Utrecht University | School of Economics

Master Thesis U.S.E

Trade Barrier Effect on European Union Member States Export Diversification From 1995 to 2022[1]

Curie Wang 7190514

z.wang25@students.uu.nl

Supervisors

Dr. Julia Swart

Bruhan Konda

[1] I am thankful to my supervisors Dr. Julia Swart and Bruhan Konda for their valuable guidance and insightful comments on my work. My thanks also extend to my partner, Tyler Davis, for providing all-round support.
This thesis is completed without any financial support or sponsorship.

Abstract

This paper explores the trade barriers' impact on export diversification at the country level in the European Union. Using a database with EU-27 countries over 28 years at the HS4 level of disaggregation (872 exported products), we investigate diversification choices under a protective trade environment. This paper finds the trade barriers, import concentration, inflows FDI stocks, and the European Union membership negatively correlated with export diversification. The enlargement of service and agriculture sectors diversifies a country's exports. Additionally, this paper finds a nonlinear relationship between GDP per capita and export diversification in the EU, consistent with Imbs and Wacziarg (2003) and Cadot et al. (2011a).

JEL classification: F14, F43, F63

Key words: European Union, trade barriers, export diversification, panel data

1. Introduction

Governments strive to diversify countries' export diversification and often express concern about the export concentration on primary or low-sophisticated products. Indeed, according to structural models, countries should diversify exports to achieve sustainable economic growth (Chenery, 1979; Syrquin, 1989). Moreover, the export concentration increases a country's vulnerabilities such as foreign exchange rate risks, inflation in the trade partners, and secular decline in terms of trade (Lederman and Maloney, 2002) which means that more wealth is leaving than flowing in the country. A vulnerable economy can suffer severely from macroeconomic environment changes and lead to development setbacks. Therefore, countries often strive to increase their export diversification and seek market expansion to realize the benefits of diversified export sectors.

Openness to trade is one of the solutions to diversify export (Giri et al., 2019) by exposing a country to new markets, cultures, technology, and products that can strengthen efficiency, and technological development, expand the export market and enhance competitiveness in the international market for the home country. Under certain circumstances, trade openness can drive economic growth and improve welfare (Haddad et al., 2013). However, amidst the backdrop of a growing anti-globalization sentiment in trade, evidenced by studies such as Dluhosch (2018), Osgood (2022), and Colantone et al. (2022), a countertrend has emerged. The anti-globalization trend increases trade barriers, including tariff and non-tariff measurements, by implementing protectionist trade policies. This sentiment gained traction notably during the 2016 U.S. presidential election, when both candidates openly opposed the Trans-Pacific Partnership (TPP) trade agreement, facilitating a public reassessment of trade agreements and instilling skepticism regarding their benefits. Donald Trump adopted a protectionist trade policy stance that heightened awareness and apprehension about global trade practices and their impact on domestic markets.

Europe has been a strong player in the exporting market, and its export diversification choice can influence the global trade market. Europe ranked as the first exporting value continent until Asia surpassed it in 2020 driven by the rise of Chinese exporters. The European Union (EU) still exhibits a robust export performance, with most member states consistently demonstrating growth trajectories (Basedow, 2020). Notably, the EU commands a substantial market share in exporting high-tech products (Curran and Zignago, 2009), and its export resilience has strengthened over time (European Commission, 2023). Export resilience describes the retrieval ability of the export system after an exogenous shock.

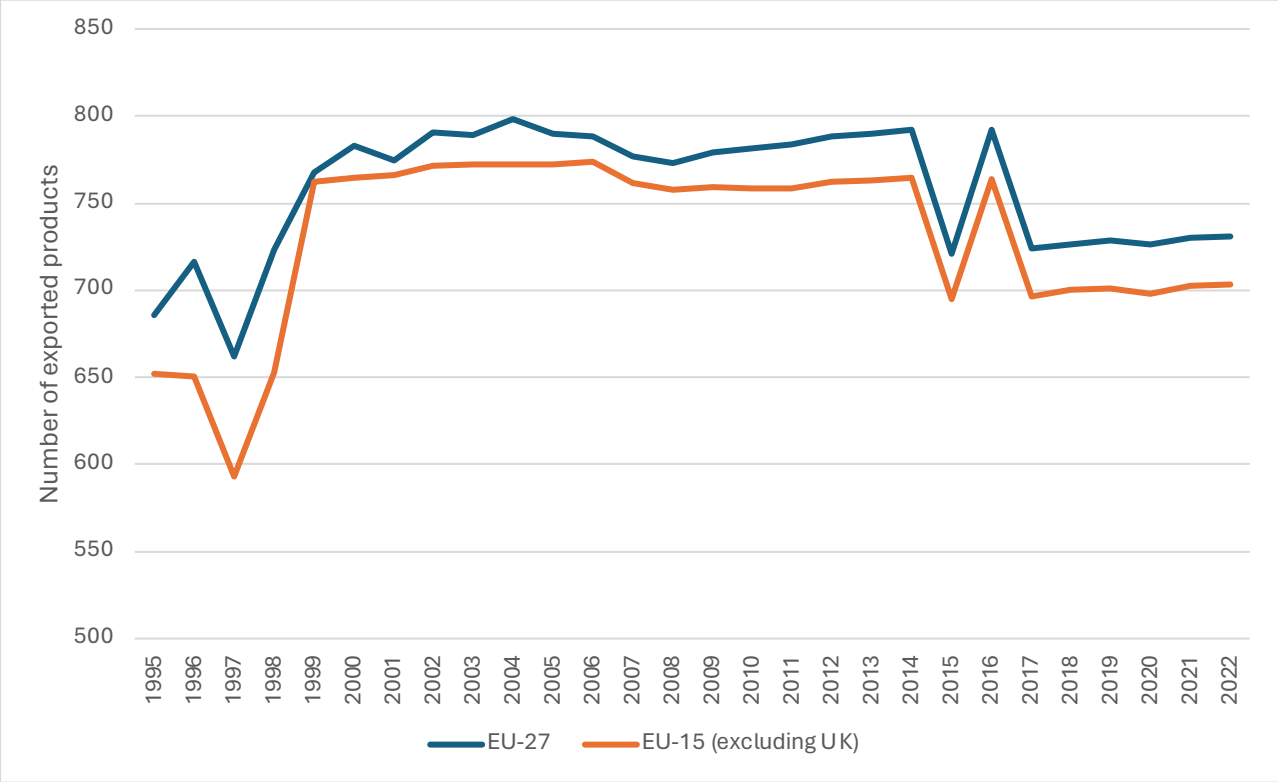

Figure 1 – Average export product lines at HS 4-digits level in EU from 1995 to 2022
Source: UN COMTRADE database and author calculation

Figure 1 shows a country's average exported products in the European Union from 1995 to 2022 and the decline of exported products is noticeable. EU-15 is the composition of the European Union since 1995, which complies with EU trade policy throughout the period covered by this study. EU-15 contribute significantly to the EU export diversifications, parallel with the overall performance. After the implementation of Trump's protectionist trade policy, concerns over unfair competition from EU citizens have fueled the adoption of protectionist trading policies within the EU (Dür et al., 2020). Since 2016, the EU has adopted several protectionist trade policies and modifications. In 2017, the European Commission introduces a new methodology for calculating dumping margins from countries with significant market distortions, allowing for higher anti-dumping duties. In 2018, the European Commission reforms the Trade Defense Instruments (TDI) to impose provisional measures more quickly, shorten investigation periods for anti-dumping and anti-subsidy cases, and introduce higher duties under the lesser duty rule. In 2019, the European Commission implement a regulation to screen foreign direct investments (FDI) in critical sectors. In 2021, the European Commission modify Trade Enforcement Regulation to enhance the EU's ability to enforce trade rules and impose countermeasures against unfair trade practices. These measurements increase trade costs for trade partners, decrease EU consumer welfare (Bieleková and Pokrivčák, 2020), and heighten a country's overall risk exposure

(Parteka and Tamberi, 2013d). As the declining EU exported products, we can conclude that the anti-globalization trend has materialized in the European Union.

Although many papers have examined the relationship between export diversification and economic growth (Agosín et al. 2012, Cadot et al. 2011a, Kaitila 2018, Easterly et al. 2009, Hesse 2009), much less attention has been paid to developed countries and the relationship between trade barriers and export diversification. This study aims to fill this gap and provide room for future research and potential policy recommendations. This study investigates the effect of trade barriers on country-level export diversification in the European Union. This study employs econometric techniques on a panel database in the manufacturing sector.

This study aims to fill the literature gap and provide room for future research and potential policy recommendations. This study investigates the effect of trade barriers on country-level export diversification in the European Union. Although many papers have examined the relationship between export diversification and economic growth (Agosín et al. 2012, Cadot et al. 2011a, Kaitila 2018, Easterly et al. 2009, Hesse 2009), much less attention has been paid to developed countries and the relationship between trade barriers and export diversification.

To accommodate the goal of this study, we employ econometric techniques on a panel database in the manufacturing sector, which has higher disaggregation data and is irrelevant to countries' natural endowments. Our data cover all 27 EU member states from 1995 to 2022 and 872 exporting products from the COMTRADE dataset at the Harmonized System (HS) 4-digit level. This study calculates the annual export diversification for each member state in two metrics (Theil index and Hirschman–Herfindahl index). This study employs three estimators, namely fixed effect, random effect, and pooled OLS, to ensure the effectiveness of the analysis.

This paper is organized as follows. Section 2 summarizes relevant literature including theoretical papers and empirical studies, and section 3 introduces the empirical approach, starting with the measurement of export diversification, followed by baseline model and endogeneity issues. Section 4 includes baseline and robustness analysis results and explores the potential explanations. Section 5 is conclusions.

2. Literature

2.1 Theoretical frameworks

Classical trade theory is originating from the seminal works of Adam Smith (1766) and David Ricardo (1817). Smith's (1766) concept of absolute advantage posits that countries can increase their wealth by specializing in the production of goods for which they are more efficient in production (absolute advantage), for example, because of lower costs, and subsequently trading with other nations. Under the assumption of perfect competition, Smith advocates for the unrestricted flow of goods across borders as a pathway to prosperity. Building upon Smith's framework, Ricardo (1817) introduces the concept of comparative advantage. Comparative advantage is the different productivity levels between countries. Ricardo's theory (1817) contends that if one country possesses a comparative advantage in a selection of goods, mutual gains from trade can still be achieved. Countries should specialize in the production of goods for which they have a relatively lower opportunity cost, thereby maximizing overall output and welfare through trade.

The diversification trade policy is somewhat contrary to the trade theories. Smith (1766) and Ricardo (1817) emphasize countries should specialize under free trade conditions, not diversify. According to the Heckscher-Ohlin model (Ohlin & Ohlin, 1967), a country's exporting choice depends on its endowments, implying a country should accumulate an abundance of labour, capital, land, and other productive resources, instead of export diversification. There is empirical evidence supporting that exporters have the highest productivity compared to other producers (Bernard & Jensen, 2004; Helpman, 2006). These high-productivity firms boost national productivity and transform the country's production structure.

In modern research, scholars introduce imperfect competition and economies of scale into specialization choices. Ethier (1979) examines the industry-level diversification and argues that a complete vertical industrial specialization is not necessary under free trade conditions, and exporters' costs decrease due to the economics of scale. He suggested that with the development of transportation and communication, the free trade of intermediate goods is crucial for the diversification choice of an industry. When producers can trade intermediate goods freely, they can specialize in the most value-added stages of production that align with their expertise. In his example, the Swiss watch industry uses intermediate goods from Germany or other countries. After Swiss watchmakers collect all the parts, they focus on resembling the watch only, instead of specializing in the entire watch-making industry. Ethier (1979) also concluded that a small increase of tariff reduces the manufacturing production, and the output of primary products increase. Ethier (1982) further refined this theory by

applying his model to 5 theories (Factor-Price equalization, Rybczynski Theorem, Stolper-Samuelson Theorem, Stolper-Samuelson Theorem, Complementarity Theorem) and comes to the same conclusion.

