# An analysis of the determinants of Trade in Services in the European Union between 2005 and 2019: Using a quantile regression approach.

**Ziyaad Nazir Ebrahim (PhD)**

The University of Adelaide (Adelaide, Australia)

Co-funded by the
Erasmus+ Programme
of the European Union

# An analysis of the determinants of Trade in Services in the European Union between 2005 and 2019: Using a quantile regression approach.

# Table of Contents

## 1. Introduction

The European Union (EU) has established itself as prolific global services trader. Between 2005 and 2018, its global share of trade in services was between 16 per cent and 18 per cent, compared to the United States (US) which was between 5 per cent and 6 per cent, China between 1.3 per cent and 3.2 per cent and Japan between 1.3 per cent and 1.9 per cent.

The EU has a long history of promoting economic integration amongst its membership. The Treaty of Rome (1957) which established it and laid much of the groundwork for the present-day EU, enshrined the free movement of goods, services, people and capital (Veld, 2019). The operationalisation of the Treaty, began with the creation of the EU Customs Union through the implementation of the Common External Tariff (CET) for goods in 1968 and eventually the Single European Act (1986), which transitioned into a single market by 1992. Today, this market comprises of approximately 450 million and made up of 27 economies[1] (Sunesen and Thelle, 2018).

According to data, the best performers in the EU during this period, were Germany, France, Netherlands, Ireland and Italy; altogether they accounted for 57.9 per cent of the EU's total trade in services. It also suggests that the lowest performers were the smallest transition economies; Slovenia, Lithuania, Estonia and Latvia. The main motivation for this study, is to understand the determinants of trade in services (import and export) in the EU and to explain to some extent the heterogeneity in performance amongst the EU membership. Many empirical studies utilise the mean-based Ordinary Least Squares (OLS) regression method to understand the causal effects (Bilici, 2014). The quantile regression method which was first introduced by Koenker and Basset (1978), allows us to overcome the disadvantages associated with the central distribution of the mean framework and we tend lose the causal effects that are present in the tail-end of the distribution (Hao and Naiman, 2007).

This study identifies 8 variables which have an effect on both imports and exports of services in the EU. They are regressed using the OLS, Fixed (FE) and Random Effects (RE) (under the Hausman test) methods. To provide a better understanding of the entire distribution, the quantile regression method is used and the quantiles chosen are; $10^{th}$, $25^{th}$, $50^{th}$, $75^{th}$ and $90^{th}$. The results are available in Tables 1 and 2. This paper is divided into five sections; the next section provides an overview of trade in services in the EU, the third section provides a

[1] Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

literature review on the determinants of trade in services, fourth section is the model specification and results and the fifth section is the conclusion.

## 2. Trade in Services in the European Union between 2005 and 2019

The free movement of goods, services, people and capital within the EU was enshrined in the Treaty of Rome (1953) and by 1968, the EU Customs Union was established through the implementation of a Common External Tariff (CET) for goods (Veld, 2019). The Single European Act (1986) transformed the EU from a common market to a single market by 1992.

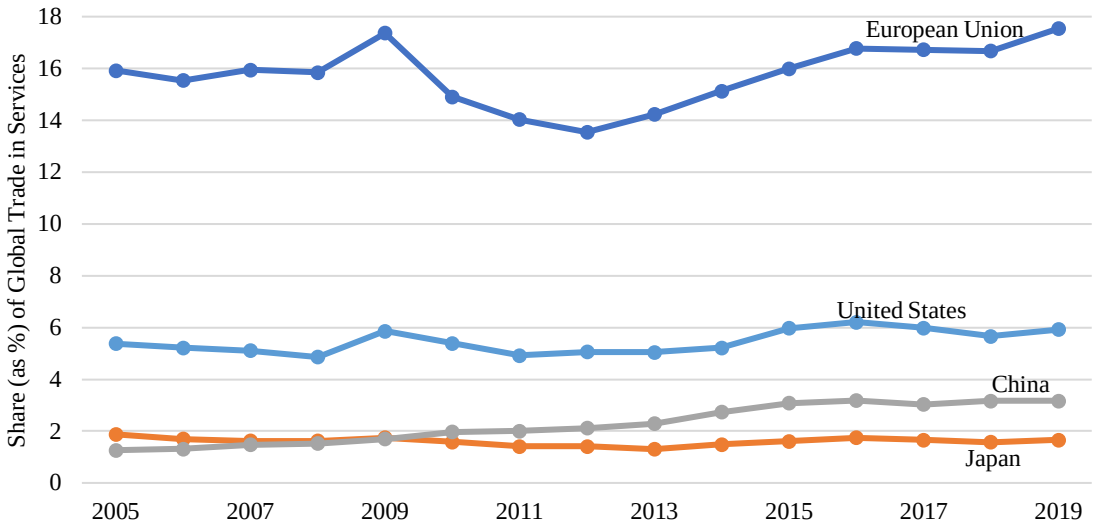
Today, the single market has a combined population of more than 450 million people and offers EU business the opportunity to specialise, gain scale and improve efficiency and offers EU consumers, while consumers benefit from greater choices, lower costs and better quality through competition (Sunesen and Thelle, 2018). There are four gaps which have been identified; adequacy – trade in services regulations are outdated; implementation – the EU Services Directive is not fully implemented; enforcement – given that the Directive is not fully implemented, it is difficult to enforce; and; reality – country differences in the way the goods and services are traded within the EU.

### 2.1 The EU's global share of trade in services

Global trade in services in 2005 was worth US$ 12.9 trillion and by 2019 it reached US$ 24.7 trillion. The trade in services data indicates EU has the largest share of global trade in services. Figure 1 shows that its share was substantially higher than the other major global services traders; United States (US), China and Japan between 2005 and 2019. It indicates that it had a 15.9 per cent share in 2005 in global trade in services and by 2009, it grew to 17.4 per cent.

