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Assessing the impact of the EU's Recovery and Resilience Facility on institutional quality: a Bayesian synthetic control approach

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Abstract

The Recovery and Resilience Facility (RRF), launched in 2021, aims to promote long-term economic growth in EU Member States by incentivising structural reforms and investments. This paper explores a related supply-side transmission mechanism: improvements in institutional quality, as measured by the Worldwide Governance Indicators. Using a Bayesian synthetic control model and data up to 2024, we find robust and economically meaningful RRF-induced improvements in institutional quality in Italy. For other main RRF beneficiary countries, the evidence of such an effect ranges from suggestive to limited. We show that this cross-country variation is broadly consistent with the implementation of the national Recovery and Resilience Plans in terms of implementation speed and reform mix. While it is too early to draw firm policy conclusions, the findings lend support to the view that conditional, reform-linked financing instruments of the RRF type can improve institutional quality and, thereby, long-term growth prospects – provided that the reforms are well designed and effectively implemented.

Keywords: institutions, reforms, Recovery and Resilience Facility, NextGenerationEU

JEL Classification: C11, E02, E65, O43

Non-technical summary

The Recovery and Resilience Facility (RRF), launched in 2021, aims to promote long-term economic growth in EU Member States by incentivising structural reforms and investments. To this end, the temporary policy instrument offers around €600 billion of debt-financed EU funds to Member States in the form of loans and non-repayable grants. Payments are conditional on achieving pre-defined milestones and targets. This paper studies a key supply-side transmission mechanism of the RRF: improvements in institutional quality, i.e. improvements in the effectiveness of the formal and informal "rules of the game" for economic activities.

Our empirical analysis uses World Bank data available up to end-2024 and a Bayesian synthetic control model to assess the causal impact of the RRF on institutional quality. We construct a no-RRF counterfactual separately for each main RRF beneficiary country, describing how institutional quality would likely have evolved in the absence of the programme. The counterfactual is derived from developments in control countries, i.e. peer countries with little or no exposure to the RRF. By comparing actual developments in institutional quality to the counterfactual, this approach yields both a point estimate of the programme's impact and a measure of the uncertainty surrounding it.

The results show clear cross-country differences. For Italy, we find robust and economically meaningful improvements in institutional quality resulting from the RRF. For Bulgaria, Croatia and Greece, the evidence for such an effect points in a positive direction but is surrounded by significantly higher uncertainty. For Poland, Portugal and Spain, we find little indication that the programme has improved institutional quality. These differences are broadly consistent with plan implementation patterns which reinforces confidence in our findings. Countries that implemented their reform and investment commitments more quickly and focused on governance-related reform measures tend to show stronger effects.

The findings should be interpreted with caution. The programme is ongoing, institutional indicators may adjust only gradually and the estimates for some countries may be confounded by the euro adoption and Schengen entry process. Nevertheless, the early evidence suggests that conditional, reform-linked EU funding instruments can improve structural economic conditions and thus long-term growth prospects, as most clearly illustrated by our findings for Italy. At the same time, the cross-country variation in our estimates indicates that reform design and plan implementation matter.

1 Introduction

In February 2021, the EU established the Recovery and Resilience Facility (RRF) to address the economic fallout from the COVID-19 pandemic. A key objective of the RRF, beyond short-term demand stabilisation, is to boost the EU's potential output in the longer term. To this end, the temporary policy instrument offers around €600 billion of debt-financed EU funds to Member States in the form of loans and non-repayable grants. To obtain these funds, Member States need to implement pre-agreed structural reforms and investments summarised in the so-called Recovery and Resilience Plans.

This paper aims to provide initial insights into the RRF's effectiveness in achieving its objective of boosting long-run economic growth. A major challenge in this assessment is data availability. Beyond the fact that the implementation of RRF-linked investments and reforms is still ongoing, it also takes time for these policy measures to fully unfold their economic impact – particularly for structural reforms, where resulting gains typically emerge only with a considerable lag (Bouis et al., 2012).

To address these data challenges, our paper looks at the causal impact of the RRF on *institutional quality*, i.e. the effectiveness of the formal and informal "rules of the game" for economic activities (North, 1992). This focus is motivated by three key considerations. First, institutional quality is a crucial determinant of long-term economic growth (Acemoglu and Johnson, 2005). Second, many RRF-linked reforms and investments have the potential to improve standard measures of institutional quality. In fact, the RRF-linked reform mix is geared towards public sector reforms, such as policy measures to enhance the efficiency of public administration and the judiciary (Bańkowski et al., 2024), which could be expected to have a bearing on institutional quality.[1] In several countries, these reforms are accompanied by RRF-financed investment in the digitalisation of the public sector, which could also improve institutional quality. Hence, institutional quality is likely to be a key transmission channel through which the RRF could eventually boost long-term economic growth. Third, the effects of the RRF on standard measures of institutional quality may become visible relatively quickly. This is because many of the underlying data sources for institutional quality – such as surveys

[1] The literature on structural reforms often looks at OECD indicators capturing employment protection legislation (EPL) or product market regulation (PMR). However, only a relatively small fraction of the RRF-linked investments and reforms seem conducive to improvements in these standard structural indicators. Moreover, these indicators are not suitable for our empirical analysis since they are either only available at a frequency exceeding one year (PMR) or stop before the beginning of the RRF treatment period (EPL).

and expert assessments – can in principle react swiftly to changes in governance, regulatory effectiveness or administrative capacity. The data could thus provide first insights into the effectiveness of the RRF in boosting long-term output, despite the current data limitations.

Following Helliwell et al. (2014) and Masuch, Moshammer and Pierluigi (2017), we measure institutional quality using a composite of four of the World Bank's Worldwide Governance Indicators (WGI) – government effectiveness, regulatory quality, rule of law, and control of corruption – which are available up to 2024 at annual frequency. A key advantage of this indicator is that it is more encompassing than other often-used measurements and thus likely to capture a larger share of the heterogeneous policy measures linked to the RRF. Moreover, the indicator is available for a broad set of countries over a relatively long period of time and existing studies have shown that it is positively associated with longer-term economic performance. Specifically, Masuch, Moshammer and Pierluigi (2017) find that improvements in the indicator increase GDP per capita growth in euro area countries over a 15-year horizon. Consolo, Langiulli and Sondermann (2019) show that euro area countries with higher institutional quality tend to record more dynamic business investment, which in turn could be expected to support long-term output. Rodrik, Subramanian and Trebbi (2004) estimate that the quality of institutions, as measured by WGI data, is a more important determinant of country-level income levels than geography and trade.

Notable limitations of our approach are that the RRF may affect long-term growth prospects through channels other than institutional quality and that some of its impact on institutional quality itself may become visible only with delay. This timing issue is particularly relevant for perception-based metrics such as the WGI, where observers may revise their assessments only gradually as the outcome of recent reforms becomes evident. Delays may also arise because some of the underlying sources feeding into the WGI are updated infrequently. Against this backdrop, we consider the finding of RRF-induced improvements in institutional quality as a sufficient, but not necessary, condition to demonstrate a positive impact of the RRF on long-term growth prospects.

To infer the causal impact of the RRF on institutional quality in the main RRF beneficiary countries, we set up a Bayesian synthetic control (BSC) model to derive the no-RRF counterfactual. The model is implemented in a Bayesian structural time-series framework following Brodersen et al. (2015) and constructs the counterfactual on the basis of developments in institutional quality in control countries. The uncertainty surrounding the mean estimates is

quantified using posterior predictive distributions. The methodology is well suited to the evaluation of infrequent or one-off policy interventions, such as the RRF. While closely related in spirit to the classic synthetic control method proposed by Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010), it allows for a Bayesian characterisation of uncertainty. Accordingly, we refer to it as a Bayesian synthetic control approach.

A key advantage of our framework is that it allows us to explicitly quantify the uncertainty surrounding the estimated mean effects. This is particularly important in our setting, where the (post-) treatment period is short and individual data points may be noisy. In addition, our country-by-country design helps avoid the identification problems that would arise in a standard panel framework. In such a setting, countries with stronger institutions might implement RRF-linked policy measures more quickly and score better on governance indicators, giving rise to endogeneity concerns.

Applying our model, we carefully construct a no-RRF counterfactual separately for each main RRF beneficiary country, i.e. those with an RRF envelope exceeding 10% of GDP.[2] Our dataset covers the EU-27 countries and nine other advanced economies over the period 2004-24, with 2022-24 being the treatment period. The causal effect of the RRF on institutional quality is then given by the difference between the actual indicator of institutional quality and the counterfactual. We also run a series of alternative model specifications to assess the robustness of our baseline results.

Our empirical findings show a mixed picture across the main beneficiary countries. For Italy, we find a robust and quantitatively sizeable RRF-induced improvement in institutional quality. In our baseline model specification, we estimate that the RRF reduced the country's distance to the frontier in terms of institutional quality by 16.8% up until 2024. The 90% credible interval is fully in positive territory and the posterior probability of a positive RRF effect is close to 1. For a second group of countries — Bulgaria, Croatia and Greece — we find suggestive evidence of a positive RRF effect with the group also exhibiting robust positive mean estimates. Those are however notably smaller than for Italy (ranging from 0.05 to 0.15 index points in the baseline specification, compared with 0.25 for Italy). In addition, the posterior probabilities of a positive effect are lower than in Italy and the corresponding credible intervals include zero in at least one model specification for each of these countries. This

[2]The main RRF beneficiary countries – according to the size of the RRF envelope in percent of 2019 GDP – are Greece, Croatia, Spain, Italy, Portugal, Poland and Bulgaria.

indicates substantial uncertainty around an economically meaningful RRF effect in this group. For a third group — Poland, Portugal and Spain — the results provide limited evidence of a positive RRF effect on institutional quality. Estimated mean effects are at best modestly positive and either turn negative in some robustness checks or remain negative across all model specifications amid significant uncertainty.

We show that this cross-country variation is broadly consistent with the implementation of the national Recovery and Resilience Plans in terms of implementation speed and reform mix. Notably, Italy stands out as a frontrunner in implementation and completed a particularly large share of governance-related reforms during the treatment period, including several measures that plausibly strengthened institutional quality materially. Within the group showing suggestive evidence (Bulgaria, Croatia and Greece), the picture is not uniform. However, for Croatia and Greece, the reform mix implemented is at least consistent with a positive effect and implementation was relatively advanced. The results for Bulgaria, where the reform mix was geared towards areas less relevant for institutional quality, may be confounded by reform efforts in preparation of the country's euro adoption (1 January 2026) and Schengen entry (1 January 2025), both issues also relevant for Croatia, which joined both the euro and Schengen in January 2023. In the group of countries with limited evidence of a positive RRF effect (i.e. Poland, Portugal and Spain), only small shares of implemented RRF-linked reforms were directly related to institutional quality. In addition, Poland and Spain were among the three worst performers among the main beneficiary countries in terms of implementation speed. Portugal performed better in this regard, but implemented the lowest share of governance-related reforms in the sample.

The remainder of this paper is structured as follows. Following a short review of the relevant literature in Section 2, Section 3 explains our empirical approach and the underlying data. Section 4 presents and interprets the results. Section 5 concludes and outlines key policy implications of our analysis.

