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Service Imports, Workforce Composition, and Firm Performance: Evidence from Finnish Microdata

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ABSTRACT

This paper uses unique Finnish firm-level micro data on service imports, work- force composition, and firm characteristics to examine changes in employment composition and performance of Finnish service importers during a period of a significant increase in services imports (2002-2012). We use world service export supply shocks, which we allocate to firms based on their highly specialized service input structure, as an instrument to identify the impact of service offshoring. We find that firms that increase imports of service inputs reduce employment of low-skill service workers, increase employment of (high-skilled) managers and improve their performance in terms of sales (turnover), assets, service exports, and firm survival. The employment composition and performance responses to service imports differ across firms in the manufacturing sector and those in the service sector.

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1 Introduction

The well-known dramatic increase in global merchandise trade has fostered a number of empirical studies examining the impact of imports on domestic labor markets (e.g. Feenstra and Hanson, 1996; Autor et al., 2013; Hummels et al., 2014). While starting from a lower level, there has been a similar six-fold increase in global service trade over the same period. Because the labor force in most developed economies is predominantly in the service sector, and because tradable service industries are more skill intensive in general than manufacturing,[1] there is increasing interest in the impact of service imports on job displacement – particularly among higher skilled workers. Yet, due to limitations in the availability of detailed information on trade in services, the impact of service imports has received less attention in the literature.[2] In this paper, we combine detailed information on firm-level imports of services with detailed worker-level information on firms' occupation and skill mix to examine how firms adjust their labor force as they increase foreign sourcing of service inputs and how these changes affect firm performance across a number of dimensions. The empirical setting for the analysis is Finland which, in addition to having uniquely detailed employment and trade data, experienced a dramatic increase in service imports of almost 5 percentage points of GDP.[3] To put this in context, the "China Shock" involved an increase of about 2 percentage points of GDP in U.S. merchandise imports from China.[4]

We find that firms that increase imports of service inputs reduce employment of low-skill service workers and increase employment of managers. At the same time, they experience improvements in their performance in terms of sales (turnover), assets, service exports, and firm survival. Distinguishing between firms in the manufacturing and services sector, we show that service offshoring has heterogeneous effects across industries. For firms in the services sector, the skill upgrading just described is accentuated by an increase in the employment of high-skilled professionals. This category of workers includes engineers, computer programmers, and scientists, suggesting that firms could be refocusing more on R&D related activities. These changes are associated with improved firm performance: employment, sales, assets, and service exports increase. In contrast, for firms in the manufacturing sector, medium-skilled professional employ-

[1] See, for example Jensen and Kletzer (2005) and Gervais and Jensen (2019)

[2] Notable exceptions include Jensen and Kletzer (2005), Amiti and Wei (2005), Crinò (2010b), Liu and Trefler (2019) and Eppinger (2019).

[3] From 7.4 percent of GDP to 12.3 percent of GDP during the period of this study (2002-2012). Source: Statistics Finland.

[4] U.S. merchandise imports from China increased from 0.3 percent of GDP in 1990 to 2.2 percent of GDP in 2007. Source: U.S. Bureau of Economic Analysis.

ment also decreases and increasing foreign sourcing of service inputs is associated with higher survival, though we do not observe any other significant improvement in firm performance.

Our ability to examine the impact of firm-level changes in service importing on the composition of a firm's labor force is possible because of rich, detailed information on firm-level accounts, service trade, and worker occupational and educational characteristics for Finland during the period 2002-2012. These data can be linked together and provide an unusual level of detail on services trade, workforce composition, and a range of other firm-level measures. We are thus able to go beyond the usual employment classification of blue/white collar and low/high-skilled workers and precisely identify the detailed occupations affected by service offshoring. We can link the transformation of the occupational structure of firm employment to changes in performance with a rich set of covariates. In addition, because we observe service imports at the firm level, the data allow us to create a measure of service offshoring that goes beyond the traditional definition based on the industry affiliation of the firm (e.g. Feenstra and Hanson, 1996; Amiti and Wei, 2005, 2009; Crinò, 2010b). A key advantage of our approach is that because the measure of service imports is firm-specific, firms outside the service sector that import services can be classified as involved in service offshoring. This allows us to perform our analysis on a broader set of firms sourcing services from abroad and to examine the heterogeneity across sectors in the impact of service offshoring. We examine two measures of service imports. For the first measure of service imports, we focus on services that are potentially related to offshoring activities performed by the firm. We use information from the Finnish input-output supply tables to identify service categories that account for more than one percent of total sales in the firm's 2-digit industry and classify these as narrow service offshoring (NSO) services.[5] For the second measure of service imports (which are included in the robustness section), we use the overall firm service imports. Our empirical results are robust to the choice of service imports measure.

The analysis begins with a description of the scope of service offshoring in Finland. Between 2002 and 2012 (the period of this study), service imports tripled in Finland, with services potentially associated with offshoring accounting for at least half of this growth. Finland's service imports increased from 7.4 percent of GDP to 12.3 percent of GDP, an increase of almost 5 percent of GDP.[6] This suggests that Finland presents

[5]We assume that if a service category accounts for more than one percent of sales in an industry, this service is likely to be produced by firms in the industry.

[6]Source: Statistics Finland.

an interesting empirical setting to study service offshoring. We observe significant increases in imports in a number of business service categories, including computer services; intellectual property rights; trade related services between related companies; legal, advertising and consulting services; and R&D and technical services. We show that firms that source service inputs from abroad are relatively rare, accounting for three percent of firms in Finland. These firms are present in both the manufacturing and service sector and, despite being relatively rare, they represent an important share of the Finnish economy; they account for 45% of revenues, more than 13% of employment, and almost 20% of value added in Finland. Finally, we document that over the period of our analysis firms engaged in foreign sourcing of service inputs changed the composition of their workforces. Firms in the service sector that engaged in service offshoring decreased employment of low-skilled workers and experienced significant increases in medium-skilled and high-skilled workers. In addition, they increased substantially the number of workers in medium-skilled professional occupations. Firms in the manufacturing sector reduced low-skilled and medium-skilled employment. In occupational terms, they reduced employment in goods producing, service producing, and medium-skilled professional occupations.

In the second section, we go beyond descriptive statistics and analyze the consequences of increasing foreign sourcing of service inputs. To properly identify the impact of service offshoring on workforce composition and firm performance, we need to address the possible endogeneity of our offshoring measure. In particular, we need an instrument that is correlated with the firm's decision to offshore services but uncorrelated with the firm's employment and performance changes. We exploit shocks in the export supply of specific service-country pairs which are arguably exogenous to Finland and allocate them based on the relative importance of each service-country in the total service imports of the firm in the initial year in which it is observed importing services. This approach exploits a strong empirical regularity in the data: firms tend to consistently purchase the same service input from the same origin country. This means that trade relations are pre-determined and exogenous to over-time variation in firm employment and performance. Thus, we can use initial firm-service-origin country weights to distribute aggregate supply shocks which are exogenous to Finnish firms. This feature of service imports is similar to the evidence of a highly specialized sourcing structure for trade in goods presented in Hummels et al. (2014) and allows us to properly identify the effect of service offshoring in a similar way.

Using this strategy, we first analyze employment composition changes. We find

that firms that increase imports of service inputs decrease the number of low-skilled workers and increase the number of high-skilled workers. Looking into narrowly defined occupational categories, we show that this is due to a reduction in employment of workers related to low-skilled service activities such as office clerks and customer services and an increase in employment of managers. These results suggest that when firms offshore services, they reduce their production of low-skilled service inputs and increase the number of managers, presumably to oversee the increased international activities.

Differentiating across firms belonging to manufacturing and service industries, we find a heterogeneous impact of service offshoring. For firms in the service sector, service offshoring is also associated with an increase in the number of high-skilled professionals. Thus, increasing the sourcing of services from abroad provides an opportunity for service firms to focus more on R&D related competencies by increasing the number of high-skilled professionals such as engineers and scientists. For firms in the manufacturing sector, foreign sourcing of service inputs is associated with a decrease in medium-skilled professionals.

Switching to the analysis on performance, we find that service offshoring leads to growth only for firms in the service sector in terms of overall employment, sales, assets and services exports. Instead, we find no evidence of increased employment, sales, assets, or exports when firms in the manufacturing sector increase service offshoring. However, for perhaps the most important performance indicator, service offshoring is associated with higher firm survival in both manufacturing and services industries.

In the third section, we show that these results hold under a number of robustness checks: using an alternative broader measure for service offshoring, excluding the years during the 2008-2009 crisis, and controlling for firm-specific demand shocks, goods offshoring and import competition.