It however, declined in the subsequent three years to reach 13.5 per cent in 2012. In 2013, it began an upward trajectory and by 2016 it reached 16.7 per cent and remained at that level until 2018. It then rose to reach 17.5 per cent in 2019. During the same time period of time, US' share fluctuated between 5 per cent and 6 per cent annually. While China's share was between 1.3 per cent and 3.2 per cent, annually. Whereas, Japan's share moved between 1.3 per cent and 1.9 per cent, on an annual basis.

**Figure 1: European Union's share of global trade in services from 2005 to 2019**



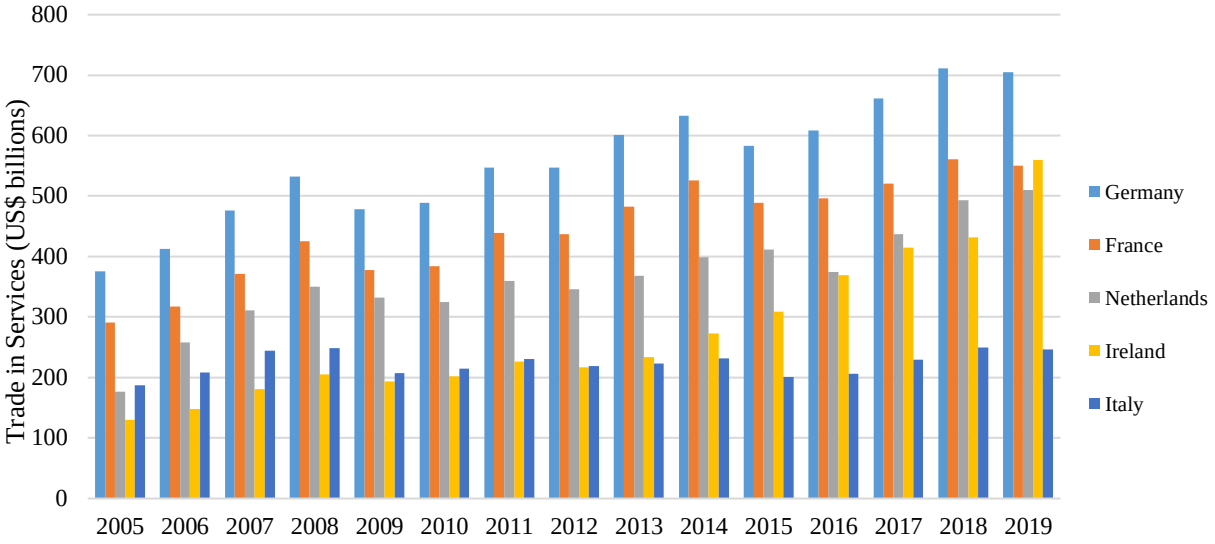

Source: UNCTAD (2005 – 2019) and Author's calculations

2.2 Best and lowest performers in the EU

Figure 2 indicates the best performers between 2005 and 2019 in the EU. The data shows that during this period Germany was the strongest performer, in 2005, the country's total trade in services was worth US$ 375.4 billion and by 2019, it reached US$ 705.3 billion – almost a two-fold increase. Whereas, for the second-best performer; France, its total trade in services grew from US$ 290.8 billion in 2005 to US$ 550.5 billion in 2019.

The data also suggests that Netherlands' total trade in services grew by almost three times, increasing from US$ 176.5 billion in 2005 to US$ 510.5 billion in 2019. Ireland's total trade in services experienced the highest growth rate within this period of time, according to the data. It grew from US$ 130.1 billion to US$ 560.1 billion – a four-fold increase. Italy's total services trade experienced the lowest growth within this period of time, it increased from US$ 186.8 billion in 2005 and by 2019, it reached US$ 246.2 billion.

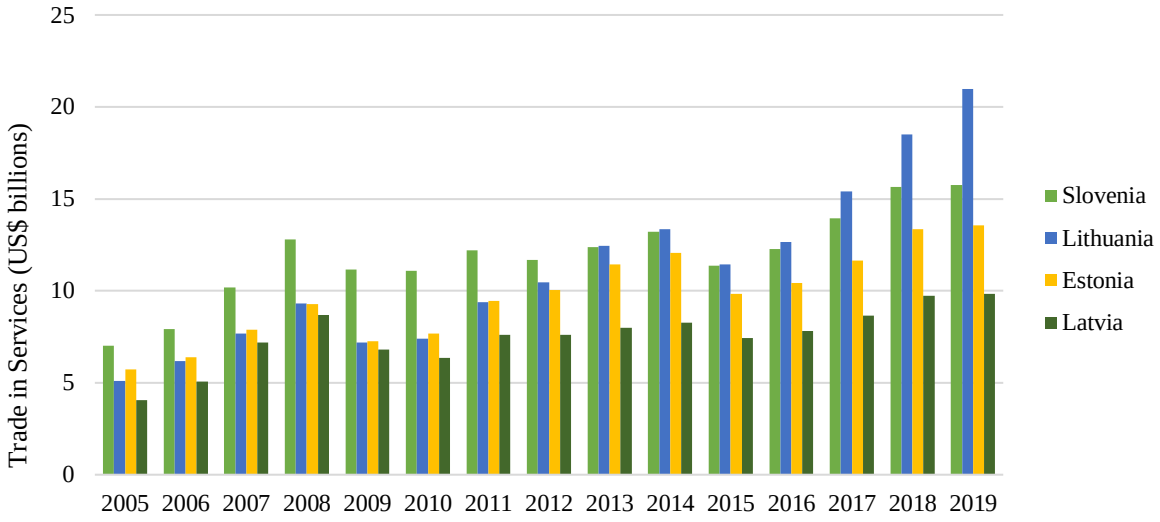
**Figure 2: Best Performers in the EU between 2005 and 2019**




Source: UNCTAD (2005 – 2019) and Author's calculations

Figure 3 shows the lowest performers in the EU between 2005 and 2019. The worst performer within this group was Latvia, its total trade in services increased from US$ 4.1 billion in 2005 to US$ 9.8 billion in 2019.

