GROWINPRO

Growth Welfare Innovation Productivity

Working Paper

Servitization across countries and sectors: Evidence from World Input-Output Data

Klaus S. Friesenbichler
Agnes Kügler
Austrian Institute of Economic Research (WIFO)

20/2021 June

Servitization across countries and sectors: Evidence from World Input-Output Data[*]

Klaus S. Friesenbichler[†]   Agnes Kügler[‡]

Abstract

This paper uses the supply tables underlying WIOT data to explore the provision of services by manufacturing. The service shares differ substantially across countries and sectors, while they remain largely stable over time. Findings from a latent class analysis reveal that servitization increase with labor productivity. The service intensities in the sectoral production mix of broadly defined manufacturing sectors are lower in countries with higher manufacturing shares. This holds for both catching-up and developed economies. Yet, servitization is largely unrelated to productivity and employment growth. We therefore argue that the degree of servitization is contingent on and an attribute of the respective economic model in which a sector operates.

[††] Austrian Institute of Economic Research (WIFO), Arsenal Objekt 20, 1030 Vienna, Austria; Tel.: +43 1 798 26 01 296; Fax: +43 1 798 93 86; Klaus.Friesenbichler@wifo.ac.at

[‡] Austrian Institute of Economic Research (WIFO), Arsenal Objekt 20, 1030 Vienna, Austria; Agnes.Kuegler@wifo.ac.at

Servitization across countries and sectors: Evidence from World Input-Output Data

1. Introduction

In the last decades, researchers have documented both the growth contribution and the structural change dynamics of manufacturing. Manufacturing has been identified as a growth driver and its share in the overall economy follows an inverted U-shape as economies become more productive (Herrendorf, Rogerson, and Valentinyi 2013). Change has also occurred within the sector. According to management literature manufacturing firms increasingly offer *'fuller market packages or 'bundles' of customer focused combinations of goods, services, support, self-service and knowledge in order to add value to core corporate offerings'* (Vandermerwe and Rada 1988). The bulk of the evidence draws on firm-level data from single countries or takes a case-study approach (Kowalkowski, Gebauer, and Oliva 2017; Eloranta and Turunen 2015). However, cross-country and cross-sector evidence is rare, which makes the generalization of the results problematic.

The aim of this paper is to provide evidence about servitization across countries and manufacturing industries and its impact on performance. We use the supply sheets that underlie the World Input Output Data (WIOD) covering a total of 37 countries and eleven broadly defined manufacturing sectors for the period 2000-2014 to provide evidence based on internationally comparable data. The supply provide information on the the goods and services which are produced in the domestic economy. This allows us to measure servitization as the value-added share of services provided by the manufacturing sector. We draw on a Eurostat classification to further split the share of services in manufacturing industries into groups of knowledge intensive services and other services.

We pursue two guiding research questions:

First, do changes in the intensity of services effect productivity or employment growth? Second, we ask if servitization is contingent on the economic context and on the economic regime in which a sector operates.

Linking the servitization indicators to economic performance reveals that offering more services is *per se* unrelated to performance. Moreover, ANOVA results show that mostly country and sector effects explain the variance in servitization intensities. A latent class analysis assigns sectors to "servitization typologies". These identify manufacturing-based or service-driven economic models which again differ between catching-up and developed economies. The results indicate that servitization generally increases with development. Economies whose economic regime relies rather on services than manufacturing tend to have higher service shares in manufacturing industries as well.

We contribute to the literature in multiple ways. We differentiate the services offered by their knowledge intensities in an international empirical framework. This allows us to systematically study the extent and nature of servitization. Such information is yet rare, which is surprising given the large research interest.[1] We therefore contribute to the consolidation of the servitization literature. We explore if servitization is related to economic performance indicators such as productivity and employment growth. The literature almost exclusively focuses on firm-specific aspects such as idiosyncratic capabilities, resources or firm-level contextual factors to optimally include services in the product portfolio. Eventually, we offer a novel way to assign sectors to economic models which have been defined by country-specific and sectoral characteristics. We use servitization as an example of demand changes across economic regimes.

---

[1] A Google Scholar search produced 16,700 results (accessed on April 29, 2021).

2. Defining servitization

For decades, servitization of businesses has been discussed in management literature, but no clear-cut definition is available. Originally, servitization was referred to as a trend of firms to increasingly offer `fuller market packages or "bundles" of customer-focused combinations of goods, services, support, self-service, and knowledge' (Vandermerwe and Rada 1988). Since then the concept has received different notions. For instance, Baines et al. (2009a) defined it as an `innovation of an organization's capabilities and processes to better create mutual value through a shift from selling product to selling Product Service Systems (PSS)'. Altering business models that increasingly offer service can also be technology induced, especially through ICT or cloud based systems (Berman et al. 2012). However, the central idea of these market strategies always consists of manufacturing firms that add value added to their core (physical) products through services.

2.1 Quantifying servitization

We draw on input-output data which captures the production structure and the flows of goods and services between countries and industries. To construct a measure of the service content of manufacturing, we use data at the industry-level which underlie the World Input-Output Database (WIOD)(Dietzenbacher et al. 2013; Timmer et al. 2014). We draw on WIOD's supply and use tables (SUTs), which are the basic building blocks of the database that underwent extensive data cleaning and harmonization effort to render data comparable across countries and industries (Erumban et al. 2012). Hence, the supply and use tables are the precursory data used to construct the input-output data. Both WIOD and the supply and use tables are publicly available.[2]

---

[2] See http://www.wiod.org/database/nat_suts16 (accessed on April 26, 2021).

Defining servitization, we use the supply sheets, which describe the supply the goods and services which are either produced in the domestic economy or imported.[3] WIOD contains 59 products based on CPA, a product classification. Hence, the supply tables depict the product portfolio of each sector-country-year combination. This allows us to compute the service share of each manufacturing industry included in WIOD across countries and years, and to further disaggregate the degree of servitization by computing a variety product groups capturing of knowledge-intensive services.

Unfortunately, supply tables are not available for all countries, which is why we cannot consider Mexico, France, Indonesia, Russia, China and Taiwan. The final sample covers 37 countries and eleven broadly defined industries that are classified according to the International Standard Industrial Classification revision 4 (ISIC Rev. 4).[4]

The key variable is the servitization share, which we define as the value-added share generated by services, as opposed to physical products. We compute this ratio for eleven manufacturing sub-sectors in each country and year. Hence, we conceptualize the degree of servitization as the level of the service content in manufacturing in monetary terms as a share of each unit of value added. This measure resembles previous approaches used in the Input-Output literature (Falk and Peng 2013).

