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Structural Funds, Misallocation and Regional Disparities*

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Abstract

In the face of increasing amounts of structural funds transferred to EU regions, we document increasing GDP dispersion (σ-divergence) and misallocation (inefficient factor allocation) across regions over the first two decades of the 2000s. To reconcile this evidence, we estimate a simultaneous equation model showing that EU structural funds reduce income gaps (thereby reducing GDP dispersion), on average, as a direct effect, while also fostering dispersion due to increasing misallocation, as an indirect effect offsetting about 85% of the direct channel. Estimates carried out by quartiles of GDP gap show that the sign of these relationships reverse when regions with a below-the-median GDP gap are addressed: the direct effect turns positive (implying higher GDP gaps), while misallocation becomes convergence-enhancing. This pattern is consistent with a Solow-type mechanism according to which EU transfers promote productivity, rather than factor accumulation, as one approaches the GDP frontier.

Keywords: Regional Convergence, Misallocation, Economic Efficiency, EU Structural Policy

JEL Codes: R11, R13, R58, O47, O52

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1 Introduction

Since its inception, the European Union has placed economic cohesion at the center of its integration project, devoting substantial policy effort and financial resources to reducing territorial disparities and promoting convergence across member states and regions.

Yet, while EU regional transfers expanded substantially over the first two of the 2000s, we document increasing GDP per capita dispersion across EU regions over the same period, pointing to persistent σ-*divergence* Sala-i Martin (1996).

This counterintuitive relationship suggests that the effect of cohesion policy can be correctly understood only by examining the potential action of concurrent channels through which EU funding can affect regional economies. A notable potential channel is *misallocation*, meant as inefficient allocation of productive resources across regions. Indeed, misallocation can generate large productivity losses, which in turn translates into aggregate GDP losses, compared to an economically efficient outcome (Restuccia and Rogerson (2008); Hsieh and Klenow (2009); Asker et al. (2014); Autor et al. (2013); Bollard et al. (2013); Chen and Irarrazabal (2014); Dias et al. (2016); Gopinath et al. (2017)). As emphasized by Calligaris et al. (2018), this effect can be associated with different types of market frictions such as access to credit and labor market rigidities. Crucially, large-scale transfers of public funds can themselves alter the allocation of resources. By eventually redirecting production factors toward low marginal productivity regions, structural funds are likely to worsen the extent of misallocation, thereby generating a divergence channel that partially offsets their redistributive effect. This channel has been overlooked by the existing literature on EU cohesion policy and regional convergence.

Against this background, we examine the role of EU structural funds by studying how transfers impact regional income disparities both directly and, indirectly, by affecting regional misallocation dynamics.

Using 2000–2022 regional (NUTS-2) data for 26 EU countries, we estimate a simultaneous equations model in which misallocation depends on transfers, while GDP per-capita gaps depend on both misallocation and transfers. The model is estimated by Three-Stage Least Squares (3SLS) with region and year fixed effects. Identification relies on eligibility thresholds for structural funding Becker et al. (2010).

Results show that misallocation widens income gaps on average and increases dispersion along the GDP distribution. EU structural funds interact with this channel: they reduce income gaps directly, on average, but also increase misallocation, which is found to absorb about 85% of the direct, convergence-enhancing, effect.

When analyzed across GDP quartiles, the sign of these relationships is consistent with a Solow-type mechanism according to which EU transfers yield different effects depending on the position along the regional GDP distribution. On the one hand, funds increasingly foster productivity growth as one approach the GDP frontier, thereby resulting in i) wider GDP gaps as direct effect and ii) lower GDP gaps as an indirect effect occurring through misallocation. The rationale for such a mechanism is that misallocation is in this case driven by productivity growth not associated with an increase in the amount of resources used. This sort of "good" economic inefficiency comes along with GDP growth (although with an output loss, compared to the efficient outcome). On the other hand, as long as low GDP regions are considered, structural funds reasonably foster factor accumulation, so that: i) the direct effect turns negative (lower gaps), thanks to relaxing resource accumulation constraints, and ii) the misallocation effect turns positive, as weaker productive structures and tighter accumulation constraints make inefficient

allocation more costly the farther away the region is from the GDP frontier.

Thus, the relationship between EU cohesion policy and regional income disparities is not limited to the amount of resources transferred, but extends to how economically efficient the implied reallocation mechanisms are. Overall, the analysis shows that misallocation helps explain the σ-divergence that across EU regions in the first two decades of the century and that EU structural funds interact with this channel. Structural transfers can promote convergence, but their effectiveness is weakened when they increase distortions in the allocation of productive inputs.

The contribution relates to two main strands of literature. On the one hand, the empirical literature on EU structural funds and regional convergence (Boldrin and Canova (2001); Becker et al. (2010); Esposti and Bussoletti (2008)). On the other hand, the literature on misallocation and aggregate productivity (Restuccia and Rogerson (2008); Hsieh and Klenow (2009)).

Despite substantial empirical effort, a shared consensus about the effect of structural funds on regional convergence has yet to emerge. A meta-analysis of 323 estimates from 17 studies conducted by Dall'Erba and Fang (2017) shows that funds exert a positive effect on regional growth, yet this effect is highly heterogeneous and depends on methodology, programming period, fund type, and regional characteristics. Several contributions report positive growth effects, especially in Objective 1 regions.[1] Among these, Puigcerver-Peñalver (2007) finds significant impact of Structural Funds on GDP per worker between 1989 and 1999, particularly when supported by human capital and private investment. Moderate but positive effects, often stronger in regions with higher administrative capacity and better institutions, are documented by Becker et al. (2010). Similarly, Goecke and Hüther (2016) shows that EU regional subsidies increase the probability of convergence when allocated to areas with a robust industrial base and directed toward manufacturing, transport, and environmental planning.[2] Regression discontinuity designs applied to Objective 1 regions establish a causal positive effect on per-capita GDP growth, with impacts ranging between 1.2 and 1.8 percentage points annually depending on the programming period Becker et al. (2018). However, they find that returns are strongly conditional on absorptive capacity and institutional quality. According to Canova and Pappa (2025), short-term effects on output, investment and employment vary by the type of structural fund. Macro-model simulations for the 2014–2020 period confirm that the funds reduce territorial disparities, particularly in less-developed regions Crucitti et al. (2024). A common message emerging from this evidence is that the effect of cohesion policy is highly heterogeneous. Aggregate convergence remains elusive, and distinct convergence clubs persist along a North-West versus South-East divide Borsi and Metiu (2015). Even when funds support convergence on average, their effects vary with regional characteristics, including urban–rural structure, distance to large agglomerations, local territorial capital, and national implementation models (Maynou et al. (2016); Gagliardi and Percoco (2017); Bachtrögler et al. (2020); Crescenzi and Giua (2020)).

[1]The main convergence objective—historically known as Objective 1 (now called "less developed regions")—targets the poorest regions, defined as those with GDP per-capita below 75% of the EU average at the start of each programming period.

[2]Less recent literature on this theme includes: Boldrin and Canova (2001), who argue that European funds have neither induced structural transformation nor sustained productivity growth; Esposti and Bussoletti (2008), who find no evidence that Objective 1 funds led to conditional convergence in the 1989–2004 period; Rodríguez-Pose and Fratesi (2004), who argue that only human-capital investments generate robust medium-term growth; Rodríguez-Pose and Fratesi (2004), according to which infrastructure and business-support spending show weak or null effects.

This heterogeneity is also evident in studies of treatment intensity. Extending the RDD framework to continuous treatment, Cerqua and Pellegrini (2018) show that the relationship between Structural Funds and growth is concave: after a certain threshold, additional transfers generate sharply diminishing returns.

A growing literature shows that subsidies and place-based transfers can affect not only the level of economic activity, but also the allocation of resources across firms, sectors, and regions. When public support is not aligned with marginal productivity, it may sustain low-productivity units, distort factor allocation, and weaken aggregate productivity. Evidence from firm-level studies supports this view. Byrne and Goodhead (2025) examine capital misallocation across manufacturing firms in 19 European countries and show that firm-specific distortions, including subsidies, account for a substantial part of productivity differences across European regions. Related evidence from China reaches a similar conclusion Jin (2018). In the European context, Fattorini et al. (2020) provide a more nuanced picture for ERDF support. Broad business support has little effect on firm competitiveness, whereas targeted support for product and process innovation raises TFP, especially among initially low-productivity firms. Taken together, these studies indicate that the productivity effects of public support depend critically on whether transfers relax productive constraints or instead distort the allocation of resources. Evidence from agriculture points in the same direction. Rizov et al. (2013) show that Common Agricultural Policy subsidies had a negative effect on farm productivity before the decoupling reform, while their effect became more heterogeneous afterward. They interpret this pattern as the net result of two opposing forces: productivity gains induced by investment and productivity losses generated by allocative and technical inefficiencies. Morando and Newman (2022) provide direct evidence on this second channel, showing that farm-specific subsidies can generate capital misallocation and sizable aggregate productivity losses. These findings are useful for our setting because they show that subsidy programs may simultaneously support production and distort the allocation of inputs, making their aggregate effect depend on the balance between investment and misallocation channels. Taken together, this evidence suggests that subsidies can affect productivity not only by changing the level of investment, but also by changing the allocation of resources across production units.

