision and the preference of French manufacturing firms for services offered by French suppliers because these services may be specifically tailored to the national demands. Always in this strand of literature, Raff and von der Ruhr (2007) model the entry of service affiliates in foreign host locations as dependent on the tight relationship with downstream affiliates. Being the provision of services characterized by scale economies and monopolistic competition, the market thickness allows firms to obtain the necessary efficiency to survive in foreign markets. Here, local customers do not know the quality of the service provided by the foreign affiliates and might not buy the service thus implying an under-exploitation of the scale economies. The thickness of the host downstream market increases the probability of informed customers and, thus, the probability of selling the service. From another point of view the thickness of the informed customer market stimulates the production of high quality services.

In this framework, we mean to provide evidence on the role of spillovers from downstream manufacturing firms for the export performance of Business Services (BS) firms[5]. The main idea is that if services are naturally born local, due to the need of a close contact with customers, their international activity is a much more difficult task compared to the one performed by manufacturing firms, hence, their ability to cross the borders may depend on their local conditions that may reduce the high cost of exporting. So we firstly test the idea that being in a network with manufacturing exporters helps service firms to start servicing foreign markets. It might well be the case that service firms go international pushed by the internationalisation strategies of their customers and/or in order to follow them. Secondly, we explore

[4]They especially find that this significant and positive linkage is at work for business services because of their strict linkages with the manufacturing sector, while for retail trade, that is more oriented toward final consumption, no effect is detected.

[5]A recent and partly related strand of literature focuses instead on the efficiency of manufacturing firms and the potential backward/forward spillovers that could originate from more productive and internationalised service sectors (Arnold et al. 2009; Mariotti et al., 2010)

the hypothesis that thickness of downstream manufacturing sectors can also stimulate efficiency and high quality in services and enhance the exploitation of scale economies thus helping service firms in becoming exporters. Finally, from the evidence of the great heterogeneity in service activities, especially with respect to their knowledge intensity, we focus our analysis on the sub-sample of KIBS firms to uncover whether the linkages with manufacturing customers have a different impact for the internationalisation of these sectors.

3 Descriptive Statistics

The sample - In the following analysis we make use of a sample of business service firms built from the 2001-2003 CAPITALIA survey which provides information on 1,521 firms in the services activities defined according to the NACE Rev.1 classification. The firms included are the ones classified in the Section G (*Wholesale and retail trade repair of motor vehicles, motorcycles and personal and household goods*), I (*Transport, storage and communication*) and Section K (*Real estate, renting and business activities*)[6]. We use data for 2003 - the only year for which we have information on the firms' export activity - and after a cleaning procedure[7] we end up with 1211 firms, 658 of which belong to *KIBS* and 553 to the remaining services activities which we can label as *Other BS* (Table 1). Our sample effectively represents about 4% of turnover and exports in the corresponding service sectors (respectively 6.5% and 8% for the KIBS)[8].

The lower part of Table 1 shows the distribution of firms across the four areas of the Italian territory[9]. We can observe that the highest share of firms is located in the North, especially the North-West, while the South only accounts for about 16% of the total sample. When we distinguish between *KIBS* activities and other business services we can notice that *KIBS* are mainly concentrated in the North-West of the country while the remaining activities are evenly distributed across the geographical areas.

Export activity - Turning now to the international involvement of Italian services firms, the questionnaire provides several pieces of information on

[6]The survey collects information on a sample of service firms with more than 5 employees. The sampling strategy is based on strata defined according to the firm size class and firm geographical area.

[7]We drop observations with missing or inconsistent values for the variables of our interest.

[8]Details on the sample representativeness are available from the authors upon request.

[9]We split the Italian territory in the following areas: North-East, North-West, Centre and South.

Table 1: Distribution of Firms

Across Sectors			
	KIBS	Other BS	Total
Section G			
50		2	2
51		133	133
52		163	163
55		16	16
Section I			
60		23	23
63		82	82
64		12	12
Section K			
70		72	72
71		23	23
72	289		289
73	18		18
74	351	27	378
Total	658	553	1,211
Across Areas			
	KIBS	Other BS	Total
North-West	257	153	410
North-East	176	155	331
Centre	113	121	234
South	112	124	236

their export status and intensity, export destinations and also on their FDI (Foreign Direct Investments) and offshoring status. However, only a very small fraction of our firms engage in offshoring and FDI (respectively 2.9% and 3.4% of the total sample) while, as shown in the first column of Table 2, about 22% of the firms can be defined as an exporter. From the survey the definition of exporter is straightforward by means of the following questions:

- In 2003, has the firm sold all or part of its services abroad?
- What percentage of the total sales [does the firm export]?

From the first question we build an export status dummy variable taking value 1 for exporters and 0 otherwise, and from the second one we directly measure the firm export intensity. Also, the survey allows for the identification of five export destination markets: EU-15; New EU members; other European countries; Extra-European high-income countries and Extra-European low-income countries.

For the following empirical analysis, building on the idea that exporting to more *distant* markets represents a more difficult task for a firm, we group these markets according to the presence/absence of trade and/or transport

costs[10] into:

- **Europe**: including EU-15, New EU members and other European countries;
- **Extra-Europe**: including Extra-European high-income countries and Extra-European low-income countries.

From the latter group, in the estimation of the empirical model we also distinguish the group **Extra-Europe High-income economies**, according to the belief that more developed and distant markets involve tougher competition[11].

Table 2 shows the share of exporters and the average export intensity by destination. Closer markets are preferred by firms in both types of activities, while the share of exporters decreases when the destinations are rich and distant markets.

Table 2: Export activity by destination

	Share of Exporters(%)			
	All	Europe	Extra-Europe	Extra-Europe High
KIBS	21.6	17.2	8.4	6.8
Other BS	22.0	20.0	9.5	8.0
Total	21.8	18.5	8.9	7.4
	Export Intensity(%)			
	All	Europe	Extra-Europe	Extra-Europe High
KIBS	6.0	3.5	2.4	1.8
Other BS	5.4	4.0	1.3	1.1
Total	5.7	3.8	1.9	1.5

The export intensity is very low when compared to the export intensity of manufacturing firms (about 30% from the same survey in the same year), however we can find the same pattern. A low share of exporters and a low export intensity in services firms is also reported by Jensen (2008) for the United States.

[10]In this respect, markets are classified as distant both in geographical and economic meaning.

[11]We will only focus on high-income markets because, in our sample, the overall number of firms exporting to low-income destinations is very small so it cannot be used in the empirical analysis below.

The importance of input-output linkages - The trend of advanced economies is towards an increase in the weight of service sectors in the domestic economic system. This process of *tertiarisation* of the economy goes with the deepening of the linkages between services and manufacturing operators. Distinguishing between *KIBS* activities and the total of business services, the upper panel of Table 3 shows that the share of services inputs in overall intermediate inputs for manufacturing has grown since 1995, thus highlighting the effects of firms' outsourcing/offshoring strategies. Especially we can see that the great part of services bought by manufacturing firms are KIBS.

Table 3:

Weight of service inputs in total inputs (production) for manufacturing sector

Sector	1995	2000
Total BS	27.58 (5.44)	29.73 (6.36)
KIBS	18.07 (3.58)	19.72 (4.25)

Weight of sales to manufacturing sector in total services sector intermediate sales (production)

Sector	1995	2000
Total BS	28.70 (15.13)	27.06 (14.79)
KIBS	30.44 (21.83)	28.16 (19.43)

Source: National Accounts and IO Tables, ISTAT.

