

Income Convergence and Divergence in European Regions: Insights and Policy Implications

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Abstract: The allocation of wealth in society has been a fundamental question and challenge in economics. Concentrating most wealth in a small segment of society while leaving the rest with a smaller portion can lead to income inequality and social issues. Income inequality varies across cultures, historical periods, economic structures, and economic systems. Our study tests and analyzes comparative income convergence in Eastern Europe, Western Europe, Central Europe, and the Baltic regions. It is important to note that our model is region-specific rather than country-specific. Our study asserts that income levels converge at an average level and within states, promoting income distribution convergence. The analysis was conducted to examine stochastic convergence in Europe within the panel stationarity (Fourier KPSS) test, revealing that regional economic inequalities in Europe are likely to either persist or even widen.

Keywords: Income convergence, Europe, Taxation, Panel data analysis

JEL: C23, D31, O18, H20

Introduction

Neo-classical growth theories by Solow and Swan (1956) focus on income convergence, where average income levels of countries become more similar over time. In contrast, Benabou (1996) highlights the link between economic growth and income inequality, focusing on the convergence of per capita income. Theoretical discussions on income convergence hypotheses, highlighted by Sala-i-Martin (1996), include three main concepts: Sigma Convergence: This hypothesis posits that income distribution within a country evolves over time, leading to reduced income inequality between economies. Beta Convergence: This concept argues that poorer countries should experience faster per capita gross domestic product (GDP) growth than richer ones, thereby closing the income gap, as supported by Sala-i-Martin's analysis. Stochastic Income Convergence: This hypothesis suggests that convergence rates vary and examines beta convergence without requiring it as a prerequisite.

The goal of this study is to consider the smooth transitions of non-linearity and structural breaks (such as economic crises, internal and external shocks, natural disasters, or events like COVID-19) using the Fourier approach. In recent years, studies focused on the factors driving income convergence in both developed and developing countries. While there is

ample research on international income inequality, regional dynamics, particularly within the European Union (EU), have received less attention. Moreover, the redistributive effects of economic integration are often overlooked. It remains uncertain whether policies aimed at reducing GDP per capita disparities between regions have effectively addressed income inequality. This study posits that both average income levels and income distribution within states are converging. The paper is organized as follows: Section 1 addresses the emergence of income convergence in Europe, Section 2 reviews the relevant literature, Section 3 describes the data and methodology employed, and the Conclusion provides insights into the findings and their implications for growth policies and income convergence in Europe.

1. Causes of Income Convergence in Europe

The term “Europe” specifically refers to a small portion of the world’s landmass, which is separated from northwest Asia by a peninsula. In Semitic languages, Erep (or Irib) means “the side where the sun sets”. This name was passed from the Phoenicians to the Greeks and became “Europa” in Greek. In this context, the Greeks coined the term “Europe” in the 7th century BC to refer to the northern part of the region where they lived. Therefore, during the Greek civilization, Europe was perceived as a distinct geographical entity.

The geography of Europe has been the cradle of many civilizations and nations for centuries. While the concept of unifying Europe can be traced back to Ancient Greece, the first concrete idea of a united Europe emerged in the Middle Ages. Despite numerous proposals for European unification in later periods, it was not until the 19th century that these ideas began to materialize. The notion of an EU first took shape during this time. The removal of internal trade barriers in Prussia in 1819 and the establishment of a Customs Union among the German states in 1834 served as early examples of steps towards European integration (Akdemir, 2019:3-10).

The 1st and 2nd World Wars significantly impacted shaping the continent politically. After World War II, European politicians began working on creating the European Union to prevent future conflicts. The process started with the establishment of the Council of Europe in 1949. European integration advanced over the years with the creation of the EU, which now includes most European countries. The EU is a supranational political entity that falls between a confederation and a federation and is based on a system of European treaties. Initially, The EU’s precursor, the European Economic Community (EEC), was founded in 1957 with six members: Belgium, France, Germany, Italy, Luxembourg, and the Netherlands whereas under the Maastricht Treaty from 1992, 15 countries joined the European Union, but it now has 27 members (European Union 2024). Europe favors a gradual approach to fostering economic growth. Since the establishment of the European Union, development policies have been meticulously planned by the European Commission, prioritizing predictability over surprises. However, there is an ongoing debate about the extent to which these policies can affect countries and regions.

EU Commission (2023) cohesion policy represents a crucial growth-enhancing initiative of the European Commission, primarily due to its adaptability to the specific needs of diverse EU regions. The disparities in GDP per capita within the EU are significant, reflecting varied growth models across member states. Investments facilitated by cohesion policy are designed to address this diversity, thereby accelerating the upward convergence that has been observed over the past two decades. A growth strategy that lacks cohesion

risks exacerbating existing concentration trends, further entrenching territorial and social divisions. The overarching objective of cohesion policy is to mitigate disparities in GDP per capita across regions, particularly by promoting growth in less affluent areas to foster convergence with their more prosperous counterparts.

In our study, we will be using different classifications to distinguish between European countries. These classifications include geographical regions. The study aims to analyze income convergence in Eastern Europe, Western Europe, Central Europe, and the Baltic provinces. To have a better understanding of the politics of the regions, it is essential to identify the countries in each region. Country and region comparison is of great importance to research and practice since it not only gives us information about the relative position of a particular country and region in the world but also shows the differences among countries and regions. The comparison may vary depending on the criteria used. Since the European Union represents not only economic integration but also a political community, we will base this distinction on the list of member states provided by the CIA World Factbook (Central Intelligence Agency, 2024), compiled by the Central Intelligence Agency of the United States of America. In their 2009 study, Hua, Skaletsky, and Westermann demonstrated the academic effectiveness of using data from the CIA Factbook. They constructed Kohonen Self-Organizing Maps (SOM) to identify global patterns related to humanity, economy, communication, and defense for 180 countries. The primary aim of this study was to explore how countries cluster around specific geographical locations, providing insights into global demographics. Our research emphasizes demographic factors, historical political order, and the compatibility of collected data when identifying regions and the countries within those regions. As a result, our study will concentrate on the countries located on the European continent, as outlined in the CIA World Factbook.

- **Eastern Europe (including Baltic States):** Bulgaria, Croatia, Greece, Lithuania, Latvia, Romania, Estonia, Serbia, Bosnia and Herzegovina, Albania
- **Western European Countries:** Belgium, France, Luxembourg, Netherlands, Portugal, Spain, Italy, Ireland
- **Central Europe and the Scandinavian Countries:** Austria, Czech Republic, Germany, Hungary, Poland, Slovakia, Slovenia, Denmark, Finland, Sweden, Norway

The Eastern European (including Baltic States) countries include the former Soviet Union and Eastern Bloc countries. In 1989, the Eastern Bloc collapsed, and in 1991, the Soviet Union dissolved, leading to the emergence of new independent countries. Before 1991, Eastern European economies operated under a planned economy structure in which the state owned the means of production, controlled the market, and made decisions about production and distribution throughout the country instead of a free market economy. Following the collapse of the Eastern Bloc and the dissolution of the Soviet Union, the political propositions of neo-liberalism spread globally. This process resulted in the replacement of planned economies with free market economies in the Eastern Bloc countries and the countries that became independent from the dissolved Soviet Union. These countries reformed their price systems, largely eliminated subsidies, and liberalized their trade. Private ownership expanded rapidly, the role of the state diminished, and competition intensified. Unlike in planned economies where wages were generally similar, the transition to free market economies led to greater differentiation of wages based on education and skills. This

change is considered one of the reasons for the deterioration of income distribution in Eastern European countries compared to the pre-transition period (Inotai, 1995: 98; Kazazi et al., 2022: 245-246).

Western European countries have never adopted a planned economy strategy. Instead, they have all implemented a free market economy, particularly after World War II. As a result, income distribution has been shaped by free market conditions.

