Open Economies Review
https://doi.org/10.1007/s11079-025-09801-z

ORIGINAL RESEARCH

Do European Cohesion Policies Mitigate the Impact of Fiscal Consolidation on Regional Income Inequality?

Luca Agnello[1] · **Pietro Pizzuto**[1]

Accepted: 13 March 2025

Abstract
In this paper we investigate the role of EU Structural and Investment Funds in affecting the dynamic impact of regional fiscal consolidation on regional income inequality. Relying on a panel of 162 NUTS-2 regions of twelve European countries, we find that regional spending cuts increase regional inequality in the medium-term, with the effects surviving to a large battery of robustness checks. The uneven distributional impact of regional austerity measures is however cushioned by larger EU funds expenditures, especially through the European Regional Development Fund (ERDF), with the effect magnified during periods of recession and when the regional quality of government is higher.

Keywords Fiscal consolidations · Regional inequality · Cohesion policy · EU structural and investment funds

JEL Classification E62 · R11 · R12

1 Introduction

Following the global financial crisis of 2008–2009, many governments in developed countries adopted large fiscal stimuli plans with the ultimate goal of boosting economic activity. However, expansionary fiscal measures and tax revenues shrinkage caused a sharp increase of public deficits and debt that raised concerns about long-term fiscal sustainability. In order to bring the public debt back to a sustainable path,

✉ Pietro Pizzuto
pietro.pizzuto02@unipa.it

Luca Agnello
luca.agnello01@unipa.it

[1] Department of Economics, Business and Statistics (SEAS), University of Palermo, Palermo, Italy

Published online: 26 March 2025

many fiscal authorities decided to exit from fiscal stimuli and engaged in budgetary consolidation packages.

The implementation of such measures and the widening of disparities entailed by the financial crisis become crucial for renewing a long-standing debate among economists about the impact of fiscal consolidation on income level and income distribution.

There is a consensual view that fiscal consolidation affects interpersonal income inequality. By reducing output and employment in the short-term, fiscal austerity generally leads to a decline in wages of lower-income and unskilled groups of workers (see e.g. Jenkins et al. 2011 and Mukoyama and Sahin 2006) thereby increasing wage inequality. Such negative effects on market income distribution are magnified during recessions (e.g. Jordà and Taylor 2013) and when the level of unemployment is already high (Blanchard and Leigh 2013). In addition, the composition of the fiscal austerity packages matters to explain the impact of the implemented consolidation measures on interpersonal income distribution. For instance, Agnello and Sousa (2014), Woo et al., (2013) and Ball et al. (2013) find that austerity packages are regressive and that their effects on income inequality are exacerbated when consolidation plans are driven by spending cuts.

In OECD countries, the financial turmoil of 2008–09 also impacted on the public finances of many subnational governments (SNGs).[1] SNGs experiencing large fiscal unbalances lost their reputation as good borrowers and were perceived as less creditworthy by the financial market participants. As a consequence, SNG bond yields dramatically increased making more difficult to access financing at sustainable interest rates. Because of the deep integration of the economic and financial space, the deterioration of SNG borrowing conditions also contributed to threat the fiscal credibility of national governments.[2]

Thus, after benefiting from the large stimuli programs implemented by Central Governments (CGs) with the objective to counter-act the effects of the global financial crisis,[3] SNGs were involved in the national consolidation programs (Vammalle and Hulbert 2013).[4]

In order to ensure fiscal discipline at subnational levels, many CGs significantly cut their discretionary transfers to SNGs and, depending on the level of legal or

[1] With the term SNGs we refer to all levels of government below the central government level (i.e. includes both regional, state and local governments).

[2] See e.g. Agnello et al. (2018) for an assessment of the key economic, financial and political drivers of sovereigns borrowing ability.

[3] In particular, CGs tried to stimulate SNGs investment by reducing regulations, relaxing fiscal rules and debt limits (Vammalle and Hulbert 2013).

[4] As highlighted in OECD/Korea Institute of Public Finance (2012a), in most of countries, SNGs account for a large share of public expenditures (including public investment). For example, if we look at the OECD countries in 2010, SNGs represent (on average) 15% of public debt, 13% of public deficits and 30% of public spending. They also account for around 65% of public investment. These figures support the consensual view that a successful fiscal consolidation plan requires a strong commitment of both CGs and SNGs to achieve more sustainable levels of deficit and debt.

de facto autonomy of SNGs, they also set and/or required budget constraints (e.g. imposing deficit targets, spending limits and cuts).[5]

SNGs with some degree of tax autonomy tried to meet the CG-imposed fiscal targets by increasing (*autonomous*) revenues[6] while SNGs with less fiscal space needed to adjust their budgets by cutting public investments.

From an historical perspective, the size, composition and duration of austerity plans varied considerably across European and non-European countries.[7]At the same time, the geographic patterns of incomes across EU countries suggest a certain degree of spatial clustering in income distribution which translates into regional disparities.

This has recently revived the interest in understanding the impact of fiscal consolidation measures on regional economic outcomes and regional income inequality.

Although the literature on this topic is still scant, results of few empirical studies conducted at subnational level and based on NUTS-2 data, indicate that fiscal consolidation programs contribute to widen regional income gap and that spending cuts (such as wage bill, social transfers, and welfare payments) are more likely to hit the low-income regions (e.g. Agnello et al. 2016; Gabriel et al. 2023).

Interestingly, this empirical evidence at EU regional level brings new questions into the scene: How does the budgetary consolidation measures implemented to meet the fiscal targets under the Stability Growth Pact, combine with the European policy efforts to achieve regional cohesion? More specifically, does the EU cohesion policies (CPs) help to mitigate the impact of regional spending cuts on regional income inequality? If any, is the counteracting effect of European CPs on regional inequality state-dependent?

In our paper, we try to address these questions by contributing to the existing literature in several directions.

First, we use a novel approach to identify regional fiscal expenditure shocks by taking into account the link between national and regional fiscal adjustments. Specifically, we identify regional spending shocks by combining regional sensitivities to changes in national government expenditures with the national austerity episodes as narratively identified by Alesina et al. (2020). Then, we estimate the dynamic impact of such shocks on regional income inequality via local projections (Jordà 2005).

Second, within a nonlinear framework (e.g. Auerbach and Gorodnichenko 2012; Ramey and Zubairy 2018) we test whether the impact of regional spending-driven fiscal adjustments on regional income inequality depends on local authorities' expenditures of European Structural and Investment Funds (SFs) such as the

[5] Transfers represent a large share of SNG revenues. Chapter three of OECD (2012b) provides information on the fiscal measures taken by national government of OECD countries to reach their consolidation objectives and that affected SNGs finances.

[6] For example, as documented in OECD (2012b), Spanish autonomous communities and local governments increased in 2010 some taxes (e.g. taxes on property transactions, tax of real estate property, tax on registration of new vehicles, boats and planes).

[7] Interestingly, Agnello et al., (2013) show that characteristics of both spending-driven and tax-driven consolidation plans are mostly determined by the fiscal stance and national economic environment and that both type of programs are of shorter duration in EU than for Non-EU countries.

European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF) and the European Agricultural Fund for Regional Development (EAFRD).

Third, we check for the existence of additional state dependencies via a three-way interaction method. In particular, we test whether the combined impact (*interactive effect*) of expenditure of SFs and regional fiscal consolidation on regional income inequality depends on the state of the regional business cycle (downturns vs. expansions) and the quality of regional institutions (high vs. low quality of regional institutions).

Relying on a panel of 162 NUTS-2 regions of twelve EU countries, our main results can be summarized as follows. Regional fiscal consolidation leads to a rise in regional income inequality. In particular, Impulse Response Functions (IRFs) based on Local Projections (LPs) suggest that a 1% increase in the size of regional spending cuts leads to an average increase of the regional disparities by 0.25 Gini point over the horizon of 3–4 years. This effect is economically relevant since it roughly corresponds to one-third standard deviation of the change in Gini in our sample. However, such damaging effects are significantly reduced (almost halved) when EU SFs expenditures (especially through ERDF) are larger. In addition, we find that the effectiveness of EU SFs in reducing the impact of fiscal consolidations on income disparities is magnified during recession periods and when the quality of regional institutions is very high.

The main policy implication uncovered by our findings is that regional policy authorities can compensate regions that suffers from large adverse income distributional effects of consolidation by (significantly) increasing their relative share of EU SFs expenditure. By contrast, a low level of SFs expenditure in time of fiscal consolidation could make vain the European policy efforts to reduce income gaps existing between regions.

The plan of the paper is as follows. Section 2 reviews the literature. Section 3 presents the data. Section 4 describes the econometric methodology. Section 5 discusses the empirical findings. Finally, Section 6 concludes.

2 Review of the Literature

Our study touches upon two strands of the literature. The first one is still largely unexplored, and it focuses on the impact of fiscal consolidations on interpersonal and regional income inequality. In this respect, we provide a contribution to the large set of studies developed to investigate the trends and causes of regional income inequalities (see e.g. Capello and Cerisola 2024 and reference therein). The second one is devoted to assess the effectiveness of CPs in promoting growth and regional convergence.

So far, only few studies have investigated the distributional effects of fiscal consolidation programs. The existing empirical evidence at national (NUTS-0) level supports the view that fiscal austerity significantly affects income distribution. Using a panel of eighteen industrialized countries over the period 1978–2009, Agnello and Sousa (2014) find that interpersonal income inequality significantly rises during

periods of fiscal consolidation. Moreover, such effects depend on the size (as percentage of GDP) of the consolidation plan and are magnified when austerity packages are driven by spending cuts rather than tax hikes. Similarly, Woo et al. (2013) show that spending-based consolidations are regressive thereby contributing to increase interpersonal income gap and that progressive taxation and targeted social benefits and subsidies can help to offset some of the adverse distributional impact of consolidation. Ball et al. (2013) examine the impact on short- and long-term effects of fiscal consolidation measures and find that their implementation leads to a prolonged increase in inequality, decline in wage income and increases in long-term unemployment.

For a long time, an assessment of the relationship between national fiscal consolidation and inequality at subnational level (NUTS-2 or NUTS-3 levels) has been largely neglected, though it is well recognized that macroeconomic policies implemented at the national level may have asymmetric effects on local economies (see Mazzola and Pizzuto 2020 for a broad review). Only recently, few papers have investigated the effect of national fiscal consolidation on regional income inequality. Using annual data at the regional NUTS-2 level for thirteen European countries over the period 1980–2008, Agnello et al. (2016) find that fiscal consolidation episodes increase regional income disparities, particularly when fiscal programs are more severe and implemented through spending cuts. More recently, Gabriel et al. (2023) find that fiscal consolidation leads to a significant fall in regional output, private investment, employment and wages. In addition, cuts in government spending lowers the income share of working households thereby increasing disparities and ending up in increasing distrust in the political environment. Consistently with the abovementioned empirical evidence, Furceri et al. (2022) find that expansionary national fiscal policies and higher intergovernmental transfers contribute to reduce regional disparities in the aftermath of economic downturns.