2 Literature review

To the best of our knowledge, our paper is the first to provide an empirical assessment of the supply-side effects of the RRF – in particular its reform components – across all main beneficiary countries. Existing studies with such broad country coverage use theoretical mod-

els to quantify the expected macroeconomic impact of the RRF (or NextGenerationEU more generally) ex ante.[3] Based on a rich DSGE model, Pfeiffer and in't Veld (2023) estimate that NGEU will increase the level of real GDP in the EU by around 1.2% by 2026 compared to a no-policy change baseline. Looking at various theoretical models and scenarios, Bańkowski et al. (2024) conclude that NGEU has the potential to increase euro area GDP by around 0.8-1.2% by 2031. Domínguez-Díaz, Hurtado and Menéndez (2025) demonstrate in an endogenous growth model for the Spanish economy that NGEU could boost annual GDP growth by 0.08-0.13 percentage points over the implementation period. Other studies draw lessons for the RRF on the basis of historical experience, for instance with EU structural funds (e.g. Canova and Pappa, 2025).

With the RRF's implementation progressing, a few recent papers have started to explore the economic impact of the RRF empirically. Some of these papers are case studies focused on specific reforms in individual countries and thus not directly comparable to our paper (e.g. Giavazzi and Goretti, 2024). More closely related to the spirit of our analysis is the study by Aparicio-Pérez et al. (2025). The authors use the synthetic control method to estimate the economic impact of NGEU on individual regions in Spain. They find that, on average, NGEU increased GDP per capita by 5.5% up to 2024 compared to a counterfactual. The study uses different inference methods to show that the regional counterfactual estimates are jointly significant, although no individual regional estimate is statistically significant.

While Aparicio-Pérez et al. (2025) look at GDP per capita as an outcome variable, we focus on institutional quality as an intermediary transmission channel. A key advantage of our narrow focus is that it highlights a concrete (supply-side) transmission channel and reduces the risk of contamination by factors unrelated to the RRF. This comes at the price of providing only a partial picture of the overall RRF impact on the EU economies. At the same time, our analysis covers all main recipient countries.

3 Empirical approach

3.1 Data and stylised facts

To proxy institutional quality, we follow Helliwell et al. (2014) and Masuch, Moshammer and Pierluigi (2017). Specifically, we use a composite of four metrics from the World Bank's

[3] The RRF is the main instrument of the NextGenerationEU (NGEU) programme.

WGI dataset. These indicators capture the quality of economic and administrative institutions (Kaufmann and Kraay, 2024): government effectiveness, regulatory quality, rule of law, and control of corruption (see Appendix A for details). Institutional quality is defined as the unweighted average of these four WGI metrics.

The WGI dataset is based on a broad range of primary data sources. It is widely used in the literature due to its extensive geographic and temporal coverage. Additionally, aggregation of data from numerous sources enhances the comprehensiveness of the WGI data. This comes at the expense of being based on perceptions and complex aggregation methods. Another drawback of the WGI dataset is its susceptibility to methodological changes and data revisions.

Our initial sample comprises the EU-27 countries and nine non-EU advanced economies.[4] The time period spans from 2004 to 2024, covering both the pre-treatment and treatment periods. The starting point of 2004 is motivated by the presence of structural breaks in the institutional quality series observed prior to this year in several sample countries. There are no missing observations in our WGI dataset.

A first look at the data shows that the level of institutional quality prior to the implementation of the RRF was typically lower in EU Member States that receive a larger RRF envelope (see Figure 1). This negative correlation arguably reflects the fact that both the distribution of RRF funds across EU Member States and institutional quality are correlated with GDP per capita. The variable is not only a key factor that legally determines the cross-country distribution of available RRF funds but also a well-known predictor of institutional quality in a cross-sectional setting. Either way, the correlation suggests that there could be scope for RRF-induced improvements in institutional quality in the treatment period.

3.2 Model specification

Our objective is to quantify the effect of the RRF on institutional quality. Let y_t denote the observed level of institutional quality for a main RRF beneficiary (treated) country at time t, and let $\tilde{y}_t$ denote the counterfactual level of institutional quality that would have prevailed in

[4]The non-EU economies are Australia, Canada, Japan, New Zealand, Norway, South Korea, Switzerland, the United Kingdom and the United States.

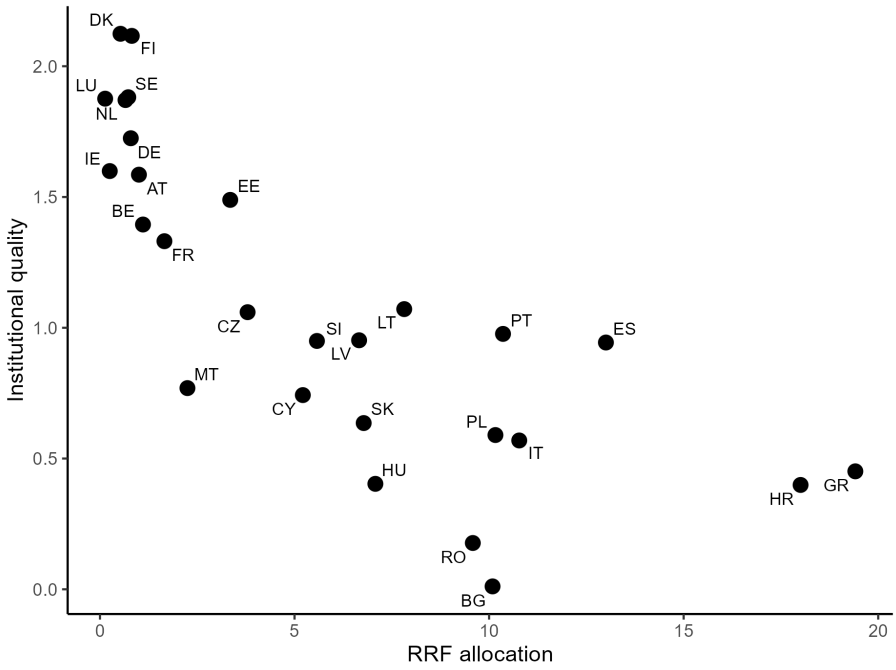

Figure 1: X-axis: RRF allocation (percent of 2019 GDP). Y-axis: Institutional quality in 2021, i.e. unweighted average of four World Bank Worldwide Governance Indicators (WGI): Government Effectiveness, Regulatory Quality, Rule of Law, Control of Corruption. Sources: European Commission, Eurostat and World Bank.

the absence of the RRF. The period-specific causal effect is defined as

$$\tau_t = y_t - \tilde{y}_t, \qquad t \geq T_0, \tag{1}$$

where T_0 denotes the start of the treatment period. The central empirical task is therefore to estimate the unobserved counterfactual $\tilde{y}_t$ and gauge the uncertainty surrounding it.

Following Brodersen et al. (2015), we use a Bayesian structural time series framework to construct counterfactual trajectories of institutional quality. Within this framework, we estimate the no-RRF counterfactual through a regression-based synthetic control component. Concretely, we model the treated country's counterfactual institutional quality path as a combination of institutional quality developments in specific non-treated (control) countries, where the regression coefficients estimated on data from the pre-intervention period determine the importance of each control country in the synthetic series. We refer to this specification as a *Bayesian synthetic control* approach, as it is closely related in spirit to the classic synthetic control method (e.g. Abadie and Gardeazabal, 2003; Abadie, Diamond and Hain-

mueller, 2010), while providing a Bayesian characterisation of uncertainty. Note that, unlike in the classical synthetic control method, the coefficients of the individual control countries are not restricted to be non-negative or sum to one.

Formally, the model is given by

$$y_t = \alpha + \mathbf{x}_t'\beta + \varepsilon_t, \qquad \varepsilon_t \sim \mathcal{N}(0, \sigma_\varepsilon^2), \tag{2}$$

where vector $\mathbf{x}_t$ captures institutional quality in the control countries at time t, β is a vector of regression coefficients and α is an intercept. The regression coefficients determine the importance of the individual control countries in the synthetic control. The counterfactual trajectory in the absence of the RRF is obtained as

$$\tilde{y}_t = \alpha + \mathbf{x}_t'\beta, \qquad t \geq T_0, \tag{3}$$

i.e. by projecting the pre-treatment relationship between the treated country and the control countries into the treatment period.

3.3 Prior selection and inference

The model specification requires priors for the regression coefficients (β), the intercept (α) and for the observation variance σ_ε^2. We follow the prior structure in Brodersen et al. (2015).

For the regression coefficients, the methodology employs a spike-and-slab prior. This prior combines two distributions: a "spike" distribution, which concentrates mass around zero to encourage sparsity in the regression coefficients, and a "slab" distribution, which accommodates non-zero coefficients. Intuitively, the spike-and-slab prior allows the model to select only those control countries that provide meaningful predictive power for the treated country's pre-treatment evolution in institutional quality, while shrinking uninformative predictors towards zero. This is particularly useful in our setting because the pool of control countries can be large relative to the number of pre-treatment observations, and the model should retain only those series that provide predictive information for the treated unit.

For the spike, let $\boldsymbol{\phi} = (\phi_1, \ldots, \phi_J)$ denote the binary inclusion indicators for the J control countries, where $\phi_j = 1$ indicates that country j is included (i.e. $\beta_j = 0$) and $\phi_j = 0$ otherwise. Let $\boldsymbol{\beta}_{\boldsymbol{\phi}}$ denote the subvector of included coefficients, and let $\boldsymbol{\Sigma}_{\boldsymbol{\phi}}$ denote the corresponding

prior covariance matrix. The spike-and-slab prior factorises as

$$p(\boldsymbol{\phi}, \boldsymbol{\beta}, 1/\sigma_\varepsilon^2) = p(\boldsymbol{\phi})\, p(\sigma_\varepsilon^2 \mid \boldsymbol{\phi})\, p(\boldsymbol{\beta}_{\boldsymbol{\phi}} \mid \boldsymbol{\phi}, \sigma_\varepsilon^2). \tag{4}$$

The inclusion indicators follow independent Bernoulli distributions,

$$p(\boldsymbol{\phi}) = \prod_{j=1}^{J} \pi_j^{\phi_j} (1 - \pi_j)^{1-\phi_j}, \tag{5}$$

where π_j is the prior inclusion probability of control-country j. In the absence of strong prior information regarding the respective control-country relevance, we assign $\pi_j = 0.5$ for all j, corresponding to an agnostic prior that assigns equal ex-ante weight to inclusion and exclusion of each control country.

For the slab portion of the prior, we use a conjugate normal-inverse Gamma prior,

$$\boldsymbol{\beta}_{\boldsymbol{\phi}} \mid \sigma_\varepsilon^2 \sim \mathcal{N}\left(\mathbf{0},\, \sigma_\varepsilon^2 \boldsymbol{\Sigma}_{\boldsymbol{\phi}}\right), \tag{6}$$

and

$$\frac{1}{\sigma_\varepsilon^2} \sim \mathcal{G}\left(\frac{\rho_\varepsilon}{2},\, \frac{s_\varepsilon^2}{2}\right), \tag{7}$$

where ρ_ε controls the effective prior sample size and s_ε^2 is a scale parameter. Following Brodersen et al. (2015), these hyperparameters can be elicited using an expected in-sample fit $R^2 \in [0, 1]$ and a prior weight ρ_ε, by setting

$$s_\varepsilon^2 = \rho_\varepsilon (1 - R^2)\, s_y^2, \tag{8}$$

where s_y^2 is the sample variance of the treated country's institutional quality series in the pre-treatment period. The slab covariance follows a Zellner-type g-prior. Specifically, the slab covariance is given by

$$\boldsymbol{\Sigma}_{\boldsymbol{\phi}} = g \left(\mathbf{X}_{\boldsymbol{\phi}}' \mathbf{X}_{\boldsymbol{\phi}}\right)^{-1},$$

where $\mathbf{X}_{\boldsymbol{\phi}}$ denotes the matrix of included control series.