On the other hand, the lower panel of the same Table displays the importance of manufacturing firms as customers for services sectors. Despite the weight of manufacturing in total service sectors' sales has slightly declined, manufacturing firms represent more than one fourth of the total intermediate sales in services thus representing a potential important channel for spillovers. Looking at the KIBS sectors and the shares on production in parenthesis (including also the products for final consumption) it is clear that the linkages with manufacturing are stronger for KIBS than for other sectors (e.g. retail) that are more oriented towards final consumption. To gather some information on backward linkages at the firm level, we exploit some additional information reported in the questionnaire on the firm network and customers. In particular firms can be classified according to their belonging to a group and to their involvement with large/small and industrial/non-industrial customers. Table 4 shows that in our sample about 26% of firms belong to a group (*Group*), the *KIBS* firms sell about 48% of their product in Italy outside the boundaries of their region while this percentage drops

to 31% for *Other BS* ($Sale_{nat}$), about 50% of the *KIBS* firms in our sample sell to large industrial firms ($sell_{large}$) and 59% of them sells to small and medium firms ($sell_{SMEs}$), while the remaining services firms are more skewed towards small and medium sized industrial customers.

Table 4: Relationship with customers and other firms

	$Group(\%)$	$Sale_{nat}(\%)$	$Sell_{large}(\%)$	$Sell_{SMEs}(\%)$
KIBS	26.7	48.0	49.8	58.7
Other BS	24.6	31.0	33.4	44.6
Total	25.8	40.2	42.4	52.3

Group: dummy for firms belonging to a group.
$Sale_{nat}$: Share of Sales the boundaries of their region over Total Sales (%).
$Sell_{large}$: dummy for firms selling to large industrial firms.
$Sell_{SMEs}$: dummy for firms selling to small and medium industrial firms.

4 Modeling export determinants and the role of spillovers from manufacturing

To model the export determinants we build on Koenig (2009) and take as hypothesis that spillovers from downstream manufacturing sectors reduce the sunk cost of exporting. A firm exports if its expected profits in the export market, $\frac{\Pi^{exp}}{r}$, are higher than the fixed entry cost F

$$\frac{\Pi_i^{exp}}{r} > F \tag{1}$$

then rearranging and taking the logs, the probability for firm i to be a service exporter can be written as

$$Pr(Export_i > 1) = Pr(ln\Pi_i^{exp} - lnr - lnF > \epsilon_i) \tag{2}$$

Now, following Melitz (2003) and assuming that firms face common home and foreign prices for final services, intermediate and primary inputs and hypothesizing heterogeneous productivity levels across firms, profits in the export market depend on the firm specific productivity level. This is why, in the final empirical specification, we include labour productivity together with further regressors suggested by the theory and by the existing empirical literature and reported in Table 5[12]. Also, area (North-West, North-East,

[12]For the details see what reported in Conti et al. (2010).

Centre and South) and two-digit NACE sector dummies are included to account for regional and activity heterogeneity. Finally, under the assumption that ϵ_i is normally distributed, we can estimate equation 2 by means of a probit model.

Table 5: Export Determinants

Variable	Measure of
LP	Labor Productivity
Age, Age^2	experience
Lab, Lab^2	size
$FDIOFF$, FDI or Offshorer	network
$Group$, Being in a group	network
$Sale_{nat}$, $Sale_{nat^2}$, National Sales over Total Turnover	intensity of domestic experience
$Sell_{Large}$	Backward linkages/experience
$Sell_{SMEs}$	Backward linkages/experience
$Inno_{Serv}$, Service innovation	innovation
$Inno_{Proc}$,Process innovation	innovation

As mentioned above, in equation 2, F is assumed to be a function of our spillover measures

$$F = g(Spillover_{reg}^{back}) \tag{3}$$

with

$$\begin{aligned} Spillover_{reg}^{back} &= \sum_{h=1}^{n} X_h * S_h, \\ S_h &= \frac{sales_h}{\sum_{h=1}^{z} sales_h} \end{aligned} \tag{4}$$

here manufacturing sectors are indexed from **1** to **n** and the remaining sectors, including final consumption, from **o** to **z**; $sales_h$ measures the sales from service two-digit NACE sector $\boldsymbol{j}$ to manufacturing NACE subsections $\boldsymbol{h}$[13] and $\sum_{h=1}^{z} sales_h$ is the overall sales from sector $\boldsymbol{j}$. Thus, S_h represents the input-output coefficient from National Input-Output Tables. We use the Symmetric Input-Output Tables available from ISTAT for 2000[14]. Finally,

[13]We adopt th aggregation level used by ISTAT in the Regional Accounts, i.e. the data source adopted to retrieve data of regional-sectoral value added.

[14]Unfortunately Regional Input-Output Tables with a fine sector disaggregation are not available. Nevertheless, National Input-Output Tables are usually adopted in the computation of spillover measures, in particular Blalock and Veloso (2007) make use of national coefficients in order to build a regional spillovers from import competition of downstream sectors in Indonesian manufacturing. Nefussi and Schwellnus (2010) make the assumption that the input demands of French manufacturing affiliates abroad are similar to the input demands of manufacturing plants located in France.

X_h refers to local (regional) manufacturing market thickness - number of firms in the region sector - and export performance - share of total exports on the total value added in the region-sector pair [15]. Also, we want to test if stronger effects can be detected when service firms export to the same destination market as the downstream manufacturing firms do, according to the belief that export costs are destination specific. Then, we build additional measures capturing the feedbacks coming from the export involvement of manufacturing downstream sectors in a specific geographical area. Especially, we focus on the spillovers from the foreign experience of manufacturing customers in European countries, Extra-European countries and Extra-European High income countries. These classifications are the same used in the definition of the destination-specific export status of service firms (see Section 3).

Finally, from the existing evidence on the firm-level determinants of the export status (Conti et al., 2010; Eickelpasch and Vogel, 2009), the role of sales in the national market outside the region is always strongly positive and significant so we extend our backward linkage measure to include the possibility that knowledge and efficiency spill over from other regions too. The idea of *cross-border* demand linkages originates from the New Economic Geography notion of market potential in applied works (Combes and Overman, 2004 and Midelfart et al, 2004) and directly maps into an extended measure of thickness spillovers including externality effects from other regions also. We borrow the same empirical setting to take into account the potential export spillovers from other markets outside the region. Thus, building on formula 4, for each region $\boldsymbol{r}$ and service sector $\boldsymbol{j}$ we have calculated a further measure equal to the sum of the local spillovers from each $\boldsymbol{f}$ Italian region corrected by the distance between region $\boldsymbol{r}$ and region $\boldsymbol{f}$, d_{rf}[16]:

$$\begin{aligned} Spillover^{back}_{nat\ \mathbf{rj}} &= \sum_f \frac{Spillover^{back}_{reg\ \mathbf{fj}}}{1 + lnd_{rf}} \\ where\ d_{\mathbf{rr}} &= 1 \end{aligned} \tag{5}$$

Summing up, Table 6 shows the measures of spillovers through backward

[15]Export data are from COE dataset (ISTAT source), while value added is retrieved from Regional Accounts (ISTAT source). We cannot use output at the denominator (as usual in literature) because this variable is not available for 8 regions due to confidentiality reasons.

[16]We take the log of the distance to allow our measure not to be dependent on the scale adopted (e.g. kms vs miles), also, being the minimum distance 1, we add 1 to avoid undefined forms. The distance between $\boldsymbol{r}$ and region $\boldsymbol{f}$ is the road distance between regional capitals and is retrieved from the Istituto Geografico De Agostini. For the islands we have imputed 100km for each hour of navigation.

Table 6: Regional and National Spillovers

$Spillover^{back}_{reg} = \sum_{h=1}^{n} X_h * S_h$	
N^{back}_{reg}	thickness in downstream manufacturing sectors in the same region.
Exp^{back}_{reg}	regional downstream manufacturing sectors' export openness.
$ExpEURO^{back}_{reg}$	regional downstream manufacturing sectors' export openness to European countries.
$ExpEX^{back}_{reg}$	regional downstream manufacturing sectors' export openness to Extra-European countries.
$ExpEXhigh^{back}_{reg}$	regional downstream manufacturing sectors' export openness to Extra-European high-income countries.
$Spillover^{back}_{nat\ \mathbf{rj}} = \sum_f \frac{Spillover^{back}_{reg\ \mathbf{fj}}}{d_{rf}}$	
N^{back}_{nat}	thickness spillover from the national market.
Exp^{back}_{nat}	export spillover from the national market.
$ExpEURO^{back}_{nat}$	export spillover from the national market due to exporting to European countries.
$ExpEX^{back}_{nat}$	export spillover from the national market due to exporting to Extra-European countries.
$ExpEXhigh^{back}_{nat}$	export spillover from the national market due to exporting to Extra-European high-income countries.

linkages that we are going to use in the empirical model.

