# 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, employment, and firm characteristics to examine changes in workforce composition and performance of Finnish service importers during a period of a significant increase in service 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 sourcing services from abroad. 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, and service exports. These effects are heterogeneous across sectors: while manufacturing firms also reduce employment of medium-skilled workers and experience weaker improvements in performance, firms in the service sector experience additional skill upgrading by increasing the employment of high-skilled professionals. Our results suggest the effects of importing service inputs are pervasive and different from imports of intermediate products: they involve firms in all sectors and workers beyond low-skilled occupations.

**Keywords:** service imports; employment; firm performance.
**JEL Classification:** F10, F14, L80.

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# 1 Introduction

Firms' decisions related to the international location of production have implications for important outcomes such as trade patterns, productivity, and labor demand.[1] The rapid increase in intermediate goods trade has fostered a large and growing literature on manufacturing firms and the employment consequences associated with importing intermediate products (e.g., Feenstra and Hanson, 1996; Hummels et al., 2014, 2016). Less recognized is that global services trade, while starting from a lower level, has experienced a similar six-fold increase over the same period. Yet, we have surprisingly little direct evidence regarding how importing intermediate service inputs influences the employment composition and the performance of firms, particularly outside the manufacturing sector.[2]

The need for empirical evidence on the consequences of importing intermediate service inputs from abroad is driven by two key considerations differentiating services trade from goods trade. First, service intermediate inputs are used more broadly across the economy than many manufactured intermediate inputs. For example, all firms need accounting services, while the same is not necessarily true for intermediate capital goods, machinery, or components. Therefore, it is crucial to extend the analysis beyond the manufacturing sector. Second, services – and tradable business services in particular – are more skill-intensive than other industries. Thus, while the mechanisms of displacement may be similar, traded service intermediates are likely to embody more skill than traded product intermediates, and are therefore likely to affect different workers and occupations. In addition, the skill-intensity of importing firms is likely to vary across sectors. Examining the impact of increasing service imports across different industries fills an important gap in the empirical literature.

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 across the economy adjust their labor force as they increase foreign sourcing of service inputs. In addition, we examine how these changes affect firm performance across a number of dimensions, including total employment, sales, assets, and service exports. 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 im-

[1] See, for example, Hummels et al. (2001); Bernard et al. (2009); Goldberg et al. (2010); Antràs et al. (2017); Bernard et al. (2018a).

[2] Crinò (2010a), and Andersson et al. (2016a,b) examine how importing services is associated with changes in the share of college graduates in manufacturing firms, and Eppinger (2019) studies the relationship between service imports and total employment at a broad range of firms.

ports of almost 5 percentage points of GDP.[3] To put this in context, the "China Shock" analyzed in Autor et al. (2013, 2016) involved an increase of about 2 percentage points of GDP in U.S. merchandise imports from China.[4] To properly identify the impact of service imports on workforce composition and firm performance, 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 import at the firm-level, similar to Hummels et al. (2014).

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, and service exports. Distinguishing between firms in the manufacturing and service sector, we show that increases in service imports have heterogeneous effects across industries. For firms in the services sector, the skill upgrading just described is accompanied 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 employment decreases, and increasing foreign sourcing of service inputs is associated with smaller increases in performance indicators. These results provide new evidence that the effects of service imports extend beyond service industries (i.e., affecting firms and workers also in the manufacturing sector) and beyond low-skilled service activities.

Our ability to examine the impact of firm-level changes in service importing on the composition of a firm's labor force and its performance 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 a surge in service imports. We can link the transformation of the occupational structure of firm employment to changes in performance with a rich set of covariates. A key advantage of our approach

[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.

is that, because our measure of service imports is firm-specific rather than industry-specific, firms outside the service sector that import services can be included in the analysis. This allows us to study firms in all economic sectors and to examine the heterogeneity in the impact of foreign sourcing of services across manufacturing and service industries.

Between 2002 and 2012, service imports tripled in Finland, increasing from 7.4 percent of GDP to 12.3 percent of GDP, i.e., almost 5 percent of GDP.[5] This suggests that Finland presents an interesting empirical setting to study the impact of service imports. We observe significant increases in imports in a number of high-skill business service categories, including computer services; intellectual property rights; services between related companies; legal, advertising and consulting services; and R&D and technical services. While firms that source service inputs from abroad represent only 20% of all firms with more than 5 employees, they are present in both the manufacturing and services sectors and 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, our descriptive statistics 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 decreased employment of low-skilled workers and increased employment of medium-skilled and high-skilled workers. 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.

To properly identify the impact of service imports on workforce composition and firm performance, we need to address the possible endogeneity of our service import measure. In particular, we need an instrument that is correlated with the firm's decision to increase foreign sourcing of service inputs 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

[5]Source: Statistics Finland.

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 imports 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 increase service purchases from abroad, they reduce their production of low-skilled service inputs and increase the number of managers, presumably to oversee the increased international activities.

Differentiating between firms in the manufacturing and service sectors, we find a heterogeneous impact of increased service imports. For firms in the service sector, the changes just described are also associated with an increase in the number of high-skilled professionals. Thus, increasing the sourcing of services from abroad appears to provide 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 also associated with a decrease in medium-skilled professionals workers, such as technicians. Thus, sourcing service inputs from abroad affects demand for more educated workers.

We find that increasing foreign service sourcing does not only affect the occupational composition of firms, but it also fosters firms' growth. Firms in the service sector experience an increase in overall employment, sales, assets and service exports. Firms in the manufacturing sector that increase service imports reduce employment, but increase sales and assets. Therefore, increased service imports are associated with changes in firms' performance that are more pronounced for firms in the service sector than for firms in the manufacturing sector.

We are able to exploit the availability of some of our dependent variables for the years prior to 2002 to investigate whether our results are influenced by long run trends due to omitted factors. We find increases in imports of services in the period 2005-2012 are not correlated with changes in employment and performance during the preceding period, i.e., 1993-2000. Therefore, future shocks cannot predict past changes in outcome variables and our results do not appear to capture long-run trends arising from other

unobserved mechanisms. Furthermore, our results hold under a number of robustness checks: using an alternative measure for service imports, excluding the years during the 2008-2009 crisis, and controlling for firm-specific demand shocks, goods offshoring and import competition.

Our results contribute to the literature in several ways. Most broadly, they relate to the growing literature on importing firms (e.g., Bernard et al., 2007, 2018a; Antràs et al., 2017; Furusawa et al., 2017). In particular, we focus on service imports rather than on goods imports and we show that firms in all sectors are affected both in terms of employment composition and performance. These results highlight that the within-firm channel for changes in factor demands recently emphasized by Amiti and Davis (2012), Mion and Zhu (2013), Hummels et al. (2014), and Bernard et al. (2018b) is important also in the context of services and for firms in all economic sectors.

At the same time, this paper complements empirical research that analyzes whether and how service imports affect employment. An early literature on the impact of services trade on employment used sectoral or aggregate occupational data to investigate the reallocation of employment associated with increases in service trade.[6] A more recent literature makes use of increasingly available firm-level data to investigate within-firm changes in employment composition due to service imports. In particular, Crinò (2010a), and Andersson et al. (2016a,b) study how the share of college graduates is affected by service imports for firms in the manufacturing sector; and Eppinger (2019) uses firms in all economic sectors, but focuses on the effect on total employment only. We complement and extend these previous studies by precisely identifying the skills and detailed occupation of affected workers, by including in the analysis firms in all sectors, and by studying the implications of importing intermediate services for firm-level performance.

This paper also relates to the growing literature on firms that engage in services trade.[7] One particular aspect of this literature is that manufacturing firms also engage in trade in services.[8] We show that firms in both the service and the manufacturing sectors import services and that these firms 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

[6]See, for example, Jensen and Kletzer (2005), Amiti and Wei (2005), Amiti and Wei (2009), Geishecker and Görg (2013), Crinò (2010b), Crinò (2012), and Liu and Trefler (2019).

[7]For example, Breinlich and Criscuolo (2011), Jensen (2011), Kelle (2013), Gaulier et al. (2011), Federico and Tosti (2017), Ariu (2016b), and Walter and Dell'mour (2010).

[8]For example, Kelle (2013); Lodefalk (2013); Crozet and Milet (2017b).

services trade.[9] Our results show that importing intermediate services from abroad is an opportunity for firms in all sectors to reorganize employment and improve 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.

### 2.1.1 Finnish Longitudinal Employer Employee Database

Our main source of information is the register-based Finnish Longitudinal Employer Employee Database from Statistics Finland. 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 9 in Appendix B for the list of detailed occupations included in each of our five macro categories).[10] This level of detail allows us to go beyond the traditional blue/white collar

[9] See, for example, Blanchard et al. (2017); Crozet and Milet (2017a); Breinlich et al. (2018); Ariu et al. (2018, 2019).

[10] 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

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., up to 9 years of education); medium-skilled (upper secondary education, e.g 10-12 years of education) and high-skilled (tertiary education, e.g., more than 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.

### 2.1.3 International Trade in Services Survey

Service trade data are collected since 2002 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, financial 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

the nearest non-missing year observation (either 2000 or 2004).

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 data 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 Sample of Analysis

Starting from the universe of Finnish firms having at least five employees, we keep only those that have imported services for at least two consecutive years.[11] The resulting sample includes more than eight thousand firm-years for which there are positive service imports that we can employ in our econometric analysis. For any of them, 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 of goods (from Custom declarations) and exports of services (International Trade in Services Survey). Finally, we merge industry-year trends for all of the above variables, constructed using all firms in the economy and excluding the firm considered. To provide a meaningful portrait of service importers, the next subsection uses information on all Finnish firms with more than 5 employee during the period 2002-2012.

