Trade and Innovation in Services

Evidence from a Developing Economy

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Abstract

Studies on innovation and international trade have traditionally focused on manufacturing because neither was seen as important for services. Moreover, the few existing studies on services focus only on industrial countries, although in many developing countries services are already the largest sector in the economy and an important determinant of overall productivity growth. Using a recent firm-level innovation survey for Chile to compare the manufacturing and “tradable” services sector, this paper reveals some novel patterns. First, although services firms have on average a much lower propensity to export than manufacturing firms, services exports are less dominated by large firms and tend to be more skill

intensive than manufacturing exports. Second, services firms appear to be as innovative as—and in some cases more innovative than—manufacturing firms, in terms of both inputs and outputs of “technological” innovative activity, although services innovations more often take a “non-technological” form. Third, services exporters (like manufacturing exporters) tend to be significantly more innovative than non-exporters, with a wider gap for innovations close to the global technological frontier. These findings suggest that the growing faith in services as a source of both trade and innovative dynamism may not be misplaced.

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1. INTRODUCTION

The literature on innovation and international trade has, until recently, focused almost exclusively on the manufacturing sector. One reason for this is that the bulk of international trade has actually taken place in manufactured products. Another is that technological developments have been traditionally associated with new or improved *physical* products. The services sector has been relatively neglected as an object of analysis because it was seen as largely untouched by both trade and innovation. This neglect has persisted despite the growing importance of services in the trade of most economies, and the growing importance of productivity growth in services for overall economic growth. For example, according to IMF balance of payments data, 70 percent of mid- and high-income economies have seen the share of service exports in total exports expand over the last 30 years. As a consequence, today many developing economies, from Malaysia to Mexico, see services exports and innovation as a potential source of dynamism for their economies and as a way of breaking out of the so-called middle income trap.¹ Is this faith justified?

The literature studying the internationalization of services companies is still in its infancy, with only a limited number of micro-level studies focusing on technological change and trade. The most notable exception is a set of studies from the innovation and marketing literature, which has focused on the analysis of the services sector in its own merit and comparing the innovative behavior of services firms with manufacturing ones. However their focus and methodologies are relatively distant from the current theoretical and empirical economic literature. Erramilli and Rao (1993) is an example.² Moreover, the few firm-level analyses of services companies have so far focused exclusively on developed economies. This paper presents a firm-level empirical analysis comparing the manufacturing and ‘tradable’ services sector from a joint trade and innovation perspective.³ We focus on Chile, an upper-middle economy that

has undertaken a special effort to promote the internationalization of its service sector.¹ We use a firm level innovation survey that includes both the manufacturing and services sectors. This survey was carried out in 2007 and covers the period 2005-2006.

In this study we present three sets of findings: the first two relate, respectively, to services firms' exporting and innovating behavior; while the third relates to the links between trade and innovation.

First, services firms have a much lower propensity to export than manufacturing firms but the exporter size premium for the services sector is significantly lower than for the manufacturing sector. In other words, fewer services firms export but those that do are not necessarily much larger than non-exporters. We suggest that this pattern can be explained by the relatively greater importance in services exports of skills rather than scale. In fact, we find that while all exporters tend to be more skill-intensive than non-exporters, the "export skills premium" is greater in services than in manufacturing.

Second, services firms appear to be as innovative as manufacturing firms, in terms of inputs in and outputs of innovative activity, measured using both subjective and objective indicators. But, as expected, services firms tend to rely relatively more on non-technological forms of innovation than manufacturing firms. These refer to innovations in product design and organizational management in production, work environment or management structure of the firm, as opposed to "technological" innovation, which refers to introduction of new products or processes in the market, and expenditure related to R&D, physical equipment acquisition and training related to them.⁴

Third, we find that exporters tend to be significantly more innovative than non-exporters, both in manufacturing and services. Moreover, the gap in innovation between exporters and non-exporters

¹ Because of data limitations our analysis focuses on cross-border trade and not on other modes of supply (i.e. FDI or movement of people). Specifically we do not cover foreign sales by subsidiaries, and hence cannot do justice to services like retail where Chilean firms have been heavily investing abroad and become leaders in the region.

increases for innovations that are closer to the global technological frontier. However, we also find that in each group (exporters and non-exporters) services firms show a higher propensity to innovate than manufacturing.

These three findings provide some preliminary evidence in favor of the optimistic view of services as a source of economic dynamism.

The paper is organized as follows. In section 2 we provide an overview of the literature of innovation and trade in services, and discuss its main empirical findings. Section 3 describes the data and provides descriptive statistics of both sectors. Finally in section 4 we present our empirical results and policy implications.

2. WHY SHOULD WE EXPECT SERVICES FIRMS TO BE DIFFERENT FROM MANUFACTURING FIRMS?

To address this question, we review in this section, some of the existing firm-level literature, first on innovation in services, and then on services exports.

(a) Characterization of innovation in services

The service sector is remarkably heterogeneous. It comprises activities that require huge amounts of capital and sunk/fixed costs in markets that are oligopolistic or monopolistic to produce standardized services, such as electricity distribution and air transportation; activities that require a lot of skills and information and communications technology but relatively little physical capital, such as management consulting, banking and financial services, back-office and front-office outsourcing for firms; and activities as diverse as hair cutting and social and government services such as education, healthcare or waste removal. Some sub-sectors are similar in their innovation to manufacturing in their R&D effort and technological intensity. Others exhibit the ‘supplier dominated’ trait, in which their innovation is

mainly the adoption of technologies developed in other sectors. In the words of one of the leading researchers in the area, “the service sector is a composite of many subsectors, each with different levels of technological input and whose characteristics are very different. There is no unique input-output process, and even the very measurement of input or output is difficult” (Pires et al (2008)).

The characteristics and heterogeneity of the services sector have clearly influenced the conceptualization and analysis of innovation within this sector. In fact, the view of innovation in services has significantly evolved in a relatively short period of time. The initial ‘neglectful’ perspective considered the service sector a laggard in terms of innovation, merely “serving” important sectors in the economy. This was followed by an ‘assimilation’ view which assumed the inputs and outputs of innovation are the same as, and should be measured and evaluated in the same way as, manufacturing (technological) innovation. The ‘independence’ or ‘demarcation approach’ held that innovation is so different in services that it has to be understood and measured in a completely independent way from manufacturing (Djellal and Gallouj (2001) and Gallouj and Weinstein (1997) are good examples of this approach). Today, we have arrived at some sort of ‘synthesis’ wherein it is recognized that there is a lot of common ground between manufacturing and services but also particularities of the services sector which affect the way innovation takes place (Nijssen et al. (2006), Tether and Howells (2007), Drejer (2004) , Howells (2000)).

