



Course of

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Academic Year

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1. Introduction

NextGenerationEU (NGEU) is an instrument created by the European Union to support Member States in the economic recovery after the COVID-19 crisis and to build a more resilient and efficient Europe. The EU expects to raise €733 billion, which are divided under the Recovery and Resilience Facility (RRF) for a total of €650 billion, and several small instruments such as the Just Transition Fund, Horizon Europe, InvestEU, RescEU, and ReactEU accounting for €83.1 billion (those values refer to 2018 euros).

The RRF is composed of €359 billion in grants and €291 billion in loans; all funds have been requested by Member states by presenting a National Recovery and Resilience Plan (NRRP) outlining the reforms and investments they will implement by end-2026 with clear milestones and targets. Moreover, all measures have to follow the general goal of NGEU: to increase efficiency and resiliency and decrease external dependency. The RRF is divided into six pillars –green transition; digital transformation; smart, sustainable, and inclusive growth; social and territorial cohesion; health, economic, social, and institutional resiliency; policies for next generation–, each with specific policy areas of investments and indicators that measure the effectiveness of the funds.

The European Commission has not set many requirements for the allocation of funds; the only obligation is for countries to invest at least 37% of their budget in measures contributing to climate objectives and at least 20% of the expenditure on digital objectives. Note that those objectives do not represent the green transition and digital transformation pillars. Those percentages were calculated differently by measuring if an action contributes fully (100%), partly (40%), or has no impact (0%) to those objectives. Since many of the investments are affecting both objectives, their value can be misleading. For example, in Luxembourg, 80.05% of the funds were directed to climate objectives, and 37.50% were directed to digital objectives. It has invested less than 50% of the funds received in the green transition and digital transformation pillars combined.

1.1 Green Transition

The main goal here is achieving climate neutrality by 2050 and incentivizing sustainability throughout the Union. Overall, the Member States have requested €173,49 billion, which represents approximately 27% of the total funds, reflecting the ever-

increasing importance of sustainability and global warming in European policies. The funds were directed to improving energy efficiency, sustainable mobility, renewable energy, and R&D&I (research, development, and investment) in green activities.

1.2 Digital Transformation

This pillar aims to increase the connectivity of European citizens and streamline the bureaucracy through the digitalization of the governments. Surprisingly, this pillar is ranked 4th per the amount of money requested, registering only €82,44 billion or approximately 13% of the total RRF funds. It improves several areas, such as e-government, digital public services, digitalization of businesses, the roll-out of high-capacity networks, human capital in digitalization, and R&D in the IT sector.

1.3 Smart, Sustainable, and Inclusive Growth

This pillar has the objective to improve competitiveness, to enable a sustainable recovery, and to make the economy more resilient. This pillar has a staggering €186,26 billion investment, representing 28,64% of total funds, and is the sector most impacted by the RRF. This might be a consequence of the COVID-19 crisis, which has strained European small and medium enterprises (SMEs) in the past years, needing support from the government. As proof of this, the Member States have invested mainly in competitiveness, support to SMEs, building renovation and construction, R&D&I, business environment/entrepreneurship, industrialization and re-industrialization, and business infrastructure.

1.4 Social & Territorial Cohesion

The key point of this pillar is to promote cohesion by fighting poverty, the marginalization of disadvantaged groups, and the improvement of territorial and social infrastructure, ensuring everyone has the same support and opportunity to find a high-quality job. These pillar investments are very substantial, a total of €133,30 billion representing approximately 20,50% of the total funds. Those investments reflect the vulnerability of modern cities to extreme natural phenomena exacerbated by global warming, as well as the wide social differences across European countries.

1.5 Health and Economic, Social, and Institutional Resilience

The COVID-19 crisis highlighted the need for a stronger healthcare system throughout the Union. The clear goal of this pillar is to create a stronger and more resilient, accessible, sustainable, and digital healthcare system. The investment reflects this goal almost perfectly, adding only a focus on strategic autonomy and crisis preparedness. Nonetheless, the funds allocated for this sector are €45,81 billion, representing more than 7% of total funds.

1.6 Policies for the Next Generation

The young generation will become the backbone of future society, so a high-quality and higher-level education for young people is needed to ensure that Europe's competitiveness improves on a global scale. In fact, in this pillar, Member States have concentrated investments into improving accessibility, affordability, quality, and inclusiveness of education in general (comprehending all levels, from early childhood to PhDs) and into providing support to the employment of young people. This pillar is the smallest one in terms of investments, only €29.11 billion or almost 4,5% of total funds.

In this thesis, we will develop a comprehensive predictive framework to assess the short-term economic effects of investments under the RRF's Social & Territorial Cohesion pillar. Given the scale of these interventions, producing robust long-term impact projections is essential: the findings will inform future cohesion policy design, ensure efficient resource allocation, and ultimately contribute to building a more inclusive and resilient Europe.

1.7 List of Abbreviations

Abbreviation	Description
NGEU	Next Generation EU
RRF	Recovery and Resilience Facility
NRRP	National Recovery and Resilience Plan
STC	Social and Territorial Cohesion
GDP	Gross Domestic Product
GDPpc	Gross Domestic Product per capita
EU	European Union
EC	European Commission
OLD	Ordinary Least Squares
JRC	Joint Research Center
RHOMOLO	Regional Holistic Model
SES	SocioEconomic Status
GSMI	Global Social Mobility Index
EUSPI	EU Social Progress Index
WGI	Worldwide Governance Indicators
GSP	Global Social Progress Index
SME	Small and Medium Enterprises
SCF	Structural and Cohesion Fund

2. Literature Review

In recent years, several studies have been carried out on how investments in STC positively affect the economy and how a more cohesive society is fundamental for its sustainable growth. This chapter will discuss these papers in detail and provide a summary to explain their main points.

2.1 Social Capital

Social capital can be defined as the exploitable network of a person, as well as the social norms, values, and trust that facilitate collaboration inside or between social groups. According to **Chetty et al. (2022)**, in a study of 21 billion Facebook friendships, three dimensions measure social capital: economic connectedness, network cohesiveness, and civic engagement. The first is a key form of social capital that significantly influences upward income mobility. Research indicates that when low-SES (socioeconomic status) individuals have high-SES individuals in their social networks, their incomes can increase by up to 20%. This is primarily due to the transfer of knowledge, resources, and opportunities that come with access to higher-income networks and positively shape low-SES individuals' aspirations. The other forms of social capital, network cohesiveness and civic engagement, also contribute to economic outcomes by promoting trust and collaboration within communities, which can lead to higher investment, innovation, and economic resilience. A related study – **Chetty et al. (2022)** – breaks down economic connectedness into exposure to high-SES individuals and friending bias –i.e., the tendency to befriend high-SES individuals–. They identified two scenarios analyzing school cohorts:

- Low friending bias.
- High friending bias.