[11]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.

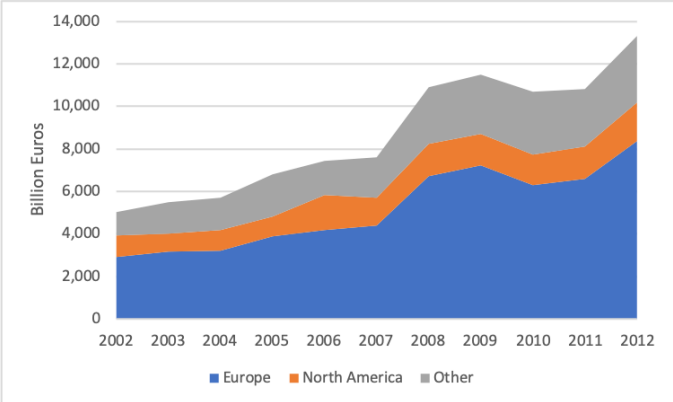
## 2.2 Descriptive Statistics

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

### 2.2.1 Aggregate Trends of Service Imports

Figure 1 shows that during the period from 2002 to 2012 imports of services almost tripled in Finland. This is significant growth with respect to: i) Finnish GDP, which increased of less than 1.5% per year in the same period; ii) Finnish goods imports, which roughly doubled; and iii) service imports of other countries, such as UK or US, which only doubled in the same period. This threefold growth in service imports is also economically 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. Figure 1 shows that Finland imports services primarily from Europe, while North America and other countries only account for roughly one third of all service imports. Interestingly, imports of services from European countries almost tripled during the period 2002-2012, while it nearly doubled for imports originating from North America and other countries. Finland's service import shock came mostly from neighboring and developed countries, in contrast to the surge in imports of manufacturing products of the 'China Shock' (e.g., Autor et al., 2013, 2016; Dauth et al., 2014).

Figure 1: Composition of Service Imports Growth




**Note:** This figure depicts the growth of Finnish service imports during the period 2002-2012 distinguishing by origin country (Europe, North America and other countries). Data source: International Trade in Services Survey.

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 the

Table 1: 2002-2012 Imports 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% |

**Note:** The table shows the growth of service imports by service type for the years 2002-2012. Data Source: International Trade in Services Survey, Statistics Finland.

imports. In terms of evolution over time, most services categories grew substantially, with exceptional growth in "Computer Services" which almost quadrupled between 2002 and 2012. These figures indicate that service imports experienced dramatic growth during our period of analysis that represents a potentially important shock for the domestic economy.

Table 2: Share of Workers Classified as High-Skill by Sector, 2002, 2012

| **Manufacturing** | | | **Services** | | |
|---|---|---|---|---|---|
| Sector | 2002 | 2012 | Sector | 2002 | 2012 |
| Mining and Quarrying | 0.18 | 0.33 | Recycling | 0.21 | 0.27 |
| Food Beverages and Tobacco | 0.18 | 0.26 | Construction | 0.18 | 0.21 |
| Textiles | 0.16 | 0.26 | Sales of Vehicles | 0.25 | 0.28 |
| Wood, Pulp and Paper | 0.21 | 0.29 | Wholesale and Retail | 0.43 | 0.46 |
| Publishing, Printing | 0.31 | 0.41 | Post and Telecommunications | 0.36 | 0.41 |
| Chemical | 0.28 | 0.36 | Financial | 0.69 | 0.75 |
| Metals | 0.18 | 0.24 | Computer | 0.57 | 0.69 |
| Machinery | 0.28 | 0.37 | R&D | 0.77 | 0.80 |
| Other Machinery | 0.34 | 0.45 | Business | 0.57 | 0.57 |
| Communication Equipment | 0.33 | 0.53 | Education | 0.53 | 0.57 |
| Vehicles | 0.17 | 0.25 | Other Services | 0.37 | 0.38 |
| Furniture | 0.18 | 0.24 | | | |

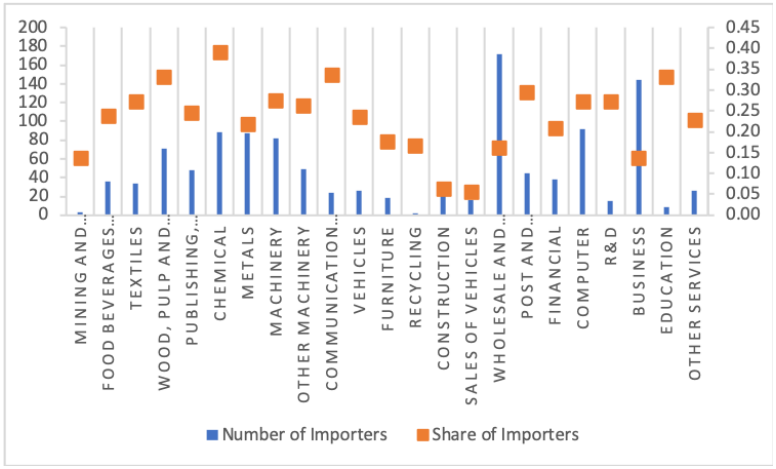
**Note:** The table shows average share of workers in a firm classified as high-skill by sector for 2002 and 2012. Data Source: Data Sources: FLEED and Finnish Annual Accounts Panel, Statistics Finland.

### 2.2.2 Service Imports Participation

To understand how many firms are involved in service imports, we plot in Figure 2 the number (left scale) and the share of firms (right scale) that report positive service imports by industry. On average, 20% of firms with more than 5 employees sources intermediate services from abroad and these firms are spread in all economic sectors of the economy, i.e., both in services and manufacturing industries. This highlights the fact that services are intermediates for the production of final output in all sectors and

that the effect of importing services could potentially be heterogeneous across them. For this reason, in our analysis, we provide results differentiating firms belonging to the manufacturing and service sector. "Business Services" and "Wholesale and Retail" account for most of importing firms, followed by the "Computers" and "Chemical" sectors. Importantly, in every sector importers represent a non-negligible share of firms. For example, they represent 40% of the companies in the "Chemical" industry and 35% in the "Communication" industry. These figures highlight that firms across a broad range of sectors import services.

Figure 2: Service Import Participation by Industry




**Note:** This graph shows the number (left scale) and share (right scale) of service importers among all firms with more than five employees by sector. Data sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

### 2.2.3 Service Importing Firms Characteristics

Service importing 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 and their 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 service importing firms are bigger than firms that do not import services and they are becoming more important in aggregate over time. To quantify these differences, we compare service importing and non-importing 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 3. Services' importers 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 service imports.

Table 3: Services Importers and Non-Importers Characteristics

| | **Service Importers** | | **Non-Importers** | |
|---|---|---|---|---|
| | Obs. | Mean | Obs. | Mean |
| Employees (ln) | 13,762 | 4.46 | 51,261 | 3.03 |
| VA per empl. (ln) | 12,877 | 11.13 | 48,373 | 10.89 |
| Turnover (ln) | 13,534 | 16.86 | 51,002 | 15.07 |
| Capital per empl. (ln) | 13,608 | 10.39 | 49,412 | 9.77 |
| Average wage bill (ln) | 13,594 | 10.62 | 50,046 | 10.42 |

**Note:** This table presents the average log number of employees, productivity (measured as value added per worker), turnover, capital per employee and average wage for firms that import services and firms that do not. Each observation represents a firm-year. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

### 2.2.4 Employment Changes for Importing Firms

To analyze the evolution of employment composition for firms that import, we decompose the changes in the number of workers by educational category and sector between 2002 and 2012 in Panel a of Table 4. We find that the aggregate number of low-skilled employed in importing firms decreased while the number of high-skilled increased. For the manufacturing sector, the number of medium-skilled also decreased. These results suggest that service importing 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.

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 4. 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, because firms in many industries import services, service imports can have potential negative effects on employment not only in service industries but also in the manufacturing sector. Second, service imports might differentially affect firms depending on the industry of affiliation. Therefore, it could potentially represent different strategies depending on whether the firm produces primarily goods or services. In the next section, we examine more systematically the relationship between the increase in service imports and the changing employment

Table 4: 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 |

**Note:** This table shows in 2002 and 2012 the number of workers employed in firms that import services for the manufacturing and services sectors by education (Panel a) and occupation (Panel b) category. Data Sources: FLEED and International Trade in Services Survey.

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 imports. 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:

$$Y_{it} = \alpha_0 + \alpha_1 IMP_{it}^S + \gamma X_{jt} + \mu_i + \epsilon_{it}$$

where $Y_{it}$ is defined as the (log) level of employment in the educational and occupational category of workers for firm $i$ at time $t$ or one of our performance variables. $IMP_{it}^S$ is our main variable of interest, i.e., the (log) measure of service imports 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. Finally, $\mu_i$ is a firm fixed effect and $\epsilon_{it}$ is our error term. Identification comes from the within-firm over-time variation in the $IMP_{it}^S$ measure of service imports. More specifically, we can test whether changes in the exposure of the firm to service imports are related to changes in employment by occupational and educational category, and to changes in firms' performance.

One important element to take into account for a proper identification is the possible

endogeneity of our service import measure, $IMP^S_{it}$. To correct for this issue, we need an instrument that is correlated with the firm's decision to import 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:

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

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. $IMP^S_{isct^*}$ captures the imports of services of firm $i$, of service $s$ from country $c$ in the initial year in which the firm is observed importing services, $t^*$. $IMP^S_{it^*}$ represents the total imports of 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 firms' 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,[12] 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 imports that can potentially affect the estimates.

There are three main threats that could affect our instrument: unobserved demand

[12]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 level and half a 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.

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 firms in the same sector are controlled for by means of industry trends.[13] 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 imports. 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 importing 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.