Even though the latter view is more prevalent in recent studies, it has not yet been fully reflected in data collection strategies. These are still heavily biased towards measuring innovation through a “manufacturing lens”, although in the most recent surveys, questions about organizational and marketing innovation are now being asked.⁵ Furthermore, some empirical studies which exclusively address the service sector innovation have elaborated service sector specific surveys which focus on

“soft” innovation and collaboration. The distinction between “hard” and “soft” innovation corresponds roughly to the distinction between technological and non-technological innovation discussed above. Thus “soft” innovation has referred to organizational innovation and skill upgrading, as opposed to “hard” innovation which corresponds to clear-cut technological innovation through the introduction of new processes or products.⁶

There is also little formal modeling and theorizing on innovation in services and most of the conceptualization comes from the marketing literature (See for example, Tether et al. (2007)). The few papers that we are aware of that theorize on innovation in services have little formalization and are mainly conceptual (see Barras (1986), Howells (2000), Drejer (2004)). This implies that empirical papers have not adopted structural approaches or followed from theoretical models. Rather, they have tended to analyze more broadly how the characteristics of firms in the services sector correlate with the probability of innovating, and compared these findings with firms belonging to manufacturing sectors.

The main findings of the empirical literature (mostly using traditional innovation surveys) is that overall, service firms appear to be as innovative as manufacturing ones (Pires et al. (2008), Sirilli and Evangelista (1998)), but there is a large sub-sectoral heterogeneity in the way firms produce, innovate and sell (Fitzsimmons (1999); Pires et al. (2008); Miles (2005); Tether et al. (2007)). Second, skill intensity seems to be specifically important in services innovation, as the number of highly skilled employees is correlated with both higher process and product innovation, something not always observed in manufacturing (Pires et al. (2008), Eickelpasch and Vogel (2009)). Third, the intangible nature of most services makes it difficult to distinguish between process and product innovation, and to identify clear-cut innovation. Often, there are cumulative small improvements so that for the same actual innovation effort, the measured innovation in manufacturing, which tends to be based on discrete identifiable efforts, might be higher than in services (Tatikonda and Zeithaml (2001) in Nijssen et al. (2006)). Fourth,

services firms tend to be more reliant on non-technological forms of innovation (Pires et al. (2008), Tether et al. (2007)). In other words, for the same expenditure in innovation, one should expect less innovation outcomes in a regular technological innovation survey that aims at measuring “hard innovations” with questions on new products or services rather than in surveys which also cover more “soft” (non-technological) types of innovation such as organizational changes (Hauknes (1998)). Also, given the fact that expenditure in innovation is still heavily associated with technological innovation one should expect that, *ceteris paribus*, under the traditional measures of innovation expenditures, services firms should appear to spend less in innovation, relative to manufacturing ones. Fifth, innovation in services tends to be driven by an external technological ‘pull’ – consumer/client led- rather than an internal ‘push’ –science and technology led. This implies that external sources of information, particularly cooperation with clients, should be relatively more important for services firms, while pure science-and-technology inputs (especially R&D) should be less important (Kanerva et al. (2006); Love and Mansury (2007); Nijssen et al. (2006)). Finally, although still important, size appears to be less relevant for innovation in services than for manufacturing (Pires et al. (2008), Sirilli & Evangelista (1998)).

(b) Export orientation of service firms

When it comes to the analysis of the determinants of exports in the service sector and its differences with the manufacturing sector, the literature is much thinner. As far as we know, there is no theoretical analysis of how the particularities of the services sectors lead to different predictions with respect to export status, except by applying the concepts of traditional models based on manufacturing. This is also reflected in the absence of disaggregated micro level data on services exports, especially for developing

economies. As an example, the Chilean customs data, which by international standards are reliable and quite disaggregated, has a single code for services exports.⁷

Nevertheless, using some of the identified characteristics of services companies, and drawing upon the existing empirical literature, we can make some conjectures about services firms' exporting behavior. The existing firm-level literature, focusing on manufacturing firms and pointing to the existence of large fixed costs of entering export markets, has been used to explain the generally (but not invariably) positive relationship between productivity (and hence size) and exporting status (Bernard and Jensen 1999). The argument being that only the more productive (and hence larger) firms can afford to pay the fixed costs required to start exporting (Melitz 2003). Since scale economies appear to be a less important feature of services, it is conceivable that the selection into exporting of the (more productive) larger firms mechanism is weaker in services than in manufacturing (Love & Mansury (2007b)).⁸ However, the "immaterial" nature of many services implies a more critical problem of asymmetric information between producers and consumers.⁹ Furthermore, services often tend to be less standardized and more designed to fulfill the needs of specific consumers. These characteristics are likely to create the need to invest in developing a solid reputation in specific export markets, to establish a close relationship with consumers and to customize services. These requirements may imply higher fixed costs to enter export markets for services companies and thus larger barriers for smaller and less efficient firms to penetrate export markets. According to Eickelpasch & Vogel (2009), for example, customized services which require intensive communication and interaction with clients should require more geographical proximity/connections than manufacturing. Overall, the correlation between size and export status is therefore a-priori ambiguous. US data reveals that the percentage of service firms that export is low and lower than in manufacturing (Jensen (2008)).

The importance of contacts and customization for service provision and innovation, also suggests that the relation with clients may be an important determinant of innovation in services (Tether et al. (2007), Fitzsimmons (1999)). It is not, however, clear whether collaboration would be higher for services exporters or non-exporters. The latter may be closer to their customers but the former may be exposed to more demanding and informed customers.

Most existing empirical analyses are solely within the context of the service sector and examine the probability of exporting of firms, as well as the factors that are significantly correlated with export status. They mostly find that research/innovation intensity, human capital¹⁰, average director pay, exchange rate volatility, product diversification, increase the probability of becoming an exporter and the export intensity ((Gourlay et al. (2005), (Eickelpasch and Vogel (2009), Ebling and Janz (1999), Love and Mansury (2007), Chiru (2007)). As for the importance of firm size, as would be expected on the basis of the discussion above, the evidence is less clear. Love & Mansury (2007) find a hump-shaped effect, Gourlay et al. (2005) a positive linear relationship between size and the probability of exporting, Eickelpasch and Vogel (2009) a positive relationship (but negative square coefficient) and Ebling and Janz (1999), no effect.

Very few studies have compared manufacturing and services companies with respect to their export behavior. The main findings of the few that have analyzed this are that (US) service firms tend to require lower levels of financial investment than manufacturing firms for foreign market entry Erramilli and Rao (1993). Resource constraints seem less relevant for exporting in services than manufacturing (Westhead et al. (2001)). Finally, the export status of firms is more strongly positively correlated by internationalized clients than in manufacturing (Westhead et al. (2001)). The work that is the closest to our empirical methodology however is Jensen and Kletzer (2008) and Jensen (2008), which look at the exporter premiums in wages, sales and employment – for manufacturing and services separately- for

the US. The present paper, explicitly compares the premiums between industries for a developing economy and includes also the innovation dimension to the comparative analysis.