These results contribute to the literature in a number of ways. First, they complement recent research that analyzes whether and how service offshoring affects employment. There are two broad waves in this research. The first employs sectoral or aggregate occupation data to analyze employment reallocation induced by offshoring. For instance, Jensen and Kletzer (2005) use US data to show that workers in tradable service sectors have higher displacement rates and lower employment growth than workers in non-tradable services sectors (especially at the lower end of the skill distribution). Amiti and Wei (2005) use industry data for several countries and find no evidence of job losses related to service offshoring. Amiti and Wei (2009) show a positive effect of service offshoring on industry productivity in the US. Using individual data and measures

of service offshoring at the industry level for UK, Geishecker and Görg (2013) show that service offshoring is associated with a decrease in the real wage of low and medium-skilled and an increase for high-skilled. Using similar data for US, Crinò (2010b) and Crinò (2012) show that service offshoring increases the demand for high-skilled more than for low-skilled. Finally, Liu and Trefler (2019) find that service offshoring increases job turnover in occupation categories but there is only weak evidence of negative effects of offshoring services on employment, wages or earnings. The second wave makes use of the increasing availability of firm-level data, and focuses on within firm changes due to service offshoring. Crinò (2010a) compares service offshoring firms to non-offshoring firms in Italy and finds that employment levels remain unaffected after offshoring but the employment composition shifts in favor of high-skilled workers. Andersson et al. (2016a,b) using data for Sweden find that service offshoring firms experience an increase in the demand for high-skilled labor. Eppinger (2019) uses German firm-level data to show that service offshoring firms increases their employment. Our paper contributes to this literature by offering a uniquely detailed description of the consequences of service offshoring on the firm employment composition. More specifically, we are able to precisely identify the skills and the detailed occupation of the workers that are affected by offshoring. Furthermore, we can analyze the firm-level consequences of this strategy in terms of performance. Therefore, we offer to the literature a more detailed and comprehensive analysis of service offshoring at the firm level.

Second, our results identify and emphasize the within-firm channel for changes in factor demands. An important channel emphasized in the literature since Melitz (2003) and Bernard et al. (2003) is the reallocation of activity across firms with different characteristics. Another channel that has received more attention recently is within-firm changes in factor demands (e.g. Hummels et al., 2014; Bernard et al., 2018b; Mion and Zhu, 2013; Amiti and Davis, 2012). Our results suggest that the within-firm channel for changes in factor demands is important in the case of service offshoring. More specifically, sourcing service intermediates from abroad decreases the number of low-skilled workers and increases high-skilled workers. This is due to a decrease in the number of workers related to low-skilled service activities and to an increase in the number of managers. Bernard et al. (2018b) show that goods offshoring leads firms in the manufacturing sector to reorganize employment towards R&D related occupations. Similarly, we find that service offshoring expands the number of workers related to high-skilled service activities for firms in the services sector. In addition, we show that this strategy is associated with higher performance (e.g. increasing overall employment,

sales, assets and services exports). Finally, our results provide an alternative mechanism for the skill upgrading experienced by Norwegian firms following broadband internet adoption analyzed in Akerman et al. (2015): if increased access to broadband internet led to more opportunities to source services from abroad, firms might have exploited the opportunity to change the composition of employment in favor of high-skilled.

Third, our results relate to the growing literature on service firms that engage in international trade. Since Breinlich and Criscuolo (2011) and Jensen (2011), a number of papers examined trade in services data to understand similarities and differences of firm characteristics between firms that trade goods and firms that trade services.[7] One particular aspect of this literature is that manufacturing firms also engage in trade in services (e.g. Breinlich and Criscuolo, 2011; Lodefalk, 2013; Kelle, 2013; Crozet and Milet, 2017b). Our paper shows that service offshoring involves firms in both the service sector and the manufacturing sector and these firms, while being relatively rare, account for a substantial share of the economy in terms of sales, employment and value added. Recent papers study why manufacturing firms get into services activities and the relation between goods and services trade (e.g. Breinlich et al., 2018; Ariu et al., 2018; Crozet and Milet, 2017a; Ariu et al., 2019; Blanchard et al., 2017). With our paper, we show that importing intermediate services from abroad is an opportunity for firms to reorganize employment and affect performance.

The paper is organized as follows: section 2 describes the data, section 3 outlines the empirical strategy and presents the results, and 4 provides some robustness check. Finally, section 5 concludes.

2 Data Description and Descriptive Statistics

In this section, we describe the datasets and different samples used in the analysis and provide some descriptive statistics of the data.

2.1 Data

Our study covers the years 2002-2012 and relies on four different microdata sources: the Finnish Longitudinal Employer Employee Database (FLEED), the Finnish Annual Accounts Panel for firm-level financial accounts details, the International Trade in Services Survey by Statistics Finland, and the Finnish Custom Declarations for goods trade.

[7] For example, Kelle (2013) for Germany, Gaulier et al. (2011) for France, Federico and Tosti (2017) for Italy, Ariu (2016b) for Belgium and Walter and Dell'mour (2010) for Austria.

2.1.1 Finnish Longitudinal Employer Employee Database (FLEED)

Our main source of information is the register-based Finnish Longitudinal Employer Employee Database (FLEED) from Statistics Finland for the period 2002-2013. This database covers the universe of working age population with detailed information on individual characteristics, such as education, occupation, annual wages, gender, family status, and previous work history. We include only workers from 20 to 55 years old in order to exclude exits due to (early) retirement.

In our analysis, we distinguish workers by education level and occupation. We define five occupational categories: goods production workers, service production workers, medium-skilled professionals, high-skilled professionals and managers (see Table 8 in Appendix B for the list of detailed occupations included in each of our five macro categories).[8] This level of detail allows us to go beyond the traditional blue/white collar categorization of workers and determine more precisely their actual occupation. For example, we can distinguish between blue collar workers that produce goods (e.g machine operators) and those producing services (e.g. office clerks) and between medium-skilled professionals (e.g technicians) and high-skilled professionals (e.g. engineers). The three educational categories follow the usual distinction: low-skilled (lower than secondary education, e.g. less than 9 years of education); medium-skilled (upper secondary education, e.g 9-12 years of education) and high-skilled (tertiary education, e.g. more then 12 years of education).

2.1.2 Finnish Annual Accounts Panel

The firm-level information comes from the financial statement Panel and includes annual accounts variables (e.g., value added, turnover, total value of assets, industry affiliation and R&D purchases). It is important to highlight that all firms in Finland are legally bounded to declare their financial statements, therefore, similar to the worker data, we have information on the population of active firms. We restrict the analysis to those that have a minimum of 5 employees in the first year in which we observe them in order to avoid our estimates being driven by micro firms.

[8]FLEED has three-digit ISCO-88 occupation code information for all employed individuals only in the years 2000 and 2004-2009. For the years missing occupation codes in the FLEED, we first complement the occupation codes from the Structure of Earnings data which has three-digit ISCO codes for the entire time period but it is not comprehensive of all workers. For the remaining small number of individuals which are not in the Structure of Earnings who are missing an occupation code in the FLEED and the Structure of Earnings data (2001-2003), we enter the occupation code that is the nearest non-missing year observation (either 2000 or 2004).

2.1.3 International Trade in Services Survey

Service trade data are collected from all firms known to have international service trade activity. In addition to firms that responded to previous surveys, a random sample is drawn from all other companies in Statistics Finland's Business Register each year. The database covers 1,800-3,100 enterprises annually. Firms have to declare every year service imports and exports by country and service type (EBOPS classification of the balance of payments at the 3-digit level). The data contains modes 1, 2 and 4 of trade in services defined in the GATS. Unfortunately, firms do not need to declare the mode, therefore, it is not possible to carry out the analysis distinguishing across them. The survey covers manufacturing services, maintenance and repair services n.i.e., postal and courier services, transport services, construction services, financing services, telecommunication, information technology and information services, royalties and license fees, other business services, and personal, cultural and recreational services. Tourism, transportation and insurance services are not included because data on these service trade transactions are collected with other surveys. Therefore, they are excluded from the analysis. The data account for about 98% of total imports of services for Finland, which insures that our sample includes the bulk of international trade in services by Finnish firms. Annually, around 53-69% of the firms included in the survey show positive service imports and 37-52% show positive service exports.

2.1.4 Finnish Custom Declarations

The firm-level goods trade data is obtained from the Custom declarations. Both imports and exports are available at the level of the 8-digit Combined Nomenclature (CN8) by partner-country from 1999 onwards. Stemming from compulsory registration in Finnish Customs, extra-EU trade data consist of all transactions. Similar to other EU countries such as France (Eaton et al., 2011; Mayer et al., 2014) and Belgium (Amiti et al., 2014; Ariu, 2016b), intra-EU trade transactions are available for firms with an annual import or export to all other EU countries above 100,000 euro. According to Finnish Customs, the data incorporates about 96.5 percent of the total imports and exports from/to other EU countries. We use these information to control for firms that also engage in goods imports and to control for firm-specific demand shocks that could represent potential confounding factors in our analysis.

2.1.5 Measuring Service Offshoring

We use the detailed firm-level information on service imports combined with industry-level information from the Finnish input-output "supply" tables to construct a novel measure of narrow services offshoring. We focus on service activities that accounted for more than one percent of total sales in the firm's 2-digit industry for the initial 2002-2003 period as more likely to be produced internally by firms within the industry and define these service activities as narrow services offshoring (NSO) categories for each 2-digit industry. We assume that if a service category accounts for more than one percent of sales in an industry, this service is likely to be produced by firms in the industry. We then aggregate firm imports of these NSO categories to obtain a firm-level measure of narrow service offshoring. Purchases of R&D services and services between related enterprises might not satisfy this criteria, but could still involve offshoring since many manufacturing firms carry out these activities without selling them to other firms. We define services between related enterprises as a narrow service offshoring category in all industries and R&D in the industries where its intensity (measured by total R&D expenditure over total revenue) is above the median value of 0.6 percent in the period considered. The full lists of EBOPS categories of services included in the narrow measure per industry are reported in Table 7 in appendix A. A key advantage of this measure compared to the traditional use of the industry affiliation (e.g. Feenstra and Hanson, 1996; Amiti and Wei, 2005, 2009; Crinò, 2010b) is that firms in the manufacturing sector can potentially be classified as involved in service offshoring. Our measure has the advantage of identifying which firms actually import services, instead of simply using the industry affiliation of the firm as an indication of service offshoring. Our approach enables us to examine a broad range of Finnish firms importing services and to examine the potential heterogeneous impact of service offshoring across firms in different sectors. As we show in the robustness section, our empirical results are robust to a broader measure of service imports.