The remainder of the paper is structured as follows. Section 2 describes the data sources and defines the variables of interest. Section 3 offers a preliminary investigation of the key patterns. Section 4 presents the analysis. Section 5 performs robustness checks. Section 6 concludes.

2 Data and variables definition

The analysis relies on combining granular information on the regional allocation and disbursement of European Union funds, drawn from the EU Cohesion Policy Open Data Portal[3], with economic, demographic, and financial data provided by the Annual Regional Database of the European Commission database (ARDECO).

As a result of the merge, the analysis is based on a harmonized panel of NUTS-2 regions, covering 26 EU countries, over the period 2000–2022. While the United Kingdom is included, our data do not allow us to cover the whole EU-28 group due to incompatible NUTS classifications and missing information on transfers for Ireland and Croatia,

[3]European Commission, Cohesion Open Data.

respectively.

EU funds are used to promote economic, social, and territorial cohesion across member states and regions[4]. Although each fund has a specific purpose, they all contribute to reducing disparities and supporting development. We therefore consider all types of EU funds. The Cohesion Fund (CF), which is designed to support member states with lower income levels, finances environmental projects and transport infrastructure with the aim of reducing development gaps and promoting more balanced growth across the EU. The European Regional Development Fund (ERDF) aims to reduce regional disparities and improve competitiveness, supporting investments in infrastructure, innovation, digitalization, and environmental transition. Focused on rural areas, the European Agricultural Fund for Rural Development (EAFRD) aims to improve the competitiveness of agriculture, encourage the sustainable management of natural resources, and support the economic and social development of rural communities. The European Maritime and Fisheries Fund (EMFF) was created to support fisheries, aquaculture, and coastal communities. Its purpose was to promote sustainable activities linked to the sea and to strengthen the resilience of these areas. The European Social Fund (ESF) supports employment, education, training, and social inclusion, especially for groups facing difficulties in the labor market. Under EU cohesion policy, NUTS-2 regions are classified according to their level of development. Objective 1 regions receive the highest intensity of structural funds. In order to counter poverty, the Fund for European Aid to the Most Deprived (FEAD) provided basic material assistance, such as food and essential goods, while also promoting measures of social inclusion. The Youth Employment Initiative (YEI) is aimed at improving youth access to jobs, apprenticeships, traineeships, and training opportunities.

In cumulative terms, the ERDF and EAFRD together account for nearly 60% of total EU transfers, while the ESF represents around 20%, with the remaining funds—including CF, EMFF, FEAD, and YEI—covering the residual share. This distribution reflects the longstanding centrality of regional competitiveness and rural development in the EU's cohesion agenda.

From the EU Cohesion Policy Open Data Portal, we extract the"modeled annual expenditure" series, which provides the amount of annual transfers for each type of fund. To capture the total fiscal impulse received by each region (NUTS-2), we aggregate this information at the regional level (in the robustness section we also limit the analysis to CF and ERDF transfers).

For *income*, we consider real GDP per-capita (i.e., *GDPpc*), which is also used to obtain a measure of distance with respect to the GDP frontier (i.e., *GDPpc GAP*), identified by the 5% richest regions at the beginning of the period (i.e., 2000). Specifically, for each region (r) - year (t), the GDP gap is defined as the difference between the average real GDP per-capita at the frontier and the GDP per capita of the region: $GDPpc\ Gap_{r,t} = \overline{GDPpc}_{f,t} - GDPpc_{r,t}$.[5]. *GDPpc GAP* provides a region-specific indi-

[4]EU candidate countries could also receive financial support before formal accession to the EU through pre-accession assistance instruments, aimed at preparing them for membership and alignment with EU rules and policies (European Commission, Pre-accession Assistance).

[5]As a result of belonging to the highest 5% of the GDP distribution in 2000, the following are set as frontier regions throughout the analysis: Inner London, Outer London, Luxembourg, Brussels, Hamburg, Hovedstaden, Stockholm, Vienna, Île-de-France, the area Berkshire-Buckinghamshire-Oxfordshire, and Uusimaa.

cator of convergence dynamics over time, with a decreasing trend denoting convergence towards the frontier.

Information on real GDP per-capita is provided at the regional level by ARDECO, from which we also draw information on compensation of employees (at current prices), gross fixed capital formation (at current prices), and gross value added (at basic prices).

To address the extent of economic inefficiency in the allocation of resources across regions, referred to as *regional misallocation*, we adopt a Hsieh and Klenow (2009) framework in which misallocation is measured by the dispersion of the marginal revenue product (MRP) of inputs (marginal product times output price) across regions.

In an ideal economy with frictionless factor markets, firms equalize the MRP of each factor to its nominal cost (the economic efficiency condition). With all firms located in a given region bearing the same factor cost, the MRP is equalized across firms and the average (in the region) MRP of each factor equals its factor cost. With firms in different EU regions facing the same factor cost, the MRP is equalized also across regions and the average (across regions) MRP of each factor equals its factor cost.

Deviations from this ideal economic efficiency condition indicate the presence of misallocation, entailing the coexistence of regions exhibiting a MRP higher than the average, using a "too low" amount of inputs, and regions exhibiting a MRP lower than the average, using a "too high" amount of inputs. The observed dispersion in factors' MRPs across regions therefore signals distortions in the allocation of resources.

Formally, the production function for region r at time t in sector s can be expressed as:

$$Y_{rst} = A_{rst} K_{rst}^{\alpha_{st}} L_{rst}^{1-\alpha_{st}} \tag{1}$$

where Y_{rst} is output, K_{rst} and L_{rst} are capital and labor respectively. α and $(1-\alpha)$ are, respectively, the factor shares for capital and labor, which are assumed to be sector-year specific. The term A_{rst}, denoting the Hicks-neutral TFP component, can be written as

$$TFP_{rst} \equiv A_{rst} = \frac{Y_{rst}}{K_{rst}^{\alpha_{st}} L_{rst}^{1-\alpha_{st}}} \tag{2}$$

With its revenue-based equivalent (i.e., TFPR – Revenue Total Factor Productivity) defined as:

$$TFPR_{rst} \equiv P_{rst} A_{rst} = \frac{P_{rst} Y_{rst}}{K_{rst}^{\alpha_{st}} L_{rst}^{1-\alpha_{st}}} \tag{3}$$

where P_{rst} is the average price set at time t by sector s firms located in region r.

Profit maximization yields the economic efficiency condition according to which the MRP of each factor (i.e., capital and labor) equals its cost (ω_{rst}^K, ω_{rst}^L)[6] :

$$MRPK_{ist} \equiv \alpha_{st} \frac{Y_{ist}}{K_{ist}} = \omega_{st}^K \quad \text{and} \quad MRPL_{ist} \equiv (1-\alpha_{st}) \frac{Y_{ist}}{L_{ist}} = \omega_{st}^L. \tag{4}$$

[6]Intuitively, in a frictionless environment, firms expand by attracting additional inputs until their MRPs (given the assumption of decreasing MP) are driven down to the common factor prices. This process continues until no firm can increase profits by adjusting its input bundle, which occurs precisely when $TFPR$ is equalized across firms.

Under the hypothesis that EU factor markets are fully efficient and integrated, EU firms operating in a given sector face the same factor cost, entailing that the sector-year MRP of each factor is the same across EU regions and, as a consequence, equal to its average value (i.e., $MRPL_{rst} = \overline{MRPL}_{st}\ \forall r \in EU$). However, if firm-specific inefficiencies (i.e., wedges) are present, the above first-order conditions yield:

$$MRPK_{rst} = \omega_{st}^{K}(1+\tau_{rst}^{K}) \quad \text{and} \quad MRPL_{rst} = \omega_{st}^{L}(1+\tau_{rst}^{L}) \tag{5}$$

where τ_{rst}^{K} and τ_{rst}^{L} subsume the distortions in capital and labor markets, respectively. Cross-firm and cross-region heterogeneity in these wedges prevents firms/regions from operating under the economic efficiency condition, thereby determining an inefficient allocation of inputs which materializes in terms of MRP dispersion: the larger the dispersion, the larger the inefficiency. In this context, within-EU dispersion in regional MRP can be understood as measuring the extent of market frictions/inefficiencies in EU factor markets, preventing the cross-region allocation from being fully efficient.