It is noteworthy that there is no analysis of these two dimensions of the services sector in developing economies. Many of these countries are seeing increasing shares of services in both GDP and international transactions, and looking to services to revive flagging growth rates. Whether these hopes are justified depends critically on the scope for trade and innovation in services.

3. EMPIRICAL ANALYSIS

The period under analysis in this paper (2005-2006) is located in the middle of an explicit effort by the Chilean government to promote 'global' or 'offshorable' services, with the medium term measurable goal of significantly increasing the export capacity in subsectors like ITC processes, business processes, back-office and customer services, and logistics and distribution. This promotion policy -which included FDI promotion, subsidies and training- is currently in the final stage of a three phase plan, which started in 2000, as part of the 'Programa de Atracción de Inversiones Tecnológicas' from CORFO, the Chilean development agency (Castillo (2009)).¹¹ In fact, services have been the most dynamic sector in the economy in terms of both inward FDI and investment of Chilean firms abroad. 60% of total FDI flowing to the country has been allocated to the service sector in the last decade-and-a-half. Over the same period, over 70% of the investment of Chilean firms abroad has been in the service sector.¹² Recent trade literature stresses that among all firms within an industry, it is the most productive the ones that engage in exporting, and among them the most productive invest abroad (Antras and Helpman (2004) and Helpman (2006)).

However, although the government claims to have been successful in achieving the goal of significantly expanding the sector's exports, a simple analysis of the data does not show a dramatic change in recent

years, at least relative to exports in general. Figure 1 shows the evolution of services exports relative to total (non-copper) exports. The share of services exports has been relatively stable, representing 30%-35% of non-copper exports. Actually, between 2001 and 2006 services exports grew at an average of 11% per year, whereas non-copper goods exports grew at 13% on average in the same period.

Figure 2 shows the decomposition of services exports for 2006. Most exports are accrued by traditional exportable services such as transportation and travel. However Business services represent close to 17% of total exports and have steadily been growing in their share up to more than 18% in 2010.

Finally, before moving to the empirical analysis it is important to notice two additional elements. Relative to other OECD countries innovation performance, Chile is in the bottom half of the distribution (see Figure 2A). So our findings are especially relevant for more advanced developing countries and other emerging markets and less relevant for OECD countries.

[Figure 2A about here]

Furthermore, analyzing the overall structure of R&D in Chile, manufacturing industries appear not to be particularly innovative relative to services (and even more so relative to resource-based industries), at least to the extent that we can measure innovative effort using R&D investments data (see Figure 2B).

[Figure 2B about here]

We now move to our analysis. We use micro level data available for Chilean manufacturing and service firms to evaluate empirically some of the hypothesis discussed in the previous section. We evaluate the differences between the manufacturing and services sectors as well as within sectors between exporters

and non-exporters, and in terms of innovation inputs and outputs, outward orientation, and the (joint) decision to export and innovate. In particular, we examine if the exporter premiums are different between these sectors, using the same methodology as in Bernard and Jensen (1999). Analyzing the exporter premium provides a simple way of actually comparing groups of firms within a sector, as well as of comparing sectors.

(a) Data description

We analyze the fifth round of the Technological Innovation Survey carried out in Chile in 2007.¹³ This survey covers the period 2005-2006.¹⁴

The survey analyzes the manufacturing sector, service sector and primary sector, classified according to ISIC rev 3, at two digits of aggregation. We focus on the first two in this paper. This survey provides data on 2933 plants (51% from manufacturing) for these two sectors. Weights are available for each plant so for most of our analysis we will use weighted descriptive statistics and regressions, given that we want to conduct a sector-wide comparative analysis.¹⁵

The survey provides information on objective measures of innovation, such as expenditure in non R&D innovation, R&D expenses, training, salaries of personnel involved in innovation activities, and percentage of sales from innovative products. It also provides subjective measures, such as if the firm has introduced new products, processes or services in the market, the degree of innovativeness of the new product or service, the existence and extent of collaboration and sources of information for innovation, etc. Additionally, it provides information on the firm's export status.

Since we want to compare exporters and non-exporters in both sectors, to narrow our analysis to services sectors where analyzing export behaviors is meaningful, we divide the services sector into 'tradable' and 'non tradable' services. The tradable services sector includes categories I (transport, storage and communications), J (financial intermediation), K(72) and K(73) (business services). To define

each group we follow the previous literature that has tried to decompose this heterogeneous aggregate according to its tradability. Most of the papers that decompose the tradability of the service sector, however, use ad hoc definitions. An interesting exception is Jensen and Kletzer (2005) who use geographical concentration of service activity as a measure of how tradable it is. Since concentration of activity suggests that services are being produced in a location different from where they are consumed, long distance delivery and hence trade are deemed to be feasible. The higher is the concentration, the greater the tradability. They find that the most tradable sectors in services are Transportation, Professional, Scientific and Technical Services; Management; and Information. Our definition is similar to theirs, but includes also financial services (excluding this group, however, doesn't significantly alter the results we obtain). Figure 1 tends to confirm that the sectors we chose are actually relatively more tradable.

Some basic facts about each sector in the economy can be seen in the Table 1.¹⁶

The table indicates that, relatively to manufacturing companies, the median services firm has lower sales, fewer employees, but a higher skill intensity and higher innovation expenditure as a percentage of sales, which is in line with some of the studies previously mentioned that indicate that service firms are not less innovative than manufacturing firms.¹⁷

(b) Empirical results

(i) Are manufacturing firms more outward oriented than services firms?

We first analyze how outward oriented each sector is. Figure 3 shows that the propensity to export is significantly lower in the service sector. Close to 30% of firms in the manufacturing sector export while only 4.2% of firms in the tradable service sector do so. However, among exporting firms, the proportion of sales devoted to exporting is similar between the two sectors (see appendix A.2). As a point of comparison, for the US, Jensen (2008) also finds that a smaller percentage of high tech services firms

export, when compared to manufacturing. The difference appears to be smaller than what we find for the Chilean data. Additionally, he also finds that the export intensity of exporting services firms is smaller than for manufacturing. We do not find such a difference in export intensity. The low percentage of export participation among tradable service firms could reflect the fact that Chile's traditional comparative advantage has been in the primary sector and in low technology manufacturing goods rather than in services. It could also be because Chile specializes in services activities that are less tradable or because Chilean firms in any given services sector are less export-oriented. Also, as shown by Jensen and Kletzer (2005) it is possible that the aggregated categories we use in the "tradable services" group might include some subsectors that are actually non-tradable. Despite these caveats, the tradable services companies still appear to be substantially less export-oriented than manufacturing companies.

(ii) Is there a differential exporter premium in manufacturing and services?