The mean of the degree of servitization in manufacturing industries is about 9.9%, which has slightly increased from 10.3% in the base year 2000 to 11.2% in the last year covered by our sample, 2014. The lower mean indicates a trough between the years 2001 and 2008, where the average share of services amounted to only 9%.

---

[3] For futher information on the definition of supply tables see https://www.oecd-ilibrary.org/economics/data/oecd-national-accounts-statistics/supply-and-use-tables-supply-and-use-indicators-edition-2018_5a109fe6-en (accessed on April 26, 2021).

[4] See http://wiod.org/home (accessed on April 26, 2021).

There is substantial cross-country variance. The countries with the lowest values in the sample are South Korea (0.7%), Cyprus (1.4%) and the highest values are reported for Luxembourg (42.5%), the Netherlands (20.1%) and Sweden (16%).

The servitization degrees also differ vastly across sectors. The mean of the service share in the manufacture of food products, beverages and tobacco is merely 4.3%. Then again, in the industry group consisting of the manufacture of wood and of products of wood and cork (except furniture), paper and paper products and printing and reproduction of recorded media, the servitization share amounts to 21.2%.

2.2 Types of services

Changes in the technology base, especially in the advent of ICT, not only induced changes in the overall composition of the economy, but also in the product range of the industrial sector itself (Ochel and Wegner 2019). This suggests that - given the vast differences between countries and sectors – both the degree and the composition of the services offered differs. The data structure allows us to apply taxonomies to differentiate services by their knowledge content. We draw on Eurostat indicators to split the service sector into different subsectors, for which we compute the respective fraction in the industry-year.[5]

- Knowledge-intensive market services (KIMS; e.g., testing and analysis, advertising and market research, consultancy, engineering, legal and accounting activities)

- High-tech knowledge-intensive services (HTKI; e.g., scientific R&D, computer programming, information service activities)

- Knowledge-intensive financial services (KIFS; financial and insurance activities)

---

[5] See https://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf (accessed on January 4, 2021).

- Other knowledge-intensive services (OKIS; e.g., publishing, education, veterinary activities)

First descriptive statistics reveal that most services offered by manufacturing industries are not knowledge-intensive. The median service share is 5.8%, of which 3.8 percentage points are assigned to activities not classified as knowledge-intensive. Among the subgroups of knowledge-intensive services, knowledge intensive market services and high-tech knowledge intensive services took the biggest share. Other knowledge-intensive services and especially financial services played minor roles with mean and median values at, or close to, nil (see Table 1).

Table 1 about here

2.3 ANOVA results and descriptive statistics across service types

To establish whether these servitization shares differ across countries, sectors or years we implement an analysis of variance (ANOVA). The estimated model explains approximately 45% of the total variance in servitization shares, of which 26 percentage points can be attributed to country- and 19 to sector-effects. This is broadly in line with firm-level evidence that finds that higher levels of development increases the manufacturing share over and above firm characteristics (Neely 2008). However, it does not support firm-level results that find that national differences play only a minor role in explaining the degree of servitization (Dachs et al. 2014). The presence of strong sectoral heterogeneity is a typical empirical result (Crozet and Milet 2017). The ANOVA results indicate that time effects account for less than one percent of the total variance in the period studied. Evidence from previous time periods till 2005/08 report stronger increases in the degree of servitization (Falk and Peng 2013).

We next implement the ANOVA for the individual types of services. Country and sector effects play a varying role, with time effects taking a minor position throughout the specifications.

Across the entire sample, the means of the high-tech knowledge intensive services (HTKI) such as R&D have increased from 2.5% in 2000 to 3.2% in 2014. Country and sector effects explain 15 percentage points each. The highest shares of high-tech knowledge intensive services are found in the Manufacture of computer, electronic and optical products and the Manufacture of electrical equipment (6.6%). The lowest mean shares in the sample is found in the Manufacture of textiles, of wearing apparel and of leather and related products (1.2%). Using a pooled sample again, the highest mean values of high-tech service provision are reported by Luxembourg (7.6%), Finland (6.8%) and Sweden (5.6%), which are all members of the group of innovation leaders in the EU (European Commission 2020). At 1%, the lowest values are in Brazil, India, Japan and South Korea.

Table 2 about here

The picture changes fundamentally for knowledge-intensive market services (KIMS), where the ANOVA explains 22% of the total variance, of which country effects make 15 and sector effects seven percentage points. At 4.7%, the sector with the highest share is the NACE Rev. 2 division group 16 through 18, consisting of Manufacture of wood and of products of wood and cork, except furniture; manufacture, the Manufacture of paper and paper products and Printing and reproduction of recorded media. The lowest mean share of knowledge-intensive market services is reported by Manufacture of computer, electronic and optical products and the Manufacture of electrical equipment (1.7%). At the country level, the highest mean values are observable in Luxembourg (6.5%), Croatia (5.9%) and Australia and the USA (5.6% each).

The categories knowledge-intensive financial services (KIFS) and other knowledge-intensive services (OKIS) account for a substantially smaller share of output, 1.0% and 1.8%, respectively. These shares are stable over time. While financial services are largely explained by country effects which reflects the geographical clusters of financial service supply (e.g. Luxembourg), sector effects bear more explanatory power with OKIS.

3. Servitization and growth

Even though the roots of the debate about servitization can be traced back as far as the 1960s (Lightfoot, Baines, and Smart 2013), the current discussion has emerged in the late 1980s (Vandermerwe and Rada 1988). Typically, the product-service configuration is at the core of research, though, additional aspects like product-service differentiation or costumer relationships have been studied by a multitude of management disciplines. We seek to make an empirical contribution with respect to the link between servitization and performance (Eloranta and Turunen 2015; Kowalkowski, Gebauer, and Oliva 2017; Lightfoot, Baines, and Smart 2013; Baines et al. 2009b; Bustinza et al. 2015).

3.1 Growth conjectures

Many empirical findings recommend the integration of services into manufacturing firms' product range, because an increased provision of services is an instrument to differentiate from competitors and tap into yet unexplored markets. Servitization can create a competitive advantage, increase firms' profits and can thus be a reaction of firms in developed economies to low-cost competitors from emerging economies (Baines et al. 2009b; Eloranta and Turunen 2015; Wise and Baumgartner 1999; Vandermerwe and Rada 1988; Dachs et al. 2014; Neely 2008; Lightfoot, Baines, and Smart 2013).

However, servitization also entails risks and firms often struggle when seeking to establish an alternative business line to their core competencies in manufacturing (see Dachs et al. 2014 for an overview). Thus, the empirical results on the effects of servitization on economic performance have been mixed. While some studies report no systematic effects (Eloranta and Turunen 2015; Kowalkowski, Gebauer, and Oliva 2017), there is evidence for Germany (Eggert et al. 2011) and France that firms which sell services experience an increase in their profitability and employment (Crozet and Milet 2017). Fang, Palmatier, and Steenkamp (2008) find evidence for a U-shaped relationship, where servitization initially causes a slight decline in market value and increases at later stages. Further evidence shows that manufacturing firms that have servitized are larger in terms of sales revenues than comparable firms, but also generate lower profit to sales margins (Neely 2008).