This prior scales coefficient uncertainty to the variance and correlation structure of the control country data. Following Brodersen et al. (2015), the scaling parameter g is implicitly determined by the prior expected R^2 and the prior sample size, rather than fixed exogenously.

Specifically, the scale of the regression prior is chosen such that the prior predictive distribution of the treated series assigns an expected fraction R^2 of its variance to the regression component, with the remaining variance attributed to the observation noise. This induces a Zellner-type g-prior covariance proportional to $(\mathbf{X}'_{\boldsymbol{\phi}}\mathbf{X}_{\boldsymbol{\phi}})^{-1}$, with g endogenously determined.

To calibrate the expected R^2, we perform auxiliary non-Bayesian regressions on institutional quality trajectories in the pre-treatment period: we regress each EU control country's institutional quality trajectory on the trajectories of the remaining EU control countries and compute the resulting R^2 values. The average R^2 across these regressions is about 0.85, and we therefore set the prior expected R^2 to 0.85. We use $\rho_\varepsilon = 10$, reflecting the number of auxiliary regressions. This calibration provides a transparent and data-driven basis for the expected R^2. Non-EU advanced economies are excluded from this prior specification process. Otherwise, the number of regressors in the auxiliary regressions would become very large relative to the pre-treatment sample, which would mechanically result in an excessively high R^2.[5]

Consistent with equation 2, we also include an intercept α in the regression to capture the average level of institutional quality in the treated country. In line with standard practice, the intercept is assigned a weakly informative Gaussian prior,

$$\alpha \sim \mathcal{N}(\bar{y}, \sigma_\alpha^2),$$

where $\bar{y}$ denotes the pre-treatment sample mean of the institutional quality series in the treated country and σ_α^2 is set sufficiently large so as not to materially restrict the parameter space. Placing the prior mean near a plausible value improves numerical stability while remaining weakly informative, ensuring that the intercept is primarily identified by the data.

Posterior inference and construction of treatment effects

Posterior inference proceeds via Markov Chain Monte Carlo (MCMC) simulations as in Brodersen et al. (2015). In each iteration, the regression coefficients and their inclusion indicators are updated under the spike-and-slab prior, and the observation variance σ_ε^2 is drawn from its full conditional distribution. Based on the resulting posterior draws, we obtain the posterior predictive distribution of the counterfactual path $\tilde{y}_t$ in (3) and of the treatment effect τ_t de-

[5] We also ran a robustness check where we set the prior R-squared to 0.6 rather than 0.85 as in the baseline specification. While this results in wider credible intervals for some countries, the main findings reported below remain qualitatively robust. Figure 10 in the Appendix shows the corresponding results.

fined in (1). Our implementation uses 10,000 posterior draws, from which we construct mean estimates and credible intervals for the estimated effects.

3.4 RRF treatment

Another crucial step in our analysis is the definition of the RRF treatment. This requires us to take a stance on which countries should be considered treated entities and when the treatment started.

We opt for 2022-24 as the RRF treatment period.[6] This modelling decision, which is consistent with the approach by Aparicio-Pérez et al. (2025), is motivated by the common RRF timeline and rules imposed on all EU Member States. More specifically, the RRF entered into force as an EU-wide programme in February 2021. However, Member States spent the better part of 2021 preparing detailed Recovery and Resilience Plans outlining their planned investments and reforms. By the end of 2021, the Recovery and Resilience Plans of 22 Member States had been approved by the Council of the EU. The remaining plans followed over the course of 2022, with the plans of the Netherlands and Hungary being the last to be approved in October and December 2022, respectively. The signing of the so-called Operational Arrangements – which translate the plans into actionable commitments – took additional time, although actual implementation may have started in parallel in some cases. Against this backdrop, only four disbursement requests were submitted in 2021 (all in the final quarter) and only a single RRF payment request was disbursed in the same year.[7] The implementation of the Recovery and Resilience Plans gained considerable momentum in 2022, as indicated by 13 disbursements in that year. We see RRF payment requests and the associated disbursements as useful indicators of implementation progress since Member States need to provide the European Commission with evidence showing that they have satisfactorily fulfilled pre-agreed objectives related to their investments and reforms (so-called "milestones and targets").

Notably, announcement effects are unlikely to play a significant role in the context of our analysis. There is no compelling reason to expect that countries voluntarily implemented – or delayed – major structural reforms in 2020 or 2021 in anticipation of the imminent RRF. Member States arguably treated reforms as a "price to pay" in exchange for RRF-funded invest-

[6] The end date reflects the fact that the WGI data currently stop in 2024.

[7] These payment requests were submitted by Spain, France, Greece and Italy. Spain was the only country to receive a disbursement in 2021 (on 27 December).

ments. The design of these reforms was subject to discussions with the European Commission over the course of 2020-21. At the same time, the RRF rules allow Member States to include reforms in their national plans that had already been implemented before the RRF came into force. Hence, there was no clear incentive to either accelerate or postpone reforms in response to the RRF announcement. It is equally unlikely that the RRF announcement alone immediately led to the implementation of new investment projects by EU Member States, considering the long lead time usually involved in such projects.

Next, the question arises if all EU Member States should be considered treated entities. What might speak in favour of such an approach is that RRF funds were allocated to all Member States. However, in several countries the RRF allocation is of limited macroeconomic significance, often amounting to less than 2% of annual GDP spread over several years. Some countries may also need to contribute to the repayment of debt incurred by the EU for the financing of the RRF, which would diminish the present value of their net receipts. Countries with a smaller RRF allocation can also be expected to pursue a less ambitious reform agenda under the RRF umbrella. This reflects the RRF rules, according to which the reform commitments need to be commensurate with the RRF allocation. Overall, it thus seems unlikely that the RRF will have an economically significant impact on institutional quality in the countries with the smallest RRF allocations.[8]

Therefore, only the EU Member States with the largest RRF allocations are included in our group of treated countries. More specifically, this group consists of all EU Member States with an RRF allocation in excess of 10% of GDP. The average RRF allocation across these seven Member States is 13.1% of GDP.[9] The ten Member States with RRF allocations below 2% of GDP remain in the sample as non-treated countries.[10] Their average RRF allocation amounts to 0.8% of GDP. The ten countries in-between are dropped from the sample since they could pollute the results as borderline cases.[11] Aparicio-Pérez et al. (2025) use a similar strategy in their synthetic control study.[12] Our approach delivers a sharp cliff between the

[8]In terms of output effects, these "non-treated" countries might still benefit from macroeconomic spillovers from the treated countries. See Pfeiffer and in't Veld (2023).

[9]The treated countries are (in decreasing order of RRF allocation): Greece, Croatia, Spain, Italy, Portugal, Poland and Bulgaria.

[10]These ten countries countries are (in decreasing order of RRF allocation): France, Belgium, Austria, Finland, Germany, Sweden, the Netherlands, Denmark, Ireland and Luxembourg.

[11]The following countries are dropped from the sample (in decreasing order of RRF allocation): Romania, Lithuania, Hungary, Slovakia, Latvia, Slovenia, Cyprus, Czechia, Estonia and Malta.

[12]More specifically, Aparicio-Pérez et al. (2025) look at the lower 25th percentile of EU regions in terms of RRF funds to construct the counterfactual.

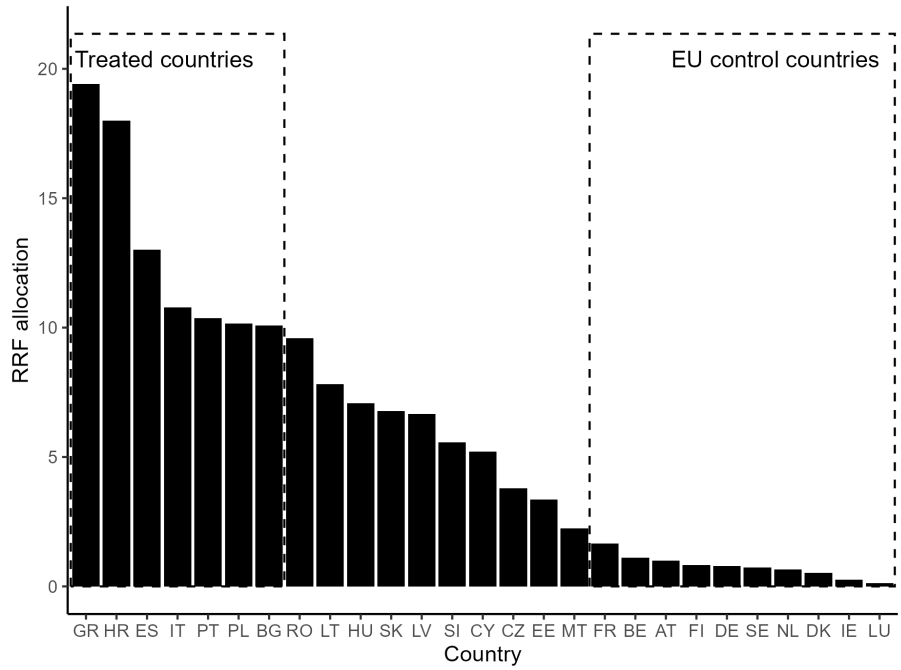

Figure 2: RRF allocation, i.e. sum of grants and loans, as a percentage of 2019 GDP. Sources: European Commission and authors' calculations.

treated and non-treated EU Member States in our estimation sample when it comes to their RRF allocation (see Figure 2). More specifically, the lowest RRF allocation among the treated countries is 10.1% of GDP, while the highest allocation among the non-treated countries in the estimation sample is 1.7 % of GDP.

It should be noted that a given non-treated country can receive a negative regression coefficient in the β vector. Hence, even if such a country were to experience a treatment effect that we fail to take into account, this would not automatically bias downwards our results for the treated countries. In addition, we will subsequently show a robustness check to excluding all EU control countries from the sample.