**Figure 3: Lowest Performers in the EU between 2005 and 2019**

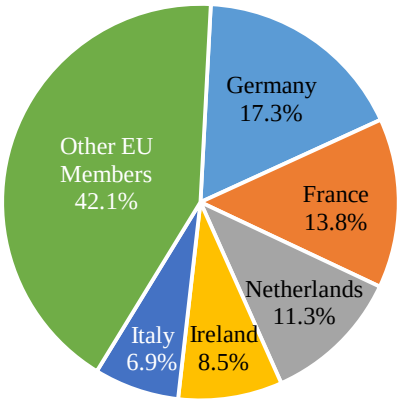



Source: UNCTAD (2005-2019) and Author's calculations

The best performer amongst this group was Lithuania, its total trade in services grew from US$ 5.1 billion in 2005 to US$ 21 billion in 2019 – a four-fold increase. Slovenia's total trade in services expanded by two-fold, from US$ 7 billion to US$ 15.7 billion during

this period of time. Estonia's total trade in services increased from US$ 5.7 billion in 2005 to US$ 13.6 billion in 2019.

**Figure 4: Share of Trade in Services in the EU between 2005 and 2019**




Source: UNCTAD (2005-2019) and Author's calculations

The data in Figure 4 indicates the share of trade in services in EU between 2005 and 2009. It shows that these five Members of the EU account for 57.9 per cent of the EU's total trade in services during this period. Germany accounted for 17.3 per cent; France was 13.8 per cent; Netherlands 11.3 per cent; Ireland 8.5 per cent; and; Italy 6.69 per cent.

## 3. Determinants of Trade in Services

The World Trade Organization's General Agreement on Trade in Services (GATS) recognises four modes of supply for services. The Agreement, itself does not specify any measure that constitutes a barrier to trade in services. However, provisions of GATS Article XVI:2 allows WTO Members to specify six measures[2] that can apply across all service sectors (horizontally) scheduled or in all four modes of supply restricting market access. While, GATS Article XVII allows for the discrimination between national and foreign service suppliers, although, these measures need to be specified in their respective WTO schedules. GATS Article XVI also identifies an economic needs test (ENT) as barrier to trade but allows the

[2] (a)limitations on the number of service suppliers; (b) limitations on the total value of transactions or assets; (c) limitations on the total number of services operations or on the total quantity of service output; (d) limitations on the total number of natural persons (in particular non-nationals) that may be employed in the sector (or the share of wages paid to foreign labour); (e) restrictions on, or requirements of, specific types of legal entity through which that service may be supplied; and;(f) limitations on the participation of foreign.

WTO Members to apply them in all four modes of supply, as long as they are specified in their Schedule of Commitments (UNCTAD, 1999).

There is also a recognition that Governments can implement "Domestic Regulations" (GATS Article VI) to regulate service sectors. However, they impede trade in services through a myriad of regulations deep inside the border (WTO, 2019). Saez *et al.* (2014) also point out that the foreign investment attractiveness and productivity of the domestic market is diminished through the lack of clarity and predictability in domestic laws. Research by Dee (2007), Schwellnus (2007), Nordas and Kox (2009) and Mirodot, Sauvage and Sheppard (2013) document the effects of regulations on trade in services. Sahoo, Dash and Mishra (2015) use the cumulative number of services-related Trade Agreements, as a proxy for regulatory barriers. Their thinking presupposes that the economies lower their barriers because of their legal commitments taken. For the purpose of this study, the regulatory quality (RQ) scores as provided under the World Bank's World Governance Indicators (WGI), has been included in this study because of the importance of regulations to trade in services. The scores reflect on the ability of the government to formulate and implement policies that are conducive to private sector development.

Services play a role in the different stages of the production process in the agriculture and manufacturing sectors and the distribution of final products. Hoekman and Mattoo (2011) find that high quality services from low-cost suppliers such as telecommunications, transport, finance and distribution enhance the development capacity of firms. Francois (1990a) and Greenfield (1966) suggest that services play a role in directing economic resources and facilitating specialization. Diaz-Mora Gandoy and González-Díaz (2018) suggest that domestic technology-intensive manufacturing firms depend on the foreign service providers in enhancing their export capacity.

The connectivity enabled by services allows industries to integrate into global production networks. Services are like "glue" that enables economic linkages and networks to operate both locally and internationally and without them, markets will also be more segmented (Low, 2015). Services enable connectivity over basic infrastructure that enables trade in goods, without them goods cannot be traded, digital platforms created by ICT service providers have become a backbone of the global e-commerce wholesale and retail trade such as Amazon and Alibaba (Roy, 2017). This study uses trade in goods (value of imports and exports of goods) as obtained from the WTO database.

Portugal-Perez and Wilson (2010) make a distinction between 'hard' and 'soft' infrastructure. They consider hard infrastructure to be physical structures such as electricity

power lines, railways and roads, soft infrastructure refers to ICT networks and other digitization technology. Roy (2017) suggests that there is a strong beneficial link between infrastructure and trade in services, it facilitates the storage and trading of services within and across borders. The variation between physical and soft infrastructure depends on the level of sophistication of trade in services. The traditional services sectors such as air, maritime and tourism require a high degree of physical infrastructure such as port facilities and hotels. Whereas, modern services such as banking and financial sectors require sufficient investment in ICT networks. To measure the technological progress, this study uses research and development (R&D) expenditure as percentage of Gross Domestic Product (GDP), as a proxy.

There are a number of studies which suggest that physical infrastructure does not necessarily boost trade. Research by Portugal-Perez and Wilson (2012) suggests that as income increases, physical infrastructure has a diminished impact on trade with the exception of ICT-related infrastructure. Martinez-Zarzoso and Nowak-Lehmann (2003) find that investment in infrastructure tends to favour exporters. While, Grigoriou (2007) mentions that benefits of improving infrastructure in landlocked economies are not fully realized because of the bargaining power and transport costs in transit economies. Digital platforms such as Upwork and Amazon MTurk allow low value projects to be traded and facilitate the transaction between customers and suppliers (WTO, 2019). For the purpose of this study, internet penetration has been used as a proxy for infrastructure quality.