Figure 4 digs deeper into the firm characteristics that are associated with exporting. It shows that size, measured by the number of employees, is related to the probability of exporting, particularly in manufacturing. The figure shows a monotonic relation between firm size and the probability of being an exporter. More than 85% of relatively large firms in the manufacturing sector export, compared to less than 10% of firms with 10 or less employees. This is consistent with what is now conventional wisdom that size is positively associated with the probability of exporting for manufacturing firms (Bernard and Jensen (1999)).¹⁸ At a much lower scale, also larger firms in the service sector tend to have a higher probability of exporting.

Table 2 below shows the estimates of the size and skill premium by export status and sector. It shows the results of regressions where the outcomes are either log of sales, or log of employment or skill intensity, and the explanatory variables are dummies that reflect the export status and the sector (i.e.

services or manufacturing) to which the firms belong.¹⁹ We highlight in grey the premium we want to analyze, which reflects the difference between exporters and non-exporters within the same sector (the omitted dummy in the regression). The results indicate that exporter size premiums are positive and significant both in the manufacturing (specifications (1) and (3)) and tradable services sector (specifications (2) and (4)). However, the premium is significantly smaller in the tradable services sector. The average services exporter has 76% more workers than a non-exporter while in the manufacturing sector this premium is nearly twice as big. These differences are statistically significant at the standard 95 percent confidence level. In the manufacturing sector, while the average firms employs 37 workers, the average exporter employs 105 workers and the average non-exporter employs only 24. In the services sector, the average exporter employs 25 workers while the average non-exporter employs 12. These differences are even bigger when looking at sales.

Additionally, in specifications (5) and (6) we examine if there is also a (differential) premium in skill intensity between the two sectors, and define the skills intensity of a company as the share of highly educated workforce (e.g. workers with PhDs, masters or engineers degrees involved in innovation activities). As before, we find that in both there is a skills premium for exporters that is significant at the 1% level. However, in this case it is tradable services exporters that have a larger premium (2.8%) than their manufacturing counterparts (0.3%). The point estimate of this skills premium for services companies is more than 8 times that for manufacturing ones, but the standard errors are also very large due to a small sample size²⁰. Nevertheless, a comparison of the confidence intervals confirms that the premium in services is significantly larger than that in manufacturing. In fact, in the manufacturing sector the mean skills intensity for non-exporters is 0.33%, and increases to 0.68% for exporters. In the tradable services the skills intensity of non-exporters is 1.0% against 3.82% for exporters, a result that is also confirmed by the descriptive statistics presented in Table 1.

In sum, exporters in general seem to be characterized by a larger scale of production (i.e. exporter size premium) than non-exporters, as well as by higher skill intensity (i.e. exporter skills premium). However while the exporter size premium is greater in manufacturing, the exporter skills premium is greater in services.

(iii) Is the service sector less innovative than the manufacturing sector?

When comparing innovation in services and manufacturing, we find that the service sector appears as innovative as the manufacturing sector. First of all, looking at innovation inputs, we find that economy-wide expenditure in innovation is similar across both sectors, as shown in figure 5.²¹

Second, we look at the propensity to spend on innovation in each sector in Figure 6. We define this propensity as the number of plants out of the total in the corresponding group that spend any amount of money in innovation according to the survey. The figure shows that the propensity to spend on innovation is virtually the same (both for exporters and non-exporters), although marginally higher in the tradable service sector than in the manufacturing sector.

Thus, figures 5 and 6 corroborate previous findings in the recent services innovation literature that services firms are as likely to spend on innovation as manufacturing firms (See for example Pires et al. (2008) and Sirilli and Evangelista (1998)). We confirm here that the similarity extends to both exporters and non-exporters.

Third, we perform regressions analogous to those shown in Table 2, estimating and comparing the ‘innovator’ premium between services and manufacturing. Here we again define an ‘innovator’ as a firm that spends any amount of money in innovation.²² The results are shown in Table 3, for (log) sales and skill intensity.

The results are qualitatively and quantitatively similar to those presented in Table 2. Firms that spend on innovation tend to be larger in both sectors than firms that do not, but the difference is larger in manufacturing. Comparing the results with Table 2, the size premium for spenders on innovation is smaller than the size premium for exporters in both sectors. Furthermore, firms that spend on innovation tend to be more skill-intensive in both sectors than those that do not, but the difference is again significantly larger in services.²³

Finally, an additional way of analyzing the “degree of innovativeness” of firms is by looking at innovation *outputs*, for example, by analyzing the probability of introducing a new product or process. A simple descriptive table by sector (Table 4) shows that firms in the services sector have a marginally lower probability of introducing new products or services (the difference is statistically significant). Columns in this table are ordered in terms of how close to the “frontier” innovations are. However, they are not mutually exclusive. Each column on the left encompasses also the types of innovation covered in the columns to its right. That is, each column reflects the propensity to innovate at least in that category. ‘Technological improvements’ refers to the propensity of firms to make any technological innovations in products, including those that are not considered by the firm to lead to new products. ‘New to the firm’ indicates the propensity to introduce products that are at least new to the firm; ‘new to the market,’ when the innovation leads at least to products not previously present in the Chilean market; finally ‘new to the world’ refers to the propensity to introduce new products that according to the firm are new to the world. Tables further on in the paper as well as the regressions use these definitions.²⁴

However, these average differences at sectoral level hide huge heterogeneity within the service sector. Table 5 shows the same numbers but disaggregating the exportable services sector into subsectoral percentages. The lower propensities to innovate of the tradable service sector are driven by low propensity to innovate in transportation, communications and financial intermediation. However,

business services' rates of innovation are much higher than any other sector, clearly outperforming manufacturing as a whole.

(iv) Is the extent of innovation different between exporters and non-exporters and between sectors?

In table 6 below we show that when the propensities to innovate are separated into exporters and non-exporters, the higher average propensity to innovate of manufacturing relative to services (observed in Table 4) is reversed: services firms do not appear to be less innovative than manufacturing firms. If anything, tradable services appear to be more innovative than manufacturing though most differences are not significant.

There is a simple explanation for the reversal. The overall propensity to innovate in each sector is a weighted average of the propensity to innovate of exporters and non-exporters. Exporters in each sector have a higher propensity to innovate than non-exporters, but the proportion of exporters is much higher in manufacturing than in services. Table 6 also shows a large difference between exporters and non-exporter's propensity to innovate for each sector and type of innovation. Innovation occurs much more extensively in exporters, both in the services sector and in the manufacturing sector (Even though not shown in the table, all differences between exporters and non-exporters are statistically significant at the 1% level. See table A.3.2.b in Appendix A.3 for details).