Figure 3 provides an aggregate overview of recent developments in institutional quality in the different country groups. Between 2021 and 2024, i.e. in the RRF treatment period, institutional quality remained broadly unchanged in the typical (median) treated country (-0.5%). Over the same period, the median control country both within and outside the EU witnessed a decline of 2.2% and 1.6%, respectively. However, the median conceals pronounced heterogeneity within the country groups, as shown by the interquartile range in Figure 3 and the country-level information in Table 1 in Appendix A. In fact, our measure of institutional

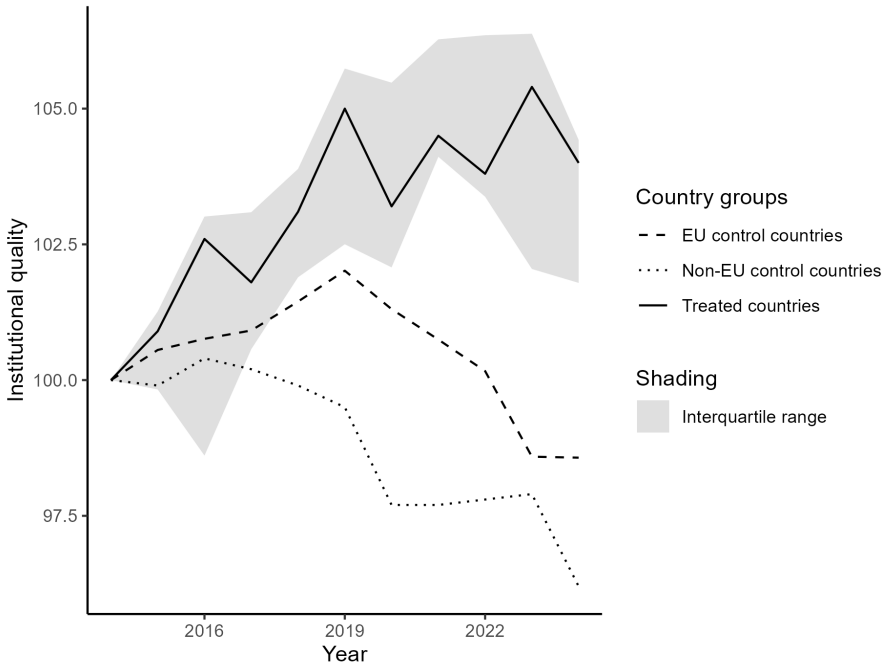

Figure 3: Institutional quality by country group (indices, 2014=100). The country groups are represented by the median, calculated on the basis of country-level indices of WGI scores. The shaded area corresponds to the interquartile range of the treated countries. Sources: World Bank and authors' calculations.

quality improved in only two treated countries (Italy and Poland) in the treatment period. At the same time, institutional quality remained broadly unchanged in Bulgaria and Croatia, and deteriorated noticeably in Greece, Spain and Portugal. Importantly, these developments should be seen against the backdrop of the dynamics in the EU and non-EU control countries, of which almost 80% saw a decline in institutional quality in the period 2021-24. Hence, even treated countries that recorded a decline in institutional quality in the treatment period may have outperformed their peers in the group of control countries. Our model-based analysis will investigate more rigorously to what extent the RRF influenced the observed changes in institutional quality in the treated countries. It is furthermore noteworthy that, at the level of individual WGI components, changes between 2021 and 2024 were most pronounced in government effectiveness and regulatory quality, whereas rule of law and especially control of corruption exhibited comparatively smaller and more moderate shifts across our sample (Table 2).

An important question is whether our empirical approach might erroneously attribute the impact of reforms implemented outside the RRF umbrella to the RRF. While possible in

theory, this risk is arguably limited in practice since the main recipient countries already found it challenging to implement their RRF-linked policy commitments. Administrative capacity appears to have been a key limiting factor in this regard, along with supply-side bottlenecks in the aftermath of the COVID-19 pandemic (Bańkowski et al., 2024). Overall, there is a clear incentive for the main RRF recipient countries to implement their most ambitious structural reforms under the RRF umbrella. To this day, the RRF-related policy commitments continue to dominate the policy agenda in these countries.

A final conceptual question is *how* the the RRF influences institutional quality and specifically if the impact is driven by RRF-linked reforms or investments. We are agnostic in this regard since our model does not allow us to disentangle the impact of RRF-linked reforms and investments, respectively. However, we conjecture that the reform channel is likely to be dominant in the context of our analysis for several reasons. First, the planned reforms are front-loaded relative to RRF-funded expenditures and are thus more likely to have influenced our results, which only cover the first years of the implementation phase. The de-facto front-loading of reforms has been further accentuated by implementation delays for RRF-funded investments in the post-COVID era. Second, the reform mix is geared towards public sector reforms, which in turn are particularly likely to affect institutional quality (Bańkowski et al., 2024). Third, the RRF-funded government expenditure is concentrated on areas with a lose or non-existent connection to institutional quality. Around one-third of total RRF-funded expenditure in the euro area countries between 2021 and 2026 is expected to reflect government consumption, private sector loans, equity injections and similar categories without a direct bearing on institutional quality (Bańkowski et al., 2024). Out of the remaining grants and loans funding government capital spending, a sizeable share is earmarked for green projects and thus unlikely to directly affect the WGI. The remaining funds cover a relatively broad array of expenditure areas, of which only a fraction is likely to influence institutional quality.

Notwithstanding this, we cannot exclude that some RRF investments will also affect our measure of institutional quality. A case in point is investment into the digitalisation of the public sector, which is envisaged by the Recovery and Resilience Plans of some countries. Therefore, we refrain from fully attributing the RRF effect to its reform component, although we see it as the dominant channel, and speak of the "RRF effect" in general. This is consistent with a core design principle of the RRF, according to which investments and reforms should be mutually reinforcing.

3.5 Model validation

Our model demonstrates solid performance during the pre-treatment period. Most importantly, as can be seen from Figure 11, the estimated counterfactual trajectories (dashed lines) closely track observed institutional quality (solid lines) prior to the RRF intervention across treated countries, indicating a sound model fit.

To further assess model adequacy, we also examine the properties of the pre-treatment residuals. Figure 14 shows the posterior distribution of residuals, defined as the difference between the observed series and the estimated counterfactual. Across all treated countries, residuals fluctuate around zero without displaying systematic patterns over time. Moreover, the dispersion of residuals appears broadly stable, supporting the assumption of approximately constant observation-noise variance.

Finally, Figure 15 reports posterior distributions of the autocorrelation function (ACF) of the pre-treatment residuals. These plots provide a diagnostic check for remaining serial dependence not captured by the model. While some countries exhibit mild autocorrelation at short lags, the median autocorrelations are generally close to zero and do not display a systematic or persistent pattern across countries. This indicates that the regression-based synthetic control absorbs the dominant time series structure in institutional quality and that any remaining serial correlation is limited.

4 Results

In this section, we use our model to assess the causal impact of the RRF on institutional quality in the main recipient countries and discuss the results. At any given moment, the RRF effect is represented by the difference between the observed institutional quality metric and the counterfactual without RRF treatment (equation 1). Our analysis focuses on 2024, the final year of the treatment period in our sample, since our model is based on a level series of institutional quality.

We start by reporting the posterior probability of a positive RRF effect on institutional quality in 2024 (Figure 4), defined as the share of the posterior distribution of the treatment effect that lies above zero. The posterior probability is on average 0.77 across main beneficiary countries and exceeds 0.5 in all countries except Poland. In other words, the RRF is more likely than not to have exerted a positive impact on institutional quality in most main bene-

ficiary countries, according to the baseline specification. In Italy, the posterior probability is particularly high and close to 1.

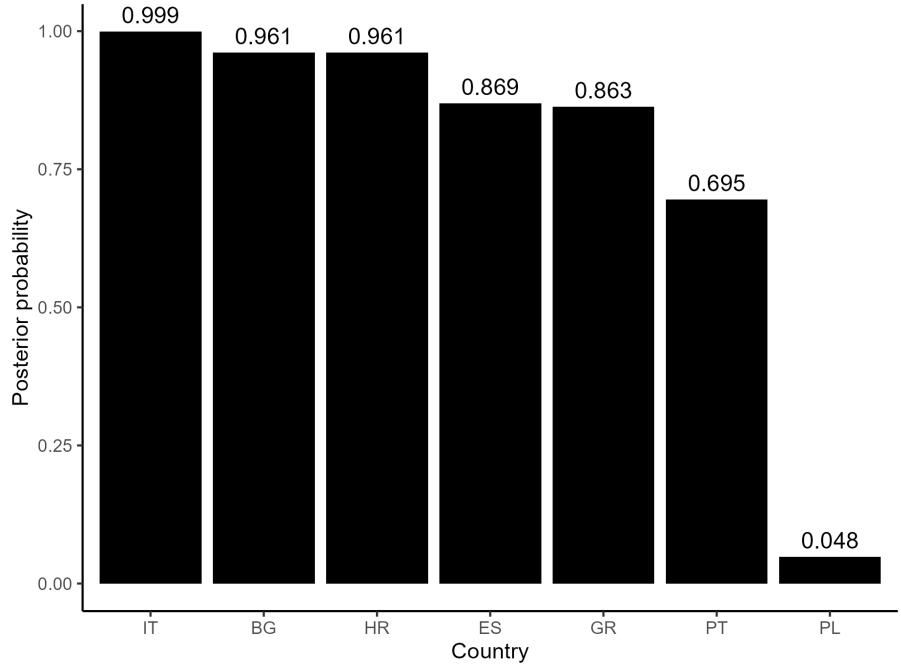

Figure 4: Posterior probability of a positive RRF effect on institutional quality (baseline). Source: Own illustration.

However, the posterior probability of a positive effect only captures the probability mass above zero and is silent on the magnitude and precision of the RRF effect. Therefore, Figure 5 presents the mean estimates along with the 90% credible intervals for our baseline specification. Italy stands out with a positive estimated effect of about 0.25 index points and its 90% credible interval well above zero. Bulgaria, Greece, Spain, Croatia and Portugal also exhibit positive mean estimates, though smaller in magnitude. Moreover, the lower bound of Bulgaria's credible interval is only narrowly above zero, while the intervals for Greece, Spain, Croatia and Portugal include zero. Poland is the only country with a negative mean of the posterior distribution, although the wide credible interval implies substantial uncertainty around the mean estimate.

A comparison of Figures 4 and 5 may raise the question how we can reconcile the findings that the 90% credible interval for some countries includes zero while the posterior probability of a positive effect is relatively high. The reason is that although most of the probability mass in these countries is located in positive territory the posterior distribution exhibits a long left

tail. Consequently, it is likely that the RRF effect is positive in these countries – according to the baseline specification – but we can be less certain about this than, say, in the case of Italy. This illustrates how the Bayesian features of our model add nuance to our findings and thereby enrich the information available to policymakers.

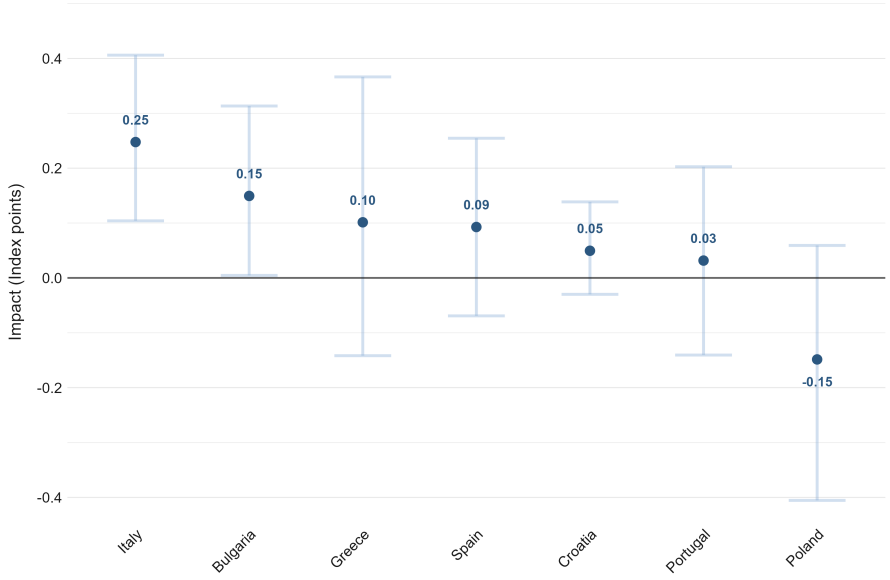

Figure 5: Baseline results. Estimated RRF effect on institutional quality in 2024. Points represent mean estimates, while bars indicate 90% credible intervals. Source: Own illustration.