2.1.6 Sample of Analysis

Starting from the universe of Finnish firms having at least five employees, we keep only those that have imported services according to the NSO definition for at least two consecutive years.[9] The resulting sample includes more than eight thousand firm-years

[9]Since our analysis aims at understanding the effect of an increase in imports of service inputs, those firms that we observe only for one year would be anyway dropped from the regression analysis. Our baseline results focus on the set of firms engaged in NSO. In the robustness section, we present results for all service importers.

and we can identify 1,167 unique firms that show positive narrow service offshoring that we can employ in our econometric analysis. However, to provide a meaningful portrait of service offshoring and compare NSO firms with those not involved in NSO, we also use all Finnish firms not involved in NSO in the next subsection.

For every firm-year observation, we match information on: i) the number of employees by occupational and educational categories from the FLEED dataset; ii) productivity (measured as log of value added per employee), turnover, value of assets, R&D expenditure and the industry classification of firms from the Finnish Financial Statement Panel; iii) imports and exports for both goods (from Custom declarations) and services (from the Trade in Services Survey). Finally, we add industry-year trends for all of the above variables computed using all firms in the economy and excluding the firm considered.

2.2 Descriptive Statistics

Using the data just described, we present below descriptive statistics on the scale and scope of service offshoring in Finland.

2.2.1 Aggregate Trends of NSO

Figure 1 shows that during the period from 2002 to 2012 imports of services increased almost three times in Finland. This is significant growth both with respect to Finnish GDP (which increased of less than 1.5% per year in the same period) but also with respect to countries such as UK or US that roughly doubled their services imports. Figure 1 shows that Finland imports services primarily from developed economies (which account for about 75 percent of service imports at the end of the period), with both categories of countries contributing to the growth in service imports. This threefold increase in service imports is empirically relevant because it is equivalent to 5 percent of Finnish GDP. To provide a benchmark, the "China Shock" examined in Autor et al. (2013, 2016) involved growth in U.S. manufacturing imports from China of about 2 percent of GDP.

Distinguishing across broad and narrow service imports, NSO accounts for at least half of the observed growth. A closer look at the different service categories in Table 1 reveals that "R&D and Technical Services", "Legal, Advertising and Consulting", "Trade Related Services & Services between related Companies" and "Computer Services" account for most of imports. In terms of evolution over time, most services categories grew substantially, with exceptional growth in "Computer Services" which

Figure 1: Composition of Service Imports Growth

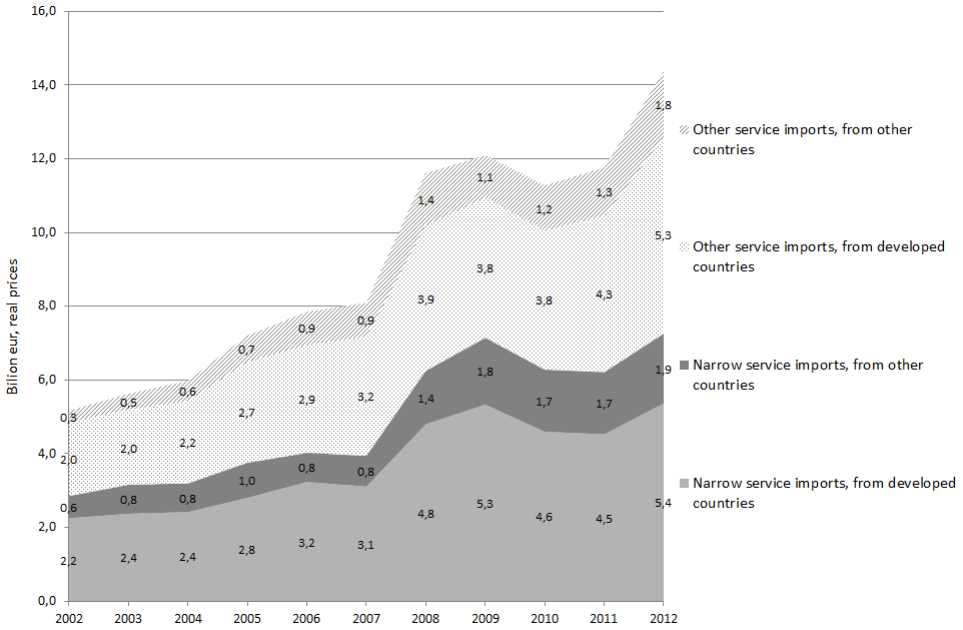


Table 1: 2002-2012 Growth by Service Type (Millions of Euros)

	2002	2012	% Change
Postal, Information and Telecommunication	325	450	38%
Construction and Mining	225	257	14%
Computer services	363	1,794	394%
IPR	641	1,385	116%
Trade Relat. Services & Services bw Relat. Companies	1,216	3,138	158%
Legal, Advertising, Consulting	917	2,263	147%
R&D and Technical Services	1,569	3,707	136%
Personal, Health, Education and Government	192	143	-26%

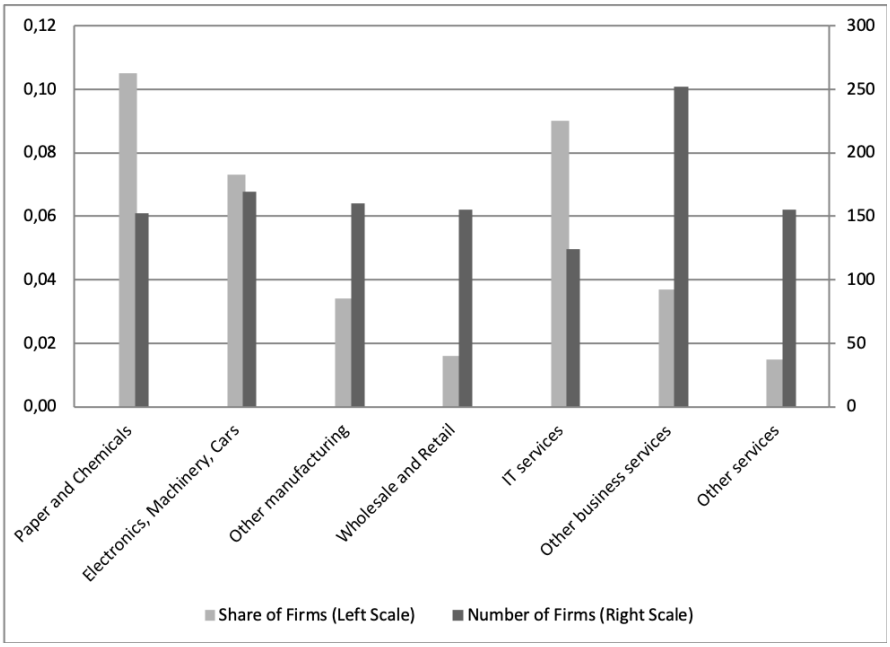
almost quadrupled between 2002 and 2012. These figures indicate that services imports experienced substantial growth during our period of analysis and that NSO played an important role in these aggregate trends.

2.2.2 NSO Participation

To understand the scope of service offshoring, we plot in Figure 2 the number (right scale) and the share of firms (left scale) that report positive narrow service offshoring by industry. On average only 3% of firms source intermediate services from abroad and most of them are in the services sector. "Business Services" accounts for most of them, followed by "Wholesale and Retail", "Other Services" and "IT Services".

The manufacturing sector also has a significant number of NSO firms.[10] Firms that produce goods need service inputs and they actively source them from foreign markets. Thus, they can be involved in service offshoring and, in our analysis, we provide results differentiating firms belonging to the manufacturing and service sector.

Figure 2: NSO Participation by Industry



Looking at the left scale, we observe that service offshorers represent a small but non negligible share of firms in their respective sector. For example, NSO firms represent 10% of the companies in the "Paper and Chemical" industry, 8% in the "IT Services". These figures are in line with many studies that find that import participation is rather low among firms even within the same sector (e.g. Bernard et al., 2018a) and especially for service imports (e.g. Breinlich and Criscuolo, 2011). While the number of service offshoring firms may be small, we show in the next subsection that these firms are actually large and important players in the economy.

2.2.3 NSO and Non-NSO Firms

Despite being relatively rare, NSO firms represent an important share of the Finnish economy. During the period of analysis, they account on average for 45% of revenues, more than 13% of employment and almost 20% of value added in Finland. Their

[10]For confidentiality issues we needed to aggregate manufacturing industries in sub-categories. Paper and Chemicals include NACE codes 21-25, Electronics, Machinery and Cars 29-25 and Other Manufacturing all the remaining codes.

importance is growing over time. For example, the revenues generated by firms that import service intermediates increased from 40% of all Finnish revenues to almost 50% in 2012. This means that NSO firms are bigger than firms that do not offshore services and they are becoming more important in aggregate over time. To quantify these differences, we compare the NSO and non-NSO firms in terms of standard performance measures such as employment size, value added per worker, turnover, capital intensity and skill intensity (measured as average wage) in Table 2.[11] NSO firms are bigger in terms of number of employees, they have higher performance in terms of value added per worker, turnover, capital intensity and they pay higher wages. These figures confirm that it is larger, more productive firms that are engaged in services offshoring.