Hsieh and Klenow (2009) show that quite standard model assumptions yield proportionality between MRP and $TFPR$. In other words, MRP equalization implies TFPR equalization, entailing that TFPR dispersion can be used, instead of MRP dispersion, to quantify the extent of factor market frictions.[7]

To obtain a region-sector-year TFPR indicator, we refer to Equation (3) using Gross Value Added as the output measure. For capital and labor, we refer to Gross Fixed Capital Formation and Compensation of Employees. We compute the labor share $(1-\alpha_{s,t})$ as the average wage bill to value added ratio within each industry s - year t; the capital share is obtained by complementarity. Since funds are not sector specific, we then aggregate at the regional-year level using the industry's Gross Value Added as a weight to obtain the region-year specific TFPR measure (i.e., $TFPR_{r,t}$). This measure is used to obtain a region-year specific measure of misallocation based on the intuition that, using $\overline{TFPR}_t$ to denote the average across all EU regions, the ratio $TFPR_{r,t}/\overline{TFPR}_t$ can be seen as an indicator of whether, and how much, the region is allocated a too low, or too large, amount of resources. Indeed, $TFPR_{r,t}/\overline{TFPR}_t < 1$ implies that the region is "inefficiently large" and should be allocated less inputs. Conversely, $TFPR_{r,t}/\overline{TFPR}_t > 1$ implies that the region is "inefficiently small" and should be allocated more capital and labor. Draining resources from the former to the latter would allow both regions to restore the economic efficiency condition $TFPR_{r,t}/\overline{TFPR}_t = 1$. Since both cases entail economic inefficiency, we measure the extent of misallocation across regions as the absolute value of the log deviation of regional TFPR from its annual mean:

$$Misallocation_{r,t} = \left| \ln\left(\frac{TFPR_{r,t}}{\overline{TFPR}_t}\right) \right| \tag{6}$$

Under this definition, an increase in misallocation is consistent with different underlying patterns: resources may be flowing into a region that was previously over-allocated or out of a region that was already under-allocated. Both dynamics increase

[7] Concerns about what cross-firms TFPR dispersion actually captures, beyond misallocation *per se*, have been raised by Asker et al. (2014) and Haltiwanger (2016). Indeed, the dispersion of TFPR across firms can actually reflect adjustment costs in factor markets, markup heterogeneity across regions or sectors, or demand-side differences in output markets, none of which necessarily constitute misallocation in the allocative efficiency sense. In our regional framework, these issues are attenuated, although not eliminated, by aggregation. To the extent that these factors vary systematically by geography or income gaps, our TFPR dispersion measure can be interpreted as a proxy for allocative inefficiency, capturing overall dispersion in revenue productivity across regions rather than isolating pure distortions in factor allocation.

$Misallocation_{r,t}$, although implying opposite directions.

Descriptive statistics are reported, for *Misallocation* and *EU Funds*, in Table 1 and, for *GDPpc* and *GDPpc GAP*, in Table 2.

3 Basic facts

In this section we document descriptive facts about GDP dispersion (i.e., σ-convergence), resource misallocation and structural funding across EU regions. Taken together, these facts motivate analyzing whether and how the EU cohesion policy can be thought of to have affected regional income dynamics in Europe in the first two decades of the century, both directly and, indirectly, through its eventual impact on resource misallocation patterns.

Fact 1. Income dispersion across European regions has increased over the period 2000–2022 (i.e., σ-*divergence*).

Figure 1 shows the evolution of the standard deviation of real GDP per-capita across EU regions, with the upward trend pointing to increasing regional disparities over the two decades. To gain intuition on where, along the regional GDP distribution, the increasing dispersion is mostly located, Figure 2 splits the standard deviation across GDP quartiles (taken at the beginning of the period) defining the contribution of each quartile to the overall standard deviation as $\sigma^Y_{qt} = \frac{1}{R_q}\sum_{r\in R_q}(Y_{rt} - \bar{Y}_t)^2$, with $\sigma^Y_t = \frac{1}{R}\sum_{r\in R}(Y_{rt} - \bar{Y}_t)^2 = \sum_{q=1}^4 \sigma^Y_{qt}$, R denoting the whole set of EU regions and R_q referring to the subset of regions belonging to quartile q. Regions in higher quartiles feature lower GDP per capita. While the drop around 2020 mainly reflects the exit of UK regions (with a stronger mechanical effect in the first and fourth quartiles), the rising dispersion is a broad feature of the regional distribution. However, a minor contribution to the overall increase is exerted by the last quartile, that is by the regions located furthest away form the frontier.

Fact 2. TFPR dispersion across European regions (i.e., *regional misallocation*) has increased over the period 2000–2022.

Figure 3 shows that regional misallocation increased after the 2008 financial crisis and remained quite high for much of the following decade. This might suggest that allocative distortions may be part of the mechanism behind σ-divergence. Indeed, the pattern suggests that the rise in income dispersion occurred together with a deterioration in the allocation of resources across regions.

Similarly to Figure 1, Figure 2 splits the TFPR standard deviation across GDP quartiles, defined as above. The contribution of each quartile to the overall misallocation is defined as $\sigma^{TFPR}_{qt} = \frac{1}{R_q}\sum_{r\in R_q}(TFPR_{rt} - \overline{TFPR}_t)^2$, with $\sigma^{TFPR}_t = \frac{1}{R}\sum_{r\in R}(TFPR_{rt} - \overline{TFPR}_t)^2 = \sum_{q=1}^4 \sigma^{TFPR}_{qt}$. The largest contribution stems from legging regions.

Fact 3. EU regional funding expanded over the period 2000–2022.

The aggregate evolution of EU structural funds is reported in Figure 5. Transfers increase over time, with fluctuations reflecting the multi-annual programming structure

of EU financial frameworks. Peaks in total funding are visible around 2013 and 2020, reflecting the acceleration of expenditure toward the end of EU programming cycles. The decline observed around 2016 is consistent with the administrative transition between the 2007–2013 and 2014–2020 programming periods: the early implementation of the new cycle was slow, partly because Member States were still closing programmes from the previous period and absorbing remaining funds. Figure 6 shows that the expansion is not uniform across the income-gap distribution. While the trend is positive in the first and last quartiles, most part of the funding, in terms of magnitude, is directed towards lagging behind regions.

Taken together, facts 1 to 3 suggest that the effect of funds on convergence may depend not only on the amount of resources transferred, but also on how those resources affect allocative efficiency.

The next section therefore moves beyond descriptive evidence and estimates these relationships formally, in particular by decomposing the potential effect of funds into a direct channel and an indirect channel operating through allocative (in)efficiency. This allows us to assess whether cohesion policy operates only through its intended effect on regional income gaps, or also through its impact on the efficiency with which productive resources are allocated across European regions.

4 Analysis

This section studies whether EU Structural Funds affect regional convergence directly and indirectly through their impact on allocative efficiency.

To account for the joint determination of transfers, misallocation, and convergence, we estimate the following system of equations:

$$\begin{aligned} \mathit{Misallocation}_{r,t-1} &= \rho_0 + \beta_1 \mathit{EU\ Funds}_{r,t-2} + \delta \mathit{GDPpc}_{r,t-2} + \lambda_r + \lambda_t + \varepsilon_{r,t-1} \\ \mathit{GDPpc\ GAP}_{r,t} &= \rho_1 + \gamma \mathit{Misallocation}_{r,t-1} + \beta_2 \mathit{EU\ Funds}_{r,t-1} + \lambda_r + \lambda_t + u_{r,t} \end{aligned} \tag{7}$$

where region and year fixed effects are denoted by λ_r and λ_t, respectively, and all variables are expressed in logarithms.

The timing in the system of equations is intended to capture a sequential transmission from transfers to allocation and, subsequently, to convergence outcomes. Indeed, the lag structure reflects institutional programming cycles and the gradual adjustment of production structures. More specifically, EU funds enter the misallocation equation with a two-period lag, $t-2$, to reflect the time required for allocated resources to be absorbed and translated into changes in factor allocation. Given the multi-annual nature of EU programming cycles and the gradual implementation of funded projects, the effects of transfers on production structures are unlikely to materialize contemporaneously. Misallocation, in turn, enters the convergence equation with a one-period lag, $t-1$, as allocative distortions affect income per capita through aggregate productivity, a mechanism that operates gradually as firms and regions adjust their input use.

Misallocation appears both as an outcome and as a regressor, creating simultaneity and cross-equation correlation in the disturbances. For this reason, the system is estimated using a Three-Stage Least Squares (3SLS) approach, which jointly instruments endogenous regressors and exploits cross-equation covariance to improve efficiency relative to equation-by-equation IV estimation.