So far, we have looked at the likelihood of a positive RRF effect and its magnitude and precision. We will now turn to the robustness of our baseline estimates. A potential concern in this context is the inclusion of EU countries in the control group. Since even the countries with the lowest allocations have received some RRF funds, their presence in the control group could potentially bias the results if the RRF significantly affected institutional quality in those countries. However, as previously noted, we expect this effect to be minimal due to the limited (direct) macroeconomic significance of the RRF in these countries, their obligation to contribute to the fund's financing and the expectation of these countries to pursue a less ambitious reform agenda under the RRF. To further ensure the robustness of our findings, we nevertheless re-estimate the model with a specification that excludes EU countries from the control group. This exercise also provides a robustness check with respect to control group composition more generally.

Figure 6 presents the corresponding estimates. The overall pattern remains broadly consistent with the baseline specification. Italy continues to display a positive effect of roughly the

same order of magnitude as in the baseline specification, with the credible interval remaining entirely above zero. Bulgaria, Greece and Croatia retain positive, though somewhat lower mean estimates with all credible intervals now containing zero. Spain and Portugal shift to a mildly negative mean estimate while Poland's mean estimate remains in negative territory.

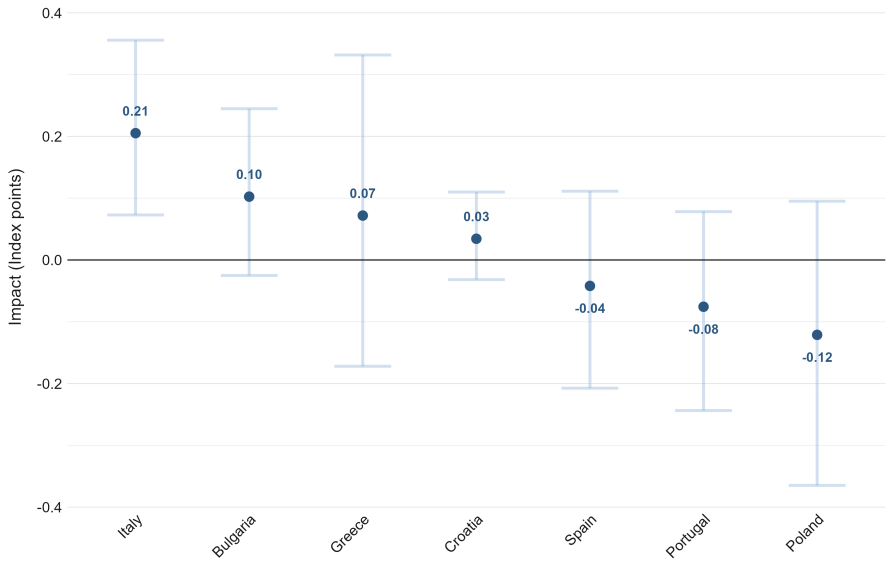

Figure 6: Robustness check with only non-EU control countries. Estimated RRF effect on institutional quality in 2024. Points represent mean estimates, while bars indicate 90% credible intervals. Source: Own illustration.

In line with the synthetic control literature, we furthermore conduct placebo tests by applying the model to control countries. Poor pre-treatment model fit in placebo simulations or large estimated effects for controls would indicate that the model may produce spurious results driven by idiosyncratic shocks or noise in the control group.

Figures 12 and 13 in the appendix illustrate the results of these placebo tests. Across both EU and non-EU control countries, the model fit is strong and the actual data points over the period 2022-2024 are contained in the 90% credible intervals in the majority of cases, which supports the validity of the results. At the same time, there are several country cases in which one or more observed data points during the 2022–2024 period fall outside the corresponding credible interval or lie very close to its boundary indicating possible idiosyncratic shocks in these countries that could bias our results. To address this concern, we run an additional robustness check in which we exclude the affected control countries from the control group.[13]

[13]These countries are Belgium, France, Germany, the Netherlands, Sweden, Canada, New Zealand, Norway and

The corresponding results in Figure 7 again remain broadly consistent with the baseline specification, reinforcing confidence in the robustness of the findings. Notably, Italy continues to exhibit a positive effect, with the 90% credible interval remaining well above zero and the mean estimate even increasing somewhat relative to the baseline specification. Positive mean estimates are also observed again for Greece, Bulgaria, Croatia and Spain, while Portugal and Poland are in negative territory.

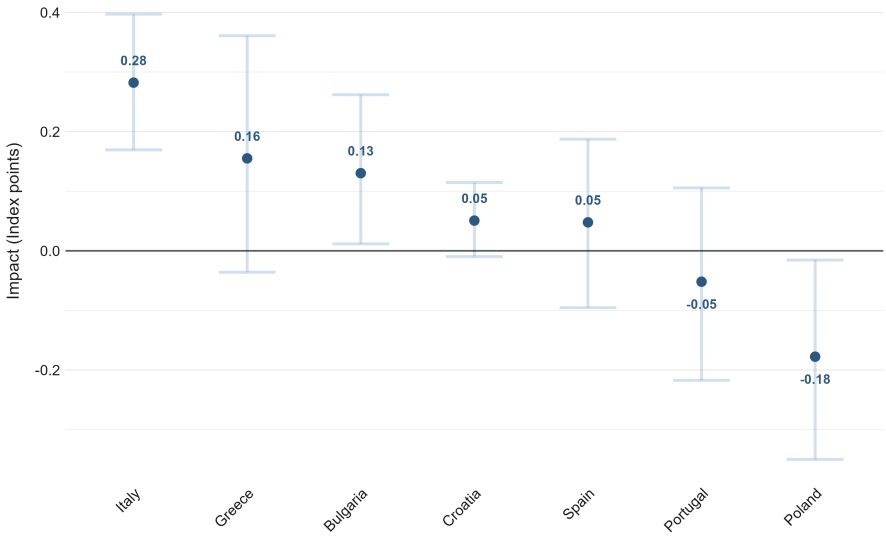

Figure 7: Robustness check excluding control countries for which placebo studies suggest idiosyncratic shocks. Estimated RRF effect on institutional quality in 2024. Points represent mean estimates, while bars indicate 90% credible intervals. Source: Own illustration.

Taken together, our baseline results and robustness checks point to considerable cross-country heterogeneity in the estimated impact of the RRF on institutional quality.

Italy stands out as the only country for which we find a robust, economically meaningful positive contribution of the RRF to institutional quality. The posterior probability of a positive RRF effect is close to unity, the mean estimates are consistently positive and the corresponding credible intervals lie entirely on the positive side across all model specifications. Moreover, the magnitude of the estimated RRF effect on institutional quality in Italy is sizeable. To show this, we define the WGI frontier as the average across the three best-performing EU and OECD countries in 2021 (i.e. Denmark, Finland and Norway). Our estimates imply that the RRF contributed to a shrinking of Italy's distance to the frontier by 16.8% between 2021 and

Switzerland.

2024.

For **Bulgaria, Croatia and Greece**, our results provide suggestive evidence of a positive RRF effect, but the signals are notably weaker than for Italy. In this group, mean estimates are also robustly positive across all model specifications, but substantially smaller in magnitude than for Italy. Moreover, the corresponding credible intervals include zero throughout all specifications for Croatia and Greece, and in one specification — while remaining close to zero in the others — for Bulgaria. This indicates substantial uncertainty around a quantitatively meaningful RRF-induced improvement in institutional quality in this group despite posterior probabilities of a positive effect between 0.86 and 0.96 in the baseline specification.

For **Poland, Portugal and Spain**, the evidence of a positive RRF effect is limited. Poland is the only country for which the posterior probability of a positive effect is close to zero in the baseline specification. Moreover, the country's mean estimates are negative across all model specifications. Hence, the model interprets the observed improvement in actual WGI data for Poland in the treatment period as unrelated to the RRF. For Portugal and Spain, the mean estimates are positive in the baseline specification but this finding does not survive our robustness checks.

To corroborate these findings, we look at cross-country evidence on the implementation of the Recovery and Resilience Plans, as well as details of Italy's plan – the country where our empirical results most clearly point to a positive RRF effect. An in-depth analysis of the remaining Recovery and Resilience Plans goes beyond the scope of this paper.

To recall, the progress in implementing the plans can be monitored on the basis of the RRF payment requests and the corresponding deliverables ("milestones and targets"). Figure 8 suggests that Italy had been more advanced than the other treated countries in implementing its Recovery and Resilience Plan by the end of 2024. More specifically, Italy – closely followed by Croatia – had already fulfilled almost 60% of its milestones and targets, compared to around 40% in Bulgaria and Spain, with the remaining countries lying in-between. Furthermore, Italy, together with Spain and Greece, has been an early mover as it submitted its first RRF payment request already in the final quarter of 2021. Croatia and Portugal followed in the subsequent quarter. By contrast, Bulgaria and Poland submitted their first requests only towards the end of 2023. A potential concern relates to the fact that some of the corresponding policy measures could already have been in place before the final submission of the payment requests and may have thus influenced the WGI data. Figure 8 therefore also reports the progress

made by end-2025. The picture remains broadly unchanged for the vast majority of countries, with the notable exception of Bulgaria which records a significant catch-up during 2025.

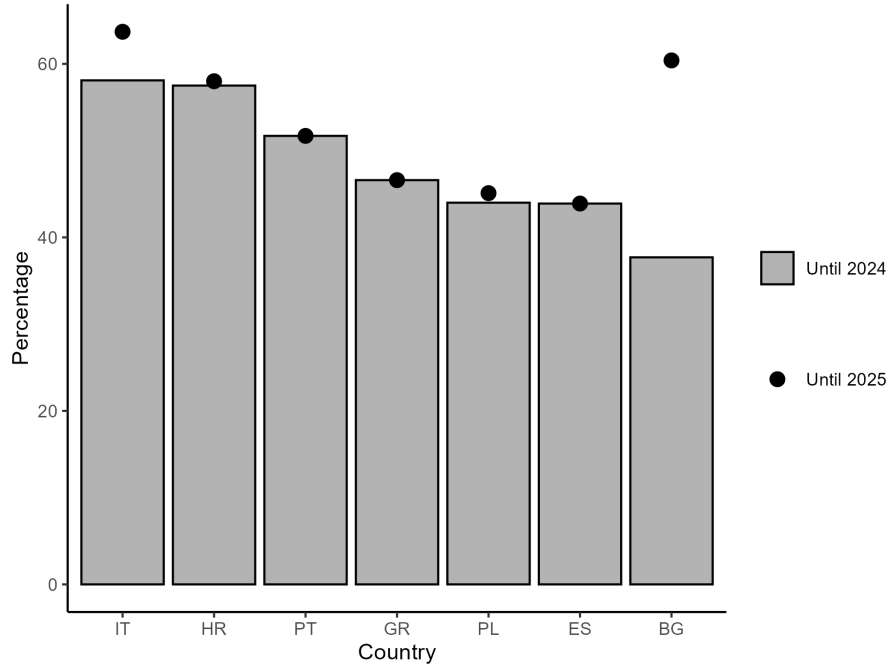

Figure 8: The chart shows the RRF-linked milestones and targets fulfilled by the end of 2024 and 2025, respectively, as a percentage of the overall number of milestones and targets to be achieved by the end of the RRF. Sources: European Commission and authors' calculations.