Estimation Issues - The next section is devoted to the presentation and discussion of the results from the estimation of the empirical model 2. As standard in the literature, we estimate a probit for the export status. However we are not really able to address the issue of endogeneity and to identify a causal effect of our right hand side variables with respect to the probability of export. For many of our right hand side variables the suspect of endogeneity is unlikely and the direction of causality can be considered almost certain. In particular, we believe that the suspicious endogenous variables are the firms' size (Lab), Labour Productivity (LP), and the dummy $FDIOFF$. Then, interpreting our results as correlations can be limiting but however insightful. Nevertheless, for our variables of interest, namely the spillovers from downstream manufacturing sectors to service firms, we believe that endogeneity and reverse causality are not an issue here: we have included the average productivity of manufacturing firms in the region, LP^m_{reg}, to avoid the omission of regional features that might drive the probability to export and, to control for simultaneity we have included the spillover measures in t-2, the first year of the survey, as robustness check of our main findings. Finally, as far as causality is concerned, service firms usually start as local - be it regional or national - firms targeted to serve local customers, then it is unlikely that their export status causes local manufacturing firms to go abroad. The same line of reasoning could stand for the direction of causality from the thickness of downstream manufacturing sectors to service suppliers. Anyway, in this case there could be the chance that the probability of the

service firm to export has a feedback on the thickness of its downstream customer sectors. However, since we are not focusing on the feedback from the effective customers of the service firm but on the whole population of the potential customers, i.e. downstream manufacturing sectors, it is unlikely that the overall downstream sectors features are affected by an individual service firm export status. Nevertheless, the endogeneity of the remaining regressors could affect the estimates of the coefficients of interest unless there is a zero correlation between the endogenous regressors and the exogenous ones. Table 12 in the Appendix shows the pairwise correlation coefficients for the variables in our model: our variables of interest are not significantly correlated with most of our suspects of endogeneity, in particular none of them is correlated with the dummy $FDIOFF$.

5 Results

This section presents the results from the estimation of the probit model 2 and each Table reports the coefficient estimates and the robust standard errors in brackets. Also, the first half of each Table reports the estimates on the total sample and the second half displays the results for the subsample of *KIBS*. We clustered the observations at the region level in order to correct for the downward bias in the estimation of standard-errors that may arise when individual variables are regressed on aggregate variables (Moulton, 1990). Possibly, a cluster at the region-sector level would be preferable since our spillovers display such kind of variation. However the inclusion of the average labour productivity of manufacturing sector at the regional level - being the latter the highest level of aggregation in our analysis - led us to prefer a regional cluster[17].

Turning now to the interpretation of the estimates, as far as the firm level characteristics are concerned, from all of the following Tables we confirm in general the results shown in Conti et al. (2010): firm productivity only turns significant when far and tougher markets have to be reached, the firm's age and size is not always significant while making business with large industrial firms ($Sell_{large}$) and acquiring experience in the national market outside the local one ($Sale_{nat}$) are positively and significantly related to the probability of being a service exporter. For sake of brevity, here we will not discuss further on them, since they are described in more detail in that paper. Instead, starting from the evidence of the importance of manufacturing firms as customers for being an exporter, we will focus on the main target of this work:

[17]Nevertheless, as robustness check of the following results we have changed the cluster option to the finer category and, as discussed below, the results stay unchanged.

the backward spillover effects from downstream manufacturing sectors, especially export spillovers that may be a prominent channel to ease the flow of information on the foreign markets and, as a consequence, the export entry of service firms.

As previously stated, we define our export spillover measure as the export openness of downstream sectors. We try to detect the effects of the general international involvement of manufacturing sectors regardless of the export destinations, and then we test whether spillovers are destination-specific. Table 7 shows that the export openness of downstream manufacturing sectors is positive and significant when exporters to extra-Europe markets are considered. From the evidence both on the total sample and on the sub-sample of the *KIBS*, we can notice that more than export openness of downstream sectors per se, what really matters is the destination-specific experience of manufacturing customers, that turns out to be significant when business service firms enter distant and rich markets. This is confirmed both for the export propensity out of Europe and, especially, for the exports to Extra-European high-income countries. Since the work of Roberts and Tybout (1995), we know that firms entering foreign markets have to bear sunk costs and these costs may be higher for distant markets that require additional efforts[18]. This could be particularly true for service firms that are naturally born-local. In addition our evidence is an indirect test that export sunk costs are destination-specific, as also documented in Koenig (2009) and Koenig et al. (2010). Then, our evidence suggests that international experience of customers may reduce the export costs of service firms and ease their penetration in "difficult" markets. Especially, due to the importance of *KIBS* for advanced countries and their long-run growth, these linkages may positively affect the development of the economy[19].

[18]Eaton et al. (2009) show for France that the number of exporters drops dramatically when exports to distant markets are analysed. In addition, they show that only larger firms succeed to penetrate the distant markets.

[19]In our analysis we focus on the firm export activity and we do not study other firms' internationalisation strategies. This decision is due to data constraints. In fact, we have at our disposal information on the delocalisation strategies, foreign direct investments and commercial penetration of services firms. Anyway, the number of firms involved in these more sophisticated strategies is small, thus we can not analyse the determinants of each single strategy. In opposite we have tried to take into account the different internationalisation strategies together in one single dummy and we have obtained similar results to the ones concerning only the export status. Unluckily this analysis can not be applied for the destination-specific firm involvement in foreign markets since the breakdown by foreign country groups is different across the internationalisation strategies. For these reasons, we have preferred to focus on the export status that allow us to study the destination-specific effects and that is the most important internationalisation strategy. Anyway, it would be interesting to extend the analysis to other internationalisation processes because there

Turning to the results on market thickness of downstream sectors in Table 8, the first half of the Table shows that the number of plants in downstream manufacturing sectors is in general important for the export performance of service firms. In this case, the effect arises also for the propensity to export to European Countries in addition to distant markets that are difficult to penetrate. Thus, the agglomeration seems to have a positive impact on the learning process of service firms and the exploitation of scale economies [20]. The estimates on the *KIBS* sub-sample in the second half of the Table show that thickness spillovers disappear for the propensity to export to European countries, while the coefficient is slightly significant when exporters to Extra-Europe High income destinations are considered. Summing up, when all the sample is considered local downstream sectors market thickness and export openness matter especially for exporting to non European markets; for firms operating in KIBS sectors, only export openness matters and, in particular, downstream manufacturing firms' export openness towards a specific destination turns out to be significant for the probability to be an exporter of KIBS to the same market [21]. These results are confirmed when the export and thickness spillovers are included in the same specification (see table 13 in the appendix).

Now, to ascertain whether the linkages between manufacturing and service firms are also effective when the scope of the interaction is not exclusively local, Tables 9 and 10 show the results concerning the overall spillover measure from formula 5. The results concerning "'national' export spillovers mimic the previous ones, thus it seems that enlarging the scope of the spillover does not affect the probability to export: from the marginal effects in Table 11 it is possible to highlight that the bulk of the effect can be attributed to the local spillover since the estimated effects are only slightly higher for the aggregate spillover: for the whole sample an increase of 1 percentage point in the spillover from downstream manufacturing firms exporting to a specific destination outside Europe increases the probability of exporting to that destination of about 3 percentage points, which turns into 7 percen-

could be an heterogeneity in the effects of spillovers from manufacturing sector. This research line calls for additional and more detailed data and is in our future agenda.