On the other hand, Dornbusch et al., (1977) argue that the reduction of transportation costs leads to a lower export diversification. They use the Ricardian trade model that focuses on the relative wage as the key element for export comparative advantage. They also introduce the transfer cost as the "shrinkage" effect (Samuelson, 1954) that only a fraction of the commodity arrives as a cost of transfer. With the lowering transfer cost and the shrinkage adjustment, the home country produces goods that have a lower labour cost compared to other nations, and foreign countries respond similarly. The production choice spiked the demand for labour in certain export sectors. As a result, the relative wage increases in the home country, causing previously exported goods to become nontrade domestic goods.

Krugman (1987) approaches diversification choice by introducing learning patterns. He established a model that considers learning dynamics to develop a country's competitive advantage in trade. His model suggested that countries develop their advantage over time by "learning-by-doing", and the pattern stays unchanged after the establishment. Countries do not produce goods that do not have a competitive advantage, instead, they are importing from the country that does. This trading choice maximises productivity allocation. By importing these goods, countries can reallocate labour and resources to sectors where they have a competitive advantage, therefore strengthening the advantage. Krugman (1987) found a lower trade barrier results in a lower export diversification level, which collaborates with the classical trade theory. Krugman (1987) argued that even a partial and temporary protectionist policy can affect trade partners' export patterns permanently. The trade partners are forced to alter their comparative advantages and learning patterns to adopt the new policy environment.

The theory from Ethier (1979, 1982) is built on the premise of free trade, and studied how imposing tariffs affect a country's output. On the other hand, Krugman (1987) focuses on a country's comparative advantage and how a country responds to protectionist trade policy from trade partners. The underlying assumption in Krugman's theory is closer to the core question in this study. Therefore, the first hypothesis in this study is formulated according to Krugman (1987) and tested in this study.

Hypothesis 1: Trade barriers increase export diversification.

In addition, Acemoglu and Zilibotti (1997) discuss the choice of diversification to avoid risks during the development of countries. They introduce an overlapping generations model to study the resource allocation equilibrium under uncertainty and risks. Their findings indicate that in the initial stage of a country's development, the limitation of a country's "primitive accumulation" restrains the possibility of diversification, and the risk-averse further constrains the development process by avoiding "high-

risk-high-return" investments. This theory explains the low export diversification in the initial development stage but does not further point out the diversification pattern with the economic growth.

Regarding technological advances, Krugman (1979) includes a technology development factor in his theory that focuses on the trade behaviour between trade partners when new technology emerges. Following the work of Vernon (1966), Krugman (1979) created a North-South trade model to describe the equilibrium when there are technological differences between countries. In his model (Krugman, 1979), the North and the South represent the innovating and non-innovating countries. Krugman (1979) concludes that the innovating country enjoys a temporary technological advantage before the non-innovating country catches up with the gap by imitating, and both countries benefit from the trade. However, the technology eventually transferred to the South, resulting in a shrinking margin for the North. Therefore, the innovating country has incentive to protect technological advantage and increase the innovation rate by employing innovation policies.

Peretto (2003) presents how the homogenization effect decreases the export diversification in trading and benefits society. The homogenization effect describes the products on the market tend to be homogenous during the competition between producers. It starts with the decrease of trade barriers, and all active firms enter the global market with a higher competition level, which leads to firm elimination. With fewer firms active on the market, the variety of goods decreases. Peretto (2003) concludes that the consequence of free trade is global oligopolists and the reduction of export diversification. The rationalization effect describes the overall societal welfare increase, which follows the creation of oligopolists due to the extended economics of scale and lower costs.

Summarizing the trade theory, absolute or comparative advantage is the key for a nation to benefit from trade and accumulate wealth worldwide. The above trade theories suggest that a nation develops a sustainable absolute or comparative advantage in export through specialization – only produce and export the goods that they have an advantage and import other goods from foreign producers.

2.2 Empirical studies

This study examines extensive empirical research on the impact of trade barriers on diversification patterns, specialization, economic development, and other determinants of export diversification. Table 1 summarizes the recent literature on specialization, trade openness, and development.

Studies find trade openness's impact on export diversification is mixed. A lower trade barrier can contribute to a lower export diversification, as shown by Amiti (1999) and Agosín et al. (2012), which

TABLE 1

Recent empirical literature on specialization, trade openness, and development

Author and year	*Time period*	*Countries*	*Disaggregation level*	*Index of specilization*	*Explanatory Variables*	*Method*	*Estimator(s)*	*Main findings*
Amiti(1999)	1986 - 1990	15 EU	NACE3 and ISIC3	Gini	Factor intensities, intermedia-goods intensity, scale in production.	Parametric	Ordinary least squares (OLS)	Trade liberalization increases specilization in the EU.
Parteka and Tamberi (2013)	1985 - 2004	60	SITC 3 digit (Rev.2)	Relative Theil and relative Gini	GDP per capita, squared GDP per capita	Parametric	Ordinary least squares (OLS), fixed effect, and IV-2SLS	Accessing to a large market via open trade can limite a country's risk exprosure. The concentration level declines with expending the market globaly due to economic scale and swifting to manufacturing export.
Agosín et al. (2012)	1962 - 2000	79	SITC 4 digit (Rev.1 & 2)	Gini, Herfindahl, and Theil	Trade openess, GDP per capita, financial development, human capital, remoteness to trade center, terms of trade, domestic credit, exchange rate volatility, overvaluation.	Parametric	Two-step system GMM	Increase of trade openness, remoteness, and terms of trade in high human capital countries decrease diversification respectively; accumulation of human capital increase diversification.
Giri et al. (2019)	1975 - 2015	92	HS 6-digit level	Theil	GDP per capita and its squared, population, inflation, natural resource, trade agreement, trade openness, schooling, terms of trade, quality of institution, democracy, doing business components	Parametric	Ordinary Least Squares (OLS), Bayesian Model Averaging (BMA)	Reducing trade barriers and human capital accumulation are key drivers of export diversification.
Easterly et al. (2009)	2000	151	HS 6-digit level	Number of nonzero export flows	GDP, GDP per capita	Parametric	Ordinary least squares (OLS)	Most countries gain higher economic development tend to specialize in manufacturing export.
Hesse (2009)	1961 - 2000	99	SITC 4 digit (Rev.2)	Herfindahl	Initial income, schooling, population growth, investment, export concentration, agriculture to GDP ratio, service to GDP ratio, manufacturing to GDP ratio, openness	Parametric	System GMM	Developing countries can benefit from export diversification, yet developed countries can benefit from speclization.
Imbs and Wacziarg (2003)	1969 - 1997	99	UNIDO 1, 3& 4-digit level	Gini and Herfindahl	GDP per capita and its squared	Parametric and nonparametric	Fixed effect	U-shape pattern in production and employment with economic development: diverse in the low income stage and reconcentrate when pass a certain higher income level.
Koren and Tenreyro (2007)	1963 - 1998	42	UNIDO 3-digit level	Weighted Herfindahl	Decomposed volatility into sectoral shocks, country shocks, and global sectoral shocks.	Parametric and nonparametric	Factor model (par) and LOWESS (nonpar)	Confirm the U-shape pattern in domestic production and GDP growth.
Cadot et al. (2011a)	1988 - 2006	156	HS 6-digit level	Gini, Herfindahl, and Theil	GDP per capita and its squared	Parametric	Fixed effect, random effect, pooled OLS	Confirm the U-shape pattern also exist in export diversification and economic development.
Kaitila (2018)	1995 - 2015	EU-27	HS 8-digit level	Herfindahl	GDP per capita, investment to GDP, export to GDP, product coverage rate	Parametric	Panel least squires in Eviews	Cannot find U-shape in EU. Insignificant between economy openness and export diversification.
Iwamoto and Nabeshima (2012)	1980 - 2007	175	SITC 4 digit (Rev.2)	Herfindahl	FDI to GDP, GDP per capita, population, inflation, trade openness	Parametric	One-step system GMM	FDI stock increase the export diversification.
Tadessea and Shukralla (2011)	1980 - 2004	131		Number of products exported	Country size, growth of public sector, population density, economic openness, change of exchange rate, bilateral trade	Parametric and semi-parametric	Ordinary least squares (OLS), quantile regression	FDI has an overall positive impact on export diversification.

supports Krugman's (1979) theory. According to Krugman, reduced trade barriers can decrease export diversification as countries focus on goods with a comparative advantage. However, other scholars argue that lower trade barriers can be a key determinant for export diversification. Parteka and Tamberi (2013) suggest that reducing trade barriers provides better access to global markets, enabling countries to diversify their exports. This diversification enhances economic stability and resilience, making economies less vulnerable to external economic disruptions. Reducing trade barriers can have profound impacts on export diversification, which allows countries to expand their range of exported products and markets (Shepherd, 2010), and trade liberalization drives export diversification (Giri et al., 2019). Other drivers of export diversification include human capital accumulation (Giri et al., 2019; Agosín et al., 2012) and foreign direct investment (FDI) (Iwamoto & Nabeshima, 2012; Tadesse & Shukralla, 2011).

Many empirical studies support the benefit of export diversification in the country's development. The rationale lies in its potential to not only bolster short-term national income streams (Dennis & Shepherd, 2011b) but also to cushion the impact of sectoral shocks (Kalemli-Özcan et al., 2003). Funke & Ruhwedel (2001) underscore the positive relationship between income per capita and export diversification. Cadot (2011) further elucidates that the ability to produce sophisticated products serves as a cornerstone for successful export endeavours. However, there is no conclusive evidence indicating the diversification pattern when a country reaches a high development stage, which is the aim of this study.

Regarding FDI, Tadesse and Shukralla (2011) and Iwamoto and Nabeshima (2012) find that FDI is positively associated with export diversification. These two studies (Tadessea and Shukralla 2011, Iwamoto and Nabeshima 2012) use different measurements of export diversification and empirical approaches with large panel data and come to the same conclusion. Tadessea and Shukralla (2011) find that FDI's impact could vary between countries due to different stages of diversification. However, Tadessea and Shukralla (2011) cannot conclude any significant difference between developing and developed countries. On the other hand, Iwamoto and Nabeshima (2012) observe positive effects only in developing countries.

The choice of export diversification varies depending on the stage of economic development. Easterly et al. (2009) find that countries that specialise in certain sectors obtain greater economic development, and this economic growth can be more noticeable in developed countries (Hesse, 2009). Imbs and Wacziarg (2003) revealed a U-shape pattern of diversification and reconcentration in production with income development of countries. The U-shape pattern indicates that the domestic production

diversification increases with a country's income per capita growth, but reconcentrating after a turning point that can differ between countries. Koren and Tenreyro (2007) find the same U-shape pattern by including decomposed risks that may affect countries' diversification choices. The discovery of the U-shape pattern piques scholars' interest in whether the same pattern could be found in countries' exports, which are tightly connected with domestic production. Klinger and Lederman (2004, 2006) and Cadot et al. (2011a) find the U-share pattern in export diversification, which suggests that countries choose to diversify their export at the early stage of development (low-income stage) and reconcentrate at a higher income level after a country-specific turning point. However, Kaitila (2018) does not find the U-shape pattern in the European Union.

To observe the U-shape in the European Union, this study creates two figures following Cadot et al. (2011a). This study uses the actual value of 27 EU member states from 1995 to 2022, instead of the predicted values in Cadot et al. (2011a). Figures 2 and 3 show the curves of the actual Theil index and exported products respectively. The export data is drawn from the UN COMTRADE database at a 4-digit level Harmonized System (HS), and the calculation of the Theil index is done by the author. GDP per capita is taken from the World Bank's World Development Indicators (WDI). The curves are fitted using second-order polynomial regressions performed in Excel. The turning point in the European Union is around $60,000 GDP per capita, which is higher than the turning point found by Cadot et al. (2011a) at around $ 30,000. The European Union consist of high-income countries; therefore, a higher turning point is expected.

This study aims to test the nonlinear relationship between GDP per capita and export diversification in the EU with the second hypothesis. This study expects a significant nonlinear relationship.