Following the quasi-experimental framework by Becker et al. (2010), identification exploits the institutional assignment rule governing Objective 1 status from the 2007–2013 programming period onward. Under EU Cohesion Policy, NUTS-2 regions whose GDP per-capita falls below 75% of the EU average qualify for preferential access to structural funds during the subsequent programming period. Because the threshold is centrally defined and based on pre-determined income conditions, it generates quasi-exogenous variation in access to EU funds across regions and programming cycles. For this reason, we map the sample into five programming periods: 1995–1999, 2000–2006, 2007–2013, 2014–2020, and 2021–2027. For each region r and programming period p, we construct a binary indicator $Eligibility_{r,p}$, which is constant within each period and captures whether the region qualifies for preferential treatment, under the institutional rule, on the basis of pre-program income conditions. Specifically, for each region r, and period p, we compute the average $GDPpc$ of the region and of the EU as a whole over a reference window preceding the start of the programming period. Let $\mathcal{T}_p$ denote the corresponding pre-program years, we define:

$$\overline{GDPpc}_r^{pre,p} = \frac{1}{|\mathcal{T}_p|} \sum_{t \in \mathcal{T}_p} GDPpc_{r,t}, \qquad \overline{GDPpc}_{EU}^{pre,p} = \frac{1}{|\mathcal{T}_p|} \sum_{t \in \mathcal{T}_p} GDPpc_{EU,t} \tag{8}$$

The eligibility is then given by:

$$Eligibility_{r,p} = \mathbf{1}\left\{\overline{GDPpc}_r^{pre,p} < 0.75\, \overline{GDPpc}_{EU}^{pre,p}\right\} \tag{9}$$

The reference windows mirror the institutional assignment rule: 1997–1999 for the 2000–2006 period, 2004–2006 for 2007–2013, 2011–2013 for 2014–2020, and 2018–2020 for 2021–2027. For the initial 1995–1999 period, for which no three-year pre-window is available, eligibility is determined using GDP per-capita in 1997.

A potential concern is that eligibility is defined in terms of GDP per-capita relative to the EU average and is therefore mechanically related to the convergence outcome in the second equation of the system. Two considerations mitigate this concern. First, eligibility is determined using income conditions observed before the start of the relevant programming period, so it does not respond to contemporaneous shocks to convergence outcomes within the period. Second, the empirical specification includes region and year fixed effects, so identification relies on variation in access to EU funds induced by the institutional threshold across regions and programming cycles, rather than on persistent cross-sectional income differences per se. Accordingly, the exclusion restriction requires that, conditional on fixed effects and the lag structure, eligibility affects subsequent GDP per-capita gaps only through its impact on EU fund allocation. While this assumption cannot be tested directly, it follows the identification strategy in Becker et al. (2010) and is supported by the institutional nature of the assignment rule. Although eligibility confers preferential access to funding, actual transfers vary continuously and are not mechanically fixed by the rule. The assignment therefore induces a discrete increase in the expected intensity of EU transfers without perfectly determining funding levels.

We exploit this institutional variation by using $Eligibility_{r,p}$ as an instrument for European funds in the first-stage equation:

$$EUFunds_{r,t} = \rho_0 + \rho_1\, Eligibility_{r\,p(t)} + \lambda_r + \lambda_t + \nu_{r,t} \tag{10}$$

In the second stage, predicted EU funds replace actual transfers in both the misallocation and $GDPpc$ equations. Within the 3SLS framework, the eligibility indicator instruments

lagged EU funds, allowing us to identify both the *direct effect* of EU funds on *GDPpc GAP* (β_2) and the *indirect effect* operating through misallocation ($\beta_1 \times \gamma$).

Table 3 reports benchmark 3SLS estimates, using the EU eligibility rule as an instrument for structural funds, both in the full set of EU regions (Column 1) and by quartile of the income-gap distribution (Columns 2 to 5).

Overall, EU funds increase regional misallocation, and misallocation increases the GDP per-capita gap. At the same time, EU funds have a direct negative effect on the gap. Hence, transfers promote convergence directly, coherently with Puigcerver-Peñalver (2007); Becker et al. (2010, 2018); Crucitti et al. (2024), but they also generate an indirect divergence force by increasing allocative distortions, consistent with Jin (2018); Chen et al. (2022); Rizov et al. (2013); Morando and Newman (2022).

The aggregate result is therefore straightforward: EU funds reduce income gaps as a direct effect; however, part of this effect is lost because funds also increase misallocation, which in turn reduces regional GDP. This contributes to explaining the inconclusive evidence on the relationship between regional funding and regional convergence in EU.

Table 4 quantifies these mechanisms by decomposing the effect of EU funds into a direct component –coefficient β_2 in (7)–, an indirect component operating through misallocation –the product of coefficients β_1 and γ in (7)–, and a total effect (the algebraic sum of the two). Coefficients are expressed as the effect of a one percent increase in misallocation on the GDP per-capita gap, in thousand euros. In the full sample, the direct effect is negative and statistically significant, equal to -26.64, while the indirect effect is positive and statistically significant, equal to 22.52. The total effect remains negative, equal to -4.12, but it is much smaller than the direct effect. The misallocation channel offsets about 84.5% of the direct convergence effect of EU funds. This is a strong result: structural transfers promote convergence on average, but their direct effect is mostly absorbed by the allocative distortions they generate.

The quartile estimates in columns 2 to 5 show that this mechanism is strongly heterogeneous along the GDP gap distribution. While the distortionary effect of transfers (i.e., increasing misallocation) appears across most of the distribution (with the exception of the last quartile), the GDP gap increasing effect of such distortions (i.e., the estimated coefficient of $Misallocation_{r,t-1}$) is concentrated in quartiles 3 and 4. In this part of the distribution, misallocation directly reinforces divergence by reducing the capacity of poorer regions to close the distance to the frontier. On the contrary, in the quartiles closer to the frontier (Q1 and Q2), misallocation reduces, on average, the regional GDP gap with respect to frontier regions. Moreover, and somewhat surprisingly, in this part of the distribution, structural transfers are found to widen the average GDP gap, entailing a negative, rather than positive, effect on σ-convergence.

The direct effect of EU funds on the GDPpc gap can be interpreted through a Solow-type logic. In regions closer to the frontier (Q1 and Q2), capital scarcity is less binding and the relevant margin is productivity: when funds allow relatively richer regions to generate productivity improvements, they move further ahead in terms of TFP; if frontier regions take more advantage of this mechanism, the measured gap increases. This is what the positive coefficients in Q1 and Q2 indicate: funds are associated with a widening of gaps because the productivity response of richer regions dominates. This also explains the gap-increasing direct effect in Q1 and Q2: the richer the region, the more the TFP channel dominates the capital-deepening channel, so that funds are associated with stronger productivity performance and widening average gaps with respect to frontier regions. By

contrast, in Q3, where regions are sufficiently far from the frontier for accumulation constraints to matter, funds reduce the gap. Here the Solow-type capital-deepening channel dominates: transfers relax investment constraints and support convergence. In Q4, the direct effect is not statistically robust, suggesting that among the most distant regions funds are not sufficient to generate a clear convergence effect.

The magnitude of the implied direct and indirect effect along the quartile decomposition (see Table 4) clarifies this offsetting mechanism. In Q1 and Q2, the direct effect of funds is positive (110.78 and 121.61, respectively) while the indirect effect is negative (-50.35 in Q1 and -70.01 in Q2). The compensation is sizeable: the indirect channel offsets around 45.5% and 57.6% of the direct effect in Q1 and Q2, respectively. Differently from the overall result, the total effect here remains positive and statistically significant: among regions closer to the frontier, EU funds are associated with larger GDPpc gaps even after accounting for the offsetting misallocation channel.

The pattern changes in Q3. Here, the direct effect of EU funds is negative and statistically significant (-33.70), while the indirect effect is positive and statistically significant (22.10). Q3 is therefore the part of the distribution where funds have the clearest direct convergence-enhancing effect. In this part of the distribution, the Solow-type accumulation channel dominates: transfers reduce the distance from the frontier by supporting capital deepening and convergence. However, funds also increase misallocation, and because Q3 regions are farther from the frontier, the GDP-reducing effect of misallocation increases their gap. The indirect channel therefore works against σ-convergence and offsets about 65.6% of the direct gain. The total effect remains negative and statistically significant, equal to -11.60.

In Q4, neither the direct nor the total effect is statistically robust. This indicates that, among the most distant regions, structural transfers do not generate a statistically clear convergence effect. The interpretation is that these regions are likely too structurally weak for transfers alone to translate into a measurable reduction in the income gap. Even if funds may support investment, their effect is not strong enough to dominate the deeper constraints that characterize the bottom of the distribution.

To understand how the estimated effect of misallocation on the GDP gaps entails a σ-divergence pattern, Figure 7 adds the estimated effect of misallocation on $GDP_{pc}GAP$ (i.e., the coefficient of $Misallocation_{r,t-1}$ in Table 3 divided by 100) to the quartile-specific average $GDP_{pc}GAP$. The figure highlights how misallocation results into a wider difference between the average GDP gap in Q4 and the average GDP gap in Q1, entailing higher GDP dispersion.