Countries in Central Europe and Scandinavia have diverse economic models. For example, the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Serbia, Bosnia and Herzegovina, and Albania, although classified as Eastern European countries in some cases, have transitioned from a planned economy to a free market economy after breaking away from Soviet Russia and Yugoslavia. Following the collapse of Communism in 1989–1990, East and Central Europe saw the emergence of more market-oriented economies. The most significant changes occurred in Poland, where early “shock treatment” swiftly shifted the economy towards a market-oriented direction. Hungary and the Czech Republic also underwent substantial economic transformation, although the changes were more gradual in those countries (Kelley, Zagorski, 2004: 321-322). The Nordic economies share some similarities with a capitalist system, such as a free market, globalization, outsourcing, and a democratic form of government. However, they also exhibit characteristics commonly found in socialist economies, such as a high tax rate, a welfare state, and higher participation in labor unions. This economic model incorporates features from both capitalism and socialism but is distinct from both in its entirety (Iqbal and Todi, 2015: 341). Germany currently operates under a free market economy, but before the unification of East and West Germany in 1990, the eastern part was governed by a planned economy.

Today, economic growth is a priority for almost every country worldwide. Governments often aim to increase savings through tax policies as part of their economic objectives. This can lead to tax policies that favor high-income groups with a greater tendency to save (Pinar, 2006: 293). When such tax policies are implemented, capital may not be taxed adequately, and tax reductions and incentives may be offered to the highest income group. Investment incentives provided through the tax system include investment allowances, accelerated depreciation, lower tax rates, and tax exemptions. Among these incentives, investment allowances and tax exemptions are commonly utilized. However, frequent use of these practices can lead to distortions in the income distribution of countries. For example, a 2023 study by Uliczka found that the corporate tax incentives implemented by the Irish government in 1997 had significant positive effects on the income share of the top 1% of society, while negatively affecting the income of the upper middle 40% of earners (Uliczka, 2023: 1).

To address income inequality among social groups, it is essential to implement a tax policy that taxes high-income groups at higher rates and low-income groups at lower rates and redistributes the revenues to those with insufficient income. Namely, some of the incomes recognized by taxpayers come from labor, which includes wages and salaries. The other type is capital income. Generally, capital incomes tend to be more stable and continuous compared to labor incomes. This is due to the fact that labor income depends on the health and ability to work on the one hand and the age and duration of employment on the other. It is not appropriate for countries to tax labor incomes in the same manner as wealth incomes or to treat them equally regarding taxation. In the interest of fairness, labor incomes should be taxed at a lower rate than capital incomes. Additionally, a portion of

employees' incomes should be exempted from the tax base. (Türk, 1999: 141). This demonstrates the social impact and effectiveness of tax policies.

Moreover, an important issue is the extent to which the state can eliminate inequality in personal income distribution before it reaches a high level. This depends to a large extent on the type of taxes that the state imposes to limit income inequality between individuals. More taxes can be collected through taxes on consumption than through taxes on income. This means that capital, which plays a role in the success of economic growth, is to some extent exempt from taxation (Türk, 2010: 347). When taxes are imposed on capital income earners, corporate tax acquires a progressive nature. However, with the increased mobility of capital due to globalization, the tax burden has shifted predominantly onto the immobile labor force. In more open economies, the progressivity of corporate tax diminishes as its burden increasingly falls on labor. Nevertheless, as economic theory suggests, corporate tax retains a modest degree of progressivity and contributes to improving income distribution (Eser, Genç, 2020: 231). Consequently, the compatibility of a country's tax policy with its economic policy is crucial. A tax policy inconsistent with the overall financial strategy is destined to fail and can have a detrimental effect on the broader policy framework. Therefore, it is imperative to develop a tax policy that aligns with other policies (Öner, 2018: 206). Table 1 illustrates the ratio of taxes on capital to total tax revenues in Eastern Europe (including the Baltic States), Western Europe, Central Europe, and the Scandinavian Countries.

Table 1: Ratio of Taxes on Capital to Total Tax Revenues in Eastern Europe (Including Baltic States), Western Europe, Central Europe and the Scandinavian Countries (%)

TIME	1995	2000	2005	2010	2015	2020	2021	2022
Eastern Europe (Including Baltic States)								
Bulgaria	0.7	4.0	2.3	1.8	2.2	2.2	2.8	2.9
Croatia	1.2	1.3	2.3	1.9	1.8	2.3	2.2	3.2
Greece	2.2	4.0	3.3	2.6	2.2	1.4	2.0	2.5
Lithuania	2.1	0.7	2.1	1.0	1.5	1.7	2.1	2.3
Latvia	1.7	1.5	1.9	1.0	1.6	0.7	0.9	1.0
Estonia	2.3	0.9	1.4	1.3	2.1	1.6	1.5	1.7
Romania	3.8	3.2	2.7	2.0	2.3	1.9	2.2	3.1
Western Europe								
Belgium	2.3	3.1	3.2	2.5	3.3	3.3	3.8	4.0
France	1.8	2.8	2.5	2.3	2.6	2.7	2.9	3.3
Italy	3.2	2.3	2.3	2.3	2.0	2.1	1.9	2.7
Luxembourg	6.5	6.7	5.8	5.4	4.2	4.8	4.5	4.4
Ireland	2.7	3.7	3.3	2.4	2.6	3.2	3.6	4.5
Netherlands	3.0	4.0	3.4	2.3	2.7	3.1	3.9	4.8
Spain	1.6	2.9	3.8	1.8	2.2	2.0	2.6	2.7
Portugal	2.3	3.7	2.6	2.7	3.1	2.8	2.4	3.3
Central Europe and the Scandinavian Countries								
Austria	1.6	2.1	2.3	2.0	2.3	2.2	2.8	3.5
Germany	1.9	2.7	2.3	2.0	2.4	2.2	3.1	3.2

Poland	2.7	2.4	2.1	2.0	1.8	2.3	2.6	2.8
Hungary	1.8	2.2	2.1	1.1	1.6	1.2	1.2	1.3
Denmark	2.3	3.2	3.5	2.3	3.0	2.9	4.0	3.3
Slovenia	0.5	1.1	2.7	1.8	1.5	2.0	2.5	2.3
Slovakia	5.9	2.6	2.7	2.4	3.6	3.0	3.6	3.7
Finland	2.2	5.7	3.2	2.4	2.2	2.1	2.7	3.0
Sweden	2.5	3.5	3.4	3.1	2.9	3.0	3.5	3.5
Czechia	4.2	3.1	4.1	3.2	3.4	3.1	3.8	4.2
Norway	4.3	8.8	11.4	9.8	4.5	2.8	9.8	18.4

Source: Eurostat, Main national accounts tax aggregates, https://ec.europa.eu/eurostat/databrowser/view/gov_10a_taxag_custom_12713053/default/table?lang=en, 31.08.2024

The data in Table 1 is derived from Eurostat data. Therefore, Serbia, Albania, and Bosnia-Herzegovina, which are part of Eastern Europe, cannot be included in Table 1 as they are in Table 2. The panel data analysis in the study, which examines income convergence in the European region, covers the period from 1990 to 2022. In Table 1, which depicts the ratio of taxes on capital and labor to total tax revenues, the data starts from 1995 and is assessed every five years until 2020. Additionally, data for 2021 and 2022 have been included. Since Eurostat data does not include information from 1990, Table 2 in our study starts from 1995.

Taxation is fundamentally based on three elements: capital, labor, and consumption. Addressing taxes on labor, consumption, and capital is essential when examining the issue of income convergence.