Servitization may not only affect performance, but also the production function. By definition, offering services is more labor intensive than offering manufactured goods. Dachs et al. (2014) find that servitization is linked to firm size in a U-shape manner. Other quantitative findings show that servitization is not only linked to larger firms, but also that offering services increases employment growth (Crozet and Milet 2017). Based on this literature, we want to test the following two hypotheses:

Growth hypothesis I: A greater degree of servitization at the sector level is positively related to performance growth.

Growth hypothesis II: A greater degree of servitization at the sector level is positively related to employment growth.

3.2 Estimation strategy

To test the first and second hypothesis, we implement a first difference model in which we regress logarithmic performance growth on logarithmic changes in servitization.

We estimate the following growth regression:

$$\Delta \ln (Y_{ijt}) = \beta_1 \Delta \ln (SERV_{ijt-1}) + \beta_1 \Delta \ln (CAP_{ijt}) + \beta_1 \Delta \ln (GAP_{ijt}) + \mu_c + \mu_j + \mu_t + u_{ijt}, (1)$$

We are interested in the effect of servitization on changes in employment and performance, where the latter is measured by both labor productivity and total factor productivity. This leads us to three types of economic outcomes (Y) in sector j, country i at time t:employment (number of employees), labor productivity (real value added divided by the number of employees, base year 2010) and total factor productivity obtained from the EUKLEMS database. SERV stands for the servitization indicators, which is in the baseline regression the logarithmic change of the service share in manufacturing industries and in a second set of regressions the logarithmic changes of the shares of knowledge-intensive services. We use the lagged growth rates of the servitization indicators to control for endogeneity issues.

We control for changes in the capital stock when explaining employment and labor productivity growth. GAP denotes the output gap, which captures macroeconomic cyclical dynamics obtained from the AMECO database. The output gap is defined as the "Gap between actual and potential gross domestic product at 2010 reference levels". μ denotes fixed effects at the year (t), country (c) and sector (s) level. Robust standard errors (u) are estimated in all specifications.

3.3 Regression results

The coefficients of changes in servitization are insignificant. Also, the coefficients for the knowledge-intensive services are insignificant, apart from knowledge-intensive market

services, which are weakly associated with an employment growth dampening effect (see Table 3).

Table 3 about here

Table 4 about here

In addition, we explore whether these effects vary across country groups and run the regressions separately for the (i) New Member States of the European Union (EU), which consist of countries that acceded the EU after 2004, (ii) the Old Member States of the EU (countries that were EU Members prior to 2004) and (iii) the OECD countries. Overall, the coefficients of changes in servitization are again insignificant for both employment and performance growth. One exception are changes in high-tech, knowledge-intensive services in New Member States, which are negatively related to labor productivity growth rates (see Table 4).

The control variables perform as expected. We obtain positive coefficients for changes in the capital stock and changes of the output gap. Changes in the capital stock are positively related with contemporaneous changes in employment, which seems to be driven by sectors in industrialized economies. The coefficients for changes in capital are insignificant using the total sample and for the group of New Member States of the EU but turn positive and significant for Old Member States and OECD countries.

4. Servitization across economic regimes

The previous analysis shows that differences in servitization are explained by country and sector effects. Since our regressions find that changes of the intensity of servitization itself have little effect on economic performance indicators, the observed varying intensities suggest that

servitization is rather an attribute which co-evolves as sectors grow. Indeed, firm level evidence suggests that national differences play a role in the degree of servitiziation. Developed countries such as the United States or Scandinavian countries show the highest servitization intensities. However, companies in countries such as Germany have lower servitization rates, which could mirror a different strategic orientation of firms. In addition, there is substantial cross-country variance, with catching-up economies showing lower servitization intensities (Dachs et al. 2014; Neely 2008).

Servitization has been argued to be contingent on a multitude of contextual factors at the country and sector level which also mirror demand conditions (Peneder 2009). These differ are likely to differ across development stages and economic regimes, which the following analysis seeks to explore.

4.1   Latent Class Analysis

To systematically identify differences between economic regimes, we group sectors using latent class analysis (LCA), which is a special case of structural equation models. Originally developed as a statistical tool in psychology (Lazarsfeld 1950) and later widely applied in political sciences and medical studies (Hagenaars and McCutcheon 2002), LCA is also known as Bayesian classification and has, for instance, been applied in economics in a Bayesian model averaging framework to uncover regularities in growth patterns (Cuaresma et al. 2016).

The basic idea of latent class analysis is to relate the observed variables to an unobserved, categorical latent variable. This latent variable captures the underlying dependency structure between the observed variables and allows to cluster observations by minimizing the dependency between variables. A class is characterized by a pattern of conditional probabilities indicating the chance that variables take on certain values.

We use variables typically linked to structural change patterns, to the production function and the position in the value chain of a given sector (Herrendorf, Rogerson, and Valentinyi 2013; Timmer, Miroudot, and de Vries 2019). Given the negligible explanatory power of time, we use country-industry means in the LCA. The total sample consists of 402 industry-country pairs.

Table 6 about here

4.2   Variables related to servitization intensities

We use a set of indicators to paint a holistic picture, including contextual variables which have been argued to be underdeveloped in the servitization literature (Eloranta and Turunen 2015). These capture the degree of servitization, the level of development at the country level, the level of development at the sector level measured by both productivity and a sophistication indicator, the relevance of final demand and sourced services along the value chain for a sector, and the country-wide manufacturing share.

Servitization

We draw on three indicators of servitization described above. We use (i) the share of high-tech knowledge intensive services, (ii) the share of knowledge-intensive market services, and (iii) the share of all other services offered.

Country-level productivity

We use GDP per capita in natural logs as a proxy for the development level of a given sector's country context. It has been documented that the share of the service sector in the total economy increases with the level of development (Buera and Kaboski 2012), which renders it likely that the demand for general services, and especially knowledge intensive services,

increases with economic development. It has been argued that wealthier economies tend to have more service-oriented manufacturing firms (Neely 2008)

Sector-level productivity

Sectoral labor productivity in natural logs is used as another proxy for the level of development that captures country-sector specific characteristics. The indicator is correlated with yet differs from GDP per capita.