[20]Strangely enough, when considering firms exporting to Extra-Europe High income destinations, the coefficient on the average regional labour productivity in the manufacturing sector turns negative and slightly significant. This could seem counterintuitive, however, once accounted for the local market thickness, there might be a crowding out effect: having the chance to sell to efficient local customers may reduce the incentive to make additional efforts and export to distant market. However, this issue would need for further investigation.

[21]We have also tried to use an alternative measure of agglomeration, replacing the thickness indicator with the regional GDP and the insights from the analysis hold.

tage points for high income destination countries and about 4 percentage points for firms providing KIBS. On the other hand, when market thickness is considered, the scope of the service-manufacturing interaction seems to be non-exclusively local. From the total sample results, doubling the local downstream manufacturing market thickness increases the probability of becoming an exporter of about 2 percentage points which turns into a higher increase of 5-6 percentage points for the probability to export to non European markets, while doubling the overall downstream manufacturing market thickness increases the probability of becoming an exporter of about 7 percentage points which turns into a higher increase of 16-18 percentage points for the probability to export to non European markets. Anyway, when the *KIBS* sub-sample is considered the extent of the spillover is essentially local.

Table 7: Export Openness of downstream manufacturing sectors I

	ALL SAMPLE								KIBS					
VARIABLES	All	Europe		Extra-Europe		Extra-Europe High		All	Europe		Extra-Europe		Extra-Europe High	
LP	0.011	0.001	0	0.037	0.038	0.035	0.036	0.013	0.006	0.008	0.143	0.138	0.301***	0.298***
	[0.044]	[0.052]	[0.052]	[0.038]	[0.040]	[0.062]	[0.066]	[0.066]	[0.075]	[0.076]	[0.113]	[0.111]	[0.099]	[0.106]
Age	0.019***	0.017***	0.017***	0.01	0.01	-0.001	0.001	0.009	0.005	0.005	0.007	0.008	0.005	0.007
	[0.005]	[0.006]	[0.006]	[0.008]	[0.008]	[0.009]	[0.010]	[0.014]	[0.013]	[0.013]	[0.012]	[0.012]	[0.016]	[0.016]
Age^2	-0.000***	-0.000**	-0.000**	0	0	0	0	0	0	0	0	0	0	0
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Lab	0.388	0.392	0.402	0.343	0.321	0.218	0.208	0.264	0.199	0.201	0.164	0.16	0.06	0.038
	[0.255]	[0.266]	[0.267]	[0.264]	[0.273]	[0.278]	[0.296]	[0.320]	[0.294]	[0.292]	[0.416]	[0.420]	[0.405]	[0.427]
Lab^2	-0.055	-0.054	-0.056	-0.048	-0.045	-0.031	-0.029	-0.035	-0.028	-0.029	-0.028	-0.027	-0.006	-0.003
	[0.035]	[0.035]	[0.035]	[0.032]	[0.033]	[0.031]	[0.033]	[0.043]	[0.039]	[0.039]	[0.052]	[0.053]	[0.048]	[0.052]
$FDIOFF$	0.771***	0.466***	0.471***	0.709***	0.713***	0.671**	0.718***	0.801***	0.291	0.292	0.703***	0.722***	0.49	0.531
	[0.176]	[0.164]	[0.166]	[0.218]	[0.224]	[0.262]	[0.267]	[0.235]	[0.205]	[0.209]	[0.243]	[0.249]	[0.317]	[0.327]
$Group$	-0.109	-0.012	-0.012	-0.034	-0.036	-0.073	-0.066	-0.042	0.078	0.079	-0.039	-0.041	-0.005	0.002
	[0.138]	[0.157]	[0.157]	[0.117]	[0.117]	[0.108]	[0.114]	[0.145]	[0.173]	[0.173]	[0.087]	[0.083]	[0.113]	[0.111]
$Sale_{nat}$	0.044***	0.044***	0.044***	0.041***	0.041***	0.035***	0.035***	0.046***	0.045***	0.045***	0.040***	0.040***	0.035***	0.034***
	[0.003]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]	[0.005]	[0.006]	[0.006]	[0.009]	[0.009]	[0.010]	[0.010]
$Sale^2_{nat}$	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$Sell_{Large}$	0.377***	0.251***	0.253***	0.464***	0.487***	0.483***	0.494***	0.508***	0.352***	0.349***	0.764***	0.774***	0.923***	0.956***
	[0.074]	[0.073]	[0.073]	[0.158]	[0.162]	[0.174]	[0.182]	[0.093]	[0.117]	[0.117]	[0.139]	[0.138]	[0.140]	[0.144]
$Sell_{SMEs}$	-0.166**	-0.061	-0.062	-0.330***	-0.323***	-0.287***	-0.279***	-0.278**	-0.121	-0.121	-0.626***	-0.626***	-0.624***	-0.610***
	[0.070]	[0.075]	[0.075]	[0.084]	[0.086]	[0.075]	[0.079]	[0.108]	[0.112]	[0.112]	[0.114]	[0.115]	[0.096]	[0.102]
$Inno_{serv}$	0.059	0.091	0.091	0.096	0.105	-0.049	-0.047	-0.102	-0.027	-0.031	-0.092	-0.076	-0.221*	-0.203
	[0.049]	[0.065]	[0.066]	[0.071]	[0.079]	[0.087]	[0.095]	[0.092]	[0.117]	[0.118]	[0.089]	[0.087]	[0.131]	[0.140]
$Inno_{proc}$	0.054	0.047	0.047	0.037	0.037	0.059	0.054	0.163	0.112	0.114	0.164	0.164	0.17	0.142
	[0.121]	[0.120]	[0.120]	[0.184]	[0.191]	[0.186]	[0.197]	[0.138]	[0.158]	[0.159]	[0.133]	[0.133]	[0.178]	[0.179]
LP^m_{reg}	0.865*	0.828*	0.751	0.903	0.766	0.181	-1.215	1.731***	1.159*	1.311*	1.860***	1.329*	1.256***	-0.696
	[0.480]	[0.481]	[0.504]	[0.846]	[0.560]	[1.116]	[1.061]	[0.519]	[0.612]	[0.693]	[0.680]	[0.735]	[0.478]	[0.643]
Exp^{back}_{reg}	0.013	0.018		0.019		0.014		0.026*	0.022*		0.028**		0.040*	
	[0.013]	[0.013]		[0.024]		[0.028]		[0.014]	[0.013]		[0.013]		[0.022]	
$ExpEURO^{back}_{reg}$			0.011							0.028				
			[0.014]							[0.020]				
$ExpEX^{back}_{reg}$					0.186***							0.101***		
					[0.057]							[0.034]		
$ExpEXhigh^{back}_{reg}$							0.553***							0.371***
							[0.148]							[0.070]
$Const.$	-6.003***	-6.124***	-5.659***	-6.562**	-6.412***	-3.93	0.284	-9.289***	-7.134***	-7.423***	-10.475***	-8.527***	-8.928***	-2.487
	[1.957]	[2.006]	[2.066]	[3.145]	[2.073]	[4.040]	[3.672]	[2.129]	[2.440]	[2.566]	[2.718]	[2.694]	[2.156]	[2.200]
Observations	1159	1159	1159	1137[a]	1137[a]	1135[a]	1135[a]	635	635	635	635	635	526[a]	526[a]
Pseudo-R2	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.245	0.245	0.245	0.245	0.245	0.245	0.245
Log-likelihood	-240.5	-240.5	-240.5	-240.5	-240.5	-240.5	-240.5	-114.2	-114.2	-114.2	-114.2	-114.2	-114.2	-114.2

Robust Standard errors in brackets are clustered by region.
Area and Sector Dummies are included in every regressions.
[a] The drop of observations is because some sector and area dummies perfectly predict the export status.