Table 7 calculates these propensities, controlling for firm observables (in terms of size and foreign ownership)²⁵, and confirms that a higher proportion of firms in the tradable services sector have an innovative output than similar firms in the manufacturing sector. In most specifications the propensity to innovate is significantly lower in manufacturing, and there are no cases of significantly higher innovation propensity in this sector. Interestingly the differences in the propensities for exporters are

larger than for non-exporters. Table 7 also provides some insight on the relation of foreign ownership with the probability of innovating. Foreign investment does not seem to increase the likelihood of innovation by exporters or non-exporters.²⁶

Table 7 has already revealed that a higher proportion of exporting firms than non-exporting firms say they have introduced technological innovations. We take this analysis further, looking at how the ratio of the percentage of innovating exporters to innovating non-exporters varies between manufacturing and services and across different levels of innovation.²⁷ The results are shown in Figure 7.

We can observe that in both manufacturing and services, exporters tend to have a much higher probability of innovating than non-exporters. Interestingly, the more “at-the-frontier” the innovation is, the larger the wedge between exporters and non-exporters. Exporters are 3 times more likely to produce an innovation at least new to the firm and this ratio increases to between 6 and 9 times for the likelihood to introduce an innovation new to the world.²⁸ Exporters seem to be more likely to be ‘cutting-edge’ innovators, while non-exporters seem relatively more likely to be adaptors of existing technology. This is consistent with the notion that exporters face tougher competition and need to innovate more aggressively to successfully compete on international markets.

Comparing these indicators between sectors, services firms looks similar to their manufacturing counterparts with a marginally higher ratio of innovations that are new to the world.

(v) Are services firms particularly intensive in ‘soft’ forms of innovation?

The existing literature stresses the idea that services firms are more intensive in “non-technological innovations.” The Chilean innovation survey asks questions on non-technological improvements such as improvements in distribution, management, working environment and in relationships with other firms, which require binary subjective responses. Interestingly, running simple regressions on the probability of innovating in non-technological innovation shows no significant difference between services and

manufacturing (The average propensity for non-technological innovation (of any type) is 27.1 percent for tradable services, and 1.5 percent lower in manufacturing, but this difference is statistically insignificant). However, once we separate exporters and non-exporters the differences widen significantly. Among non-exporters, services firms are 6.7 percent more likely to produce non-technological innovations than their manufacturing counterparts (significant at the 1 percent level). Among exporters that difference widens to 10 percent, although it is not significant.²⁹ Finally, if we decompose the propensity to innovate into different types of soft innovation, we can see a more detailed picture, as shown in Figure 8.

The figure reveals certain patterns. First, if we look at all the pair-wise comparisons between manufacturing and services firms, in six out of eight cases we observe that services firms are more prone to innovate in soft forms of innovation than manufacturing firms. Second, looking at exporters, differences between manufacturing and services firms are particularly marked in the case of distribution and management, but the differences are not statistically significant. Third, looking at non-exporters, services firms appear to innovate more than manufacturing firms in all types of soft innovation except distribution, and these differences are statistically significant.³⁰ Finally, comparing exporters and non-exporters, the former tend to innovate significantly more than the latter in these soft measures, suggesting that it is not only technological innovation that matters for outward oriented firms, but also non-technological innovation. For each type 'soft' innovation, the difference between exporters and non-exporters is statistically significant at 1% for all cases except work environment and relationships with other firms, for tradable services (See Table A.3.4 in Appendix A.3 for details of regressions behind the figure and for differences between exporters and non-exporters).

4. POLICY IMPLICATIONS AND CONCLUSIONS

In this paper we examined services and manufacturing firms in an economy, Chile, from both a trade and innovation perspective. We compared, in particular, exporter premiums and innovation inputs and outputs between sectors and within sectors, for exporters and non-exporters.

Our findings are generally in line with the existing firm-level trade literature, that exporters are different from non-exporters. This difference is significant not only for manufacturing but also for services firms. This has been found recently to be true also in the US by Bernard and Jensen (1999) for traditional measures such as sales, wages and inputs. We find though that the size premium for exporters of services is much lower than the size premium for exporters of manufactures. However, despite the lower size premium, service firms participate significantly less in exports. One reason may be that scarcity of skills is a bigger factor in services than the inability to reap economies of scale. Indeed, we do find that the skill intensity premium is much larger for exporters of tradable services than exporters of manufactures.

We provide novel findings with respect to innovation and exports. First, with respect to innovation inputs, we show that the situation in an upper middle-income economy like Chile is similar to that in industrial countries: services firms too are devoting resources on innovation. The propensity to spend on innovation is significantly higher for exporters in both sectors when compared to non-exporters. We do find, again in line with the literature, that service firms overall are more likely than manufacturing firms to innovate in ways that are not considered technological. Moreover, the ratio of firms that innovate relative to those that do not is increasing in both sectors the more cutting edge the innovation is, suggesting that exporters face tougher competition and need to make upgrades in their products and processes to effectively compete in foreign markets.

Our findings provide some initial facts and lessons for policy makers. First, governments, even in developing economies, should see the service sector as a relevant actor when it comes to the design of policies that promote innovation and trade. Second, in services, the focus for innovation and trade promotion policies should not be exclusively on large firms but should target firms of a wider range of sizes. Finally, since skills seem to matter more for services firms both for exports and innovation, any government support should ideally be directed towards skill upgrading at the firm level and in upstream technical education and training.

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Endnotes

¹ The “middle income trap” supposedly occurs when a country's growth plateaus after reaching middle income levels. This can happen when developing economies with rising wages and declining cost competitiveness are unable to compete with advanced economies in high-skill innovations, or with low income, low wage economies in the cheap production of manufactured goods.

² Other studies in the area include Love and Mansury (2007), Pires et al. (2008), Chiru (2007), Eickelpasch and Vogel (2009) and Jensen and Kletzer (2005)

³ We define what we mean by ‘tradable’ services in section 3.

⁴ See OECD (2005) for an “official” definition and discussion of the two general types of innovation.

⁵ The most recent rounds of the Community Innovation Surveys (CIS - 4) from Europe and the Chilean innovation survey explore both types of innovations.

⁶ See Tether et al. (2007) chapters 1 and 2, Hauknes (1998), and Djellal and Gallouj (2001).

⁷ The standard source for services trade is, of course, balance-of-payments data because in most cases the associated international financial transactions are easier to identify and record than the passage of services across borders.

⁸ Love and Mansury (2007b) also acknowledge that “As trade costs overall fall, mainly through tariff reduction and trade liberalization in manufactures, other elements such as transportation and information costs are becoming relatively more important. Since services generally face little in the way of transportation costs, there may be fewer barriers to smaller and less efficient firms entering export markets in services.”

⁹ It is also true that this immaterial nature and its associated electronic delivery changes the variable costs of transport for services but does not affect fixed costs.

¹⁰ However, Eickelpasch & Vogel (2009) also control for unobserved firm heterogeneity, and find that the initial positive effects of product per worker and human capital disappear as determinants of the probability of exporting.