Relevance of final demand

Especially in the 1980s and 1990s, it has been argued that manufacturing firms should build on their core competencies and expand their activities downstream to services. These activities were thought to be of higher value-added than manufacturing activities (Bowen, Siehl, and Schneider 1991; Wise and Baumgartner 1999). This implies that servitization is a downstream phenomenon whose provision is not independent of the position in the value chain. Hence, servitization is assumed to become more likely when a sector is closer to final demand. We therefore rely on a measure of the value chain positioning based on WIOD (see also Antràs et al. 2012; De Backer and Miroudot 2013). We use the share of outputs which is directly consumed by final demand, i.e. the fraction of final demand of gross output. The greater the share the lower the fraction of output that is used as intermediaries in international value chains.

Service sourcing

It has been argued that firms offering more complex products, which also rely on technologically sophisticated components, require more services such as maintenance or training (Oliva and Kallenberg 2003), which is also reflected by the sourcing of more complex capital goods (Davies 2004). We construct an indicator that hinges on the partitioning of the "induced value added" (IVA) that weights the IVA of the services sourced by a sector by its total sectoral IVA. Hence, we calculate a sector's intensity of sourced services by computing

its upstream value chain integration, i.e. backward linkages. We draw on the value-added share of services used as inputs accumulated along the value chain. This indicator hinges on the partitioning of the induced value added of services, or IVA (IVA = vLf), where vector f denotes a sector's value of final demand in a given country and year, v is the value-added per unit of production (diagonal matrix) and L stands for the Leontief inverse. The Leontief inverse incorporates the structure of direct and intermediate inputs for the production process meeting the final demand. The vector IVA contains the value-added shares of all sectors of all countries required to produce the output. By summing up all value-added of service sectors in IVA we obtain the service share of the considered manufacturing output (Peneder and Streicher 2017; Johnson and Noguera 2012; Friesenbichler, Kügler, and Reinstaller 2021).

Manufacturing share

The share of the value added produced by the manufacturing sector in total value added poses a proxy of the relevance of manufacturing industry. This is the core indicator of the deindustrialization literature discussing structural change processes (Rowthorn and Ramaswamy 1999; Bernard, Smeets, and Warzynski 2017) which are also likely to affect a sector's product portfolio and therefore service intensity.

Sectoral sophistication

Firm-level evidence has shown that servitization is positively related to complexity of a firm's product portfolio (Dachs et al. 2014). We use a measure of sophistication of a sector's products based on "complexity scores" (Hidalgo and Hausmann 2009). These approximate the sophistication of a product line by recovering latent information from a bipartite network linking product lines to exporting countries. A higher score indicates that the country is exporting a specific product line with comparative advantage and/or only few other countries are capable of exporting the same product line. Hence, the complexity score may be interpreted

as reflecting the breadth and the depth of the knowledge base required to become a significant exporter (Reinstaller and Reschenhofer 2019; Klimek, Hausmann, and Thurner 2012).

Table 5 about here

4.3   LCA results and discussion

Six latent classes were defined. Table 6 shows the marginal predicted means of the covariates within each latent class. Even though there is some sectoral variance across classes, country-specific factors dominate the results. This allows us to provide a first differentiation using the three variables that do not differ across sectors: GDP per capita, manufacturing share and sophistication. The sample can be roughly grouped into developing economies (Class I), catching-up economies (Class II and III), and developed economies (Class IV, V and VI). Combining these results with the manufacturing share and sophistication indicator, we obtain country groups that can be categorized based on stylized growth models: rather manufacturing-based (Class III and Class V) and service-driven groups (Class II, Class IV and Class VI). Class I and VI capture statistical outliers related to peculiar growth models. Class I consists of developing economies. Class VI consists of highly service-intensive industries in developed economies.

Table 6 about here

Next, we jointly interpret the results. We study differences in the sectoral characteristics between countries' economic model.

Class I consists of developing economies such as India, Turkey, Romania and Bulgaria. These countries had not yet developed a growth pattern in the period covered by WIOD. Much of the output is consumed in final demand. Servitization is low.

Class II is a group of catching-up economies like Spain, Portugal or Greece., in which manufacturing plays a smaller role. The service share tends to be higher. A large share of the sectoral output is absorbed by final demand, which implies they are not used as intermediates, which again indicates that these sectors are integrated in value chains to a lesser degree than sectors in other countries that implement a more manufacturing-driven strategy.

Class III consists of catching-up economies that rely to a larger degree on manufacturing. The sophistication of their export portfolio is markedly higher. They produce for global value chains rather than for final demand directly. However, their servitization share is lower than in service-driven catching-up economies, except the high-tech service share which is marginally higher in manufacturing-driven than in service-driven catching-up economies. Countries assigned to this class are for instance Hungary, the Czech Republic, Slovenia or South Korea.

Class IV comprises developed economies that implement a service-driven economic model. Both the manufacturing share and the sophistication of the export portfolio are lower than in manufacturing-driven economies. In contrast, the mean values of the shares of high-tech services, knowledge-intensive market services and of total services are higher. Countries such as the United States, United Kingdom, the Netherlands or Belgium are assigned to Class IV.

Class V is a group of well-developed, manufacturing-based economies. This group has the highest value of product sophistication and the group's sectoral labor productivity is also slightly higher than in Class IV. Countries in this group are for instance Japan, Germany, Austria or Finland.

Class VI is required to control for sectors that can be regarded as outliers due to the specific industry structure. For instance, many sectors of Luxembourg are clustered in this group. The underlying economic model is driven by the financial sector and administrative bodies of the EU.

Eventually, there are some observations across the classes. The output share that is directly absorbed by final demand is substantially lower in catching-up economies with an industry structure that is dominated by manufacturing sector. This mirrors the manufacturing-driven catching-up model that countries in CEE pursued. There is no difference between the classes with respect to the upstream accumulation of services along the value chain. Across regimes, product sophistication, a proxy for capabilities, is - by construction - positively related to the manufacturing share.

5. Conclusions

The aim of this paper was to provide a bird's eye view on servitization across countries and industries. We draw on the supply tables that underlie the World-Input-Output-Tables (WIOT). The supply tables describe the supply the goods and services which are produced in the domestic economy. This allows us to construct a measure of the intensity of servitization provided by broadly defined manufacturing sectors or industry groups, respectively. We next argued that servitization itself can take on multiple forms, which is why we used a Eurostat taxonomy defining knowledge-intensive services to consider the type of services. This allowed us to compute the composition of services provided by manufacturing. While slightly more than half of all services offered by manufacturing sectors are not knowledge-intensive at all, there is a slight trend towards the increased provision of high-tech services. The shares of other knowledge-intensive services, such as market or financial services, remain rather stable. We find that knowledge intensive financial services play a minor role in the product range of

manufacturing industries. This does not support findings on value chains that document an increase in financial content per unit of output produced (Dávila-Fernández and Punzo 2020).