The literature focusing on the effectiveness of EU CPs and their impact on regional economic growth and territorial disparities is very broad and it has not produced clear-cut results so far. Some studies support the view that EU SFs have a positive and significant impact on regional growth and convergence (e.g. Pinho et al. 2015; Cappelen et al. 2003; Ramajo et al. 2008; Becker et al. 2010) even though such effects have been found heterogeneous across european regions (Cerqua and Pellegrini 2018; Crescenzi and Giua 2016; Vedrine and Le Gallo (2021); Amendolagine et al. 2024).

Others are more skeptical about the ability of cohesion policies to promote territorial cohesion. A number of works show that the impact of EU SFs on regional growth is very weak (Le Gallo et al. 2011; Llussá and Lopes (2011); or even not significant (Dall'Erba and Le Gallo 2008). Some authors conclude that EU SFs negatively impact on regional growth (e.g. Fagerberg and Verspagen 1996).

In addition, another stream of the literature also considers various types of nationally financed funds along with the EU SFs, to jointly assess their impact on regional growth and the performance of local governments thereby contributing to the policy debate on the importance of coordination between European Union Cohesion Policies and domestic regional policies to boost regional economic performance (see

e.g. Coppola et al. 2020; Psycharis et al. 2020 and Caldas et al. 2018 for evidence from Italy, Greece and Portugal, respectively).

Interestingly, a variety of contextual and national factors have been found crucial to explain the heterogenous impact of SFs. Rodríguez-Pose and Fratesi (2004), for example, argue that the ineffectiveness of SFs to reduce regional disparities can be ascribed to: i) the increasing concentration of economic activity in the EU's core economies; (ii) the limited amount of EU funds to be used; iii) the distortionary effects of national policies designed to protect certain strategic companies; and iv) a general orientation towards short-term goals (on this point see also Mazzola and Gambina 2024). Barbero et al. (2023) and Rodríguez-Pose and Garcilazo (2015) find that CPs are more effective when the quality of regional institutions and governance is high. Di Caro and Fratesi (2022) find that heterogeneous effects of CPs are also related to the level of national development and regional human capital endowment. Other factors that influence the effectiveness of EU CPs include the industrial (Cappelen et al. 2003; Percoco 2017) and settlement (Gagliardi & Percoco 2017) structures, the territorial capital (Fratesi and Perucca 2014, 2019) and the potential trade-off between productivity improvement and job creation at regional level (Bourdin et al 2024).

Also the intensity of CPs treatments and the typology of EU SFs matters. For example, Cerqua and Pellegrini (2018) and Fiaschi et al. (2018) show that the amount of SFs distributed to regions play a role in determining the effectiveness of cohesion policies while Rodríguez-Pose and Fratesi (2004) find that only investments in education and human capital have a positive effect over regional growth. Recently, Canova and Pappa (2025) found the ERDF being effective in the short-term, while the ESF having positive and economically important effects only in the medium-term.

Finally, some scholars argue that evidence concerning the effectiveness of SFs is not conclusive due to differences in: i) the time horizon of the analysis and the sample used (Puigcerver-Peñalver 2007); ii) the model specification (Ederveen et al. 2003).

In the current work, we bring together both these two apparently unrelated strands of the literature to empirically assess whether the distributional consequences of fiscal austerity measures on regional income inequality are mitigated by the EU SFs. Our analysis sheds lights on how the objective of fiscal discipline combines with the one of regional convergence and therefore it ultimately contributes to the long-standing debate on whether member states' policies compete with, or alternatively, complement EU CPs and if they result into regional convergence or increasing divide.

3 Data

We have collected data over the last three decades for 162 NUTS-2 regions of twelve European countries: Austria, Belgium, Germany, Denmark, Spain, Finland, France, United Kingdom, Ireland, Italy, Portugal and Sweden (Table 6 reports the full list).

Table 1 Descriptive statistics

Variable	N	Mean	SD	Min	Max
Gini index	5386	9.45	7.02	0.02	45.30
Coefficient of variation	5386	20.62	15.24	0.06	97.14
Theil index	5386	2.51	4.10	0.00	39.68
% change in regional spending ($G_{i,t}$)	5386	−1.91	3.71	−55.61	25.27
Instrument ($S_{i,t}$)	5386	0.41	0.73	−0.33	6.28
Change in Total EU funds expenditures	3727	20.24	68.32	−290.41	608.77
Regional GDP growth	5227	1.89	3.28	−20.08	61.93
European quality of government index (EQI)	5386	0.56	0.70	−1.97	1.76

Using the Annual Regional Database of the European Commission Directorate General for Regional and Urban Policy (ARDECO) containing time-series indicators for EU sub-state regions, we construct regional income inequality indicators (our dependent variable, $y_{i,t}$) using popular measures such as the Gini index, the coefficient of variation, and Theil index. They are computed at NUTS-2 level using NUTS-3 data, so that we measure within regions income inequality. Table 1 provides some descriptive statistics on such inequality measures.

Given that regional government spending series are not available at the European regional level, following Brueckner et al. (2023) and Canova and Pappa (2025), and in the spirit of Gabriel et al. (2023), we use the per-capita GVA of the non-market sector series as a *proxy* for regional government spending ($G_{i,t}$).[8] Then, we identify exogenous regional spending shocks using the method proposed by Gabriel et al. (2023). As further discussed in Sect. 4, it accounts for a "pass-through" transmission mechanism by which austerity measures implemented by national governments translates into shifts of regional government spending.[9]

To perform state-dependency analysis we use data on European Structural Funds (SFs) gathered from the DG regional policy database maintained by the EU commission. We have considered the modelled regionalized annual EU expenditure for four typologies of EU funds: European Regional Development Fund (ERDF), the European Social Fund (ESF), the Cohesion Fund (CF) and the European Agricultural Fund for Regional Development (EAFRD).

[8] GVA series are retrieved from ARDECO. As mentioned in Brueckner et al. (2023) it exists a close link between government spending and the GVA of the non-market sector at the national level, that is the reason why we extend the same line of reasoning at the regional level. As shown in the robustness checks, results are robust to the inclusion of intermediate consumption as in Gabriel et al. (2023). We remark that we will refer to our regional proxy for government spending as government spending throughout the paper.

[9] The basic assumption, supported by the experience of many SNGs, as highlighted in Sect. 1, is that regional authorities react to lower transfers from central governments by increasing local taxes and reducing spending (see e.g. Vammalle and Hulbert 2013; Obstfeld and Peri 1998; Marattin et al. 2022 and reference therein).

The ERDF is designed to strengthen economic, social and territorial cohesion in the European Union, with the aim to correcting imbalances between regions, enabling investments especially in infrastructure and services of low-income regions. The ESF, instead, aims at enhancing employment and fairer life opportunities for all. It aims at helping people to get a job (or a better job) through investing in their skills. Differently from the ERDF and ESF, the CF is targeted to countries (instead of regions) having less than a fixed percent of the EU average GNI (75% until 2014). Its main goals relate to the reduction of economic and social disparities and the promotion of sustainable development. Finally, EAFRD consists of measures useful to improve the competitiveness of agriculture, encourage sustainable management of natural resources, and achieve a balanced territorial development of rural economies and communities.

The unbalanced database we build, covers almost four programming periods starting from 1989 until the last available year in the data set (2014) that depends on data availability of our measure of national fiscal consolidation (Alesina et al. 2020), which is carefully explained in the next section.

4 Methodological Approach

Our modelling strategy consists of two steps. First, we estimate, within a linear framework, the unconditional dynamic effects of regional spending-driven fiscal adjustments on regional income inequality. Then, we use a non-linear model and two- and three-way interaction approaches to evaluate the interactive effects of SFs expenditure and regional fiscal consolidation on income distribution and check whether their combined impact also depends on different regimes.

4.1 Linear Model

To estimate the dynamic effects of regional spending-driven fiscal adjustments on regional income inequality ($y_{i,t}$), we use the local projection method pioneered by Jordà (2005). Specifically, we estimate, for each horizon k (with $k=0,.....m$) the following equation:

$$y_{i,t+k} = \alpha_i^k + \gamma_t^k + \beta^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}} + \theta^k X_{i,t} + \varepsilon_{i,t}^k \tag{1}$$

where $\left(G_{i,t} - G_{i,t-1}\right)/G_{i,t-1}$ is the growth rate of government spending in region i. $X_{i,t}$ is a vector of controls including two lags of the dependent variable and of the expenditure shock. To keep the baseline parsimonious, we do not include other controls, while we show in the next section, how our results are robust to the inclusion of additional variables potentially affecting regional inequality. α_i^k and γ_t^k are the regions and time fixed effects, respectively. Estimates of the parameter β^k directly yield the unconditional response, at horizon k, of regional income inequality to a change in the impulse variable (regional spending shocks) by one percent.

In order to account for the linkage between regional spending cuts and national fiscal consolidation programs and arrive at the identification of regional spending-driven fiscal adjustment shocks, we follow Gabriel et al. (2023) and we instrument $\left(G_{i,t} - G_{i,t-1}\right)/G_{i,t-1}$ using a Bartik-type instrument (Bartik 1991) by combining regional sensitivities to changes in national government expenditures with the national consolidation episodes as identified by Alesina et al. (2020).[10] This instrument $S_{i,t}$ is computed as follows:

$$S_{i,t} = \widetilde{g}_{I,t} \times \frac{\overline{G_i}}{\overline{G_I}} \tag{2}$$

where $\widetilde{g}_{I,t}$ denotes fiscal consolidation shock at time t in country I and it is computed as the sum of the unexpected adjustments that occur in year t ($g^u_{I,t}$) and the past announced adjustments also implemented in year t ($g^a_{I,t-1,t}$):

$$\widetilde{g}_{I,t} = g^u_{I,t} + g^a_{I,t-1,t} \tag{3}$$

$(\overline{G_i}/\overline{G_I})$ is the ratio between the average of per capita government spending in region i ($\overline{G_i}$) and the average of per capita government spending in country I ($\overline{G_I}$). It measures the regional spending sensitivities to national fiscal consolidation shock. Roughly speaking, by interacting $(\overline{G_i}/\overline{G_I})$ with $\widetilde{g}_{I,t}$ we assume that regions that rely more heavily on public spending cut back expenditures more strongly when the national government implements austerity measures.

Using this approach, we identify regional spending-driven fiscal adjustment shocks from 1980 to 2014. Impulse Response Functions (IRFs) over the time horizon k are obtained using the estimated coefficients β^k and the confidence intervals are computed based on the estimated standard errors (clustered at the regional level) of the same coefficients.