In corporatist nations, the tax burden on labor is typically higher than that on non-labor income. Two primary types of compulsory payments are imposed on labor income: payroll tax, which labor income earners must pay, and social security contributions. Additionally, limited labor taxes are not common in many countries. Examples include the national insurance surtax in the UK, the family burden equalization fund contribution and community tax in Austria, and the occupational safety tax in Sweden. However, since these taxes are limited in application, they are often overlooked in studies on labor taxation. Therefore, the focus tends to be on payroll taxes and social security contributions as the main components of the labor tax burden (Giray, 2018: 55).

Table 2: Ratio of Social Contributions on Labor Revenues and Payroll Taxes on Labor to Total Tax Revenues in Eastern Europe (Including Baltic States), Western Europe, Central Europe, and the Scandinavian Countries (%)

TIME	1995		2000		2005		2010		2015		2020		2021		2022	
	S.C	P.T	S.C	P.T	S.C	P.T	S.C	P.T	S.C	P.T	S.C	P.T	S.C	P.T	S.C	P.T
Eastern Europe (Including Baltic States)																
Bulgaria	33.4	0.0	31.0	0.8	30.5	0.6	26.1	0.1	26.9	0.0	29.9	0.1	28.8	0.1	26.5	0.1
Croatia	36.7	-	33.5	-	31.6	-	32.3	-	30.8	0.1	30.6	0.1	30.1	0.1	28.9	0.1
Greece	34.9	0.0	33.2	0.0	36.8	0.0	38.4	0.0	34.5	0.0	36.7	0.0	35.6	0.0	32.6	0.0
Lithuania	26.1	-	33.1	-	31.1	-	42.5	-	40.9	-	33.4	-	32.4	-	31.8	-
Latvia	36.1	-	33.8	-	28.9	0.1	30.8	0.1	28.5	0.0	32.6	0.0	31.8	0.0	31.5	0.0
Estonia	34.0	-	35.2	-	34.3	-	37.3	-	34.1	-	36.7	-	34.9	-	35.1	-

Romania	28.3	-	37.4	-	36.0	-	34.6	-	28.8	-	44.0	-	41.5	-	38.8	-
Western Europe																
Belgium	35.9	0.0	34.0	0.0	34.0	0.0	35.8	0.0	35.0	0.0	35.2	0.0	33.8	0.0	33.7	0.0
France	45.3	2.7	38.7	2.5	39.4	2.8	40.8	3.3	39.2	3.5	35.6	4.1	35.5	4.0	35.0	4.1
Italy	34.8	0.3	29.3	0.0	31.1	0.0	31.8	0.0	30.5	0.0	32.1	0.0	31.6	0.0	31.1	0.0
Luxembourg	30.3	0.0	28.4	0.0	30.4	0.0	31.4	0.0	31.9	0.0	31.3	0.0	29.7	0.0	29.9	0.0
Ireland	18.0	1.1	15.4	0.0	16.4	0.6	20.0	0.7	19.3	0.6	19.9	0.9	18.6	0.8	18.2	0.9
Netherlands	42.0	0.0	40.9	0.2	38.0	0.3	39.0	0.2	37.7	0.2	36.1	0.4	34.3	0.2	33.7	0.2
Spain	37.8	0.0	36.6	0.0	34.9	0.0	39.6	0.0	35.2	0.0	38.5	0.0	36.4	0.0	35.0	0.0
Portugal	31.5	0.0	31.3	-	33.8	-	35.3	-	31.3	-	34.0	-	33.8	-	32.1	-
Central Europe and the Scandinavian Countries																
Austria	37.6	5.9	35.7	5.5	35.6	5.5	35.6	6.1	34.7	6.0	37.7	5.7	36.2	5.7	35.0	5.6
Germany	44.5	-	43.2	-	44.6	-	42.5	-	40.5	-	42.7	-	40.9	-	40.5	-
Poland	32.5	0.6	41.2	0.6	39.0	0.8	36.7	0.8	40.4	0.7	39.8	0.9	37.1	1.5	39.0	1.6
Hungary	36.1	0.1	33.4	0.3	33.6	0.5	32.0	1.1	34.1	1.8	30.9	2.9	31.1	3.2	28.1	2.0
Denmark	3.5	0.9	4.9	0.9	3.1	0.9	3.0	1.1	2.1	1.4	1.8	1.2	1.7	1.3	1.7	1.5
Slovenia	44.4	0.1	40.0	3.8	38.9	4.4	41.7	0.2	41.0	0.1	44.9	0.1	43.0	0.1	43.0	0.1
Slovakia	37.5	-	41.5	-	40.2	-	43.5	-	42.6	-	44.6	-	43.9	-	42.7	-
Finland	31.7	0.0	25.6	0.0	27.5	0.0	29.9	-	29.2	-	27.6	-	28.0	-	27.8	-
Sweden	12.7	16.8	10.3	19.6	7.4	20.0	7.3	20.0	7.6	20.4	8.0	20.4	7.9	20.5	7.7	20.5
Czechia	41.1	-	44.1	-	42.7	-	44.0	-	41.8	-	44.3	-	46.1	-	45.1	-
Norway	23.9	0.1	21.3	0.0	20.7	0.0	22.6	0.0	27.3	0.0	28.7	0.2	22.8	0.2	17.5	0.1

Source: Eurostat, Main national accounts tax aggregates, https://ec.europa.eu/eurostat/databrowser/view/gov_10a_taxag_custom_12713053/default/table?lang=en, 09.12.2024.

Note: In this table, social contributions are abbreviated as S.C. and payroll taxes as P.T.

Effective tax rates on labor are generally high in EU countries. However, the payroll taxes and social security contributions paid by labor income earners are similar in Eastern European countries, including the Baltic states.

In Eastern Europe (including the Baltic States), the ratio of taxes on capital to total tax revenues varies between 2–3% in all countries except Latvia and Estonia. In Latvia, the ratio is low, but the incentives for capital owners are not as broad as in Romania. In Latvia, tax incentives are mainly directed towards free ports and special economic zones. In Romania, tax exemptions are granted to companies' technological equipment assets used for production, processing, renovation, and research and development. Additionally, companies enjoy wide tax exemptions in various fields (Price Waterhouse Coopers, 2024).

To reduce income inequality among different social groups and ensure fairness in taxation, it is widely understood that capital income should be taxed at higher rates than labor income. A comparison of Table 1 and Table 2 reveals that labor is taxed more heavily than capital across Europe. This is mainly due to the challenges member states face in finding alternative financing options within budget constraints. This pattern also holds for Eastern Europe, including the Baltic countries. However, in Eastern Europe, the ratio of payroll taxes to total tax revenues is quite low, and the proportions of revenue generated from social security contributions to total tax revenues are similar across the countries in this region.

In Western Europe, the percentage of total tax revenues from payroll taxes is higher than in Eastern Europe, although it is not as high as the share from social security contributions. In Western Europe, labor income is heavily taxed, particularly in the Netherlands, Belgium, and France. Notably, in France, the ratio of payroll taxes to total tax

revenues is higher than in other countries, in addition to having elevated social security contribution rates.

In Western Europe, Belgium, Luxembourg, Ireland, and the Netherlands have a similar ratio of taxes on capital to total tax revenues of around 4%. It should be noted that these four countries are neighbouring each other within the region. This is because the countries use the advantage of the region. For example, in 2012, the Double Irish Dutch Sandwich method provided a major tax advantage by taking advantage of all the loopholes in the Apple tax legislation.