On average, we found service shares to vary significantly across countries and manufacturing industries. The servitization shares only changed little over time, so that time effects hardly explain any variance. This is not in line with input-output data until the mid-2000s which report an increase in both inputs and outputs of services for manufacturing sectors (Falk and Peng 2013).

The management literature has long recommended servitization as a means in increase performance (Neely 2008). Hence, we regress productivity growth on the lagged changes of the servitization indicators using a cross-country, cross-industry fixed effects panel. The regression results do not establish a systematic relationship. The coefficients are largely insignificant, which is in line with parts of the previous firm-level literature, which struggles to establish a relationship between servitization and economic performance (Eloranta and Turunen 2015; Neely 2008; Gustafsson, Edvardsson, and Brax 2005). This supports the notion that simply 'moving downstream' into services is not a viable strategy, which is, however, what some of the business strategy literature recommends (Davies 2004). The provision of services also links to employment. A study for France linked increase in services to employment growth (Crozet and Milet 2017). Using the same regression framework, we seek to explain sectoral employment growth by changes in servitization and again find no statistically significant effect.

If the notable differences in the degree of servitization are unrelated to growth but still differ across countries and sectors, we argued that servitization is contingent on the economic environment. This is, the economic model in which in which a sector operates shapes the intensity of servitization. Implementing a Latent Class Analysis, we identified six economic classes, of which four shape the degree of services that a sector offers. The economic regimes are service-oriented catching-up economies, manufacturing-oriented catching-up

economies, developed service-based economies and developed manufacturing-based economies. Two additional classes control for statistical outliers with respect to their peculiar economic model. One class captures developing economies and another class countries that are extremely reliant on services (e.g., Luxembourg).

Servitization, and especially the provision of high-tech knowledge intensive services, tends to increase with the level of economic development. This effect is more pronounced in economies where the manufacturing share is smaller, i.e. where the economy-wide service share is more prominent. There are no differences in the share of services sourced along the value chain across regimes. Altogether, these results indicate shifts in the demand pattern that occur across economic regimes (Buera and Kaboski 2012). The increase in high-tech services with GDP per capita may indicate a greater degree specialization (Timmer, Miroudot, and de Vries 2019)

Literature

Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry. 2012. "Measuring the Upstreamness of Production and Trade Flows." *The American Economic Review* 102 (3): 412–16.

Baines, Tim S, Howard W Lightfoot, Ornella Benedettini, and John M Kay. 2009a. "The Servitization of Manufacturing: A Review of Literature and Reflection on Future Challenges." *Journal of Manufacturing Technology Management*.

Baines, Tim S., Howard W. Lightfoot, Ornella Benedettini, and John M. Kay. 2009b. "The Servitization of Manufacturing: A Review of Literature and Reflection on Future Challenges." *Journal of Manufacturing Technology Management* 20 (5): 547–67.

Berman, Saul J, Lynn Kesterson-Townes, Anthony Marshall, and Rohini Srivathsa. 2012. "How Cloud Computing Enables Process and Business Model Innovation." *Strategy & Leadership*.

Bernard, Andrew B, Valerie Smeets, and Frederic Warzynski. 2017. "Rethinking Deindustrialization." *Economic Policy* 32 (89): 5–38.

Bowen, D, C Siehl, and B Schneider. 1991. "Developing Service-Oriented Manufacturing." *Making Organizations Competitive, Jossey-Bass, San Francisco, CA*, 397–418.

Buera, Francisco J, and Joseph P Kaboski. 2012. "The Rise of the Service Economy." *American Economic Review* 102 (6): 2540–69.

Bustinza, Oscar F., Ali Ziaee Bigdeli, Tim Baines, and Cindy Elliot. 2015. "Servitization and Competitive Advantage: The Importance of Organizational Structure and Value Chain Position." *Research-Technology Management* 58 (5): 53–60. https://doi.org/10.5437/08956308X5805354.

Crozet, Matthieu, and Emmanuel Milet. 2017. "Should Everybody Be in Services? The Effect of Servitization on Manufacturing Firm Performance." *Journal of Economics & Management Strategy* 26 (4): 820–41. https://doi.org/10.1111/jems.12211.

Cuaresma, Jesus Crespo, Bettina Grün, Paul Hofmarcher, Stefan Humer, and Mathias Moser. 2016. "Unveiling Covariate Inclusion Structures in Economic Growth Regressions Using Latent Class Analysis." *European Economic Review* 81: 189–202.

Dachs, Bernhard, Sabine Biege, Martin Borowiecki, Gunter Lay, Angela Jäger, and Doris Schartinger. 2014. "Servitisation of European Manufacturing: Evidence from a Large Scale Database." *The Service Industries Journal* 34 (1): 5–23.

Davies, Andrew. 2004. "Moving Base into High-Value Integrated Solutions: A Value Stream Approach." *Industrial and Corporate Change* 13 (5): 727–56. https://doi.org/10.1093/icc/dth029.

Dávila-Fernández, Marwil J., and Lionello F. Punzo. 2020. "Financialisation as Structural Change: Measuring the Financial Content of *Things*." *Economic Systems Research* 32 (1): 98–120. https://doi.org/10.1080/09535314.2019.1643294.

De Backer, Koen, and Sébastien Miroudot. 2013. "Mapping Global Value Chains." OECD Trade Policy Papers 159. https://doi.org/10.1787/5k3v1trgnbr4-en.

Dietzenbacher, Erik, Bart Los, Robert Stehrer, Marcel Timmer, and Gaaitzen De Vries. 2013. "The Construction of World Input–Output Tables in the WIOD Project." *Economic Systems Research* 25 (1): 71–98.

Eggert, Andreas, Jens Hogreve, Wolfgang Ulaga, and Eva Muenkhoff. 2011. "Industrial Services, Product Innovations, and Firm Profitability: A Multiple-Group Latent Growth Curve Analysis." *Industrial Marketing Management* 40 (5): 661–70. https://doi.org/10.1016/j.indmarman.2011.05.007.

Eloranta, Ville, and Taija Turunen. 2015. "Seeking Competitive Advantage with Service Infusion: A Systematic Literature Review." *Journal of Service Management* 26 (3): 394–425. https://doi.org/10.1108/JOSM-12-2013-0359.

Erumban, Abdul Azeez, Reitze Gouma, Gaaitzen de Vries, Klaas de Vries, and Marcel Timmer. 2012. "Sources for National Supply and Use Table Input Files." *WIOD*, April, 32.

European Commission. 2020. "European Innovation Scoreboard Edition 2020." 2020. https://ec.europa.eu/docsroom/documents/42981.

Falk, Martin, and Fei Peng. 2013. "The Increasing Service Intensity of European Manufacturing." *The Service Industries Journal* 33 (15–16): 1686–1706. https://doi.org/10.1080/02642069.2011.639872.