In both cases, it is possible to increase economic connectedness using different strategies. In the first scenario, the authors identified that an increase in high-SES exposure leads to greater economic connectedness. In the second scenario, exposure alone is insufficient: an increase in cross-SES interactions among existing members is much more effective in enhancing economic connectedness.

2.2 Inequality's Drag on Demand

A report by **Bivens and Banerjee (2022)** documents how rising income inequality has negative economic and fiscal consequences. They identified that in the timeframe between 1979 and 2018, the rise in income inequality in the US reduced aggregate demand growth by 1.5% of GDP. This happens because overall spending falls when income is transferred from lower-income to higher-income families. This is backed by data showing that the top 1% of wealthiest households received 16.4% of national income, which increased from 8.9% in 1979. The demand reduction is due to differences in saving and spending rates across families; the wealthiest tend to have a higher saving rate and, thus, a lower spending rate. For example, in 2018, the top 1% of families were saving 30.6% of income, more than 60 times as much as the bottom 5% of households, and an increase in the saving rate translates to less spending, thus a lower demand.

2.3 Heterogeneous Impacts of Investments

The European Cohesion Policy has diversified its investments across various sectors, potentially resulting in a heterogeneous impact on growth. A study by Scotti et al. (2022) analyzed the Structural and Cohesion Fund (SCF) investments in the NUTS-2 regions between 2007 and 2014. They found that sectors such as energy, human resources, R&D, and transportation tend to yield the highest returns and show the most persistent growth. These findings align with a reduction in production costs (such as cheaper energy and transportation), easier access to innovations and technological advancements, and more productive employees in general. The authors found that the effects were amplified when investments were less concentrated in a single sector, suggesting that diversification could facilitate a more effective local development path. Moreover, they recognized that investments also generate growth indirectly through cross-national spillovers, particularly in countries like Belgium, the Netherlands, and Slovakia. This is probably due to their importance in the European theater, their central geographical location, and the presence of important logistics hubs. To conclude, this study highlighted the critical importance of fund allocation to the economic outcomes of those investments.

Another study by **Crescenzi et al. (2016)** analyzed investments in the European Union. They focused their attention on the transport infrastructure – construction and maintenance of highway and secondary roads – measuring the influence of regional

quality of government on the regional economic performance. They identified a weak or insignificant correlation between economic growth and regional road investments alone. Interestingly, when they started considering the investments in conjunction with government quality, the correlation with economic growth became strong and highly significant. Those results show how a good investment, if not treated optimally, can yield low or even negative returns. This reduction in yield is probably linked to less effective use of the funds, which are employed to solve political and individual interests rather than economical and collective ones. Moreover, the analysis found that the maintenance of road infrastructure follows the same pattern: it shows only a weak correlation with economic performance on its own, but this correlation becomes significantly stronger when the quality of governance is considered. This study highlights the significant influence of local governments on investment outcomes. It emphasizes the need for the EU to oversee not only the allocation and timing of funds but also the completion of funded projects.

2.4 The Outcome of Social Cohesion Improvements

Other than the already discussed study by **Scotti et al. (2022)**, the scientific literature identifies the investments in social and territorial cohesion as positively impacting the country's economic performance. For example, **Maucorps et al. (2020)** analyzed the financial effects of EU social policy using structural equation modeling (SEM) on the 276 NUTS-2 regions in the period 2008-2016. They found a strong positive correlation between investments and economic growth, identifying both direct and indirect effects on the economy. Another example of a positive relationship between STC investments and economic growth is determined by the study of **Majeed (2016)**, which analyzed the Organization of Islamic Conference countries using a large number of social indices covering inequality, trust, terrorism, and conflict. Subsequently, the author did a panel regression between 1986 and 2010, showing that social cohesion significantly boosts growth by minimizing social conflicts and riots, and by attracting investment, lowering transaction costs, and enhancing institutional quality.

2.5 A European perspective

All discussions up to this point have focused on the scientific literature; however, it is equally important to consider the European Union's perspective, as such investments

would not have been approved without evidence of economic returns in their assessments. The European Commission, has developed with the Joint Research Center (JRC) an estimate of long-term economic growth of its Cohesion Policy by analyzing the investments and reforms from 2014 to 2027. The assessment was carried out with RHOMOLO, a dynamic general equilibrium model developed by the JRC, which estimated a growth for every euro invested of €1.3 by 2030 and of €3 by 2043.

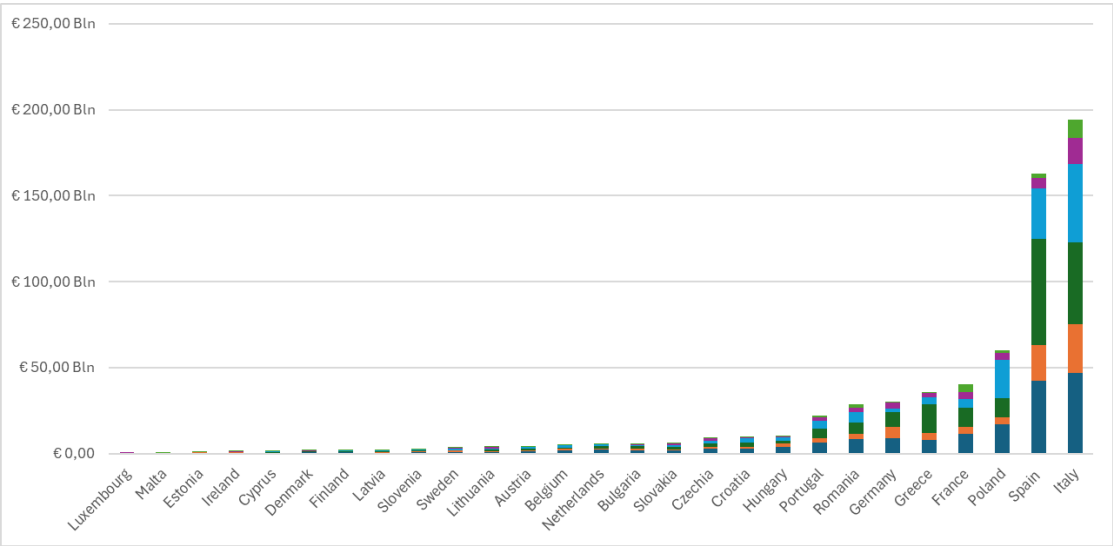
3. Data and methodology

3.1 Data

The data relative to the RRF funding was collected from the Recovery and Resilience Facility Scoreboard website, gathering the precise amount of funds allocated to each country and to which pillar they were directed. Instead, data relative to the Member States' economic performance was provided by the Eurostat database. Lastly, data about any indices was recovered from the entity's databases that calculated it.