4.2 Nonlinear Model

Following Auerbach and Gorodnichenko (2013), we estimate a smooth transition (ST) model to evaluate the role of EU SFs expenditures in shaping the response of regional income inequality to regional spending cuts. In particular, using again the local projection method, we compute IRFs over the horizon k (with $k=0,\ldots..m$) to estimate the dynamic response of income inequality in the scenarios of low (L) and

[10] We remark that although cyclical adjusted primary balance (CAPB) is a benchmark to assess fiscal policy stance, it should be regarded as an inaccurate measure of discretionary policies. In fact, the construction of CAPB is subject to several methodological shortcomings (see e.g. Larch and Turrini 2009 and Agnello and Cimadomo 2012). In particular, the main limitation is the high degree of uncertainty surrounding the cyclical-adjustment procedure and related to: a) the choice of the statistical smoothing technique used to extract the cyclical component from the unadjusted budget balance; b) the strong assumption (not supported by the empirical evidence) of constant elasticities of budget balance items with respect to output. By contrast, discretionary changes in fiscal policy identified using a variety of narrative sources as originally proposed by Romer and Romer (2007) and also suggested by Alesina et al. (2020) reflect better the discretionary stance of fiscal policy.

high (H) EU SFs expenditure changes. The local projection smooth transition model specification is written as:

$$y_{i,t+k} = \alpha_i^k + \gamma_t^k + F(z_{i,t})[\beta_L^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}}] + (1 - F(z_i))[\beta_H^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}}] + \theta^k X_{i,t} + \varepsilon_{i,t}^k \tag{4}$$

where $F(z_{it}) = \frac{exp^{-\gamma z_i}}{(1+exp^{-\gamma z_i})}$ is the so-called smooth transition function, z is an indicator which accounts for the EU CPs policy stance and it normalized to have zero mean and unit variance; γ is the smoothing parameter, set to γ=1 to provide an intermediate degree of intensity to the regime switching. We exploit both within and cross-country variation in the normalization, that is we use $z_{it} = \frac{s_{it} - \bar{s}}{sd(s_{it})}$.

We use the interaction terms $[S_{i,t} * F(z_{i,t})]$ and $[S_{i,t} * (1 - F(z_{i,t}))]$, where $S_{i,t}$ is defined as in Eq. (2), as instruments of the variable $(G_{i,t} - G_{i,t-1})/G_{i,t-1}$ interacted with the two state indicators (i.e. low and high EU SFs expenditure changes, respectively).

According to our model specification, the estimated parameters β_L^k and β_H^k now yield the impact at horizon k of a regional spending-driven fiscal adjustment shock on regional income inequality in the scenario of low (L) and high (H) EU SFs expenditure changes, respectively.[11]

Finally, in the spirit of Ramey and Zubairy (2018) and Colombo et al. (2024), we extend the specification (4) to investigate whether the combined effects of cohesion policy expenditures and regional spending cuts on regional disparities depend on: i) regional business cycle regimes (recessions vs. expansions) and ii) levels of institutional quality (high vs. low quality). Thus, we estimate the following model:

$$\begin{aligned} y_{i,t+k} = \alpha_i^k + \gamma_t^k + D_{i,t}\{\left[F(z_i)\beta_{lL}^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}}\right] + \left[(1 - F(z_i))\beta_{lH}^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}}\right]\} \\ +(1 - D_{i,t})\{[F(z_i)\beta_{hL}^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}}] + [(1 - F(z_i))\beta_{hH}^k \frac{G_{i,t} - G_{i,t-1}}{G_{i,t-1}}]\} + \theta^k X_{i,t} + \varepsilon_{i,t}^k \end{aligned} \tag{5}$$

where $D_{i,t}$=1, if regional GDP growth < 0, and $D_{i,t}$=0 otherwise, or alternatively, $D_{i,t}$=1, if the average regional Quality of Government (as measured by the European Quality of Government Index–EQI) for region *i,* is below the sample median, and D_i=0 otherwise.[12]

[11] Formally, the scenario of low Cohesion Fund expenditure implies that $F(z_{it}) \approx 1$ and z goes to minus infinity while the scenario of high Cohesion Fund expenditure implies that $(1 - F(z_{it})) \approx 1$ and z goes to plus infinity.

[12] The European Quality of Government Index (EQI) captures average citizens' perceptions and experiences with corruption, quality, and impartiality in their region of residence. It is available for a broad sample of regions belonging to EU countries. To reduce missing data issues, we take the average value across the available releases.

5 Results

5.1 Baseline

Figure 1 shows the estimated dynamic response of regional inequality (measured using the Gini index) to consolidation- driven regional spending shock over a five-year window, together with the 90 and 68 percent confidence intervals around the point estimate. One-percent reduction in regional spending increases regional inequality in the medium-term, with a peak effect of about 0.25 point three years after the shock. The effects are strongly statistically significant, and not negligible in terms of magnitude. Specifically, a one-percent reduction in regional spending increases regional inequality by approximately 1/3 standard deviation (roughly corresponding to 0.70) of its yearly change in the sample.

Table 2 reports the associated estimation results and the F-statistics, for instrument strength, of the first stage, which suggest that the instrument is "strong". Specifically, the Kleibergen−Paap rk Wald F statistics—which are equivalent to the F-effective statistics for non-homoskedastic error in case of one endogenous variable and one instrument (Andrews et al. 2019)—are well above the associated Stock-Yogo critical value.

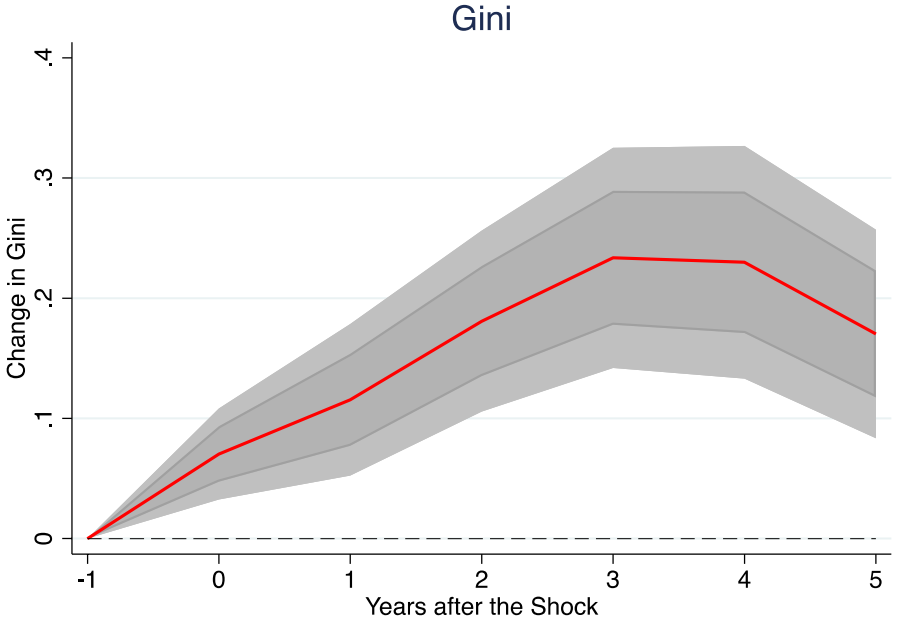


Fig. 1 The impact of fiscal consolidations on regional inequality– baseline. Notes: The graph shows the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (k) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1)

Table 2 The impact of fiscal consolidations on regional inequality– baseline

	k = 0	k = 1	k = 2	k = 3	k = 4	k = 5
$\%\Delta G_{i,t}$	0.070***	0.115***	0.181***	0.234***	0.230***	0.170***
	(0.023)	(0.038)	(0.046)	(0.056)	(0.059)	(0.053)
$\%\Delta G_{i,t-1}$	−0.010**	−0.009*	−0.013*	−0.015*	−0.010	0.001
	(0.004)	(0.005)	(0.007)	(0.008)	(0.008)	(0.009)
$\%\Delta G_{i,t-2}$	0.003	0.004	0.003	0.008	0.014	0.015
	(0.003)	(0.006)	(0.007)	(0.007)	(0.009)	(0.010)
$Gini_{i,t-1}$	0.917***	0.881***	0.841***	0.791***	0.768***	0.698***
	(0.026)	(0.039)	(0.054)	(0.063)	(0.061)	(0.065)
$Gini_{i,t-2}$	−0.000	−0.046	−0.082*	−0.106*	−0.161***	−0.181***
	(0.022)	(0.032)	(0.045)	(0.055)	(0.055)	(0.063)
Observations	5,062	4,900	4,738	4,576	4,414	4,252
R-squared	0.853	0.699	0.514	0.320	0.215	0.208
Kleibergen-Paap_rk_Wald_F_statistic	108.3	123.4	134.6	115.5	118.5	106.9

k = 0 is the year of the shock. *k* indicates the years after the shock. Estimates based on Eq. (1). Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regional and time effects included but not reported

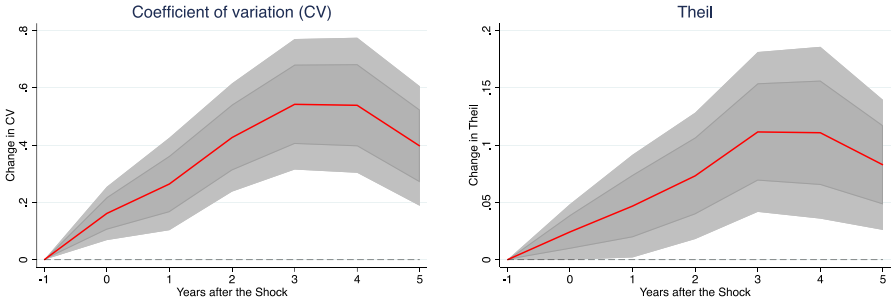


Fig. 2 Robustness checks – alternative measures of inequality. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (*k*) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1)

Taking the effects presented in Fig. 1 at the face value and translating it to major consolidation episodes (corresponding to a reduction in regional government spending at the 99th percentile of the distribution in our sample—that is around 9%), it implies an increase in regional inequality of about 2.25 Gini points—that is roughly proxied by what happened, for example, in Inner London (East and West) in early 2000s, where an average reduction of regional spending of about 20% led to an increase in regional inequality of about 2.80 Gini points.

