Economic Integration and Inequality: The Influence of Intra-EU Trade on Domestic Income Inequality

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1. Introduction

Income inequality, along with its causes and effects, is a topic of much debate for both academics and policymakers. Many studies find evidence for rising within-country income inequality in western countries over the last decades (e.g., Chancel and Pickety, 2021; Dervis and Qureshi, 2016), and the same is true for countries in the European Union (World Inequality Lab, 2022). This trend has sparked discussions on the drivers of inequality and the appropriate policy responses.

Many theories have attributed this rise in income inequality to globalization and trade integration. However, empirical research on the link between the two has led to inconclusive results (e.g. Asteriou et al., 2014; Milanovic and Squire, 2005). This has caused economists and sociologists alike to look for different explanations. Beckfield (2006, 2009), for example, argues that research has focussed on the wrong type of trade integration, suggesting regionally bound trade integration, rather than globally bound trade integration, is of greater explanatory value as a predictor of income inequality.

The creation of the European Union can be described as a unique natural experiment, as there has been no comparable form of a regional integration-process in history. While the European Union has received much praise for its unprecedented way of uniting a once heavily divided continent, many scholars have pointed out that the European integration process is biased in favour of economic interests and ignores the social policy dimension (e.g. Martin, 2004; Pollack, 2005; Scharpf, 2002). This raises the question: has European integration contributed to the increase in income inequality?

The balance between economic advancements and social dimensions is crucial for a well-functioning European Union, as it allows the EU to enjoy the benefits of economic liberalization and growth while ensuring that social, environmental, and political goals are met. To implement the right policies, the understanding of mechanisms through which regional integration influences social factors is essential.

This paper aims isolate one of these mechanisms as it investigates the relationship between intra-union trade volumes and income inequality within the European Union. Both empirical evidence and theoretical insights (as discussed in Section 2) suggest that such a link exists. However, the existing literature is limited and somewhat unspecific on this topic. This paper aims to expand the literature with a specific and up-to-date analysis, using a panel of 15 European Union countries in the period 1995-2019. I employ Fixed Effects models to isolate the effect of intra-EU trade on within-country inequality.

2. Background and Literature Review

2.1 EU History

To fully understand the context of this paper, it is important to have some background knowledge on the history of the European Union. I briefly explain the history and discuss the most important events, highlighting how the concept of European integration evolved from a focus on preventing war to the introduction of the single market.

While ideas of European unity had been around before the 20th century, it was not until after the First World War that ideas that can be related to our modern form of European unity started to gain traction. In his influential book, *The Economic Consequences of the Peace*, John Maynard Keynes (1919) argued for the economic reconstruction of Europe, which included calls for a European Free Trade Union as. During the interwar period, the idea of a federal Europe became increasingly prominent, primarily as a means to resolve the enduring Franco-German enmity. However, these aspirations were not realized during this time. By the late 1930s, Europe once again descended into conflict, culminating in the outbreak of the Second World War in 1939.

After the German surrender European integration was seen as a way to counter extreme nationalism and consequently as a way to limit the possibility of future war. This was characterized by Winston Churchill's now-famous 1946 speech at the University of Zurich, in which he called for a 'United States of Europe' as part of the solution to rebuilding Europe.
On the 5th of May 1949 the 'European Council' was created by western European countries; this was one of the first institutions to bring the sovereign states of (then only Western) Europe together and is seen as the first important step towards further cooperation between then. It was only a year later, on the 9th of May in 1950 when French foreign minister Robert Schuman presented the plans that would form the foundations for the modern European institutions. To highlight the importance of this event, it is important to mention that the European Union now celebrates Europe day on May the 9th.

The Schuman Declarations directly led to the six founding members (Belgium, West Germany, France, Italy, Luxembourg and the Netherlands) to sign the Treaty of Paris on the 19th of April 1951. It established the European Coal and Steel Community (ECSC), a common market in coal and steel. It was governed by a supranational High Authority which was responsible for regulating the coal and steel market to ensure stability and fair competition and had the power to issue binding decisions and directives to member states and companies within the ECSC. The 6 nations had now essentially pooled their steel and coal supplies.

It is important to note that the main goal of this collaboration was still to avoid another war on the continent. Since coal and steel were the two main resources required to wage war, the prospect of this became much less likely.

Six years later, on the 25th of March 1957, the next important step towards a single European market was taken when Belgium, France, Italy, Luxembourg, the Netherlands, and West Germany signed the Treaty of Rome. This created the European Economic Community (EEC) and established a customs union. Most importantly, it proposed to create a common market for goods, labour, services, and capital across member states. The EEC would later merge with the ECSC and the European Atomic Energy Community to form what would simply be called the European Communities.

After Denmark, Ireland and the United Kingdom (1973) and Greece (1981) have already joined the communities, the next big step towards the coveted single market was set. In 1986 (at Luxembourg City on the 17th of February and at The Hague on the 28th of February) the Single European Act (SEA) was signed. The Act set the European Community an objective and clear timeline of establishing a single market by 31 December 1992.

The plan prevailed. On the 1st of January 1993 the Treaty of Maastricht, (signed 7 February 1992) came into effect, this was the official beginning of the European Union. It paved the way for a future introduction of a shared currency. In addition to that, it introduced the concept of EU-citizenship and it strengthened, expanded and created European institutions. It also finalized the introduction of the Single Market, which was introduced on the same day, this meant free movement of goods, capital, services, and people.

In 1999 the Euro was introduced, and the monetary system was centralized, at first the Euro only existed as an 'invisible' currency, only used for accounting purposes and electronic payments. Coins and notes were introduced in 2002 in participating countries after a three-year transitionary period.

In the following decade the EU, which had grown to 26 countries after the beginning of 2007, would be greatly affected by the Credit Crisis, which started in 2007 in the US and hit the EU in 2008. The crisis would later transform into the European Sovereign Debt Crisis, the effects of which were felt all over the EU well into the 2010s. (European Commission, n.d.)

At the moment of writing, the EU consists of 27 countries after the UK left the union on the 31st of January 2021.