Table 8: Market Thickness of downstream manufacturing sectors I

	ALL SAMPLE				KIBS			
VARIABLES	All	Europe	Extra-Europe	Extra-Europe High	All	Europe	Extra-Europe	Extra-Europe High
LP	0.008	-0.003	0.025	0.025	0.013	0.002	0.139	0.284***
	[0.043]	[0.051]	[0.039]	[0.063]	[0.065]	[0.071]	[0.115]	[0.107]
Age	0.019***	0.017***	0.009	-0.002	0.009	0.006	0.007	0.004
	[0.005]	[0.006]	[0.008]	[0.009]	[0.014]	[0.013]	[0.012]	[0.015]
Age^2	-0.000***	-0.000**	0	0	0	0	0	0
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Lab	0.404	0.414	0.417	0.302	0.26	0.195	0.179	0.084
	[0.252]	[0.268]	[0.284]	[0.304]	[0.316]	[0.297]	[0.412]	[0.416]
Lab^2	-0.058*	-0.057	-0.058*	-0.041	-0.036	-0.028	-0.029	-0.008
	[0.035]	[0.036]	[0.035]	[0.035]	[0.042]	[0.040]	[0.051]	[0.049]
$FDIOFF$	0.774***	0.473***	0.702***	0.645**	0.834***	0.336	0.749***	0.551
	[0.174]	[0.163]	[0.212]	[0.258]	[0.257]	[0.220]	[0.269]	[0.357]
$Group$	-0.109	-0.012	-0.044	-0.097	-0.042	0.086	-0.046	-0.029
	[0.139]	[0.158]	[0.118]	[0.108]	[0.146]	[0.174]	[0.086]	[0.115]
$Sale_{nat}$	0.044***	0.044***	0.041***	0.036***	0.045***	0.044***	0.040***	0.034***
	[0.003]	[0.005]	[0.006]	[0.006]	[0.005]	[0.006]	[0.009]	[0.010]
$Sale^2_{nat}$	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$Sell_{Large}$	0.382***	0.258***	0.480***	0.501***	0.511***	0.354***	0.756***	0.908***
	[0.073]	[0.072]	[0.163]	[0.179]	[0.092]	[0.120]	[0.136]	[0.139]
$Sell_{SMEs}$	-0.167**	-0.061	-0.346***	-0.311***	-0.290***	-0.127	-0.631***	-0.632***
	[0.071]	[0.075]	[0.089]	[0.079]	[0.108]	[0.117]	[0.112]	[0.094]
$Inno_{serv}$	0.065	0.101	0.122	-0.028	-0.094	-0.011	-0.084	-0.204*
	[0.048]	[0.063]	[0.086]	[0.103]	[0.091]	[0.111]	[0.090]	[0.114]
$Inno_{proc}$	0.049	0.039	0.002	0.014	0.171	0.11	0.173	0.174
	[0.122]	[0.121]	[0.198]	[0.205]	[0.140]	[0.163]	[0.139]	[0.179]
LP^m_{reg}	0.513	0.316	-0.555	-1.662*	1.466***	0.556	1.314*	-0.261
	[0.559]	[0.542]	[0.668]	[0.952]	[0.547]	[0.486]	[0.768]	[0.659]
N^{back}_{reg}	0.061	0.089**	0.411***	0.491***	-0.001	0.112	0.044	0.188*
	[0.046]	[0.045]	[0.088]	[0.151]	[0.061]	[0.088]	[0.055]	[0.102]
$Const.$	-4.953**	-4.524**	-3.954*	0.381	-7.662***	-5.098***	-8.088***	-3.332
	[2.017]	[1.935]	[2.368]	[3.365]	[2.032]	[1.944]	[2.866]	[2.287]
Observations	1159	1159	1137[a]	1135[a]	635	635	635	526[a]
Pseudo-R2	0.199	0.199	0.199	0.199	0.235	0.235	0.235	0.235
Log-likelihood	-247.8	-247.8	-247.8	-247.8	-115.7	-115.7	-115.7	-115.7

Robust Standard errors in brackets are clustered by region.
Area and Sector Dummies are included in every regressions.
[a] The drop of observations is because some sector and area dummies perfectly predict the export status.

Table 9: Export Openness of downstream manufacturing sectors II

	ALL SAMPLE							KIBS						
VARIABLES	All	Europe		Extra-Europe		Extra-Europe High		All	Europe		Extra-Europe		Extra-Europe High	
LP	0.010	-0.001	-0.001	0.038	0.036	0.040	0.035	0.002	0.001	0.001	0.136	0.135	0.289***	0.297***
	[0.044]	[0.051]	[0.052]	[0.038]	[0.040]	[0.063]	[0.065]	[0.065]	[0.073]	[0.073]	[0.111]	[0.110]	[0.099]	[0.103]
age	0.019***	0.017***	0.017***	0.009	0.009	-0.002	0.000	0.01	0.006	0.006	0.007	0.007	0.006	0.007
	[0.005]	[0.006]	[0.006]	[0.008]	[0.008]	[0.009]	[0.010]	[0.014]	[0.013]	[0.013]	[0.012]	[0.012]	[0.016]	[0.015]
age^2	-0.000***	-0.000**	-0.000**	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Lab	0.396	0.401	0.405	0.339	0.327	0.207	0.212	0.289	0.213	0.212	0.165	0.163	0.032	0.040
	[0.255]	[0.268]	[0.268]	[0.262]	[0.275]	[0.276]	[0.302]	[0.327]	[0.298]	[0.298]	[0.420]	[0.422]	[0.410]	[0.432]
Lab^2	-0.057	-0.056	-0.056	-0.048	-0.046	-0.029	-0.029	-0.039	-0.031	-0.031	-0.028	-0.028	-0.003	-0.003
	[0.035]	[0.036]	[0.036]	[0.032]	[0.033]	[0.031]	[0.034]	[0.044]	[0.040]	[0.040]	[0.053]	[0.053]	[0.050]	[0.053]
$FDIOFF$	0.776***	0.475***	0.476***	0.710***	0.723***	0.667**	0.728***	0.791***	0.289	0.291	0.709***	0.723***	0.475	0.549*
	[0.175]	[0.165]	[0.165]	[0.217]	[0.222]	[0.268]	[0.266]	[0.228]	[0.200]	[0.201]	[0.242]	[0.242]	[0.301]	[0.296]
$Group$	-0.108	-0.012	-0.012	-0.036	-0.035	-0.078	-0.068	-0.045	0.076	0.076	-0.038	-0.039	0.006	-0.002
	[0.138]	[0.157]	[0.157]	[0.119]	[0.118]	[0.111]	[0.115]	[0.143]	[0.172]	[0.172]	[0.087]	[0.084]	[0.112]	[0.104]
$Sale_{nat}$	0.044***	0.044***	0.044***	0.041***	0.041***	0.035***	0.034***	0.046***	0.044***	0.044***	0.040***	0.040***	0.034***	0.034***
	[0.003]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]	[0.005]	[0.006]	[0.006]	[0.009]	[0.009]	[0.010]	[0.010]
$Sale^2_{nat}$	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$Sell_{Large}$	0.380***	0.254***	0.255***	0.463***	0.488***	0.479***	0.493***	0.532***	0.364***	0.364***	0.768***	0.772***	0.950***	0.956***
	[0.073]	[0.072]	[0.072]	[0.159]	[0.161]	[0.177]	[0.183]	[0.092]	[0.119]	[0.119]	[0.138]	[0.138]	[0.137]	[0.147]
$Sell_{SMEs}$	-0.167**	-0.061	-0.062	-0.331***	-0.326***	-0.285***	-0.281***	-0.276**	-0.12	-0.12	-0.619***	-0.621***	-0.612***	-0.614***
	[0.070]	[0.075]	[0.075]	[0.085]	[0.086]	[0.077]	[0.079]	[0.107]	[0.110]	[0.109]	[0.111]	[0.112]	[0.094]	[0.096]
$Inno_{serv}$	0.061	0.095	0.094	0.108	0.125	-0.037	-0.025	-0.104	-0.023	-0.021	-0.085	-0.073	-0.21	-0.188
	[0.047]	[0.064]	[0.064]	[0.077]	[0.083]	[0.094]	[0.096]	[0.095]	[0.119]	[0.119]	[0.086]	[0.085]	[0.140]	[0.132]
$Inno_{proc}$	0.053	0.045	0.046	0.034	0.029	0.055	0.041	0.152	0.102	0.102	0.155	0.158	0.145	0.138
	[0.121]	[0.120]	[0.120]	[0.187]	[0.193]	[0.190]	[0.203]	[0.140]	[0.157]	[0.157]	[0.131]	[0.132]	[0.179]	[0.178]
LP^m_{reg}	0.745	0.705	0.651	1.129	0.753	0.658	-1.427	1.192***	0.82	0.787	1.474**	1.337*	0.441	-1.042
	[0.499]	[0.486]	[0.500]	[0.763]	[0.524]	[0.971]	[0.931]	[0.419]	[0.636]	[0.763]	[0.666]	[0.725]	[0.552]	[0.728]
Exp^{back}_{nat}	0.004	0.010		0.039*		0.055*		-0.024	-0.008		0.004		-0.007	
	[0.010]	[0.009]		[0.022]		[0.031]		[0.017]	[0.017]		[0.020]		[0.023]	
$ExpEURO^{back}_{nat}$			0.005							-0.009				
			[0.013]							[0.026]				
$ExpEX^{back}_{nat}$					0.210***							0.071*		
					[0.053]							[0.043]		
$ExpEXhigh^{back}_{nat}$							0.663***							0.469**
							[0.174]							[0.227]
Const.	-5.828***	-6.197***	-4.801**	-6.952**	-10.949***	-6.442*	0.271	-3.954*	-4.346	-4.27	-8.680***	-9.090***	-3.65	-2.637
	[1.896]	[1.905]	[2.070]	[2.966]	[2.477]	[3.839]	[3.081]	[2.326]	[3.225]	[4.385]	[3.135]	[2.866]	[2.594]	[1.808]
Observations	1159	1159	1159	1137[a]	1137[a]	1135[a]	1135[a]	635	635	635	635	635	526[a]	526[a]
Pseudo-R2	0.233	0.210	0.210	0.213	0.224	0.203	0.227	0.18	0.133	0.133	0.238	0.239	0.236	0.246
Log-likelihood	-467.7	-442.4	-442.6	-277.4	-273.5	-246.5	-239.2	-271.5	-252.4	-252.4	-140.8	-140.6	-115.5	-114.1