Yet, implementation progress by itself is not sufficient to assess potential RRF effects on institutional quality, as these also depend on the nature of the policy measures implemented. We therefore provide a quantitative overview of all reform-related RRF milestones and targets in the treated countries by policy area. For the sake of consistency, we restrict our analysis to measures fulfilled by the end of 2024, which marks the end of the time period covered by our sample. The classification of policy measures follows Bańkowski et al. (2022, 2024), with the only refinement that reforms in the area "public sector" are split into (i) those directly linked to institutional quality and governance and (ii) other public sector reforms. For instance, we assess measures linked to Italy's civil justice reform to be part of the former group while Croatia's efforts to improve the adequacy of pensions are in the latter group. Of course, such a classification involves judgement and should thus only be seen as illustrative. With this caveat, Figure 9 indicates that only a small share of the RRF-linked reforms in Portugal, Poland, Bulgaria and Spain are directly related to institutional quality and governance. In these countries, the reforms are focused on other policy areas, such as labour markets, that

are unlikely to have a major impact on our measure of institutional quality. In Croatia and Greece, the share of governance-related reforms is higher, at around 30%. However, Italy stands out, with almost 50% of all RRF-linked reforms directly related to institutional quality and governance.

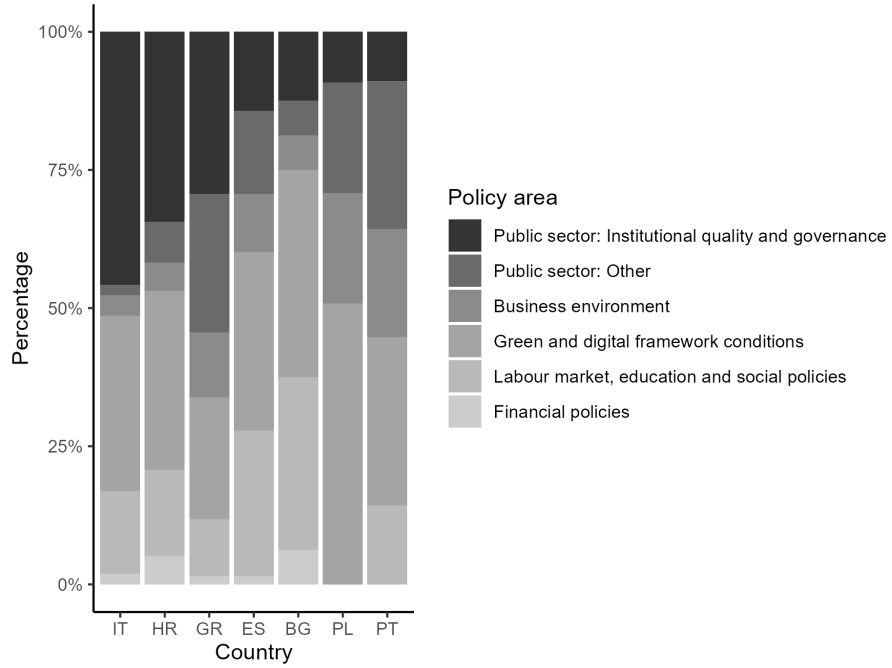

Figure 9: The chart provides a breakdown of all reform-related RRF milestones and targets by policy area, focussing on measures fulfilled by the end of 2024. Sources: Information on the milestones and targets was taken from the European Commission's Next Generation EU scoreboard. The classification is a refined version of Bańkowski et al. (2022, 2024).

A closer look at Italy's Recovery and Resilience Plan reveals that it had implemented several policy measures that plausibly strengthened institutional quality materially. As illustrated by Table 3 in the appendix, Italy's plan includes ambitious reforms that address long-standing institutional weaknesses, most notably in the judicial system and public administration.[14]

The preceding discussion corroborates the positive impact of the RRF on institutional quality that we find in Italy given the country's swift RRF implementation and the relatively high share of (ambitious) governance-related reforms implemented. For the group of countries where we find suggestive evidence of RRF-induced improvements in institutional quality (i.e. Bulgaria, Croatia and Greece), the picture is not uniform. However, for Croatia and Greece, the reform mix implemented over the treatment period is at least consistent with a positive ef-

[14]For more details, see Corti and Núñez Ferrer (2021); Giavazzi and Goretti (2024); D'Andrea et al. (2024).

fect and overall plan implementation was relatively advanced. The results for Bulgaria, where the reform mix was largely geared towards areas less relevant for institutional quality, may be confounded by reform efforts in preparation of the country's euro adoption in January 2026 and Schengen entry in January 2025, idiosyncratic factors during the treatment period that are difficult to disentangle from a genuine RRF effect in our empirical framework. Concerns related to a possible confounding of the estimates due to euro adoption and Schengen entry are also present for Croatia, which joined both the euro and Schengen in January 2023, albeit to a lesser extent since the evidence on the implementation of Croatia's Recovery and Resilience Plan is more in line with our empirical estimates than in the case of Bulgaria. In the group of countries with limited evidence of a positive RRF effect (i.e. Poland, Portugal and Spain), only small shares of implemented RRF-linked reforms were directly related to institutional quality. In addition, Poland and Spain were among the three weakest performers in terms of implementation speed. Portugal performed better in this regard but had the lowest share of governance-related reforms in the sample of main RRF beneficiary countries.

Overall, the econometric estimates are thus broadly consistent with cross-country information on the implementation of the national Recovery and Resilience Plans in terms of implementation speed and reform mix, reinforcing confidence in our findings.

5 Conclusion

The RRF incentivises structural reforms and investments with a view to promoting long-term economic growth in EU Member States. Although the programme is approaching the end of its lifecycle in 2026, empirical studies on its effectiveness and economic impact remain scarce. This paper contributes to the literature by applying a Bayesian synthetic control model to study a key supply-side transmission channel: improvements in institutional quality, as measured by the Worldwide Governance Indicators.

Using this framework, we estimate the causal effect of the RRF on institutional quality in the main RRF beneficiary countries. Under our baseline specification, the posterior probabilities of a positive RRF effect are large – 77% on average – and exceed 85% in five of the seven country cases, indicating that the RRF likely had a positive overall impact on institutional quality. At the individual country level, we find robust and economically meaningful RRF-induced improvements in Italy. For the other countries in our sample, the evidence of such an

effect ranges from suggestive to limited despite relatively high probabilities of a positive effect in several cases. The estimated mean effects are generally smaller than for Italy, surrounded by credible intervals that often include zero, occasionally become negative in robustness checks, or remain negative across all model specifications. The observed cross-country variation is broadly consistent with the implementation of the national Recovery and Resilience Plans in terms of implementation speed and reform mix, reinforcing confidence in the findings.

Several caveats apply. Most notably, our data cover only the period until end-2024, while EU Member States have time until August 2026 to implement their Recovery and Resilience Plans. Moreover, the WGI indicators are perception-based, and some underlying data sources are updated only infrequently. The full effect of the RRF on institutional quality may therefore not yet be visible in the data. In addition, our estimates for Croatia and Bulgaria – two countries for which we find suggestive evidence – may be confounded by reform efforts related to euro adoption and Schengen entry.

While additional data are needed before firm policy conclusions can be drawn, the available evidence nevertheless supports the view that conditional, reform-linked financing instruments of the RRF type can improve long-term economic performance. This is most clearly illustrated by our findings for Italy. At the same time, the cross-country variation in our estimates indicates that reform design and plan implementation matter. This has important implications for the design of future EU funding instruments, including the Multiannual Financial Framework and the broader EU economic governance framework. Drawing firmer conclusions will require cross-validating our results once data from the later years of the RRF lifecycle and the subsequent period become available. This should provide a clearer picture of cross-country differences and allow for a better understanding of their drivers.

We also see several other promising avenues for future research on the impact of the RRF. Further work could aim at disentangling the relative contributions of the reform and investment channels. Within the reform channel, examining effects on structural outcomes not fully captured by institutional quality – such as labour market performance – would be particularly valuable and would complement our analysis.

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A Appendix

Institutional quality and RRF allocation

Following Helliwell et al. (2014) and Masuch, Moshammer and Pierluigi (2017), we define institutional quality as the unweighted average of four WGI metrics capturing the following dimensions of institutional quality (World Bank, 2025):

1. *Government Effectiveness* captures "perceptions of the quality of public services, the civil service, policy formulation and implementation, and the credibility of a government's decisions".

2. *Regulatory Quality* reflects "perceptions of the government's ability to design and implement policies and regulations that promote private sector development".

3. *Rule of Law* relates to "perceptions of the extent to which agents respect and follow the rules of society, including contract enforcement, property rights, the police, courts, and the likelihood of crime and violence".

4. *Control of Corruption* captures "perceptions of the extent to which public power is used for private gain, including both petty and grand corruption, as well as capture of the state by elites and private interests".

Each of these components is based on a broad range of primary data sources and captures the perceptions of experts and other survey respondents. All indicators range between between -2.5 and 2.5. In each year, the indicators are centred around the global average for that year. Hence, any given country-year observation should be interpreted as relative to the global mean. However, as noted by Kaufmann and Kraay (2024) and World Bank (2025), the global mean of these components has been broadly stable over time. Therefore, Kaufmann and Kraay (2024) conclude that "the changes over time in countries' positions in the WGI relative to the global mean can reasonably also be interpreted as absolute changes". In any case, we are mainly interested in comparing the WGI developments in the RRF beneficiary countries with those in the control group. Such a cross-country comparison would remain meaningful even with more perceptible changes in the global mean of our synthetic WGI indicator. Table 1 provides an overview of recent developments in our measure of institutional quality at the country level.

Country	**RRF allocation** (% of 2019 GDP)	**WGI 2021** (index)	**Δ WGI 2021-24** (index points)
	(a) Treated countries		
Greece	19.4	0.45	-0.13
Croatia	18.0	0.40	-0.02
Spain	13.0	0.94	-0.10
Italy	10.8	0.57	0.08
Portugal	10.4	0.98	-0.08
Poland	10.2	0.59	0.09
Bulgaria	10.1	0.01	0.00
	(b) EU control countries		
France	1.7	1.33	-0.20
Belgium	1.1	1.39	-0.10
Austria	1.0	1.59	-0.13
Finland	0.8	2.12	-0.12
Germany	0.8	1.72	-0.11
Sweden	0.7	1.88	-0.10
Netherlands	0.7	1.87	-0.10
Denmark	0.5	2.12	-0.09
Ireland	0.3	1.60	0.04
Luxembourg	0.1	1.88	0.04
	(c) Other EU countries		
Romania	9.6	0.18	0.12
Lithuania	7.8	1.07	0.14
Hungary	7.1	0.40	-0.14
Slovakia	6.8	0.64	-0.20
Latvia	6.7	0.95	-0.01
Slovenia	5.6	0.95	-0.06
Cyprus	5.2	0.74	-0.03
Czechia	3.8	1.06	0.07
Estonia	3.3	1.49	-0.03
Malta	2.2	0.77	-0.24
	(d) Non-EU control countries		
Australia	-	1.68	0.03
Canada	-	1.62	-0.07
Japan	-	1.51	0.06
New Zealand	-	1.83	-0.01
Norway	-	1.94	-0.09
South Korea	-	1.14	-0.02
Switzerland	-	1.93	-0.09
United Kingdom	-	1.48	-0.11
United States	-	1.26	-0.07

Table 1: RRF allocation and institutional quality (WGI). Higher WGI readings correspond to higher institutional quality. Sources: European Commission, World Bank and own calculations.