2.2 Heckscher-Ohlin

When discussing trade liberalization and its effect on inequality, one cannot forget to mention the influential model developed by Eli Heckscher (1919) and his student Bertil Ohlin (1933). Together they developed the framework for what is now known as the Heckscher-Ohlin (H-O) model. The model expanded on David Ricardo's fundamental theory that introduced the idea of comparative advantage (1817). In Ricardo's model of trade, trade flows are decided by differences in technology between countries. In contrast, in the H-O model trade is entirely driven by differences in initial factor endowments.

The Heckscher-Ohlin model is a general equilibrium model of international trade. The parameters of its most common version consist of two countries, two production factors (often high and low-skilled labour, or capital and labour), and two products, which each use one of the two production factors intensively in their production process. Since the model assumes the two countries to be completely identical except for their resources (e.g. technology is the same across countries), trade in the model is driven only by the initial factor endowments. Furthermore, the model assumes no movement of factors across countries.

Countries have a comparative advantage in producing the good that utilizes their relatively abundant factor of production intensively. This leads to a difference in production costs and goods prices between the two countries, driving international trade. A labour-abundant country exports the labour-intensive good because that products price is initially higher in the capital-abundant country. The reverse happens in a capital-abundant country.
In autarky, the prices of the good that uses the locally abundant production factor are lower compared to the prices of that same good in the other country. Once trade barriers are removed, profit-seeking firms will export this good to the market where prices are (temporarily) higher. Trade volumes will increase until the prices reach their international equilibrium prices.
This means that in the labour-abundant country, the prices of the exported, labour-intensive good will rise compared to their initial price. In the capital-abundant country the price of the labour-intensive good will drop compared to autarky levels.

The main idea of the H-O model is that countries export the product which uses its abundant production factor relatively intensively and imports that what uses its scarce production factor relatively intensively. Countries will specialise in the production of the exported good and will import the other good.[1]

Stolper and Samuelson (1941) expand further on the H-O model with their appropriately named Stolper-Samuelson (S-S) theorem, revealing the implications the H-O model has on the distribution of the gains made from trade.
The main idea of the S-S theorem is that when the relative price of a good increases, the real return to the production factor that is used intensively in the production of that good also increases. Conversely, the real return to the other production factor decreases. Intuitively, this means that when the two countries open up to trade (and prices move to their international equilibrium levels), the real return to labour increases while the real return to capital decreases in the labour- abundant country. The reverse happens in the capital-abundant country.

[1] While the main idea of exporting the good in which you have a comparative advantage and importing the good in which the other country has a comparative advantage is in line with Ricardo's theory, complete specialisation does not occur in the H-O model as it does in Ricardo's model. In the H-O model, a country will specialize and produce more of its exported good than of its imported good but will produce both.

The real-world implication is that, in theory, emerging economies with an abundance in labour will see their income gap decrease after opening their markets to the rest of the world since the workers (who are generally poorer) benefit more from trade than the capital owners (who are generally richer). The opposite happens in developed countries, who experience a widening of the income gap due to the real increase in the return on capital.[2]

While the Stolper-Samuelson theory is fundamental to the field of trade and international economics and is seen as critically important in the understanding of the dynamic between trade liberalization and wage distribution, its real-world implementation and empirical support has been a point of contention for experts.
Empirical studies testing the theory often yield mixed results, however, they very rarely completely support the theory. Therefore, there is no definitive theoretical conclusion regarding the relationship between trade openness and inequality.

2.3 Link between globalization and income inequality

There is quite extensive empirical literature that tries to explain the relationship between trade liberalization and globalization on income inequality. Results are ambiguous, as mentioned before.
Milanovic and Squire (2005) illustrate this ambiguity well in their panel analysis of 104 countries in the years 1983 until 2000. By employing First-Differencing, they analyse the relationship between tariff rates and inter-occupational as well as inter-industry wage inequality. They conclude that reducing tariffs lowers inter occupational and inter-industry wage inequality in developed countries. Interestingly, the reverse is observed for developing economies. While their research is based on the frameworks laid by the H-O model and the S-S theorem, their findings contradict what the theory predicts. To explain the results of their analysis they look at labour union-strength, stating that because tariff liberalizations often coincide with anti-labour policies, sectors that previously benefited from both trade union support and protective tariffs will lose on both fronts when trade barriers are eliminated.

To further illustrate the ambiguity of the research results on this topic, both sides of the empirical argument will be presented in more detail in the following sections.

2.4 Trade liberalization reduces inequality

Reuveny and Li (2003) analyse a panel of 69 developed and developing economies during the period 1960-1993. They employ Pooled Time-Series Cross-Sectional (TSCS) OLS Regression to measure the effect of economic openness (the sum of exports and imports divided by gross domestic product and Financial Direct Investment (FDI) inflows) and level of democracy (an index ranging from -10 to 10) on income inequality (Gini coefficient).

[2] The Stolper-Samuelson theorem can also apply to different production factors, such as low-skilled and high-skilled labour. An increase in the relative price of a good that uses low-skilled labour intensively will increase the real wages of low-skilled workers and decrease the real wages of high-skilled workers, and vice versa.

Their results are only partially supported by the H-O and S-S models, as they find that trade openness is negatively linked with income inequality, in both developing and developed economies.

In the same trend, in a study focused on a panel of EU-countries, Asteriou et al. (2014) investigate the relationship between globalization and income inequality over a panel of 27 EU countries in the years 1995 until 2009. They divide globalization into four measurements: trade openness, foreign direct investments, capital account openness and stock market capitalization. In this paper, trade openness is defined as the trade share of income (the sum of exports and imports divided by gross domestic product) and inequality is measured by the Gini coefficient. They analyse the panel using Common Constant, Fixed Effects and Random effects models and employ the same techniques on different country-subgroups. Their findings suggest that trade openness has an equalizing effect on income inequality across all subgroups. However, the other measures of globalization are identified as the main causes of increased inequality in the EU. While the theoretical background regarding the effect of trade on income inequality in the paper are based on the H-O and S-S models, the results, again, only partially align with the predictions of the theories.