Robust Standard errors in brackets are clustered by region.
Area and Sector Dummies are included in every regressions.
[a] The drop of observations is because some sector and area dummies perfectly predict the export status.

Table 10: Market Thickness of downstream manufacturing sectors II

	ALL SAMPLE				**KIBS**			
VARIABLES	All	Europe	Extra-Europe	Extra-Europe High	All	Europe	Extra-Europe	Extra-Europe High
LP	0.008	-0.004	0.024	0.023	0.006	-0.004	0.139	0.276***
	[0.044]	[0.051]	[0.039]	[0.062]	[0.065]	[0.070]	[0.114]	[0.107]
age	0.019***	0.017***	0.009	-0.002	0.009	0.006	0.007	0.007
	[0.005]	[0.006]	[0.008]	[0.009]	[0.014]	[0.013]	[0.012]	[0.016]
age^2	-0.000***	-0.000**	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Lab	0.404	0.416	0.425	0.314	0.28	0.206	0.164	0.04
	[0.252]	[0.269]	[0.285]	[0.308]	[0.323]	[0.299]	[0.419]	[0.423]
Lab^2	-0.058*	-0.057	-0.059*	-0.042	-0.038	-0.029	-0.028	-0.003
	[0.035]	[0.036]	[0.035]	[0.035]	[0.043]	[0.040]	[0.053]	[0.051]
$FDIOFF$	0.777***	0.477***	0.710***	0.654**	0.792***	0.308	0.706***	0.478
	[0.174]	[0.164]	[0.212]	[0.262]	[0.226]	[0.199]	[0.242]	[0.300]
$Group$	-0.109	-0.013	-0.049	-0.100	-0.043	0.085	-0.037	0.000
	[0.139]	[0.158]	[0.116]	[0.107]	[0.143]	[0.173]	[0.089]	[0.109]
$Sale_{nat}$	0.044***	0.044***	0.041***	0.036***	0.046***	0.044***	0.040***	0.035***
	[0.003]	[0.005]	[0.006]	[0.006]	[0.005]	[0.006]	[0.009]	[0.010]
$Sale^2_{nat}$	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$Sell_{Large}$	0.383***	0.260***	0.480***	0.501***	0.524***	0.363***	0.769***	0.949***
	[0.073]	[0.073]	[0.160]	[0.175]	[0.093]	[0.120]	[0.138]	[0.141]
$Sell_{SMEs}$	-0.168**	-0.061	-0.344***	-0.309***	-0.273**	-0.11	-0.621***	-0.611***
	[0.070]	[0.075]	[0.087]	[0.076]	[0.107]	[0.111]	[0.110]	[0.097]
$Inno_{serv}$	0.064	0.101	0.121	-0.03	-0.101	-0.014	-0.089	-0.209
	[0.048]	[0.063]	[0.085]	[0.101]	[0.095]	[0.117]	[0.087]	[0.139]
$Inno_{proc}$	0.050	0.040	0.004	0.012	0.153	0.092	0.157	0.134
	[0.122]	[0.120]	[0.198]	[0.208]	[0.138]	[0.155]	[0.131]	[0.182]
LP^m_{reg}	0.537	0.296	-0.508	-1.727*	1.514***	0.466	1.578**	-0.288
	[0.575]	[0.539]	[0.724]	[0.952]	[0.554]	[0.481]	[0.787]	[0.699]
N^{back}_{nat}	0.172	0.305**	1.204***	1.521***	-0.095	0.400	-0.117	0.464*
	[0.135]	[0.129]	[0.243]	[0.348]	[0.189]	[0.314]	[0.182]	[0.254]
Const.	-5.331***	-5.620***	-10.788***	-9.025***	-6.507***	-7.022***	-7.738***	-5.960**
	[1.944]	[1.846]	[2.824]	[3.331]	[1.545]	[2.682]	[2.376]	[2.364]
Observations	1159	1159	1137[a]	1135[a]	635	635	635	526[a]
Pseudo-R2	0.233	0.211	0.222	0.219	0.179	0.134	0.238	0.238
Log-likelihood	-467.6	-442.1	-274.1	-241.8	-272.0	-252.0	-140.8	-115.3

Robust Standard errors in brackets are clustered by region.
Area and Sector Dummies are included in every regressions.
[a] The drop of observations is because some sector and area dummies perfectly predict the export status.