Human resource capacity is seen as a source of comparative advantage in trade in services because it has an effect on the nature of the services that produced and traded within and across borders (Hoekmann and Mattoo, 2007). This is evidenced through research undertaken by Francois (1990b), Francois and Nelson (2002), Askenazy (2005), Lennon, Mirza and Nicoletti (2009) and Goldin (2014). A study by De and Raychaudhuri (2008) of India suggests that the demand for skilled workforce is skewed largely towards skilled labour in modern services such as finance, information technology and distribution. In addition, Mehta and Hassan (2012), UNCTAD (2013) and Petit (2017) point out that services export sector tends to favour skilled workers. This study uses the human capital index scores obtained from the Penn World Tables (PWT 10.0).

Economic development has a bearing on the level of sophistication in the production of goods and services. Anand, Mishra and Spatafora (2012) find Least Developed Countries (LDCs) have a lower level of export sophistication. In addition, Mishra, Lundstrom and Anand (2011) suggest that as the economies, services occupy a greater share of national output, it is however not well researched. The rapid expansion of digital technologies and the expansion

of the internet in the 1990s have significantly enhanced the nature, productivity and tradability of services (Ghani and Kharas, 2010). They also aid the process of offshoring (Aron and Singh, 2005, Elia, Massini and Narula, 2019). GDP per capita is used as a measure for economic development.

## 4. The Model Specification and Discussion of Results

The objective of this study seeks to understand the determinants of trade in services in the EU. Bilici (2014) explains that most empirical studies explain the causal effects through the mean based on the OLS regression method. Hao and Naiman (2007) point out that the quantile regression method overcomes the disadvantages associated with the central distribution of the mean framework and there is a tendency to lose information on the causal effects that are present towards the tail-end of the distribution. This study employs the quantile regression approach, which was first introduced by Koenker and Basset (1978).

The import and export models will be regressed using Ordinary Least Squares (OLS) and Fixed and Random Effects (under the Hausman Test) methods. The results have been reproduced in Tables 1 and 2.

The conditional quantile in the regression model as proposed by Buchinsky (1998b), which can be written as follows:

$$y_i = x'_i\beta_\theta + u_{i\theta} \quad (1)$$

Where; *y* is the dependent variable, *x* is the vector for explanatory variables, $\beta_\theta$ is the vector of unknown parameters which is to be estimated and $u_{i\theta}$ is an unknown error term. It is assumed the error term satisfies the constraint:

$$Quant_{ui}(\theta|x_i) = 0 \quad (2)$$

We then solve the estimator $\beta_\theta$ as follows:

$$\hat{\beta}_\theta = \arg min_{\beta_\theta} \left[\sum_{i:y_i>x'_i\beta_\theta} \theta\,|y_i - x'_i\beta_\theta| + \sum_{i:y_i>x'_i\beta_\theta} 1-\theta\,|y_i - x'_i\beta_\theta|\right] \quad (3)$$

From the solution in (3), we obtain the $\theta^{\text{th}}$ conditional quantile $Q_{\frac{Y}{X}}(\theta) = x\beta_\theta$. This enables us to understand the magnitude of the effects of the explanatory variables across the distribution. The value of the many estimators of $\beta$ is dependent on the scale of the research and the

researcher's choice of quantiles, so long as the values are between 0 and 1. For this purpose, five percentiles have been chosen – 0.1, 0.25, 0.5, 0.75 and 0.9.

There are number of studies which employ quantile regression to enhance the understanding of the determinants of trade or the effects of trade. For instance, Foster (2008) assesses the impact of trade liberalisation on economic growth. While, Marquez-Ramos (2016) seeks to understand the effects of the institutional environment on international trade in regional Spain. Van Ha and Tran (2017) evaluate the impact of international trade on employment in Vietnam. Martínez-Zarzoso, Nowak-Lehmann and Rehwald (2017) appraise the export performance of Aid for Trade (AfT) beneficiaries.

We consider the following import and export models and they are as follows:

$$Q_\tau(lnSI_{it}) = \alpha_0^\tau + \beta_1^\tau lnGDPpc_{it} + \beta_2^\tau lnPop_{it} + \beta_3^\tau HC_{it} + \beta_4^\tau lnFDI_{it} + \beta_5^\tau RESEXP_{it} + \beta_6^\tau Internet_{it} + \beta_7^\tau RQ_{it} + \beta_8^\tau lnIXG_{it} + \gamma_{it} + \varepsilon_0^\tau \quad (4)$$

$$Q_\tau(lnSE_{it}) = \alpha_0^\tau + \beta_1^\tau lnGDPpc_{it} + \beta_2^\tau lnPop_{it} + \beta_3^\tau HC_{it} + \beta_4^\tau lnFDI_{it} + \beta_5^\tau RESEXP_{it} + \beta_6^\tau Internet_{it} + \beta_7^\tau RQ_{it} + \beta_8^\tau lnIXG_{it} + \gamma_{it} + \varepsilon_0^\tau \quad (5)$$

In equations (4) and (5) the variables are defined as follows:
$Q_\tau(lnSI_{it})$ denotes a conditional quantile function of services imports and $Q_\tau(lnSE_{it})$ represents a conditional quantile function of services exports, all evaluated at $\tau^{th}$quantile, where $\tau \in (0,1)$ and *i* is the country at time *t*. In addition, $\gamma_{it}$ denotes fixed country effects at time *t*.

- *lnSI* is the natural logarithm of service imports in current US$ millions, the import data was obtained from United Nations Committee on Trade and Development (UNCTAD) statistics database.
- $lnSE$ is the natural logarithm of service exports (in current US$ millions), the export data was obtained from UNCTAD statistics database.
- *lnGDPpc* is the natural logarithm of the Gross Domestic Product (GDP) per capita, obtained from the World Bank's World Development Indicators (WDI) database.
- *LNPOP* is the natural logarithm of population size, data obtained from the World Bank's WDI database, used as a proxy for country size.
- *HC* is human capital index - based on years of schooling and returns to education obtained from the Penn World Tables (PWT 10.0).