Figure 1

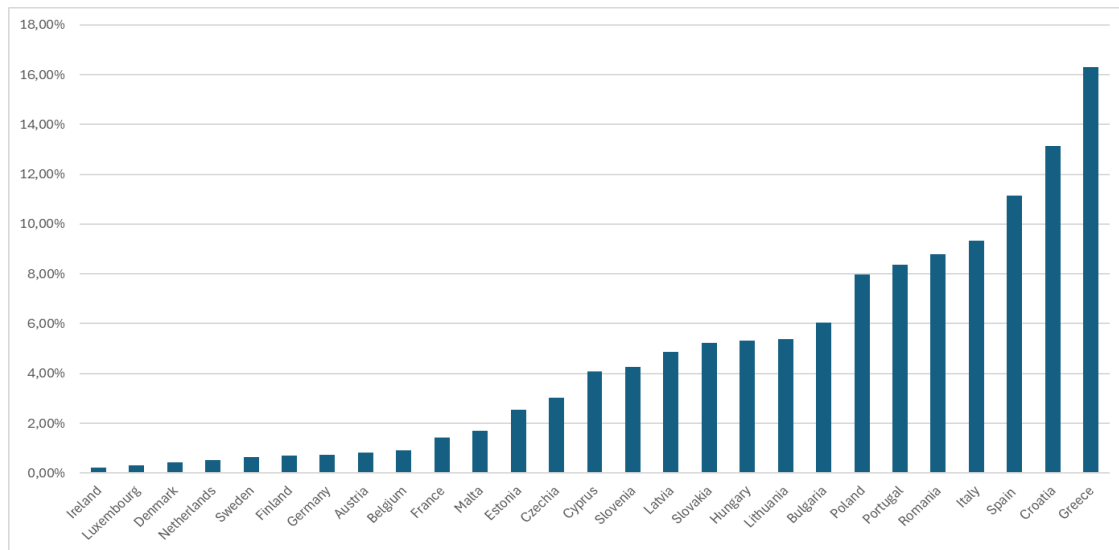
RRF funds allocation divided by pillar



Note. Each color represents a different pillar. Starting from the bottom, they represent the following: Green Transition; Digital Transformation; Smart, Sustainable, and Inclusive Growth; Social and Territorial Cohesion; Health and Economic, Social, and Institutional Resilience; Policies for the Next Generations. A detailed view, with exact numbers, is present in the Appendix—Table A1. Source. *Author's calculations based on data gathered from the RRF scoreboard website.*

Figure 2

RRF funds allocation as a percentage of each country's GDP in 2020



Note. A detailed view, with exact numbers, is present in the Appendix—Table A2. Source. *Author's calculations based on data gathered from the RRF scoreboard website.*

Figure 1 and Figure 2 represent the funds allocations approved by the European Commission. Figure 1 illustrates the RRF allocation per country divided into six segments representing the fund pillars, and Figure 2 represents the RRF funds as a percentage of each country's GDP in 2020.

Several insights can be understood by looking at those pictures. Notably, the worse a country's economic conditions, the greater the aid package it receives. The so-called PIGS countries –Portugal, Italy, Greece, and Spain– have received an important proportion of the RRF funds package; Italy and Spain received respectively €194.38 billion and €163.01 billion, the most significant volume across the Union, while Greece and Portugal got aids equal to 16.32% and 8.37% of their GDP respectively, ranking them on the top of Figure 2. Moreover, countries with the lowest real GDP per capita in 2020 –Bulgaria, Poland, Romania, and Croatia– rank at the top of both graphs, demonstrating their commitment to closing the gap with the top-performing economies in Europe. In contrast, smaller and/or wealthier countries such as Luxembourg, Ireland, the Netherlands, Denmark, and the other Nordic countries obtained the lowest amount of funds across the Union. Suggesting the strength and resiliency of their economies. Overall, this visual analysis reinforces the observation that the RRF has been used not only as a short-term

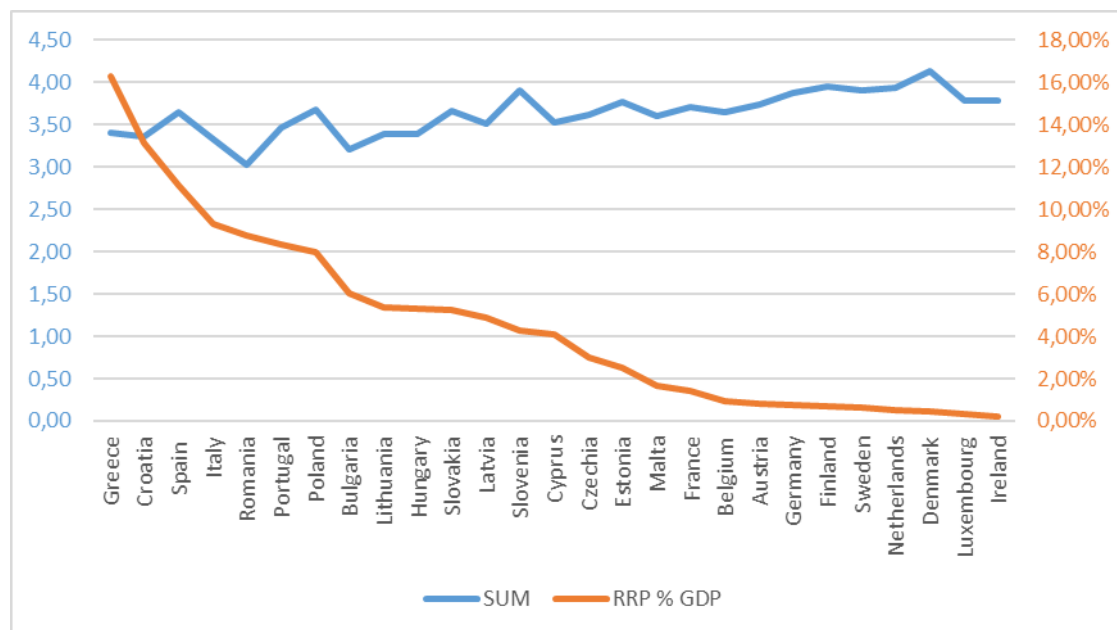
economic stimulus but also as a strategic tool for medium to long-term structural transformation, adapted to the specific socioeconomic contexts of each Member State.