¹¹ Although the government claims to have been successful in achieving the goal of significantly expanding the sector's exports, a simple analysis of the data doesn't show a dramatic change in recent years, at least relative to exports in general. Between 2001 and 2006 services exports grew at an average of 11% per year, whereas non-copper goods exports grew at 13% on average in the same period.

¹² Sources: Central Bank of Chile, Foreign Investment Committee and DIRECON.

¹³ Five innovation surveys have been carried in Chile in the last decade. They closely follow the Oslo Manual (OECD 2005) to elaborate and undertake the survey and thus are comparable to the CIS in Europe, for example. We were not able to use the previous surveys in our analysis either because the services sector was not covered (1st through 3rd round) or because there were some serious problem in the construction of expansion weights (4th round).

¹⁴ We thank the Ministry of Economy of Chile for providing us with the data under the usual confidentiality agreement.

¹⁵ See appendix A.1 for details.

¹⁶ Skill intensity is defined as the proportion of the total workforce with PhDs, Masters and Engineers devoted to R&D. Innovation expenditures include the cost of patents and licenses, training for innovation purposes, acquisition of machinery and equipment for innovation, introduction of new

products into the market and R&D expenditures. In all our calculations, we excluded the plants whose the value of skill intensity is greater than one. We also excluded plants that declared a value of innovation expenditure as a proportion of sales greater than one.

¹⁷ We expand the analysis on the innovativeness of each sector in section 3.iii, 3.iv and 3.v.

¹⁸ However, new research is putting the above relationship into discussion. Hallak et al. (2009) indicate that the relation between size and export status is actually not monotonic, and propose a measure of caliber to explain the fact that some small firms export and some big firms do not.

¹⁹ In all regressions year fixed effects are included. Only the manufacture and tradable services sector were included. Estimations are performed with robust standard errors and weights, which are provided by the survey.

²⁰ Only 63 firms export in the services sector per year, and among them 20 have skill intensity different from zero.

²¹ The sum of tradable and non-tradable services expenditure is higher than the expenditure in manufacturing.

²² The results do not change qualitatively if we define an innovator in terms of innovation outcomes (if it produces an innovation in products or services).

²³ For the case of skill intensity, the premiums in each and the fact that they are larger than for innovators relative to non-innovators is straightforward since non-innovators should not hire people to innovate if they do not spend on innovation. The differences between the two sectors thus reflect what is shown in table 1, where we observe that on average tradable services firms having larger skill intensity than manufacturing.

²⁴ Results do not change significantly if we use mutually exclusive definitions.

²⁵ We build an indicator of foreign ownership that takes a value of 1 if a firm has more than 50% of foreign equity participation and zero otherwise to examine the influence of foreign participation. Previous studies found evidence of a negative correlation between belonging to a multinational and the probability of introducing product innovation. See Pires et al. (2008).

²⁶ The only exception is for innovations new to the world, where foreign ownership appears to be positively correlated with the probability of innovating (although at the 10% level). Unexpectedly, the coefficients are consistently negative for exporters and positive for non-exporters.

²⁷ As in all innovation surveys, these data are subjective and based on the perception of the person that answered the survey.

²⁸ For a given quality of innovation, it is unlikely that exporters are biased towards identifying their innovations as more groundbreaking than non-exporters.

²⁹ See appendix A.3 for the regressions behind these numbers.

³⁰ In Figure 6, the differences between manufacturing and services appear larger for the case of exporters than for the case of non-exporters. So it may be surprising that the former are not statistically significant while the latter are. The reason may be that we have less than one third the number of observations for exporters than for non-exporters, so the statistical insignificance of the different propensities to innovate between services and manufacturing firms for exporters are probably due to a low N.

Appendix 1: Tables and Figures from main text

Figure 1: Chilean exports (non-copper) and weight of services in total

Figure 2: Composition of services exports 2006

Figure 2A: Innovation Performance Snapshot (Source: OECD 2012)

Figure 2B: Structural Composition of Private R&D (Source: OECD 2012)

Figure 3: Outward orientation of firms: % of firms that export
2005-2006 weighted sample

Figure 4: Export propensity and firm size: % of firms in relevant size category that export
2005-2006 weighted sample

Figure 5: Total economy-wide expenditure in innovation by sector
(Average 2005-2006, using weights)

Figure 6: Propensity to spend on innovation

Figure 7: Ratio of percentage of firms that innovate between exporters and non-exporters

* Significantly different at 10% ** Significantly different at 5% *** Significantly different at 1%

Figure 8: Non-technological innovation propensity and export status

Table 1: Basic Descriptive Statistics (weighted sample)

Variable	Manufacturing 2005-2006		Tradable Services 2005-2006	
	Mean	Median	Mean	Median
Sales (CH\$ Million)	12,248.6	670.8	4,737.3	281.0
Employment	106.6	28.0	56.3	9.0
Skill intensity (# of PhDs, masters and engineers as a % of total workforce)	0.4%	0.0%	1.1%	0.0%
innovation expenditure as a % of sales	0.9%	0.0%	1.5%	0.0%
Number of observations (unweighted)	2991		1687	
Number of observations (weighted)	8378		16566	

Table 2: Exporter premium in size (log sales and log employment) and skill intensity: Means and OLS regressions

Dependent variable	mean log sales	mean log employment	mean skill intensity	Log Sales		Log Employment		Skill Intensity	
				(1)	(2)	(3)	(4)	(5)	(6)
Dummy manufacture exporter	15.44	4.65	0.68%	2.256*** (0.103)	2.814*** (0.104)	1.471*** (0.082)	2.190*** (0.091)	0.003*** (0.001)	-0.003 (0.003)
Dummy tradable service non-exporter	12.63	2.46	1.00%	-0.558*** (0.063)		-0.719*** (0.056)		0.007** (0.003)	
Dummy tradable service exporter	13.92	3.22	3.80%	0.735*** (0.220)	1.293*** (0.220)	0.043 (0.187)	0.762*** (0.191)	0.035*** (0.010)	0.028*** (0.010)
Dummy manufacture non-exporter	13.18	3.18	0.33%		0.558*** (0.063)		0.719*** (0.056)		-0.007** (0.003)
Observations				4,728	4,728	4,799	4,799	4,729	4,729
R-squared				0.223	0.223	0.212	0.212	0.010	0.010

Note: premium coefficients are with respect to omitted variables in the regression

Note: coefficients and standard errors used in graphs appear in grey

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%

Table 3: Innovator premium in size (log sales) and skill intensity: Means and OLS regressions