This evidence helps reconcile the mixed evidence on cohesion policy. The negative direct effect is consistent with studies documenting positive effects of Structural Funds on regional performance Puigcerver-Peñalver (2007); Becker et al. (2010, 2018); Crucitti et al. (2024). The positive indirect effect through misallocation provides a mechanism through which these gains can be reduced, consistent with contributions finding weak, null, or negative effects of cohesion policy Boldrin and Canova (2001); Dall'Erba and Le Gallo (2008); Esposti and Bussoletti (2008).

5 Robustness checks

We assess the robustness of the baseline results along a number of dimensions.

Table 5 estimates the benchmark 3SLS specification separately for Northern, South-

ern, and Eastern Europe[8] showing that the main result is not driven by specific macroregional patterns, although some quantitative differences emerge. In particular, the effect of funds on misallocation is largest in Southern Europe, while the effect of misallocation on the GDPpc gap is stronger in Northern and Eastern Europe. The direct convergence effect of funds is strongest in Eastern Europe and weaker in Southern Europe. In Southern Europe, funds generate the strongest increase in misallocation.

Table 6 reports panel fixed-effects estimates for the two equations, separately estimated. Results are broadly consistent with the system-based 3SLS mechanism. The only difference is a weaker effect of misallocation on the GDPpc gap. This is expected, because the panel specification does not jointly estimate the two-equation transmission mechanism and does not exploit the same system structure.

As a further check, we restrict the treatment variable to Cohesion Fund and ERDF resources. Tables 7 and 8 confirm that the main mechanism is not driven by the broader definition of EU funds.

To assess whether the quartile-specific results are driven by individual countries, we perform a leave-one-country-out exercise by sequentially excluding a country from the sample and re-estimating the 3SLS system. For each exclusion, we retain the coefficient of $Misallocation_{r,t-1}$ in each quartile. Figure 8 reports the resulting estimates. As in Table 4, coefficients can be interpreted as the effect of a one percent increase in misallocation on the GDP per-capita gap, expressed in thousand euros. The dashed horizontal lines report the corresponding full-sample estimates. Robustness is strong with some minor differences, not in direction but in the magnitude of the effect of misallocation on gap in Q1 in Denmark, Q3 in Greece and Q4 in Malta and Romania.

Finally, to check whether the quartile-specific results are driven by specific aggregate shocks, or subperiods, we re-estimate the quartile-specific 3SLS system after excluding, in turn, the global financial crisis years (2008-2009), the COVID period (2020-2021), late (2020-2022) and early (2000-2004) years, and all crisis years jointly (2008-2009 and 2020-2021). Figure 9 reports the resulting estimates for the coefficient of lagged misallocation in the GDP per-capita gap equation. The period-exclusion exercise confirms the robustness of the main distributional pattern. The second quartile proves slightly more sensitive to the exclusion of crisis periods.

6 Conclusions

We studied how structural transfers impact regional income disparities both directly and, indirectly, by affecting regional misallocation dynamics.

Using a harmonized panel of 2000–2022 regional data, covering 26 EU countries, we estimated a simultaneous equations model in which misallocation depends on transfers, while GDP per-capita gaps depend on both misallocation and transfers. The model is estimated by Three-Stage Least Squares (3SLS) with region and year fixed effects. Identification relies on eligibility thresholds for cohesion funding Becker et al. (2010).

The analysis shows that, while EU funds reduce GDP dispersion (i.e., foster σ-convergence) through the direct channel, part of the effect is lost because funds also increase misallocation, which in turn reduces the GDP of lagging behind regions more

[8]Countries are aggregated into macro-regions as follows. Northern Europe: AT, BE, FR, DE, SE, LU, NL, FI, DK, UK; Southern Europe: ES, IT, PT, CY, MT, EL; Eastern Europe: PL, CZ, SK, HU, RO, BG, EE, LV, SI, LT.

than that of frontier regions. The magnitude of this indirect channel is sizable, as it is found to absorb about 85% of the direct, convergence-enhancing, effect.

Estimates carried out by quartiles of the GDP gap show that the above mechanism is strongly heterogeneous along the GDP distribution. While the distortionary effect of transfers (i.e., increasing misallocation) appears across most of the distribution, the gap-increasing effect of such distortions is concentrated in regions with an above the median income gap. In these regions, a (Solow-type) accumulation channel dominates: transfers reduce income gaps by fostering factor accumulation, as a direct effect. However, since funds also increase misallocation, and the costs associated with economic inefficiency are higher the farther away the region is from the GDP frontier, the indirect channel works against σ-convergence, offsetting about 65.6% of the direct gain.

On the contrary, factor scarcity is less binding in richer regions, where the dominant margin is productivity: when funds allow relatively richer regions to generate productivity improvements, they move further ahead in terms of TFP: if frontier regions take more advantage of this mechanism (i.e., if the productivity response of richer regions dominates), the direct effect widens the gap while the indirect effect turns convergence-enhancing. As a result, in regions with a below-the-median GDP gap, the compensation (in terms of percentage of the direct effect offset by the indirect channel) offsets between 45.5% and 57.6% of the "divergence-enhancing" direct effect.

These findings help rationalize the evidence of aggregate σ-divergence characterizing the EU regional income dynamics during the first two decades of the 2000s, despite the sizeable increase in structural transfers. The main policy implication is that the effect of cohesion policy on income dynamics should be understood not only in terms of amount of resources, but also taking into account how transfers affect factor allocation across regions. In the presence of misallocation, structural funds are more likely to promote convergence when they relax factor accumulation constraints than when they translate into productivity growth. Improving the allocation of cohesion spending is therefore central to strengthening its long-run impact on regional disparities.

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Figure 1: σ-convergence across EU regions (standard deviation of *real GDP per-capita*).



Figure 2: Contribution to σ-*convergence* by GDP per capita quartiles.



Notes: Quartiles numbered in ascending order of GDP gap.

Figure 3: Standard deviation of TFPR (i.e., *Misallocation*).

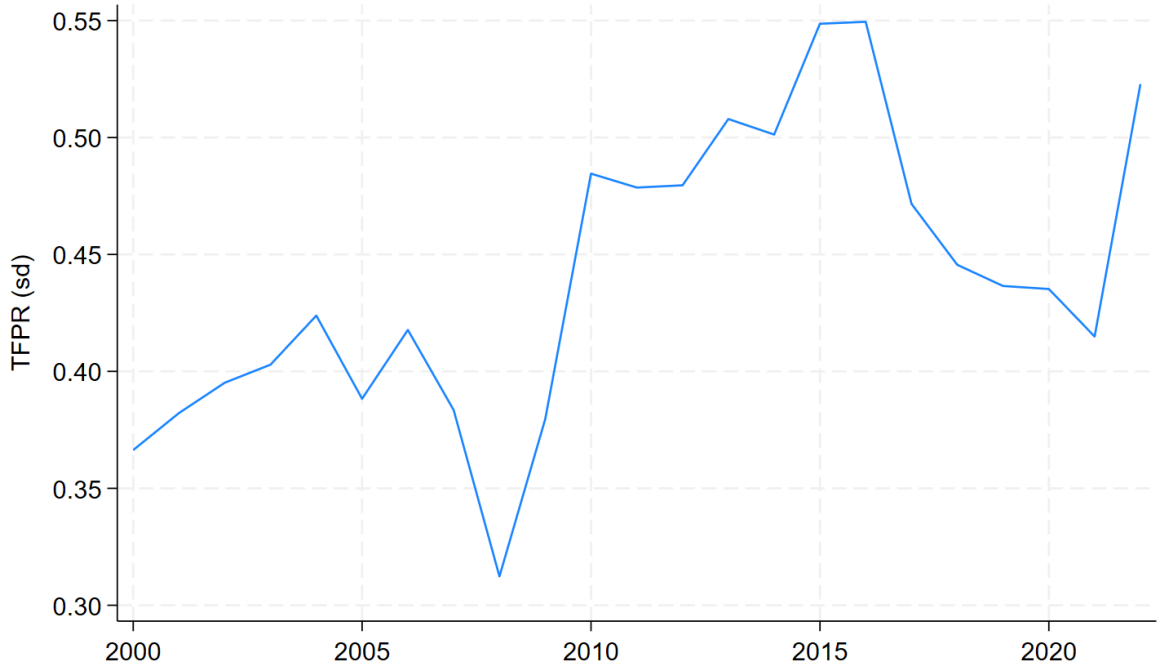


Figure 4: Standard deviation of TFPR (i.e., *Misallocation*) by GDP per capita quartiles.



Notes: Quartiles numbered in ascending order of GDP gap.

Figure 5: Evolution of EU Structural funds.