Fang, Eric (Er), Robert W Palmatier, and Jan-Benedict E M Steenkamp. 2008. "Effect of Service Transition. Strategies on Firm Value." *Journal of Marketing* 72 (5): 1–14.

Friesenbichler, Klaus, Agnes Kügler, and Andreas Reinstaller. 2021. "Does Value Chain Integration Dampen Producer Price Developments? Evidence from the European Union." *The World Economy* 44 (1): 89–106. https://onlinelibrary.wiley.com/doi/10.1111/twec.12993.

Gustafsson, Anders, Bo Edvardsson, and Saara Brax. 2005. "A Manufacturer Becoming Service Provider–Challenges and a Paradox." *Managing Service Quality: An International Journal*.

Hagenaars, Jacques A, and Allan L McCutcheon. 2002. *Applied Latent Class Analysis*. Cambridge University Press.

Herrendorf, Berthold, Richard Rogerson, and Ákos Valentinyi. 2013. "Two Perspectives on Preferences and Structural Transformation." *American Economic Review* 103 (7): 2752–89. https://doi.org/10.1257/aer.103.7.2752.

Hidalgo, César A, and Ricardo Hausmann. 2009. "The Building Blocks of Economic Complexity." *Proceedings of the National Academy of Sciences* 106 (26): 10570–75.

Johnson, Robert C, and Guillermo Noguera. 2012. "Accounting for Intermediates: Production Sharing and Trade in Value Added." *Journal of International Economics* 86 (2): 224–36.

Klimek, Peter, Ricardo Hausmann, and Stefan Thurner. 2012. "Empirical Confirmation of Creative Destruction from World Trade Data." *PloS One* 7 (6): e38924.

Kowalkowski, Christian, Heiko Gebauer, and Rogelio Oliva. 2017. "Service Growth in Product Firms: Past, Present, and Future." *Industrial Marketing Management* 60 (January): 82–88. https://doi.org/10.1016/j.indmarman.2016.10.015.

Lazarsfeld, Paul F. 1950. "The Logical and Mathematical Foundation of Latent Structure Analysis." *Studies in Social Psychology in World War II Vol. IV: Measurement and Prediction*, 362–412.

Lightfoot, H., T. Baines, and P. Smart. 2013. "The Servitization of Manufacturing: Investigating Contributionsto Knowledge Production." *International Journal of Operations & Production Management* 33 (11/12): 1408–34.

Neely, Andy. 2008. "Exploring the Financial Consequences of the Servitization of Manufacturing." *Operations Management Research* 1 (2): 103–18. https://doi.org/10.1007/s12063-009-0015-5.

Ochel, Wolfgang, and Manfred Wegner. 2019. *Service Economies in Europe: Opportunities for Growth*. New York, Abingdon: Routledge, Taylor and Francis. https://books.google.at/books?hl=de&lr=&id=FGQPEAAAQBAJ&oi=fnd&pg=PP1&dq=%22service+demand%22+economic+growth+club++&ots=2g0kuQ24G-&sig=n3HwzkuZpVtY_Q9A-CCJziM2BdQ#v=onepage&q=%22service%20demand%22%20economic%20growth%20club&f=false.

Oliva, Rogelio, and Robert Kallenberg. 2003. "Managing the Transition from Products to Services." *International Journal of Service Industry Management* 14 (2): 160–72. https://doi.org/10.1108/09564230310474138.

Peneder, Michael. 2009. *Sectoral Growth Drivers and Competitiveness in the European Union*. Office for Official Publications of the European Communities.

Peneder, Michael, and Gerhard Streicher. 2017. "De-Industrialization and Comparative Advantage in the Global Value Chain." *Economic Systems Research*, 1–20.

Reinstaller, Andreas, and Peter Reschenhofer. 2019. "The Impact of the Scope of Technological Search on Path-Dependence in Export Specialization: Evidence for European Countries." *Industrial and Corporate Change* 28 (6): 1611–35. https://doi.org/10.1093/icc/dtz026.

Rowthorn, Robert, and Ramana Ramaswamy. 1999. "Growth, Trade, and Deindustrialization." *IMF Staff Papers* 46 (1): 18–41.

Timmer, Marcel P, Abdul Azeez Erumban, Bart Los, Robert Stehrer, and Gaaitzen J de Vries. 2014. "Slicing up Global Value Chains." *The Journal of Economic Perspectives* 28 (2): 99–118.

Timmer, Marcel P, Sébastien Miroudot, and Gaaitzen J de Vries. 2019. "Functional Specialisation in Trade." *Journal of Economic Geography* 19 (1): 1–30.

Vandermerwe, Sandra, and Juan Rada. 1988. "Servitization of Business: Adding Value by Adding Services." *European Management Journal* 6 (4): 314–24.

Wise, Richard, and Peter Baumgartner. 1999. "Go Downstream." *Harvard Business Review* 77 (5): 133–133.

Tables and Figures

Table 1: Knowledge-intensive services: descriptive statistics

	Service share	HTKI	KIMS	OKIS	KIFS	Not KIS
Mean	9.86	1.66	1.66	0.77	0.00	5.76
Median	5.76	0.33	0.43	0.00	0.00	3.78
Std.Dev.	13.14	4.24	4.06	5.36	0.03	7.19

Note: This table provides the descriptive statistics for the share of services provided by manufacturing in the pooled sample and an ANOVA using sector, country and time effects as explanatory variables. HTKI denotes "High-tech knowledge-intensive services", KIMS "Knowledge-intensive market services (excluding financial intermediation and high-tech services)", OKIS "Other knowledge-intensive services" and KIFS "Knowledge-intensive financial services".

Table 2: Knowledge-intensive services: ANOVA results

	Service share	HTKI	KIMS	OKIS	KIFS	Not KIS
R²	0.45	0.31	0.22	0.23	0.15	0.42
Sector	0.19	0.15	0.07	0.14	0.04	0.10
Country	0.26	0.15	0.15	0.09	0.11	0.32
Year	0.01	0.01	0.00	0.00	0.00	0.01

Note: This table provides the ANOVA results that show the fraction of the variance explained by sector, country and time effects. HTKI denotes "High-tech knowledge-intensive services", KIMS "Knowledge-intensive market services (excluding financial intermediation and high-tech services)", OKIS "Other knowledge-intensive services" and KIFS "Knowledge-intensive financial services".