## 3.2 Employment Composition

Our first objective is to understand whether importing services is associated with a change in the composition of employment within firms. Table 5 reports the results distinguishing employment by education and occupation.[14] Consistent with our stylized facts, we observe in Panel a that service imports are related to 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 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 an increase in service imports. 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

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

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

Table 5: The Effect of Service Imports 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 | Med.-skilled professionals | High-skilled professionals | Managers | Non-Routine | Interactive |
| $IMP_{it}^{S}$ | -0.306$^{a}$ | -0.037 | 0.177$^{a}$ | -0.312$^{a}$ | -0.316$^{a}$ | -0.088 | 0.177$^{a}$ | 0.331$^{a}$ | 0.269$^{a}$ | 0.810$^{a}$ |
| | (0.082) | (0.064) | (0.050) | (0.100) | (0.100) | (0.073) | (0.068) | (0.071) | (0.066) | (0.138) |
| Observations | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald Stat. | 42.51 | 45.18 | 43.77 | 45.7 | 36.16 | 45.14 | 45.61 | 47.5 | 45.01 | 45.13 |

**Panel b: Firms in Manufacturing Sectors**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Education** | | | **Occupation** | | | | | **Task Intensity** | |
| | Low | Medium | High | Goods Production | Service Production | Med.-skilled professionals | High-skilled professionals | Managers | Non-Routine | Interactive |
| $IMP_{it}^{S}$ | -0.626$^{a}$ | -0.345$^{a}$ | -0.062 | -0.634$^{a}$ | -0.376$^{c}$ | -0.287$^{a}$ | 0.035 | 0.183$^{b}$ | 0.119$^{c}$ | 0.510$^{a}$ |
| | (0.180) | (0.120) | (0.066) | (0.181) | (0.221) | (0.111) | (0.082) | (0.081) | (0.071) | (0.150) |
| Observations | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald Stat. | 18.69 | 25.31 | 24.94 | 25.69 | 13.17 | 24.49 | 23.79 | 29.4 | 26.29 | 25.48 |

**Panel c: Firms in Services Sectors**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Education** | | | **Occupation** | | | | | **Task Intensity** | |
| | Low | Medium | High | Goods Production | Service Production | Med.-skilled professionals | High-skilled professionals | Managers | Non-Routine | Interactive |
| $IMP_{it}^{S}$ | -0.126 | 0.121 | 0.319$^{a}$ | -0.306$^{b}$ | -0.249$^{b}$ | -0.002 | 0.406$^{a}$ | 0.403$^{a}$ | 0.322$^{a}$ | 1.115$^{a}$ |
| | (0.080) | (0.082) | (0.104) | (0.126) | (0.109) | (0.104) | (0.141) | (0.120) | (0.111) | (0.268) |
| Observations | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald Stat. | 17.14 | 15.4 0 | 14.08 | 18.52 | 18.11 | 19.53 | 17.28 | 19.39 | 17.86 | 18.78 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

both. The fact that service imports actually affect 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.

Separating the sample into firms that pertain to the manufacturing sectors (Panel b) and those belonging to services sectors (Panel c), we observe that for manufacturing firms importing services has negative effects on low- and medium-skilled employment. Therefore, also workers with an intermediate education, such as technicians, are negatively affected by the relocation of service activities abroad. This is a new result with respect to previous studies, where the negative effect of importing services are accounted solely by low-skilled workers. 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 service imports is not statistically significant.

These results highlight that for both industries, importing services changes the skill

composition of employment in favor of high-skilled workers. The augmented need for international coordination due to the increased service imports might lead firms to increase the number of managers. For service firms however, the increase in the number 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. The decrease in low-skilled jobs observed in the manufacturing sector includes basic service activities such as transportation, cleaning, customer assistance and basic back office; and, for the first time, we also observe that it is also accompanied by a decrease in the number of medium-educated workers such as technicians.[15] Therefore, while for manufacturing firms importing services 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 5 that the number of workers performing non-routine and interactive tasks increases following increases in service imports. By splitting the results for the manufacturing (Panel b) and services (Panel c) industries, we find that for firms in both sectors service imports are associated with an increase in the use of interactive tasks. This is in line with the increased international dimension of services' sourcing that could require a more intensive coordination effort, especially provided by the increased employment of managers. At the same time, increasing imports of services 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 importing services can represent a strategy for firms to refocus on high-skilled and R&D related activities.

## 3.3 Firms' Performance

A key question in the analysis of the consequences of increasing service imports is whether the changes in the composition of employment are associated with changes

[15]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.

in 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 6 indicate that on average there is no effect on the number of employees, productivity (value added per worker) and R&D expenditure.[16] 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 6 presents the results for firms in the services sector. We observe here that the skill upgrading due to increase in service imports translates into a slightly larger 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 foreign service sourcing); iii) higher performance in the form of higher sales, assets and service exports. Therefore, for firms which are in the growing services sector, imports of services appear to offer firms an opportunity to improve their performance by refocusing employment on R&D related activities. Panel b of Table 6 shows that service imports induces firms in the manufacturing sector to decrease the number of employees but to grow in terms of sales and assets. These results support the idea that for manufacturing firms, importing services is a cost minimizing strategy that allows the firms to get rid of marginal service activities. Therefore, it could be seen as a possible way to increase performance in an environment which involves a high level of competition. 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 stay competitive (e.g., Bloom et al., 2016; Breinlich et al., 2018).

# 4 Robustness Checks

Our instrumental strategy allows us to infer causality on the effect of importing services and mitigates a number of the most important econometric challenges. However, there are several other potential issues that could affect our results that we discuss in this

[16] Please note that the first stage of the 2SLS is available in Table 11 in Appendix C.

Table 6: The Effect of Service Imports on Firms' Performance

| **Panel a: Complete Sample** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total Value of Assets | (5) R&D Expenditure | (6) Services Exports |
|---|---|---|---|---|---|---|
| $IMP_{it}^{S}$ | 0.064 | 0.092 | 0.306[a] | 0.505[a] | 0.197 | 1.474[a] |
| | (0.058) | (0.072) | (0.060) | (0.097) | (0.439) | (0.447) |
| Observations | 7,514 | 6,974 | 7,349 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald Stat. | 43.36 | 24.8 | 41.34 | 29.53 | 43.56 | 42.85 |
| **Panel b: Manufacturing Firms** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total Value of Assets | (5) R&D Expenditure | (6) Services Exports |
| $IMP_{it}^{S}$ | -0.269[a] | 0.063 | 0.200[b] | 0.341[b] | -0.343 | 1.122 |
| | (0.104) | (0.082) | (0.080) | (0.152) | (0.790) | (0.743) |
| Observations | 3,491 | 3,306 | 3,440 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald Stat. | 22.59 | 13.45 | 18.84 | 7.672 | 23.83 | 23.9 |
| **Panel c: Service Firms** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total Value of Assets | (5) R&D Expenditure | (6) Services Exports |
| $IMP_{it}^{S}$ | 0.255[a] | 0.086 | 0.387[a] | 0.596[a] | 0.239 | 1.567[a] |
| | (0.098) | (0.153) | (0.097) | (0.157) | (0.564) | (0.599) |
| Observations | 3,984 | 3,628 | 3,868 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald Stat. | 14.77 | 6.20 | 18.78 | 14.29 | 19.03 | 18.45 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, [c] $p < 0.1$, [b] $p < 0.05$, [a] $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

section.

## 4.1 Falsification Test

A possible concern for our analysis is that increased service imports could be a consequence of the decline in the number of certain categories of workers and the rise of others. This could be driven, for example, by an unobserved common factor that increases service imports and decreases the number of certain categories of workers. To test for this issue, we regress past employment levels and performance indicators of the firm (1993-2000) on future firm-level imports of services (2005-2012).[17] Following the idea of Autor et al. (2016), this falsification test is be able to assess whether future changes in service imports explain past changes in employment and performance of the firm. If so, this would mean that our main variable of interest is capturing long run trends rather than identifying the effect of importing services per se.

[17]These are the two time periods for which we have the maximum number of observations.

Table 7: Falsification Test

| | **Education 1993-2000** | | | **Performance 1993-2000** | | | |
|---|---|---|---|---|---|---|---|
| | Low | Medium | High | Employees | Productivity | Turnover | Assets |
| $IMP^{S}_{it,2005-2012}$ | -0.429 | -0.092 | 0.782 | 0.492 | -0.465 | -0.756 | -4.311 |
| | (1.010) | (0.876) | (1.109) | (1.960) | (1.416) | (2.976) | (11.777) |
| Observations | 3,441 | 3,443 | 3,443 | 3,155 | 3,009 | 3,150 | 3,165 |

**Note:** All regressions include firm fixed effects. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: FLEED, Finnish Annual Accounts Panel and International Trade in Services Survey.

This exercise is possible thanks to the fact that Finland started collecting some of our outcome variables starting in 1993. For this past period, we are able to distinguish workers by level of education, though not by by occupation. With respect to the performance variables, we are able to retrieve for the same period total employment, productivity, turnover and the assets of the firm. One caveat of this robustness check is that it is possible to carry it out only for those firms that are actually active in both the 1993-2000 and the 2005-2012 periods. However, as it is possible to see by the number of observations in Table 7, we can track the bulk of firms in our analysis. Results show that future values of service imports do not explain past levels of employment by skill level and past performance indicators of the firm. Therefore, our measure of service imports at the firm-level does not capture long-run trends in employment and performance of the firm due to unobserved factors.