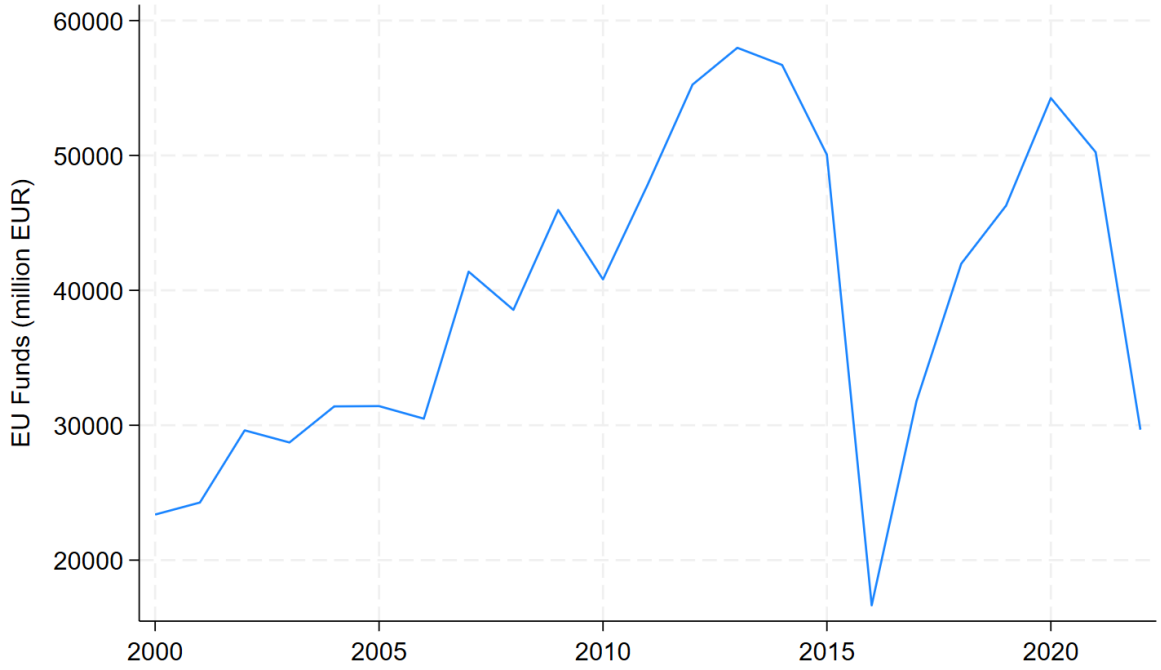
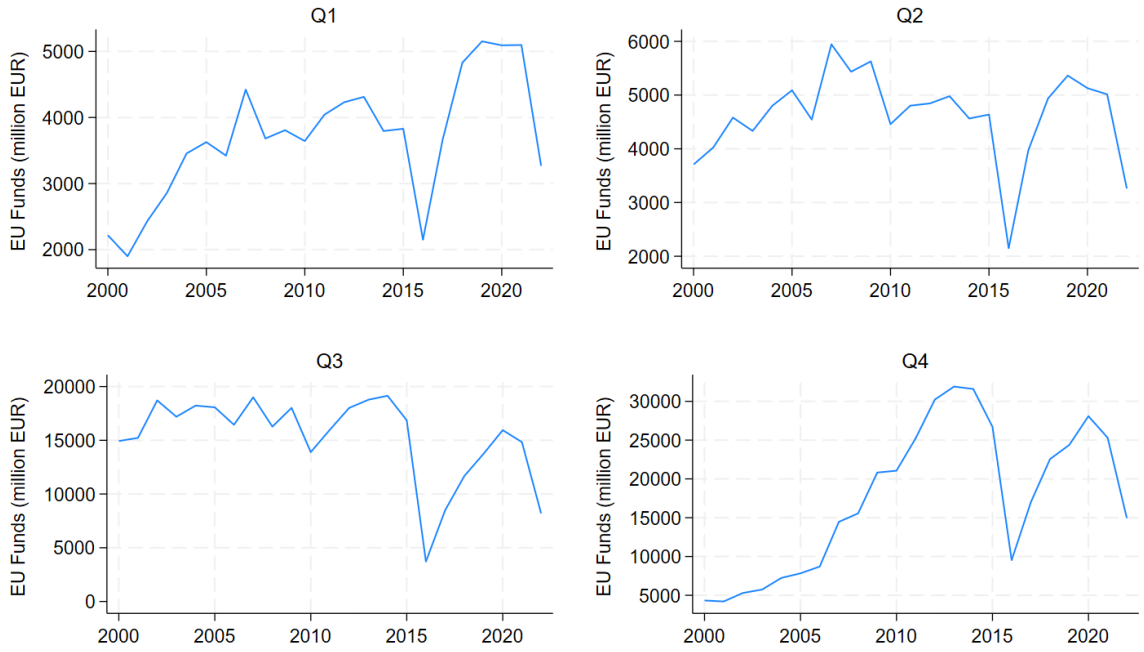
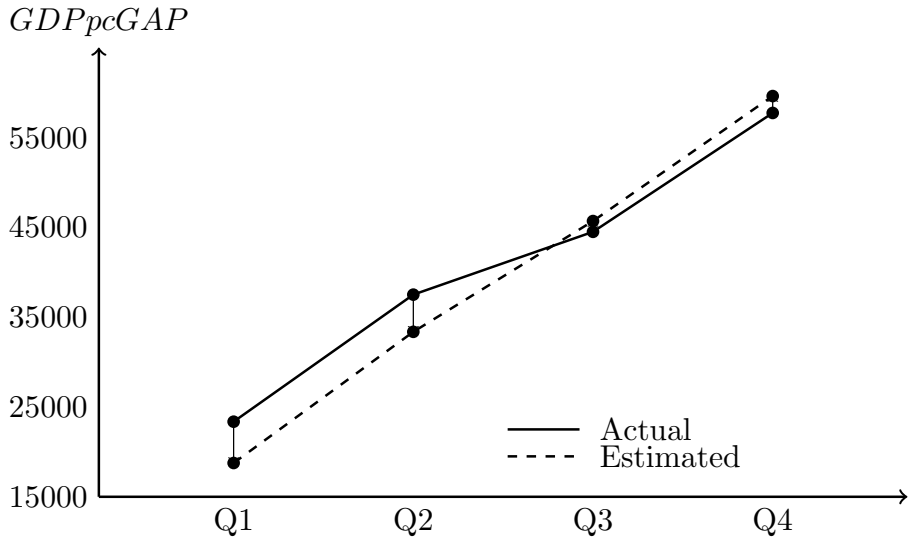


Figure 6: Evolution of EU Structural funds by GDP per capita quartiles.



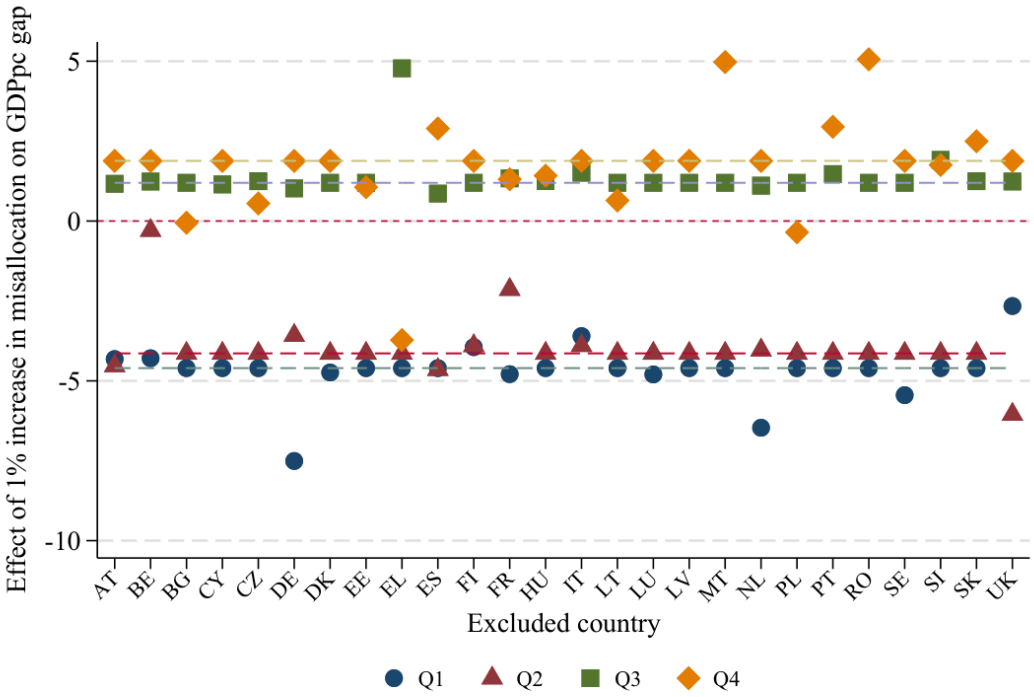
Notes: Quartiles numbered in ascending order of GDP gap.