Jaumotte et al. (2013) find something similar. Using Fixed Effects models, they analyse a panel of 57 countries in the years 1981 until 2003, in which they test the link between technology (the share of ICT capital to physical capital), trade (trade share of income and tariff rates), financial integration (various variables including FDI) and inequality (Gini coefficient). They find that trade openness has a moderate equalizing effect while FDI and especially technological advancement increase income inequality. The theoretical framework of the study is based on the H-O and S-S models. However, they explain that by relaxing the assumption of no movement of capital and the assumption of technology being the same across countries, results that contradict the S-S theorem can be better explained. The study incorporates technological advancement and FDI, which involve the movement of capital across borders by definition.

2.5 Trade liberalization increases inequality

Conversely, Rojas-Vallejos and Turnovsky (2017) find evidence of a positive relationship between increased freedom in trade and income inequality. In their panel analysis of 37 countries in the period 1984-2010, they employ Fixed Effects models to analyse the relationship between tariff rates and income inequality, measured as the Gini coefficient. The theory in the study is based on the H-O and S-S models as well the Sen-Turnovsky model (1989). This model builds on classical trade models, including H-O and S-S. It provides a framework to analyse the distributional effects of trade policies, considering both short-term adjustments and long-term outcomes. Rojas-Vallejos and Turnovsky find evidence suggesting that tariff reduction increases income inequality in the short-run, but less conclusive evidence that the same happens in the long-run.

Similarly, Székely and Sámano (2012) find a positive connection between trade liberalization and inequality in Latin-America. In their Fixed Effects and Random Effects panel analysis of 18 Latin-American countries in the years 1980-2010, they investigate the effect of tariff reductions on income inequality measured by the Gini coefficient.

The analysis leads to evidence that suggests that a reduction in tariff rates is associated with a simultaneous rise in inequality. However, once enough time is allowed for the economy to adjust to openness, no further increases in inequality are observed.
Meschi & Vivarelli (2009) also find a positive link between trade and income inequality. They use a Dynamic Fixed Effects Model with Least Squares Dummy Variable Corrected estimator to analyse the relationship between trade and income inequality, measured by the sum of total export and import volumes and numerous inequality measures, including the Gini coefficient. In their panel of 65 developing countries during 1980-1999, they find that trade with high-income countries leads to more inequality in the developing economies. This evidence is at odds with the S-S theorem. In the same trend as Jaumotte et al. (2013), they contribute this contradiction to technological differences between countries. Specifically, technologies transferred from more advanced countries are generally more skill-intensive than the technologies used domestically in developing countries. Thus, trade-induced technology upgrading might shift labour demand towards skilled labour, raising the skill premium and hence income inequality.

2.6 Regional integration

The literature on trade liberalization and integration on a global scale, often called globalization, is quite extensive, and extensive enough to make it evident to the interested reader that results are inconclusive. Importantly, the studies mentioned in the previous paragraphs do not differentiate between overall trade openness and region-specific trade, even when focusing on a particular region (e.g., Asteriou et al., 2014; Székely and Sámano, 2012). They could have done the same research for any selection of countries. There is nothing EU or region specific about their research.

Consequently, I was surprised to find out that literature on the effect of regional-bounded integration on within-country inequality is relatively hard to come by. The two papers by Beckfield (2006, 2009) are to my knowledge the first to test the relationship between EU-integration and within-country inequality. And some of the few papers that clearly make a distinction between globalization and EU-specific integration. He argues that researchers have been looking at the wrong place in order to explain the rise in income inequality and that not globalization, but regional integration (regionalization) is the main driver behind rising income inequality. Regional integration and globalization are two distinct processes. While the two are similar and often go hand in hand, one might even say regional integration is a form of globalization, there are clear differences. Beckfield identifies three of these key differences regarding the way regional integration impacts income inequality compared to globalization.
To further illustrate the importance of distinguishing between globalization and regionalization when analyzing their effects on income inequality, the following paragraphs will briefly discuss these three differences.

First of all, regional integration is geographically bound, whereas globalization is not.
Both involve increased flows across borders, but when these flows are limited to a specific region, the economic and social impacts are different from those of general globalization.

These differences arise because geographical proximity and similarity often coincide with political and cultural similarities. Beckfield argues that market competition is higher within integrated regions than between them because political institutions and human capital stock are more similar. These similarities create a more uniform and predictable business environment. Consequently, businesses face more direct competition, which drives innovation and consumer choices, and this shapes the economic environment. This is highly relevant to the effects of economic integration on income inequality.

Secondly, regionalization differs from globalization is that regional trade institutions are more powerful and can make more requirements for potential new candidates to join the organization. The EU has way more power than the World Trade Organization (WTO) in this regard, it has more governing power leading to more common regulations, standards and consequentially more homogenous markets. Because of this, firms looking to expand internationally will choose to do so within the EU, creating regional competition for labour, more so than global competition. This is again very relevant for the effect of economic integration on income inequality.

Thirdly, Beckfield mentions that regional integration has progressed much further than globalisation. Meaning that, at any given time, regional economic integration impacts income inequality more than globalization.

Beckfield (2009) examines a panel of 12 Western European countries in the years 1972 to 1997. Using both random-effects and fixed-effects models to test the effect of European trade integration (exports to EU15 countries as share of total exports) and political integration (number of cases sent from national courts to the European Court of Justice) on income inequality (Gini coefficient). He finds evidence suggesting that regional economic integration raises income inequality.
The main mechanisms identified in the paper are through labour strength. Beckfield states that economic integration can be expected to increase income inequality as workers are exposed to the competition of regional labour markets and that economic integration tends to increase income inequality by shifting the labour/capital balance of power in favour of capital.

In a more recent study, a long-term within-country analysis of the EU15, Tober (2022) finds empirical evidence regarding the labour mechanism through which European integration influences income inequality.
In a Fixed Effects panel analysis of 15 EU countries in the years 1955-2014, he examines the effect of trade union membership and European institutional integration, measured by an extensive index[3], on inequality, measured by top decile (top 10% income share) and top percentile (top 1% income share) of the national income distribution. He concludes that the equality-enhancing effects of trade unions are weaker when European integration is higher.

[3] The numerical composite index accounts for institutional change from the beginnings of the EU until 2004 by attributing scores to each single event of European institutional integration, the index is developed by the European Central Bank (Dorrucci et al., 2002).