To support this analysis, we gathered data from five indices that measure the level of STC. Note that all data refers to 2020, capturing the status of the European countries before the funds were allocated:

- Global Social Mobility Index (GSMI)
- EU Social Progress Index (EUSPI)
- Worldwide Governance Indicators (WGI)
- Global Social Progress Index (GSP)
- GINI Index

Figure 3

Relationship between indices values and requested funds by Member States



Note. ‘SUM’ represents the normalized sum of all indices. ‘RRP% GDP’ represents the funds allocated relative to their 2020 GDP. A detailed view, with exact numbers, is present in the Appendix—Table A3.

Source. *Author’s calculations.*

Most of the indices use a scale from 0 to 100. However, the WGI ranges from -2.5 to 2.5, and the GINI Index works on a reverse scale, where 100 indicates maximum inequality

and 0 indicates no inequality. To have a fair comparison, I normalized all data on a scale from 0 to 1 using the following formula:

$$\frac{INDEX_i - MIN}{MAX - MIN}$$

Where $INDEX_i$ represents the value associated with a country i , and MIN and MAX represent the minimum and maximum possible value for the index, respectively.

After the normalization, all values were summed for each country and compared with the relative share of the RRF fund to the country's GDP. Figure 3 represents the results. Although not immediately apparent in the graph, the two datasets have a negative correlation equal to -66.28%. Finally, we ran a linear regression to test the hypothesis that the more disadvantaged a country was in 2020, the greater the funds allocated by the European Union. Results are shown in Table 1.

Table 1

Linear regression on indices data.

	Dependent variable: FundShareGDP		
	Value	Standard error	p-value
Constant	0,458	0,093	0,000
SUM	-0,114	0,026	0,000
Observations: 27	R ² : 0,439		Adjusted R ² : 0,417

Note. FundShareGDP is the relative share of the RRF funds to the country's GDP. SUM is the normalized sum of the indices. Data of the indices are present in the appendix –Table A6. Source. *Author's calculations*.

3.2 Social and Territorial Cohesion Pillar Structure

A clear understanding of the allocation of RRF funds is essential. The following section provides a detailed analysis of the STC pillar, outlining the specific areas targeted for investment by the European Union. It is divided into seven categories, with the percentage of investments relative to the total pillar funds indicated in parentheses:

1. Territorial infrastructure and services (63%).
2. Social housing and other social infrastructure (8%).
3. (Non-youth) employment support and job creation, including hiring and job transition incentives and support for self-employment (7%).
4. Adult learning, including continuous vocational education and training: recognition and validation of skills (7%).

5. Social protection, including social services and integration of vulnerable groups (6%).
6. Development of rural and remote areas (e.g., islands) (6%).
7. Modernization of labor market institutions, including employment services and forecasting of skills and labor inspectorates; employment protection and organization; social dialogue and wage setting mechanisms; adaptation of workplaces (3%).

To simplify the explanation of the likely economic effects of the STC funds, the categories will be grouped as follows: infrastructure, covering the first and second categories; human capital, the third and fourth categories; and social programs, the remaining categories.

The infrastructure investments are the most prominent among this pillar, accounting for a total of 71% of STC funds. This signals that improvements such as better and more sustainable transportation for both people and goods, more efficient energy delivery, and increased protection against natural disasters are factors considered crucial for stimulating economic growth and reducing costs. For example, an improvement in the transport sector can lower logistics costs for businesses, and an improvement in the energy transmission sector can benefit both consumers and companies due to the increased regional energy efficiency.

The human capital area accounts for approximately 14% of the STC funds. As Mario Draghi's report (The Future of European Competitiveness, 2024) has already identified, the main European economic problem lies in productivity, which has been systematically lower than that of China and the US for several years. The human capital category addresses this issue by enhancing the general population's abilities, knowledge, and skills, boosting productivity, and promoting sustainable economic growth.

Lastly, there are the social programs, which account for approximately 15% of the funds. These investments try to address social inclusion, poverty reduction, and healthcare improvements, contributing to social cohesion and stability. By reducing inequalities, these measures will generate a positive economic outcome, as the middle class grows, demand and consumption will increase.

3.3 Methodology

The analysis will be based on the work of **Scotti et al. (2022)**, who found that investments diversified as much as RRF usually have different yields across sectors. The authors identified ten distinct sectors using OLS statistical analysis of the Structural and Cohesion Fund between 2007 and 2013. To estimate the impact on GDP, one or more of these sectoral coefficients will be assigned to the seven categories defined by the European Union. Of these, only six sectors correspond to the Social and Territorial Cohesion Pillar: the numbering below aligns with the order presented at the beginning of the 'Social and Territorial' paragraph 3.2.

1. IT Infrastructure, transportation, energy. Since it is challenging to accurately determine the portion of investments allocated to each of these sectors, the funds are assumed to be distributed equally among them. This methodological limitation will be addressed in detail in the limitations section of this study.
2. Social infrastructure
3. Human resources
4. Human resources
5. Social infrastructure
6. Rural development
7. Human resources

Table 2

Expenditure percentage of EU funds by sector

	EC Dataset	Author's estimates
Energy	6,69%	6,66%
Environment	16,44%	20,58%
Human Resources	0,45%	0,52%
IT Infrastructure	4,38%	5,84%
R&D	16,81%	13,06%
Rural Development	3,94%	6,25%
Social Infrastructure	8,42%	5,44%
Tourism	4,22%	6,37%
Transportation	38,65%	35,28%

Note. There is a discrepancy between the EC dataset and the author's estimates because the article is based on the reconstruction of the real data; in this thesis, the author's estimated values are used. Source. *Scotti et al. (2022)*.

Table 3

OLS regression model with White heteroskedasticity robust standard errors.