## 4.2 Clustered Standard Errors

As highlighted by Bertrand et al. (2004), using many years of data for the same firm might mean that outcomes can be serially correlated and thus standard errors might be inconsistent. In our case, this means that there is persistence in the employment and performance over time for the same firm. So, errors can be correlated within all the years in which the firm is importing services. To solve the issue it is sufficient to correct standard errors by clustering them on the firm dimension. Tables 12 and 13 in Appendix C show that taking into account this issue increases significantly the standard errors, however, the significances remain above standard accepted levels.

## 4.3 Different Measures of Service Imports

Our main results focus on the impact of all service imports on firms' workforce composition and performance. As a robustness check, we reproduce our analysis using a subset of service imports that focuses on services most likely to replace domestic labor. 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 different measure of services that are potentially related to the reduction of domestic employment that we call narrow service imports ($\text{NSI}_{it}$).

We define service categories that accounted for more than one percent of total sales in the firm's 2-digit industry for the initial 2002-2003 period as narrow service imports categories since they are likely to be produced internally by firms. We then aggregate firm imports of these NSI categories to obtain a firm-level measure of narrow service imports. Purchases of R&D services and services between related enterprises might not satisfy this criteria, but could still involve the relocation of labor abroad since many manufacturing firms carry out these activities without selling them to other firms. We define services between related enterprises as a narrow service imports 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 8 in appendix A. Regression results in Tables 14 and 15 in Appendix C show that using this alternative measure of service imports does not change our findings. Coefficients and significances are very similar for employment (Table 14). With respect to performance (Table 15), the only noticeable difference is that for the manufacturing sector we do not observe anymore an increase in firms' growth following an increase in service imports.

A second issue related to our measure of service imports is that it includes also services between related enterprises. Besides representing an important channel of employment relocation abroad, 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 service imports could potentially be contaminated by profit shifting motives. When removing this category in our services' import measure, we actually find very similar results (Tables 16 and 17 in Appendix C). Therefore, our results do not appear to be driven by the opportunity of firms to engage in profit shifting.

## 4.4 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 period in which the firm imports services, 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 service import decision. Tables 18 and 19 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.

## 4.5 Goods Imports

Firms might simultaneously engage in both goods and service imports. 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 in the relocation of manufacturing activities abroad. Tables 20 and 21 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.[18]

## 4.6 Import Competition

Even if we are controlling for industry-year trends, our measure of firm-level of service imports could potentially embed import competition effects (as opposed to those related to the relocation of domestic activities abroad). More specifically, import competition and offshoring service activities can have different consequences for the employment and performance of firms (e.g., Bernard et al., 2018b; Hummels et al., 2016; Mion and

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

Zhu, 2013), thus potentially confounding our results. 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 22 and 23 in Appendix C show that our results are not affected by this potential threat.

### 4.7 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 service import strategies could potentially be affected by the crisis. To remove this remaining doubt, we exclude the years after 2007 from the analysis. Tables 24 and 25 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, worker characteristics, and firm-level measures from Finland, this paper investigates the implications of importing services on employment composition and firm performance. We find that importing services is a widespread phenomenon across firms in all sectors that leads to skill upgrading of the workforce and an improvement in performance. For firms in the service sector, the performance improvements are more pronounced and the employment changes also include an increase in high-skilled professionals (e.g., engineers, computer programmers, scientists), suggesting these firms could be upgrading skills and focusing more on R&D related activities. Manufacturing firms reduce the number of medium-skilled professionals and experience smaller improvements in performance indicators than firms in the service sector. Therefore, importing services involves firms across sectors and affects workers beyond low-skilled activities.

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 ability for firms to source inputs at the lowest cost is potentially important to firm competitiveness.

Therefore, any public policy responses to the challenges faced by workers as a result of service imports need to recognize these benefits.

# References


Amiti, M. and Davis, D. R. (2012). Trade, Firms, and Wages: Theory and Evidence. *Review of Economic Studies*, 79(1):1–36.

Amiti, M., Itskhoki, O., and Konings, J. (2014). Importers, Exporters, and Exchange Rate Disconnect. *American Economic Review*, 104(7):1942–78.

Amiti, M. and Wei, S.-J. (2005). Fear of Service Outsourcing: Is It Justified? *Economic Policy*, 20(42):308–347.

Amiti, M. and Wei, S.-J. (2009). Service Offshoring and Productivity: Evidence from the US. *The World Economy*, 32(2):203–220.

Andersson, L., Karpaty, P., and Savsin, S. (2016a). Firm-level effects of offshoring of materials and services on relative labor demand. *Review of World Economics (Weltwirtschaftliches Archiv)*, 152(2):321–350.

Andersson, L., Karpaty, P., and Savsin, S. (2016b). Labour Demand, Offshoring and Inshoring: Evidence from Swedish Firm-level Data. *The World Economy*, 40(2):240–274.

Antràs, P., Fort, T. C., and Tintelnot, F. (2017). The Margins of Global Sourcing: Theory and Evidence from US Firms. *American Economic Review*, 107(9):2514–2564.

Ariu, A. (2016a). Crisis-Proof Services: Why Trade in Services Did Not Suffer During the 2008-2009 Collapse. *Journal of International Economics*, 98(C):138–149.

Ariu, A. (2016b). Services Versus Goods Trade: A Firm-Level Comparison. *Review of World Economics (Weltwirtschaftliches Archiv)*, 152(1):19–41.

Ariu, A., Breinlich, H., Corcos, G., and Mion, G. (2019). The Interconnections Between Services and Goods Trade at the Firm-Level. *Journal of International Economics*, 116:173–188.

Ariu, A., Mayneris, F., and Parenti, M. (2018). One Way to the Top: How Services Boost the Demand for Goods. CEPR Discussion Papers 12918, C.E.P.R. Discussion Papers.

Autor, D. H., Dorn, D., and Hanson, G. H. (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review*, 103(6):2121–68.

Autor, D. H., Dorn, D., and Hanson, G. H. (2016). The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade. *Annual Review of Economics*, 8:205–240.

Becker, S. O., Ekholm, K., and Muendler, M.-A. (2013). Offshoring and the Onshore Composition of Tasks and Skills. *Journal of International Economics*, 90(1):91–106.

Behrens, K., Corcos, G., and Mion, G. (2011). Trade Crisis? What Trade Crisis? *The Review of Economics and Statistics*, 95:702–209.

Bernard, A., Jensen, J. B., Redding, S., and Schott, P. (2018a). Global Firms. *Journal of Economic Literature*, 56(2):565–619.

Bernard, A. B., Fort, T. C., Smeets, V., and Warzynski, F. (2018b). Heterogeneous Globalization: Offshoring and Reorganization. Technical report, Mimeo.

Bernard, A. B., Jensen, J. B., Redding, S. J., and Schott, P. K. (2007). Firms in International Trade. *Journal of Economic Perspectives*, 21(3):105–130.

Bernard, A. B., Jensen, J. B., Redding, S. J., and Schott, P. K. (2009). The Margins of US Trade. *American Economic Review*, 99(2):487–493.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How Much Should We Trust Differences-In-Differences Estimates? *The Quarterly Journal of Economics*, 119(1):249–275.

Blanchard, P., Fuss, C., and Mathieu, C. (2017). Why do Manufacturing Firms Produce Services? Evidence for the Servitization Paradox in Belgium. NBB Discussion Papers 330, National Bank of Belgium.

Bloom, N., Draca, M., and Reenen, J. V. (2016). Trade Induced Technical Change? The Impact of Chinese Imports on Innovation, IT and Productivity. *Review of Economic Studies*, 83(1):87–117.

Breinlich, H. and Criscuolo, C. (2011). International Trade in Services: A Portrait of Importers and Exporters. *Journal of International Economics*, 84(2):188–206.

Breinlich, H., Soderbery, A., and Wright, G. C. (2018). From Selling Goods to Selling Services: Firm Responses to Trade Liberalization. *American Economic Journal: Economic Policy*, 10(4):79–108.

Crinò, R. (2010a). Employment effects of service offshoring: Evidence from matched firms. *Economics Letters*, 107(2):253–256.

Crinò, R. (2010b). Service Offshoring and White-Collar Employment. *Review of Economic Studies*, 77(2):595–632.

Crinò, R. (2012). Service Offshoring and the Skill Composition of Labour Demand. *Oxford Bulletin of Economics and Statistics*, 74(1):20–57.

Crozet, M. and Milet, E. (2017a). Should Everybody be in Services? The Effect of Servitization on Manufacturing Firm Performance. *Journal of Economics and Management Strategy*, 26(4):820–841.

Crozet, M. and Milet, E. (2017b). The Servitization of French Manufacturing Firms. In Fontagné, L. and Harisson, A., editors, *The Factory-Free Economy: Outsourcing, Servitzation, and the Future of Industry*. Oxford University Press.

Dauth, W., Findeisen, S., and Suedekum, J. (2014). The Rise of the East and the Far East: German Labor Markets and Trade Integration. *Journal of the European Economic Association*, 12(6):1643–1675.

Eaton, J., Kortum, S., and Kramarz, F. (2011). An Anatomy of International Trade: Evidence From French Firms. *Econometrica*, 79(5):1453–1498.

Eppinger, P. S. (2019). Service Offshoring and Firm Employment. *Journal of International Economics*, 117:209–228.

Federico, S. and Tosti, E. (2017). Exporters and Importers of Services: Firm-Level Evidence on Italy. *The World Economy*, 40(10):2078–2096.

Feenstra, R. C. and Hanson, G. H. (1996). Globalization, Outsourcing, and Wage Inequality. *The American Economic Review*, 86(2):240–245.

Furusawa, T., Inui, T., Ito, K., and Tang, H. (2017). Global Sourcing and Domestic Production Networks. Technical report.

Gaulier, G., Mirza, D., and Milet, E. (2011). French Firms in International Trade in Services. *Economie et Statistique*, (435-436):125–147.