The Double Irish Dutch Sandwich strategy operates as follows: The “Double Irish” component of the formula involves two Irish entities, “Apple Operations” and “Apple Sales,” both based in Ireland. When Apple sells a product in the United States, it pays royalties to its Irish subsidiary for that sale, as its patents are held in Ireland. This arrangement allows the company to be taxed at Ireland’s corporate tax rate of approximately 12.5%, instead of the higher 35% corporate tax rate in the United States. The movement of profits through Ireland follows a specific structure: Due to a “loophole” in Irish tax law, if the directors of the Irish subsidiary are based in another jurisdiction—such as a Caribbean tax haven—the profits can be transferred out of Ireland without incurring tax liabilities. The Irish subsidiary is used for sales made in any country outside the US, further reducing the company’s global tax burden. The “Dutch Sandwich” element comes into play as a result of Ireland’s membership in the European Union. The second Irish entity transfers profits to a Dutch subsidiary tax-free. The Dutch company, acting as an intermediary or “sandwich,” channels the profits back to the first Irish company, from which the funds are then transferred to the Caribbean. This complex tax structure enables Apple to minimize its overall tax obligations by exploiting differences in national tax laws, with the Dutch subsidiary acting as a conduit between the two Irish entities (The New York Times, 2012).

In 2022, Torslov et al. quantified the financial impact of profit shifting through artificial means by analyzing data from tax havens worldwide. Their findings revealed that, in addition to the Netherlands and Ireland, four other countries—Luxembourg, Belgium, Malta, and Cyprus—generate substantial profits through tax avoidance strategies, including the Double Irish Dutch Sandwich method.

As shown in Table 1, in 2010—the year in which the Double Irish Dutch Sandwich was most effectively employed—the ratio of taxes on capital to total tax revenues in Belgium, the Netherlands, and Ireland was strikingly similar. By 2022, Luxembourg’s ratio of taxes on capital to total tax revenues is also closely aligned with those of Belgium, the Netherlands, and Ireland. Consequently, these four countries, which are geographically proximate and share similarities in historical development and cultural characteristics, have successfully exploited legislative gaps within the European Union to their advantage.

Table 1 indicates that the ratios of taxes on capital to total tax revenues in the Netherlands and Ireland were remarkably similar in 2005. Specifically, in 2005, the ratio stood at 3.3% for Ireland and 3.4% for the Netherlands. By 2010, these figures had decreased to 2.4% for Ireland and 2.3% for the Netherlands. This situation has positioned Ireland and the Netherlands as more favorable destinations for investment compared to other Western countries.

In Western Europe, as indicated in Tables 1 and 2, the ratio of taxes on labor to total tax revenues is higher than the ratio of taxes on capital to total tax revenues. However, unlike in Eastern Europe, some countries in Western Europe have payroll taxes that contribute

significantly to labor income taxes. For example, in France, this rate was 4.1% in 2022. Notably, France has not only higher social security contribution rates but also a greater ratio of payroll taxes to total tax revenues than many other countries. In contrast, Ireland has a much lower ratio of revenues from social security contributions to total tax revenues compared to other nations. Additionally, given that profit shifting through capital, using methods such as the Double Irish Dutch Sandwich, is prevalent in Western Europe, the hypothesis of income grievance does not seem applicable in this region.

When analyzing the labor revenues of Central European and Scandinavian countries, it becomes evident that there are significant differences in both the ratio of payroll taxes to total taxes and the ratio of revenues from social security contributions to total taxes. In neighboring Central European countries such as Germany, Poland, Czechia, Slovenia, and Slovakia, the ratio of revenues from social security contributions to total tax revenues ranges from 39% to 45%. This variation can be attributed to the historical political organization of the region, as all these countries are part of Continental Europe, which is characterized by the continental European social welfare state approach.

In contrast, Scandinavian countries show differences regarding payroll taxes and social security contributions. Denmark maintains the lowest rates for both categories. In Denmark, social security is primarily financed through national taxes, while in Norway, taxes play a significant role in funding social security (Özmen, 2017: 602).

The ratios within the Scandinavian countries and among the Central European countries are quite similar aside from Norway and Hungary. In 2022, Norway has an extremely high ratio, while Hungary's ratio is lower compared to other countries. Norway's unique situation stems from not being a member of the European Union, which allows it to set its policies. On the other hand, Hungary has broad tax exemptions to attract foreign direct investment, keeping them at the minimum amounts required by EU law. Furthermore, the tax incentives for large enterprises investing in Budapest's Pest district are under review as EU and Hungarian legislation is being harmonized. Similar practices in other countries may lead to income disparities, but some European Union practices can also promote income convergence in the region, especially due to the Scandinavian countries' high budget aid to the EU countries in the region (Price Waterhouse Coopers, 2024).

The economic models of Central European and Scandinavian countries differ significantly, as does their approach to social security systems, as illustrated in Tables 1 and 2. However, a common characteristic of these countries is that their payroll tax revenues are generally higher than those in Western Europe. This situation can lead to both convergence and divergence between Central European and Scandinavian countries over time. Therefore, it is useful to examine the ratio of indirect taxes to total tax revenues across all three regions.

Table 3: Ratio of Value Added Taxes to Total Tax Revenues in Eastern Europe (Including Baltic States), Western Europe, Central Europe, and the Scandinavian Countries (%)

TIME	1995	2000	2005	2010	2015	2020	2021	2022
Eastern Europe (Including Baltic States)								
Bulgaria	23.5	23.8	32.1	32.6	30.6	30.0	30.5	29.1
Croatia	-	30.5	32.4	30.9	33.1	33.0	35.5	35.2
Greece	19.6	18.1	20.1	20.6	18.2	18.7	19.8	20.9

Lithuania	26.9	24.4	24.0	27.0	26.3	25.3	25.6	26.1
Latvia	27.6	23.6	26.2	23.5	25.5	26.7	27.7	30.5
Estonia	26.5	27.1	26.8	25.7	26.6	26.2	26.8	27.4
Romania	17.9	21.2	28.3	27.9	28.8	22.7	23.6	24.5
Western Europe								
Belgium	14.6	15.2	15.1	15.4	14.2	14.0	15.1	14.5
France	16.7	16.1	16.1	15.4	14.5	14.8	15.8	15.8
Italy	13.2	15.6	14.6	14.4	14.0	13.9	15.4	16.5
Luxembourg	13.2	13.7	15.7	16.9	15.4	15.5	15.5	16.6
Ireland	20.2	22.0	23.2	21.1	18.7	16.5	17.7	17.5
Netherlands	15.5	16.4	18.3	17.7	16.9	18.0	18.5	18.3
Spain	15.4	17.2	17.2	16.0	18.5	16.8	17.7	18.3
Portugal	21.7	22.7	24.0	22.6	23.3	22.5	23.8	24.8
Central Europe and the Scandinavian Countries								
Austria	17.6	18.0	18.1	18.3	17.3	17.2	17.1	18.2
Germany	15.5	15.8	15.5	18.0	17.1	15.6	16.8	17.6
Poland	16.2	20.4	22.5	23.5	20.9	21.8	22.8	20.6
Hungary	18.3	22.1	22.5	22.9	24.4	27.0	29.2	28.8
Denmark	18.8	19.0	19.7	20.4	19.8	20.7	20.4	21.9
Slovenia	0.0	22.4	21.6	20.9	21.6	19.7	21.1	21.8
Slovakia	20.6	20.2	24.3	21.6	20.7	20.9	21.0	21.7
Finland	17.1	17.3	19.8	20.3	20.6	22.0	21.7	21.6
Sweden	18.7	16.5	18.0	20.8	20.6	21.2	21.0	21.8
Czechia	16.7	18.2	19.0	20.1	21.0	20.6	21.1	22.3
Norway	22.6	19.6	18.0	18.4	21.2	23.1	18.9	14.9

Source: Eurostat, Main national accounts tax aggregates, https://ec.europa.eu/eurostat/databrowser/view/gov_10a_taxag_custom_12713053/default/table?lang=en, 11.12.2024.

To ensure a fair distribution of income within a country or region, the government needs to tax those who can afford to pay and allocate those funds to support those who cannot. A crucial aspect of this process is determining which type of tax to implement. Direct taxes on labor and capital tend to have a more negative psychological effect on taxpayers, whereas indirect taxes, such as value-added tax (VAT), are less noticeable. Since indirect taxes on expenditures are included in the price of goods and services, taxpayers often focus solely on the cost of the item and are unaware of the tax being included. Consequently, when the government raises taxes, it often prioritizes increasing indirect taxes (Akdoğan, 2009: 297).