Country	Government effectiveness (Δ 2021–24)	Regulatory quality (Δ 2021–24)	Rule of law (Δ 2021–24)	Control of corruption (Δ 2021–24)
	(a) Treated countries			
Greece	-0.38	0.08	-0.15	-0.09
Croatia	-0.05	-0.05	-0.04	0.05
Spain	-0.01	-0.30	0.01	-0.10
Italy	0.22	0.07	0.03	0.01
Portugal	-0.22	-0.01	-0.10	0.01
Poland	0.08	0.01	0.17	0.11
Bulgaria	0.06	-0.03	0.00	-0.01
	(b) EU control countries			
France	-0.34	-0.14	-0.10	-0.20
Belgium	-0.03	-0.15	-0.12	-0.08
Austria	-0.30	-0.10	-0.04	-0.07
Finland	-0.34	-0.05	-0.05	-0.03
Germany	-0.28	-0.11	-0.01	-0.05
Sweden	-0.19	-0.01	-0.06	-0.12
Netherlands	-0.10	-0.10	-0.07	-0.12
Denmark	-0.28	-0.07	-0.01	-0.01
Ireland	-0.01	0.17	0.05	-0.04
Luxembourg	0.09	-0.02	0.03	0.05
	(c) Other EU countries			
Romania	0.50	0.07	-0.09	0.02
Lithuania	0.22	0.12	0.16	0.07
Hungary	-0.28	-0.07	-0.10	-0.09
Slovakia	-0.08	-0.34	-0.15	-0.25
Latvia	-0.14	-0.00	0.11	-0.02
Slovenia	-0.25	-0.03	0.05	-0.02
Cyprus	0.01	-0.11	-0.08	0.04
Czechia	0.08	-0.01	0.02	0.20
Estonia	-0.07	-0.16	-0.00	0.13
Malta	-0.40	-0.23	-0.14	-0.20
	(d) Non-EU control countries			
Australia	0.11	-0.06	-0.10	0.17
Canada	0.08	-0.27	-0.09	0.02
Japan	0.43	-0.07	-0.02	-0.10
New Zealand	0.25	-0.01	-0.06	-0.20
Norway	-0.15	0.02	-0.11	-0.11
South Korea	-0.14	0.03	-0.05	0.09
Switzerland	-0.24	0.01	-0.03	-0.10
United Kingdom	-0.14	-0.09	-0.04	-0.15
United States	-0.08	-0.11	-0.07	-0.04

Table 2: Change between 2021 and 2024 across WGI components (index points). Higher values indicate improvements. Sources: World Bank and own calculations.

Key RRF-linked policy measures implemented in Italy by end-2024

Policy area	Description
Judicial system: reforms aimed at improving the functioning of the civil, criminal and tax justice system	Legislative measures to shorten proceedings and reduce backlogs. Including simplified procedures at first instance/trial level, enhanced 'filtering procedures' at appeal level and extended use of mediation in civil justice. Simplified procedures, time limits and incentives for shorter proceedings in civil and criminal justice. Digitalisation of judicial proceedings through mandatory electronic filing of documents and electronic workflows. Enhanced enforcement of tax law and reduction of appeals at the Court of Cassation.
Public administration: efficiency-enhancing reforms	Simplification of administrative procedures, including through silent-consent mechanisms and enhanced interoperability. Introduction of Key Performance Indicators. Enhanced public employment management, for instance through the creation of a single recruiting platform, modernised recruitment processes, life-long learning and horizontal mobility.
Public procurement and payments: efficiency-enhancing reforms	Procedural simplification and digitalisation of public procurement (e.g. National eProcurement System). Creation of dedicated procurement offices and reduction of organisational fragmentation. Enhanced monitoring and anti-corruption measures in procurement. Removal of bottlenecks causing late public sector payments to businesses.
Digitalisation of public administration: reforms and investments to modernise public sector IT and expand digital public services	Streamlining and acceleration of the procurement process for ICT services and assets. Launch of an integrated 'ecosystem' of digital public services. Measures to facilitate cloud solutions and data interoperability. Creation of a digital transformation office. Targeted digitalisation investments for large administrative bodies.
Tax administration: reforms aimed at strengthening administrative processes and tools	Including pre-populated VAT tax returns and digital infrastructure for big data analysis.

Table 3: Selected Italian RRP measures implemented up to end-2024. Source: European Commission (RRF Scoreboard).

Additional charts and tables

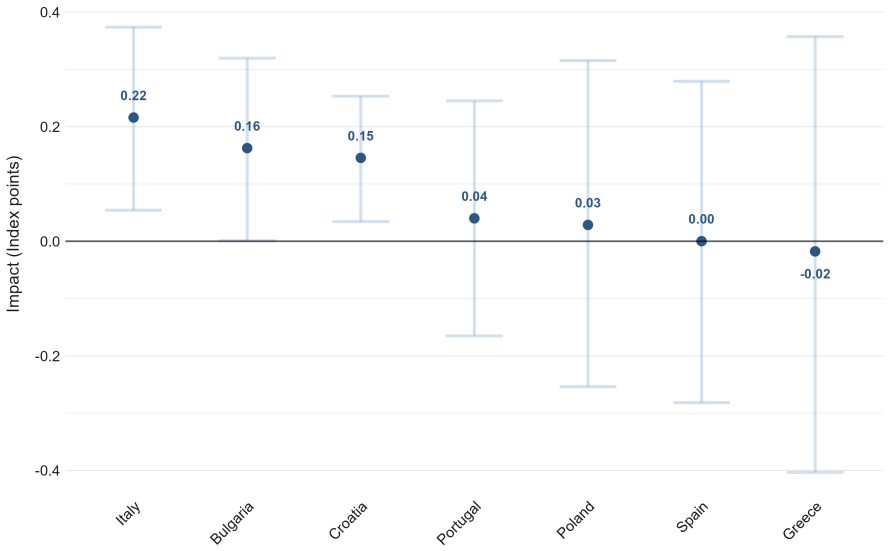
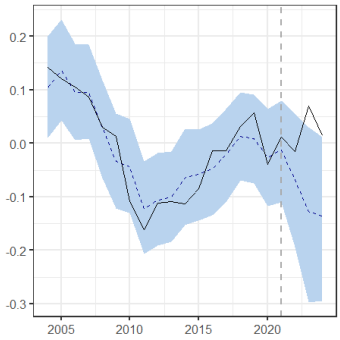
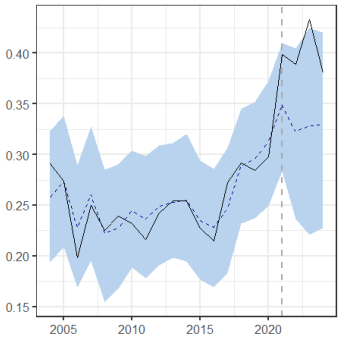


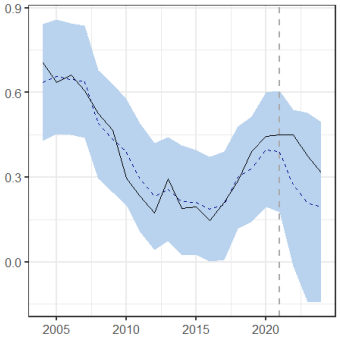
Figure 10: Robustness check with prior R-squared=0.6 Estimated RRF effect on institutional quality in 2024. Points represent mean estimates, while bars indicate 90% credible intervals. Source: Own illustration.



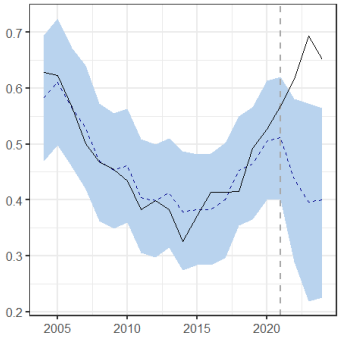
(a) Bulgaria



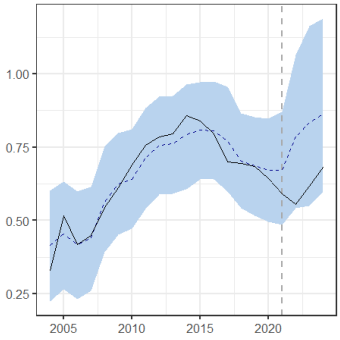
(b) Croatia



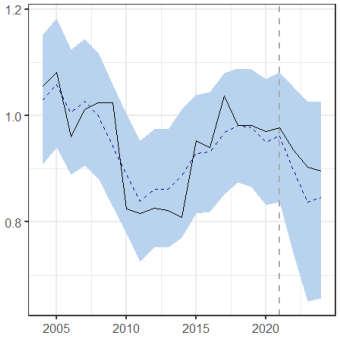
(c) Greece



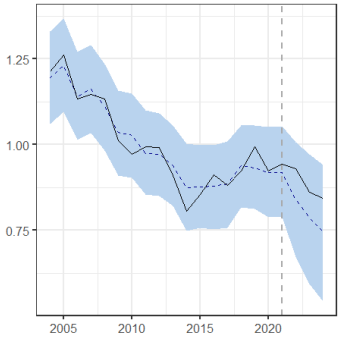
(d) Italy



(e) Poland

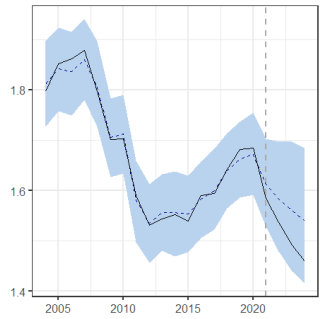


(f) Portugal

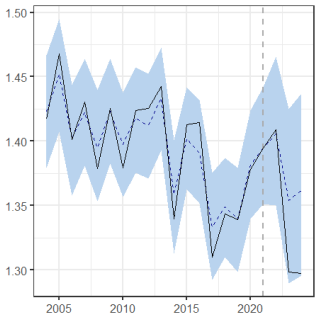


(g) Spain

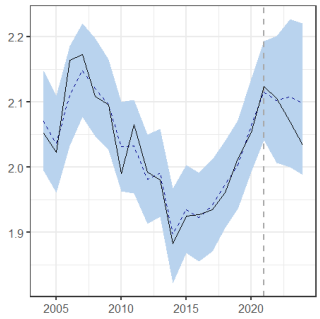
Figure 11: Baseline results. The solid line shows the observed institutional quality series, the dashed line the model-based counterfactual. The vertical line delineates treatment from pre-treatment period while the blue-shaded area indicates the 90% credible interval.