- *lnFDI* is the natural logarithm of foreign direct investment inflow received by country *i* (in US$ millions), within time *t*, data obtained from the UNCTAD statistical database.
- *RESEXP* refers to the research and development expenditure as a ratio of Gross Domestic Product (GDP), data was obtained from the World Bank's WDI database, used as a proxy for technological advancement.
- *Internet* refers to the percentage of the population that use the internet, used as a proxy for quality of infrastructure, data provided by the International Telecommunications Union (ITU).
- *RQ* is the score attributed under the World Governance Indicators (WGI) for Regulatory Quality developed by the World Bank.
- *lnIXG* is the natural logarithm of the sum of import and export, data obtained from the World Trade Organization (WTO).
- $\varepsilon$ represents the error term in the model.

Tables 1 and 2 provide the results of the Fixed Effects (FE) and FE quantile regression results. Under the Hausman Test, the FE results are preferred over the Ordinary Least Squares (OLS) and Random Effect (RE) models for both imports and exports.

The results presented in Table 1 (column 1) indicates that all the independent variables chosen for this study are significant and positively correlated to EU service imports. The quantile results, as in indicated in columns 2 to 6, show that GDP per capita, population size, FDI and internet penetration are significant in all five quantiles.

Human capital is significant in the first four quantiles (0.1, 0.25, .5 and .75), similar to trade in goods. Whereas, technological advancement, proxied by Research and Development (R&D) expenditure as percentage of GDP, is significant in the $10^{th}$, $25^{th}$ and $50^{th}$ quantiles.

**TABLE 1: EU SERVICE IMPORTS**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **FE** | **10%** | **25%** | **50%** | **75%** | **90%** |
| **Gross Domestic Product per capita (*lnGDPpc*)** | 0.612*** (0.144) | 0.554*** (0.194) | 0.58*** (0.137) | 0.611*** (0.1) | 0.643*** (0.13) | 0.669*** (0.184) |
| **Population Size (*lnPOP*)** | 2.163*** (0.54) | 2.118*** (0.511) | 2.138*** (0.362) | 2.162*** (0.264) | 2.187*** (0.342) | 2.207*** (0.486) |
| **Human Capital (HC)** | 0.5** (0.243) | 0.66** (0.281) | 0.589*** (0.199) | 0.501*** (0.145) | 0.413** (0.187) | 0.341 (0.267) |
| **Foreign Direct Investment (*lnFDI*)** | 0.022*** (0.008) | 0.02* (0.013) | 0.021** (0.01) | 0.022*** (0.006) | 0.023*** (0.008) | 0.024** (0.012) |
| **Research Expenditure (*RESEXP*)** | 0.08* (0.041) | 0.133** (0.055) | 0.109*** (0.04) | 0.081*** (0.029) | 0.053 (0.037) | 0.029 (0.052) |
| **Internet** | 0.479** (0.199) | 0.394* (0.255) | 0.432** (0.18) | 0.479*** (0.132) | 0.524*** (0.17) | 0.562** (0.242) |
| **Regulatory Quality (RQ)** | 0.292*** (0.08) | 0.301*** (0.103) | 0.297*** (0.073) | 0.292*** (0.053) | 0.287*** (0.069) | 0.282*** (0.098) |
| **Trade in Goods (*lnIXG*)** | 0.23** (0.103) | 0.302* (0.167) | 0.27** (0.119) | 0.231*** (0.087) | 0.191* (0.112) | 0.159 (0.159) |
| **Constant** | -35.74 | - | - | - | - | - |
| **Observations** | 348 | 348 | 348 | 348 | 348 | 348 |
| **$R^2$** | 0.6112 | - | - | - | - | - |
| ***rho*** | 0.9982 | - | - | - | - | - |

Notes: (1) ***p<0.01, **p<0.05, *p<0.1[3]
(2) (-) Robust Standard Errors

The FE results presented in Table 2 (column 7) indicate that a significant and positive correlation between EU service exports and the chosen independent variables except for R&D Expenditure. The quantile results also show a negative correlation between itself and EU service exports in the 75th and 90th quantiles (columns 11 and 12), albeit it is statistically insignificant.

The quantile regression results show that GDP per capita, population size, Human Capital, internet and Regulatory Quality are significant in all five quantiles. Whereas, FDI is significant in the 50th, 75th and 90th quantiles. They also show that trade in goods is significant in the 25th, 50th and 75th quantiles.

[3] The variables with the highest significance are indicated by (***) and they would be within the 1 per cent significance level. In addition, the (**) indicates that the variables are within the 5 per cent significance level and the (*) indicate that the variables are in the 10 per cent and beyond significance level.

**TABLE 2: EU SERVICE EXPORTS**

| | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|
| | **FE** | **10%** | **25%** | **50%** | **75%** | **90%** |
| **Log Gross Domestic Product per capita (*lnGDPpc*)** | 0.579*** (0.08) | 0.592*** (0.211) | 0.587*** (0.158) | 0.579*** (0.105) | 0.57*** (0.129) | 0.564*** (0.182) |
| **Population Size (*lnPOP*)** | 1.25*** (0.426) | 1.548*** (0.58) | 1.435*** (0.435) | 1.263*** (0.005) | 1.082*** (0.353) | 0.954* (0.5) |
| **Human Capital (HC)** | 0.908*** (0.29) | 1.09*** (0.421) | 1.019*** (0.316) | 0.911*** (0.21) | 0.797*** (0.256) | 0.716** (0.022) |
| **Foreign Direct Investment (*lnFDI*)** | 0.018** (0.007) | 0.01 (0.015) | 0.013 (0.011) | 0.018** (0.008) | 0.024*** (0.009) | 0.027** (0.013) |
| **Research Expenditure (*RESEXP*)** | 0.027 (0.031) | 0.085 (0.088) | 0.062 (0.066) | 0.028 (0.044) | -0.009 (0.053) | -0.035 (0.076) |
| **Internet** | 0.545*** (0.149) | 0.504* (0.334) | 0.52** (0.251) | 0.544*** (0.166) | 0.57*** (0.204) | 0.588** (0.287) |
| **Regulatory Quality (RQ)** | 0.23*** (0.086) | 0.22* (0.138) | 0.224** (0.104) | 0.23*** (0.069) | 0.235*** (0.084) | 0.24** (0.119) |
| **Trade in Goods (*lnIXG*)** | 0.202* (0.105) | 0.235 (0.202) | 0.222* (0.152) | 0.203** (0.101) | 0.182* (0.123) | 0.168 (0.174) |
| **Constant** | -21.632 | - | - | - | - | - |
| **Observations** | 348 | 348 | 348 | 348 | 348 | 348 |
| **$R^2$** | 0.6699 | - | - | - | - | - |
| ***rho*** | 0.9946 | - | - | - | - | - |