> *Hypothesis 2: The relationship between GDP per capita and export diversification is nonlinear in the European member states.*

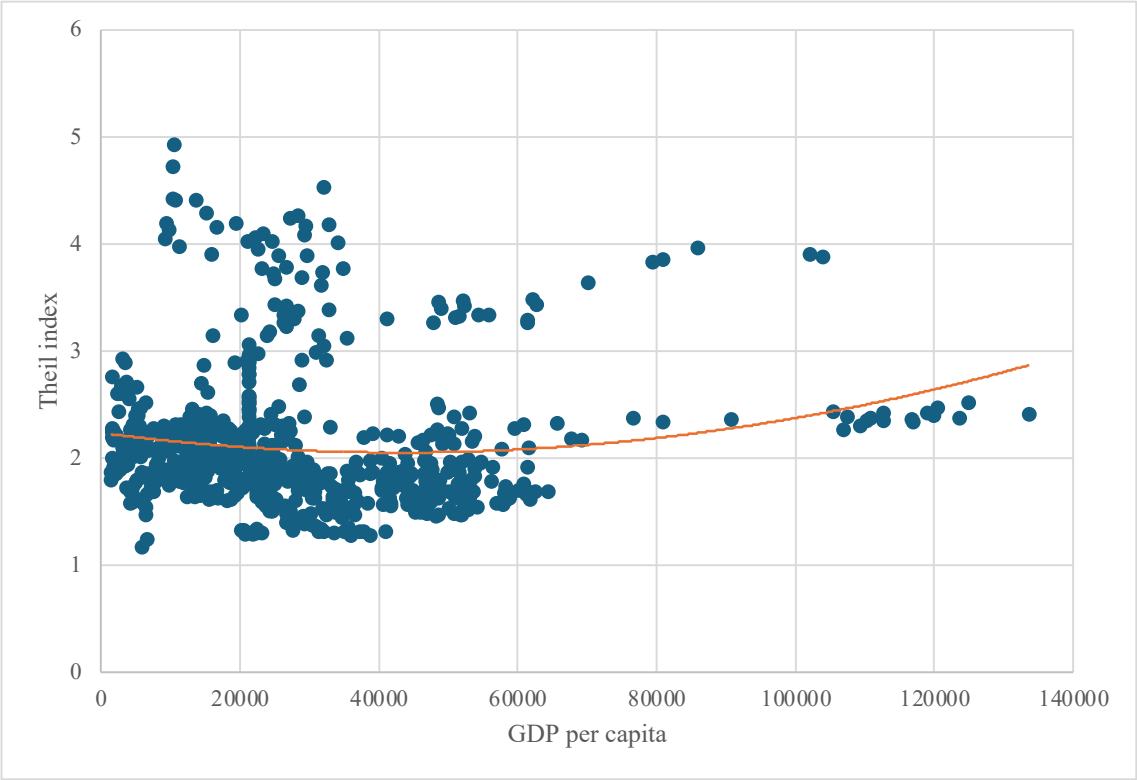

Figure 2 – Theil concentration index and GDP per capita in EU from 1995 to 2022
Source: UN COMTRADE database, Word Bank and author calculation

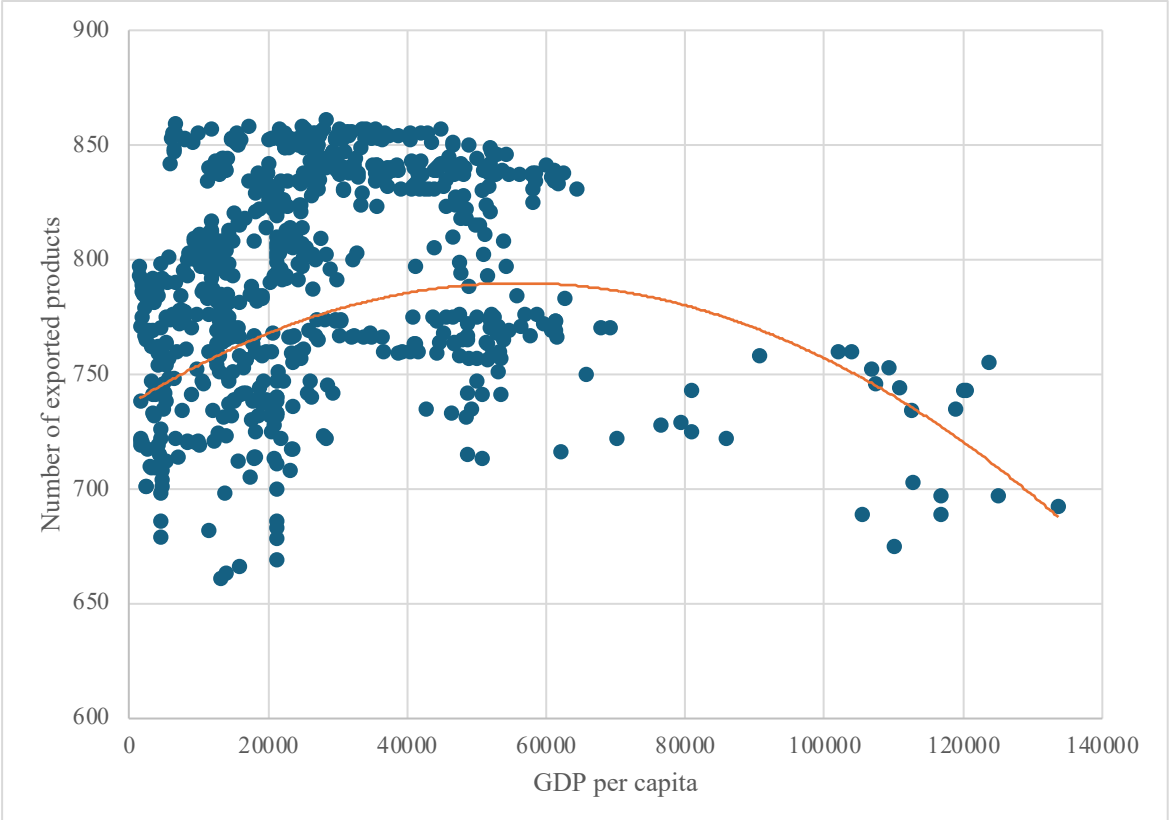

Figure 3 – Number of exported products and GDP per capita in EU from 1995 to 2022
Source: UN COMTRADE database and Word Bank

3. Empirical Approach

3.1 Measuring Export Diversification

This study uses the Theil index to measure the annual export diversification for each member state, and the robustness check is conducted by the Hirschman–Herfindahl index (HHI) to ensure the results are not sensitive to the measurement. In the empirical literature on export diversification, multiple methods are employed to measure export diversification. Commonly used approaches include the number of goods exported and utilizing various export specialization indices (Cadot et al. 2011a; Dennis and Shepherd 2011). The former approach defines export diversification as the export of a broader range of goods, while the latter view it as a more even distribution of exported goods. Utilizing the specialization indices to measure export specialization, and the lower specialization index suggests a higher level of diversification. The common specialization indices are the Theil index, Gini coefficient, and Hirschman–Herfindahl index (HHI), and the selection of measurement should not affect the result (Cadot et al. 2011).

Theil index (Theil, 1972) calculation is given by:

$$Theil = \frac{1}{n}\sum_{k=1}^{n}\frac{x_{ik}}{\mu}\ln\left(\frac{x_{ik}}{\mu}\right) \qquad \text{where} \qquad \mu = \frac{1}{n}\sum_{k=1}^{n} x_k$$

x_{ik} is the export value of product k in country i; n is the number of export lines; and μ represents the average exports. The Theil index spans from zero to infinite, where zero indicates an even distribution, and larger values indicate a greater degree of concentration. The Theil index is calculated by Python after the data collection.

This study uses export data from UNCTA's COMTRADE database to calculate the Theil index at the 4-digit level Harmonized System (HS), which includes 872 lines of exporting products. Appendix 3 lists a detailed HS section number, chapter number, and description that is included in this study.

Herfindahl-Hirschman Index (HHI) measures the degree of product concentration. The following normalized HHI calculation is given by Cadot et al., (2011a):

$$H_i = \frac{\sum_{i=1}^{n}\left(\frac{x_{ik}}{X_i}\right)^2 - \frac{1}{n}}{1-\frac{1}{n}} \qquad \text{where} \qquad X_i = \sum_{i=1}^{n} x_{ik}$$

$\sum_{i=1}^{n}\left(\frac{x_{ik}}{X_i}\right)^2$ represents the value share of product k in the total export value X_i. n is denoted as the number of products on the Harmonized System (HS) 4-digit level. The value of HHI is between 0 and 1, where 0 indicates a zero-concentration level that exporting products are evenly distributed; when

HHI closer to 1 indicates a high level of export concentration which means a few products contribute to most of the export volume.

3.2 Data and samples

This study uses trade data in the manufacturing sector from the UN COMTRADE database and covers 27 current EU member states from time 1995 to 2022. A list of countries with available trade statistics included in our sample is presented in Appendix 1. The interest of studying in the manufacturing sector stems from the availability of disaggregated data and the characteristics of the sector. First, manufacturing data is generally more disaggregated than data on the service sector. A high level of disaggregation allows for a nuanced analysis of export diversification and improves the accuracy and robustness of results. Conversely, the nature of the services sector is inherently intangible and heterogeneous, making accurate measurement and categorization challenging. Second, studying the manufacturing sector allows us to focus on products that are not constrained by country-specific natural endowments and can potentially be produced anywhere in the world. In contrast, the comparative advantage of agricultural products heavily depends on natural resources and conditions.

The key independent variable is trade barriers measured by the Trade Freedom index from the Heritage Foundation. The Trade Freedom index consists of tariff barriers and non-tariff barriers (NTB) to evaluate the overall trade barrier of a country. The range of the Trade Freedom index is between 0 to 100, where 0 represents the highest trade barriers, and 100 represents a low protectionism level. The calculation of the Trade Freedom index is as follows:

$$Trade\ Freedom_i = 100 \times \frac{Tariff_{max} - Tariff_i}{Tariff_{max} - Tarrif_{min}} - NTB_i$$

Where Trade Freedom is the index for country i; $Tariff_{max}$ and $Tariff_{min}$ represent the tariff bounds rate (%), in which $Tarrif_{min}$ is set to 0 percentage naturally, and $Tariff_{max}$ is set at 50 percentage; $Tariff_i$ is the weighted average tariff rate (%) in country i. NTB_i , non-trade barriers, is a penalty that subtracts a certain percentage of the base score. The penalty percentage derives from qualitative measurements of the trading policies of the country. The numerator indicates the difference between the tariff of the country and the upper bound, and the denominator normalizes the numerator by providing the entire possible tariff range. This ratio times 100 is the basic score - the lower the tariff, the higher the score.

According to the Heritage Foundation, the NTB penalty rate considers five quantitative and qualitative aspects: quantity restrictions (trade quotas, bans, countertrade etc.), regulatory restrictions (licensing, sanitary and phytosanitary standards, and industrial regulations), customs restrictions (advance deposit, valuation/classification/clearance procedure), direct government intervention (subsidies and aids, policies, state monopolies, and exclusive franchises), and the in force non-tariff measures counts from World Trade Organization (WTO).

The Trade Freedom index measures both tariff and non-tariff barriers. The Trade Freedom index includes trade policies and various trade restrictions, therefore reflecting the trade openness itself. On the other hand, the Trade Openness Index is calculated by the sum of the imports and exports divided by the GDP. The Trade Openness Index captures only trade transactions but fails to account for trade that did not occur due to trade barriers. Considering the popularity of the Trade Openness Index, this study uses the Trade Openness Index for the robustness check on the Trade Freedom index.

This study expects a higher trade barrier to decrease export diversification and is tested by Hypothesis 1. Given the increasing trade barriers from the European Commission protect the EU producer, thus the competition level in the internal market decreases. We expect EU exporters to switch focus to the internal market, which is less competitive and offers a higher margin. As a result, EU member states export diversification decreased.