	Dependent variable:					
	GDPpc growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	−0,000 (0,046)	−0,000 (0,046)	−0,000 (0,044)	−0,378 (0,245)	−0,293 (0,255)	0,129 (0,282)
Initial GDPpc	−0,054*** (0,004)	−0,054*** (0,006)	−0,073*** (0,008)	−0,055*** (0,019)	−0,053** (0,025)	−0,114*** (0,037)
Energy	0,025 (0,087)	0,027 (0,090)	0,069 (0,092)	0,121 (0,101)	0,111 (0,099)	0,209** (0,091)
Environment	−0,145*** (0,052)	−0,137** (0,064)	−0,094 (0,059)	−0,084 (0,069)	−0,082 (0,086)	−0,098 (0,084)
Human Resources	0,162*** (0,069)	0,157** (0,070)	0,145** (0,069)	0,306*** (0,089)	0,292*** (0,090)	0,291*** (0,076)
IT Infrastructure	−0,020 (0,052)	−0,021 (0,053)	−0,006 (0,048)	0,053 (0,056)	0,054 (0,056)	0,040 (0,048)
R&D	0,107* (0,062)	0,102 (0,062)	0,116* (0,063)	0,125** (0,060)	0,097 (0,060)	0,124** (0,057)
Rural Development	−0,041 (0,087)	−0,037 (0,090)	−0,073 (0,081)	−0,004 (0,094)	0,017 (0,099)	0,012 (0,091)
Social Infrastructure	−0,027 (0,092)	−0,041 (0,096)	−0,069 (0,100)	−0,084 (0,105)	−0,067 (0,107)	−0,037 (0,105)
Tourism	−0,035 (0,063)	−0,030 (0,064)	−0,049 (0,061)	−0,196 (0,173)	−0,182 (0,175)	−0,187 (0,172)
Transport	0,165* (0,098)	0,172* (0,102)	0,205** (0,092)	0,193* (0,113)	0,208* (0,121)	0,180* (0,108)
SFC Concentration	−0,110* (0,065)	−0,115* (0,067)	−0,123* (0,066)	−0,137* (0,078)	−0,135* (0,077)	−0,142* (0,076)
Capital Formation		−0,038 (0,059)	−0,046 (0,053)		−0,047 (0,070)	−0,035 (0,065)
Population Growth		−0,012 (0,061)	−0,112* (0,061)		0,057 (0,085)	−0,022 (0,081)
Schooling		−0,003 (0,058)	0,083 (0,063)		0,111 (0,160)	0,078 (0,151)
Employment A			−0,183*** (0,065)			−0,327*** (0,077)
Employment B-E			−0,028 (0,060)			−0,106 (0,085)
Employment F			0,111** (0,050)			0,125** (0,057)
Employment G-J			−0,140* (0,072)			−0,214** (0,097)
Employment K-N			0,281*** (0,089)			0,427*** (0,135)
Observations	258	258	258	258	258	258
R ²	0,453	0,454	0,504	0,513	0,516	0,573
Adjusted R ²	0,428	0,423	0,464	0,431	0,427	0,482

Note. *p<0,1; **p<0,05; ***p<0,01. Columns 4–6 show the results introducing country-fixed effects and clustered standard errors at a national level. Standard errors are reported in parentheses. Source. *Scotti et al. (2022)*.

Table 2 and Table 3 summarize the information needed for the analysis. The OLS regression consists of two main models. The second model extends the first by incorporating country fixed effects and clustered standard errors at a national level. Each model is further divided into three regressions: the first includes only the sectoral investment variables identified by the authors; the second introduces additional controls - capital formation, population growth, and schooling; finally, the third further incorporates employment level. As the regression coefficients are derived from the investment amounts in each sector (Table 1), they must be adjusted to be compatible with the RRF allocation. This is done by dividing each coefficient by the original sectoral investment value and then multiplying the result by the RRF allocation for that sector. The adjusted estimates are presented in Table 4. For a more detailed view, Table A4 in the Appendix shows the per-euro investment effects in each sector. These values are subsequently used to forecast the expected increase in GDP.

Table 4

GDP per capita growth estimates adjusted for RRF investments

	Dependent variable:					
	GDPpc growth (EU)					
	(1)	(2)	(3)	(4)	(5)	(6)
Energy	0,028 (0,096)	0,030 (0,100)	0,076 (0,102)	0,134 (0,112)	0,123 (0,110)	0,231 (0,101)
Human Resources	1,858 (0,791)	1,800 (0,803)	1,663 (0,791)	3,509 (1,021)	3,349 (1,032)	3,337 (0,872)
IT Infrastructure	-0,025 (0,066)	-0,026 (0,067)	-0,008 (0,061)	0,067 (0,071)	0,068 (0,071)	0,050 (0,061)
Rural Development	-0,014 (0,029)	-0,012 (0,030)	-0,025 (0,027)	-0,001 (0,032)	0,006 (0,033)	0,004 (0,031)
Social Infrastructure	-0,024 (0,083)	-0,037 (0,087)	-0,062 (0,090)	-0,076 (0,095)	-0,060 (0,097)	-0,033 (0,095)
Transport	0,034 (0,020)	0,036 (0,021)	0,043 (0,019)	0,040 (0,024)	0,043 (0,025)	0,038 (0,023)
Sum	1,857 (1,086)	1,790 (1,107)	1,688 (1,090)	3,673 (1,353)	3,528 (1,367)	3,627 (1,181)

Note. Standard errors are reported in parentheses. The coefficients not used in this thesis are excluded from the table. All calculations made to the estimates are also applied to the standard errors. Source. *Author's calculations.*

Table 4 shows interesting results. Although the majority of funds are concentrated in the territorial infrastructure and services category, – accounting for 63% of the total allocations and distributed across the energy, IT infrastructure, and transport sectors – the

most significant estimated impact on GDP arises from investment in the human resources sector. This highlights the structural weakness of the European Economy in terms of productivity and labor skills.

4. Analysis

With all necessary information now available, proceeding with the GDP forecast is possible. The EU's GDP in 2024 was €17,944 trillion. Given the presence of two models, regressions three and six, selected for their higher R² values, are used to generate a range of estimates, providing both lower and upper bounds for the expected GDP increase. The first step in this process involves calculating the 95% confidence interval of those two estimates:

$$GDP\ growth_3 = \bar{x} \pm \frac{s}{\sqrt{n}} = 1,688 \pm \frac{1,090}{\sqrt{258}} = 1,688 \pm 0,133$$

$$GDP\ growth_6 = \bar{x} \pm \frac{s}{\sqrt{n}} = 3,627 \pm \frac{1,181}{\sqrt{258}} = 3,627 \pm 0,144$$

Starting with the low scenario, the GDP is forecasted to grow between 1,821% and 1,555%, translating to €326,68 billion and €278,95 billion, respectively. In the high scenario, the growth will be between 3,771% and 3,483%, or €676,68 billion and €625,00 billion.