Dependent variable			Log Sales		Skill Intensity	
	mean log sales	mean skill intensity	(1)	(2)	(3)	(4)
Dummy manufacture innovator	15.06	1.50%	1.713*** (0.102)	2.536*** (0.094)	0.015*** (0.001)	0.015*** (0.001)
Dummy tradable service non-innovator	12.52	0.00%	-0.823*** (0.081)		-0.000 (0.000)	
Dummy tradable service innovator	13.25	5.19%	-0.096 (0.122)	0.726*** (0.115)	0.052*** (0.011)	0.052*** (0.011)
Dummy manufacture non-innovator	13.34	0.00%		0.823*** (0.081)		0.000 (0.000)
Observations			4,728	4,728	4,729	4,729
R-squared			0.180	0.180	0.095	0.095

Note: premium coefficients are with respect to omitted variables in the regression

Note: coefficients and standard errors used in graphs appear in grey

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%

Table 4: Proportion (%) of firms that report having introduced technological innovations in products

	At least			
	Technological Improvements	New to the Firm	New to the Market	New to the World
Manufacturing	19.9	18.9	9.9	3.8
Tradable Services	16.5	14.7	8.1	1.8
Stat signif difference	**	***	*	***

* 10% ** 5% *** 1%

Table 5: Proportion (%) of firms that say they have introduced technological innovations in products

	At least			
	Technological Improvements	New to the Firm	New to the Market	New to the World
Manufacturing	19.9	18.9	9.9	3.8
Transportation, storage and communications	11.6	9.4	4.8	0.7
Financial intermediation	12.2	12.0	3.8	2.1
Business Services	44.9	42.3	30.0	6.3

Table 6: Proportion (%) of firms that say they have introduced technological innovations in products

		At least			
		Technological improvements	New to the firm	New to the market	New to the world
Manufacturing		37.2	35.9	19.4	9.0
Tradable Services	exporters	48.5	40.7	37.6	9.8
Stat sig difference				**	
Manufacturing		12.9	12.0	6.0	1.6
Tradable Services	non-exporters	15.1	13.6	6.8	1.5
Stat sig difference					
* 10% ** 5% *** 1%					

Table 7: Propensities to innovate in at least each category among exporters and non-exporters, with controls (Probit regressions, showing marginal effects)

	(1) Technological improvements exporters	(2) Improvements non - exp	(3) Innovations new to firm exporters	(4) Innovations new to firm non - exp	(5) Innovations new to country exporters	(6) Innovations new to country non - exp	(7) Innovations new to world exporters	(8) Innovations new to world non - exp
1 if in manufacture	-0.151* (0.084)	-0.038*** (0.015)	-0.086 (0.088)	-0.033** (0.013)	-0.245*** (0.090)	-0.017** (0.009)	-0.044 (0.036)	0.001 (0.004)
1 if foreign ownership >50%	-0.063 (0.062)	0.012 (0.041)	-0.046 (0.059)	0.019 (0.040)	-0.014 (0.049)	0.012 (0.022)	-0.043 (0.036)	0.035* (0.021)
log sales	0.023* (0.013)	0.039*** (0.005)	0.024** (0.012)	0.041*** (0.004)	0.032*** (0.010)	0.021*** (0.003)	0.023*** (0.006)	0.004*** (0.001)
Pseudo R2	0.013	0.040	0.008	0.054	0.046	0.051	0.042	0.067
Observations	1,141	3,587	1,141	3,587	1,141	3,587	1,141	3,587

Appendix A.1: Survey Data Sampling Methodology

The 5th Innovation Survey was carried during 2007 and gathered data on innovative activity for Chilean plants in the following ISIC rev. 3 one and two digit sectors (number of plants in parenthesis):

Table A.1.1: ISIC rev.3 categories considered in the 5th round Innovation Survey in Chile

Category	Description
A	Agriculture, hunting and forestry (267)
B	Fishing (138)
C	Mining and quarrying (47)
D	Manufacturing (1534)
E	Electricity, gas and water supply (130)
F	Construction (288)
I	Transport, storage and communications (268)
J	Financial intermediation (199)
K	Real estate, renting and business activities (285)
K 72	Computer and related activities
K 73	Research and development
N	Health and social work
O	Other community, social and personal service activities (123)
O 90	Sewage and refuse disposal, sanitation and similar activities
O 92	Recreational, cultural and sporting activities

Most firms in sectors K and O do not declare their 2-digit subsector. Thus we assume that they belong to the surveyed sectors, even though there is a very small percentage of firms that declared belonging to different two-digit sub-sector. These plants were eliminated from the analysis. Unfortunately, the retail sector (category G) was not surveyed. This sector has provided an important share of Chile's FDI outside the country, and thus is potentially very innovative.

The universe of firms considered were those with sales in 2005 above UF2,500, or roughly \$75,000. For the specific case of Manufacturing (category D) it considered all plants that had 10 or more workers. For the case of Electricity (sector E) it included all plants that produced more than 2 MW per year (generation) and all plants (distribution). The sampling was done probabilistically by two digit economic activity and plant size, thus being representative at the category level and sales size (In some sectors

there was a forced inclusion of many firms due to size and because they declared previously innovative activity in previous innovation and R&D surveys).

Prior to the analysis some plants were dropped based on anomalous values in the key variables analyzed in the study:

- A share of skilled employment over total employment larger than one
- A share of innovation expenditure over total sales larger than one

Also, as already explained in the main text, the final analysis only considered a comparison between sector D (Manufacturing) and sectors I, J, K 72 and K 73 which were defined as ‘tradable services’. The remaining sectors (E, F, N and O90 and O92), were defined as ‘non-tradable services’.

The following table shows the number of plants and observations finally considered for analysis for the paper and the loss due to the abovementioned filters.

Table A.1.2: Observations before and after filters

Sector	before filters		after filters	
	plants	obs	plants	obs
Commodities	452	904	452	904
Manufacturing	1,534	3068	1530	3060
Tradable Services	875	1750	871	1739
Non tradable Services	624	1247	624	1247

Appendix A.2: Additional Graphs

Figure A.2.1: Export intensity by sector

Appendix A.3: Regression outputs

Table A.3.1: OLS Regressions for Table 4 – Differential propensity to innovate between manufacturing and services

	(1) Tech improvement	(2) New for the firm	(3) New for the country	(4) New for the world
1 if in manufacture	0.034** (0.016)	0.042*** (0.015)	0.018* (0.011)	0.019*** (0.006)
Constant	0.165*** (0.013)	0.146*** (0.012)	0.081*** (0.009)	0.019*** (0.004)
Observations	4,799	4,799	4,799	4,799
R-squared	0.002	0.003	0.001	0.003

Note: omitted sector is tradable services

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%

Table A.3.2a: OLS Regressions for Table 6 – Differential propensity to innovate between manufacturing and services, separated by exporters and non-exporters