Perhaps the most similar study to mine is the one of Busemeyer and Tober (2015). In their study they analyse 14 EU countries in the period of 1999-2010. The study distinguishes itself by using an EU integration index (different from the previously mention European institutional integration index) as the predictor of inequality, the index is made up of a political and economic component[4]. The study employs Fixed Effects models in which the EU integration index is used as the predictor for income inequality, measured by the Gini coefficient. Interestingly, no evidence is found that suggests an association between European economic integration and income inequality. However, political economic integration is found to increase income inequality.
The theoretical framework on the paper regarding the link between economic integration and income inequality is based on labour strength. Busemeyer and Tober hypothesise that the increased competition of the regionally integrated labour markets can lead to higher income inequality and that economic integration can decreases the bargaining power of organized workers, reiterating the channels presented in Beckfield (2009) and Tober (2022).

In a study focussed on within-region integration that is not the EU, Pham (2014) examines the relationship between intra-regional trade and within-country inequality in Asia. Even though Asia is difficult to compare to Europe in the sense of economic, political and demographic characteristics and the economic regional integration in Asia is not on the same level as the thoroughly integrated European Union, the results of this study are still valuable since it introduces a different scope of intra-regional trade compared to previously mentioned studies. The theoretical framework of the paper is largely based on the H-O and S-S models as well as import induced technology transfers.
The paper employs an Augmented Gravity analysis on a panel of 19 Asia – Pacific countries over the period 1998-2011. It uses intra- regional import, intra-regional export and the sum of both divided by GDP as the predictors for income inequality, measured by the Gini coefficient. It finds evidence suggesting that intra-regional exports can reduce income inequality, while the opposite is true for intra-regional imports. However, the research suggests that trade openness in general increases income inequality.

Table 1.1 and 1.2, displayed on the next pages, provide a clear overview of the literature reviewed in the previous section. these tables summarize the sample, research method, main findings, and theoretical framework of each study, aiming to assist in understanding of the literature review.

[4] An index that captures political and economic indicators of European integration. Which includes elements of economic integration (the sum of a country's intra-EU imports and exports as a percentage of GDP, and as a percentage of its total sum of imports and exports) and political integration (index combining institutional participation in the Schengen area and EMU, as well as compliance with EU law). (König and Ohr, 2013)

Table 1.1: overview of literature

Reference	Sample	Research method	Findings	Theories
Milanovic and Squire (2005)	**Panel:** 104 countries **Period:** 1983-2000	**Model:** First differencing. **X=** tariff rates **Y=** inter-occupational and inter-industry wage inequality	Reducing tariffs increases inter occupational and inter industry wage inequality in developing economies. Reverse effect for developed economies.	H-O & S-S Union strength
Reuveny and Li (2003)	**Panel:** 69 countries **Period:** 1960-1996	**Model:** Pooled Time-Series Cross-Sectional (TSCS) OLS Regression **X**= export and import as share of GDP & democracy index between -10 and 10 & FDI inflow **Y**= Income inequality (Gini)	trade openness decreases income inequality, in both developing and developed economies.	H-O & S-S Technology transfers
Asteriou et al. (2014)	**Panel:** 27 EU countries (Split in in 4 different sub-groups) **Period:** 1995-2009	**Model:** Common constant, Fixed Effects, Random Effects **X**= export and import as share of GDP & Multiple globalization measures including FDI **Y**= Income inequality (Gini)	Trade openness decreases income inequality. FDI is the most dividing factor	H-O & S-S
Jaumotte et al. (2013)	**Panel:** 57 countries **Period:** 1981-2003	**Model:** Fixed Effects: **X=** export + import as share of GDP & Tarrif rates & Various financial globalisation variables including FDI & Technology as the share of ICT capital to physical capital **Y=** income inequality (Gini)	Decreases income inequality while FDI and especially technological advancement increase income inequality	H-O & S-S Capital transfers (FDI) Technology transfers
Rojas-Vallejos and Turnovsky (2017)	**Panel:** 37 countries **Period:** 1984 - 2010	**Model:** Fixed Effects **X**= tarrif rate **Y=** income inequality (Gini)	tariff reduction increases income inequality in the short-run, but no evidence for long-run.	H-O & S-S Sen-Turnovsky (difference in long and short-term effects)
Székely and Sámano (2012)	**Panel:** 18 Latin-American countries **Period:** 1980-2010	**Model:** Fixed Effects and Random Effects **X=** tarrif rates **Y=** income inequality (Gini)	Reduction in tariff rates increase inequality. once economy has adjusted to openness no changes in inequality are observed.	Difference in short and long-term effects

Table 1.2: overview of literature

Reference	Sample	Research method	Findings	Theories
Meschi & Vivarelli (2009)	**Panel:** 65 developing countries **Period:** 1980–1999	**Model:** Dynamic Fixed Effects (with Least Squares Dummy Variable Corrected estimator) **X=** multiple household income inequality variables including gini **Y=** total trade volumes	Trade with high-income countries leads to more inequality in the developing economies.	H-O & S-S Technological differences
Beckfield (2006, 2009)	**Panel:** 12 Western European countries **Period:** 1972 - 1997	**Model:** Fixed Effects and Random Effects **X=** political integration (number of cases sent from national courts to the European Court of Justice.) & economic integration (country's total exports to EU15 as share of total exports) **Y=** income inequality (Gini)	Regional economic integration raises income inequality.	Labour strengh
Busemeyer and Tober (2015)	**Panel:** 14 EU countries **Period:** 1999-2010	**Model:** Fixed Effects **X=** European integration index (economic integration + political integration) **Y=** income inequality (Gini)	No association between European economic integration and income inequality. Political economic integration increases income inequality.	Labour strength
Pham (2014)	**Panel:** 19 Asia-Pacific countries **Period:** 1998-2011	**Model:** Augmented gravity analysis. **X=** regional export & regional import & Total regional trade as share of GDP **Y=** income inequality (Gini	Intra-regional exports decrease income inequality, intra-regional imports increase income inequality. Trade openness in general increases income inequality.	H-O & S-S Technology transfers

Note: *overview of discussed literature, with the sample, research method, main findings and theoretical framework laid out per paper.*