Table 11: Marginal Effetcs

VARIABLES	ALL SAMPLE				KIBS			
	All	Europe	Extra-Europe	Extra-Europe High	All	Europe	Extra-Europe	Extra-Europe High
SPILLOVER FROM DOWNSTREAM MANUFACTURING EXPORT ACTIVITY								
Marginal Effects from Table 7								
Exp_{reg}^{back}	0.00303	0.00387	0.00253	0.00166	0.00637*	0.00482*	0.00339**	0.00425*
	[0.00291]	[0.00272]	[0.00327]	[0.00342]	[0.00332]	[0.00287]	[0.00148]	[0.00228]
$ExpEURO_{reg}^{back}$		0.00231				0.0061		
		[0.00292]				[0.00439]		
$ExpEX_{reg}^{back}$			0.0250***				0.0121***	
			[0.00801]				[0.00365]	
$ExpEXhigh_{reg}^{back}$				0.0655***				0.0379***
				[0.0189]				[0.00659]
Marginal Effects from Table 9								
Exp_{nat}^{back}	0.000956	0.00213	0.00511*	0.00638*	-0.00568	-0.00176	0.000487	-0.00078
	[0.00220]	[0.00201]	[0.00282]	[0.00362]	[0.00394]	[0.00382]	[0.00243]	[0.00246]
$ExpEURO_{nat}^{back}$		0.000958				-0.00197		
		[0.00270]				[0.00583]		
$ExpEX_{nat}^{back}$			0.0275***				0.00855	
			[0.00701]				[0.00525]	
$ExpEXhigh_{nat}^{back}$				0.0743***				0.0503**
				[0.0196]				[0.0224]
SPILLOVER FROM DOWNSTREAM MANUFACTURING MARKET THICKNESS								
Marginal Effects from Table 8								
N_{reg}^{back}	0.0138	0.0188*	0.0541***	0.0572***	-0.00015	0.0249	0.00535	0.0223*
	[0.0105]	[0.00966]	[0.0116]	[0.0176]	[0.0149]	[0.0195]	[0.00673]	[0.0116]
Marginal Effects from Table 10								
N_{nat}^{back}	0.0386	0.0646**	0.161***	0.180***	-0.0228	0.0882	-0.0141	0.0537*
	[0.0308]	[0.0277]	[0.0331]	[0.0430]	[0.0453]	[0.0685]	[0.0218]	[0.0293]

5.1 Further robustness checks

The above findings have proved robust to a number of checks for which detailed results are available from the authors upon request. All these tests have been implemented making use of the more complete specification including both regional export and thickness spillovers.

- **Different cluster**: as previously mentioned, we clustered the observations at sector-region level and even with smaller clusters our main findings do not change;

- **Exclusion of Lombardy**: we have excluded from our analysis firms in Lombardy region because an important share of service firms are located in this region and we want to make sure that the effects are not driven only by this region. Backward spillovers are confirmed to be significant and positively related to international performance of firms in business services.

- **Different input-output coefficients**: following Javorcik (2004) for the computation of spillover measures we use the input-output coefficients built as proportion of the sectoral output supplied to manufacturing sector excluding products supplied for final consumption, that is taking into account (at the denominator) the total sales of intermediates, instead of the total production of the sector. The findings mimic the results shown above.

- **Lagged spillover measures**: we have substituted the spillover measure with its value in 2001, the first year of the survey, to account for possible simultaneity effects and the results again stay unchanged.

- **Small number of exporters**: to ensure that our results on the export status in extra-European advanced markets are not affected by the smaller number of exporters to these destinations, we have also repeated our estimates on the pooled sample 2001-2003. In other words, building on the widespread evidence of persistence in the export status we have extended the information for 2003 to the two previous years in the survey, thus exploiting the panel dimension of some regressors (our spillovers, size and labour productivity). Main results are confirmed.

- **Omitted variables**: to deal with the potential omitted variable bias we try to add two variables in order to take into account the "traditional" involvement of the region in international activities. First of all, we include in the regressions an indicator capturing both the overall and

origin-specific regional import penetration in downstream manufacturing sectors, built following the formula shown above for export spillovers (equation 4). Secondly, we include a measure of regional "trade openness" (both overall and region-specific), calculated as export plus imports over total value added. The inclusion of these variables does not affect the sign and the significance of the main results for the export spillovers. The destination-specific downstream export experience still remains significantly related to the probability to export of services firms even if we control for other internationalisation measures in the region. Only the positive linkage between the downstream experience in Extra European countries and the service firm's export propensity in that area loose its significance in the Total Sample [22]. These robustness check is important in order to discard the possibility that previous results are driven by some specific characteristics that affect the general trade propensity of the region.

6 Conclusion

With this paper we have tried to contribute to the scant existing evidence on the interdependencies among sectors in terms of internationalisation and efficiency. Within the limited evidence on this topic, to the best of our knowledge, this is the first piece of research investigating the backward linkages from downstream manufacturing sectors to service firms. Using standard econometric techniques our results convey interesting suggestions. The findings show that the thickness in downstream manufacturing sectors matter for the export performance of the service firms, especially when the destination countries are distant and high income countries that make the export activity a difficult task.

As far as the international involvement of downstream manufacturing is concerned, only destination-specific export openness of downstream manufacturing sectors play a significant role. Especially service firms' export performance in rich and distant markets is positively related to the international involvement of downstream manufacturing sectors in the same geographical areas. Also, despite experience in the national market is an important feature of exporters in services it seems from our results that the extent of knowledge spillovers is mainly local.

[22] This relationship still stays significant for the sub-sample of KIBS sectors. In opposite, the role of the downstream experience in High-Income Extra European countries always preserves its significance. Results are available upon request.

Our evidence confirms that there are important complementarities between service and manufacturing sectors and these effects may help the development and growth of a country.

In this framework, it is important to take into account the process of the internationalisation of both industrial and services firms that may sustain each other and useful policy implications may emerge from our work. As far as knowledge intensive business services become the new growth creating sectors it is important to spur their production across the country. In this regard, national policies should address the lack of industrial development in laggard regions more effectively. Also, although our results suggest that spillovers, especially from manufacturing export experience, are essentially local, some room may still exist for learning from neighbouring realities. Policies, in addition to fostering industrialisation in the South, could address the easing of spatial linkages between industrial and non industrial regions to allow for the location of service activities in the latter to serve the industrial market of the former.

As shown, the input-output linkages between services and manufacturing are becoming more and more important, also due to the diffusion of firms' outsourcing/offshoring strategies. This fact together with the greater weight of services in all economies opens new interesting research lines also taking into account the geographical and spatial perspective of economic activities, and enlarging the attention to developing countries, where the lack of efficient manufacturing sectors might also prevent the spur of advanced services thus representing a severe constraint for growth.

Finally, the analysis of spillovers originating from other internationalisation strategies of manufacturing may give interesting insights. Especially, the regional inward and outward foreign direct investment in manufacturing may help the involvement of services firms in foreign markets, both through export activity and other channels (foreign direct investment and offshoring). This is an additional research line in our future agenda.

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7 Appendix

Table 12: Correlations

	LP	age	age^2	Lab	Lab^2	$FDIOFF$	$Group$	$Sale_{nat}$	$Sale^2_{nat}$	$Sell_{Large}$	$Sell_{SMEs}$	$Inno_{serv}$	$Inno_{proc}$	LP^m_{reg}	Exp^{back}_{reg}	N^{back}_{reg}	Exp^{back}_{nat}	N^{back}_{nat}
LP	1																	
age	0.07	1																
age^2	0.05	0.88*	1															
Lab	-0.11*	0.12*	0.08*	1														
Lab^2	-0.10*	0.12*	0.07	0.10*	1													
$FDIOFF$	0.01	0.04	0.04	0.12*	0.15*	1												
$Group$	0.19*	-0.08*	-0.05	0.24*	0.24*	0.09*	1											
$Sale_{nat}$	0.16*	-0.09*	-0.08*	0.08*	0.08*	0.09*	0.12*	1										
$Sale^2_{nat}$	0.15*	-0.09*	-0.07	0.09*	0.09*	0.07	0.12*	0.98*	1									
$Sell_{Large}$	0.05	-0.03	-0.05	0.04	0.03	0.05	0.03	0.18*	0.14*	1								
$Sell_{SMEs}$	0.02	0.01	-0.02	-0.07	-0.07	-0.06	-0.03	-0.02	-0.04	0.31*	1							
$Inno_{serv}$	0.014	-0.06	-0.07	-0.01	-0.02	0.02	0.00	0.08*	0.07	0.11*	0.09*	1						
$Inno_{proc}$	-0.01	-0.08*	-0.07	0.07	0.06	0.02	0.05	0.16*	0.16*	0.09*	0.06	0.41*	1					
LP^m_{reg}	0.20*	0.06	0.07	-0.05	-0.04	0.06	0.07	0.17*	0.17*	0.12*	0.07	0.06	0.06	1				
Exp^{back}_{reg}	0.09*	0.04	-0.02	0.00	0.00	0.06	0.03	0.22*	0.19*	0.09*	0.01	-0.02	0.02	0.35*	1			
N^{back}_{reg}	0.15*	-0.03	-0.08	-0.03	-0.02	0.06	0.05	0.22*	0.20*	0.13*	0.06	0.01	0.07	0.58*	0.62*	1		
Exp^{back}_{nat}	0.08*	0.05	-0.00	0.02	0.01	0.04	0.14	0.22*	0.19*	0.07	-0.00	-0.04	0.01	0.23*	0.81*	0.68*	1	
N^{back}_{nat}	0.11*	-0.00	-0.04	0.01	0.01	0.05	0.11	0.25*	0.22*	0.13*	0.04	0.01	0.06	0.43*	0.73*	0.90*	0.84*	1