Geishecker, I. and Görg, H. (2013). Services offshoring and wages: evidence from micro data. *Oxford Economic Papers*, 65(1):124–146.

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N., and Topalova, P. (2010). Imported Intermediate Inputs and Domestic Product Growth: Evidence from India. *The Quarterly Journal of Economics*, 125(4):1727–1767.

Hummels, D., Ishii, J., and Yi, K.-M. (2001). The Nature and Growth of Vertical Specialization in World Trade. *Journal of International Economics*, 54(1):75–96.

Hummels, D., Jörgensen, R., Munch, J., and Xiang, C. (2014). The Wage Effects of Offshoring: Evidence from Danish Matched Worker-Firm Data. *American Economic Review*, 104(6):1597–1629.

Hummels, D., Munch, J. R., and Xiang, C. (2016). Offshoring and Labor Markets. NBER Working Papers 22041, National Bureau of Economic Research, Inc.

Jensen, J. B. (2011). *Global Trade in Services: Fear, Facts, and Offshoring*. Peterson Institute for International Economics.

Jensen, J. B. and Kletzer, L. G. (2005). Tradable Services: Understanding the Scope and Impact of Services Outsourcing. Working Paper Series WP05-9, Peterson Institute for International Economics.

Kelle, M. (2013). Crossing Industry Borders: German Manufacturers as Services Exporters. *The World Economy*, 36(12):1494–1515.

Liu, R. and Trefler, D. (2019). A Sorted Tale of Globalization: White Collar Jobs and the rise of Service Offshoring. *Journal of International Economics*, 118:105–122.

Lodefalk, M. (2013). Servicification of manufacturing - evidence from Sweden. *International Journal of Economics and Business Research*, 6(1):87–113.

Mayer, T., Melitz, M. J., and Ottaviano, G. I. (2014). Market Size, Competition, and the Product Mix of Exporters. *American Economic Review*, 104(2):495–536.

Mion, G. and Zhu, L. (2013). Import Competition from and Offshoring to China: A Curse or Blessing for Firms? *Journal of International Economics*, 89(1):202–215.

Nilsson Hakkala, K. and Huttunen, K. (2016). Worker-Level Consequences of Import Shocks. IZA Discussion Papers 10033, Institute for the Study of Labor (IZA).

Walter, P. and Dell'mour, R. (2010). Firm-Level Analysis of International Trade in Services. *IFC Working Papers No.4*.

# A Appendix: NSI Definition

Table 8: NSI Definition by Industry

| Nace 2-digit | Industry Name | NSI 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 | Vehicles | 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 |

**Note:** 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 9: 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 10: First Stage Number of Employees

| Dep. Var | (1) $IMP_{it}^S$ | (2) $IMP_{it}^S$ | (3) $IMP_{it}^S$ | (4) $IMP_{it}^S$ | (5) $IMP_{it}^S$ | (6) $IMP_{it}^S$ | (7) $IMP_{it}^S$ | (8) $IMP_{it}^S$ | (9) $IMP_{it}^S$ | (10) $IMP_{it}^S$ |
|---|---|---|---|---|---|---|---|---|---|---|
| $WES_{it}$ | $0.108^a$ | $0.110^a$ | $0.109^a$ | $0.111^a$ | $0.099^a$ | $0.110^a$ | $0.110^a$ | $0.116^a$ | $0.110^a$ | $0.110^a$ |
| | (0.017) | (0.016) | (0.017) | (0.016) | (0.017) | (0.016) | (0.016) | (0.017) | (0.016) | (0.016) |
| Observations | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 |
| $R^2$ | 0.799 | 0.799 | 0.799 | 0.799 | 0.799 | 0.799 | 0.799 | 0.799 | 0.799 | 0.799 |
| Kleibergen-Paap Wald stat | 42.51 | 45.18 | 43.77 | 45.7 | 36.16 | 45.14 | 45.61 | 47.5 | 45.01 | 45.13 |
| Industry Trends: | Low Skilled | Medium Skilled | High Skilled | Goods Production | Service Production | Medium-skilled professionals | High-skilled professionals | Managers | Non-Routine | Interactive |

**Note:** This table shows the first stage of our 2SLS strategy in which we regress the log imports of the firm on the instrument together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^c$ $p < 0.1$, $^b$ $p < 0.05$, $^a$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 11: First Stage Performance

| Dep. Var | (1) $IMP_{it}^S$ | (2) $IMP_{it}^S$ | (3) $IMP_{it}^S$ | (4) $IMP_{it}^S$ | (5) $IMP_{it}^S$ | (6) $IMP_{it}^S$ |
|---|---|---|---|---|---|---|
| $WES_{it}$ | $0.109^a$ | $0.078^a$ | $0.101^a$ | $0.089^a$ | $0.108^a$ | $0.106^a$ |
| | (0.065) | (0.067) | (0.066) | (0.067) | (0.065) | (0.065) |
| Observations | 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 |
| Kleibergen-Paap Wald stat | 14.77 | 6.20 | 18.78 | 14.29 | 19.03 | 18.45 |
| Industry Trends: | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |

**Note:** This table shows the first stage of our 2SLS strategy in which we regress the the log imports of the firm on the instrument together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^c$ $p < 0.1$, $^b$ $p < 0.05$, $^a$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 12: Service Imports Effect on Employment by Education, Occupation and Task Intensity: Standard Errors Clustered at the Firm-Level

| **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 |
| $IMP_{it}^{S}$ | -0.306$^{a}$ | -0.037 | 0.177$^{b}$ | -0.312$^{b}$ | -0.316$^{b}$ | -0.088 | 0.177$^{b}$ | 0.331$^{a}$ | 0.269$^{a}$ | 0.810$^{a}$ |
| | (0.082) | (0.064) | (0.050) | (0.100) | (0.100) | (0.073) | (0.068) | (0.071) | (0.066) | (0.138) |
| Observations | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 21.86 | 23.19 | 22.43 | 23.49 | 18.96 | 23.26 | 23.5 | 24.53 | 23.22 | 23.32 |
| **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 |
| $IMP_{it}^{S}$ | -0.626$^{b}$ | -0.345$^{c}$ | -0.062 | -0.634$^{b}$ | -0.376 | -0.287$^{c}$ | 0.035 | 0.183$^{c}$ | 0.119 | 0.510$^{a}$ |
| | (0.180) | (0.120) | (0.066) | (0.181) | (0.221) | (0.111) | (0.082) | (0.081) | (0.071) | (0.150) |
| Observations | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 10.67 | 14.4 | 14.25 | 14.61 | 7.79 | 13.98 | 13.91 | 17.30 | 15.18 | 14.71 |
| **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 |
| $IMP_{it}^{S}$ | -0.126 | 0.121 | 0.319$^{c}$ | -0.306$^{c}$ | -0.249$^{c}$ | -0.002 | 0.406$^{a}$ | 0.403$^{b}$ | 0.322$^{b}$ | 1.115$^{a}$ |
| | (0.080) | (0.082) | (0.104) | (0.126) | (0.109) | (0.104) | (0.141) | (0.120) | (0.111) | (0.268) |
| Observations | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 9.27 | 8.28 | 7.62 | 9.96 | 9.83 | 10.59 | 9.35 | 10.27 | 9.75 | 10.11 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Standard errors clustered at the firm-level in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 13: Service Imports Effect on Firm Performance: Standard Errors Clustered at the Firm-Level

| **Panel a: Complete Sample** | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | 0.064 | 0.092 | 0.306$^{a}$ | 0.505$^{a}$ | 0.197 | 1.474$^{b}$ |
| | (0.087) | (0.086) | (0.079) | (0.122) | (0.587) | (0.604) |
| Observations | 7,514 | 6,974 | 7,349 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 22.23 | 13.25 | 21.67 | 16.24 | 22.57 | 22.23 |
| **Panel b: Manufacturing Firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | -0.269$^{c}$ | 0.063 | 0.200$^{c}$ | 0.341$^{c}$ | -0.343 | 1.122 |
| | (0.149) | (0.085) | (0.105) | (0.197) | (1.008) | (0.986) |
| Observations | 3,491 | 3,306 | 3,440 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 12.76 | 8.188 | 11.88 | 4.89 | 13.68 | 13.94 |
| **Panel c: Service Firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | 0.255 | 0.086 | 0.387$^{a}$ | 0.596$^{a}$ | 0.239 | 1.567$^{b}$ |
| | (0.159) | (0.178) | (0.125) | (0.189) | (0.732) | (0.781) |
| Observations | 3,984 | 3,628 | 3,868 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 8.06 | 3.611 | 10.05 | 8.265 | 10.39 | 10.02 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Standard errors clustered at the firm-level in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 14: Narrow Service Imports 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 |
| $NSI_{it}$ | -0.136$^{a}$ | -0.022 | 0.046$^{b}$ | -0.106$^{a}$ | -0.258$^{a}$ | -0.045$^{c}$ | 0.036 | 0.106$^{a}$ | 0.072$^{a}$ | 0.284$^{a}$ |
| | (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 |
| Kleibergen-Paap Wald stat | 21.28 | 25.07 | 24.55 | 26.31 | 24.92 | 26.45 | 26.92 | 28.44 | 26.54 | 26.50 |
| **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 |
| $NSI_{it}$ | -0.279$^{b}$ | -0.143$^{b}$ | -0.051$^{c}$ | -0.245$^{b}$ | -0.399$^{a}$ | -0.121$^{b}$ | -0.007 | 0.072$^{b}$ | 0.012 | 0.132$^{b}$ |
| | (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 |
| Kleibergen-Paap Wald stat | 6.038 | 9.653 | 10.71 | 8.728 | 8.351 | 10.64 | 9.972 | 11.63 | 10.66 | 10.46 |
| **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 |
| $NSI_{it}$ | -0.052 | 0.037 | 0.098$^{b}$ | -0.087$^{b}$ | -0.155$^{a}$ | -0.015 | 0.098$^{b}$ | 0.108$^{a}$ | 0.088$^{b}$ | 0.376$^{a}$ |
| | (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 |
| Kleibergen-Paap Wald stat | 9.580 | 9.896 | 8.482 | 15.17 | 15.07 | 14.43 | 14.19 | 15.63 | 13.13 | 15.65 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 15: Narrow Service Imports Effect on Firm Performance