We carry out several robustness checks to test the validity of the baseline findings. First, we check the sensitivity of our results to alternative measures of

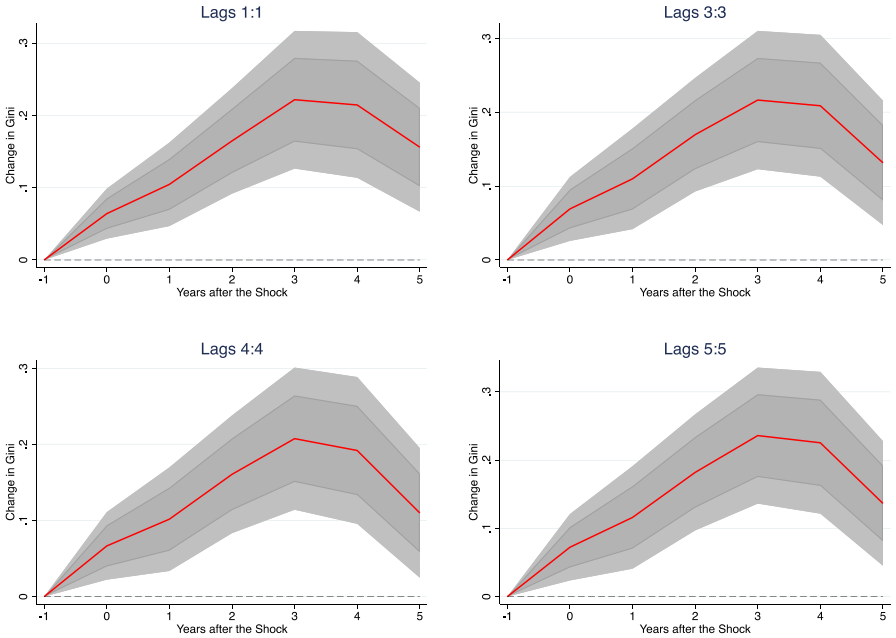


Fig. 3 Robustness checks – alternative lag structures. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (*k*) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1) using alternative lag structures

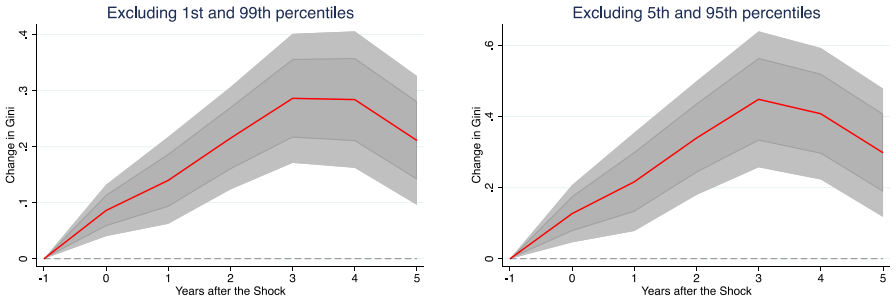


Fig. 4 Robustness checks – excluding outliers in regional spending. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (*k*) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1) excluding extreme values below the 1st (5th) and above the 99th (95th) percentiles of the distribution of the change in regional expenditures

inequality, namely the coefficient of variation and the Theil index. The results in Fig. 2 confirm our main findings suggesting that regional fiscal consolidations increase regional inequality, with results that are quantitatively similar across inequality measures.

Second, we examine whether our baseline results are driven by the lag structure or the presence of outliers. Figures 3 and 4 show that these are not the cases: regardless of the number of the lags for the policy shock and for the dependent variable or the exclusion of outliers (i.e., excluding extreme values below the 1st (5th) and above the 99th (95th) percentiles of the distribution of the change in regional expenditures) the results are very similar and broadly unchanged with respect to the baseline.

Third, we check whether the results are driven by alternative fixed effects specifications. Figure 5 shows that the results obtained are similar and not statistically different across alternative specifications such as those obtained including: (i) only regional fixed effects; (ii) regional-specific time trends; (iii) regional-specific time trends in addition to time fixed effects.

Fourth, we check whether the results are driven by any particular country, and we re-estimate Eq. (1) by alternatively dropping one country at a time. The

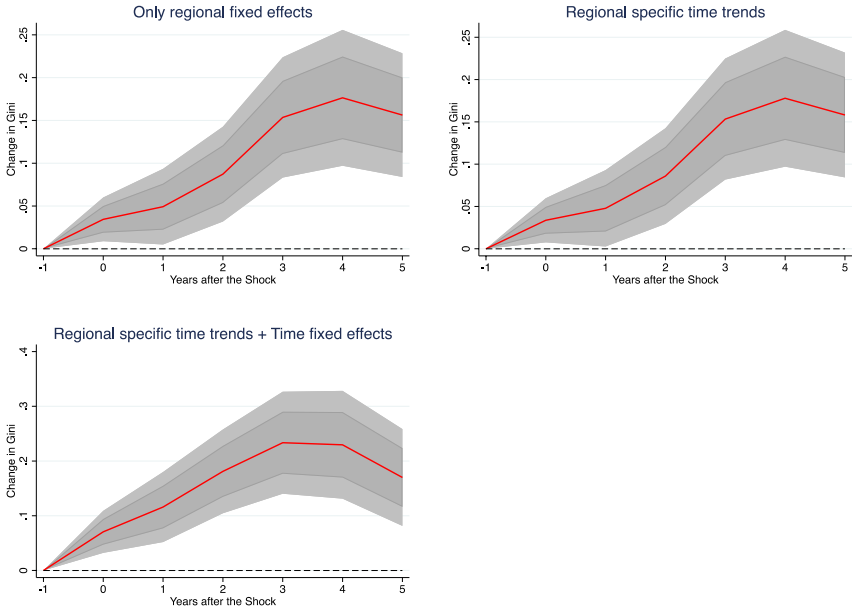


Fig. 5 Robustness checks – alternative fixed effects' structures. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (k) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1) adopting alternative fixed effects' structures

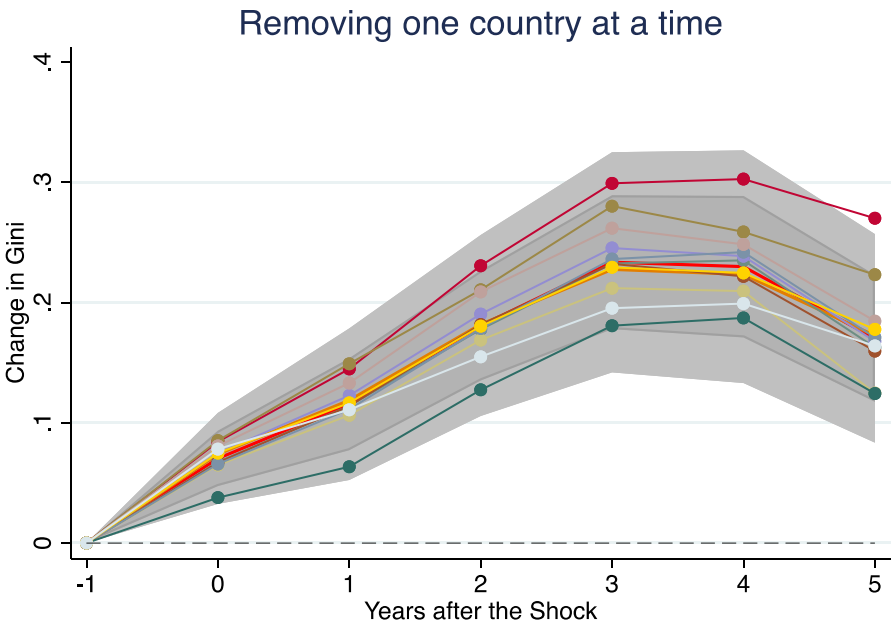


Fig. 6 Robustness checks – removing one country at a time. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (k) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1) removing one country at a time

results in Fig. 6 show that the corresponding IRFs are similar to the baseline and fall well-inside the baseline confidence bands when excluding one country at a time.[13]

Fifth, following Gabriel et al. (2023), we include also intermediate consumption in our regional government expenditure proxy, whose exclusion can bias our main findings.[14] Reassuringly, the impulse response functions resulting from this exercise do not point to different results with respect to the baseline (Fig. 7).

Finally, in order to mitigate omitted variable bias, we included several controls that could be related to regional expenditures and affect regional inequality—such as GDP per capita, employment rate and degree of urbanization (population to area ratio)—with data taken from ARDECO and Eurostat databases. We estimated Eq. (1) including all the controls at the same time. The results presented in Fig. 8 are very close to those in Fig. 1, thus confirming our baseline findings.

[13] Results (available upon request from the authors) are very similar and broadly unchanged also when re-estimating the model for subsets of countries (i.e. Southern European or peripheral countries).

[14] Data are available for eight out to twelve countries in our sample: Austria, Finland, France, Germany, Italy, Portugal, Spain, Sweden.

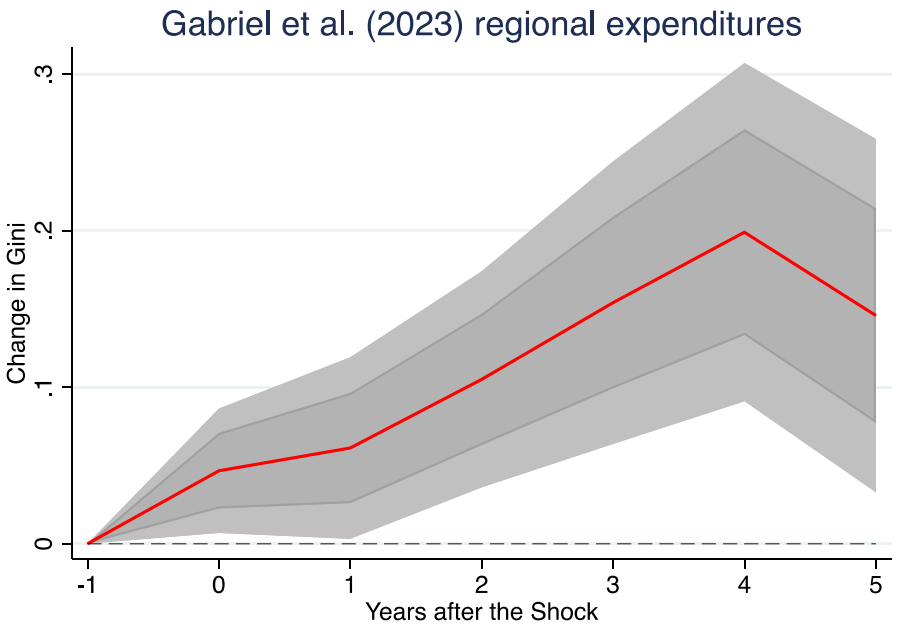


Fig. 7 Robustness checks – Gabriel et al. (2023) regional expenditures. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (k) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1) using Gabriel et al. (2023) regional expenditure measure (that includes intermediate consumption, but is available for only eight countries: AUT, FIN, FRA, DEU, ITA, PRT, ESP, SWE)

5.2 The Role of European Structural and Investment Funds

The average response of regional inequality to fiscal consolidation episodes may mask significant heterogeneity across policy support directed to regions through the European Structural and Investment Funds (SFs). Indeed, as broadly discussed in the introduction, EU funds, may help mitigating the impact of economic and policy shocks on regional income inequality, such as consolidation-driven regional spending cuts. To test for this hypothesis, we estimate Eq. (4) using the percent change in total EU SFs expenditures as a regime variable.[15] Figure 9 (top panel) and Table 3 show the results for this exercise and suggests that a larger amount of spending in EU SFs (approximately an increase of 90% with respect to the previous period) is associated with a lower increase in regional inequality (approximately halved with respect to the baseline effect). In contrast, the average effect is almost double than the baseline, when fiscal consolidations happen in periods with smaller amount of

[15] Total Structural Funds expenditures include ERDF, CF, ESF and EAFRD.