2.7 Summary and Hypothesis

In summary, the literature on trade liberalization, both globally and regionally bound, presents mixed findings regarding their impacts on income inequality. While the Heckscher-Ohlin (H-O) model and Stolper-Samuelson (S-S) theorem provide foundational frameworks, empirical evidence often contradicts these theoretical predictions. Relaxing the assumptions of technological similarity and no movement of capital could explain some of the contradictions of the S-S theorem, as these mechanisms are found to increase income inequality in multiple studies. In addition to that, labour strength seems to be another path through which economic integration, including trade liberalization, could influence income inequality, as increased labour market competition and the diminishing power of labour unions are thought to increase income inequality

The literature on the general effect of trade on income inequality is inconclusive. The literature with a focus on intra-regional trade is scarce and outdated, with the few relevant studies leading to mixed or inconclusive results when analysing the effect of intra-regional trade on income inequality. This paper makes a valuable addition to the existing literature by analysing an EU-country panel over a larger, more recent period (1995-2019). It is especially valuable since, in the last ten years of that period a lot has happened in the EU, most notably the aftereffects of the credit crisis and the consequent Eurozone debt crisis.

The ambiguous results of the relevant literature mean the link between intra-EU trade flows and within-country inequality is unclear. This paper aims to clarify the relationship, employing a comprehensive Fixed Effects analysis of a modern panel of 15 EU countries in which the following hypothesis is tested:

Hypothesis: An increase in intra-EU trade leads to an increase in within-country income inequality.

3. Data and methodology

This paper estimates the effect of the increase in intra-EU trade on income inequality using a comprehensive panel of the EU15 countries. This analysis spans from 1995, the year Austria, Finland, and Sweden joined the European Union, to 2019, which is the most recent year for which reliable data for all 15 countries is available.

3.1 Model

I employ an entity fixed-effects (FE) regression to control for omitted variable bias stemming from unobserved, time-invariant heterogeneity. This method is simple to implement and is widely used in similar longitudinal panel-based research. The FE model effectively isolates the impact of variables that vary over time within each country, providing more accurate estimates of the relationship between intra-EU trade and income inequality. (Beckfield ,2009; Székely and Sámano ,2012)

The fixed effects model accounts for unobserved characteristics that stay constant over time by giving each country its own unique intercept. This method helps the model focus on changes within each country over time. By removing the influence of factors that don't change, the fixed effects model ensures the estimated coefficients accurately show the impact of variables that do change over time.

When fixed-effects regression is an option, random-effects models should also be considered. A Hausman test (also known as Durbin–Wu–Hausman test) is performed to test which model fits the data set best. The test results are presented below.

Table 2: Hausman test results

	(1) Chi-Square (X^2)	(2) Degreed of Freedom (df)	(3) P-value	(4) *N*
Hausman Test	29.09	6	0.001	332

In panel data analysis, the Hausman test is used to determine whether the favoured model should be random effects or fixed effects. The null hypothesis of the Hausman test states that the random effects model is preferred, while the alternative hypothesis suggests that the fixed effects model provides a better fit.
As seen in Table 2, the p-value is below 0.05, which means that the null hypothesis is rejected. Therefore, it can be concluded that the FE model is the preferred option for this research.

In this paper, the following Fixed Effects model is estimated:

$$log\left(\frac{GINI_{it}}{100 - GINI_{it}}\right) = \beta_0 + a_i + \beta_1 XTS_{it} + \beta_2 GDPPC_{it} + \beta_3 EMP_{it} + \beta_4 EDU_{it} + \beta_5 RD_{it} + \beta_6 LAG_{it} + \beta_7 EURO_{it} + e_{it}$$

Where the entity (country) is i with $i = 1, \dots, N$ and period (year) is t with $t = 1, \dots, T$. The dependent variable is the transformed Gini coefficient $log\left(\frac{GINI_{it}}{100-GINI_{it}}\right)$. It is the natural logarithm of the Gini coefficient over 100 minus the Gini coefficient. This makes the dependent variable linear and unbounded and makes it better fitting for regression analysis. The unobserved time-invariant individual effect is denoted by a, and β is the regression estimator for the different independent variables. The main independent variable of interest is XTS_{it}, the export trade share, which is the total export value from country i to any of the EU15 countries divided by gross domestic product. $GDPPC_{it}$ is the gross domestic product per capita, added to control for economic performance. The control variable EMP_{it} controls for the total employment levels. The control for the quality of education is total government spending on education as a percentage of GDP, denoted by EDU_{it}. To control for technological advancements, total spending on research and development (R&D) Is added as a percentage of GDP, this is indicated by the variable RD_{it}. Furthermore, the 10-year lag of the Gini coefficient is represented by LAG_{it}. The last independent variable is the dummy variable $EURO_{it}$, included to indicate if a country is part of the euro-area. It takes the value of 1 if the country has adopted the Euro and 0 if it has not. The error term is indicated by e_{it}, it captures the errors that are assumed to be uncorrelated with the independent variables.

To measure income inequality, the Gini coefficient is used as the dependent variable. In the literature, the Gini coefficient is the preferred method for measuring economic equality because it provides a more complete description of the distribution of income or wealth than other common measurements. Other methods, such as the 80/20 or 90/10 ratios, can be useful but are often less reliable. These can be considered if complete data on income distribution is unavailable or unreliable. The Gini coefficient, by contrast, captures the entire income distribution, making it a more robust measure for this analysis.

Fortunately, reliable and extensive data on Gini coefficients for the EU15 countries are available from the World Inequality Database (WID), which uses pre-tax Gini coefficients.

The Gini coefficient is derived from the Lorenz curve of income, which is a graphical representation showing the cumulative percentage of total income earned by different segments of the population. On the Lorenz curve, the x-axis represents the cumulative percentage of the population, starting from the poorest share, and the y-axis represents the cumulative percentage of total income.