Table 2: NSO and Non-NSO Firms' Characteristics

	NSO Firms		**Non-NSO Firms**	
	Obs.	Mean	Obs.	Mean
Employees (ln)	8,490	4.8	49,295	3.1
VA per empl. (ln)	7,877	11.2	45,617	10.9
Turnover (ln)	8,284	17.2	48,311	15.2
Capital per empl. (ln)	8,366	10.5	46,657	9.8
Average wage bill (ln)	8,336	10.6	47,273	10.3

2.2.4 NSO Firms Employment Changes

To analyze the evolution of employment composition for NSO firms, we decompose the changes in the number of workers by educational category and sector between 2002 and 2012 in Panel a of Table 3. We find that the aggregate number of low-skilled employed in NSO firms decreased while the number of high-skilled increased. For the manufacturing sector, the number of medium-skilled also decreased. This is suggestive that service offshoring might also be affecting medium-skilled workers in manufacturing industries. These results show that NSO firms experienced a skill upgrading contributed to by a decrease in the number of low-skilled workers and by an increase in the number of high-skilled workers during the period of analysis.

[11] Each observation represents a firm-year.

Table 3: Employment Changes by Education and Occupation

Panel a: Education	Manufacturing			Services		
	2002	2012	Change	2002	2012	Change
Low-Skilled	34,083	19,276	-14,807	23,716	19,426	-4,290
Medium-Skilled	73,627	60,193	-13,434	46,317	63,060	16,743
High-Skilled	59,538	61,137	1,599	50,195	72,614	22,419
Panel b: Occupation	Manufacturing			Services		
	2002	2012	Change	2002	2012	Change
Goods Production	78,342	56,849	-21,493	12,581	14,941	2,360
Service Production	24,112	13,130	-10,982	50,250	60,159	9,909
Medium-skilled Professionals	35,495	31,303	-4,192	27,294	42,264	14,970
High-skilled Professionals	22,394	26,451	4,057	21,289	27,126	5,837
Managers	4,851	7,636	2,785	5,295	7,473	2,178

Because of the great level of detail available in our data, we can perform a similar decomposition by occupational category in Panel b of Table 3. In the service sector, all occupational groups of workers increased. In contrast, for the manufacturing sector, we observe a decrease in the number of service production workers and, to a lesser extent, of medium-skilled professionals. Keeping in mind that these are simple descriptive statistics, two points are worth mentioning. First, service offshoring can have potential negative effects on employment not only in service industries but also in the manufacturing sector. Second, service offshoring might differentially affect firms depending on the industry of affiliation. Therefore, it could potentially represent different strategies depending on whether the firm produces goods or services. In the next section, we examine more systematically the relationship between the dramatic increase in service offshoring and the changing employment composition observed in this section.

3 Empirical Strategy and Results

To go beyond the stylized facts highlighted in the previous section, we need to address the issue of the endogeneity related to the firm-level choice of pursuing service offshoring. We describe our approach to addressing this potential problem below.

3.1 Empirical Strategy

The equation that we bring to the data takes the following form:

$$Y_{it} = \alpha_0 + \alpha_1 \text{NSO}_{it} + \gamma X_{jt} + \mu_i + \epsilon_{it}$$

where Y_{it} is defined as the (log) level of employment in the educational and occupational category of workers for firm i at time t. NSO_{it} is our main variable of interest, i.e. the (log) measure of narrow service offshoring for firm i at time t. X_{jt} represent industry j trends that control for aggregate shocks that affect all firms within the same industry.[12] Finally, μ_i is a firm fixed effect and ϵ_{it} is our error term. Identification comes from the within-firm over-time variation in the NSO_{it} measure of narrow service offshoring. More specifically, we can test whether changes in the exposure of the firm to service offshoring are related to changes in employment by occupational and educational category.

One important element to take into account for a proper identification is the possible endogeneity of our service narrow offshoring measure, NSO_{it}. To correct for this issue, we need an instrument that is correlated with the firm's decision to offshore services but uncorrelated with the firm's changes in the level and composition of the workforce. We exploit shocks in the export supply of specific service-country pairs which are exogenous to Finland and allocate them based on the relative importance of each service-country in the total service imports of the firm in the initial year in which it is observed importing services. Analytically, our instrument is constructed as following:

$$\text{WES}_{it} = \sum_s \sum_c \left[EXP_{sct} * \left(\frac{NSO_{isct^*}}{NSO_{it^*}} \right) \right]$$

Where EXP_{sct} indicates the world exports supply of service s and country c at time t excluding exports directed to Finland computed using COMTRADE data. NSO_{isct^*} captures the imports of services following our narrow definition of firm i, of service s from country c in the initial year in which the firm is observed importing the narrow services, t^*. NSO_{it^*} represents the total imports of narrow services for firm i in the initial year in which the firm is observed importing services, t^*.

Our identification strategy is similar to the one used in Hummels et al. (2014) for goods offshoring and it relies crucially on the high level of specialization in the sourcing structure. In the context of manufacturing inputs sourcing, Hummels et al. (2014) find that the median product-origin country is imported by only one firm. Despite the fact that the level of disaggregation for the services classification is very low,[13]

[12]Note that the trend is computed using all firms in Finland and for each observation the industry trend is computed excluding the firm considered.

[13]There are only about thirty service categories. This means that we have half the number of the categories present in CN classification for trade in goods at the lowest level of disaggregation, i.e 2-digit

we find that the median service-origin country is actually imported by only two firms and this relation remains quite stable over time. In other words, for both goods and services, firms rarely use the same input-country combinations and they do not change them over-time. These features make the firm-service-country relation pre-determined and exogenous with respect to changes over-time in firm employment and performance. Therefore, the initial importance of the service-origin country combination for each firm can be used to allocate exogenous service-country changes over-time in export supply. This highly specific sourcing structure implies that any shock that affects a particular service-origin country will impact firms within the same sector differently. Therefore, the widely used industry-level weights would introduce noise in the measure of service offshoring that can potentially affect the estimates.

There are three main threats that could affect our instrument: unobserved demand shocks, supply shocks, and technological shocks. With respect to the first, our instrument uses an aggregate supply shock which is orthogonal to the demand that the firm faces. Of course, it could be that the world export supply is not only due to a pure supply shock but to a demand shock that affects all countries including Finland. Our strategy to overcome this issue is the use of industry-year trends which control for aggregate demand changes and are constructed excluding the firm considered. Therefore, demand shocks common to all sectors are controlled for by means of industry trends.[14] Second, supply-side shocks specific to Finnish firms could propagate to customers and suppliers and thus influence the world export supply. This is very unlikely because Finland is a small country and its share of service exports and imports is less than 1% among OECD countries. Therefore, the extent to which Finnish shocks can propagate internationally appears quite negligible with respect to the case of a large country like the US or UK. Third, technological shocks could also induce firms to change the composition of employment and service offshoring. Our instrument has an important feature that alleviates this concern: firm-level weights are time invariant. Therefore, the instrument should be exogenous to short term changes in technology at the level of the firm which could drive both the offshoring decision and the composition of the workforce. In any case, our industry-year trends can also capture industry-wide technological trends and mitigate this potential bias.

level and half percent of the number of products with respect to the 6-digit level used in Hummels et al. (2014), which counts about 5,300 products.

[14] We discuss the case of firm-specific demand shocks in the robustness check section.

3.2 Results

Our first objective is to understand whether service offshoring is associated with a change in the composition of employment within firms. In Table 4 we analyze how service offshoring affects the number of employees in each education and occupational category.[15] Consistent with our stylized facts, we observe in Panel a that service offshoring is related with a reduction in the number of low-skilled workers and to an increase in high-skilled workers. Most of the decrease in the number of low-skilled is explained by a reduction in the number of workers related to the production of services and to a lesser extent to a reduction in goods production workers. This implies that workers in occupations such as clerks, personal and protective services workers, salespersons and customer services clerks experience a decrease in their numbers following service offshoring.[16] The fact that offshoring actually affects negatively some educational and occupational categories suggests that our measure is not merely capturing a switch from arm's-length domestic suppliers to foreign suppliers because that would not involve a decrease in the employment of the firm. To provide a quantitative assessment of our results, we perform a simple back of the envelope calculation that ignores all the possible general equilibrium effects. An increase of ten percent in the average level of NSO (i.e. an increase of 660 thousand Euros on average), leads to a decrease of 81 low-skilled workers and to an increase of 91 high-skilled workers. Given that the average firm employment in our sample is 418 workers, these represent sizable changes in employment composition.

Separating the sample into manufacturing firms (Panel b) and service firms (Panel c), we observe that for manufacturing firms service offshoring has negative effects on low and medium-skilled employment; workers such as technicians are negatively affected by the relocation of services abroad. The positive increase in the number of high-skilled is not significant and the increase in managers is lower than in the complete sample. For firms in the services sector, we observe a strong increase in high-skilled employment which is explained by an increase in the number of managers and high-skilled professionals. For the low-skilled workers, the effect of NSO is still negative but weaker than for the complete sample.