* Significant at 1%

Table 13: Market Thickness and Export Openness of downstream manufacturing sectors I

	ALL SAMPLE							KIBS					
VARIABLES	All	Europe		Extra-Europe		Extra-Europe High		All	Europe		Extra-Europe		Extra-Europe High	
LP	0.01	-0.001	-0.002	0.025	0.029	0.024	0.032	0.015	0.002	0.002	0.142	0.141	0.291***	0.297***
	[0.044]	[0.051]	[0.051]	[0.038]	[0.040]	[0.061]	[0.065]	[0.066]	[0.072]	[0.072]	[0.115]	[0.114]	[0.106]	[0.109]
Age	0.019***	0.016***	0.017***	0.009	0.009	-0.002	-0.001	0.009	0.006	0.006	0.007	0.008	0.006	0.007
	[0.005]	[0.006]	[0.006]	[0.008]	[0.008]	[0.009]	[0.010]	[0.014]	[0.013]	[0.013]	[0.012]	[0.012]	[0.016]	[0.016]
Age^2	-0.000***	-0.000**	-0.000**	0	0	0	0	0	0	0	0	0	0	0
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Lab	0.394	0.4	0.409	0.416	0.381	0.316	0.265	0.264	0.197	0.2	0.166	0.156	0.07	0.038
	[0.254]	[0.267]	[0.268]	[0.287]	[0.289]	[0.312]	[0.310]	[0.319]	[0.296]	[0.295]	[0.418]	[0.420]	[0.415]	[0.430]
Lab^2	-0.056	-0.055	-0.056	-0.058	-0.053	-0.043	-0.036	-0.035	-0.028	-0.028	-0.028	-0.027	-0.006	-0.003
	[0.035]	[0.035]	[0.036]	[0.035]	[0.035]	[0.036]	[0.035]	[0.043]	[0.040]	[0.040]	[0.052]	[0.053]	[0.050]	[0.052]
$FDIOFF$	0.769***	0.465***	0.468***	0.701***	0.701***	0.651**	0.680***	0.798***	0.303	0.303	0.705***	0.717***	0.497	0.531
	[0.175]	[0.163]	[0.164]	[0.216]	[0.218]	[0.258]	[0.263]	[0.236]	[0.205]	[0.208]	[0.244]	[0.249]	[0.313]	[0.327]
$Group$	-0.109	-0.012	-0.012	-0.045	-0.046	-0.097	-0.089	-0.044	0.086	0.088	-0.039	-0.041	-0.01	0.001
	[0.139]	[0.159]	[0.158]	[0.118]	[0.117]	[0.107]	[0.112]	[0.143]	[0.173]	[0.174]	[0.087]	[0.083]	[0.111]	[0.111]
$Sale_{nat}$	0.044***	0.044***	0.044***	0.041***	0.042***	0.036***	0.036***	0.046***	0.045***	0.045***	0.040***	0.040***	0.035***	0.034***
	[0.003]	[0.005]	[0.005]	[0.006]	[0.006]	[0.006]	[0.006]	[0.005]	[0.006]	[0.006]	[0.009]	[0.009]	[0.010]	[0.010]
$Sale^2_{nat}$	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
$Sell_{Large}$	0.378***	0.253***	0.254***	0.480***	0.489***	0.504***	0.498***	0.509***	0.351***	0.348***	0.764***	0.775***	0.923***	0.956***
	[0.074]	[0.073]	[0.073]	[0.163]	[0.164]	[0.178]	[0.183]	[0.092]	[0.118]	[0.118]	[0.139]	[0.139]	[0.141]	[0.146]
$Sell_{SMEs}$	-0.167**	-0.06	-0.061	-0.346***	-0.335***	-0.315***	-0.293***	-0.279***	-0.119	-0.117	-0.626***	-0.626***	-0.625***	-0.610***
	[0.071]	[0.075]	[0.075]	[0.089]	[0.090]	[0.078]	[0.081]	[0.108]	[0.114]	[0.113]	[0.114]	[0.114]	[0.099]	[0.100]
$Inno_{serv}$	0.063	0.098	0.099	0.122	0.12	-0.025	-0.038	-0.104	-0.019	-0.021	-0.091	-0.08	-0.213*	-0.203
	[0.049]	[0.064]	[0.065]	[0.085]	[0.086]	[0.102]	[0.101]	[0.092]	[0.115]	[0.116]	[0.089]	[0.086]	[0.125]	[0.138]
$Inno_{proc}$	0.05	0.04	0.039	0.003	0.01	0.012	0.027	0.166	0.103	0.103	0.163	0.168	0.157	0.142
	[0.122]	[0.120]	[0.120]	[0.198]	[0.199]	[0.206]	[0.205]	[0.136]	[0.158]	[0.158]	[0.133]	[0.133]	[0.178]	[0.180]
LP^m_{reg}	0.682	0.554	0.475	-0.526	-0.245	-2.025*	-2.011**	1.831***	0.83	0.945	1.799**	1.493*	0.593	-0.705
	[0.513]	[0.503]	[0.523]	[0.865]	[0.537]	[1.127]	[0.979]	[0.635]	[0.569]	[0.642]	[0.799]	[0.806]	[0.637]	[0.870]
N^{back}_{reg}	0.053	0.079	0.089*	0.409***	0.314***	0.512***	0.312***	-0.028	0.092	0.11	0.015	-0.043	0.124	0.002
	[0.049]	[0.051]	[0.047]	[0.088]	[0.075]	[0.140]	[0.109]	[0.076]	[0.097]	[0.092]	[0.070]	[0.077]	[0.133]	[0.110]
Exp^{back}_{reg}	0.012	0.016		0.002		-0.018		0.027**	0.02		0.028**		0.036	
	[0.013]	[0.013]		[0.023]		[0.029]		[0.014]	[0.014]		[0.013]		[0.024]	
$ExpEURO^{back}_{reg}$			0.011							0.027				
			[0.014]							[0.020]				
$ExpEX^{back}_{reg}$					0.133**							0.106***		
					[0.067]							[0.036]		
$ExpEXhigh^{back}_{reg}$							0.396**							0.371***
							[0.156]							[0.065]
$Const.$	-5.588***	-5.415***	-5.139***	-4.058	-4.759***	1.913	1.525	-9.372***	-6.376***	-6.803***	-10.236***	-8.845***	-7.092***	-1.309
	[1.844]	[1.850]	[1.820]	[3.066]	[1.791]	[4.267]	[3.001]	[2.349]	[2.285]	[2.356]	[2.957]	[2.794]	[2.308]	[2.624]
Observations	1159	1159	1159	1137[a]	1137[a]	1135[a]	1135[a]	635	635	635	635	635	526[a]	526[a]
Pseudo-R2	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.245	0.245	0.245	0.245	0.245	0.245	0.245
Log-likelihood	-238.4	-238.4	-238.4	-238.4	-238.4	-238.4	-238.4	-114.2	-114.2	-114.2	-114.2	-114.2	-114.2	-114.2

Robust Standard errors in brackets are clustered by region.
Area and Sector Dummies are included in every regressions.
[a] The drop of observations is because some sector and area dummies perfectly predict the export status.