However, low-income groups typically spend a large portion, if not all, of their income on consumption. This means that indirect taxes or consumption-based taxes can impose a significant burden on these individuals. The heavy taxation of consumption, combined with the exclusion of savings from taxation, exacerbates existing inequalities and injustices in income distribution (Pehlivan, 2020: 311).

Table 3 presents the ratio of value-added tax (VAT)—typically the largest component of indirect taxes—to total tax revenues. In Eastern Europe, including the Baltic countries, this ratio ranges from 20% to 35%. In Western Europe, the ratios are between 14% and 25%,

while in Central Europe and the Scandinavian countries, they fall between 14% and 29%. The consistent share of VAT revenues within these ranges across all three regions is largely the result of indirect tax harmonization in the European Union. In Eastern European countries, which generally have lower per capita gross national products and income levels, it is common to observe higher VAT ratios. Since indirect taxes are relatively easy to collect, partly due to taxpayer behavior, it is often advantageous for developing countries to rely on increasing these taxes.

In our study, we are examining the existence of income convergence on a regional basis, making the ratio of VAT to total taxes within these regions significant. However, it is challenging to draw definitive conclusions about income convergence from these data because of indirect tax harmonization in the European Union.

2. Literature Review

In the existing literature, various theories of convergence exist, such as beta, sigma, divergence, absolute convergence, conditional and unconditional convergence, deterministic and stochastic convergence, and micro and macro convergence, among others. This section only provides evidence of income convergence or divergence for European countries. Ezcurra and Pascual (2005) use the panel to investigate income inequality across regions in the European Union, providing evidence that there is convergence in regional income inequality. They argue that this convergence is primarily due to a reduction in the relatively high levels of inequality observed in 1993. Similarly, Tselios (2009), employing a growth model with regional interaction effects, confirms that income and income inequality are converging among European regions.

Abiad et al. (2007) examined the impact of capital flows from wealthy to less affluent countries on income convergence among EU member states, noting that these flows facilitate both financial integration and income convergence. However, Europe exhibits distinct characteristics compared to other regions due to the varied GDP per capita levels among EU nations, spanning from middle to high-income classes. According to the Gravity model, participation in large markets provides advantages through international trade by mitigating trade barriers and transaction costs. The study's findings indicate that European financial markets have effectively fulfilled their role in reallocating capital within the region.

Stanisic (2012) conducts a comparative analysis between the EU-15 and the CEE-10, examining both beta and sigma income convergence with respect to GDP per capita. The long-term empirical findings reveal that, while GDP per capita is diverging among the EU-15 countries, sigma convergence is observed among the CEE-10 countries. However, during the economic crisis, these long-term trends reversed, with the pace of convergence slowing compared to previous periods.

Savacı and Karşıyakalı (2016) examined income convergence between Turkey and 13 European Union member countries using unit root tests, focusing on GDP per capita data from 1960 to 2013, both before and after the establishment of the Customs Union. Their findings reveal that nearly all break years correspond to periods of economic crises, indicating that crises, shocks, or any factors influencing GDP per capita play a significant role in the convergence process. However, it is notable that the impact of each break year on the convergence process is not uniform.

Matkowski et al. (2016) investigated real income convergence among Central and Eastern European (CEE) countries from 1993 to 2015, assessing both beta and sigma

convergence. Their analysis revealed that, although there is evidence of a catching-up process between Western Europe and the EU, this process is intermittent and subject to disruptions. These findings suggest that for CEE countries to achieve sustained and healthy economic growth, the implementation of appropriate social and economic policies is essential. The growth rate alone is insufficient to ensure ongoing income convergence in these nations.

In her (2019) study, Cinzia highlighted three distinct patterns within the EU. These include significant convergence among member states since the turn of the century, challenges faced by many Southern regions in keeping pace with the overall progress of the European Union, and pronounced internal income divergence in Southeastern member states. The evidence indicates that even a nation with a long history of strong integration is no longer advancing in terms of income convergence. Currently, it displays a level of income dispersion across states comparable to that observed within the EU.

In a study by Belke et al. (2019), nine Central and Eastern European countries were analyzed: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Poland, Slovenia, Slovak Republic, and Romania. The study utilized first and second-generation unit root tests, revealing that these countries' economies are converging towards a common long-term stationary level, thereby supporting the convergence hypothesis. Despite initial differences in income distribution levels, the research showed that these countries are moving towards a common level of income inequality. The findings also underscored the importance of inclusive growth for improving inequality. Furthermore, the study indicated that an increase in per capita income does not necessarily lead to better income distribution. These results align with the findings of Chambers and Dhongde (2016-2017), further highlighting increasing income inequality in CEE countries. In summary, the convergence observed among CEE countries suggests a movement towards a similar model of growth and inequality.

In their 2023 study, Altuzarra et al. analyzed real GDP income and trade elasticity using ARDL and Error Correction Methods for OECD members, Latin America, Asian Countries, and the World from 2007 to 2017. The research found that the global economy is shifting towards less trade dependence and greater trade openness, leading to policymakers embracing export-led growth strategies. Additionally, economies with less trade dependence are more resilient to external shocks, possibly due to their environmentally friendly practices and alignment with lower income inequality.

Bolkol (2023) conducted a study on income convergence in Turkey's regions, analyzing real GDP per capita from 2004 to 2017 using NUTS1-NUTS2-NUTS3. The study found a U-shaped relationship between economic growth and the ratio of R&D personnel to total employment. According to the results, the East region has a comparative advantage from the perspective of endogenous growth policies and can play a beneficial role in reducing income disparities between the West and East regions.

In their 2023 study, Wozniak-Jechorek and Kuzmar explored the reasons behind income inequalities in the EU27 from 2017 to 2021, which covered three years before the pandemic and two years after. They focused on the impact of digitalization and compared it internationally with the Gini Index. Their research highlighted digitalization as a key factor in enhancing the Union's resilience and reducing external dependencies. The researchers used the Digital Economy and Society Index (DESI) as an indicator for the selected period. The findings indicated that Central and Eastern European countries experienced greater job

losses and slower digitalization progress compared to EU14. The study also emphasized the importance of digital technology and internet access for socioeconomic inclusion, showing a correlation with a larger decrease in the Gini index in the EU27.

Egri and Lengyel (2024) conducted a study on the NUTS3 region and six Central and Eastern European member states of the EU. They gathered data from Eurostat for the years 2000–2019 and analyzed beta and sigma convergences. The empirical results revealed weak convergence on average in the period before COVID-19. Before and after the 2008 crisis, both sigma and beta convergences differed significantly in the NUTS3 regions of the CEE6. In the CEE6 countries, economic growth is closely tied to the economy of the capital regions. However, the catch-up of less developed regions is relatively slow.

In Savoia's (2024) study, new data from the Luxembourg Income Study (LIS) was utilized to examine income inequality convergence across Europe's regions from 1989 to 2013. The analysis employed panel Fixed Effects, Pooled OLS, and GMM (Generalized Method of Moments) models. The findings suggest that income inequality is converging among EU regions, particularly in the NUTS2 region where the trend is more pronounced and rapid. The study highlights the significant political role of Europe's cohesion policy in facilitating a catching-up process in the second period with an acceleration effect.

In a study by Batog and Batog (2024), vertical income convergence was analyzed for the period between 1993 and 2022, taking into account the two economic downturns from 2007 to 2020 in Europe. The researchers examined GDP per capita using both the absolute convergence equation and a proposed marginal vertical β -convergence equation. The empirical results revealed differences in income convergence between the old and new members of the European Union, with varying convergence coefficients due to economic growth heterogeneity among member states. These findings have significant implications for future economic growth policies within the EU.