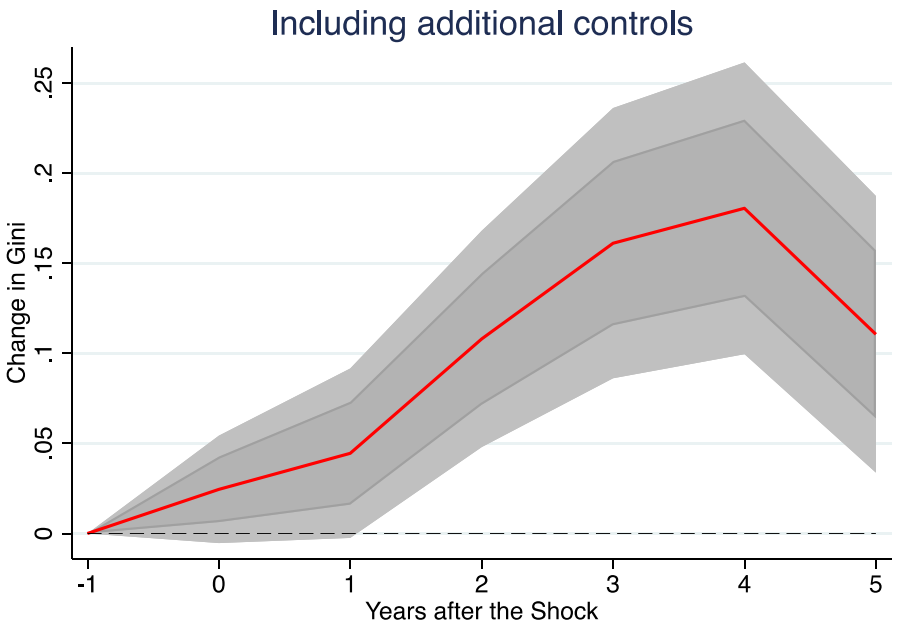


Fig. 8 Robustness checks – additional controls. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded area. Impulse response functions are estimated using a sample of 162 EU regions over the period 1980–2014. The x-axis shows years (*k*) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (1) including additional control variables at the regional level: GDP per capita, employment rate, degree of urbanization (population/area)

spending in EU SFs (i.e. when it is observed an average reduction of 40%).[16] Interestingly, the effects seem driven by the ERDF expenditures. When re-estimating Eq. (4), alternatively, for changes in ERDF expenditures, and changes in all the other funds considered in this paper (CF, ESF and EARFD), the results suggest a prevailing effect of the ERDF with respect to the other funds whose effects do not significantly differ across regimes and are less precisely estimated (Fig. 9 middle and bottom panels).

This finding is in line with previous literature highlighting the key role of ERDF in promoting social cohesion (Fratesi 2016). Indeed, ERDF is the most relevant EU fund in term of allocated resources and its expenditures are explicitly targeted to strengthen economic, social and territorial cohesion in the European Union aiming at investing in the infrastructure and services of low-income regions to attract investments, boost productivity, create employment and increase compensations.

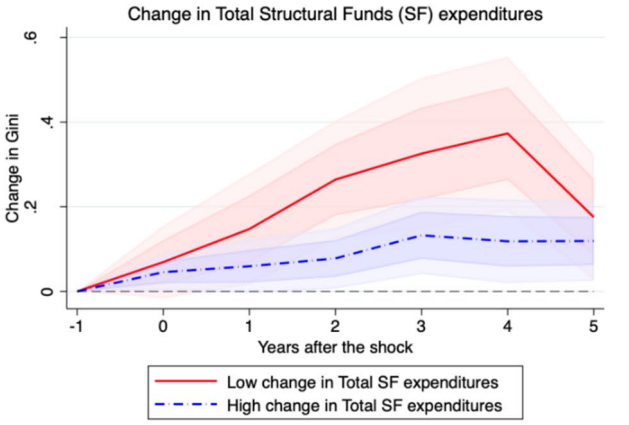
[16] The large numbers are not surprising since as noted by previous literature (see for example Schwab 2024), the absorption rate of EU funds expenditures is low and declining from one programming cycle to the next. In several cases the expenditures are mostly conducted in latest years of the cycle (thus generating large percentage changes). The least developed regions tend to exhibit the lowest absorption rates of cohesion funds, especially due to deficits in the quality of governance and institutional capacity.

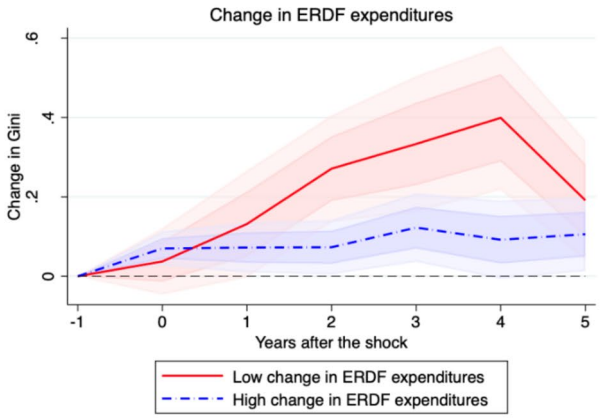
Fig. 9 The impact of fiscal consolidations on regional inequality: the role of structural funds. Notes: ▶ The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded areas. Impulse response functions are estimated using a sample of 162 EU regions over the period 1989–2014. The x-axis shows years (k) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (4) using the percent change in, alternatively, Total Structural Funds expenditures (including ERDF, CF, ESF EAFRD); only ERDF; Other Funds (including, CF, ESF EAFRD)

The results are also consistent with Canova and Pappa (2025) who highlight the different role of ERDF and ESF expenditures on economic outcomes at the regional level. While ERDF is found to have positive short-term impact on several economic variables, making it potentially useful for countercyclical purposes, ESF impact is often insignificant in the short-term, but it displays positive average effects on all regional variables considered in the medium-term, suggesting that it could be a good instrument to achieve medium-term transformation objectives. Moreover, our findings are also in line with another result by Canova and Pappa (2025), who suggest regions in the central portion of the income distribution as the most advantaged (especially in terms of income and employment multipliers) from EU SFs, with regions at the fourth quartile benefitting the less. However, our conclusions differ from Canova and Pappa (2025) interpretation of the role of EU SFs. While they suggest that "their asymmetric effects may lead to an increase in polarization and regional inequality" when looking at quartiles of the regional income distribution, in our framework (and using measures that look at the entire distribution) it is evident how EU Funds (especially ERDF) are beneficial for regional inequality since they help to mitigate the impact of consolidation-driven regional spending cuts on regional income inequality.

Further, we investigate whether the cushioning effects of SFs expenditures on regional inequality in the aftermath of fiscal consolidation episodes varies with the states of the economy. Indeed, existing literature at the national and regional level has highlighted that fiscal multipliers are typically larger during busts than booms (see among the others, Auerbach and Gorodnichenko 2011; Coppola et al. 2024), and this in turn may affect the evolution of regional inequality. To test for this hypothesis we estimate Eq. (5), where $D_{i,t} = 1$, if regional GDP growth < 0, and $D_{\mathrm{i,t}} = 0$ otherwise. The results of this exercise presented in Fig. 10 and Table 4, suggest that the cushioning effect of EU SFs expenditures on regional inequality following fiscal consolidations is magnified during downturn periods. Indeed, while point estimates in both cases (busts and booms) suggest that lower spendings in EU SFs are associated with a larger increase in regional inequality, the magnitude of the differential effect is so far greater in recessions than in expansions.

Finally, we check for the potential role of the quality of regional institutions in mediating the effectiveness of EU SFs. It is broadly recognized that cohesion policy works differently in very different local economic and social contexts (Crescenzi and Giua 2020), with particular attention on the ability (and quality) of regional and national policy makers to manage the EU SFs. Some evidence on the higher effectiveness of EU SFs in context characterized by higher institutional quality has been provided by existing literature. Accetturo et al. (2014), Rodríguez-Pose and


Change in Total Structural Funds (SF) expenditures
Change in Gini
0
.2
.4
.6
-1
0
1
2
3
4
5
Years after the shock
Low change in Total SF expenditures
High change in Total SF expenditures


Change in ERDF expenditures
Change in Gini
0
.2
.4
.6
-1
0
1
2
3
4
5
Years after the shock
Low change in ERDF expenditures
High change in ERDF expenditures

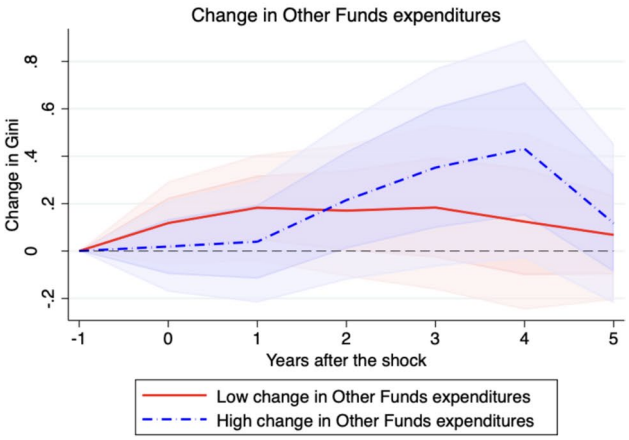

Change in Other Funds expenditures
Change in Gini
-.2
0
.2
.4
.6
.8
-1
0
1
2
3
4
5
Years after the shock
Low change in Other Funds expenditures
High change in Other Funds expenditures