3.3 Estimation Strategy

To analyse the effects of trade barrier on the export diversification of EU member states, the baseline estimation is:

$$Theil_{it} = \beta_0 + \beta_1 TF_{it} + \beta_2 X_{it} + \eta_t + \varepsilon_{it} \qquad (1)$$

where TF is the Trade Freedom index, X_{it} is the set of control variables of country i at year t, η_t is year dummies, and ε_{it} is the error term. This study covers the period before and after the 2016 U.S. presidential election, thereby we add year dummy variables. Following Cadot et al. (2011a), this paper uses fixed effect and random effect estimators for panel data analysis, as well as pooled OLS.

This study controls for other factors affecting trade flows. The selection of control variables is based on a wide range of theoretical and empirical literature. Control variables include GDP per capita, population, inflows of FDI stocks (Tadessea & Shukralla, 2011), terms of trade, R&D spending to GDP, human capital, and a binary variable that indicates whether a country is part of the European Union.

Following Agosín et al. (2012) and Cadot et al. (2011), human capital is proxied by mean years of school from UNDP. The Appendix 2 includes a summary of the variables used in this study.

The economic development of a country is expected to impact export diversification, and we control GDP per capita and its square to capture a nonlinear relationship. A higher-income country is expected to result in firms finding more financial resources to diversify exports to mitigate risks, such as sectional stock (Kalemli-Özcan et al., 2003) or expanding markets. Some studies (Imbs and Wacziarg 2003, Cadot et al. 2011a) find a nonlinear relationship between income per capita and a country's export diversification, and this study controls for squared GDP per capita. This study includes only the European member states, and we expect to observe a nonlinear relationship, consistent with Hypothesis 2.

Population is another variable that affects a country's export diversification. A larger population can support more exporting product lines and can also mean a more diverse labour force. Cadot et al. (2011), Parteka and Tamberi (2013) and Giri et al. (2019) find a positive relationship between population and export diversification levels. Therefore, this study controls for the population in millions and expects to observe a larger population increase in a country's export diversification.

FDI plays a pivotal role in facilitating countries' export growth, whether through direct investment in exporting firms or indirectly by enhancing the capabilities of domestic firms (Popovici, 2018; Rădulescu & Șerbănescu, 2012; Jordaan et al., 2020) through capital or new market access. Cadot et al. (2011) find the increased net FDI inflows decrease export diversification due to multinational specialization. Conversely, Tadesse and Shukralla (2011b) find inflows of FDI stock increase export diversification. Yet Bebczuk and Berrettoni (2006) find no significant relation between FDI stocks and export divarication. Considering the possible influence of FDI stocks, this study includes the natural logarithm of FDI stock, and this study expects an increase in FDI stocks to diversify exports.

Research and development (R&D) are crucial for innovating countries to maintain the leading technology position and comparative advantage in trading (Krugman, 1979) by developing new products and skills to increase productivity, contributing to export diversification. Similarly, human capital is the root of diverse business activities – a long education increases the variety of talents and equips different skill sets of the labour force, supporting a broader range of production and innovation activities. This study expects a long education and higher R&D spending to GDP ratio correlate with EU member states' export diversification positively.

This study also controls for import diversification and the European Union membership. Bas and Strauss-Kahn (2014) find that a higher diversified imported input increases firm productivity and has

TABLE 2

Descriptive statistics: 27 EU countries, 1995 - 2022

Variable	*Observation*	*Mean*	*Std. Dev.*	*Min*	*Max*
Theil index	745	2.12	0.63	1.17	4.92
Trade Openness	756	116.39	63.09	37.11	393.14
HHI Export	745	0.04	0.05	0.01	0.47
Trade Freedom	746	81.58	7.07	46.8	88
HHI Import	756	0.1	0.05	0.04	0.38
ln(GDPpc)	756	9.94	0.85	7.22	11.8
ln(GDPpc^2)	756	99.55	16.46	52.07	139.32
Population in million	756	16.35	21.27	0.38	83.8
R&D spending to GDP (%)	697	1.44	0.88	0.2	3.87
Mean years of school	756	11.22	1.55	6.14	14.26
Inflows FDI stocks in billion	745	207.23	322.66	0.3	2744.45
EU member state	756	0.83	0.38	0	1

TABLE 3

Pairwise Correlations

Variables	Free Trade	Trade Openness	ln (GDPpc)	ln (GDPpc^2)	Import HHI	Population	Human Capital	ln (FDI Stocks)	R&D	EU	Service to GDP	Agriculture to GDP
Free Trade	1											
Trade Openness	0.185*	1										
ln (GDPpc)	0.511*	0.303*	1									
ln (GDPpc^2)	0.498*	0.316*	0.998*	1								
Import HHI	0.064	0.547*	0.02	0.018	1							
Population	0.029	-0.455*	0.115*	0.111*	-0.297*	1						
Human Capital	0.465*	0.264*	0.345*	0.350*	-0.04	-0.042	1					
ln (FDI Stocks)	0.521*	0.083*	0.729*	0.727*	-0.046	0.491*	0.280*	1				
R&D	0.255*	-0.115*	0.629*	0.635*	-0.310*	0.194*	0.402*	0.452*	1			
EU	0.643*	0.113*	0.684*	0.665*	0.039	0.167*	0.319*	0.680*	0.383*	1		
Service to GDP	0.340*	0.372*	0.616*	0.619*	0.334*	0.072*	0.108*	0.470*	0.167*	0.395*	1	
Agriculture to GDP	-0.471*	-0.331*	-0.805*	-0.785*	-0.069	-0.100*	-0.344*	-0.591*	-0.463*	-0.543*	-0.563*	1

Note:

(1) * p<0.05

a direct increase in its export variety. Their conclusion indicates import concentration can influence export diversification in various ways. For instance, a country that has a diverse import exposes itself to more foreign products and technology and eventually transfers knowledge. Especially, in the case of a higher-level diversification intermediate goods structure, leads to various domestic productions substantially (Goldberg et al. 2010), which can contribute to export diversification.

Joining the European Union eliminates trade barriers within the EU, which can alter a country's choice of diversification. If a country's main export partners are within the EU, specialization can enhance its competitive advantage. On the other hand, if its main trade partners are allocated outside the EU, the exporters in the new member state can switch to intra-EU trade due to the lower trade costs. Therefore, this study expects a lower diversification level after the intra-EU trade barriers elimination consistent with Krugman (1979).

Table 2 and Table 3 present the descriptive statistics and the correlations between the variables, respectively. Certain variables may exhibit higher correlations with each other. For instance, according to endogenous growth theory, Aghion and Howitt (1998) argue in their seminal work that human capital is the root of R&D activities, which determines a country's ability to innovate. Technological spillovers further enhance technological development at the national level. R&D activities lead to the creation of new products and skills, driving economic growth and increasing export diversification. Most of the variable coefficients are below 0.8 which is the threshold recommended by Gujarati and Porter (2009). The coefficient between agriculture-to-GDP and ln(GDP per capita) is slightly over the threshold. Agriculture-to-GDP is only used for robustness check.

3.4 Endogeneity problems

This study addresses potential issues of endogeneity. First, the measurement of the key independent variable, the Trade Freedom Index might present endogeneity. GDP per capita and export diversification could be both a cause and an effect of trade policies, as captured by the Trade Freedom Index in this study. Additionally, the accuracy of measuring non-tariff barriers might be insufficient, potentially leading to measurement errors. Second, FDI inflows might also be embedded with endogeneity issues. In our model, we test whether an increase in FDI increases export diversification. However, in reality, it might go both ways. Lastly, time-invariant country fixed effect may be correlated with the explanatory variables.

To address these endogeneity problems, this study includes year dummy variables and conducts a comprehensive robustness check. Year dummies capture time-specific events or shocks that affect all countries each year, such as global economic trends, and help mitigate omitted variable bias. In addition to the primary estimators, this study employs a one-step Generalized Method of Moments (GMM) system estimation, as proposed by Arellano and Bover (1995). This method allows for the control of endogeneity and time-invariant country effects, ensuring more reliable and robust results.

4. Results

4.1 Baseline results

Table 4.1 contains the baseline results for export diversification measured by the Theil index. This study interprets the results from within (fixed effect) and between (random effect) estimations. For completeness, the estimation from pooled OLS is presented. The results suggest significance in variables trade freedom, GDP, import concentration, population, FDI stocks, and the European Union membership. The Hausman test result in Table 4.2 favours the fixed effect estimator in the baseline results. In this case, the result supports the interpretation of within estimations, especially in the variable population, which is insignificant in the within estimations.

TABLE 4.2
Hausman Test Result

Test Statistic	p - value
147.58	0.0000

The estimated coefficients for the Trade Freedom index are positive at a 5 per cent significant level. The results can be interpreted as a higher free trade environment correlates with lower export diversification. The results are inconsistent with the classical trade theory (Smith 1766, Ricardo 1817), but in line with findings in Agosín et al. (2012) that suggest that increased free trade negatively correlates with export diversification. Therefore, hypothesis 1 is not supported. Agosín et al. (2012) argue that specialization in traditional sectors is a response to the emergence of new products and exporters resulting from the reforms and differentiations. The positive and significant coefficients for HHI import across all estimations indicate a consistent and robust relationship between import and export concentration in EU member states. The result suggests that developed countries with more concentrated imports tend to have lower export diversification. The trade of intermediate goods can

TABLE 4.1
Baseline Results

Variables	*Fixed effect*	*Random effect*	*Pooled OLS*
Trade Freedom	0.0043**	0.0044**	0.0044
	(0.0019)	(0.0020)	(0.0038)
ln (GDPpc)	-1.2111***	-1.3259***	-0.1452
	(0.2603)	(0.2544)	(0.3140)
ln (GDPpc^2)	0.0442***	0.0528***	0.0123
	(0.0147)	(0.0141)	(0.0161)
Import HHI	0.9450***	1.2911***	6.4430***
	(0.2957)	(0.2982)	(0.3446)
Population (in million)	-0.0026	-0.0123***	-0.0092***
	(0.0092)	(0.0029)	(0.0010)
Human Capital	-0.0332	-0.0317	0.0095
	(0.0241)	(0.0220)	(0.0133)
ln (FDI Stocks in billion)	0.0814***	0.0784***	0.0886***
	(0.0181)	(0.0178)	(0.0186)
R&D spending to GDP	0.0394	0.0179	-0.1618***
	(0.0322)	(0.0303)	(0.0265)
EU	0.1363***	0.1189***	-0.2394***
	(0.0415)	(0.0416)	(0.0707)
constant	9.1425***	1.2193***	1.325663
Observation	681	681	681
Number of id	27	27	
R_sq			0.6069
within	0.3467	0.3418	
between	0.0409	0.2754	
overall	0.0676	0.2725	
Adjusted			0.5849
F/ Wald chi2	9.11	325.72	
Year Dummy	Yes	Yes	Yes

Notes:

(i) Standard errors in parentheses.

(ii) ***p<0.01, **p<0.05, *p<0.1.

explain the results. When a developed country has specialized in exporting a few product lines, the need for intermediate goods can concentrate similarly, contributing to a lower export diversification. Agosín et al. (2012) did not control for import concentration level.

These empirical results can be interpreted in two ways. First, European Union member states are sensitive to EU trade policy that increases trade barriers, and the imported materials and products to EU member states are significant to their export diversification. When the European Union implement a stricter policy, such as anti-subsidies, the EU importers can face a higher cost for trading with non-EU exports due to compliance or switching costs. Consequently, the intra-EU trade becomes comparatively cheaper, feasible, and stable. Importers may choose to increase the trade with EU exporters and decrease or terminate the trade with non-EU exporters, thus, increasing import concentration. This effect can be passed on to the EU exporters who rely on non-EU imported intermediate goods. When the intermediate goods price increases due to the supply decrease, EU exporters face the dilemma of raising product prices—thereby weakening their competitive advantage in the global market—or accepting reduced margins. Ultimately, exporting such products could reach the breaking point that no longer sustains exports. Therefore, prompting a shift towards focusing on intra-EU products and decreasing EU member states' export diversification.