Chen and Hsu (2024) conducted a panel KPSS-PUR unit root test to examine the relationship between the happiness index and GDP per capita in eight European countries from 1975 to 2020 (data is gathered from the World Bank Development Indicators). They tested the catch-up hypothesis to understand how happiness and real income are linked. The analysis of stochastic convergence revealed that there is evidence of convergence in the selected countries during the period studied. Additionally, there was a catch-up effect on income for benchmark countries, such as France.

In a study conducted by Fiorelli et al. (2024), GDP per capita for NUTS2 - 249 European regions are analyzed over the period from 2000 to 2021 to examine club convergence. The data was sourced from the European Commission's regional database (ARDECO). Initially, a time-varying model was used, measured with a log t-test, followed by a comparison of a finite mixture model using the Phillips-Sul approach. The classifications of regions were then checked using K-means clustering. The results of the log-t test suggested that the European regions do not appear to converge to the same steady-state equilibrium in terms of per capita income. The Phillips-Sul approach, however, identified three clubs of convergence through the clustering algorithm. The finite mixture model indicated that clusters are moving towards a common transition path. The observed convergence may be attributed to Eastern Europe and cohesion funds.

3. Data and Methods

Economic theory does not uniformly support the convergence hypothesis. While the traditional neoclassical growth model suggests the possibility of income convergence, more contemporary endogenous growth models generally contest this notion. This is why in this study, GDP per capita, measured in current US dollars, is sourced from Eurostat for the entire region, and to analyze with balanced data over the longest period (1981–2022), it was not feasible to work with inflation-adjusted or annual (%) figures. The data must cover at least 20 years to ensure the accuracy and statistical significance of the empirical results. Particularly for the Baltic countries, it is challenging to access balanced data. The logarithmic transformation of this data is used in the model. To encompass the entire European context, data is categorized into three regions: Eastern Europe (including Baltic States), Western Europe, Central Europe, and the Scandinavian Countries. It is important to note that this model is region-specific rather than country-specific.

Income convergence is a significant topic in growth theory and development economics. The convergence hypothesis posits that, over time, the growth rates of real per capita output across countries will converge, implying that poorer countries tend to experience faster economic growth than their richer counterparts. This dynamic suggests that, under certain conditions, lower-income countries may eventually catch up to higher-income countries (Michelis, Neaime, 2004: 476-477). Therefore, when dealing with income convergence, it is important to consider the gross national income (GNI) per capita in countries.

Gross national income represents the aggregate value of the gross balances of primary incomes for all sectors of an economy. It is calculated by adding the GDP to net receipts from abroad, which include compensation of employees, property income, and net taxes less subsidies on production. Compensation of employees received from abroad refers to the earnings of residents who primarily reside within the economic territory but work abroad, as is often the case in border regions. It also includes earnings of those who temporarily live and work abroad, such as seasonal workers, whose primary economic interest remains in their home country. Property income receivable from or payable to abroad encompasses interest, dividends, and all or part of the retained earnings of foreign enterprises owned wholly or partially by resident enterprises (and vice versa). GNI, however, is less suitable for temporal comparisons, as its fluctuations are influenced not only by real economic growth but also by changes in prices and purchasing power parities (PPPs). This indicator is typically measured in US dollars and US dollars per capita at current prices, both converted using PPPs (OECD, 2024).

The World Bank classifies countries according to their gross national income per capita. The World Bank uses the Atlas conversion factor instead of simple exchange rates to calculate GNI in United States (US) dollars. The Atlas conversion factor is calculated based on the average of a country's exchange rate in that year and the exchange rates of the previous two years. It is adjusted for the difference between the domestic inflation rate and the international inflation rate. The main purpose of using this factor is to mitigate any change in the exchange rate caused by inflation. GNI per capita is calculated by dividing the GNI expressed in US dollars by the population of the country using the World Bank's Atlas method (The World Bank, 2024a).

For the fiscal year 2025, low-income economies are defined as those with a GNI per capita of \$1,145 or less using the World Bank Atlas method in 2023. Lower middle-income economies have a GNI per capita between \$1,146 and \$4,515, while upper middle-income

economies have a GNI per capita between \$4,516 and \$14,005. Any economy with a GNI per capita exceeding \$14,005 is classified as a high-income economy (The World Bank, 2024b).

Table 4: Comparison of GNI per Capita and World Bank’s Country Income Levels in Western, Eastern European (Including the Baltic States), and Scandinavian Countries (Year 2023)

Regions/ Countries	Gross National Income (GNI) per Capita by Atlas Method USD (\$)	World Bank’s Classification of Countries According to Income Levels
Eastern Europe (Including Baltic States)		
Albania	7.570	Upper middle income
Bulgaria	14.460	High income
Bosnia and Herzegovina	8.160	Upper middle income
Croatia	20.670	High income
Greece	22.580	High income
Lithuania	24.820	High income
Latvia	21.970	High income
Romania	16.670	High income
Estonia	27.240	High income
Serbia	10.030	Upper middle income
Western Europe		
Belgium	54.530	High income
France	45.070	High income
Luxembourg	88.370	High income
Netherlands	60.670	High income
Portugal	26.270	High income
Spain	32.180	High income
Italy	38.200	High income
Ireland	80.390	High income
Central Europe and the Scandinavian Countries		
Austria	55.070	High income
Czech Republic	27.110	High income
Germany	53.970	High income
Hungary	19.820	High income
Poland	19.730	High income
Slovakia	22.790	High income
Slovenia	30.620	High income
Denmark	73.360	High income
Finland	53.390	High income
Sweden	61.650	High income
Norway	102.460	High income

Source: The World Bank, GNI per capita, Atlas method (current US\$), [https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?end=2020&most recent year de sc=false&start=1990](https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?end=2020&most%20recent%20year%20de%20sc=false&start=1990), 26.08.2024.

In Table 4, all countries in Western Europe, Central Europe, and the Scandinavian Countries are categorized as high-income nations according to the World Bank. In Eastern Europe, Serbia, Albania, and Bosnia-Herzegovina are classified as high-middle-income countries, while all other countries fall into the high-income category. In 2019, Bulgaria was in the high middle-income class with a GNI per capita of USD 9,570, according to the World Bank Atlas method (Kazazi et al., 2022: 247).

In 2023, Bulgaria joined the high-income class with a gross domestic product per capita of USD 14,460, exceeding the threshold set by the World Bank for high-income countries. Albania, Serbia, and Bosnia-Herzegovina are EU candidate countries. All other countries listed in Table 2 are existing high-income EU member states. This raises the question of whether the European Union aims for all included countries to be classified as high-income based on gross domestic product per capita.

Looking at income distribution, Table 2 shows that the per capita GDPs of the countries in Eastern Europe (including the Baltic States) that have left the planned economy and joined the EU are similar. Albania, Serbia, and Bosnia-Herzegovina have slightly lower GDP per capita than the others.

In Western Europe, Luxembourg and Ireland have GNIs of around 80,000 USD, Belgium, France, and the Netherlands are in the 40,000–60,000 range, while Spain and Italy have GNIs between 20,000–40,000 USD.

Central Europe and the Scandinavian Countries, Sweden, Norway, Finland, Denmark, Austria, and Germany have GNPs between 50,000 and 100,000 USD. Norway, Sweden, Finland, and Denmark are considered the four navies of the Baltics. Today, Germany and Austria are among the developed economies.

The GNP of the Czech Republic, Hungary, Poland, Slovakia, and Slovenia, which are from the planned economy era and located in Central Europe, ranges from 19,000 to 31,000 USD.