Panel A : Exporters

	(1) Tech improvement	(2) New for the firm	(3) New for the country	(4) New for the world
1 if in manufacture	-0.113 (0.090)	-0.047 (0.092)	-0.181** (0.092)	-0.008 (0.032)
Constant	0.485*** (0.087)	0.407*** (0.089)	0.376*** (0.091)	0.098*** (0.030)
Observations	1,141	1,141	1,141	1,141
R-squared	0.009	0.002	0.032	0.000

Panel B : Non-exporters

	(1) Tech improvement	(2) New for the firm	(3) New for the country	(4) New for the world
1 if in manufacture	-0.021 (0.015)	-0.015 (0.014)	-0.008 (0.010)	0.001 (0.006)
Constant	0.151*** (0.012)	0.135*** (0.011)	0.068*** (0.008)	0.015*** (0.003)
Observations	3,658	3,658	3,658	3,658
R-squared	0.001	0.000	0.000	0.000

Note: omitted sector is tradable services

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%

Table A.3.2.b: OLS Regressions for Table 6 – Differential propensity to innovate between exporters and non-exporters, separated by sector (manufacturing and services)

Panel A : Manufacture

	(1) Tech improvement	(2) New for the firm	(3) New for the country	(4) New for the world
1 if Exporter	0.243*** (0.023)	0.239*** (0.023)	0.134*** (0.016)	0.073*** (0.011)
Constant	0.129*** (0.009)	0.120*** (0.009)	0.060*** (0.006)	0.016*** (0.004)
Observations	3,060	3,060	3,060	3,060
R-squared	0.076	0.077	0.041	0.031

Note: omitted group is non exporters

Panel B : Services

	(1) Tech improvement	(2) New for the firm	(3) New for the country	(4) New for the world
1 if Exporter	0.334*** (0.088)	0.272*** (0.090)	0.308*** (0.091)	0.083*** (0.031)
Constant	0.151*** (0.012)	0.135*** (0.011)	0.068*** (0.008)	0.015*** (0.003)
Observations	1,739	1,739	1,739	1,739
R-squared	0.033	0.024	0.052	0.015

Note: omitted group is non exporters

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%

Table A.3.3: Alternative regressions for Table 7 – Linear probability regressions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Technological Improvements				Innovations new to the firm			
	exporters		non - exporters		exporters		non - exporters	
1 if in manufacture	-0.149* (0.084)	-0.090* (0.049)	-0.041*** (0.015)	-0.014 (0.010)	-0.085 (0.087)	-0.031 (0.065)	-0.036** (0.014)	-0.012 (0.010)
1 if foreign ownership >50%	-0.064 (0.064)	-0.071 (0.063)	0.011 (0.049)	0.015 (0.023)	-0.047 (0.059)	-0.054 (0.058)	0.020 (0.048)	0.023 (0.024)
log sales	0.023* (0.012)	-0.021** (0.010)	0.044*** (0.006)	-0.004 (0.005)	0.024** (0.012)	-0.016* (0.009)	0.047*** (0.005)	0.004 (0.004)
log expenditure in innovation		0.062*** (0.002)		0.064*** (0.003)		0.057*** (0.003)		0.058*** (0.003)
Constant	0.192 (0.212)	0.469*** (0.154)	-0.404*** (0.072)	0.084 (0.059)	0.090 (0.216)	0.346** (0.164)	-0.464*** (0.061)	-0.023 (0.056)
R-Squared	0.018	0.501	0.037	0.520	0.011	0.434	0.047	0.476
Observations	1,141	1,141	3,587	3,587	1,141	1,141	3,587	3,587

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Innovations new to the country				Innovations new to the world			
	exporters		non - exporters		exporters		non - exporters	
1 if in manufacture	-0.230*** (0.087)	-0.194*** (0.070)	-0.018* (0.010)	-0.006 (0.008)	-0.047 (0.034)	-0.033 (0.034)	-0.000 (0.005)	0.003 (0.004)
1 if foreign ownership >50%	-0.020 (0.053)	-0.025 (0.054)	0.015 (0.029)	0.017 (0.023)	-0.023 (0.028)	-0.025 (0.027)	0.046* (0.025)	0.047*** (0.023)
log sales	0.031*** (0.010)	0.005 (0.009)	0.027*** (0.004)	0.004 (0.004)	0.026*** (0.007)	0.015** (0.006)	0.006*** (0.002)	-0.000 (0.002)
log expenditure in innovation		0.038*** (0.003)		0.031*** (0.003)		0.015*** (0.002)		0.008*** (0.002)
Constant	-0.046 (0.196)	0.121 (0.169)	-0.271*** (0.049)	-0.039 (0.046)	-0.262*** (0.089)	-0.194** (0.087)	-0.064** (0.028)	0.000 (0.030)
R-Squared	0.050	0.286	0.028	0.252	0.027	0.111	0.015	0.082
Observations	1,141	1,141	3,587	3,587	1,141	1,141	3,587	3,587

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%

Table A.3.4: Non-technological innovation propensity and export status-Regression Premia for Figure 6

Panel A: Manufacture premium

	Exporters				Non-Exporters			
	(1) Distribution	(2) Management	(3) Work environment	(4) Relationship with other firms	(5) Distribution	(6) Management	(7) Work environment	(8) Relationship with other firms
1 if Manufacture	-0.131 (0.097)	-0.146 (0.090)	-0.015 (0.081)	0.045 (0.065)	0.020** (0.010)	-0.041** (0.019)	-0.073*** (0.019)	-0.025* (0.015)
Constant	0.276*** (0.096)	0.482*** (0.087)	0.336*** (0.078)	0.197*** (0.063)	0.050*** (0.007)	0.205*** (0.016)	0.232*** (0.017)	0.132*** (0.012)
Observations	1,141	1,141	1,141	1,141	3,658	3,658	3,658	3,658
R-squared	0.021	0.016	0.000	0.002	0.002	0.002	0.006	0.001

Note: omitted category is tradable services

Panel B: Exporter Premium

	Manufacture				Services			
	(1) Distribution	(2) Management	(3) Work environment	(4) Relationship with other firms	(5) Distribution	(6) Management	(7) Work environment	(8) Relationship with other firms
1 if Exporter	0.075*** (0.016)	0.172*** (0.022)	0.162*** (0.022)	0.135*** (0.019)	0.226** (0.096)	0.277*** (0.089)	0.104 (0.080)	0.064 (0.064)
Constant	0.070*** (0.007)	0.165*** (0.010)	0.159*** (0.009)	0.107*** (0.008)	0.050*** (0.007)	0.205*** (0.016)	0.232*** (0.017)	0.132*** (0.012)
Observations	3,060	3,060	3,060	3,060	1,739	1,739	1,739	1,739
R-squared	0.014	0.036	0.033	0.030	0.037	0.018	0.002	0.001

Note: omitted category is non exporters for the corresponding sector

Robust standard errors in parentheses

* Significant at 10% ** Significant at 5% *** Significant at 10%