These gains can also be expressed in short-term multipliers: the STC pillar accounts for approximately €133,3 billion, so those investments will yield between €2,09 and €5,08 for every euro invested in the short term. These short-term multipliers exceed the European Commission's long-term estimate of €1,3 of growth by 2030 and €3 by 2043. This suggests that one of the two approaches may overestimate or underestimate the actual effects. This issue will be discussed in the limitations chapter.

4.1 An Italian Perspective

It is also relevant to forecast the potential GDP growth for Italy, the biggest recipient of money in absolute terms. They received €45,46 billion for the Social and Territorial Cohesion pillar, and according to the official Italian NRRP website (Home—Italia Domani—Portale PNRR), it is possible to extrapolate that approximately €23,39 billion

is invested in infrastructure, €10,61 billion in human resources, and €11,47 billion in social programs.

The website does not categorize the investment into the six RRF pillars or the seven categories of STC; instead, it uses a different subdivision that makes a more detailed breakdown impossible. To ensure consistency, I will use the same coefficient, and category groupings will be applied in this case:

1. Infrastructure: IT Infrastructure, transportation, energy, and social infrastructure
2. Human resources: Human resources
3. Social programs: Social infrastructure, rural development, human resources

Following the same procedure as before, the relevant coefficients from Table 3 were adapted to the Italian investment levels, obtaining Table A5 in the appendix, then summed according to the structure above. The two final values – one for each regression – are the starting point to calculate the 95% confidence interval:

$$GDP\ growth_3 = \bar{x} \pm \frac{s}{\sqrt{n}} = 2,201 \pm \frac{1,162}{\sqrt{258}} = 2,201 \pm 0,142$$

$$GDP\ growth_6 = \bar{x} \pm \frac{s}{\sqrt{n}} = 4,511 \pm \frac{1,274}{\sqrt{258}} = 4,511 \pm 0,155$$

The low-growth forecast is in the range of €21,15 billion - €24,37 billion, while in the high scenario, the GDP growth will be between €45.95 billion and €49,47 billion. This is underwhelming because this growth is below the European average, generating an economic boost between €0,47 and €1,09 per euro invested. This is probably connected to the higher amounts of funds directed towards Italy, suggesting the existence of diminishing returns for this type of investment.

4.2 Limitations

This thesis acknowledges many limitations due to its intrinsic structure. The first limitation is related to the Scotti et al. study, because it is based on the investments of the Structural and Cohesion Fund between 2007 and 2013. The six-year time frame considered may be too short to yield statistically robust estimates (a concern that will be addressed later) and insufficiently recent to fully align with this thesis's objective. Moreover, they used an ordinary least squares (OLS) statistical analysis, which is a very

useful instrument for measuring trends but lacks the capability of understanding the complex behavior of the economic system. Both of these problems are resolved by the European Commission, by the employment of their RHOMOLO model and the use of a wider timeframe with up-to-date information. As stated before, they estimated an increase in GDP equal to 1.3€ per euro invested by 2030, which likely means that this analysis is overestimating the final economic effects, since it forecasts a minimum increase of 2,09€ per euro invested.

The second limitation is linked to the non-statistically significant coefficient. Table 3 shows that the energy, IT infrastructure, rural development, and social infrastructure sectors are totally or partially non-significant. This implies that the findings of this thesis need to be considered cautiously. However, this limitation is likely attributable primarily to the relatively short time frame covered by the underlying study.

The third limitation relates to policy overlaps. This is a significant concern, as many investments and infrastructure are not designed to address a single issue in isolation. Furthermore, the EU categorization differs from the one employed in the source study, making precise alignment between policy areas and estimated coefficients challenging. As a result, establishing a direct correspondence between the seven investment categories identified by the European Commission and the sectors defined by the reference paper is inherently challenging. It is likely that each category includes investments spanning multiple sectors beyond those assigned in the present study. Particular attention should be given to the category 'territorial infrastructure and services', for which it was assumed that funds are evenly distributed among the energy, IT infrastructure, and transport sectors. While this simplification does not fully reflect the complexity of the real-world allocations, obtaining more granular data in an aggregated and comparable format is currently not feasible. The EC, via the RRF website, provided detailed information about each individual investment per country, but does so without standardized categorization, making comprehensive aggregation and alignment impractical.

Lastly, the time horizon considered in this analysis represents an additional limitation. The coefficients reflect only the immediate effect of the investments, excluding the longer-term impacts, which are generally more stable and substantial. As a result, the

scope of this thesis is confined to short-term outcomes, potentially underrepresenting the full economic significance of the investments over time.

4.3 Recommendations and Conclusion

It is important to highlight that this thesis's many limitations stem from the limited availability of academic literature measuring the effects on GDP of social investment in Europe. Nonetheless, this analysis provides a quantifiable and comparative framework to assess the macroeconomic outcomes of cohesion policy investments, offering a foundation for policy evaluation and strategic planning within the EU recovery context.

Based on these findings, it is recommended that European institutions prioritize investments in human resources, given their high marginal returns, by allocating increased funding towards worker education, training, and employment services. Furthermore, fund allocations and periodic checks can be improved by measuring not only economic indicators and construction progress but also institutional quality metrics. Finally, this work aims to contribute a foundational perspective to encourage further research efforts and deepen understanding of how social and territorial cohesion investments can maximize societal benefit.