Interest in panel unit root and stationarity methods has grown since John Taylor (1989) highlighted the economic significance of unit roots, including permanent effects from shocks to macroeconomic variables. Ignoring these effects can lead policymakers to adopt inappropriate economic policies. Therefore, it is essential to identify the number and timing of shocks that cause structural breaks in the data series. Becker et al. (2004) initially addressed this issue, and Enders and Lee (2004) further refined it by developing a unit root test that accounts for unpredictable and structural form breaks. Their Fourier method focuses on selecting the appropriate frequency components for modelling rather than specifying exact break dates or forms. Enders and Lee's model is particularly effective in handling gradual breaks. The main advantage of Fourier functions is their ability to capture the key features of one or more structural breaks using a small number of low-frequency components ($k = 1, 2, 3$) (Su et al., 2012). It is an accurate approach because, with a break, the frequency tends to approach zero, altering the spectral density. The Fourier KPSS test is a unit root test with good power that can identify U-shaped breaks (structural changes from agricultural toward industrial activities) and detect smooth transitions of structural breaks, even if they

are close to the end of the sample. The number and dates of breaks are determined endogenously.

Contrary to traditional views (such as the use of dummy variables), the first study on how structural breaks can be modelled for panel datasets was suggested by Becker et al. (2006) through the Fourier KPSS test. Subsequently, the Fourier DF and Fourier GLS unit root tests were further developed by various researchers for panel data analysis.

The equation (1) presented above, developed by Enders and Lee (2012), indicates the use of a single frequency component (k), as they critique the use of multiple frequencies for reducing degrees of freedom.

$$d_i(t) \cong a_{i0} + a_{ik} \sin(2\pi kt/T) + \beta_{ik} \cos(2\pi kt/T) \quad (1)$$

The parameters a_{ik} and β_{ik} represent a nonlinear trend, contrary to the assumptions of the Dickey-Fuller test. Building on equation (1), the process of generating single-frequency data can be defined as follows (Karul, 2016: 13):

$$y_{it} = \mu_i + b_i t + \gamma_{1i} \sin(2\pi kt/T) + \gamma_{2i} \cos(2\pi kt/T) + e_{it} \quad (2)$$

where e_{it} denotes the error term. Using equation (2), the null hypothesis ‘‘ $H_0: p_i = 1$, $H_1: p_i < 1$ ’’ are tested, indicating that the series is non-stationary and contains a unit root. The Fourier approach employs the LM panel test statistic, which follows an asymptotic chi-squared distribution and is computed for each cross-section in the panel (Nazlioglu et al., 2016: 173).

In our examination of stochastic convergence in Europe, we utilized panel stationary tests. We opted for panel unit root tests due to their enhanced power as the sample size grows, and their applicability to individual cross-sections and the entire panel. Specifically, we utilized the test developed by Nazlioglu and Karul (2017) because it accommodates smooth shifts and does not necessitate prior knowledge of the dates, numbers, or form of breaks. Additionally, Carino and Mills (1993) first suggested the concept of stochastic convergence.

The model is explained in detail by Mistra et al. (2024): 432,

$$y_{it} = Z_{it} \delta_i + r_{it} + \varepsilon_{it} \quad (3)$$

In this equation, y represents GDP per capita, where i denotes the cross-section dimension (1, ..., N), and T represents the time dimension. The term r denotes the random walk process, and ε is the error term. The Fourier approximation proposed by Nazlioglu and Karul (2017) considers a common factor model, defining a deterministic term as a function of time, denoted by Z_{it} . They incorporate a component ‘ k ’ representing the Fourier frequency and derive its asymptotic distribution. The frequency size (k) is the number of conversions assumed to be homogeneous between units, and it is assumed that there is at least one frequency component if a structural break exists. Normally, k is selected according to the Akaike Information Criterion. Becker et al. (2004) stated that smaller frequency values are more successful in capturing breaks. Therefore, the frequency values (single frequency) have been selected as $k=1, 2, 3$, and the critical values for the frequencies at the 5% significance level are -4.10 for $k=1$, -3.57 for $k=2$, and -3.31 for $k=3$. These values are obtained from Table 20 in Karul (2016). Additionally, the implementation section includes the Gauss code adapted from Karul (2016). Before proceeding with the Fourier approach, second-generation validation and precondition tests were conducted.

We first examined the slope coefficients of the variables using the delta test, developed by Pesaran and Yamagata in 2008, to assess heterogeneity. The null hypothesis

suggests homogeneity, and based on the results in Table 4, we cannot reject this hypothesis at the 5% significance level, indicating that the variables are homogeneous. Next, we investigated cross-sectional dependence using the CD_LM test, developed by Pesaran in 2004 and refined by Pesaran et al. in 2008. The null hypothesis here states that there is no cross-sectional dependence. According to Table 4, we reject this null hypothesis, indicating significant cross-sectional dependence among the series. The Hadri-Kurozumi Panel KPSS test was employed, yielding more reliable results when the null hypothesis of the standard Adjusted Dickey-Fuller (CADF) test cannot be rejected. Table 5 shows that the null hypothesis of no unit root was rejected for all variables at the first difference but accepted for the level with the p-values below 0.05, indicating statistical significance. Both the ZA_la and ZA_spc statistics confirm that all variables contain a unit root and they are stationary at the I(1) level.

Table 5: Second-Generation Validation and Pre-test Results With HK Unit Root Test

Delta Test		T-Statistics	Probability	
$\tilde{\Delta}$		-0.533	0.703	
$\tilde{\Delta}_{adj}$		-0.567	0.715	
CD_LM Test (for the all Model)		T-statistics	Probability	
LM (Breusch, Pagan 1980)		24.431	0.000*	
CD LM 1 (Pesaran 2004)		8.749	0.000*	
CD LM 2 (Pesaran2004)		-4.743	0.000*	
Bias-adjusted CD (Pesaran et al., 2008)		0.055	0.478	
H-K Unit Root Test	Level and Constant		First Difference and Trend	
	T-statistics	Probability	T-statistics	Probability
GDP per capita				
ZA_spc	-0.2088	0.5827	2.3473	0.0095*
ZA_la	-0.1389	0.5552	2.4354	0.0074*

Table 6: Results From Panel Stationary Tests

Regions	Intercept k=1	Intercept and Trend k=1	Intercept k=2	Intercept and Trend k=2	Intercept k=3	Intercept and Trend k=3
Eastern Europe (Including the Baltic States)	0.2758	0.0522	0.1668	0.1694	0.1618	0.1645
Panel Statistics (F-KPSS)	4.8444	2.9196	0.2396	4.3601	-0.0443	3.9879
Prob. Value	0.0000	0.0018	0.4053	0.0000	0.5177	0.0000
Western Europe	0.0628	0.0560	0.0677	0.0694	0.0863	0.0882
Panel Statistics (F-KPSS)	2.1207	1.6228	-1.0645	0.3544	-0.9238	0.7682
Prob. Value	0.0170	0.0523	0.8564	0.3615	0.8222	0.2212
Central Europe and Scandinavian Countries	0.0638	0.0461	0.1041	0.1004	0.1538	0.1257
Panel Statistics (F-KPSS)	1.0788	2.1938	-0.4994	2.1188	-0.3502	1.9928
Prob. Value	0.1403	0.0141	0.6913	0.0171	0.6369	0.0231

Fourier frequencies are crucial for drawing inferences, and the null hypothesis of stationarity is consistently rejected for Eastern Europe across all frequencies, including both $k = 2$ and $k = 3$. In contrast, for Western Europe, the null hypothesis is rejected only for $k=1$ in the presence of intercept and trend. In Central Europe and the Baltics, gradual shifts or gradual breaks fail to support income convergence for all frequencies $k = 1, 2, 3$ but are observed only when accounting for intercept and trend. These findings suggest that all regions of Europe exhibit unit root characteristics, and panel stationary tests with smooth shifts indicate a trend toward income divergence within Europe. The results from these tests confirm the presence of non-stationarity.