Notes: (1) ***p<0.01, **p<0.05, *p<0.1[4]
(2) (-) Robust Standard Errors

4.1 Discussion of the Results

The FE results in Table 1 (EU service imports) indicate that a 1 per cent increase in GDP per capita is expected to increase EU services imports by up to 0.61 per cent. The quantile results in indicate a significance at the 1 per cent level in all five quantiles (columns 2 to 6). This is expected given that an increased income would increase demand for goods and services due to increased wealth and economic activity. The results in Table 2 suggest that a 1 per cent increase in GDP per capita would increase EU service exports by up to 0.58 per cent. This is in line with a study by Mishra, Lundstrom and Anand (2011), who find that as GDP per capita growth increases, so does the export sophistication of services. They also find that as economies grow, services occupy a greater share of national output, a phenomenon that is not very well researched.

[4] The variables with the highest significance are indicated by (***) and they would be within the 1 per cent significance level. In addition, the (**) indicates that the variables are within the 5 per cent significance level and the (*) indicate that the variables are in the 10 per cent and beyond significance level.

The results in Table 1 suggest that a 1 per cent increase in population size, is expected to increase service imports by up to 2.16 per cent (column 1). This highlights the positive association between an increasing market size and increase demand for imports, which is a natural occurrence. The quantile results in indicate a significance at the 1 per cent level in all five quantiles (columns 2 to 6). Table 2 suggests that a 1 per cent increase in population size, is likely to increase exports by 1.25 per cent. Research by Nuroğlu (2010) concludes that larger countries export more and they are more diversified (Agosin, Alvarez and Bravo-Ortega, 2012, Parteka and Tamberi, 2013). The quantile results are significant at the 1 per cent level for the first four quantiles – 0.1, 0.25, .5 and .75, but significant at the 10 per cent level in the 90$^{th}$ quantile (columns 8 to 12).

Table 2 indicates that a 1 per cent increase in Human Capital increases services exports by up to 0.9 per cent (column 7). The relationship between human capital and the growth of trade in services is well documented, see discussions by Francois (1990b), Francois and Nelson (2002), Askenazy (2005), Lennon, Mirza and Nicoletti (2009), Goldin (2014). Majority of studies relating to the labour impact of services trade indicate a bias towards high-skilled labour (WTO, 2019). Services inputs are a critical component for other economic sectors and other services exports, as these services become more complex and specialised in nature, this leads to a demand for higher skilled workers. In Table 1 (column 1), suggests that a 1 per cent increase in Human Capital is expected to increase services imports by up to 0.5 per cent. This result suggests that in the impact of Human Capital is much more profound on the services exports than on imports in the EU. The quantile results are indicated in columns 2 to 6 show that they significant at the 1 per cent level in 25$^{th}$ and 50$^{th}$ quantiles and significant at the 5 per cent level in 10$^{th}$ and 75$^{th}$ quantiles, however it is not significant in the 90$^{th}$ quantile.

The results in Table 1 indicate that a 1 per cent increase in FDI (column 1) is likely to increase services imports by up to 0.02 per cent and the results in Table 2 (column 7) suggests that the same level of increment in FDI would likely increase EU services exports by up to the same amount. However, the result in Table 1 (column 1) is statistically more significant for effect of FDI on EU service imports than on exports. The quantile results in Table 1 (columns 2 to 6) show that it is significant at the 1 per cent level in quantiles .5 and .75, significant at the 5 per cent level in 25$^{th}$ and 90$^{th}$ quantiles and significant at the 10 per cent level in the 10$^{th}$ quantile.

The results indicate that a 1 per cent increase R&D expenditure, used as a proxy for technological advancement, increases services imports by up to 0.08 per cent (column 1 in Table 1). It is significant at the 1 per cent level in quantiles .25 and .5 and significant at the 5

per cent level in the 10th quantile. However, the results in Table 2 indicate that the positive correlation between R&D expenditure and service exports is not statistically significant.

The results in Table 2 suggest that a 1 per cent improvement in the level of infrastructure (proxied by internet penetration) could potentially increase services exports by 0.55 per cent (column 7), whereas the same level of improvement in infrastructure could increase service imports by up to 0.48 per cent (column 1 in Table 1). Infrastructure such as Information Communication and Technology (ICT) networks, have increased the tradability of services and assists them, in satisfying the "proximity constraints" that exist between supplier and customer, by allowing services to physically move from one party to another (Hoekmann, 2017). The quantile results in Table 1 suggest that internet penetration is significant at the 1 per cent level in quantiles .5 and .75, significant at the 5 per cent level in the 25th and 90th quantiles and significant at the 10 per cent level in the 10th quantile. The quantile results in Table 2 (columns 8 to 12) show that internet penetration is significant at the 1 per cent level in the 50th and 75th quantiles, significant at the 5 per cent level in the 25th and 90th quantiles and significant at the 10 per cent level in the 10th quantile.