Figure 7: Estimated effect of misallocation on GDP per capita gaps along the quartiles of the distribution (average values, EUR).



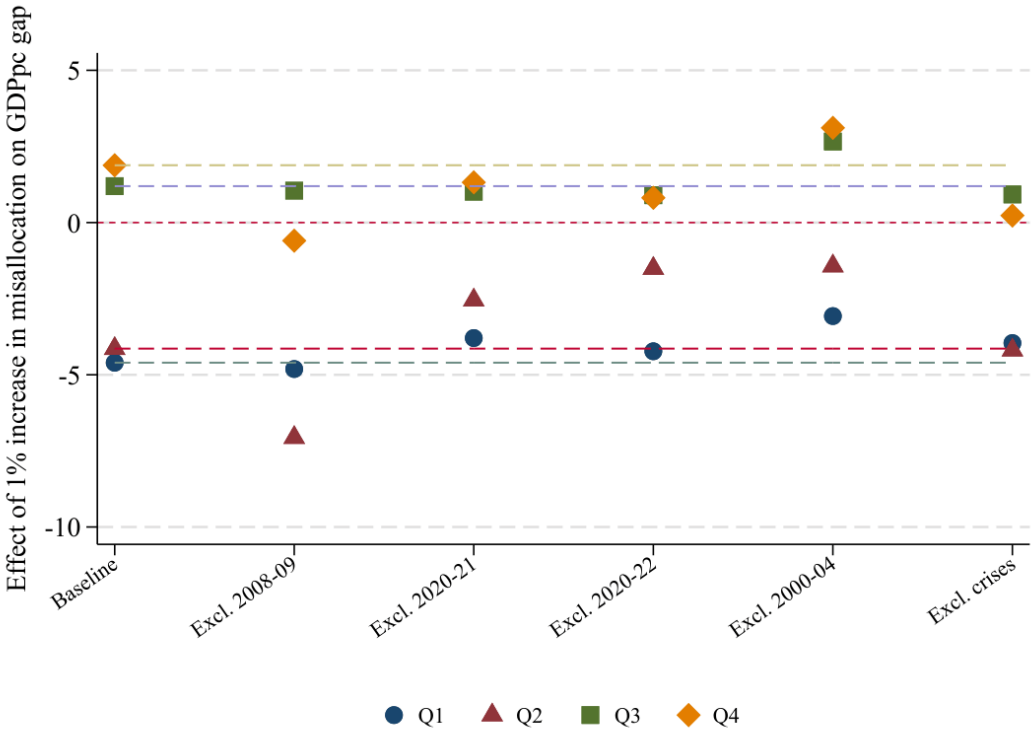
Notes: The thick line connects actual quartile averages of $GDP_{pc}GAP$. The dashed line refers to the corresponding predicted averages obatained by adding the estimated effect of misallocation on $GDP_{pc}GAP$ (i.e., the coefficient of $Misallocation_{r,t-1}$ in Table 3 divided by 100).

Figure 8: Leave-one-country-out estimates by quartile.



Notes: The figure reports "leave-one-country-out" estimates of coefficient γ in Equation (7) –i.e., the coefficient of $Misallocation_{r,t-1}$ in Table 3 estimated, by quartile, excluding one country at a time and divided by 100,000. Reported values can be interpreted as the effect of a 0.01-unit increase in $Misallocation_{r,t-1}$ on the regional GDP per-capita gap, expressed in thousand euros. The dashed horizontal lines report the full-sample baseline estimates for each quartile (as reported in Table 3).

Figure 9: Period-exclusion robustness by quartile.



Notes: The figure reports "leave-one-period-out" estimates of coefficient γ in Equation (7) –i.e., the coefficient of $Misallocation_{r,t-1}$ in Table 3 estimated, by quartile, excluding, in turn: the global financial crisis years (2008-2009), the COVID period (2020-2021), late (2020-2022) and early (2000-2004) years, crisis years jointly (2008-2009 and 2020-2021). Obtained values are divided by 100,000 so that they can be interpreted as the effect of a 0.01-unit increase in $Misallocation_{r,t-1}$ on the regional GDP per-capita gap, expressed in thousand euros. The dashed horizontal lines report the full-sample baseline estimates for each quartile (as reported in Table 3).

Table 1: Descriptive Statistics for Misallocation and EU Funds by Country

		Misallocation (eq. (6))				EU Funds (mln EUR)			
Country	Code	P25	Mean	P75	SD	P25	Mean	P75	SD
Austria	AT	0.05	0.09	0.13	0.05	28.45	60.94	79.46	46.06
Belgium	BE	0.08	0.13	0.19	0.07	13.26	28.36	32.19	27.10
Bulgaria	BG	0.06	0.16	0.25	0.12	19.90	117.36	176.28	102.77
Cyprus	CY	0.03	0.09	0.14	0.08	16.05	73.36	113.65	53.15
Czechia	CZ	0.06	0.10	0.14	0.06	62.69	261.99	412.74	210.06
Germany	DE	0.03	0.08	0.11	0.06	33.62	106.33	104.41	135.17
Denmark	DK	0.09	0.12	0.16	0.05	16.24	25.15	32.74	11.25
Estonia	EE	0.13	0.18	0.23	0.08	176.00	390.43	631.22	251.96
Greece	EL	0.09	0.20	0.30	0.14	58.67	193.08	270.13	189.78
Spain	ES	0.05	0.12	0.17	0.08	58.11	312.01	395.41	371.86
Finland	FI	0.08	0.12	0.17	0.06	51.02	90.98	140.14	71.30
France	FR	0.08	0.12	0.15	0.05	63.66	106.59	133.33	59.15
Hungary	HU	0.07	0.13	0.19	0.09	73.77	290.67	427.53	226.57
Italy	IT	0.04	0.10	0.15	0.08	52.19	230.02	234.61	300.70
Lithuania	LT	0.04	0.07	0.10	0.03	152.43	379.44	628.25	243.07
Luxembourg	LU	0.17	0.22	0.27	0.07	13.56	20.80	24.53	11.64
Latvia	LV	0.05	0.11	0.16	0.09	299.09	507.37	768.25	296.99
Malta	MT	0.04	0.09	0.11	0.06	16.35	69.92	108.17	56.21
Netherlands	NL	0.07	0.13	0.16	0.11	12.89	25.12	35.43	15.37
Poland	PL	0.04	0.10	0.14	0.07	115.71	423.14	654.39	353.38
Portugal	PT	0.06	0.14	0.17	0.11	169.25	463.70	700.89	414.07
Romania	RO	0.11	0.23	0.34	0.13	28.51	253.76	407.18	207.92
Sweden	SE	0.05	0.09	0.13	0.06	31.21	50.40	66.58	24.18
Slovenia	SI	0.04	0.09	0.13	0.06	0.00	124.86	253.62	162.67
Slovakia	SK	0.10	0.17	0.24	0.11	90.68	269.06	446.23	210.26
United Kingdom	UK	0.03	0.06	0.09	0.03	26.30	56.27	63.95	60.36
Avg		0.05	0.11	0.15	0.09	31.15	160.35	183.89	230.71

Table 2: Descriptive Statistics for Misallocation and EU Funds by Country.

	Real GDP per-capita (EUR)				GDP per-capita GAP (EUR)			
	P25	Mean	P75	SD	P25	Mean	P75	SD
AT	32572	38131	43430	7277	27550.81	32806.46	39535.38	8739.82
BE	25093	34519	38384	12847	33099.31	36418.32	46077.38	13918.60
BG	3836	5305	5805	2308	63262.81	65631.80	69958.50	6112.00
CY	21275	23197	24688	2220	45794.81	47739.89	54199.25	6702.65
CZ	11510	15169	14764	7254	55473.19	55768.06	61590.91	9009.23
DE	28246	34047	37986	8367	32438.44	36889.89	43888.94	9781.00
DK	38265	43908	46186	9644	15223.88	27029.53	33536.44	11232.23
EE	12854	14754	17369	2972	56619.94	56182.81	59072.50	6153.54
EL	13179	16019	18278	3662	49545.56	54918.39	60247.44	6749.00
ES	19243	22780	26404	4483	42972.81	48156.81	53655.44	7085.52
FI	33765	39976	47901	8163	22615.44	30961.00	39082.94	9609.12
FR	24665	26444	28726	7470	40707.94	44493.51	49521.94	9247.31
HU	6908	11888	10729	8928	52322.15	59049.55	66267.38	10622.57
IT	21059	28591	34060	7680	35182.38	42345.77	49238.12	9654.07
LT	20431	25962	32006	7371	45959.06	44975.55	49526.31	8980.11
LU	91227	94097	96755	4662	-23798.06	-23159.67	-19528.18	6271.25
LV	9109	10707	12970	2646	60250.94	60229.89	63212.88	6037.29
MT	16336	20477	25088	4519	51376.38	50459.89	53621.31	7273.61
NL	30081	37014	43475	8210	25977.94	33923.04	41349.66	9869.98
PL	7047	9639	11037	4000	60496.81	61298.38	65641.50	6963.17
PT	15226	17444	18325	3184	50029.56	53492.70	58697.81	6500.34
RO	5644	7755	7554	4672	61093.97	63182.35	67590.72	7362.32
SE	36992	41694	42381	8164	29341.34	29243.25	35531.56	9716.40
SI	15391	18980	22252	4146	48806.94	51956.94	56840.94	6969.70
SK	9072	15574	17594	9526	45627.27	55363.18	63398.62	10734.68
UK	30334	42569	38362	39639	34331.81	30025.04	42756.59	39598.02
Avg	17106	27906	34696	19410	35972.62	43227.16	53667.94	19923.69

Table 3: Benchmark results.