Table 3: Growth regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Emp. Gr.	LP gr.	TFP gr.	Emp. Gr.	LP Gr.	TFP Gr.	Emp. Gr.	LP. GR	TFP GR.
	NMS	NMS	NMS	OMS	OMS	OMS	OECD	OECD	OECD
HTKI share, log.gr., lag	0.07	-0.21***	-0.12	0.02	0.02	0.02	0.02	0.02	0.03
	(0.082)	(0.080)	(0.158)	(0.014)	(0.021)	(0.024)	(0.014)	(0.021)	(0.023)
KIMS share, log.gr., lag	-0.08	0.09	-0.05	-0.02	0.00	-0.02	-0.02	-0.00	-0.02
	(0.063)	(0.065)	(0.084)	(0.015)	(0.022)	(0.022)	(0.015)	(0.022)	(0.021)
KIFS share, log.gr., lag	0.12	0.22	0.11	-0.02	0.03	-1.67	-0.03	0.06	-1.96
	(0.173)	(0.519)	(0.347)	(0.298)	(0.462)	(6.016)	(0.299)	(0.469)	(5.726)
OKIS share, log.gr., lag	0.04	-0.07	-0.09	-0.01	0.01	0.02	-0.01	0.01	0.02
	(0.051)	(0.066)	(0.141)	(0.014)	(0.046)	(0.042)	(0.014)	(0.046)	(0.043)
Capital index, log.gr.	-0.00	0.99***		0.07***	0.61***		0.07***	0.61***	
	(0.003)	(0.006)		(0.024)	(0.113)		(0.024)	(0.110)	
Output gap, log.gr,	0.05***	0.04**	0.36**	0.06***	0.10***	0.10**	0.06***	0.11***	0.12**
	(0.014)	(0.016)	(0.166)	(0.015)	(0.033)	(0.052)	(0.015)	(0.032)	(0.049)
Sector effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Constant	-0.01	-0.01	0.02	-0.01	0.00	0.01	-0.01	0.00	0.01
	(0.016)	(0.021)	(0.026)	(0.006)	(0.025)	(0.013)	(0.006)	(0.025)	(0.012)
Observations	1,833	1,832	336	1,956	1,956	1,422	2,099	2,099	1,552
R-squared	0.104	0.968	0.135	0.184	0.321	0.154	0.195	0.319	0.153

Note: This table shows the results of the growth regressions. Servitization as a share of value added does not impact sectoral growth of employment, labor productivity or TFP. HTKI denotes "High-tech knowledge intensive services", KIMS "Knowledge-intensive market services", KIFS "Knowledge-intensive financial services" and OKIS "Other knowledge-intensive services". Robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Growth regression results across country groups

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Emp. Gr.	LP gr.	TFP gr.	Emp. Gr.	LP Gr.	TFP Gr.	Emp. Gr.	LP. GR	TFP GR.
	NMS	NMS	NMS	OMS	OMS	OMS	OECD	OECD	OECD
HTKI share, log.gr., lag	0.07	-0.21**	-0.11	0.02	0.02	0.02	0.02	0.02	0.03
	(0.082)	(0.081)	(0.157)	(0.014)	(0.021)	(0.024)	(0.014)	(0.021)	(0.023)
KIMS share, log.gr., lag	-0.08	0.10	-0.05	-0.02	0.00	-0.02	-0.02	-0.00	-0.02
	(0.063)	(0.066)	(0.084)	(0.015)	(0.022)	(0.022)	(0.015)	(0.022)	(0.021)
KIFS share, log.gr., lag	0.13	0.25	0.11	-0.02	0.04	-1.67	-0.03	0.06	-1.97
	(0.173)	(0.518)	(0.346)	(0.298)	(0.464)	(6.020)	(0.299)	(0.470)	(5.728)
OKIS share, log.gr., lag	0.04	-0.08	-0.09	-0.01	0.01	0.02	-0.01	0.01	0.02
	(0.051)	(0.066)	(0.140)	(0.014)	(0.046)	(0.042)	(0.014)	(0.046)	(0.043)
Capital index, log.gr.	-0.00	0.99***		0.06***	0.61***		0.07***	0.61***	
	(0.003)	(0.006)		(0.024)	(0.111)		(0.024)	(0.108)	
Output gap, log.gr,	0.05***	0.04**	0.36**	0.06***	0.10***	0.10**	0.06***	0.10***	0.12**
	(0.014)	(0.016)	(0.165)	(0.015)	(0.032)	(0.051)	(0.015)	(0.032)	(0.048)
Sector effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Time effects	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,840	1,839	336	1,956	1,956	1,422	2,099	2,099	1,552
R-squared	0.109	0.968	0.148	0.248	0.323	0.155	0.261	0.320	0.154

Note: This table shows the results of the growth regressions across country groups. NMS stands for New Member States (countries that acceded the EU after 2004) and OMS for "Old Member States" (countries that were EU Members prior to 2004). Servitization as a share of value added does not impact sectoral growth of employment, labor productivity or TFP, with the only exception of NMS, where increases in the provision of high-tech services has a negative effect on labor productivity growth. HTKI denotes "High-tech knowledge intensive services", KIMS "Knowledge-intensive market services", KIFS "Knowledge-intensive financial services" and OKIS "Other knowledge-intensive services". Robust standard errors are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

*Table 5: Descriptive statistics and correlation matrix of covariates of the LCA*

		Mean	St.dev.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	GDP p.c. (log)	3.20	0.88	1								
(2)	Labour prod. (log)	2.87	1.67	0.6105*	1							
(3)	Manufacturing share	0.21	0.06	-0.1514*	-0.1855*	1						
(4)	Output in final demand, share	0.29	1.38	-0.0158	-0.0141	0.0695	1					
(5)	Sophistication	1.13	0.64	0.6535*	0.5185*	0.4234*	0.0228	1				
(6)	HTKI	2.64	3.98	0.1611*	0.0608	-0.0169	0.0325	0.1134	1			
(7)	KIMS	2.64	3.75	0.1873*	0.0486	-0.1083	-0.0476	0.0845	0.3425*	1		
(8)	Other Services offered	6.69	6.73	0.1811*	0.0029	-0.1722*	0.0368	-0.0419	0.4344*	0.3767*	1	
(9)	Backward, serv.	0.30	0.05	0.0594	0.0866	-0.127	-0.1167	0.0568	0.1	0.1231	0.0985	1

Table 6: Marginal means across latent classes

	I	II	III	IV	V	VI
GDP p.c. in td. EUR	6.26	19.89	16.45	49.42	48.34	52.15
LP, in td EUR	1.39	21.35	7.14	52.70	54.21	31.04
Manufacturing share	0.21	0.16	0.29	0.17	0.26	0.17
Sophistication	0.34	0.59	1.36	1.49	2.00	1.42
Services sourced	0.29	0.32	0.29	0.31	0.31	0.31
Output in final demand	0.43	0.44	0.22	0.37	0.35	0.39
HTKI, share	1.50	2.07	2.28	2.68	2.20	16.16
KIMS, share	1.68	2.36	1.86	2.98	2.49	11.44
Other services, share	5.92	6.18	5.12	5.88	5.94	32.23

Note: The table provides both the GDP per capita and the sectoral labor productivity in thousand EURO in real terms (base year 2010). In the LCA, these variables were estimated in logarithmic terms.