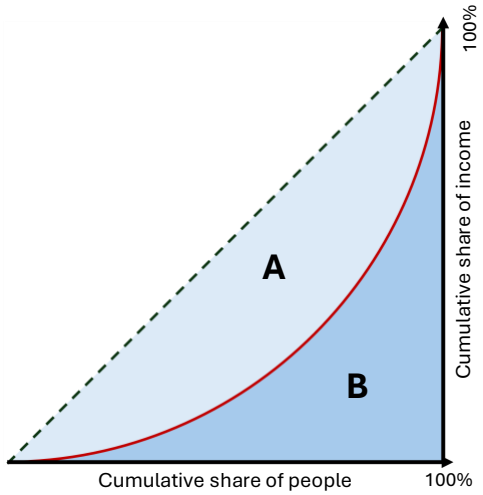

Figure 1: Lorenz curve and Gini coefficient.

Figure 1 provides a visual representation of the Gini coefficient. The curved red line illustrates a typical Lorenz curve, which shows the actual income distribution of a society. The 45-degree dashed line represents a hypothetical Lorenz curve belonging to a perfectly equal society. The Gini coefficient is calculated as the area between the Lorenz curve and the 45-degree upwards sloping line, divided by the total area under the upwards sloping dashed line. In the case of the figure above, this is expressed as $Gini = \frac{A}{A+B}$.

A Gini coefficient of 1 (or 100%) would belong to an economy with the most unequal distribution of income imaginable, where one person earns all the income, and the rest earns nothing. Conversely, a Gini coefficient that approaches zero means that the Lorenz curve is as close as possible to the 45-degree line of perfect equality. In this scenario, area B would approach the size of area A and B together, resulting in a Gini coefficient close to zero.

The Gini coefficient captures the entirety of the income distribution and essentially measures by how much it deviates from perfect equality. This makes it an ideal metric for measuring income inequality.

The Gini coefficient is inherently bounded, in the case of the used dataset between 0 and 1. Since the Fixed Effects model in this paper uses the OLS estimator, which assumes the dependent variable to be unbounded, it is best if the variable is transformed before performing the regression to provide a better fit. The Gini coefficient is transformed into $\ln(\frac{gini}{1-gini})$. This method is called a log-odds transformation and is a common approach when dealing with bounded variables (Reuveny and Li, 2003). The transformed coefficient approaches -∞ when Gini approaches 0 and approaches ∞ when Gini nears 1, providing a more linear relationship between the dependent and independent variables.

Using the log-odds transformed Gini coefficient instead of the untransformed variant results in a better fitting regression model. However, since the estimated regression coefficients are not straightforward to interpret when using the transformed Gini coefficient as dependent variable,

and to test the robustness of the results, the regression is performed using both the transformed and untransformed Gini coefficient.

The independent variable of interest is intra-EU trade. This is measured per country as the total export from that country to the other 14 EU-countries in the panel, expressed as a percentage of that country's gross domestic product. The necessary data components for calculating this variable can be found in Eurostat's comprehensive databases.

Since the beginning of the European single market on January 1st, 1993, trade flows between member countries have been monitored via one standardized system called Intrastat. Prior to this, this was done by customs authorities of individual countries. Interestingly, due to the nature of the methods by which outgoing and incoming goods are reported, the value of intra-EU imports should theoretically be slightly higher than the value of intra-EU exports of goods. This is however not the case in reality. Since the introduction of the Intrastat system, intra-EU export values have consistently been higher than the intra-EU import values (Eurostat).

According to Eurostat, these inconsistencies in accounting make intra-EU export numbers the most reliable indicator of total trade within the EU. Therefore, I choose to consider only exports to the EU15 countries in the analysis, rather than using the combined total of exports and imports, which would normally be the preferred method of measuring trade volumes.

3.2 Control Variables

While the Fixed Effects analysis aims to control for all time invariant unobserved entity-specific characteristics, it is necessary to manually control for time-varying omitted variables. Since this paper aims to estimate the causal effect of intra-EU trade increase on income inequality it is required to control for time-varying confounders. These being variables that affect both the dependent variable (income inequality) and the independent variable (intra-EU trade).
Doing so will isolate the causal effect and will make it possible to accurately interpret the estimated coefficient of the independent variable of interest. The included control variables are those that both intuitively and empirically influence intra-EU trade volumes and income inequality. By controlling for these factors, the analysis provides a clearer understanding of the causal pathways involved.

First if all, it is important to control for economic performance. This is done by including GDP per capita in constant 2015 US Dollars, which is derived from The World Bank database. This is a standard control variable in the economic and sociological literature.

Additionally, total employment share, which can be found on Eurostat's database, is included to account for variations in employment levels, which is also an indicator for economic performance. Higher unemployment levels are positively linked with increased income inequality and can alter a country's competitiveness and economic landscape, which can influence trade flows (Cysne, 2009; Naz, 2023). Employment is also a common control variable in similar sociological and economic studies.

To control for technological advancements, total research and development spending as a percentage of GDP is included, this data is taken form the OECD data base. Higher technological development means a country's workforce is more productive and this improves competitiveness, which in turn affects international trade flows. Moreover, technological advancements often lead to increased demand for high-skilled workers while reducing demand for low-skilled labour. This can increase the already existing divide in income (Acemoglu and Restrepo, 2022). Again, this control variable is common in similar studies.

Government expenditure on education (primary until tertiary) as a percentage of GDP is added to control for its confounding effect on both trade flows and the Gini coefficient. A better educational system leads to higher level of human capital on average, which decreases income inequality (Hoeller et al., 2014). This also means a change in competitive landscape which influences trade flows.

These control variables are essential for isolating the causal effect of intra-European trade on income inequality by controlling for important economic factors that could influence both trade flows and economic inequality.

Furthermore, a control for the introduction of the Euro is added to the equation. The introduction of the Euro has been of substantial influence on trade flows and income inequality (Bouvet, 2021). The Euro was adopted by almost every EU15 country in 1999, except for Denmark, Greece and the United Kingdom. Greece participated later in 2001. To control for this event, a dummy variable that is active for the participating countries in the years after they joined the Euro system is included in the analysis.

Lastly, a control for past income inequality is added, the one decade-lagged Gini coefficient. Inequality tends to be very persistent over time, occurring through different channels. Reuveny and Li (2003) clearly identify these channels, which will be briefly explained below.