The results in Table 1 (column 1) indicate that a 1 per cent improvement in the level of regulatory quality is expected to increase services imports by up to 0.29 per cent and the results in Table 2 (column 7) indicate that the same level of improvement is expected to yield up to a 0.23 per cent increase in service exports. The effects of regulations on trade in services is well documented, see discussions by Dee (2007), Schwellnus (2007), Nordas and Kox (2009) and Mirodot, Sauvage and Sheppard (2013). A study by Ferracane and van der Marel (2018) suggests that more regulatory restrictive measures on cross-border data flow is associated with lower data-intense services imports despite an economy having more robust digital infrastructure networks. While, Grossman and Helpman (1991) suggest that a high degree of trade openness (goods and services) provides economies with the possibility to access a wider range of inputs. It also facilitates the adoption of foreign technologies (Benhabib and Spiegel, 1994). The quantile results in Table 1 (columns 2 to 6) suggest that regulatory quality is significant at the 1 per cent level in all five quantiles - .1, .25, .5, .75 and .9. Whereas, the quantile results in Table 2 are significant at the 1 per cent level in the 50th and 75th quantiles, significant at the 5 per cent level in the 25th and 90th quantiles and significant at the 10 per cent in the 10th quantile.

The Table 1 (column 1) results suggest that a 1 per cent increase in trade in goods is expected to increase services imports by 0.23 per cent. The results in Table 2 (column 7) suggests that a 1 per cent increase in trade in goods is likely to increase service exports by 0.2 per cent. This

significant relationship between trade in goods and services is in line with existing literature, services enable connectivity over basic infrastructure that enables trade in goods, without them goods cannot be traded (Roy, 2017). The quantile results in Table 1 (columns 2 to 6) indicate that the trade in goods is significant at the 1 per cent level in the 50$^{th}$ quantile, significant at the 5 per cent level in the 25$^{th}$ quantile, significant at the 10 per cent level in 10$^{th}$ and 75$^{th}$ quantiles, but it is not significant in the 90$^{th}$ quantile. Whereas, the quantile results in Table 2 (columns 8 to 12) show that it significant at the 5 per cent level in 50$^{th}$ quantile and significant at the 10 per cent level in the 25$^{th}$ and 75$^{th}$ quantiles.

## 5. Conclusion

This study set out to understand the determinants of imports and exports of services in the EU. It uses the FE, OLS methods and quantile regression method, the results are available in Tables 1 and 2. The quantile regression method employed, was first introduced Koenker and Basset (1978), it allows us to overcome the challenges in understanding the distribution of the mean framework (Hao and Naiman, 2007).

The FE results which were preferred under the Hausman test suggests that a 1 per cent increase in GDP per capita is expected to increase EU services imports by up to 0.61 per cent. Whereas, a similar increase in GDP per capita would increase EU service exports by up to 0.58 per cent. The results also indicate that population size, which is used as a proxy for country size, suggest a 1 per cent increase is expected to increase imports by up to 2.16 per cent and exports by up to 1.25 per cent. This is in line with the studies undertaken by Nuroğlu (2010) concludes that larger countries export more and they are more diversified (Agosin, Alvarez and Bravo-Ortega, 2012, Parteka and Tamberi, 2013). In addition, Mishra, Lundstrom and Anand (2011) find that as economies develop, so does their export diversification and services increases its share of the national output, a phenomenon that is not well researched.

There is also positive and significant correlation between human capital, FDI, infrastructure and regulatory quality with both imports and exports of services. Technological advancement (proxied by research expenditure as a percentage of GDP) is positively correlated to both imports and exports but statistically significant only for imports.

The quantile regression results suggest that GDP per capita, population size, infrastructure and regulatory quality are positively correlated and statistically significant in all quantiles for imports and exports. Whilst FDI, is positively correlated and statistically

significant in all five quantiles for imports, it is only statistically significant in the last three quantiles – 0.5, .75 and .9 for exports.

The EU has established itself as a prolific global services trader through subsequent regulatory and institutional transformation. However, within the EU there is heterogeneous performances amongst its members. This study contributes towards understanding the differences and allows policy makers to institute changes that would create a conducive environment that fosters the growth of trade in services for the best performers within the region. It also allows an insight on possible policy interventions that could assist the lowest performers, in increasing their share of services trade.

## Bibliography


Agosin, M.R., Alvarez, R. and Bravo-Ortega, C., 2012. Determinants of export diversification around the world: 1962–2000. *The World Economy*, *35*(3), pp.295-315.

Aron, R. and Singh, J.V., 2005. Getting offshoring right. *Harvard business review*, *83*(12), pp.135-43.

Askenazy, P., 2005. Trade, services, and wage inequality. *Oxford Economic Papers*, *57*(4), pp.674-692.

Benhabib, J. and Spiegel, M.M., 1994. The role of human capital in economic development evidence from aggregate cross-country data. *Journal of Monetary economics*, *34*(2), pp.143-173.

Bilici, Ö., 2014. How Trade in Services Varies Conditional on Different Determinants: Evidence from UK Firm-level Data using Quantile Regressions. <https://www.etsg.org/ETSG2014/Papers/187.pdf>, viewed 10 June 2021.

De, P. and Raychaudhuri, A., 2008. Is India's services trade pro-poor? A simultaneous approach. *Emerging Trade Issues for Policymakers in Developing Countries in Asia and the Pacific*, p.173.

Dee, P., 2007. *A compendium of barriers to services trade*. < https://www.gtap.agecon.purdue.edu/resources/download/3492.pdf> viewed 10 May 2021.

Díaz-Mora, C., Gandoy, R. and González-Díaz, B., 2018. Looking into global value chains: influence of foreign services on export performance. *Review of World Economics*, *154*(4), pp.785-814.

Elia, S., Massini, S. and Narula, R., 2019. Disintegration, modularity and entry mode choice: Mirroring technical and organizational architectures in business functions offshoring. *Journal of Business Research*, *103*, pp.417-431.

Ferracane, M.F. and van der Marel, E., 2018. *Do Data Flows Restrictions Inhibit Trade in Services?* (No. 2). ECIPE DTE Working Paper Series.

Foster, N., 2008. The impact of trade liberalisation on economic growth: Evidence from a quantile regression analysis. *Kyklos*, *61*(4), pp.543-567.