A. Appendix

Table A1

Summary of requested funds per country in billions of euros, divided by pillar

	(1)	(2)	(3)	(4)	(5)	(6)	Total
Austria	1,190	0,639	1,020	0,759	0,171	0,182	3,961
Belgium	1,837	0,800	0,765	1,262	0,262	0,373	5,298
Bulgaria	1,780	0,981	1,465	0,685	0,458	0,320	5,689
Croatia	2,957	0,948	2,506	2,213	0,536	0,882	10,041
Cyprus	0,344	0,149	0,399	0,138	0,115	0,074	1,220
Czechia	2,867	1,060	1,882	1,775	1,093	0,551	9,227
Denmark	0,520	0,174	0,703	0,129	0,087	0,013	1,626
Estonia	0,419	0,106	0,214	0,125	0,085	0,005	0,953
Finland	0,562	0,340	0,475	0,347	0,214	0,012	1,949
France	11,648	3,992	10,759	5,246	4,108	4,517	40,270
Germany	8,904	6,434	8,742	1,886	3,495	0,863	30,325
Greece	7,983	3,797	16,714	4,262	2,503	0,690	35,948
Hungary	3,960	1,826	1,352	2,033	0,686	0,572	10,430
Ireland	0,377	0,155	0,206	0,249	0,075	0,092	1,154
Italy	47,034	28,162	47,811	45,462	15,104	10,808	194,382
Latvia	0,416	0,268	0,422	0,505	0,239	0,119	1,969
Lithuania	0,770	0,413	1,145	0,554	0,785	0,200	3,867
Luxembourg	0,107	0,012	0,067	0,049	0,006	0,000	0,241
Malta	0,114	0,033	0,046	0,041	0,081	0,012	0,328
Netherlands	2,046	0,602	1,574	0,884	0,170	0,165	5,441
Poland	17,024	3,855	11,506	22,172	3,720	1,542	59,818
Portugal	6,391	2,521	5,741	4,286	1,835	1,441	22,216
Romania	8,432	2,923	6,626	6,211	2,534	1,782	28,508
Slovakia	1,759	0,653	1,458	0,809	1,182	0,547	6,408
Slovenia	0,897	0,290	0,367	0,627	0,341	0,163	2,685
Spain	42,134	20,756	62,004	29,494	5,691	2,934	163,014
Sweden	1,014	0,551	0,297	1,103	0,233	0,248	3,446

Note. (1) = green transition; (2) = digital transformation; (3) = smart, sustainable, and inclusive growth; (4) = social and territorial cohesion; (5) = health, economic, social, and institutional resiliency; (6) = policies for next generation. Source. *Author's calculations.*

Table A2

Summary of requested funds relative to 2020 GDP, divided per pillar

	(1)	(2)	(3)	(4)	(5)	(6)	Total
Austria	0,25%	0,13%	0,21%	0,16%	0,04%	0,04%	0,83%
Belgium	0,31%	0,14%	0,13%	0,22%	0,04%	0,06%	0,91%
Bulgaria	1,89%	1,04%	1,56%	0,73%	0,49%	0,34%	6,06%
Croatia	3,87%	1,24%	3,28%	2,89%	0,70%	1,15%	13,13%
Cyprus	1,15%	0,50%	1,34%	0,46%	0,39%	0,25%	4,09%
Czechia	0,94%	0,35%	0,61%	0,58%	0,36%	0,18%	3,02%
Denmark	0,14%	0,05%	0,19%	0,03%	0,02%	0,00%	0,44%
Estonia	1,11%	0,28%	0,57%	0,33%	0,22%	0,01%	2,53%
Finland	0,20%	0,12%	0,17%	0,12%	0,08%	0,00%	0,70%
France	0,42%	0,14%	0,38%	0,19%	0,15%	0,16%	1,44%
Germany	0,22%	0,16%	0,21%	0,05%	0,08%	0,02%	0,74%
Greece	3,62%	1,72%	7,59%	1,93%	1,14%	0,31%	16,32%
Hungary	2,02%	0,93%	0,69%	1,04%	0,35%	0,29%	5,31%
Ireland	0,07%	0,03%	0,04%	0,05%	0,01%	0,02%	0,23%
Italy	2,26%	1,35%	2,29%	2,18%	0,72%	0,52%	9,32%
Latvia	1,03%	0,66%	1,04%	1,25%	0,59%	0,30%	4,88%
Lithuania	1,07%	0,57%	1,59%	0,77%	1,09%	0,28%	5,37%
Luxembourg	0,13%	0,02%	0,08%	0,06%	0,01%	0,00%	0,30%
Malta	0,59%	0,17%	0,24%	0,21%	0,42%	0,06%	1,69%
Netherlands	0,20%	0,06%	0,15%	0,09%	0,02%	0,02%	0,53%
Poland	2,27%	0,51%	1,53%	2,95%	0,50%	0,21%	7,97%
Portugal	2,41%	0,95%	2,16%	1,61%	0,69%	0,54%	8,37%
Romania	2,60%	0,90%	2,04%	1,91%	0,78%	0,55%	8,78%
Slovakia	1,43%	0,53%	1,19%	0,66%	0,96%	0,45%	5,22%
Slovenia	1,42%	0,46%	0,58%	0,99%	0,54%	0,26%	4,26%
Spain	2,88%	1,42%	4,24%	2,02%	0,39%	0,20%	11,15%
Sweden	0,18%	0,10%	0,05%	0,20%	0,04%	0,05%	0,63%

Note. (1) = green transition; (2) = digital transformation; (3) = smart, sustainable, and inclusive growth; (4) = social and territorial cohesion; (5) = health, economic, social, and institutional resiliency; (6) = policies for next generation. Source. *Author's calculations*.

Table A3

Relationship between indices values and requested funds

	SUM	RRP % GDP
Austria	3,75	0,83%
Belgium	3,65	0,91%
Bulgaria	3,22	6,06%
Croatia	3,36	13,13%
Cyprus	3,52	4,09%
Czechia	3,61	3,02%
Denmark	4,13	0,44%
Estonia	3,77	2,53%
Finland	3,96	0,70%
France	3,72	1,44%
Germany	3,87	0,74%
Greece	3,41	16,32%
Hungary	3,40	5,31%
Ireland	3,78	0,23%
Italy	3,33	9,32%
Latvia	3,51	4,88%
Lithuania	3,38	5,37%
Luxembourg	3,79	0,30%
Malta	3,60	1,69%
Netherlands	3,93	0,53%
Poland	3,68	7,97%
Portugal	3,47	8,37%
Romania	3,02	8,78%
Slovakia	3,67	5,22%
Slovenia	3,91	4,26%
Spain	3,65	11,15%
Sweden	3,90	0,63%

Note. ‘SUM’ represents the normalized sum of all indices. ‘RRP% GDP’ represents the funds allocated relative to their 2020 GDP. Source. *Author’s calculations*.