| **Panel a: Complete Sample** | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |
| $NSI_{it}$ | -0.003 | -0.009 | 0.095$^{a}$ | 0.155$^{a}$ | 0.196 | 0.597$^{a}$ |
| | (0.022) | (0.026) | (0.024) | (0.037) | (0.164) | (0.183) |
| Observations | 7,475 | 6,962 | 7,318 | 7,475 | 7,475 | 7,475 |
| Kleibergen-Paap Wald stat | 22.82 | 11.65 | 26.23 | 21.40 | 24.76 | 24.10 |
| **Panel b: Manufacturing Firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |
| $NSI_{it}$ | -0.138$^{b}$ | -0.027 | 0.055 | 0.078 | 0.105 | 0.501$^{c}$ |
| | (0.060) | (0.042) | (0.035) | (0.050) | (0.323) | (0.293) |
| Observations | 3,456 | 3,274 | 3,404 | 3,456 | 3,456 | 3,456 |
| Kleibergen-Paap Wald stat | 8.211 | 4.539 | 8.355 | 4.506 | 9.450 | 10.68 |
| **Panel c: Service Firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total Value of Assets | R&D Expenditure | Services Exports |
| $NSI_{it}$ | 0.056$^{c}$ | -0.034 | 0.115$^{a}$ | 0.182$^{a}$ | 0.166 | 0.538$^{b}$ |
| | (0.031) | (0.046) | (0.034) | (0.055) | (0.176) | (0.216) |
| Observations | 3,980 | 3,648 | 3,873 | 3,980 | 3,980 | 3,980 |
| Kleibergen-Paap Wald stat | 9.034 | 4.165 | 15.22 | 12.39 | 15.89 | 14.57 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 16: The Effect of Service Imports 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 |
| $IMP_{it}^{S}$ | -0.354$^{a}$ | -0.091 | 0.162$^{a}$ | -0.387$^{a}$ | -0.363$^{a}$ | -0.067 | 0.172$^{a}$ | 0.305$^{a}$ | 0.232$^{a}$ | 0.689$^{a}$ |
| | (0.082) | (0.063) | (0.046) | (0.096) | (0.096) | (0.066) | (0.062) | (0.061) | (0.058) | (0.111) |
| Observations | 7,414 | 7,414 | 7,414 | 7,414 | 7,414 | 7,414 | 7,414 | 7,414 | 7,414 | 7,414 |
| Kleibergen-Paap Wald stat | 50.6 | 54.13 | 52.36 | 54.93 | 43.36 | 54.31 | 54.69 | 57.03 | 53.82 | 54.22 |
| **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 |
| $IMP_{it}^{S}$ | -0.782$^{a}$ | -0.468$^{a}$ | -0.088 | -0.716$^{a}$ | -0.572$^{b}$ | -0.229$^{b}$ | -0.025 | 0.177$^{a}$ | 0.071 | 0.389$^{a}$ |
| | (0.203) | (0.132) | (0.064) | (0.178) | (0.246) | (0.098) | (0.076) | (0.067) | (0.064) | (0.111) |
| Observations | 3,448 | 3,448 | 3,448 | 3,448 | 3,448 | 3,448 | 3,448 | 3,448 | 3,448 | 3,448 |
| Kleibergen-Paap Wald stat | 21.77 | 30.67 | 30.1 | 31.14 | 14.74 | 29.88 | 29.34 | 35.02 | 31.49 | 31.05 |
| **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 |
| $IMP_{it}^{S}$ | -0.132$^{b}$ | 0.100 | 0.302$^{a}$ | -0.373$^{a}$ | -0.219$^{a}$ | 0.000 | 0.390$^{a}$ | 0.357$^{a}$ | 0.281$^{a}$ | 0.938$^{a}$ |
| | (0.072) | (0.072) | (0.089) | (0.118) | (0.093) | (0.093) | (0.122) | (0.100) | (0.094) | (0.208) |
| Observations | 3,928 | 3,928 | 3,928 | 3,928 | 3,928 | 3,928 | 3,928 | 3,928 | 3,928 | 3,928 |
| Kleibergen-Paap Wald stat | 21.46 | 19.52 | 18.00 | 22.97 | 22.55 | 24.30 | 21.75 | 24.16 | 22.10 | 23.36 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 17: The Effect of Service Imports on Firm Performance: Excluding Intra-Firm Trade in Services

| **Panel a: complete sample** | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | 0.028 | 0.092 | 0.311$^{a}$ | 0.470$^{a}$ | -0.02 | 1.837$^{a}$ |
| | (0.055) | (0.069) | (0.058) | (0.085) | (0.385) | (0.414) |
| Observations | 7,414 | 6,883 | 7,249 | 7,414 | 7,414 | 7,414 |
| Kleibergen-Paap Wald stat | 51.59 | 27.61 | 48.75 | 35.14 | 52.87 | 51.30 |
| **Panel b: manufacturing firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | -0.346$^{a}$ | 0.075 | 0.195$^{b}$ | 0.278$^{b}$ | -0.92 | 2.024$^{a}$ |
| | (0.112) | (0.084) | (0.078) | (0.139) | (0.685) | (0.706) |
| Observations | 3,448 | 3,267 | 3,397 | 3,448 | 3,448 | 3,448 |
| Kleibergen-Paap Wald stat | 26.72 | 13.83 | 21.00 | 7.392 | 29.19 | 29.20 |
| **Panel c: service firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | 0.228$^{a}$ | 0.084 | 0.392$^{a}$ | 0.553$^{a}$ | 0.263 | 1.582$^{a}$ |
| | (0.084) | (0.137) | (0.093) | (0.132) | (0.507) | (0.521) |
| Observations | 3,928 | 3,576 | 3,812 | 3,928 | 3,928 | 3,928 |
| Kleibergen-Paap Wald stat | 18.82 | 7.64 | 22.7 | 17.97 | 23.66 | 22.38 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 18: The Effect of Service Imports on Employment by Education, Occupation, and Task Intensity: Unobserved 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 |
| $IMP_{it}^{S}$ | -0.268[a] | 0.001 | 0.196[a] | -0.263[a] | -0.282[a] | -0.064 | 0.196[a] | 0.352[a] | 0.298[a] | 0.829[a] |
| | (0.076) | (0.060) | (0.051) | (0.093) | (0.095) | (0.071) | (0.070) | (0.074) | (0.068) | (0.142) |
| Service Exports | 0.007[c] | 0.003 | 0.000 | 0.008[c] | 0.013[a] | 0.007[b] | 0.000 | -0.008[b] | -0.007[b] | -0.023[a] |
| | (0.004) | (0.003) | (0.002) | (0.004) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) | (0.006) |
| Goods Exports | 0.072[a] | 0.058[a] | 0.027[a] | 0.082[a] | 0.059[a] | 0.046[a] | 0.024[a] | 0.007 | 0.022[a] | -0.024[b] |
| | (0.007) | (0.006) | (0.004) | (0.008) | (0.008) | (0.006) | (0.005) | (0.005) | (0.005) | (0.010) |
| Observations | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 42.57 | 44.78 | 43.39 | 45.35 | 36.64 | 44.8 | 45.16 | 46.67 | 44.66 | 44.7 |
| **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 |
| $IMP_{it}^{S}$ | -0.561[a] | -0.274[b] | -0.027 | -0.553[a] | -0.305 | -0.238[b] | 0.064 | 0.194[b] | 0.148[b] | 0.508[a] |
| | (0.163) | (0.108) | (0.063) | (0.153) | (0.198) | (0.098) | (0.084) | (0.083) | (0.074) | (0.146) |
| Services Exports | 0.013[b] | 0.010[b] | 0.008[a] | 0.017[a] | 0.016[a] | 0.013[a] | 0.005 | -0.001 | 0.001 | -0.009[c] |
| | (0.006) | (0.005) | (0.003) | (0.006) | (0.006) | (0.004) | (0.003) | (0.003) | (0.003) | (0.006) |
| Goods Exports | 0.112[a] | 0.098[a] | 0.057[a] | 0.129[a] | 0.093[a] | 0.065[a] | 0.051[a] | 0.024[a] | 0.046[a] | 0.003 |
| | (0.021) | (0.016) | (0.009) | (0.022) | (0.019) | (0.012) | (0.008) | (0.008) | (0.008) | (0.013) |
| Observations | 3,456 | 3,456 | 3,456 | 3,456 | 3,456 | 3,456 | 3,456 | 3,456 | 3,456 | 3,456 |
| Kleibergen-Paap Wald stat | 20.56 | 27.24 | 26.99 | 27.46 | 15.01 | 26.62 | 25.5 | 30.44 | 27.97 | 27.12 |
| **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 |
| $IMP_{it}^{S}$ | -0.099 | 0.153[c] | 0.346[a] | -0.282[b] | -0.236[b] | 0.028 | 0.445[a] | 0.435[a] | 0.359[a] | 1.157[a] |
| | (0.079) | (0.085) | (0.111) | (0.126) | (0.110) | (0.105) | (0.151) | (0.128) | (0.118) | (0.283) |
| Service Exports | 0.004 | -0.003 | -0.008 | 0.009 | 0.011[c] | -0.002 | -0.013[c] | -0.018[a] | -0.014[b] | -0.040[a] |
| | (0.004) | (0.004) | (0.005) | (0.006) | (0.006) | (0.005) | (0.007) | (0.006) | (0.006) | (0.014) |
| Goods Exports | 0.027[a] | 0.019[a] | 0.009[c] | 0.032[a] | 0.027[a] | 0.024[a] | 0.009 | 0.003 | 0.012[b] | -0.022 |
| | (0.005) | (0.005) | (0.005) | (0.007) | (0.006) | (0.006) | (0.007) | (0.006) | (0.006) | (0.014) |
| Observations | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 16.79 | 14.81 | 13.48 | 17.95 | 17.38 | 18.77 | 16.3 | 18.55 | 17.27 | 18.11 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, [c] $p < 0.1$, [b] $p < 0.05$, [a] $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 19: The Effect of Service Imports on Firm Performance: Unobserved Demand Robustness