These results highlight that for both industries, service offshoring decreases the production of low-skilled services. These can include activities such as transportation,

[15] Please, note that the first stage of the 2SLS is available in Table 9 in Appendix C

[16] The decrease in the number of goods production workers could be explained by the fact that the two production activities are complementary and shutting down or reducing one would result in a decrease in both.

Table 4: IV Estimates, NSO Effect on Employment by Education, Occupation and Task Intensity

Panel a: Complete Sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.136***	-0.022	0.046**	-0.106***	-0.258***	-0.045*	0.036	0.106***	0.072***	0.284***
	(0.040)	(0.024)	(0.019)	(0.036)	(0.056)	(0.026)	(0.024)	(0.027)	(0.023)	(0.060)
Observations	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475
Panel b: Manufacturing Firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.279**	-0.143**	-0.051*	-0.245**	-0.399***	-0.121**	-0.007	0.072**	0.012	0.132**
	(0.124)	(0.062)	(0.029)	(0.097)	(0.140)	(0.048)	(0.031)	(0.034)	(0.027)	(0.057)
Observations	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456
Panel c: Services Firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.052	0.037	0.098**	-0.087**	-0.155***	-0.015	0.098**	0.108***	0.088**	0.376***
	(0.034)	(0.028)	(0.040)	(0.040)	(0.048)	(0.035)	(0.040)	(0.037)	(0.035)	(0.097)
Observations	3,980	3,980	3,980	3,980	3,980	3,980	3,980	3,980	3,980	3,980

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

cleaning, customer assistance and basic back office.[17] The decrease in the scale of domestic service production can be associated with an increasing need for international coordination due to service offshoring and this might lead firms to increase the number of managers. For service firms however, the increase in the number and share of high-skilled is also explained by an increase in the category of high-skilled professionals, meaning that the firm increases its involvement in R&D-related activities such as engineers, software developers, lawyers, architects and scientists. Therefore, while for manufacturing firms service offshoring can potentially represent just a cost saving strategy, for service firms it appears to allow firms to strengthen the production of high-skilled activities.

Using the measures of task intensity provided by Becker et al. (2013) to classify occupations, we observe in columns (9) and (10) of Table 4 that the number of workers performing non-routine and interactive tasks increases following NSO. By splitting the results for the manufacturing (Panel b) and services (Panel c) industries, we find that

[17]While it might be counter-intuitive that services carried out by drivers and construction workers could be imported, it actually happens frequently in small countries like Finland. This is because foreign workers can freely move across EU countries and foreign companies can provide their services by sending their employees to their customers. While this phenomena is infrequent for large countries like the US, this type of service provision is classified as "Mode 4" of trade in services; it is recorded in our data and it involves potentially many firms and an important share of services trade. Unfortunately, firms are not required to declare the import mode and thus it is impossible for us to provide a quantification of this mechanism.

for firms in both sectors service offshoring is associated with an increase in the use of interactive tasks. This is in line with the increased international dimension of service offshoring that could require a more intensive coordination effort, especially provided by the increased employment of managers. For the services sector, service offshoring is associated also with an increase in the use of non-routine tasks. According to the classification of Becker et al. (2013), these are especially carried out by high-skilled professionals such as engineers, software developers and scientists, thus reinforcing the idea that service offshoring can represent a strategy for firms in the services sector to refocus on high-skilled and R&D-related activities.

3.3 Firm Performance

A key question in the analysis of the consequences of offshoring is whether the changes in the composition of employment are associated with firm performance. To analyze this issue, we perform the same regression as for employment instead using different performance measures as the dependent variable. The results for the whole sample in Panel a of Table 5 indicate that on average there is no effect on employment, productivity, R&D expenditure and goods exports.[18] However, firms expand in terms of sales, service exports and in the value of total assets. Therefore, while not directly affecting productivity, firms are able to expand their sales and their involvement in foreign markets.

Distinguishing across sectors provides interesting insights. Panel c of Table 5 presents the results for firms in the services sector. We observe here that the skill upgrading due to offshoring translates into a slightly bigger workforce and to higher performance in terms of turnover, value of assets and services exports. Therefore, it appears that by getting rid of marginal service activities, firms in the service sector were able to re-allocate resources to concentrate on more high-skilled activities. This translated into: i) a higher number of high-skilled professionals; ii) an increase in the number of managers (probably used to coordinate the increased complexity due to the international dimension of offshoring); iii) higher performance in the form of higher sales and service exports. Therefore, for firms which are in the booming services sector, service offshoring appears to offer firms an opportunity to improve their performance by refocusing employment on R&D related activities.

Panel b of Table 5 shows that NSO induces firms in the manufacturing sector to decrease the number of employees without any noticeable difference in the other perfor-

[18] Please note that the first stage of the 2SLS is available in Table 10 in Appendix C

Table 5: IV Estimates, The Effect of NSO on Firm Performance

Panel a: Complete Sample	(1) Employees	(2) Productivity	(3) Turnover	(4) Total Value of Assets	(5) R&D Expenditure	(6) Services Exports	(7) Goods Exports
NSO	-0.003	-0.009	0.095***	0.155***	0.196	0.597***	-0.115
	(0.022)	(0.026)	(0.024)	(0.037)	(0.164)	(0.183)	(0.112)
Observations	7,475	6,962	7,318	7,475	7,475	7,475	7,475
Panel b: Manufacturing Firms	(1) Employees	(2) Productivity	(3) Turnover	(4) Total Value of Assets	(5) R&D Expenditure	(6) Services Exports	(7) Goods Exports
NSO	-0.138**	-0.027	0.055	0.078	0.105	0.501*	-0.013
	(0.060)	(0.042)	(0.035)	(0.050)	(0.323)	(0.293)	(0.157)
Observations	3,456	3,274	3,404	3,456	3,456	3,456	3,456
Panel c: Service Firms	(1) Employees	(2) Productivity	(3) Turnover	(4) Total Value of Assets	(5) R&D Expenditure	(6) Services Exports	(7) Goods Exports
NSO	0.056*	-0.034	0.115***	0.182***	0.166	0.538**	-0.340*
	(0.031)	(0.046)	(0.034)	(0.055)	(0.176)	(0.216)	(0.202)
Observations	3,980	3,648	3,873	3,980	3,980	3,980	3,980

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

mance measures. This further supports the idea that for manufacturing firms, service offshoring is a cost minimizing strategy that allows the firms to get rid of marginal service activities. Therefore, it could be seen as a way to survive in an environment which involves a high level of competition and possibly also high exit rates. Indeed, several papers argue that the import competition during that period put pressure on the manufacturing sector (e.g. Autor et al., 2013; Nilsson Hakkala and Huttunen, 2016; Dauth et al., 2014) thus increasing the need to find a viable path to survive (e.g. Bloom et al., 2016; Breinlich et al., 2018). Indeed, when looking at exit rates, for offshoring firms they are less than half with respect to those of firms that do not engage in offshoring (3% against 7.5%). To provide econometric evidence, we show in Table 6 the results of regressing a dummy identifying exit on lagged service importer status and firm fixed effects.[19] We consistently find that importing service inputs is negatively associated with firm exit for both sectors. Therefore, service offshoring could potentially represent a strategy to survive in a competitive environment.

4 Robustness Checks

Our instrumental strategy allows us to infer causality about service offshoring and solves a number of the most important econometric challenges. However, there are a number

[19]Please note that this analysis is carried out using all firms in Finland. Using different lags or different definitions of service imports does not change the results.

Table 6: Service Imports and Firm Exit

	(1) All firms	(2) Manufacturing	(3) Services
Service Importer	-0.023***	-0.022***	-0.023***
	(0.004)	(0.007)	(0.005)
Observations	1,280,130	199,527	1,079,301

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects. Firm-clustered standard errors in parentheses.

of other minor issues that could affect our results that we discuss in this section.

4.1 Alternative Measure of Service Offshoring

The first check we perform is related to our measure of NSO offshoring, which we defined as all service activities that accounted for more than 1 percent of total sales in the firm's 2-digit industry. To examine whether this choice is driving our results and in order to compare to the rest of the literature which uses all the service imports, we run all regressions using as the measure of offshoring all the service imports of the firm and we define our instrument and estimation sample accordingly (i.e. using all imported inputs to construct the shares). Despite the fact that all service imports can potentially embed other motives such as an increase in demand and represent a more noisy measure of offshoring, results in Tables 11 and 12 in Appendix C show that this is actually not an issue. Results are very similar both in terms of employment levels and performance, with the only difference that for the manufacturing sector (Panel b) some performance measures are now small and positive.

A second issue related to our measure of narrow service offshoring is that it includes also services between related enterprises. Besides representing an important channel of service offshoring, this category of service imports does not specify which service is actually traded within the same firm. The lack of the determination of the service involved raises the suspicion that this category of services imports could potentially be contaminated by profit shifting motives. When removing this category in our NSO measure, we actually find very similar results (Tables 13 and 14 in Appendix C). Therefore, our results do not appear to be driven by the opportunity of firms to engage in profit shifting.