Figure 1: Latent Class Analysis
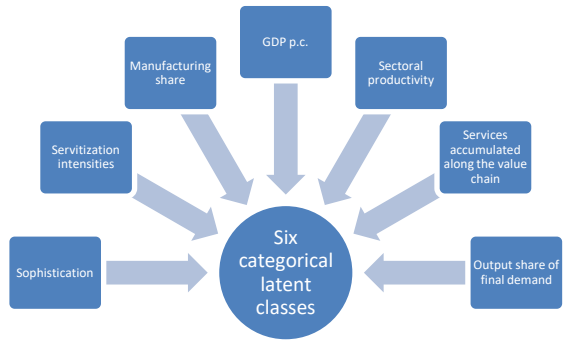
Annex

We use the World Input-Output Tables (WIOT), which in their construction rely on supply-use tables. These allow identifying the service content of industries. The WIOTs have an industry industry format as many applications require such a square matrix reflecting the economic linkages across industries. They are built from national supply and use tables which contain data on industries and products. The products are classified according to the CPA and cover 56 product categories following the primary outputs from our 56 sectors. Secondary outputs of industries are accounted for in the supply tables.[9]

Table A7: Sector coverage

Code	Description
CPA_A01	Products of agriculture, hunting and related services
CPA_A02	Products of forestry, logging and related services
CPA_A03	Fish and other fishing products; aquaculture products; support services to fishing
CPA_B	Mining and quarrying
CPA_C10-C12	Food products, beverages and tobacco products
CPA_C13-C15	Textiles, wearing apparel and leather products
CPA_C16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
CPA_C17	Paper and paper products
CPA_C18	Printing and recording services
CPA_C19	Coke and refined petroleum products
CPA_C20	Chemicals and chemical products
CPA_C21	Basic pharmaceutical products and pharmaceutical preparations
CPA_C22	Rubber and plastics products
CPA_C23	Other non-metallic mineral products
CPA_C24	Basic metals
CPA_C25	Fabricated metal products, except machinery and equipment
CPA_C26	Computer, electronic and optical products

---

[9] See http://www.wiod.org/database/nat_suts16 (accessed on April 10, 2021).

CPA_C27	Electrical equipment
CPA_C28	Machinery and equipment n.e.c.
CPA_C29	Motor vehicles, trailers and semi-trailers
CPA_C30	Other transport equipment
CPA_C31_C32	Furniture; other manufactured goods
CPA_C33	Repair and installation services of machinery and equipment
CPA_D35	Electricity, gas, steam and air-conditioning
CPA_E36	Natural water; water treatment and supply services
CPA_E37-E39	Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services
CPA_F	Constructions and construction works
CPA_G45	Wholesale and retail trade and repair services of motor vehicles and motorcycles
CPA_G46	Wholesale trade services, except of motor vehicles and motorcycles
CPA_G47	Retail trade services, except of motor vehicles and motorcycles
CPA_H49	Land transport services and transport services via pipelines
CPA_H50	Water transport services
CPA_H51	Air transport services
CPA_H52	Warehousing and support services for transportation
CPA_H53	Postal and courier services
CPA_I	Accommodation and food services
CPA_J58	Publishing services
CPA_J59_J60	Motion picture, video and television programme production services, sound recording and music publishing; programming and broadcasting services
CPA_J61	Telecommunications services
CPA_J62_J63	Computer programming, consultancy and related services; information services
CPA_K64	Financial services, except insurance and pension funding
CPA_K65	Insurance, reinsurance and pension funding services, except compulsory social security
CPA_K66	Services auxiliary to financial services and insurance services
CPA_L68	Real estate services
CPA_M69_M70	Legal and accounting services; services of head offices; management consulting services

CPA_M71	Architectural and engineering services; technical testing and analysis services
CPA_M72	Scientific research and development services
CPA_M73	Advertising and market research services
CPA_M74_M75	Other professional, scientific and technical services; veterinary services
CPA_N77	Rental and leasing services
CPA_N78	Employment services
CPA_N79	Travel agency, tour operator and other reservation services and related services
CPA_N80-N82	Security and investigation services; services to buildings and landscape; office administrative, office support and other business support services
CPA_O84	Public administration and defence services; compulsory social security services
CPA_P85	Education services
CPA_Q86	Human health services
CPA_Q87_Q88	Social work services
CPA_R90-R92	Creative, arts and entertainment services; library, archive, museum and other cultural services; gambling and betting services
CPA_R93	Sporting services and amusement and recreation services
CPA_S94	Services furnished by membership organisations
CPA_S95	Repair services of computers and personal and household goods
CPA_S96	Other personal services
CPA_T	Services of households as employers; undifferentiated goods and services produced by households for own use
CPA_U	Services provided by extraterritorial organisations and bodies
GO	Grosst Output
IMP_adj	Cif/ fob adjustments on imports
PURR	Direct purchases abroad by residents
GO_adj	Gross Output adjusted

Table A8: Service taxonomies, Eurostat

The following economic activity sectors are defined as knowledge-intensive services, abbreviated as KIS (NACE Rev.2 codes - 2-digit level between brackets):

- High-tech knowledge-intensive services:

    - Motion picture, video and television programme production, sound recording and music publishing activities (59);
    - Programming and broadcasting activities (60);
    - Telecommunications (61);
    - Computer programming, consultancy and related activities (62);
    - Information service activities (63);
    - Scientific research and development (72)

- Knowledge-intensive market services (excluding financial intermediation and high-tech services):

    - Water transport (50);
    - Air transport (51);
    - Legal and accounting activities (69);
    - Activities of head offices; management consultancy activities (70);
    - Architectural and engineering activities; technical testing and analysis (71);
    - Advertising and market research (73);
    - Other professional, scientific and technical activities (74);
    - Employment activities (78);
    - Security and investigation activities (80)

- Knowledge-intensive financial services:

    - Financial service activities, except insurance and pension funding (64);
    - Insurance, reinsurance and pension funding, except compulsory social security (65);
    - Activities auxiliary to financial services and insurance activities (66)

- Other knowledge-intensive services:

    - Publishing activities (58);
    - Veterinary activities (75);
    - Public administration and defence; compulsory social security (84);
    - Education (85);
    - Human health activities (86);
    - Residential care activities (87);
    - Social work activities without accommodation (88);
    - Creative, arts and entertainment activities (90);
    - Libraries, archives, museums and other cultural activities (91);
    - Gambling and betting activities (92);
    - Sports activities and amusement and recreation activities (93)