| **Panel a: complete sample** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total value of assets | (5) R&D Expenditure |
|---|---|---|---|---|---|
| $IMP_{it}^{S}$ | 0.088 | 0.08 | 0.328[a] | 0.511[a] | 0.259 |
| | (0.055) | (0.070) | (0.061) | (0.098) | (0.442) |
| Services Exports | 0.003 | 0.004 | 0.000 | -0.010[b] | 0.032 |
| | (0.003) | (0.003) | (0.003) | (0.004) | (0.020) |
| Goods Exports | 0.046[a] | -0.013[b] | 0.029[a] | -0.008 | 0.138[a] |
| | (0.006) | (0.005) | (0.005) | (0.006) | (0.031) |
| Observations | 7,514 | 6,974 | 7,349 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 42.87 | 25.91 | 41.5 | 30.36 | 43.38 |
| **Panel b: manufacturing firms** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total value of assets | (5) R&D Expenditure |
| $IMP_{it}^{S}$ | -0.228[b] | 0.059 | 0.246[a] | 0.334[b] | -0.243 |
| | (0.097) | (0.079) | (0.079) | (0.139) | (0.778) |
| Services Exports | 0.011[a] | 0.000 | -0.001 | -0.003 | 0.065[b] |
| | (0.004) | (0.003) | (0.003) | (0.004) | (0.031) |
| Goods Exports | -0.014 | -0.01 | -0.011 | -0.011 | -0.069 |
| | (0.014) | (0.010) | (0.011) | (0.011) | (0.069) |
| Observations | 3,491 | 3,306 | 3,440 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 24.09 | 14.87 | 20.42 | 9.194 | 25.46 |
| **Panel c: service firms** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total value of assets | (5) R&D Expenditure |
| $IMP_{it}^{S}$ | 0.282[a] | 0.053 | 0.393[a] | 0.620[a] | 0.317 |
| | (0.104) | (0.153) | (0.1 00) | (0.166) | (0.577) |
| Services Exports | -0.006 | 0.012[c] | 0.004 | -0.017[b] | -0.002 |
| | (0.005) | (0.007) | (0.005) | (0.008) | (0.027) |
| Goods Exports | 0.015[a] | -0.008 | 0.012[b] | -0.003 | 0.066[b] |
| | (0.005) | (0.006) | (0.006) | (0.008) | (0.031) |
| Observations | 3,984 | 3,628 | 3,868 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 14.17 | 6.063 | 18.28 | 13.84 | 18.31 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, [c] $p < 0.1$, [b] $p < 0.05$, [a] $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 20: The Effect of Service Imports 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 |
| $IMP_{it}^S$ | -0.341$^a$ | -0.069 | 0.163$^a$ | -0.351$^a$ | -0.351$^a$ | -0.113 | 0.165$^b$ | 0.329$^a$ | 0.257$^a$ | 0.827$^a$ |
| | (0.085) | (0.063) | (0.049) | (0.103) | (0.105) | (0.074) | (0.069) | (0.072) | (0.066) | (0.144) |
| Goods Imports | 0.093$^a$ | 0.084$^a$ | 0.038$^a$ | 0.108$^a$ | 0.084$^a$ | 0.066$^a$ | 0.030$^a$ | 0.011$^c$ | 0.032$^a$ | -0.045$^a$ |
| | (0.010) | (0.008) | (0.005) | (0.011) | (0.010) | (0.008) | (0.006) | (0.006) | (0.006) | (0.013) |
| Observations | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 40.37 | 42.89 | 41.68 | 43.43 | 34.09 | 42.84 | 43.25 | 45.77 | 42.65 | 42.74 |
| **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 |
| $IMP_{it}^S$ | -0.677$^a$ | -0.378$^a$ | -0.073 | -0.688$^a$ | -0.425$^c$ | -0.309$^a$ | 0.022 | 0.174$^b$ | 0.105 | 0.517$^a$ |
| | (0.188) | (0.119) | (0.063) | (0.182) | (0.236) | (0.110) | (0.082) | (0.083) | (0.070) | (0.155) |
| Goods Imports | 0.222$^a$ | 0.203$^a$ | 0.099$^a$ | 0.265$^a$ | 0.167$^a$ | 0.139$^a$ | 0.068$^a$ | 0.033$^a$ | 0.075$^a$ | -0.028 |
| | (0.030) | (0.022) | (0.011) | (0.031) | (0.028) | (0.018) | (0.012) | (0.011) | (0.011) | (0.021) |
| Observations | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 17.75 | 24.44 | 24.35 | 24.63 | 12.36 | 23.65 | 22.78 | 27.71 | 25.29 | 24.19 |
| **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 |
| $IMP_{it}^S$ | -0.140$^c$ | 0.104 | 0.313$^a$ | -0.324$^b$ | -0.271$^b$ | -0.019 | 0.402$^a$ | 0.401$^a$ | 0.312$^a$ | 1.142$^a$ |
| | (0.083) | (0.082) | (0.105) | (0.131) | (0.115) | (0.106) | (0.144) | (0.121) | (0.113) | (0.282) |
| Goods Imports | 0.030$^a$ | 0.026$^a$ | 0.011$^c$ | 0.036$^a$ | 0.038$^a$ | 0.029$^a$ | 0.007 | 0.006 | 0.015$^b$ | -0.049$^a$ |
| | (0.006) | (0.006) | (0.006) | (0.008) | (0.008) | (0.007) | (0.009) | (0.008) | (0.007) | (0.017) |
| Observations | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 16.34 | 14.45 | 13.28 | 17.61 | 17.11 | 18.44 | 16.31 | 18.78 | 16.77 | 17.76 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^c$ $p < 0.1$, $^b$ $p < 0.05$, $^a$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 21: The Effect of Service Imports on Firm Performance: Controlling for Goods Imports

| **Panel a: complete sample** | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^S$ | 0.039 | 0.099 | 0.289$^a$ | 0.512$^a$ | 0.165 | 1.499$^a$ |
| | (0.057) | (0.076) | (0.059) | (0.102) | (0.451) | (0.462) |
| Goods Imports | 0.065$^a$ | -0.01 | 0.042$^a$ | -0.015$^c$ | 0.086$^b$ | -0.062 |
| | (0.007) | (0.007) | (0.007) | (0.009) | (0.042) | (0.039) |
| Observations | 7,514 | 6,974 | 7,349 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 41.17 | 22.68 | 39.07 | 27.67 | 41.29 | 40.39 |
| **Panel b: manufacturing firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^S$ | -0.291$^a$ | 0.076 | 0.138$^c$ | 0.346$^b$ | -0.408 | 1.148 |
| | (0.104) | (0.090) | (0.077) | (0.160) | (0.798) | (0.764) |
| Goods Imports | 0.163$^a$ | -0.021 | 0.113$^a$ | -0.013 | 0.378$^a$ | -0.097 |
| | (0.018) | (0.016) | (0.018) | (0.019) | (0.100) | (0.095) |
| Observations | 3,491 | 3,306 | 3,440 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 21.86 | 11.8 | 16.55 | 7.006 | 22.98 | 22.45 |
| **Panel c: service firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^S$ | 0.244$^b$ | 0.09 | 0.380$^a$ | 0.604$^a$ | 0.252 | 1.584$^b$ |
| | (0.098) | (0.161) | (0.098) | (0.165) | (0.582) | (0.618) |
| Goods Imports | 0.020$^a$ | -0.004 | 0.016$^b$ | -0.012 | -0.022 | -0.028 |
| | (0.006) | (0.009) | (0.007) | (0.010) | (0.040) | (0.037) |
| Observations | 3,984 | 3,628 | 3,868 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 13.94 | 5.545 | 18.01 | 13.3 | 17.97 | 17.39 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^c$ $p < 0.1$, $^b$ $p < 0.05$, $^a$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 22: The Effect of Service Imports 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 |
| $IMP_{it}^{S}$ | -0.274$^{a}$ | -0.005 | 0.189$^{a}$ | -0.291$^{b}$ | -0.320$^{a}$ | -0.103 | 0.212$^{a}$ | 0.368$^{a}$ | 0.340$^{a}$ | 0.855$^{a}$ |
| | (0.092) | (0.074) | (0.059) | (0.117) | (0.115) | (0.085) | (0.080) | (0.085) | (0.082) | (0.164) |
| Import Competition | -0.047 | -0.046$^{c}$ | -0.017 | -0.031 | 0.005 | 0.02 | -0.049$^{b}$ | -0.055$^{b}$ | -0.098$^{a}$ | -0.061 |
| | (0.028) | (0.025) | (0.017) | (0.039) | (0.030) | (0.024) | (0.021) | (0.022) | (0.022) | (0.041) |
| Observations | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 34.12 | 35.87 | 34.56 | 36.11 | 28.75 | 35.53 | 35.97 | 38.07 | 35.42 | 35.45 |
| **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 |
| $IMP_{it}^{S}$ | -0.576$^{a}$ | -0.329$^{b}$ | -0.077 | -0.612$^{a}$ | -0.374 | -0.317$^{b}$ | 0.027 | 0.201$^{b}$ | 0.137$^{c}$ | 0.560$^{a}$ |
| | (0.195) | (0.135) | (0.075) | (0.201) | (0.234) | (0.128) | (0.090) | (0.091) | (0.080) | (0.173) |
| Import Competition | -0.082 | -0.026 | 0.024 | -0.036 | -0.005 | 0.052 | 0.016 | -0.034 | -0.034 | -0.089$^{c}$ |
| | (0.063) | (0.051) | (0.025) | (0.072) | (0.047) | (0.043) | (0.023) | (0.026) | (0.023) | (0.047) |
| Observations | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 15.6 | 20.69 | 20.42 | 21.25 | 11.67 | 20.22 | 20.17 | 24.34 | 21.77 | 21.08 |
| **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 |
| $IMP_{it}^{S}$ | -0.06 | 0.243$^{c}$ | 0.423$^{b}$ | -0.397$^{c}$ | -0.257 | 0.041 | 0.595$^{b}$ | 0.569$^{a}$ | 0.607$^{a}$ | 1.407$^{a}$ |
| | (0.109) | (0.126) | (0.168) | (0.203) | (0.163) | (0.150) | (0.236) | (0.212) | (0.226) | (0.491) |
| Import Competition | -0.071$^{c}$ | -0.150$^{a}$ | -0.127$^{b}$ | 0.093 | 0.008 | -0.043 | -0.238$^{a}$ | -0.184$^{b}$ | -0.315$^{a}$ | -0.297 |
| | (0.040) | (0.047) | (0.062) | (0.076) | (0.063) | (0.056) | (0.091) | (0.084) | (0.085) | (0.188) |
| Observations | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 8.79 | 8.77 | 8.08 | 8.99 | 9.07 | 9.53 | 9.81 | 10.09 | 9.256 | 8.92 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 23: The Effect of Service Imports on Firm Performance: Controlling for Import Competition