Another way to interpret this result is that stricter trade policies reduce the EU's exposure to the international market by limiting imported intermediate and final goods. Trade is not merely the exchange of goods; it also fosters the exchange of knowledge, information, and culture. New foreign products can serve as a foundation for innovation, diversifying products through mortifications and redesigns. Moreover, when categories of imported goods to the EU are fewer, exporters may miss out on a booming market that competitors are capitalizing on. Getting into a global business trend can facilitate knowledge transfer by trading and competing on the international market. As a result, diversify the domestic production and exports. Exporters distribute successful products worldwide, but if these products or the intermediate goods cannot enter the EU market, EU exporters face additional effort and costs to profit from these trends—costs that may not be affordable for every exporter or manufacturer. Therefore, restricting imports may lead to decreased export diversification.

The estimations show a significant nonlinear relationship between GDP per capita and export diversification. The result is consistent with Cadot et al. (2011a) and Imbs and Wacziarg (2003): negative coefficient on GDP per capita and positive on its squared, and significant in all estimators. This result supports hypothesis 2 and concludes that economic development in EU member states correlates with export diversification. The estimations show a significant negative coefficient between

population and export concentration in the between estimation, consistent with the results of Cadot et al. (2011a), Parteka and Tamberi (2013) and Giri et al. (2019), which suggest a larger population correlate to higher export diversification. However, the results from within the estimation are negative but insignificant. This result can be interpreted that population differences have a sustained impact on export diversification between member states, but the population growth within each member state is too slow to have a significant influence on export diversification.

This study finds that increased FDI stocks enhance EU member states export concentration at a 1 per cent significant level, meaning that the increased FDI stocks decrease export diversification. This result is in line with Cadot et al. (2011), who argue that a possible reason could be that multinationals' productions are highly specialized at a large volume to obtain economies of scale. This argument can be strong in the European market, which has skilled workforces, a well-established regulatory framework, thriving financial centres, and a low-risk investment destination for foreign investors. As a result, Europe attracts multinationals to set up headquarters in the EU, not only as a production hub but also as a strategic position in the global market.

Regarding European Union membership, this study finds a positive and significant correlation with a country's export concentration. This result indicates that countries' export diversifications decrease after joining the European Union. The trade barriers are eliminated for the new member state's intra-EU trade after a country joins the EU, and the country faces an overall lower trade barrier in their exports. According to the trade theory (Smith 1766, Ricardo 1817), countries tend to specialize in products with lower trade barriers. Another cause can be the highly homogenous extra-EU trade policies for member states, which are set by the European Union, and restrain the spontaneous and various trading preferences of individual member states.

Conversely, this study does not observe a significant impact of human capital on export diversification as other studies (Cadot et al. 2011, Giri et al. 2019, Agosín et al. 2012) find a higher education level correlates with higher export diversification. The reason can be these studies included developing countries in their sample, and Giri et al. (2019) only find significance in primary education but not in secondary and tertiary education. Education can play a significant role in developing countries compared to European Union member states. In the European Union, nearly 84% of the population between ages 20-24 completed at least an upper secondary level education (Eurostat, 2024), and an

average of 44.72% [2]of the population between ages 25 to 34 with tertiary education in 2022 (OECD, 2023). The high education attainment rate within the EU can explain the insignificant results.

Similarly, this study finds that R&D spending is insignificant to export diversification. Europe has a long history in R&D activities and is home to prominent researchers. Europe achieved significant developments, and many countries established stable technological advantages globally. For instance, Germany has a leading position in engineering and automotive; the Netherlands excels in electronics and semiconductors; France has a strong department in aerospace and nuclear energy. Once a country establishes a comparative advantage in manufacturing and export, the advantage has a self-enhance mechanism (Krugman, 1987). To maintain the technology leading position, the R&D activities are more likely to focus on innovating advanced products (Krugman 1979) instead of expanding the variety of products.

4.2 Robustness Analysis

In the robustness check, this study drops three small member states (Cyprus, Luxembourg, and Malta) and variable R&D spending to GDP from the database. In the first robustness check, the Theil and Trade Freedom index remain and add two additional control variables. This step aims to investigate the effects of dropping three member states, and this study expects no significant change in the results. In the second robustness check, we substitute the Theil and Trade Freedom index with the HHI and Trade Openness Index separately. This step tests whether the baseline results are sensitive to the measurements.

The considerations of individuals and variable elimination are missing values and insignificance. Dropping Cyprus, Luxembourg, and Malta can enhance the observations and reliability of the results. These countries have more missing values compared to other EU member states, which may lower data quality. Additionally, these three member states do not have significant export volumes. Finally, their economic structures can be highly specialized and not reflective. Excluding them ensures that the analysis remains representative and provides more generalizable insights. The reasons to exclude variable R&D spending from GDP due to its missing value and insignificance in the baseline results.

For additional variables, this study adds the service-to-GDP ratio and agriculture-to-GDP ratio into control variables. The reason to control the ratio of service and agriculture is the rapid growth of service sectors and the decline in manufacturing's ratio to GDP in recent decades (World Bank, 2023). This

[2] Excluding Cyprus, Croatia, and Malta.

study expects a positive correlation between the service-to-GDP ratio and export concentration and an insignificant effect from the agriculture-to-GDP ratio. When the service sector takes more ratio in a country's GDP, it squeezes out the resources and labour in the manufacturing sector, and the manufacturing can be more specialized in high-value and high-tech products.

This study tests the sensitive to the measurements of diversification and trade barriers. We calculate the HHI and extract the trade openness index from the World Bank for the robustness check. HHI is similar to the Theil index that measures the concentration level, the higher the index, the lower the diversification level. This study expects to observe a similar result from HHI. The trade openness index is popular in the study of trading openness.

The estimations in Table 5.1 and Table 6.1 validate the robustness of the baseline results. This study runs the estimations as the baseline model shown in column 1. We add service-to-GDP in column 2 and service- and agriculture-to-GDP in column 3. Table 5.1 shows the result after the change in the sample size. GDP per capita and import HHI remain the same with a slightly higher coefficient in all results, and the significant level of Trade Freedom increases to 1 per cent.

Conversely, even the sign of FDI remains the same, the significant level decreases with additional variables. There is no dramatic change in other variables. Therefore, this study can conclude that the sample size does not affect the results. Table 6.1 shows the results of switching Theil to HHI and the Free Trade index to the Trade Openness Index. Most variables remain the same compared to baseline results, and the significance of FDI reappears. Reassuringly, Trade Openness, GDP per capita, and import HHI remain the same coefficient and significant at a 1 per cent level in all results, consistent with the baseline and previous robustness estimations.

Contrary to expectation, the coefficients for the service-to-GDP and agriculture-to-GDP ratios are negative at a 1 per cent significant level. The result suggests that when services and agriculture to GDP ratio increase, diversifing the manufacturing exports. One of the possible reasons is that complementary services become a crucial part of manufacturing products, and the manufacturing sector can increase its capacity with the service sector enlargement. For instance, advanced logistics services can reduce transportation costs with higher efficiency for manufacturers and enable them to access a larger market. Thus, the manufacturers produce various market-specific products to cater to different customers' needs. FDI inflows are important for the services sector development (Arnold et al. 2011b), and adding service-to-GDP diverts the effect from FDI to manufacturing export diversification. Likewise, a strong domestic agricultural sector can foster agro-processing industries or serve as raw material inputs to manufacturing industries with a lower cost, such as textiles and bio-

TABLE 5.1
Robustness Check for Theil

	Fixed effect			*Random effect*			*Pooled OLS*		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Trade Freedom	0.0051***	0.0062***	0.0055***	0.0051***	0.0062***	0.0056***	0.0091**	0.0136***	0.0122***
	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0017)	(0.0036)	(0.0032)	(0.0032)
ln (GDPpc)	-1.5775***	-1.3136***	-2.0353***	-1.6176***	-1.4040***	-2.1195***	-0.8389**	-0.6716**	-1.7524***
	(0.2376)	(0.2436)	(0.2687)	(0.2296)	(0.2323)	(0.2600)	(0.3413)	(0.3059)	(0.3914)
ln (GDPpc^2)	0.0710***	0.0580***	0.0935***	0.0738***	0.0639***	0.0986***	0.0422**	0.0418***	0.0927***
	(0.0133)	(0.0135)	(0.0145)	(0.0127)	(0.0127)	(0.0139)	(0.0177)	(0.0159)	(0.0196)
Import HHI	1.2098***	1.1709***	1.2381***	1.2653***	1.2486***	1.3092***	4.8783***	5.7882***	5.9113***
	(0.2864)	(0.2830)	(0.2760)	(0.2863)	(0.2835)	(0.2761)	(0.4588)	(0.4173)	(0.4124)
Population (in million)	-0.0009	0.0003	0.0020	-0.0082***	-0.0068***	-0.0056**	-0.0082***	-0.0055***	-0.0052***
	(0.0078)	(0.0077)	(0.0075)	(0.0028)	(0.0026)	(0.0027)	(0.0009)	(0.0008)	(0.0008)
Human capital	-0.0004	0.0001	0.0046	0.0025	0.0016	0.0020	-0.0180	-0.0497***	-0.0676***
	(0.0228)	(0.0225)	(0.0220)	(0.0204)	(0.0200)	(0.0197)	(0.0115)	(0.0106)	(0.0112)
ln (FDI Stocks in billion)	0.0661***	0.0486**	0.0235	0.0628***	0.0490**	0.0253	0.0552***	0.0354**	0.0232
	(0.0225)	(0.0227)	(0.0225)	(0.0213)	(0.0212)	(0.0211)	(0.0189)	(0.0170)	(0.0170)
EU	0.1223***	0.0878**	0.1295***	0.1124***	0.0788*	0.1233***	-0.1474**	-0.1624***	-0.0694
	(0.0371)	(0.0377)	(0.0374)	(0.0362)	(0.0367)	(0.0366)	(0.0679)	(0.0609)	(0.0637)
Service to GDP		-0.0137***	-0.0206***		-0.0137***	-0.0202***		-0.0383***	-0.0416***
		(0.0034)	(0.0035)		(0.0033)	(0.0034)		(0.0031)	(0.0031)
Agriculture to GDP			-0.0451***			-0.0450***			-0.0544***
			(0.0079)			(0.0079)			(0.0125)
constant	9.82***	9.36***	13.59***	10.06***	9.67***	14.05***	5.23***	5.75***	12.06***
Observation	655	655	655	655	655	655	655	655	655
Number of id	24	24	24	24	24	24			
R_sq							0.3591	0.4868	0.5020
within	0.3485	0.3657	0.3989	0.3473	0.3641	0.3973			
between	0.0148	0.0557	0.043	0.2249	0.2636	0.275			
overall	0.0671	0.1066	0.0984	0.2515	0.2834	0.2981			
adjusted							0.3228	0.4569	0.4721
F/ Wald chi2	9.11	9.53	10.66	322.19	346.77	398.31	9.91	16.29	16.81
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
(i) Standard errors in parentheses.
(ii) ***p<0.01, **p<0.05, *p<0.1.