4.2 Firm-Specific Demand Shocks

We highlighted in the explanation of our empirical strategy that our instrument is constructed from a pure supply shock which is exogenous to Finland. However, it could be that demand shocks are correlated across countries and so, the supply shock could also embed demand components. Our industry-year trends capture demand shocks that are common to all firms in the same industry but they cannot exclude the case in which these shocks are firm-specific. Even if our instrument should be exogenous to firm-level demand because it is constructed using aggregate world export supply and the firm-shares are set at the beginning of the offshoring period, we still check the importance of this potential bias by adding to the regression firm level exports of services and goods. The idea is that these variables can control for idiosyncratic demand shocks coming from international markets that could have an effect on employment, performance and the offshoring decision. Tables 15 and 16 in Appendix C show that our results remain the same when adding covariates that control for demand shocks at the firm level. Therefore, it is unlikely that unobserved demand shocks specific to the firm are driving our results.

4.3 Goods Offshoring

Firms might simultaneously engage in both goods and service offshoring. As long as our instrument is uncorrelated with increases in foreign sourcing of manufacturing intermediates, this is not problematic. To dissipate any doubt on this issue, we include in our specification a measure of goods imports to control for possible increases of goods offshoring. Tables 17 and 18 in Appendix C show that our results remain the same when controlling for the fact that firms might also be increasing their sourcing of manufacturing inputs.[20]

4.4 Import Competition

Even if we are controlling for industry-year trends, our measure of firm-level narrow offshoring could potentially embed import competition effects (as opposed to the effects of offshoring). More specifically, import competition and offshoring can have different consequences for the employment and performance of firms (e.g. Bernard et al., 2018b; Hummels et al., 2016; Mion and Zhu, 2013), thus potentially confounding our results.

[20]Please note that it is not possible to compare our goods offshoring coefficient with the rest of the literature because our sample of analysis includes only those firms that import services from abroad.

To check whether this potential omitted variable is affecting our results, we add to our baseline specification a measure of import competition computed as total imports of the industry of affiliation of the firm (using all Finnish firms). Results in Tables 19 and 20 in Appendix C show that our results are not affected by the potential presence of industry import competition.

4.5 The Great Collapse

Our period of analysis includes the 2008-2009 crisis. While industry controls probably capture most of the industry response to this shock, it could still be that firms reacted heterogeneously within the same industry (e.g. Behrens et al., 2011; Ariu, 2016a). This means that changes in employment, performance and offshoring strategies could potentially be affected by the crisis. To remove this remaining doubt, we exclude the years after 2007 from the analysis. Tables 21 and 22 in Appendix C show that the great collapse does not represent a confounding factor for our results.

5 Conclusion

Using rich, detailed information on international trade in services, firm-level characteristics, and worker characteristics from Finland, this paper investigates the implications of service offshoring on employment composition and firm performance. We find that firms that increase foreign sourcing of service inputs experience a skill upgrading composed of a reduction in the employment of low-skill service workers and an increase in the employment of managers. For services firms, these changes are also associated with an increase in the employment of high-skilled professionals (e.g., engineers, computer programmers, scientists) suggesting that firms could be upgrading skills and refocusing more on R&D related activities. Following increases in imports of service inputs, service offshoring firms experience a general performance improvement in terms of employment, sales (turnover), assets, service exports and firm survival. Manufacturing firms also reduce the number of medium-skilled professionals and the occupational changes induced by the increase in service offshoring are associated with an increased survival probabilities only, without any significant improvement in other performance indicators.

These results highlight both the opportunities for firms associated with the ability to source service intermediate inputs globally and the potential challenges for workers, particularly low-skilled workers, as firms' labor demands change. They suggest a

possible need for appropriate public policies to facilitate and enable the reallocation of workers in response to increasing international trade in services. The firm survival results demonstrate that the ability for firms to source inputs at the lowest cost is potentially important to firm competitiveness and survival. Therefore, any public policy responses to the challenges faced by workers as a result of service offshoring need to recognize these benefits.

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A Appendix: NSO Definition

Table 7: NSO Definition by Industry

Nace 2-digit	**Industry Name**	**NSO EBOPS 3-digit Codes**
10-14	Mining	281, 283, 274, 285
15-16	Food and Tobacco	274, 285
17-19	Textile	279, 285
20-21	Wood and Pulp	274, 285
22	Publishing	288, 889, 290, 274, 285
23-25	Coke, Chemical, Rubber	274, 279, 285
26-28	Basic Minerals	274, 279, 285
29-31 & 33	Machinery	274, 279, 285
32	Communication Equipment	263, 274, 279, 285
34-35	Vechicles	274, 279, 285
36	Other Manufacturing	274, 279, 285
37	Recycling	279, 282, 274, 263, 250, 285
45	Construction	250, 251, 285
50	Sales and Repair of Vehicles	270, 271, 272, 285
51	Wholesale	270, 271, 285
52	Retail	270, 271, 285
64	Postal Services	246, 247, 958, 959, 279, 285
65	Financial services	260, 285
67	Aux. serv. to financial serv.	260, 285
72	IT services	263, 279, 285
73	R&D services	279, 895, 285
74	Other business services	274, 275, 276, 277, 278, 280, 284, 279, 285
80	Education	895, 285
91	NGOs	897, 985, 274, 285
92	Recreational serv., culture, sports	897, 985, 274, 285

Sectors 01-05 (Agricultural and Forest), 40-41 (Electricity and Water Supply), 70 (Real Estate), 71 (Renting of Machinery), 75 (Governmental Services), 85 (Health Services), 90 (Environmental Services), 93 (Other Services) and 99 (Other) are excluded because we do not have enough observations. Sectors 55-63 (Travel and Transport), 66 (Insurance) are not included in the survey.

B Appendix: Groupings of occupations

Table 8: Occupational groups, based on 2001 Classification of occupations, Statistics Finland

		Classification of occupations, 2001
Occupational group	Code	Name of occupation
1. Goods Production	71	Extraction and building trades workers
Workers	72	Metal, machinery and related trades workers
	73	Precision, handicraft, craft printing and related trades workers
	74	Other craft and related trades workers
	81	Stationary plant and related operators
	82	Machine operators and assemblers
2. Service Production	51	Personal and protective services workers
Workers	52	Models, salespersons and demonstrators
	83	Drivers and related water traffic operators
	91	Sales and services elementary occupations
	92	Agricultural, fishery and related labourers
	93	Labourers in manufacturing and construction
	41	Office clerks
	42	Customer services clerks
4. Medium-Skilled	31	Physical and engineering science associate professionals
Professionals	32	Life science and health associate professionals
	33	Traffic instructors and other teaching associate professionals
	34	Other associate professionals
5. High-skilled	21	Physical, mathematical and engineering science professionals
Professionals	22	Life science and health professionals
	23	Teaching professionals
	24	Other professionals
6. Managers	11	Legislators and senior officials
	12	Corporate managers
	13	Managers of small enterprises

C Appendix: Further Results and Robustness

Table 9: First Stage Number of Employees

Dep. Var	(1) NSO_{it}	(2) NSO_{it}	(3) NSO_{it}	(4) NSO_{it}	(5) NSO_{it}	(6) NSO_{it}	(7) NSO_{it}	(8) NSO_{it}	(9) NSO_{it}	(10) NSO_{it}
WES_{it}	0.286***	0.307***	0.305***	0.316***	0.310***	0.317***	0.320***	0.335***	0.317***	0.319***
	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.066)	(0.065)	(0.065)
Industry Trends:	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
Observations	7,387	7,387	7,387	7,387	7,387	7,387	7,387	7,387	7,387	7,387
R^2	0.447	0.447	0.446	0.446	0.447	0.446	0.446	0.446	0.446	0.446
Kleibergen-Paap Wald stat	15.00	17.07	16.91	17.61	17.40	17.76	18.20	19.67	17.82	17.72

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 10: First Stage Performance

Dep. Var	(1) NSO_{it}	(2) NSO_{it}	(3) NSO_{it}	(4) NSO_{it}	(5) NSO_{it}	(6) NSO_{it}	(7) NSO_{it}
WES_{it}	0.319***	0.251***	0.323***	0.301***	0.306***	0.301***	0.295***
	(0.065)	(0.067)	(0.066)	(0.067)	(0.065)	(0.065)	(0.064)
Industry Trends:	Employees	Productivity	Turnover	Total Value of Assets	R&D Expenditure	Services Exports	Goods Exports
Observations	7,387	7,387	7,387	7,387	7,387	7,387	7,387
R^2	0.446	0.447	0.446	0.446	0.447	0.447	0.449
Kleibergen-Paap Wald stat	15.88	10.40	18.13	15.73	16.51	16.18	16.41

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 11: IV Estimates, Broad Service Offshoring Effect on Employment by Education, Occupation and Task Intensity

Panel a: all firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
BSO	-0.255***	-0.053	0.124***	-0.259***	-0.477***	-0.056	0.099**	0.254***	0.177***	0.612***
	(0.090)	(0.049)	(0.044)	(0.093)	(0.138)	(0.053)	(0.050)	(0.074)	(0.059)	(0.169)
Observations	7,380	7,380	7,380	7,380	7,380	7,380	7,380	7,380	7,380	7,380
Panel b: manufacturing sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
BSO	-0.442**	-0.262**	-0.050	-0.469***	-0.604***	-0.213**	0.013	0.124**	0.065	0.319***
	(0.176)	(0.106)	(0.044)	(0.182)	(0.209)	(0.087)	(0.056)	(0.056)	(0.051)	(0.119)
Observations	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390	3,390
Panel c: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
BSO	-0.121	0.092	0.252**	-0.284*	-0.410*	0.036	0.278**	0.426*	0.253*	1.008**
	(0.107)	(0.078)	(0.129)	(0.167)	(0.211)	(0.088)	(0.133)	(0.250)	(0.130)	(0.475)
Observations	3,951	3,951	3,951	3,951	3,951	3,951	3,951	3,951	3,951	3,951