Francois, JF 1990a, 'Producer services, scale, and the division of labor', *Oxford Economic Papers*, vol. 42, no. 4, pp. 715-729.

Francois, J.F., 1990b. Trade in producer services and returns due to specialization under monopolistic competition. *Canadian Journal of Economics*, pp.109-124.

Francois, J.F. and Nelson, D., 2002. A geometry of specialisation. *The Economic Journal*, *112*(481), pp.649-678.

Ghani, E. and Kharas, H., 2010. The service revolution. World Bank.

Goldin, C., 2014. A pollution theory of discrimination: male and female differences in occupations and earnings. In *Human capital in history: The American record* (pp. 313-348). University of Chicago Press.

Greenfield, H.I., 1966. *Manpower and the Growth of Producer Services*. <https://files.eric.ed.gov/fulltext/ED016143.pdf>, viewed 11 May 2021.

Grigoriou, C., 2007. *Landlockedness, infrastructure and trade: new estimates for central Asian countries* (Vol. 4335). World Bank Publications.

Grossman, G.M. and Helpman, E., 1991. Trade, knowledge spillovers, and growth. *European economic review*, *35*(2-3), pp.517-526.

Hoekman, B. and Mattoo, A., 2008. *Services trade and growth*. The World Bank.

Hoekman, B. and Mattoo, A., 2011. Services trade liberalization and regulatory reform: re-invigorating international cooperation. *World Bank Policy Research Working Paper*, (5517).

Hao, L., Naiman, D.Q. and Naiman, D.Q., 2007. *Quantile regression* (No. 149). Sage.

In't Veld, J., 2019. Quantifying the economic effects of the single market in a structural macromodel. *European Economy Discussion Paper*, (094).

Koenker, R. and Bassett Jr, G., 1978. Regression quantiles. *Econometrica: journal of the Econometric Society*, pp.33-50.

Lennon, C., Mirza, D. and Nicoletti, G., 2009. Complementarity of inputs across countries in services trade. *Annals of Economics and Statistics/Annales d'Économie et de Statistique*, pp.183-205.

Low, P., 2016. Rethinking Services in a Changing World. In *Geneva, Switzerland: International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum*.

Martínez-Zarzoso, I. and Nowak-Lehmann, F., 2003. Augmented gravity model: An empirical application to Mercosur-European Union trade flows. *Journal of applied economics*, *6*(2), pp.291-316.

Martínez-Zarzoso, I., Nowak-Lehmann D, F. and Rehwald, K., 2017. Is aid for trade effective? A panel quantile regression approach. *Review of Development Economics*, *21*(4), pp.e175-e203.

Márquez-Ramos, L., 2016. The role of institutional environment in international trade: The case of Spanish regions. *REGION*, *3*(2), pp.125-140.

Mehta, A. and Hasan, R., 2012. The effects of trade and services liberalization on wage inequality in India. *International Review of Economics & Finance*, *23*, pp.75-90.

Miroudot, S., Sauvage, J. and Shepherd, B., 2013. Measuring the cost of international trade in services. *World Trade Review*, *12*(4), pp.719-735.

Mishra, S., Lundström, S. and Anand, R., 2011. Service export sophistication and economic growth. *World Bank Policy Research Working Paper*, (5606).

Nordås, H.K. and Kox, H., 2009. *Quantifying Regulatory Barriers to Services Trade* (No. 85). OECD Publishing.

Nuroglu, E., 2010. *The impact of population on bilateral trade flows in the case of OIC*. Working Paper, International University of Sarajevo.

Parteka, A. and Tamberi, M., 2013. What determines export diversification in the development process? Empirical assessment. *The World Economy*, *36*(6), pp.807-826.

Petit, S., 2017. International trade in services and inequalities: empirical evaluation and role of tourism services. *Tourism Economics*, *23*(5), pp.1069-1075.

Portugal-Perez, A. and Wilson, J.S., 2010. WB-Policy Research Working Paper. *Export Performance and Trade Facilitation Reform*.

Portugal-Perez, A. and Wilson, J.S., 2012. Export performance and trade facilitation reform: Hard and soft infrastructure. *World development*, *40*(7), pp.1295-1307.

Roy, M., 2017. *The contribution of services trade policies to connectivity in the context of aid for trade* (No. ERSD-2017-12). WTO Staff Working Paper.

Roy, M., 2019. *Elevating services: Services trade policy, WTO commitments, and their role in economic development and trade integration* (No. ERSD-2019-01). World Trade Organization (WTO), Economic Research and Statistics Division.

Sáez, S., Taglioni, D., van der Marel, E., Hollweg, C.H., Zavacka, V., 2014. *Valuing Trade in Services: A Toolkit for Competitiveness Diagnostics*, Washington D.C. World Bank.

Sahoo, P., Dash, R.K. and Mishra, P.P., 2015. Determinants of India's service exports. *Reviving growth in India*, *107*.

Schwellnus, C., 2007. *The effect of domestic regulation on services trade revisited*. Paris: CEPII.

Spatafora, M.N., Anand, R. and Mishra, M.S., 2012. *Structural transformation and the sophistication of production*. International Monetary Fund.

Sunesen, R and Thelle, H., 2018. *Making the EU Trade in Services Work for all: Enhancing innovation and competitiveness throughout the EU economy.* <https://www.mpo.cz/assets/cz/rozcestnik/pro-media/tiskove-zpravy/2018/11/Making-EU-trade-in-services-work-for-all.pdf> viewed 15 June 2021.

United Nations Conference on Trade and Development (UNCTAD), 1999, The Inventory of Economic Needs Test in The Schedules of GATS Commitments, *UNCTAD/ITCD/TSB/8*. New York and Geneva. UNCTAD.

United Nations Conference on Trade and Development (UNCTAD), 2013. *Adjusting to the changing dynamics of the world economy*. New York and Geneva. UNCTAD.

Van Ha, H. and Tran, T.Q., 2017. International trade and employment: A quantile regression approach. *Journal of Economic Integration*, pp.531-557.

World Trade Organization (WTO), 2019, *The future of services trade*, World Trade Report.