TABLE 6.1
Robustness Check for HHI

	Fixed effect			*Random effect*			*Pooled OLS*		
Variables	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Trade Openness	0.0004***	0.0004***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0003***	0.0002***
	(3.9E-05)	(4E-05)	(3.9E-05)	(3.6E-05)	(3.7E-05)	(3.6E-05)	(2.2E-05)	(2.2E-05)	(2.3E-05)
ln (GDPpc)	-0.0522***	-0.0508***	-0.0972***	-0.0545***	-0.0535***	-0.0993***	-0.0322**	-0.0233*	-0.0668***
	(0.0137)	(0.0141)	(0.0155)	(0.0128)	(0.0129)	(0.0146)	(0.0135)	(0.0130)	(0.0166)
ln (GDPpc^2)	0.0022***	0.0021***	0.0044***	0.0024***	0.0023***	0.0046***	0.0019***	0.0017**	0.0037***
	(0.0008)	(0.0008)	(0.0008)	(0.0007)	(0.0007)	(0.0008)	(0.0007)	(0.0007)	(0.0008)
Import HHI	0.0602***	0.0602***	0.0667***	0.0649***	0.0655***	0.0726***	0.1150***	0.1545***	0.1720***
	(0.0162)	(0.0163)	(0.0158)	(0.0162)	(0.0163)	(0.0158)	(0.0201)	(0.0200)	(0.0202)
Population (in million)	-0.0007	-0.0007	-0.0006	-7.6E-06	-6.16E-09	2.23E-05	0.0002***	0.0002***	0.0002***
	(0.0004)	(0.0004)	(0.0004)	(0.0001)	(0.0001)	(0.0001)	(4.6E-05)	(4.4E-05)	(4.4E-05)
Human capital	0.0013	0.0013	0.0017	0.0001	2.99e-05	0.0001	-0.0036***	-0.0039***	-0.0044***
	(0.0012)	(0.0012)	(0.0012)	(0.0010)	(0.0010)	(0.0010)	(0.0005)	(0.0005)	(0.0005)
ln (FDI Stocks in billion)	0.0044***	0.0044***	0.0031**	0.0045***	0.0044***	0.0034***	-0.0016	-0.0013*	-0.0014*
	(0.0013)	(0.0013)	(0.0013)	(0.0012)	(0.0012)	(0.0012)	(0.0008)	(0.0008)	(0.0008)
EU	-0.0007	-0.0008	0.0017	0.0007	0.0007	0.0034*	-0.0023	-0.0026	0.0005
	(0.0021)	(0.0021)	(0.0021)	(0.0020)	(0.0021)	(0.0020)	(0.0026)	(0.0025)	(0.0026)
Service to GDP		-0.0001	-0.0005***		-0.0001	-0.0005***		-0.0010***	-0.0012***
		(0.0002)	(0.0002)		(0.0002)	(0.0002)		(0.0001)	(0.0001)
Agriculture to GDP			-0.0028***			-0.0028***			-0.0023***
			(0.0004)			(0.0004)			(0.0006)
constant	0.2622***	0.2614***	0.5301***	0.2644***	0.2664***	0.5376***	0.1705***		0.4307***
Observation	662	662	662	662	662	662	662	662	662
Number of id	24	24	24	24	24	24			
R_sq							0.4285	0.5751	0.4892
within	0.3806	0.3808	0.4194	0.3767	0.3764	0.415			
between	0.1906	0.1895	0.196	0.2804	0.2862	0.2912			
overall	0.1928	0.1916	0.2038	0.3012	0.3059	0.3191			
adjusted							0.3966	0.4449	0.4589
F/ Wald chi2	10.59	10.28	11.74	366.01	364.55	427.38	13.41	15.72	16.15
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes:
(i) Standard errors in parentheses.
(ii) ***p<0.01, **p<0.05, *p<0.1.

based products. Therefore, the enlargement of the service and agriculture sectors can enhance thecomparative advantage in the manufacturing sector and eventually increase export diversification. In addition, among all estimations, only one result found a 10 per cent significant coefficient for variables joining the European Union. These results suggest the impact of EU enlargement may not be robust. Similarly, this estimation does not show significance for variables population.

In all the specifications, trade freedom, import concentration, and inflow FDI stock decrease member states' export diversification. On the other hand, the nonlinear relationship between GDP per capita and export diversification level is robust in all results. This study found evidence to support the nonlinear relationship between GDP and export diversification mentioned in Cadot et al. (2011a) and Imbs and Wacziarg (2003). The Hausman test results in Tables 5.2 and 6.2 in the appendix prefer the random effect estimator over the fixed effect estimator. Because there is no dramatic change between and within estimators, we do not discuss further the Hausman test results.

4.3 Extension: Alternative Estimation Model

This study follows Cadot et al. (2011a) empirical strategy to control the endogenous problem and further investigate the results from the GMM system estimator. The standard error of the GMM estimator is downward biased (Windmejier 2005), and the one-step GMM system estimator is the optimal choice for such small samples (Arellano & Bond, 1991). Therefore, this study performs a one-step GMM system estimator, which is more efficient compared to a two-step GMM estimator.

While examining whether the results from the system GMM estimator are robust, several test statistics must fall within the expected range. The first test is the Arellano-Bond (AR) test for serial autocorrelation. The first-order autocorrelation is expected due to the lagged dependent variable and the residuals (AR 1 test) should be rejected ($p < 0.05$), and the second-order autocorrelation (AR 2 test) needs to be accepted ($p > 0.05$). Second, the number of instruments should not exceed the number of individuals in the panel (Roodman, 2009b). Lastly, the null hypothesis of the Hansen test for overidentification needs to be rejected to affirm the applied instruments are jointly valid. In addition, Hansen p-value greater than 0.25 and lower than 1 suggests the optimal fitness of the instruments (Roodman, 2009b). In this one-step GMM system estimation, the instruments are individual dummies, which aim to control for the country's fixed effects. The choice of instruments also considers other problems presented in the experiment results. The Hansen p-value suggests overidentification when

TABLE 7
One-step GMM System Estimations for Theil

Variables	(1)	(2)	(3)
Lagged Theil	1.0227***	1.0228***	1.0225***
	(0.0101)	(0.0157)	(0.0151)
Trade Freedom	-0.0077***	-0.0077***	-0.0072***
	(0.0021)	(0.0022)	(0.0021)
ln (GDPpc)	0.3200***	0.3201***	0.4751***
	(0.0928)	(0.0960)	(0.1508)
ln (GDPpc^2)	-0.0158***	-0.0158***	-0.0229***
	(0.0048)	(0.0052)	(0.0073)
Import HHI	-0.5033***	-0.5041**	-0.5017**
	(0.1775)	(0.2375)	(0.2045)
Population (in million)	-0.0005**	-0.0005**	-0.0005**
	(0.0002)	(0.0002)	(0.0002)
Human capital	0.0151***	0.0151***	0.0176***
	(0.0049)	(0.0050)	(0.0046)
ln (FDI Stocks in billion)	0.0060	0.0060	0.0068
	(0.0048)	(0.0047)	(0.0050)
R&D spending to GDP	-0.0258***	-0.0258***	-0.0273***
	(0.0087)	(0.0080)	(0.0077)
EU	0.1105**	0.1105**	0.1031*
	(0.0520)	(0.0522)	(0.0543)
Service to GDP		8.05E-06	2.18E-04
		(0.0012)	(0.0011)
Agriculture to GDP			0.0082
			(0.0054)
constant	-1.2069***	-1.2072**	-2.1405**
Observations	663	663	663
Groups/Instruments	27/27	27/27	27/27
F-statistic	140415.62	144875.87	93157.52
Hansen p-value	0.398	0.349	0.319
AR(1) p-value	0.003	0.003	0.003
AR(2) p-value	0.869	0.869	0.877

Notes:

(i) Robust standard errors in parentheses.

(ii) ***p<0.01, **p<0.05, *p<0.1.

using year dummies or year and country dummies as instruments. Table 7 reports the estimations[3] for export concentration measured by the Theil index. All the results are robust as they satisfy the conditions for GMM estimation. The AR test rejects the first-order autocorrelation null hypothesis at a 1 per cent significant level and accepts the null hypothesis of second-order autocorrelation. The Hansen test assures the joint validation of the instruments, and the p-value distributes in the ideal range. Lastly, the number of instruments is not greater than the number of individuals.

Notably, there is a strong persistence in the lagged Theil index at a 1 per cent significant level, meaning that the previous Theil index persists and slightly amplifies in the current period. The strong persistence level is higher compared with Agosín et al. (2012), who find an average 0.769 coefficient on the lagged dependent variables. The lagged variable coefficient equal to 0.5 is considered a moderate level. The sample in Agosín et al. (2012) included countries in different development stages, and the period covers earlier than ours. The developed countries may tend to have a much stronger persistence than middle- and low-income countries due to the high development stage. Another reason can be that resources or investments in the production of certain goods accumulate over time, resulting in tremendous sunk costs that any policymaker or businesspeople cannot ignore. The high persistence level in the European Union consistents with Krugman's theory (Krugman, 1987). As mentioned before, the European Union member states have established advantages in certain industries, and this result reaffirms the diversification choice of the member states is influenced by the previous choice. The member states are more likely to choose to enhance the existing advantage instead of investing in a new industry.

The estimator choice has an impact on the results, which show differences between the baseline estimations. The coefficients for GDP per capita are inconsistent with Cadot et al. (2011a). This result may imply the association between GDP per capita and export diversification in the European Union can be different compared to other countries, and regions or countries' specific effects may play a role in such analysis. There are other differences in the estimations compared with the baseline results. For instance, the coefficients for Trade Freedom are significantly negative, indicating that the increase of trade freedom increases export diversification, which is opposite from previous results. The import concentration has a different coefficient sign and is significant at the 1 per cent level. Human capital and R&D spending are insignificant in baseline results but significant in GMM estimations. The increased R&D spending results in a decrease in export concentration at a 1 per cent significance level. The significance of R&D can confirm that innovation activities contribute to export diversification by

[3] The command to perform system GMM in Stata is "xtabond2" (Roodman 2009b).

TABLE 8
Two-step GMM System Estimation for Theil

Variables	(1)	(2)	(3)
Lagged Theil	1.0260***	1.0237***	1.0245***
	(0.0218)	(0.0249)	(0.0257)
Trade Freedom	-0.0077***	-0.0076**	-0.0064**
	(0.0026)	(0.0028)	(0.0028)
ln (GDPpc)	0.3253***	0.3230***	0.4309**
	(0.1161)	(0.1087)	(0.2013)
ln (GDPpc^2)	-0.0163**	-0.0161***	-0.0211**
	(0.0060)	(0.0056)	(0.0094)
Import HHI	-0.4777	-0.4580	-0.4494
	(0.3178)	(0.3261)	(0.2940)
Population (in million)	-0.0004**	-0.0004**	-0.0004*
	(0.0002)	(0.0002)	(0.0002)
Human capital	0.0169***	0.0168***	0.0157***
	(0.0054)	(0.0056)	(0.0046)
ln (FDI Stocks in billion)	0.0072	0.0073	0.0073
	(0.0047)	(0.0050)	(0.0047)
R&D spending to GDP	-0.0256*	-0.0263*	-0.0228**
	(0.0144)	(0.0139)	(0.0101)
EU	0.1075	0.1100	0.0756
	(0.0830)	(0.0829)	(0.0947)
Service to GDP		-2.49E-04	-2.45E-04
		(0.0011)	(0.0011)
Agriculture to GDP			0.0037
			(0.0059)
constant	-1.25**	-1.23**	-1.89
Observations	663	663	663
Groups/Instruments	27/27	27/27	27/27
F-statistic	5.78e+06	4.09e+06	705151.83
Hansen p-value	0.398	0.349	0.319
AR(1) p-value	0.002	0.002	0.002
AR(2) p-value	0.871	0.875	0.813

Notes:

(i) Robust standard errors in parentheses.

(ii) ***p<0.01, **p<0.05, *p<0.1.

creating new products, technology, and skills. We cannot observe significance in FDI stocks agriculture- and service-to-GDP ratio in GMM estimation. This study runs a two-step GMM estimation as a robustness check as shown in Table 8. We observe differences in the results in the insignificant level of variable import HHI, EU membership, and a lower significant level of R&D spending to GDP. The other variables remain the same as one-step GMM estimations, especially GDP per capita.

In this study, I consider baseline and extension models to have obtained robust results and the presence of endogeneity issues. The discrepancy between the fixed effect, random effect, and system GMM results can be attributed to endogeneity issues, which the GMM estimator is specifically designed to address. Another reason can be the strong persistence of the lagged Theil index, and the persistence effect in the European Union is higher compared to other studies. Cadot et al. (2011a) find consistent results in different estimators (system GMM, within, between, and pooled estimators), yet this study does not. Future researchers need to choose the estimation model wisely and address the endogenous issue with care.