| **Panel a: complete sample** | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | 0.091 | 0.093 | 0.319$^{a}$ | 0.521$^{a}$ | 0.256 | 1.389$^{a}$ |
| | (0.068) | (0.072) | (0.066) | (0.109) | (0.510) | (0.506) |
| Import Competition | -0.039$^{c}$ | -0.028 | -0.024 | -0.027 | -0.076 | 0.116 |
| | (0.021) | (0.019) | (0.021) | (0.025) | (0.136) | (0.134) |
| Observations | 7,514 | 6,974 | 7,349 | 7,514 | 7,514 | 7,514 |
| Kleibergen-Paap Wald stat | 34.56 | 24.87 | 36.15 | 25.32 | 33.34 | 33.98 |
| **Panel b: manufacturing firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | -0.266$^{b}$ | 0.064 | 0.207$^{b}$ | 0.341$^{b}$ | -0.19 | 0.789 |
| | (0.119) | (0.083) | (0.082) | (0.153) | (0.860) | (0.801) |
| Import Competition | -0.034 | -0.003 | -0.027 | 0.018 | -0.450$^{b}$ | 0.599$^{a}$ |
| | (0.041) | (0.021) | (0.035) | (0.025) | (0.258) | (0.233) |
| Observations | 3,491 | 3,306 | 3,440 | 3,491 | 3,491 | 3,491 |
| Kleibergen-Paap Wald stat | 18.11 | 13.45 | 17.47 | 7.726 | 20.33 | 20.22 |
| **Panel c: service firms** | (1) | (2) | (3) | (4) | (5) | (6) |
| | Employees | Productivity | Turnover | Total value of assets | R&D Expenditure | Services Exports |
| $IMP_{it}^{S}$ | 0.404$^{b}$ | 0.102 | 0.470$^{a}$ | 0.750$^{a}$ | 0.23 | 2.001$^{b}$ |
| | (0.176) | (0.162) | (0.150) | (0.281) | (0.841) | (0.962) |
| Import Competition | -0.164$^{b}$ | -0.042 | -0.1 | -0.154 | 0.009 | -0.436 |
| | (0.064) | (0.044) | (0.061) | (0.105) | (0.310) | (0.348) |
| Observations | 3,984 | 3,628 | 3,868 | 3,984 | 3,984 | 3,984 |
| Kleibergen-Paap Wald stat | 7.747 | 5.21 | 10.86 | 7.092 | 9.03 | 9.048 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^{c}$ $p < 0.1$, $^{b}$ $p < 0.05$, $^{a}$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.

Table 24: The Effect of Service Imports 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 |
| $IMP_{it}^S$ | -0.254$^a$ | 0.101$^c$ | 0.249$^a$ | -0.246$^a$ | -0.395$^a$ | -0.034 | 0.283$^a$ | 0.668$^a$ | 0.348$^a$ | -0.185$^a$ |
| | (0.078) | (0.060) | (0.057) | (0.088) | (0.108) | (0.068) | (0.066) | (0.117) | (0.068) | (0.066) |
| Observations | 4,679 | 4,679 | 4,679 | 4,679 | 4,679 | 4,679 | 4,679 | 4,679 | 4,679 | 4,679 |
| Kleibergen-Paap Wald stat | 42.21 | 43.71 | 41.46 | 44.17 | 33.75 | 44.55 | 44.47 | 36.68 | 44.04 | 41.74 |
| **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 |
| $IMP_{it}^S$ | -0.575$^a$ | -0.109 | 0.054 | -0.348$^a$ | -0.660$^a$ | -0.201$^b$ | 0.149$^c$ | 0.553$^a$ | 0.235$^a$ | -0.247$^a$ |
| | (0.144) | (0.078) | (0.050) | (0.120) | (0.214) | (0.080) | (0.076) | (0.158) | (0.074) | (0.086) |
| Observations | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 | 2,196 |
| Kleibergen-Paap Wald stat | 22.09 | 23.81 | 23.07 | 23.53 | 15.09 | 24.1 | 21.56 | 16.29 | 21.61 | 23.49 |
| **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 |
| $IMP_{it}^S$ | -0.062 | 0.248$^b$ | 0.461$^a$ | -0.333$^a$ | -0.185$^c$ | 0.055 | 0.457$^a$ | 0.762$^a$ | 0.438$^a$ | -0.056 |
| | (0.081) | (0.097) | (0.160) | (0.124) | (0.109) | (0.105) | (0.151) | (0.187) | (0.125) | (0.097) |
| Observations | 2,452 | 2,452 | 2,452 | 2,452 | 2,452 | 2,452 | 2,452 | 2,452 | 2,452 | 2,452 |
| Kleibergen-Paap Wald stat | 15.35 | 13.48 | 10.34 | 17.42 | 15.97 | 18.4 | 13.31 | 17.28 | 17.5 | 16.51 |

**Note:** This table shows the regression result of regressing the log of the number of workers by skill level and occupation on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^c$ $p < 0.1$, $^b$ $p < 0.05$, $^a$ $p < 0.01$. Data Sources: FLEED and International Trade in Services Survey.

Table 25: The Effect of Service Imports on Firm Performance: Excluding Crisis Period

| **Panel a: complete sample** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total value of assets | (5) R&D Expenditure | (6) Services Exports |
|---|---|---|---|---|---|---|
| $IMP_{it}^S$ | 0.167$^a$ | 0.229$^b$ | 0.426$^a$ | 0.402$^a$ | -0.339 | 1.409$^a$ |
| | (0.061) | (0.099) | (0.078) | (0.081) | (0.393) | (0.426) |
| Observations | 4,679 | 4,381 | 4,613 | 4,679 | 4,679 | 4,679 |
| Kleibergen-Paap Wald stat | 41.01 | 20.20 | 38.00 | 33.90 | 44.23 | 42.99 |
| **Panel b: manufacturing firms** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total value of assets | (5) R&D Expenditure | (6) Services Exports |
| $IMP_{it}^S$ | -0.112 | 0.305$^c$ | 0.444$^a$ | 0.288$^b$ | -0.645 | 0.971 |
| | (0.074) | (0.156) | (0.119) | (0.131) | (0.601) | (0.617) |
| Observations | 2,196 | 2,107 | 2,180 | 2,196 | 2,196 | 2,196 |
| Kleibergen-Paap Wald stat | 21.99 | 7.161 | 15.46 | 7.28 | 23.59 | 23.36 |
| **Panel c: service firms** | (1) Employees | (2) Productivity | (3) Turnover | (4) Total value of assets | (5) R&D Expenditure | (6) Services Exports |
| $IMP_{it}^S$ | 0.378$^a$ | 0.112 | 0.475$^a$ | 0.444$^a$ | -0.226 | 1.518$^b$ |
| | (0.135) | (0.161) | (0.128) | (0.128) | (0.555) | (0.629) |
| Observations | 2,452 | 2,242 | 2,399 | 2,452 | 2,452 | 2,452 |
| Kleibergen-Paap Wald stat | 11.42 | 7.069 | 16.88 | 16.69 | 18.15 | 17.43 |

**Note:** This table shows the regression result of regressing the log of different performance variables on the firm-level measure of service imports together with firm fixed effects and industry trends. Robust standard errors in parentheses, $^c$ $p < 0.1$, $^b$ $p < 0.05$, $^a$ $p < 0.01$. Data Sources: Finnish Annual Accounts Panel and International Trade in Services Survey.