The hypothesis that income convergence in Eastern Europe (including the Baltic States) is present at all frequencies is attributed to Eastern European countries being formerly structured as planned economies, as explained in Section 1. Conversely, all Western European countries originated from free market economies, which also shaped their income distribution. Furthermore, Western European countries employ various policies that exacerbate income inequality, such as the Double Irish Dutch Sandwich method, which exploits gaps in taxation systems.

The hypothesis of stationarity for the Central European and Scandinavian countries suggests that income convergence occurs only when intercept and trend are considered. This means that income convergence in these regions will only happen if specific policies are put in place. While these policies can cover a wide range of areas, this study will focus on foreign aid policy as it relates to income convergence. Some European countries excel in foreign aid, as seen in the “Commitment to Development Index” by the Center for Global Development. Countries like Sweden (1st place), Luxembourg (2nd place), Norway (3rd place), and Denmark (4th place) lead in development cooperation among wealthy nations in terms of foreign aid and support for poor countries (Center for Global Development 2023: 1-6).

Data from Eurostat on the impact of social transfers on poverty reduction shows that countries in Central Europe experience similar levels of poverty reduction when they receive foreign aid.

The concept of poverty is a crucial factor that should be emphasized among the determinants of income distribution. While income distribution is a broader concept, encompassing the allocation of resources across the entire population, there is a positive correlation between income inequality and poverty. The more unequal the distribution of income is, the higher the prevalence of poverty (Karabulut, 2006: 22).

Income distribution and poverty are not only directly related but also strongly interconnected with the economic and social policies implemented by governments. One of the primary objectives of economic policy is to promote economic growth. In line with this goal, achieving equitable income distribution and reducing poverty are also crucial objectives linked to economic growth. From the perspective of social policy, in addition to economic growth, social assistance programs represent a direct intervention approach to addressing income inequality and alleviating poverty. These programs provide support to disadvantaged individuals and households, aiming to improve their economic conditions. As a result of the economic and social policies adopted by countries to address income inequality, secondary income distribution is shaped through interventions that aim to make

the primary income distribution, which arises under market conditions, more equitable. Although the specific approaches may vary from country to country, social assistance is widely recognized as one of the most effective social policy instruments for achieving a more equitable income distribution (Özsoy, 2024: 358).

Given that social transfers are used as an important tool to ensure fairness in income distribution and reduce poverty, it is necessary to analyze the data on the impact of social transfers on poverty. For this purpose, Table 7 shows data on the impact of social transfers on poverty reduction in Europe in 2023.

Table 7: Impact of Social Transfers on Poverty Reduction (%)

Eastern Europe (Including the Baltic States)	
Bulgaria	27.72
Croatia	20.90
Greece	18.18
Lithuania	29.93
Latvia	23.47
Estonia	27.65
Romania	15.60
Western Europe	
Belgium	50.80
France	41.89
Italy	30.51
Luxembourg	27.41
Ireland	57.75
Netherlands	31.51
Spain	22.90
Portugal	19.81
Central Europe and Scandinavian Countries	
Denmark	51.44
Hungary	34.50
Czech R.	39.51
Austria	39.18
Poland	36.07
Norway	46.01
Germany	41.70
Slovenia	35.53
Slovakia	36.44
Finland	48.74
Sweden	36.86

Source: Eurostat, Impact of social transfers (excluding pensions) on poverty reduction by sex, <https://ec.europa.eu/eurostat/databrowser/view/TESPM050/bookmark/table?lang=en&bookmarkId=b001ae62-ce34-4b49-9741-28a3ef99477f>, (06.09.2024).

The data in Table 6 demonstrates that after receiving foreign aid, countries in Central Europe such as the Czech Republic, Hungary, Austria, Poland, Slovakia, and Slovenia, have experienced a poverty reduction rate of 34%–39%. Meanwhile, in the Scandinavian countries, Finland, Norway, and Denmark, this rate ranges from 46% to 52%. Even with aid to countries in Eastern Europe, there has been some decline in poverty levels. In Western Europe, similar to the results on income inequality, there is a significant disparity among countries in terms of poverty reduction post-aid. It can be concluded that aid to countries in Europe, particularly affluent nations like Sweden, Luxembourg, Norway, and Denmark, has the strongest stabilizing effect on Central European countries. This further underscores that income convergence in Central Europe and Scandinavian countries can only be achieved through the implementation of certain policies.

Conclusion (Re-written)

This study examines the convergence dynamics of GDP per capita across Eastern Europe, Western Europe, Central Europe, and the Baltics from 1990 to 2020, using a comparative stochastic convergence framework. Unlike previous research that focused on structural breaks, our analysis considers gradual changes. The results reveal that most regions are diverging, which contradicts the existing literature. Notably, convergence was only observed in Eastern Europe, while Western Europe showed signs of divergence. In Central Europe and the Baltics, convergence occurred only under specific policy conditions. These findings suggest that the hypothesis of conditional income convergence does not apply uniformly across European regions during this period, highlighting persistent regional economic inequalities. Our results align with some recent studies (Fiorelli et al., 2024; Batog and Batog, 2024) but differ from others (Chen and Hsu, 2024; Savoia, 2024).

In this study, a panel unit root test, specifically the Fourier KPSS test, was applied, and the results demonstrate the existence of stochastic income convergence across different regions of Europe, with a nonlinear smooth transition structure characterized by trigonometric terms. This indicates that shocks to GDP per capita have long-term persistence and that economies do not move together. Moreover, the presence of stochastic convergence, due to the nature of the Fourier KPSS test, also accounts for potential fluctuations or instability in a country's relative income, either above or below its expected level. Future studies could investigate absolute or conditional beta convergence analyses for these regions, even if they are not a prerequisite in this context.

In our exploration of political dynamics and income convergence across European regions, we utilized data from countries in Eastern, Western, Central, and Baltic Europe, based on the CIA's regional classification. We categorized these countries and analyzed their GNI, finding that all EU members were classified as high-income countries. In contrast, only three non-EU Eastern European nations—Bosnia-Herzegovina, Albania, and Serbia—were categorized as upper middle income. Notably, Bulgaria transitioned from upper middle income to high income within three years, illustrating the EU's influence on the economic status of member countries.

Our analysis of tax trends on capital in Eastern and Western Europe revealed similar tax-to-revenue ratios. However, significant convergence was observed in Western Europe, particularly in Belgium, the Netherlands, Ireland, and Luxembourg, due to tax avoidance strategies, such as the Double Irish Dutch Sandwich. These methods contribute to income inequality within the region. Central European and Baltic countries exhibited varying tax-

to-revenue ratios, with Hungary utilizing minimal tax exemptions to attract foreign investment, which may drive income divergence.

While the historical background of Eastern European countries in planned economies helps explain their income convergence, Western European nations, despite EU membership, often prioritize national interests, leading to divergence. The income convergence in Central European and Baltic countries depends on the implementation of specific policies, particularly in relation to the Nordic welfare model in the Baltic region.

Regional development policies are crucial for reducing disparities in Central and Eastern Europe, aiming to increase per capita income and foster regional equality. Effective social and economic policies at both the national and EU levels are essential for achieving inclusive growth. The EU's cohesion fund plays a key role in promoting territorial cohesion by supporting underdeveloped regions. However, income inequality persists due to inadequate taxation of capital, tax reductions for high-income groups, and excessive tax exemptions.

To address these disparities, implementing a progressive tax on capital may not be feasible across the EU; instead, a flat tax rate should be maintained alongside more targeted tax incentives. Harmonization of direct taxes and stronger tax audits are necessary to reduce income inequality. Additionally, increased social transfers to lower-income groups are vital for achieving a more equitable income distribution. Thus, Europe needs to align its tax legislation and expand social welfare programs to foster equitable growth.

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