5. Conclusion

Noting that the relationship between protectionist trade policy and export diversification is yet to draw the attention of researchers, this study attempts to make a contribution. I carefully assess whether there is an actual impact of trade barriers on the variety of exported goods in the European Union. Studying the manufacturing sector from 1995 to 2022 and incorporating other relevant factors mentioned by the literature, this study tests whether EU member states are concentrating exports due to higher trade barriers. Compared to previous studies, we cover an EU-specific variable and different measures of export concentration and trade barriers to ensure the results are not sensitive to the measurements. This study uses a robust and intuitive methodology that closely mirrors how export diversification is thought of in a macroeconomic context. With all the effort, this study presents a reasonable conclusion about the effects of trade barriers on export diversification.

This study examines the effect of trade barriers and finds robust evidence to support that the increase in trade barriers decreases export diversification. In the baseline results, the Trade Freedom index has affected export diversification negatively. With further robustness analysis, this study substitutes the Theil and Trade Freedom indices, and the results stand with a higher significant level. Second, this study explores the relationship between export diversification and GDP per capita. This study finds a robust nonlinear relationship in the European Union, which aligns with Cadot et al. (2011a) and Imbs and Wacziarg (2003). Another robust result is the import concentration associated with export

diversification negatively. This can be explained by the concentrated imports that can limit the output of EU exporters, and foreign products can serve as a starting point for innovation or adoption. Importing various goods enables EU exporters to expand their market and increase export diversification by innovating or modifying.

In addition, this study finds that being a member of the European Union somewhat decreases a country's export diversification but is less robust. This study uses a binary variable to indicate whether a country is part of the EU and whether the EU membership is negatively correlated with export diversification. We conclude that joining the EU may make countries practice a homogeneous policy for extra-EU trade and limited country-specific activities or trade preferences. Moreover, complying with EU trading policy can cause an increase in trading costs and the trading can swift to intra-EU trade, which increases the import concentration as discussed above.

By contrast, this study does not find any significance of R&D spending, human capital, and population effects on export diversification in EU member states as expected. Most EU member states have established their comparative advantage in the manufacturing sector with a long development history. Therefore, R&D spending can be more likely to be invested in the existing and leading industries to strengthen the advantage, instead of innovating new products. The high coverage of the educational rate in the EU can explain the insignificant findings in human capital, which is proxied by the mean year of school in this study. Education is essential in the EU compared to other developing countries. Population growth can be insignificant in the EU; therefore, this study does not observe any significant impact.

Here is the note for future researchers. It is unnecessary to emphasize more research needs to be done on this topic, and results from this study should be a starting point for further analysis rather than a relationship description between trade barriers and export diversification. For future studies, using more precise measurements of trade barriers, especially the non-tariff barrier, will be valuable and allow the researcher to reach a more reliable result. In addition, prolonging the period coverage can make the estimator more effective. In addition to the possible endogenous issues, this study discloses a strong persistence and a slight magnifying effect from the previous export diversification choice to the current stage. It can be significant for future studies to take these factors into account to choose estimators wisely and treat the data with care.

Policymakers need to understand the results from this study beyond the estimation results. It is crucial to be crystal clear about primary and secondary goals of a trade policy and lower the expectation of outcome. Given the complexity of the topic, following some promising research or results can find a

fraction of assuring, but the outcome of the policy may go a different direction. Policymakers should realize the limitations of studies and should be considered during the policymaking process, and I believe it can contribute to a better outcome.

Reference

Acemoglu, D., & Zilibotti, F. (1997). Was Prometheus unbound by chance? Risk, diversification, and growth. Journal of political economy, 105(4), 709-751.

Acemoğlu, D., & Zilibotti, F. (1997). Was Prometheus unbound by chance? Risk, diversification, and growth. *Journal of Political Economy*, *105*(4), 709–751. https://doi.org/10.1086/262091

Aghion, P., & Howitt, P. (1998). *Endogenous Growth Theory*. The MIT Press. Cambridge(MA).

Agosín, M. R., Álvarez, R., & Bravo-Ortega, C. (2011). Determinants of export diversification around the world: 1962–2000. *The World Economy*, *35*(3), 295–315. https://doi.org/10.1111/j.1467-9701.2011.01395.x

Amiti, M. (1999). Specialization patterns in Europe. *Weltwirtschaftliches Archiv*, *135*(4), 573–593. https://doi.org/10.1007/bf02707385

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies/the Review of Economic Studies*, *58*(2), 277. https://doi.org/10.2307/2297968

Arnold, J. M., Javorcik, B. S., & Mattoo, A. (2011). Does services liberalization benefit manufacturing firms?: Evidence from the Czech Republic. Journal of International Economics, 85(1), 136-146.

Bas, M., & Strauss-Kahn, V. (2014). Does importing more inputs raise exports? Firm-level evidence from France. *Review of World Economics*, *150*, 241-275.

Basedow, R. (2020). Trade policy and non-trade policy objectives: perceptions on EU strategy. *Cadmus EUI*. https://doi.org/10.2870/040096

Bernard, A. B., & Jensen, J. B. (2004). Exporting and productivity in the USA. *Oxford Review of Economic Policy*, *20*(3), 343–357. https://doi.org/10.1093/oxrep/grh020

Bieleková, E., & Pokrivčák, J. (2020). Determinants of international beer export. *AGRIS On-line Papers in Economics and Informatics*, *12*(2), 17–27. https://doi.org/10.7160/aol.2020.120202

Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011). Trade diversification: Drivers and impacts. *Trade and employment: From myths to facts*, 253-305.

Cadot, O., Carrère, C., & Strauss-Kahn, V. (2011a). Export diversification: What's behind the hump? *Social Science Research Network*.

https://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID2557500_code2091123.pdf?abstractid=2557500&mirid=1&type=2

Chenery, H. (1979). *Structural Change and Development Policy.* New York: Oxford University Press.

Colantone, I., Ottaviano, G. I., & Stanig, P. (2022). The backlash of globalization. In *Handbook of International Economics* (pp. 405–477). https://doi.org/10.1016/bs.hesint.2022.02.007

Curran, L., & Zignago, S. (2009). Evolution of EU and its Member States' Competitiveness in International Trade. RePEc: *Research Papers in Economics*.

Dennis, A., & Shepherd, B. (2011b). Trade facilitation and export diversification. *The World Economy*, *34*(1), 101–122. https://doi.org/10.1111/j.1467-9701.2010.01303.x

Dixit, A. and V. D. Norman (1980). Theory of International Trade: A Dual, General Equilibrium Approach. *Cambridge: Cambridge University Press*.

Dluhosch, B. (2018). Trade, inequality, and subjective well-being: Getting at the roots of the backlash against globalization. *RePEc: Research Papers in Economics*.

Dornbusch, R., Fischer, S., & Samuelson, P. A. (1977). Comparative advantage, trade, and payments in a Ricardian model with a continuum of goods. *The American Economic Review*, *67*(5), 823-839.

Dür, A. (2008). Bringing Economic Interests Back into the Study of EU Trade Policy-Making. *The British Journal of Politics and International Relations*, *10*(1), 27–45. https://doi.org/10.1111/j.1467-856x.2007.00316.x

Dür, A., Eckhardt, J., & Poletti, A. (2020). Global value chains, the anti-globalization backlash, and EU trade policy: a research agenda. *Journal of European Public Policy*, *27*(6), 944–956. https://doi.org/10.1080/13501763.2019.1619802

Ethier, W. J. (1979). Internationally decreasing costs and world trade. *Journal of International Economics*, *9*(1), 1–24. https://doi.org/10.1016/0022-1996(79)90045-x

Ethier, W. J. (1982). National and International Returns to Scale in the Modern Theory of International Trade. *The American Economics Review 72(3), 389-405*

European Commission (2023). Implementation and Enforcement of EU Trade Policy. *COM(2023)740*. https://ec.europa.eu/transparency/documents-register/detail?ref=COM(2023)740&lang=en

European Commission. (2017). *Regulation - 2017/2321*. EUR-Lex. https://eur-lex.europa.eu/eli/reg/2017/2321/oj

European Commission. (2019). *Regulation (EU) 2019/452* EUR-Lex. http://data.europa.eu/eli/reg/2019/452/oj

European Commission. (2024). *Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the screening of foreign investments in the Union and repealing*

Regulation (EU) 2019/452 of the European Parliament and of the Council. EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52024PC0023

Eurostata (2024), At least upper secondary educational attainment, age group 20-24 by sex, *Eurostat*. https://doi.org/10.2908/TPS00186

Funke, M., & Ruhwedel, R. (2001). Product variety and Economic Growth: Empirical evidence for the OECD countries. *Imf Staff Papers*, *48*(2), 225–242. https://doi.org/10.2307/4621668

Gnangnon, S. K. (2022). Effect of economic complexity on services export diversification: do foreign direct investment inflows matter? *International Journal of Development Issues*, *21*(3), 413–437. https://doi.org/10.1108/ijdi-01-2022-0023

Goldberg, P. K., Khandelwal, A. K., Pavcnik, N., & Topalova, P. (2010). Imported intermediate inputs and domestic product growth: Evidence from India. *The Quarterly journal of economics*, *125*(4), 1727-1767.

Gujarati, D. N., & Porter, D. C. (2009). Basic econometrics. McGraw-hill.

H. Theil. Statistical Decomposition Analysis. Amsterdam, North-Holland Publishing Co, 1972, XV p. 337 p., DFL 65.00. (1976). *Recherches Économiques de Louvain*, *42*(2), 166–166. doi:10.1017/S0770451800006916

Haddad, M., Lim, J. J., Pancaro, C., & Saborowski, C. (2013). Trade openness reduces growth volatility when countries are well diversified. *Canadian Journal of Economics*, *46*(2), 765–790. https://doi.org/10.1111/caje.12031

Helpman, E. (2006). Trade, FDI, and the organization of firms. *Journal of Economic Literature*, *44*(3), 589–630. https://doi.org/10.1257/jel.44.3.589

Helpman, E. and P. Krugman (1985). Market Structure and Foreign Trade. *Cambridge, MA: The MIT Press*

Hesse, H. (2009). Export diversification and economic growth. *Breaking into new markets: emerging lessons for export diversification, 2009, 55-80.*

Imbs, J., & Wacziarg, R. (2003). Stages of diversification. *The American Economic Review*, *93*(1), 63–86. https://doi.org/10.1257/000282803321455160

Jordaan, J. A., Douw, W., & Qiang, C. Z. (2020). Foreign direct investment, backward linkages, and productivity spillovers: What governments can do to strengthen linkages and their impact. In *World Bank, Washington, DC eBooks*. https://doi.org/10.1596/33761

Kaitila, V. (2018). Export product range and economic growth in the EU countries. *The World Economy*, *42*(3), 711–737. https://doi.org/10.1111/twec.12715

Kalemli-Özcan, Ş., Sørensen, B. E., & Yosha, O. (2003). Risk sharing and industrial specialization: regional and international evidence. *The American Economic Review*, *93*(3), 903–918. https://doi.org/10.1257/000282803322157151

Klinger, B., & Lederman, D. (2004). Discovery and Development: an empirical exploration of "New" products. In *World Bank policy research working paper*. https://doi.org/10.1596/1813-9450-3450

Klinger, B., & Lederman, D. (2006). Diversification, innovation, and imitation inside the global technological frontier. World Bank policy research working paper, (3872).

Koren, M., & Tenreyro, S. (2007). Volatility and development. *The Quarterly Journal of Economics*, *122*(1), 243–287. https://doi.org/10.1162/qjec.122.1.243

Krugman, P. (1979). A model of innovation, technology transfer, and the world distribution of income. *Journal of Political Economy*, *87*(2), 253–266. https://doi.org/10.1086/260755

Krugman, P. (1987). The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher. *Journal of Development Economics*, *27*(1–2), 41–55. https://doi.org/10.1016/0304-3878(87)90005-8

Lederman, D., & Klinger, B. (2006). Diversification, innovation, and imitation inside the global technological frontier. In *World Bank policy research working paper*. https://doi.org/10.1596/1813-9450-3872

Lederman, D., & Maloney, W. (2002). *Open questions about the link between natural resources and economic growth: Sachs and Warner revisited* (Vol. 141). Santiago, Chile: Banco Central de Chile.