First of all, the rich typically shape the rules. People with higher income and higher wealth generally have more political power than the poorer part of the population. They have the financial power and freedom to influence policy and elections and are generally more influential and disproportionally represented. Because of this, the rich have the opportunity to create an economic environment which is more favourable to them.

Secondly, people tend to marry those who are similar to them in status, wealth and income. That means that if a child is born into a wealthy family, they are more likely to become wealthy as well. Consequently, income inequality between different wealth groups carries on for generations.

Lastly, when earned income is partly decided by what ethnic group a person belongs to, which is the case in many countries, discrimination and institutionalized racism can cause the current income distribution to persist for long periods of time by maintaining the divide in income between different ethnic groups.

Overall, inequality in the past is a great predictor for inequality right now and will also have effects on policy and thus the present-day trade flows. In addition to that, including a lagged dependent variable into the analysis can also help mitigate possible reverse causality problems.

3.3 Descriptive statistics

Table 3: Descriptive statistics of all variables

Variable	N	Mean	sd	min	max	p50	p25	p75
(1) Transformed Gini	525	-.22	.18	-.77	.15	-.21	-.30	-.10
(2) Export/ GDP	371	21.15	14.75	2.73	66.08	16.65	11.66	21.95
(3) GDPPC	375	41096.74	18821.82	15789.0	112417.9	39184.8	31329.9	45570.1
(4) EMP	373	70.07	6.31	51.7	82.4	70.9	66.1	74.8
(5) RD	359	1.92	.81	.42	3.87	1.81	1.24	2.47
(6) EDU	331	5.28	1.21	2.9	8.6	5.1	4.3	5.9
(7) L10_gini	375	44.05	4.60	31.70	53.63	44.78	42.18	47.14

***Note**: Overview of descriptive statistics of full database, dummy variable is left out. (Statistics from left to right: number of observations, mean, standard deviation, minimal value, maximal value, median, 25th percentile, 75th percentile.)*

Table 3 presents the descriptive statistics for the key variables used in this analysis. These statistics provide an overview of the data distribution and central tendencies, helping to understand the characteristics of the dataset. The high number of observations for the transformed Gini coefficient is due to the data spanning from 1985 until 2019, instead of from 1995 until 2019 like the rest of the variables. This is necessary to make it possible to include the one-decade lagged Gini coefficient. Since the Gini coefficient is log-odds transformed, interpreting its descriptive statistics is not straight forward. However, the range from -0.77 to 0.15 with a standard deviation of 0.18 indicates that there is considerable variation in income inequality across countries. Furthermore, the high standard deviation and wide range in the intra-EU export variable suggest diverse levels of intra-EU trade, pointing to significant differences in trade integration. Another noteworthy observation is the wide range and high standard deviation compared to the mean of GDP per capita. This indicates considerable economic disparity among the countries.

Table 4: correlation between variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) transformed Gini	1.000						
(2) Export/ GDP	-0.237	1.000					
(3) GDPPC	-0.101	0.234	1.000				
(4) EMP	-0.390	0.162	0.396	1.000			
(5) RD	-0.551	0.106	0.223	0.643	1.000		
(6) EDU	-0.696	0.127	0.131	0.539	0.707	1.000	
(7) L10_gini	0.776	-0.175	-0.038	-0.421	-0.564	-0.662	1.000

Note: *correlation table of correlation coefficients between all variables, dummy variable is left out.*

Table 4 displays the correlation-coefficients between all the variables in this analysis, providing insights into the relationships between the variables. Interestingly, intra-EU export seems to have a negative correlation with income inequality. GDP per capita has the weakest correlation with income inequality, indicating a very weak negative relationship. The strongest correlated variable is the one-decade lagged Gini coefficient. This suggests confirmation of the theory of inequality being persistent over time.

Furthermore, multiple high correlation-coefficients are present between independent variables, for example between R&D spending and total employment or educational spending and R&D spending. While this raises concerns of multicollinearity between these variables, it is not problematic for the analysis. Interpretation of the regression coefficients of the highly correlated control variables might prove difficult. However, the independent variable of interest, intra-EU export, should be largely unaffected by this.

4. Results

Table 5: Fixed effects regression results

	(1) Transformed Gini	(2) Transformed Gini	(3) Transformed Gini	(4) Transformed Gini	(5) Transformed Gini	(6) Gini
Export/ GDP	0.00257	0.00294*	0.00319*	0.00301*	0.00327*	0.000795*
	(1.41)	(1.98)	(2.05)	(1.85)	(1.93)	(1.90)
GDPPC	0.00000541**	0.00000705*	0.00000574*	0.00000717*	0.00000586*	0.00000141*
	(2.60)	(2.07)	(1.93)	(1.93)	(1.79)	(1.80)
EMP		-0.00213	-0.00203	-0.00192	-0.00181	-0.000408
		(-0.45)	(-0.46)	(-0.44)	(-0.45)	(-0.42)
RD		0.0115	0.00528	0.0123	0.00611	0.00130
		(0.24)	(0.12)	(0.25)	(0.14)	(0.12)
EDU		-0.0300**	-0.0367**	-0.0296**	-0.0363**	-0.00887**
		(-2.17)	(-2.74)	(-2.22)	(-2.81)	(-2.85)
L10_gini			0.667*		0.667*	0.160*
			(1.81)		(1.80)	(1.77)
EURO				-0.00655	-0.00679	-0.00146
				(-0.24)	(-0.25)	(-0.22)
Constant	-0.466***	-0.254	-0.460*	-0.274	-0.481*	0.382***
	(-4.73)	(-1.04)	(-1.83)	(-1.23)	(-2.05)	(6.56)
N	371	318	318	318	318	318

Note: *robust standard errors in parentheses*
** p < 0.1, ** p < 0.05, *** p < 0.01*

The estimation results of the different Fixed Effects models are presented in Table 5. The regressions are performed with robust standard errors to control for heteroskedasticity, displayed in parentheses under the regression estimators. The significance of the estimated regression coefficients is indicated by the asterisks next to the coefficient. One asterisk means significance at the 10% level, two means the coefficient is significant at the 5% level and three asterisks means the estimated effect is significant at the 1% level.