	(1) Overall	(2) Q1	(3) Q2	(4) Q3	(5) Q4
Dependent variable: $Misallocation_{r,t-1}$					
EU $Funds_{r,t-2}$	0.0102***	0.0109***	0.0169***	0.0185***	-0.00313
	(0.00127)	(0.00326)	(0.00294)	(0.00300)	(0.00331)
$GDP_{r,t-2}$	-0.0637***	0.114***	0.0630***	-0.162***	-0.0542**
	(0.0105)	(0.0291)	(0.0112)	(0.0236)	(0.0236)
Constant	0.749***	-1.035***	-0.510***	1.763***	0.535***
	(0.109)	(0.314)	(0.120)	(0.241)	(0.199)
Dependent variable: *GDPpc GAP*$_{r,t}$					
$Misallocation_{r,t-1}$	221317.9***	-460195.3***	-414176.2***	119543.2***	188161.3***
	(56394.0)	(126207.0)	(53866.0)	(29325.4)	(42387.1)
EU $Funds_{r,t-1}$	-2664.2***	11077.8***	12160.9***	-3370.0***	142.4
	(698.8)	(4136.6)	(2797.7)	(896.9)	(618.9)
Constant	18423.0**	127684.9***	100620.0***	22982.0***	43952.3***
	(7236.2)	(32105.6)	(11591.4)	(5120.8)	(6691.0)
Observations	5516	1454	1426	1425	1211
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes

Three-Stage Least Squares (3SLS) estimates of Equation (7) using the EU eligibility rule as an instrument for EU Funds. All variables in logs except *GDPpc GAP*.

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Direct, indirect, and total effect of EU transfers on GDP per capita gaps: overall and by quartile (average values, EUR).

Effect	Overall	Q1	Q2	Q3	Q4
Direct	-26.64***	110.78***	121.61***	-33.70***	1.42
	(6.99)	(41.37)	(27.98)	(8.97)	(6.19)
Indirect	22.52***	-50.35**	-70.01***	22.10***	-5.89
	(5.06)	(21.94)	(19.11)	(5.67)	(6.98)
Total	-4.12*	60.43***	51.60***	-11.60***	-4.47
	(2.50)	(19.81)	(9.49)	(3.54)	(5.65)

Marginal effects of a 1% increase in EU Funds on *GDPpc GAP* associated to the benchmark estimates reported in Table 3. Values are expressed in Euros.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Table 5: Robustness: estimation by macro-region.

	(1) North	(2) South	(3) East
Dependent variable: $Misallocation_{r,t-1}$			
EU $Funds_{r,t-2}$	0.00969***	0.0249***	0.0135**
	(0.00189)	(0.00416)	(0.00544)
$GDPpc_{r,t-2}$	-0.0716***	-0.313***	-0.0978***
	(0.00369)	(0.0359)	(0.00548)
Constant	0.827***	3.305***	0.992***
	(0.0424)	(0.361)	(0.0674)
Dependent variable: $GDPpc\ GAP_{r,t}$			
$Misallocation_{r,t-1}$	395991.7***	50747.2***	434878.8***
	(153251.8)	(5764.7)	(35565.0)
EU $Funds_{r,t-1}$	-6347.9**	-1948.9***	-15030.6***
	(3177.9)	(339.2)	(2690.8)
Contant	-3118.0	33584.7***	-76474.7***
	(21116.0)	(1760.2)	(20599.5)
Observations	3212	1308	996
Region FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Three-Stage Least Squares (3SLS) estimates of Equation (7) using the EU eligibility rule as an instrument for EU Funds. All variables in logs except *GDPpc GAP*.

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Robustness: fixed-effects estimates.

	(1) Overall	(2) Q1	(3) Q2	(4) Q3	(5) Q4
Dependent variable: $Misallocation_{r,t-1}$					
EU $Funds_{r,t-2}$	0.00913***	0.0109***	0.0170***	0.0188***	0.00533
	(0.00137)	(0.00337)	(0.00305)	(0.00313)	(0.00363)
$GDPpc_{r,t-2}$	-0.0579***	0.114***	0.0687***	-0.144***	-0.0893***
	(0.0119)	(0.0301)	(0.0250)	(0.0288)	(0.0249)
Constant	0.719***	-1.084***	-0.565**	1.603***	0.978***
	(0.122)	(0.322)	(0.259)	(0.291)	(0.231)
Observations	5528	1454	1426	1430	1218
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.424	0.517	0.434	0.343	0.373
Dependent variable: *GDPpc GAP*$_{r,t}$					
EU $Funds_{r,t-1}$	-371.1***	303.8	-369.0***	-669.9***	-640.2***
	(48.82)	(269.3)	(98.41)	(69.26)	(57.42)
$Misallocation_{r,t-1}$	1543.2***	728.1	-1741.7**	3013.4***	2146.6***
	(555.6)	(2165.1)	(871.0)	(603.2)	(518.9)
Constant	41251.6***	25812.0***	39392.2***	45541.3***	58528.1***
	(151.2)	(944.1)	(323.2)	(173.7)	(141.6)
Observations	5778	1522	1493	1493	1270
Region FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
R^2	0.982	0.976	0.936	0.951	0.956

Independent panel-FE estimates carried out separately for the two equations of Equation (7). All variables in logs except *GDPpc GAP*.

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Robustness: analysis including CF and ERDF transfers only.

	(1) Overall	(2) Q1	(3) Q2	(4) Q3	(5) Q4
Dependent variable: $Misallocation_{r,t-1}$					
EU $Funds_{r,t-2}$	0.00706***	0.00385*	0.0103***	0.0108***	-0.00636**
	(0.00104)	(0.00203)	(0.00204)	(0.00260)	(0.00324)
$GDPpc_{r,t-2}$	-0.0591***	0.117***	0.134***	-0.117***	-0.0709***
	(0.00785)	(0.0290)	(0.00787)	(0.0284)	(0.0236)
Constant	0.692***	-1.098***	-1.251***	1.294***	0.659***
	(0.0815)	(0.311)	(0.0841)	(0.288)	(0.199)
Dependent variable: $GDPpc\ GAP_{r,t}$					
$Misallocation_{r,t-1}$	211859.5***	-420828.4***	-164611.7***	168001.5***	164032.5***
	(59152.0)	(106716.0)	(14528.6)	(37575.8)	(44449.0)
EU $Funds_{r,t-1}$	-1841.7***	3085.0*	2947.7***	-2959.1***	1179.2*
	(617.4)	(1678.0)	(762.1)	(818.6)	(627.2)
Constant	22102.6***	94774.0***	63224.9***	20066.5***	51620.6***
	(7634.3)	(20752.8)	(4244.4)	(5875.7)	(6941.4)
Observations	5477	1430	1414	1422	1211
Region Fe	Yes	Yes	Yes	Yes	Yes
Year Fe	Yes	Yes	Yes	Yes	Yes

Three-Stage Least Squares (3SLS) estimates of Equation (7) using the EU eligibility rule as an instrument for EU Funds. All variables in logs except *GDPpc GAP*.

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Robustness: direct, indirect, and total effect of CF and ERDF transfers on GDP per capita gaps : overall and by quartile (average values, EUR).

Effect	Overall	Q1	Q2	Q3	Q4
Direct	-26.64***	110.78***	121.61***	-33.70***	1.42
	(6.99)	(41.37)	(27.98)	(8.97)	(6.19)
Indirect	22.52***	-50.35**	-70.01***	22.10***	-5.89
	(5.06)	(21.94)	(19.11)	(5.67)	(6.98)
Total	-4.12*	60.43***	51.60***	-11.60***	-4.47
	(2.50)	(19.81)	(9.49)	(3.54)	(5.65)

Marginal effects of a 1% increase in CF and ERDF transfers on *GDPpc GAP* associated to the benchmark estimates reported in Table 7. Values are expressed in Euros.

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$