Table 3 The impact of fiscal consolidations on regional inequality– the role of structural funds

	k = 0	k = 1	k = 2	k = 3	k = 4	k = 5
$F(z_{i,t}) * \%\Delta G_{i,t}$	0.069	0.147*	0.264***	0.326***	0.373***	0.175*
	(0.052)	(0.079)	(0.084)	(0.109)	(0.110)	(0.090)
$[1 - F(z_{i,t})] * \%\Delta G_{i,t}$	0.046*	0.059	0.078*	0.133**	0.118*	0.119**
	(0.026)	(0.038)	(0.043)	(0.056)	(0.060)	(0.057)
$\%\Delta G_{i,t-1}$	−0.015***	−0.018**	−0.026***	−0.036***	−0.039***	−0.015
	(0.006)	(0.009)	(0.010)	(0.011)	(0.012)	(0.011)
$\%\Delta G_{i,t-2}$	0.004	0.005	−0.000	−0.002	0.003	0.002
	(0.004)	(0.007)	(0.007)	(0.008)	(0.009)	(0.010)
$Gini_{i,t-1}$	0.859***	0.779***	0.687***	0.599***	0.552***	0.449***
	(0.025)	(0.035)	(0.049)	(0.056)	(0.058)	(0.053)
$Gini_{i,t-2}$	0.026	0.002	−0.001	0.001	−0.039	−0.043
	(0.020)	(0.026)	(0.036)	(0.045)	(0.046)	(0.050)
$F(z_{i,t})$	−0.116	−0.093	0.262	0.180	0.191	0.132
	(0.139)	(0.186)	(0.218)	(0.278)	(0.306)	(0.255)
Observations	3,711	3,558	3,405	3,252	3,099	2,946
R-squared	0.787	0.594	0.384	0.168	0.017	0.076
Kleibergen-Paap_rk_Wald_F_statistic						
Low regime	68.19	69.33	75.62	51.92	50.35	49.84
High regime	136.54	134.80	127.90	101.07	95.56	93.39

k = 0 is the year of the shock. *k* indicates the years after the shock. Estimates based on Eq. (4). Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regional and time effects included but not reported

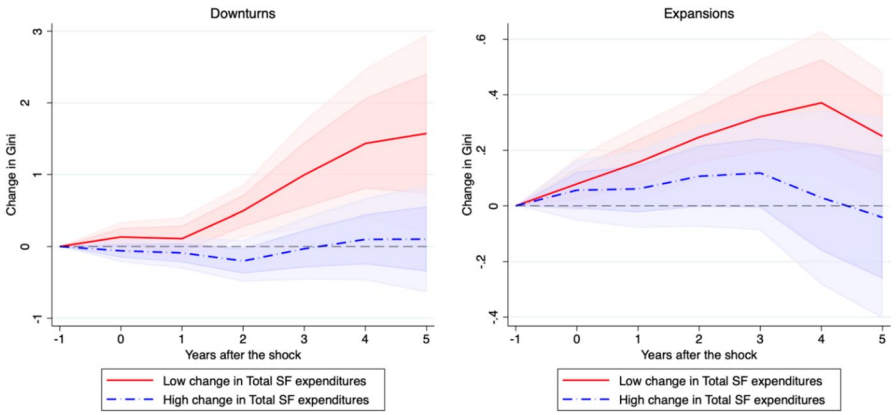


Fig. 10 The impact of fiscal consolidations on regional inequality: the role of structural funds accounting for differences across business cycle phases. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded areas. Impulse response functions are estimated using a sample of 162 EU regions over the period 1989–2014. The x-axis shows years (*k*) after the policy shock; y-axis indicates points; t = 0 is the year of the policy shock. Estimates based on Eq. (5) using regional GDP growth as additional conditioning variable (D = 1 if regional GDP growth < 0; 0 otherwise)

Table 4 The impact of fiscal consolidations on regional inequality: the role of structural funds accounting for differences across business cycle phases

	k = 0	k = 1	k = 2	k = 3	k = 4	k = 5
$D_{i,t}$ * [$F(z_{i,t})$ * %$\Delta G_{i,t}$]	0.133	0.109	0.494**	0.995**	1.433**	1.572*
	(0.125)	(0.181)	(0.219)	(0.454)	(0.630)	(0.837)
[1 − $D_{i,t}$] * [$F(z_{i,t})$ * %$\Delta G_{i,t}$]	0.079	0.156*	0.247***	0.321**	0.371**	0.251*
	(0.057)	(0.082)	(0.092)	(0.125)	(0.157)	(0.141)
$D_{i,t}$ * {[1 − $F(z_{i,t})$] * %$\Delta G_{i,t}$}	−0.060	−0.089	−0.202	−0.032	0.099	0.103
	(0.094)	(0.132)	(0.175)	(0.260)	(0.346)	(0.451)
[1 − $D_{i,t}$} * {[1 − $F(z_{i,t})$] * %$\Delta G_{i,t}$}	0.056	0.061	0.107	0.118	0.029	−0.041
	(0.066)	(0.084)	(0.110)	(0.125)	(0.190)	(0.221)
%$\Delta G_{i,t-1}$	−0.019**	−0.021	−0.032**	−0.041**	−0.038*	−0.011
	(0.009)	(0.013)	(0.015)	(0.017)	(0.022)	(0.024)
%$\Delta G_{i,t-2}$	0.004	0.006	−0.001	−0.009	−0.007	−0.008
	(0.004)	(0.008)	(0.007)	(0.010)	(0.012)	(0.014)
$Gini_{i,t-1}$	0.846***	0.748***	0.632***	0.528***	0.460***	0.358***
	(0.026)	(0.037)	(0.051)	(0.059)	(0.066)	(0.066)
$Gini_{i,t-2}$	0.026	0.003	0.012	0.017	−0.025	−0.052
	(0.021)	(0.027)	(0.033)	(0.043)	(0.051)	(0.054)
$F(z_{i,t})$	−0.148	−0.159	0.311	0.367	0.642	0.995*
	(0.181)	(0.225)	(0.285)	(0.413)	(0.555)	(0.563)
$D(z_{i,t})$	0.011	−0.017	0.135	0.790	1.402*	1.620
	(0.069)	(0.125)	(0.151)	(0.527)	(0.775)	(1.149)
Observations	3,421	3,268	3,115	2,962	2,809	2,656
R-squared	0.760	0.558	0.318	−0.053	−0.538	−0.628
Kleibergen-Paap_rk_Wald_F_statistic						
Low Funds-Low Growth	25.40	26.31	24.82	1.78	1.82	1.28
Low Funds-High Growth	72.43	70.85	68.09	49.62	42.25	42.19
High Funds-Low Growth	14.35	15.58	13.23	0.04	0.02	0.19
High Funds-High Growth	82.90	80.04	81.10	73.54	66.09	66.58

k = 0 is the year of the shock. *k* indicates the years after the shock. Estimates based on Eq. (5) using regional growth as additional conditional variable. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regional and time effects included but not reported

Garcilazo (2015), Arbolino et al. (2020) and Mendez and Bachtler (2024) are some examples focusing on different economic and social outcomes. Moreover, the existing literature has also shown that multipliers from public expenditures differ according to the level of institutional quality of countries (Avellán et al. 2020). However, very little is known on the interplay of these factors (fiscal expenditures/consolidations, cohesion policy and quality of institutions) that may be relevant in understanding the dynamic evolution of regional inequality. To shed more light on this point, we re-estimate Eq. (5) defining $D_{i,t} = 1$, if the average regional Quality of Government (as measured by the EQI index) for region *i,* is below the sample median, and $D_{i,t} = 0$ otherwise. The results shown in Fig. 11 and Table 5 point to a significant

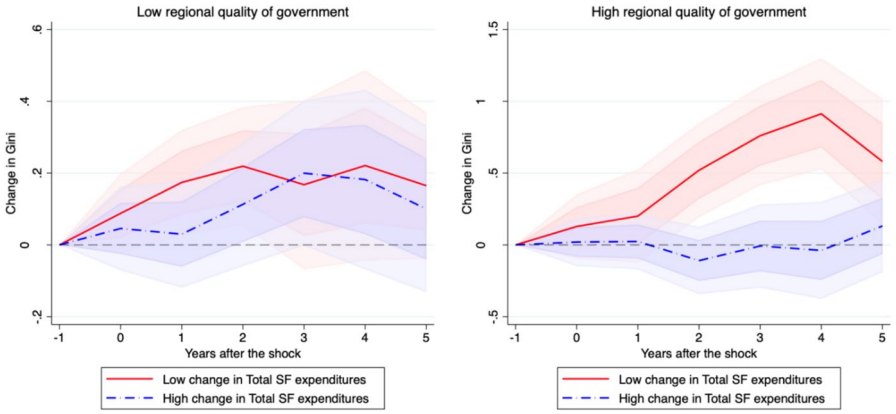


Fig. 11 The impact of fiscal consolidations on regional inequality: the role of structural funds accounting for differences in regional quality of government. Notes: The graphs show the response of regional inequality to one-percent reduction in regional spending, and 90 (68) percent confidence bands as lighter (darker) shaded areas. Impulse response functions are estimated using a sample of 162 EU regions over the period 1989–2014. The x-axis shows years (k) after the policy shock; y-axis indicates points; $t=0$ is the year of the policy shock. Estimates based on Eq. (5) using regional quality of government (EQI index) as additional conditioning variable ($D=1$ if average regional EQI < median regional EQI; 0 otherwise)

role of institutional quality in affecting the effectiveness of the cushioning effect of cohesion policy on the increase of regional inequality due to a reduction in regional government spending. In particular, when institutional quality is low the increase in regional inequality is very similar to the baseline and it is indistinguishable in the two regimes (high vs low EU SFs expenditures). In contrast, when institutional quality is high, larger EU SFs expenditures prevent the increase in regional inequality—that however peaks when EU SFs expenditures are small and not sufficient to counteract the adverse impact of austerity.

6 Conclusions

Public debts sustainability is one of the greatest challenges of our time. The main message of the Fall 2024 Fiscal Monitor provided by the International Monetary Fund is that "Global public debt is very high, rising and risky" (IMF 2024). As a result, fiscal adjustments (although "gradual, sustained and people-focused") should be pursued in several countries to maintain debt sustainability.