In column (1) the most basic model is shown with only the GDP share of export to the EU15 countries as a percentage of GDP and GDP per capita as the independent variables. In column (2) the total employment share of the population, research and development spending as percentage of GDP and educational spending as a percentage of GDP are added.

In column (3) the 10-year lag of the Gini coefficient is added to the model of column (2) and in column (4) the dummy for Eurozone participation is added to the model of column (2). Column (5) shows the coefficients of all the independent variables and is the most complete model. Column (6) uses the same predictors as column (5) but with the untransformed Gini coefficient as the dependent variable for robustness-check.

As seen in Table 5, the independent variable of interest, the GDP share of export to the EU15 countries, is positive in every column and significant at the 10% level in every column except for column (1). This indicates that the effect of Export/GDP on the Gini coefficient is sensitive to the inclusion of other variables, suggesting that the control variables better isolate the effect of Export/GDP on the Gini coefficient.

The regression coefficients for Export/GDP suggest a mild positive effect of increased exports to EU15 countries on the Gini coefficient, indicating a rise in income inequality.
The significance and magnitude of the Export/GDP coefficient are stable across models (2) to (5). This implies that a one unit increase in the Export/GDP variable $(\frac{export\ to\ EU15\ countries + import\ import\ from\ EU15\ countries}{GDP} \times 100)$ is weakly associated with an approximately 0.003 increase in the log-odds ratio of the Gini coefficient. This is not intuitively interpretable since the relationship between the (transformed) dependent variable and the (untransformed) Gini coefficient is inherently non-linear.

The results in column (6) provide a more straightforward interpretation. Specifically, a one unit increase of the Export/GDP variable is associated with a 0.000795 increase in the Gini coefficient (bounded between 0 and 1) at the 10% significance level. These results indicate a moderate positive relationship between intra-EU trade and income inequality, which supports the hypothesis presented in Section 2.7. Furthermore, the results in column (6) show the significance and signs of the coefficients do not change when the dependent variable is transformed. Adding to the robustness of the results.

Interestingly, from the selection of control variables only the variables of GDP per capita, educational spending and the one-decade lagged Gini coefficient are significant across all models. The positive sign of the coefficient of GDP per capita suggests that a higher GDP per capita leads to an increase in in income inequality. suggesting that as a country becomes wealthier, the gap between the rich and poor tends to widen. The coefficient corresponding to educational spending is negative and significant at the 5% percent level across all models, suggesting that a higher level of education leads to a reduction in inequality. The coefficient of the one-decade lagged Gini coefficient is positive and significant at the 10% level. It has the highest explanatory power out of all independent variables. Confirming that past levels of income inequality are strongly related to current levels, indicating persistence in inequality over time.

The fact that income inequality seems to be so persistent might raise concerns regarding the use of the Fixed Effects model. The model controls for all time-invariant characteristics specific to each country, and when the dependent variable (income-inequality) is stable over time and within each country, the model might leave a considerable part of the variation in the Gini coefficient unexplained, which can hurt the precision of the estimated coefficients.

Despite this drawback, Fixed Effects is employed with the aim to establish a causal effect, helping to ensure that the estimated coefficients are not biased by unobserved, time-invariant factors. Without Fixed Effects, the estimates might be inconsistent and can fail to account for unobserved heterogeneity.

Overall, the results of the Fixed Effects analysis suggest a moderate positive relationship between Intra-EU trade and within-country income inequality. However, the low statistical significance of the coefficients suggests that the results should be interpreted with caution and warrant further investigation.

5. Discussion and Future Research

Some of the most obvious limitations of this research stem from the nature and composition of the dataset. Some of the data is incomplete for certain years, this is most common in the earlier years of the dataset. While the methods used are robust to missing values, having a more complete dataset would improve the model's fit and accuracy.

The data on intra-EU trading volumes, stemming from Eurostat's databases, has one large shortcoming: the standardised data collection system for trade flows from and to EU-member countries, Intrastat, has a known problem of the import values being too low, relative to the export numbers (as explained in more detail in Section 3). The advice from Eurostat is to use only the export numbers when analysing trade flows between countries, since this better reflects the overall value. This is the approach taken in this paper. Nevertheless, this means that the data used for intra-EU trade flows provides an incomplete image per definition.

Endogeneity is another concern. Reverse causality and omitted variable bias (OVB) are difficult to address fully. Despite the control variables being selected based on renowned literature and theory, it is challenging to ensure the absolute best confounders have been selected, while avoiding overfitting and multicollinearity. More sophisticated econometric methods could better address these problems.

Furthermore, while this paper identifies multiple mechanisms through which intra-EU trade flows can influence within-country income inequality (as presented in Section 2), it does not test for these mechanisms specifically.

It would be interesting for future research to test the implications of the H-O model and S-S theorem on the European Union. Since the theory is based on relative differences in resource endowments, it should in theory be applicable to any selection of countries. Future research could make a distinction between capital-abundant and labour-abundant (or high-skill labour-abundant and low-skill labour-abundant) EU countries and test the Stolper-Samuelson theorem using intra-EU trade flows.

Regardless, the results of this paper are relevant and indicate that increased intra-EU trade flows are associated with higher income inequality. The findings should encourage policymakers to carefully consider the social dimensions when designing trade policies. To fully understand the mechanisms through which trade impacts income inequality and other social measures, further research is essential.

6. Conclusion

The goal of this paper was to test whether there is evidence that an increase in intra-EU trade leads to an increase in within-country income inequality. The results of the Fixed Effects analysis, presented in Section 4, suggest such a relationship exists. The results show a positive coefficient of the intra-EU trade variable which is significant at the 10% level. The estimated coefficients of the models presented in Section 4 are generally unfit for straightforward interpretation due to the usage of a log-odds transformed Gini coefficient. However, the model (column (6)) that incorporates the untransformed variant of the Gini coefficient suggests a one-point increase in the share of exports to EU15 countries is associated with an increase of 0.000795 in the Gini coefficient. Given the significance level, these results should be interpreted with caution.

Overall, this paper finds evidence supporting the hypothesis presented in Section 2.7, aligning with the findings of Beckfield (2009) and partially with Pham (2014) as discussed in Section 2.6. However, to confidently establish a causal relationship between intra-EU trade and within-country income inequality, further research is required.

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