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 12: IV Estimates, The Effect of Broad Service Offshoring on Firm Performance

Panel a: complete sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
BSO	0.032	0.075	0.302***	0.455***	0.466	1.561***	-0.640**
	(0.054)	(0.067)	(0.058)	(0.078)	(0.423)	(0.443)	(0.293)
Observations	6,351	6,031	6,351	6,351	6,351	6,351	6,351
Panel b: manufacturing firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
BSO	-0.202***	0.062	0.206***	0.288***	-0.201	1.276*	-0.371
	(0.077)	(0.077)	(0.072)	(0.100)	(0.705)	(0.660)	(0.354)
Observations	2,995	2,873	2,995	2,995	2,995	2,995	2,995
Panel c: service firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
BSO	0.182**	0.028	0.383***	0.524***	0.712	1.701***	-1.507**
	(0.088)	(0.141)	(0.098)	(0.133)	(0.577)	(0.646)	(0.596)
Observations	3,319	3,125	3,320	3,320	3,320	3,320	3,320

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 13: IV Estimates, NSO Effect on Employment by Education, Occupation and Task Intensity Excluding Intra-Firm Trade in Services

Panel a: all firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.273***	-0.070	0.077**	-0.265**	-0.549***	-0.080	0.058	0.221***	0.104**	0.471***
	(0.101)	(0.050)	(0.039)	(0.104)	(0.193)	(0.051)	(0.045)	(0.083)	(0.048)	(0.159)
Observations	7,318	7,318	7,318	7,318	7,318	7,318	7,318	7,318	7,318	7,318
Panel b: manufacturing sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.786	-0.501	-0.181	-0.872	-0.897*	-0.361	-0.134	0.195	-0.072	0.211
	(0.607)	(0.400)	(0.155)	(0.772)	(0.536)	(0.280)	(0.142)	(0.141)	(0.092)	(0.180)
Observations	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367	3,367
Panel c: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.066	0.054	0.133**	-0.149**	-0.215***	-0.007	0.138**	0.162**	0.109**	0.466***
	(0.047)	(0.040)	(0.057)	(0.064)	(0.077)	(0.043)	(0.058)	(0.065)	(0.048)	(0.142)
Observations	3,915	3,915	3,915	3,915	3,915	3,915	3,915	3,915	3,915	3,915

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 14: IV Estimates, The Effect of NSO on Firm Performance Excluding Intra-Firm Trade in Services

Panel a: complete sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.023	-0.023	0.106***	0.138***	0.051	0.700***	-0.296***
	(0.019)	(0.020)	(0.022)	(0.024)	(0.137)	(0.162)	(0.113)
Observations	7,475	6,962	7,318	7,475	7,475	7,475	7,475
Panel b: manufacturing firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	-0.408	-0.031	0.193	0.080	-0.885	2.755	-0.671
	(0.309)	(0.064)	(0.179)	(0.071)	(1.085)	(1.843)	(0.611)
Observations	3,367	3,185	3,315	3,367	3,367	3,367	3,367
Panel c: service firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.098**	-0.029	0.156***	0.205***	0.285	0.600**	-0.589*
	(0.050)	(0.070)	(0.050)	(0.060)	(0.229)	(0.268)	(0.335)
Observations	3,915	3,582	3,808	3,915	3,915	3,915	3,915

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 15: IV Estimates, NSO Effect on Empl. by Educ. Occ. & Task Int., Unob. Demand Robustness

Panel a: all firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Education			**Occupation**					**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.146***	-0.020	0.049**	-0.111***	-0.283***	-0.049*	0.039	0.118***	0.081***	0.316***
	(0.045)	(0.026)	(0.021)	(0.040)	(0.067)	(0.029)	(0.026)	(0.031)	(0.027)	(0.072)
Service Exports	0.024***	0.008	0.001	0.020**	0.048***	0.014***	0.002	-0.013**	-0.008	-0.048***
	(0.025)	(0.014)	(0.007)	(0.023)	(0.031)	(0.011)	(0.006)	(0.008)	(0.006)	(0.013)
Goods Exports	0.101***	0.099***	0.057***	0.121***	0.071***	0.064***	0.052***	0.032***	0.053***	0.011
	(0.007)	(0.005)	(0.004)	(0.007)	(0.009)	(0.005)	(0.004)	(0.004)	(0.004)	(0.009)
Observations	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475
Panel b: manufacturing sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Education			**Occupation**					**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.313**	-0.166**	-0.063*	-0.285**	-0.443***	-0.139**	-0.015	0.074*	0.008	0.143**
	(0.137)	(0.072)	(0.033)	(0.119)	(0.164)	(0.057)	(0.033)	(0.039)	(0.028)	(0.065)
Services Exports	0.053**	0.033**	0.020***	0.054**	0.080**	0.033***	0.011*	-0.006	0.005	-0.020
	(0.030)	(0.016)	(0.007)	(0.029)	(0.039)	(0.013)	(0.008)	(0.011)	(0.007)	(0.018)
Goods Exports	0.112***	0.098***	0.057***	0.129***	0.093***	0.065***	0.051***	0.024***	0.046***	0.003
	(0.018)	(0.014)	(0.007)	(0.019)	(0.021)	(0.010)	(0.006)	(0.005)	(0.006)	(0.008)
Observations	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456	3,456
Panel b: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Education			**Occupation**					**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.052	0.046	0.111**	-0.089**	-0.164***	-0.009	0.110**	0.119***	0.101**	0.408***
	(0.038)	(0.033)	(0.048)	(0.043)	(0.054)	(0.037)	(0.045)	(0.042)	(0.040)	(0.112)
Service Exports	0.012*	-0.001	-0.009	0.015*	0.028***	0.003	-0.010	-0.014*	-0.011	-0.056***
	(0.006)	(0.006)	(0.008)	(0.008)	(0.010)	(0.007)	(0.008)	(0.008)	(0.008)	(0.022)
Goods Exports	0.025***	0.024***	0.018***	0.024***	0.027***	0.029***	0.019***	0.017***	0.021***	0.002
	(0.004)	(0.004)	(0.005)	(0.006)	(0.007)	(0.005)	(0.006)	(0.005)	(0.005)	(0.015)
Observations	3,980	3,980	3,980	3,980	3,980	3,980	3,980	3,980	3,980	3,980

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 16: IV Estimates, The Effect of NSO on Firm Performance, Unobserved Demand Robustness

Panel a: complete sample	(1)	(2)	(3)	(4)	(5)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure
NSO	-0.004	-0.012	0.101***	0.166***	0.210
	(0.024)	(0.028)	(0.027)	(0.041)	(0.182)
Services Exports	0.007*	0.009*	-0.004	-0.021***	0.010
	(0.004)	(0.005)	(0.005)	(0.008)	(0.034)
Goods Exports	0.053***	-0.012***	0.041***	0.013***	0.152***
	(0.005)	(0.004)	(0.005)	(0.005)	(0.023)
Observations	7,475	6,962	7,318	7,475	7,475
Panel b: manufacturing firms	(1)	(2)	(3)	(4)	(5)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure
NSO	-0.166**	-0.023	0.048	0.072	0.064
	(0.072)	(0.042)	(0.035)	(0.046)	(0.348)
Services Exports	0.035**	0.005	-0.004	-0.007	0.048
	(0.014)	(0.008)	(0.007)	(0.008)	(0.066)
Goods Exports	0.082***	-0.009	0.073***	0.020***	0.269***
	(0.012)	(0.007)	(0.009)	(0.004)	(0.043)
Observations	3,456	3,274	3,404	3,456	3,456
Panel c: service firms	(1)	(2)	(3)	(4)	(5)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure
NSO	0.079*	-0.053	0.117***	0.196***	0.185
	(0.043)	(0.054)	(0.036)	(0.062)	(0.190)
Services Exports	-0.004	0.024***	0.003	-0.023**	-0.006
	(0.008)	(0.009)	(0.007)	(0.011)	(0.032)
Goods Exports	0.022***	-0.007	0.020***	0.009	0.066**
	(0.005)	(0.005)	(0.005)	(0.007)	(0.026)
Observations	3,980	3,648	3,873	3,980	3,980

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 17: IV Estimates, NSO Effect on Employment by Education, Occupation and Task Intensity, Controlling for Goods Imports