While the macroeconomic effects of austerity measures have been largely investigated, especially in the aftermath the Great Recession and the following debt crises of several European countries, the potential asymmetric effect at the regional level has been often overlooked. To the extent that a reduction in public expenditures may have larger economic implications for lagging regions and territories, resulting in increased inequality, it becomes relevant to policymakers. In the context of Europe,

Table 5 The impact of fiscal consolidations on regional inequality: the role of structural funds accounting for differences in regional quality of government

	k = 0	k = 1	k = 2	k = 3	k = 4	k = 5
$D_i * [F(z_{i,t}) * \%\Delta G_{i,t}]$	0.088	0.174*	0.219**	0.168	0.221	0.165
	(0.067)	(0.089)	(0.100)	(0.143)	(0.161)	(0.123)
$[1 - D_i] * [F(z_{i,t}) * \%\Delta G_{i,t}]$	0.129	0.201	0.520***	0.760***	0.913***	0.581**
	(0.135)	(0.198)	(0.199)	(0.209)	(0.234)	(0.265)
$D_i * \{[1 - F(z_{i,t})] * \%\Delta G_{i,t}\}$	0.046	0.030	0.113	0.200	0.182	0.100
	(0.071)	(0.090)	(0.104)	(0.122)	(0.152)	(0.141)
$[1 - D_i\} * \{[1 - F(z_{i,t})] * \%\Delta G_{i,t}\}$	0.020	0.024	−0.109	−0.007	−0.038	0.132
	(0.102)	(0.118)	(0.142)	(0.176)	(0.205)	(0.195)
$\%\Delta G_{i,t-1}$	−0.015***	−0.018**	−0.026***	−0.036***	−0.039***	−0.015
	−0.017**	−0.016	−0.028**	−0.033	−0.038	−0.011
$\%\Delta G_{i,t-2}$	(0.009)	(0.013)	(0.014)	(0.020)	(0.023)	(0.020)
	0.005	0.006	0.001	−0.003	−0.001	−0.005
$Gini_{i,t-1}$	(0.004)	(0.008)	(0.008)	(0.009)	(0.011)	(0.011)
	0.848***	0.748***	0.639***	0.550***	0.496***	0.400***
$Gini_{i,t-2}$	(0.029)	(0.039)	(0.050)	(0.057)	(0.059)	(0.060)
	0.023	0.001	−0.002	−0.007	−0.055	−0.074
$F(z_{i,t})$	(0.022)	(0.028)	(0.033)	(0.042)	(0.045)	(0.046)
	−0.135	−0.097	0.483	0.290	0.535	0.518
Observations	3,421	3,268	3,115	2,962	2,809	2,656
R-squared	0.757	0.546	0.295	−0.035	−0.298	−0.221
Kleibergen-Paap_rk_Wald_F_statistic						
Low Funds-Low EQI	84.09	85.28	77.22	45.34	43.87	44.66
Low Funds-High EQI	9.92	8.86	9.89	13.18	12.74	15.42
High Funds-Low EQI	169.38	173.66	162.33	117.83	105.83	106.66
High Funds-High EQI	23.34	22.63	21.23	20.25	18.64	17.47

k = 0 is the year of the shock. *k* indicates the years after the shock. Estimates based on Eq. (5) using EQI as additional conditional variable. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Regional and time effects included but not reported

such a result may indeed threat and vanish the European policy efforts to achieve regional cohesion.

Drawing on regional data of twelve European countries, in this paper we try to fill this gap by analysing the dynamic impact of regional fiscal consolidations on regional income inequality and how it is affected by EU Structural and Investment policy stance. Our findings, suggest that regional spending cuts increase regional inequality over the medium-term. The effect is economically relevant since a one-percent increase in the size of fiscal consolidation (through reduction in regional spending) leads to an increase of the regional disparities of about 0.25 Gini point that corresponds to one-third standard deviation of the change in Gini in our sample. These effects, however, mask important sources of

heterogeneity that are key for policy design. First, the role of EU Structural and Investment funds is relevant, since a large increase in EU SFs expenditure in the aftermath of regional fiscal consolidation, cushion the increasing effect of consolidations on regional inequality. Not surprisingly, the effect is driven by the ERDF, that is the EU fund explicitly targeted to strengthen economic, social and territorial cohesion in the European Union. Second, the counteracting effectiveness of EU SFs expenditures is dependent on the states of the economy—being more effective in recessions, and on the quality of government—where higher institutional quality is necessary to properly manage the funds, avoiding diverting them to unproductive uses.

Appendix

Table A1 List of regions included in the analysis

NUTS_ID	Nuts Name	NUTS_ID	Nuts Name
AT11	Burgenland	DEA4	Detmold
AT12	Niederösterreich	DEA5	Arnsberg
AT21	Kärnten	DEB1	Koblenz
AT22	Steiermark	DEB2	Trier
AT31	Oberösterreich	DEB3	Rheinhessen-Pfalz
AT32	Salzburg	DEC0	Saarland
AT33	Tirol	DED2	Dresden
AT34	Vorarlberg	DED4	Chemnitz
BE21	Prov. Antwerpen	DED5	Leipzig
BE22	Prov. Limburg	DEE0	Sachsen-Anhalt
BE23	Prov. Oost-Vlaanderen	DEF0	Schleswig–Holstein
BE24	Prov. Vlaams-Brabant	DEG0	Thüringen
BE25	Prov. West-Vlaanderen	DK01	Hovedstaden
BE32	Prov. Hainaut	DK02	Sjælland
BE33	Prov. Liège	DK03	Syddanmark
BE34	Prov. Luxembourg	DK04	Midtjylland
BE35	Prov. Namur	ES11	Galicia
DE11	Stuttgart	ES21	País Vasco
DE12	Karlsruhe	ES24	Aragón
DE13	Freiburg	ES41	Castilla y León
DE14	Tübingen	ES42	Castilla-la Mancha
DE21	Oberbayern	ES43	Extremadura
DE22	Niederbayern	ES51	Cataluña
DE23	Oberpfalz	ES52	Comunidad Valenciana
DE24	Oberfranken	ES53	Illes Balears

Table A1 (continued)

NUTS_ID	Nuts Name	NUTS_ID	Nuts Name
DE25	Mittelfranken	ES61	Andalucía
DE26	Unterfranken	ES70	Canarias
DE27	Schwaben	FI19	Länsi-Suomi
DE40	Brandenburg	FI1C	Etelä-Suomi
DE50	Bremen	FI1D	Pohjois- ja Itä-Suomi
DE71	Darmstadt	FR10	Île de France
DE72	Gießen	FRB0	Centre—Val de Loire
DE73	Kassel	FRC1	Bourgogne
DE80	Mecklenburg-Vorpommern	FRC2	Franche-Comté
DE91	Braunschweig	FRD1	Basse-Normandie
DE92	Hannover	FRD2	Haute-Normandie
DE93	Lüneburg	FRE1	Nord-Pas-de-Calais
DE94	Weser-Ems	FRE2	Picardie
DEA1	Düsseldorf	FRF1	Alsace
DEA2	Köln	FRF2	Champagne-Ardenne
DEA3	Münster	FRF3	Lorraine
FRG0	Pays-de-la-Loire	SE32	Mellersta Norrland
FRH0	Bretagne	SE33	Övre Norrland
FRI1	Aquitaine	UKC1	Tees Valley and Durham
FRI2	Limousin	UKC2	Northumberland and Tyne and Wear
FRI3	Poitou–Charentes	UKD1	Cumbria
FRJ1	Languedoc-Roussillon	UKD3	Greater Manchester
FRJ2	Midi-Pyrénées	UKD4	Lancashire
FRK1	Auvergne	UKD6	Cheshire
FRK2	Rhône-Alpes	UKD7	Merseyside
FRL0	Provence-Alpes-Côte d'Azur	UKE1	East Yorkshire and Northern Lincolnshire
FRM0	Corse	UKE2	North Yorkshire
IE04	Northern and Western	UKE3	South Yorkshire
IE05	Southern	UKE4	West Yorkshire
IE06	Eastern and Midland	UKF1	Derbyshire and Nottinghamshire
ITC1	Piemonte	UKF2	Leicestershire
ITC3	Liguria	UKG1	Herefordshire
ITC4	Lombardia	UKG2	Shropshire and Staffordshire
ITF1	Abruzzo	UKG3	West Midlands
ITF2	Molise	UKH1	East Anglia
ITF3	Campania	UKH2	Bedfordshire and Hertfordshire
ITF4	Puglia	UKH3	Essex
ITF5	Basilicata	UKI3	Inner London—West
ITF6	Calabria	UKI4	Inner London—East
ITG1	Sicilia	UKI5	Outer London—East and North East
ITG2	Sardegna	UKI6	Outer London—South
ITH3	Veneto	UKI7	Outer London—West and North West

Table A1 (continued)

NUTS_ID	Nuts Name	NUTS_ID	Nuts Name
ITH4	Friuli-Venezia Giulia	UKJ1	Berkshire
ITH5	Emilia-Romagna	UKJ2	Surrey
ITI1	Toscana	UKJ3	Hampshire and Isle of Wight
ITI2	Umbria	UKJ4	Kent
ITI3	Marche	UKK1	Gloucestershire
ITI4	Lazio	UKK2	Dorset and Somerset
PT11	Norte	UKK4	Devon
PT16	Centro	UKL1	West Wales and The Valleys
PT18	Alentejo	UKL2	East Wales
SE12	Östra Mellansverige	UKM6	Highlands and Islands
SE21	Småland med öarna	UKM7	Eastern Scotland
SE22	Sydsverige	UKM8	West Central Scotland
SE23	Västsverige	UKM9	Southern Scotland
SE31	Norra Mellansverige	UKN0	Northern Ireland

Acknowledgements The authors thank participants to the workshop "Regional and spatial effects of macroeconomic policies and shocks" held in Palermo on July 11-12, 2024, for useful comments. This work has been partially carried out within the activities related to the PRIN Project 2017JRWTJC_001 "A New Assessment of Cohesion Policies' Effectiveness: Macro and Micro Approaches"—CUP: B78D20000090005. Pietro Pizzuto also acknowledges the funding from the European Union-Next-GenerationEU through the Italian Ministry of University and Research under PNRR-M4C2-I1.1 Project P20224K95M—A World of shocks: multi-layers multi-shocks resilience (Mu-Res)—CUP: B53D23026330001. The views and opinions expressed are those of the authors only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission can be held responsible for them.

Funding Open access funding provided by Università degli Studi di Palermo within the CRUI-CARE Agreement.

Data Availability Data are available upon request from the authors.

Declarations

Conflict of Interest The authors declare that they have no conflict of interest.