Table A4

GDP per capita growth for every euro invested

	Dependent variable:					
	GDPpc growth					
	(1)	(2)	(3)	(4)	(5)	(6)
Energy	0,00099 (0,00344)	0,00107 (0,00356)	0,00273 (0,00364)	0,00478 (0,00399)	0,00439 (0,00391)	0,00826 (0,00360)
Human Resources	0,08198 (0,03492)	0,07945 (0,03543)	0,07338 (0,03492)	0,15486 (0,04504)	0,14777 (0,04555)	0,14727 (0,03846)
IT Infrastructure	-0,00090 (0,00234)	-0,00095 (0,00239)	-0,00027 (0,00216)	0,00239 (0,00252)	0,00243 (0,00252)	0,00180 (0,00216)
Rural Development	-0,00173 (0,00366)	-0,00156 (0,00379)	-0,00307 (0,00341)	-0,00017 (0,00396)	0,00072 (0,00417)	0,00051 (0,00383)
Social Infrastructure	-0,00131 (0,00445)	-0,00198 (0,00464)	-0,00334 (0,00484)	-0,00406 (0,00508)	-0,00324 (0,00518)	-0,00179 (0,00508)
Transport	0,00123 (0,00073)	0,00128 (0,00076)	0,00153 (0,00069)	0,00144 (0,00084)	0,00155 (0,00090)	0,00134 (0,00081)

Note. Standard errors are reported in parentheses. The coefficients not used in this thesis are excluded from the table. All calculations made to the estimates are also applied to the standard errors.
Source. *Author's calculations.*

Table A5

GDP per capita growth for estimated, adjusted for the Italian RRF investments

	Dependent variable:					
	GDPpc growth (Italy)					
	(1)	(2)	(3)	(4)	(5)	(6)
Energy	0,006 (0,020)	0,006 (0,021)	0,016 (0,021)	0,028 (0,023)	0,026 (0,023)	0,048 (0,021)
Human Resources	1,183 (0,504)	1,147 (0,511)	1,059 (0,504)	2,235 (0,650)	2,132 (0,657)	2,125 (0,555)
IT Infrastructure	-0,005 (0,014)	-0,006 (0,014)	-0,002 (0,013)	0,014 (0,015)	0,014 (0,015)	0,011 (0,013)
Rural Development	-0,007 (0,014)	-0,006 (0,014)	-0,012 (0,013)	-0,001 (0,015)	0,003 (0,016)	0,002 (0,015)
Social Infrastructure	-0,013 (0,043)	-0,019 (0,045)	-0,032 (0,047)	-0,039 (0,049)	-0,031 (0,050)	-0,017 (0,049)
Transport	0,007 (0,004)	0,008 (0,004)	0,009 (0,004)	0,008 (0,005)	0,009 (0,005)	0,008 (0,005)

Note. Standard errors are reported in parentheses. The coefficients not used in this thesis are excluded from the table. All calculations made to the estimates are also applied to the standard errors.
Source. *Author's calculations.*

Table A6

Indices data, normalized

	WEF	EUSPI	WGI	GSPI	GINI	SUM
Austria	0,80	0,74	0,61	0,89	0,70	3,75
Belgium	0,80	0,69	0,55	0,87	0,74	3,65
Bulgaria	0,64	0,50	0,73	0,75	0,60	3,22
Croatia	0,67	0,57	0,63	0,79	0,70	3,36
Cyprus	0,69	0,62	0,71	0,82	0,68	3,52
Czechia	0,75	0,68	0,60	0,84	0,74	3,61
Denmark	0,85	0,82	0,82	0,92	0,73	4,13
Estonia	0,74	0,71	0,77	0,85	0,70	3,77
Finland	0,84	0,83	0,65	0,91	0,73	3,96
France	0,77	0,72	0,68	0,85	0,70	3,72
Germany	0,79	0,72	0,82	0,87	0,68	3,87
Greece	0,60	0,57	0,78	0,80	0,66	3,41
Hungary	0,66	0,58	0,69	0,77	0,70	3,40
Ireland	0,75	0,75	0,69	0,88	0,71	3,78
Italy	0,67	0,59	0,58	0,83	0,65	3,33
Latvia	0,69	0,63	0,75	0,80	0,64	3,51
Lithuania	0,71	0,65	0,58	0,81	0,64	3,38
Luxembourg	0,80	0,75	0,70	0,88	0,67	3,79
Malta	0,75	0,67	0,67	0,83	0,69	3,60
Netherlands	0,82	0,79	0,68	0,89	0,74	3,93
Poland	0,69	0,62	0,85	0,81	0,72	3,68
Portugal	0,72	0,66	0,59	0,85	0,65	3,47
Romania	0,63	0,48	0,52	0,74	0,65	3,02
Slovakia	0,69	0,60	0,84	0,80	0,76	3,67
Slovenia	0,76	0,69	0,84	0,86	0,76	3,91
Spain	0,70	0,67	0,78	0,85	0,65	3,65
Sweden	0,84	0,82	0,63	0,91	0,71	3,90

Note. All values are normalized on a scale from 0 to 1, where 0 represents the lowest level of social cohesion and 1 the maximum. All values are calculated from the 2020 values. Source. *Author's calculations.*

Table A7

Indices data, raw

	WEF	EUSPI	WGI	GSPI	GINI	SUM
Austria	80,1	74	0,57	88,85	29,8	80,1
Belgium	80,1	69	0,24	86,75	26	80,1
Bulgaria	63,8	50,1	1,17	74,90	40,5	63,8
Croatia	66,7	56,7	0,65	79,22	29,5	66,7
Cyprus	69,4	61,9	1,03	82,08	31,7	69,4
Czechia	74,7	68,3	0,50	84,28	26,2	74,7
Denmark	85,2	81,7	1,62	91,54	27,5	85,2
Estonia	73,5	71,3	1,37	85,36	30,7	73,5
Finland	83,6	82,8	0,77	91,30	27,1	83,6
France	76,7	72	0,92	85,14	30,7	76,7
Germany	78,8	71,6	1,60	87,46	32,4	78,8
Greece	59,8	56,5	1,42	79,80	33,6	59,8
Hungary	65,8	58	0,94	76,99	29,7	65,8
Ireland	75	75,3	0,96	87,92	29,2	75
Italy	67,4	59,2	0,40	83,27	35,2	67,4
Latvia	69	63	1,27	79,61	35,7	69
Lithuania	70,5	64,7	0,39	81,34	36	70,5
Luxembourg	79,8	74,6	0,99	88,22	33,4	79,8
Malta	75	67,2	0,83	82,50	31,4	75
Netherlands	82,4	79	0,91	89,31	26	82,4
Poland	69,1	61,8	1,76	80,61	28,5	69,1
Portugal	72	65,8	0,47	84,97	34,7	72
Romania	63,1	47,9	0,08	74,41	34,6	63,1
Slovakia	68,5	59,5	1,68	79,61	24,2	68,5
Slovenia	76,4	68,7	1,68	86,27	24	76,4
Spain	70	67	1,38	85,45	34,9	70
Sweden	83,5	82,4	0,64	90,51	28,9	83,5

Note. All values refer to 2020. Source. *Databases of the entity that developed each index.*

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