Panel a: all firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.153***	-0.038	0.037**	-0.123***	-0.277***	-0.058**	0.029	0.105***	0.063***	0.292***
	(0.043)	(0.024)	(0.018)	(0.038)	(0.060)	(0.027)	(0.024)	(0.027)	(0.023)	(0.063)
Goods Imports	0.097***	0.091***	0.047***	0.107***	0.101***	0.072***	0.040***	0.021***	0.044***	-0.033**
	(0.010)	(0.007)	(0.005)	(0.010)	(0.013)	(0.007)	(0.006)	(0.006)	(0.006)	(0.013)
Observations	7,481	7,481	7,481	7,481	7,481	7,481	7,481	7,481	7,481	7,481
Panel b: manufacturing sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.262**	-0.127**	-0.041*	-0.223***	-0.384***	-0.111***	-0.003	0.073**	0.017	0.133**
	(0.113)	(0.051)	(0.024)	(0.084)	(0.132)	(0.043)	(0.029)	(0.034)	(0.024)	(0.057)
Goods Imports	0.195***	0.189***	0.097***	0.232***	0.181***	0.124***	0.069***	0.044***	0.083***	0.003
	(0.024)	(0.017)	(0.009)	(0.023)	(0.027)	(0.013)	(0.009)	(0.008)	(0.009)	(0.014)
Observations	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458
Panel c: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.061*	0.026	0.093**	-0.098**	-0.172***	-0.028	0.093**	0.107***	0.080**	0.395***
	(0.037)	(0.028)	(0.040)	(0.043)	(0.054)	(0.037)	(0.040)	(0.038)	(0.035)	(0.106)
Goods Imports	0.036***	0.033***	0.018**	0.040***	0.050***	0.040***	0.017**	0.012	0.023***	-0.054**
	(0.007)	(0.006)	(0.007)	(0.008)	(0.012)	(0.008)	(0.008)	(0.008)	(0.007)	(0.021)
Observations	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 18: IV Estimates, The Effect of NSO on Firm Performance Controlling for Goods Imports

Panel a: complete sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	-0.017	-0.008	0.087***	0.155***	0.183	0.609***	-0.165
	(0.023)	(0.027)	(0.023)	(0.038)	(0.167)	(0.190)	(0.115)
Goods Imports	0.0076***	-0.005	0.053***	0.001	0.094***	-0.031	0.299***
	(0.007)	(0.006)	(0.007)	(0.007)	(0.036)	(0.038)	(0.031)
Observations	7,841	6,962	7,324	7,481	7,481	7,481	7,481
Panel b: manufacturing firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	-0.124**	-0.027	0.056*	0.081	0.142	0.502*	0.025
	(0.052)	(0.042)	(0.031)	(0.050)	(0.316)	(0.291)	(0.148)
Goods Imports	0.152***	-0.009	0.119***	0.016*	0.342***	-0.031	0.406***
	(0.015)	(0.014)	(0.016)	(0.009)	(0.070)	(0.066)	(0.054)
Observations	3,458	3,274	3,406	3,458	3,458	3,458	3,458
Panel c: service firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.061*	-0.035	0.110***	0.185***	0.169	0.550**	-0.430*
	(0.036)	(0.049)	(0.034)	(0.058)	(0.185)	(0.229)	(0.229)
Goods Imports	0.029***	0.002	0.024***	-0.008	-0.013	-0.015	0.239***
	(0.007)	(0.007)	(0.007)	(0.011)	(0.039)	(0.044)	(0.046)
Observations	3,984	3,648	3,877	3,984	3,984	3,984	3,984

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 19: IV Estimates, NSO Effect on Employment by Education, Occupation and Task Intensity, Controlling for Import Competition

Panel a: all firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.129***	-0.011	0.050**	-0.102**	-0.267***	-0.048	0.048*	0.117***	0.422	0.298***
	(0.044)	(0.028)	(0.022)	(0.042)	(0.067)	(0.030)	(0.028)	(0.032)	(1.224)	(0.071)
Import Competition	-0.026	-0.043*	-0.014	-0.018	0.031	0.010	-0.045**	-0.043*	-1.360	-0.056
	(0.031)	(0.025)	(0.018)	(0.036)	(0.049)	(0.023)	(0.021)	(0.024)	(4.983)	(0.054)
Observations	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475	7,475
Panel b: manufacturing sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.252**	-0.131**	-0.054*	-0.224**	-0.385***	-0.125**	-0.007	0.073**	0.017	0.139**
	(0.125)	(0.066)	(0.032)	(0.102)	(0.149)	(0.054)	(0.033)	(0.037)	(0.029)	(0.064)
Import Competition	-0.107*	-0.054	0.006	-0.067	-0.059	0.012	-0.006	-0.013	-0.029	-0.022
	(0.058)	(0.043)	(0.021)	(0.062)	(0.077)	(0.035)	(0.019)	(0.023)	(0.019)	(0.043)
Observations	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458	3,458
Panel c: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.029	0.073*	0.119**	-0.100*	-0.151**	-0.003	0.127**	0.136**	0.144***	0.420***
	(0.040)	(0.040)	(0.054)	(0.053)	(0.061)	(0.043)	(0.052)	(0.053)	(0.055)	(0.138)
Import Competition	-0.061*	-0.126***	-0.073	0.047	-0.019	-0.044	-0.134**	-0.100*	-0.210***	-0.144
	(0.033)	(0.034)	(0.045)	(0.049)	(0.062)	(0.043)	(0.054)	(0.055)	(0.052)	(0.144)
Observations	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984	3,984

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 20: IV Estimates, The Effect of NSO on Firm Performance Controlling for Import Competition

Panel a: complete sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.008	-0.009	0.100***	0.158***	0.234	0.590***	-0.146
	(0.027)	(0.026)	(0.027)	(0.040)	(0.194)	(0.208)	(0.127)
Import Competition	-0.035	-0.030	-0.027	-0.018	-0.137	0.024	0.120
	(0.022)	(0.020)	(0.026)	(0.029)	(0.143)	(0.146)	(0.090)
Observations	7,475	6,962	7,318	7,475	7,475	7,475	7,475
Panel b: manufacturing firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	-0.133**	-0.026	0.060	0.078	0.213	0.372	0.007
	(0.054)	(0.043)	(0.037)	(0.051)	(0.352)	(0.306)	(0.170)
Import Competition	-0.034	-0.003	-0.027	0.018	-0.450**	0.599***	-0.094
	(0.037)	(0.016)	(0.037)	(0.017)	(0.223)	(0.212)	(0.136)
Observations	3,456	3,274	3,406	3,458	3,458	3,458	3,458
Panel c: service firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.111*	-0.009	0.102***	0.159***	0.235	0.598***	-0.146
	(0.057)	(0.026)	(0.028)	(0.041)	(0.196)	(0.210)	(0.128)
Import Competition	-0.123**	-0.030	-0.026	-0.018	-0.138	0.022	0.123
	(0.048)	(0.020)	(0.027)	(0.029)	(0.144)	(0.147)	(0.091)
Observations	3,984	6,962	7,324	7,481	7,481	7,481	7,481

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 21: IV Estimates, NSO Effect on Employment by Education, Occupation and Task Intensity Excluding Crisis Period

Panel a: all firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.083***	0.043*	0.086***	-0.086**	-0.196***	0.011	0.094***	0.213***	0.121***	-0.075***
	(0.032)	(0.024)	(0.024)	(0.035)	(0.048)	(0.024)	(0.026)	(0.052)	(0.030)	(0.024)
Observations	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765	4,765
Panel b: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	-0.254**	-0.072	-0.011	-0.179**	-0.365***	-0.092**	0.017	0.213**	0.060*	-0.143***
	(0.103)	(0.051)	(0.026)	(0.087)	(0.132)	(0.045)	(0.030)	(0.087)	(0.033)	(0.053)
Observations	2,221	2,221	2,221	2,221	2,221	2,221	2,221	2,221	2,221	2,221
Panel c: services sector	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Education				**Occupation**			**Task Intensity**	
	Low	Medium	High	Goods Production	Service Production	Medium-skilled professionals	High-skilled professionals	Managers	Non-Routine	Interactive
NSO	0.003	0.101**	0.155**	-0.106**	-0.114**	0.053	0.129***	0.233***	0.136***	-0.015
	(0.030)	(0.043)	(0.067)	(0.046)	(0.045)	(0.036)	(0.045)	(0.083)	(0.045)	(0.027)
Observations	2,516	2,516	2,516	2,516	2,516	2,516	2,516	2,516	2,516	2,516

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.

Table 22: IV Estimates, The Effect of NSO on Firm Performance Excluding Crisis Period

Panel a: complete sample	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.056**	0.024	0.138***	0.129***	0.015	-0.107	-0.025**
	(0.025)	(0.027)	(0.031)	(0.030)	(0.146)	(0.121)	(0.011)
Observations	4,771	4,483	4,705	4,771	4,771	4,771	4,771
Panel b: manufacturing firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	-0.082*	0.054	0.134**	0.067**	-0.155	-0.209	-0.049*
	(0.048)	(0.041)	(0.052)	(0.032)	(0.274)	(0.278)	(0.027)
Observations	2,221	2,127	2,204	2,221	2,221	2,221	2,221
Panel c: service firms	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Employees	Productivity	Turnover	Total value of assets	R&D Expenditure	Services Exports	Goods Exports
NSO	0.073***	-0.051	0.150***	0.144***	0.124	-0.091	-0.019*
	(0.028)	(0.058)	(0.046)	(0.046)	(0.184)	(0.116)	(0.011)
Observations	2,512	2,322	2,465	2,516	2,516	2,516	2,516

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. All regressions include firm fixed effects and industry trends. Firm clustered standard errors in parentheses.