References

Accetturo A, De Blasio G, Ricci L (2014) A tale of an unwanted outcome: transfers and local endowments of trust and cooperation. J Econ Behav Organ 102:74–89

Agnello L, Cimadomo J (2012) Discretionary fiscal policies over the cycle: new evidence based on the ESCB disaggregated approach. Int J Cent Bank 8(2):43–86

Agnello L, Sousa RM (2014) How does fiscal consolidation impact on income inequality? Rev Income Wealth 60:702–726

Agnello L, Castro V, Sousa RM (2013) What determines the duration of a fiscal consolidation program? J Int Money Financ 37:113–134

Agnello L, Fazio G, Sousa RM (2016) National fiscal consolidations and regional inequality in Europe. Camb J Reg Econ Soc 9(1):59–80

Agnello L, Castro V, Sousa RM (2018) The legacy and the tyranny of time: exit and re-entry of sovereigns to international capital markets. J Money Credit Bank 50(8):1969–1994

Alesina A, Favero C, Giavazzi F (2020) Austerity: When it Works and when it Doesn't. Princeton University Press

Amendolagine V, Prota F, Serlenga L (2024) The impact of European cohesion policy: a spatial perspective. J Econ Geogr 24(4):477–494

Andrews I, Stock J, Sun L (2019) Weak instruments in IV regression: theory and practice. Ann Rev Econ 11(1):727–753

Arbolino R, De Caro P, Marani U (2020) Did the governance of EU funds help Italian regional labour markets during the Great Recession? JCMS: J Common Mark Stud 58(2):235–255

Auerbach A, Gorodnichenko Y (2011) Fiscal multipliers in recession and expansion, No 17447, NBER Working Papers, National Bureau of Economic Research, Inc

Auerbach AJ, Gorodnichenko Y (2012) Measuring the output responses to fiscal policy. Am Econ J: Econ Policy, Am Econ Assoc 4(2):1–27

Auerbach AJ, Gorodnichenko Y (2013) In: Alesina A, Giavazzi F (eds) Fiscal multipliers in recession and expansion. University of Chicago Press, pp 63-102

Avellán L, Andrade G, José A, León-Díaz J (2020) The role of institutional quality on the effects of fiscal stimulus, IDB Working Paper Series, No. IDBWP-01113, Inter-American Development Bank (IDB), Washington, DC, https://doi.org/10.18235/0002316

Ball L, Furceri D, Leigh D, Loungani P (2013) The distributional effects of Fiscal Austerity. IMF Working Paper No. 13/151, International Monetary Fund, Washington

Barbero J, Christensen M, Conte A, Lecca P, Rodríguez-Pose A, Salotti S (2023) Improving government quality in the regions of the EU and its system-wide benefits for cohesion policy. J Common Mark Stud 61(1):38–57

Bartik TJ (1991) Who benefits from state and local economic development policies? Books from Upjohn Press, W.E. Upjohn Institute for Employment Research, number wbsle

Becker S, Egger P, Von Elrich M (2010) Going NUTS: The effect of EU Structural Funds on regional performance. J Public Econ 94(9–10):578–590

Blanchard O, Leigh D (2013) Fiscal consolidation: at what speed? Vox website, May. http://www.voxeu.org/article/fiscal-consolidation-what-speed. Accessed Oct 2024

Bourdin S, Destefanis S, Coppola G, Kubara M (2024) What are the impacts of Cohesion Policy on the trade-off between employment and productivity? Reg Stud 1–16. https://doi.org/10.1080/00343404.2024.2379444

Brueckner M, Valentinyi A, Pappa E (2023) Geographic cross-sectional fiscal spending multipliers and the role of local autonomy: evidence from European Regions. J Money Credit Bank 55(6):1357–1396 (**Blackwell Publishing**)

Caldas P, Dollery B, Marques RC (2018) European cohesion policy impact on development and convergence: a local empirical analysis in Portugal between 2000 and 2014. Eur Plan Stud 26(6):1081–1098. https://doi.org/10.1080/09654313.2018.1449815

Canova F, Pappa E (2025) The macroeconomic effects of EU regional structural funds. J Eur Econ Assoc 23(1):327–360. https://doi.org/10.1093/jeea/jvae031

Capello R, Cerisola S (2024) Towards a double bell theory of regional disparities. Ann Reg Sci 73:1701–1728

Cappelen A, Castellacci F, Fagerberg J, Verspagen B (2003) The impact of EU regional support on growth and convergence in the European Union. JCMS: J Common Mark Stud 41(4):621–644

Cerqua A, Pellegrini G (2018) Are we spending too much to grow? The case of structural funds. J Reg Sci 58(3):535–563
Colombo E, Furceri D, Pizzuto P, Tirelli P (2024) Public expenditure multipliers and informality. Eur Econ Rev 162:104703
Coppola G, Destefanis S, Marinuzzi G, Tortorella W (2020) European Union and nationally based cohesion policies in the Italian regions. Reg Stud 54(1):83–94
Coppola G, Destefanis S, Di Serio M, Fragetta M (2024) Fiscal multipliers in recession and expansion. An analysis for the Italian regions. Struct Chang Econ Dyn 71:538–556
Crescenzi R, Giua M (2016) The EU cohesion policy in context: does a bottom-up approach work in all regions? Environ Plan A: Econ Space 48(11):2340–2357
Crescenzi R, Giua M (2020) One or many Cohesion Policies of the European Union? On the differential economic impacts of Cohesion Policy across member states. Reg Stud 54(1):10–20. https://doi.org/10.1080/00343404.2019.1665174
Dall'Erba S, Le Gallo J (2008) Regional convergence and the impact of European structural funds over 1989–1999: aspatial econometric analysis. Pap Reg Sci 87(2):219–244
Di Caro P, Fratesi U (2022) One policy, different effects: estimating the region-specific impacts of EU cohesion policy. J Reg Sci 62(1):307–330
Ederveen S, Gorter J, Mooij R, Nahuis R (2003) Funds and games – the economics of European cohesion policy. European Network of Economic Policy Research Institutes, Occasional Paper no.3, October
Fagerberg J, Verspagen B (1996) Heading for divergence? Regional growth in Europe reconsidered. J Common Mark Stud 34(3):431–448
Fiaschi D, Lavezzi AM, Parenti A (2018) Does EU cohesion policy work? Theory and evidence. J Reg Sci 58(2):386–423
Fratesi U, Perucca G (2014) Territorial capital and the effectiveness of cohesion policies: an assessment for CEE regions. Investig Regionales – J Reg Res Asoc Esp Cienci Reg 29:165–191
Fratesi U, Perucca G (2019) EU regional development policy and territorial capital: a systemic approach. Pap Reg Sci 98(1):265–281. https://doi.org/10.1111/pirs.12360
Fratesi U (2016) Impact assessment of European Cohesion Policy: Theoretical and empirical issues. In Piattoni S, Polverari L (Eds.), Handbook on cohesion policy in the EU (pp. 443–460). Edward Elgar. 978-1-78471-566-3
Furceri D, Mazzola F, Pizzuto P (2022) Regional inequalities, economic crises and policies: an international panel analysis. Appl Econ 54(4):484–505. https://doi.org/10.1080/00036846.2021.1963414
Gabriel R, Klein M, Pessoa A (2023) The political costs of austerity. Rev Econ Stat 1-45. https://doi.org/10.1162/rest_a_01373
Gagliardi L, Percoco M (2017) The impact of European cohesion policy in urban and rural regions. Reg Stud 51(6):857–868
IMF (2024) Fiscal Monitor, October 2024: Putting a Lid on Public Debt. International Monetary Fund. Washington D.C.
Jenkins S, Brandolini A, Micklewright J, Nolan B (2011) The Great Recession and the Distribution of Household Income. Fondazione Rodolfo Debenedetti, Milan
Jordà O (2005) Estimation and inference of impulse responses by local projections Amer. Econ Rev 95:161–182
Jordà Ò, Taylor AM (2013) The time for austerity: estimating the average treatment effect of fiscal policy. Paper presented at the NBER Summer Institute, Cambridge, Massachusetts, July
Larch M, Turrini A (2009) The cyclically adjusted budget balance in EU fiscal policymaking. Love at First Sight Turned into a Mature Relationship. MPRA Paper No. 20594
Le Gallo J, Dall'erba S, Guillian R (2011) The local versus global dilemma of the effects of structural funds. Growth Chang 42(4):466–490
Llussá F, Lopes J (2011) Regional growth in Europe: the role of European and national policies. Nova SBE Working Paper Series wp554, Universidade Nova de Lisboa, Nova School of Business and Economics
Marattin L, Nannicini T, Porcelli F (2022) Revenue vs expenditure based fiscal consolidation: the pass-through from federal cuts to local taxes. Int Tax Publ Financ 29(4):834–872 (**Springer; International Institute of Public Finance**)
Mazzola F, Gambina D (2024) The short-run displacement of EU cohesion funds in Italy: has reprogramming a positive impact on regional growth? J Policy Model. In press

Mazzola F, Pizzuto P (2020) Resilience and convergence: short vs. long-run regional effects of economic crises and macroeconomic policies. Sci Reg 19(3):431–452
Mendez C, Bachtler J (2024) The quality of government and administrative performance: explaining cohesion policy compliance, absorption and achievements across EU regions. Reg Stud 58(4):690–703
Mukoyama T, Sahin A (2006) Costs of business cycles for unskilled workers. J Monet Econ 53(8):2179–2193
Obstfeld M, Peri G (1998) Regional non-adjustment and fiscal policy. Economic Policy 13(26):206–259
OECD (2012b) Restoring Public Finances, 2012 Update, OECD Publishing. https://doi.org/10.1787/9789264179455-en
OECD/Korea Institute of Public Finance (2012a), Institutional and Financial Relations across Levels of Government, OECD Fiscal Federalism Studies, OECD Publishing. https://doi.org/10.1787/9789264167001-en
Percoco M (2017) Impact of European cohesion policy on regional growth: does local economic structure matter? Reg Stud 51(6):833–843
Pinho C, Varum C, Antunes M (2015) Under what conditions do structural funds play a significant role in European Regional Economic Growth? Some evidence from recent panel data. J Econ Issues 49(3):749–771
Psycharis Y, Tselios V, Pantazis P (2020) The contribution of cohesion funds and nationally funded public investment to regional growth: evidence from Greece. Reg Stud 54(1):95–105
Puigcerver-Peñalver M (2007) The impact of structural funds policy on European regions' growth. Theor Empir Approach Eur J Comp Econ 4(2):179–208
Ramajo J, Márquez M, Hewings G, Salinas M (2008) Spatial heterogeneity and interregional spillovers in the European Union: do cohesion policies encourage convergence across regions? Eur Econ Rev 52:551–567
Ramey VA, Zubairy S (2018) Government spending multipliers in good times and in bad: evidence from U.S. historical data. J Political Econ 126:850–901
Rodríguez-Pose A, Fratesi U (2004) Between development and social policies: the impact of European structural funds in objective 1 regions. Reg Stud 38(1):97–113
Rodríguez-Pose A, Garcilazo E (2015) Quality of government and the returns of investment: examining the impact of cohesion expenditure in European regions. Reg Stud 49(8):1274–1290
Romer C, Romer D, (2007), The macroeconomics effects of tax change: estimates based on a new measure of fiscal shocks. NBER Working Paper 13264
Schwab T (2024) Quo Vadis, cohesion policy? European Regional development at a crossroads. Intereconomics: Rev Eur Econ Policy Sciendo 59(5):284–292
Vammalle C, Hulbert C (2013) Sub-national Finances and Fiscal Consolidation: Walking on Thin Ice. OECD Regional Development Working Papers, No. 2013/02, OECD Publishing, Paris. https://doi.org/10.1787/5k49m8cqkcf3-en
Vedrine L, Le Gallo J (2021) Does EU Cohesion Policy affect territorial inequalities and regional development? EU Cohesion Policy and Spatial Governance : Territorial, Social and Economic Challenges, Edward Elgar Publishing, pp 156-170
Woo J, Bova E, Kinda T, Zhang S (2013). Distributional consequences of fiscal consolidation and the role of fiscal policy: what do the data say? IMF Working Paper No. 2013/195, International Monetary Fund, Washington