OECD Data. (2023), In Education at a glance. *OECD indicators/Education at a glance.* https://doi.org/10.1787/e13bef63-en

Ohlin, B. G., & Ohlin, B. (1967). Interregional and international trade. Cambridge : Harvard University Press.

Osgood, I. (2022). Representation and reward: the left-wing anti-globalization alliance, contributions, and the congress. *Review of International Political Economy*, *30*(3), 991–1016. https://doi.org/10.1080/09692290.2022.2077803

Parteka, A., & Tamberi, M. (2013b). What determines export diversification in the development process? Empirical assessment. *The World Economy*, *36*(6), 807–826. https://doi.org/10.1111/twec.12064

Parteka, A., & Tamberi, M. (2013b). What determines export diversification in the development process? Empirical assessment. *The World Economy*, *36*(6), 807–826. https://doi.org/10.1111/twec.12064

Peretto, P. F. (2003). Endogenous market structure and the growth and welfare effects of economic integration. *Journal of International Economics*, *60*(1), 177–201. https://doi.org/10.1016/s0022-1996(02)00025-9

Poletti, A., & De Bièvre, D. (2013). The political science of European trade policy: A literature review with a research outlook. *Comparative European Politics*, *12*(1), 101–119. https://doi.org/10.1057/cep.2012.35

Popovici, O. C. (2018). The impact of FDI on EU export performance in manufacturing and Services. A Dynamic Panel data approach. *Romanian Journal of Economic Forecasting*, *1*, 108–123.

Rădulescu, M., & Șerbănescu, L. (2012b). The impact of FDIs on exports, and export competitiveness in central and eastern European countries. *Journal of Knowledge Management, Economics, and Information Technology*, *2*(1), 1–5. https://econpapers.repec.org/RePEc:spp:jkmeit:1244

Ricardo, D. (1817). *On the Principles of Political Economy, and Taxation*. https://doi.org/10.1017/cbo9781107589421

Roodman, D. (2009b). How to do Xtabond2: An Introduction to Difference and System GMM in Stata. *the Stata Journal*, *9*(1), 86–136. https://doi.org/10.1177/1536867x0900900106

Samuelson, P. A. (1954). The pure theory of public expenditure. *The review of economics and statistics*, 387-389.

Shepherd, B. (2010). Geographical diversification of developing country exports. *World Development*, *38*(9), 1217–1228. https://doi.org/10.1016/j.worlddev.2010.02.005

Smith, A., & Rogers, J. E. T. (1776). An Inquiry into the Nature and Causes of the Wealth of Nations. In *Oxford University Press eBooks*. https://doi.org/10.1093/oseo/instance.00043218

Syrquin, M. (1988). Chapter 7 Patterns of structural change. In *Handbook of development economics* (pp. 203–273). https://doi.org/10.1016/s1573-4471(88)01010-1

Tadesse, B., & Shukralla, E. (2011). The impact of foreign direct investment on horizontal export diversification: empirical evidence. *Applied Economics*, *45*(2), 141–159. https://doi.org/10.1080/00036846.2011.595692

Vernon, R. (1966). International investment and international trade in the product cycle. *The Quarterly Journal of Economics*, *80*(2), 190. https://doi.org/10.2307/1880689

Windmeijer, F. (2005). A finite sample correction for the variance of linear efficient two-step GMM estimators. *Journal of Econometrics*, *126*(1), 25–51. https://doi.org/10.1016/j.jeconom.2004.02.005

World Bank Open Data. (2023). *World Bank Open Data*. https://data.worldbank.org/indicator/NV.IND.MANF.ZS

Appendix

TABLE 5.2
Hausman Test for Robustness Check – Theil index

	Test Statistic	p - value
(1)	18.72	0.0662
(2)	23.56	0.0233
(3)	21.67	0.0606

TABLE 6.2
Hausman Test for Robustness Check – HHI

	Test Statistic	p - value
(1)	17.74	0.9902
(2)	24.25	0.9320
(3)	16.28	0.9988

Appendix 1
List of Countries and Adopted Abbreviations

Austria AT	Belgium BE	Bulgaria BG	Croatia HR	Cyprus CY	Czech CZ
Denmark DK	Estonia ES	Finland FI	France FR	Germany DE	Greece EL
Hungary HU	Ireland IE	Italy IT	Latvia LV	Lithuania LT	Luxembourg LU
Malta MT	Netherlands NL	Poland PL	Portugal PT	Romania RO	Slovakia SK
Slovenia SI	Spain ES	Sweden SE			

Appendix 2
Independent Variables and Sources

Variables	*Description*	*Source*
TF	Trade Freedom Index	Heritage Foundation
FDI	Inflows FDI stocks	UNCTAD
HHI_m	Import concentration HHI	UNCTAD
TOI	Trade Openness Index	World Bank
R&D	R&D spendings to GDP	World Bank
EU	Binary variable equals to 1 when a country is an EU member states; otherwise equals to 0.	The European Commission
msy	Mean years of school	WDI
Pop	Population	Eurostat, World Bank
GDP pc	GDP per capita	Eurostat, Word Bank
$\mathbf{ln}(\boldsymbol{GDPpc})$	ln(GDP per capita)	Generate by Stata
$\mathbf{ln}(\boldsymbol{GDPpc^2})$	Square of ln(GDP per capita)	Generate by Stata
svc	Service to GDP ratio	Word Bank
agri	Agriculture to GDP ratio	Word Bank

Appendix 3
List of manufacturing product lines

Section	*Chapter*	*4-digit HS*	*Description*
Chemicals & Allied Industries	28	2801-2853	Inorganic Chemicals; Organic And Inorganic Compounds Of Precious Metals; Of Rare Earth Metals, Of Radio-Active Elements And Of Isotopes
	29	2901-2942	Organic Chemicals
	30	3001-3006	Pharmaceutical Products
	31	3101-3105	Fertilizers
	32	3201-3215	Tanning Or Dyeing Extracts; Tannins And Their Derivatives; Dyes, Pigments And Other Colouring Matter; Paints, Varnishes; Putty, Other Mastics; Inks
	33	3301-3307	Essential Oils And Resinoids; Perfumery, Cosmetic Or Toilet Preparations
	34	3401-3407	Soap, Organic Surface-Active Agents; Washing, Lubricating, Polishing Or Scouring Preparations; Artificial Or Prepared Waxes, Candles And Similar Articles, Modelling Pastes, Dental Waxes And Dental Preparations With A Basis Of Plaster
	35	3501-35-7	Albuminoidal Substances; Modified Starches; Glues; Enzymes
	36	3601-3606	Explosives; Pyrotechnic Products; Matches; Pyrophoric Alloys; Certain Combustible Preparations
	37	3701-3707	Photographic Or Cinematographic Goods
	38	3801-3826	Chemical Products N.E.C.
Plastics / Rubbers	39	3901-3926	Plastics And Articles Thereof
	40	4001-4017	Rubber And Articles Thereof

Wood & Wood Products	44	4401-4421	Wood And Articles Of Wood; Wood Charcoal
	45	4501-4504	Cork And Articles Of Cork
	46	4601-4602	Manufactures Of Straw, Esparto Or Other Plaiting Materials; Basketware And Wickerwork
	47	7	Pulp Of Wood Or Other Fibrous Cellulosic Material; Recovered (Waste And Scrap) Paper Or Paperboard
	48	4801-4823	Paper And Paperboard; Articles Of Paper Pulp, Of Paper Or Paperboard
	49	4901-4911	Printed Books, Newspapers, Pictures And Other Products Of The Printing Industry; Manuscripts, Typescripts And Plans
Textiles	50	5001-5007	Silk
	51	5101-5113	Wool, Fine Or Coarse Animal Hair; Horsehair Yarn And Woven Fabric
	52	5201-5212	Cotton
	53	5301-5311	Vegetable Textile Fibres; Paper Yarn And Woven Fabrics Of Paper Yarn
	54	5401-5408	Man-Made Filaments; Strip And The Like Of Man-Made Textile Materials
	55	5501-5516	Man-Made Staple Fibres
	56	5601-5609	Wadding, Felt And Nonwovens, Special Yarns; Twine, Cordage, Ropes And Cables And Articles Thereof
	57	5701-5705	Carpets And Other Textile Floor Coverings
	58	5801-5811	Fabrics; Special Woven Fabrics, Tufted Textile Fabrics, Lace, Tapestries, Trimmings, Embroidery

	59	5901-5911	Textile Fabrics; Impregnated, Coated, Covered Or Laminated; Textile Articles Of A Kind Suitable For Industrial Use
	60	6001-6006	Fabrics; Knitted Or Crocheted
	61	6101-6117	Apparel And Clothing Accessories; Knitted Or Crocheted
	62	6201-6217	Apparel And Clothing Accessories; Not Knitted Or Crocheted
	63	6301-6310	Textiles, Made Up Articles; Sets; Worn Clothing And Worn Textile Articles; Rags
Footwear / Headgear	64	6401-6406	Footwear; Gaiters And The Like; Parts Of Such Articles
	65	6501-6507	Headgear And Parts Thereof
	66	6601-6603	Umbrellas, Sun Umbrellas, Walking-Sticks, Seat Sticks, Whips, Riding Crops; And Parts Thereof
	67	6701-6704	Feathers And Down, Prepared; And Articles Made Of Feather Or Of Down; Artificial Flowers; Articles Of Human Hair
Metals	72	7201-7229	Iron And Steel
	73	7301-7326	Iron Or Steel Articles
	74	7401-7419	Copper And Articles Thereof
	75	7501-7508	Nickel And Articles Thereof
	76	7601-7616	Aluminium And Articles Thereof
	78	7601-7806	Lead And Articles Thereof
	79	7901-7907	Zinc And Articles Thereof
	80	8001-8007	Tin; Articles Thereof

	81	8101-8113	Metals; N.E.C., Cermets And Articles Thereof
	82	8201-8215	Tools, Implements, Cutlery, Spoons And Forks, Of Base Metal; Parts Thereof, Of Base Metal
	83	8301-8311	Metal; Miscellaneous Products Of Base Metal
Machinery / Electrical	84	8401-8487	Nuclear Reactors, Boilers, Machinery And Mechanical Appliances; Parts Thereof
	85	8501-8548	Electrical Machinery And Equipment And Parts Thereof; Sound Recorders And Reproducers; Television Image And Sound Recorders And Reproducers, Parts And Accessories Of Such Articles
Transportation	86	8601-8609	Railway, Tramway Locomotives, Rolling-Stock And Parts Thereof; Railway Or Tramway Track Fixtures And Fittings And Parts Thereof; Mechanical (Including Electro-Mechanical) Traffic Signalling Equipment Of All Kinds
	87	8701-8716	Vehicles; Other Than Railway Or Tramway Rolling Stock, And Parts And Accessories Thereof
	88	8801-8805	Aircraft, Spacecraft And Parts Thereof
	89	8901-8908	Ships, Boats And Floating Structures
Miscellaneous	90	9001-9033	Optical, Photographic, Cinematographic, Measuring, Checking, Medical Or Surgical Instruments And Apparatus; Parts And Accessories
	91	9101-9114	Clocks And Watches And Parts Thereof
	92	9201-9209	Musical Instruments; Parts And Accessories Of Such Articles
	93	9301-9307	Arms And Ammunition; Parts And Accessories Thereof

	94	9401-9406	Furniture; Bedding, Mattresses, Mattress Supports, Cushions And Similar Stuffed Furnishings; Lamps And Lighting Fittings, N.E.C.; Illuminated Signs, Illuminated Name-Plates And The Like; Prefabricated Buildings
	95	9501-9508	Toys, Games And Sports Requisites; Parts And Accessories Thereof
Sum of count	60	872	