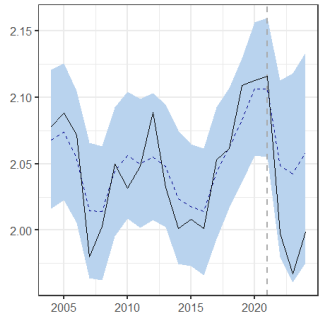
(a) Austria



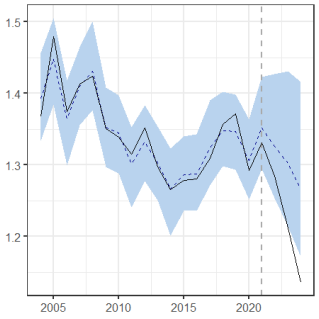
(b) Belgium



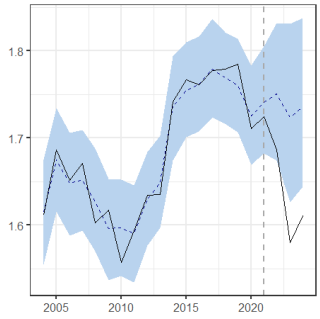
(c) Denmark



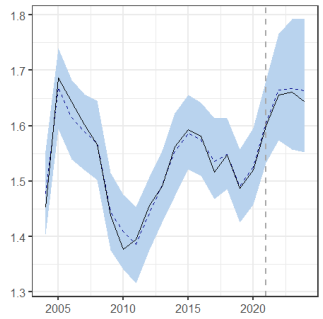
(d) Finland



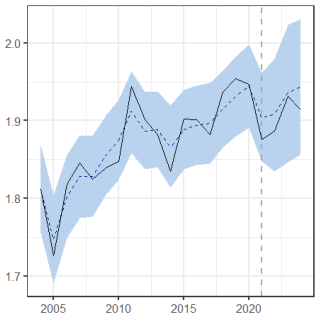
(e) France



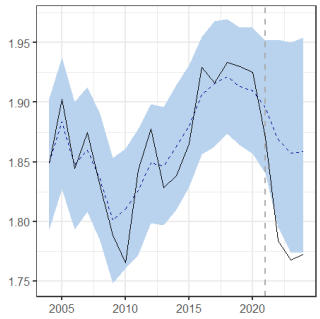
(f) Germany



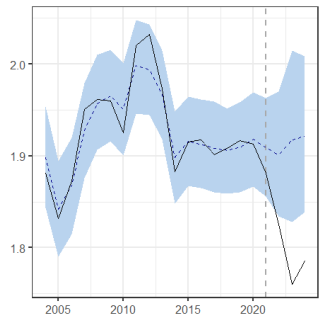
(g) Ireland



(h) Luxembourg

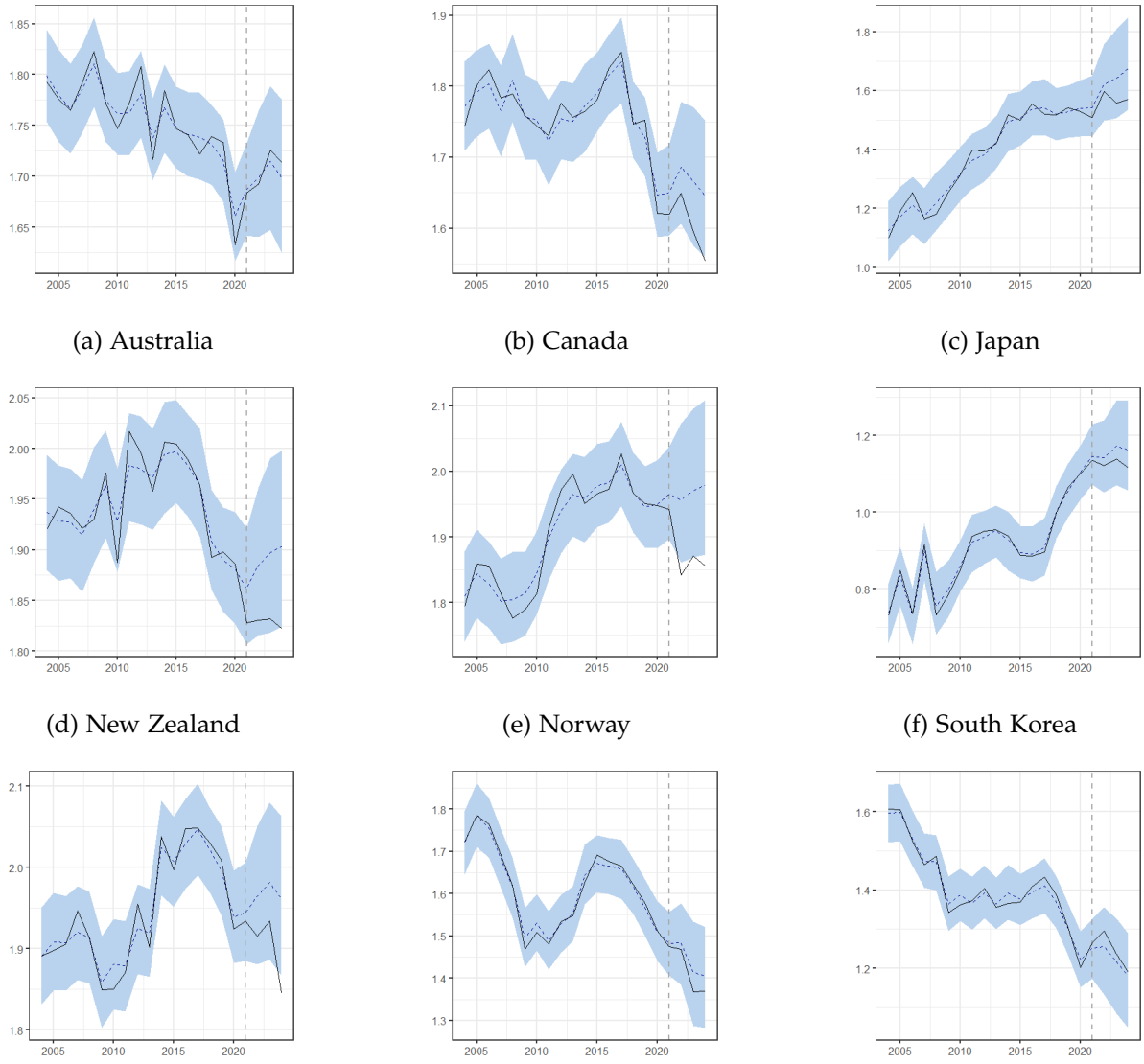


(i) Netherlands



(j) Sweden

Figure 12: Placebos - EU controls. The solid line shows the observed institutional quality series, the dashed line the model-based counterfactual. The vertical line delineates treatment from pre-treatment period while the blue-shaded area indicates the 90% credible interval.

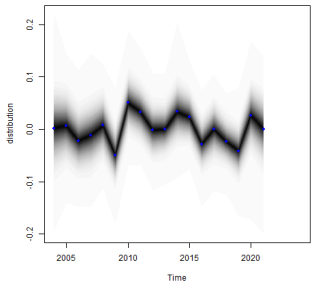


(a) Australia (b) Canada (c) Japan

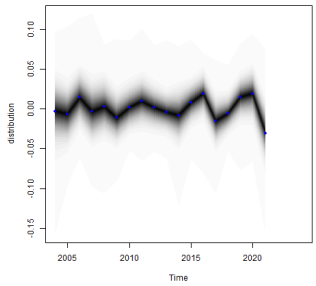
(d) New Zealand (e) Norway (f) South Korea

(g) Switzerland (h) United Kingdom (i) United States

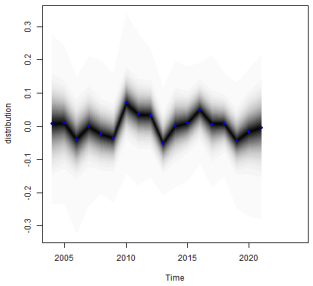
Figure 13: Placebos - non-EU controls. The solid line shows the observed institutional quality series, the dashed line the model-based counterfactual. The vertical line delineates treatment from pre-treatment period while the blue-shaded area indicates the 90% credible interval.



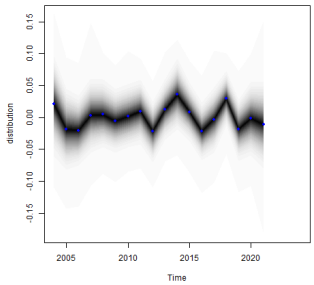
(a) Bulgaria



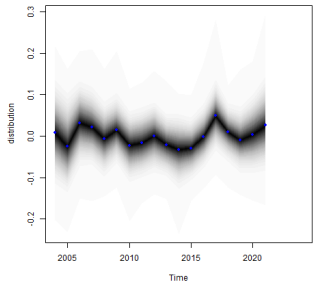
(b) Croatia



(c) Greece



(d) Italy



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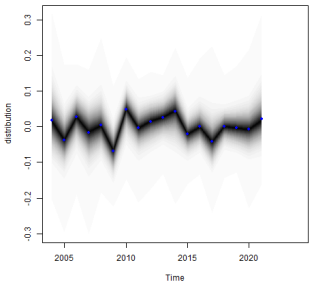
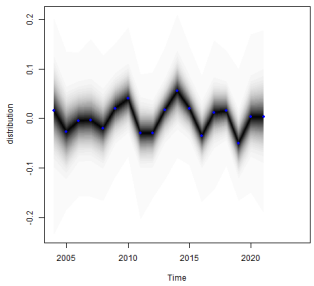
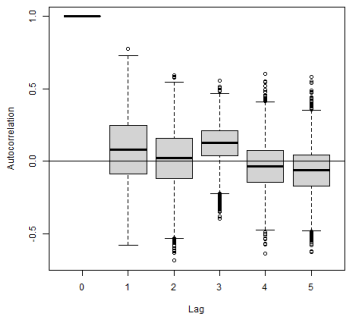


(f) Portugal



(g) Spain

Figure 14: Residuals - treated countries. The charts show the posterior distribution of the residuals between the actual series and the estimated counterfactual.



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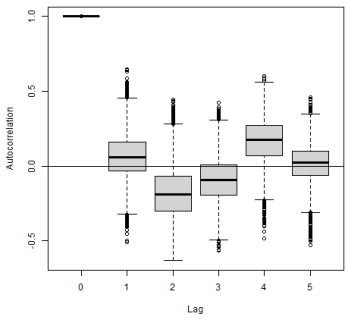

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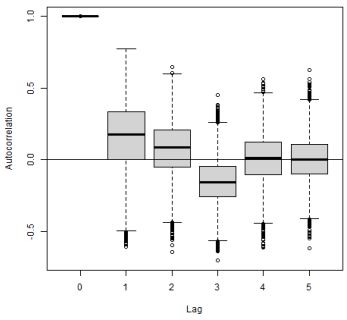
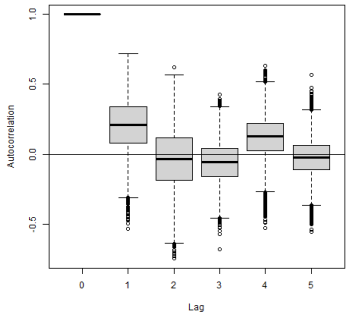
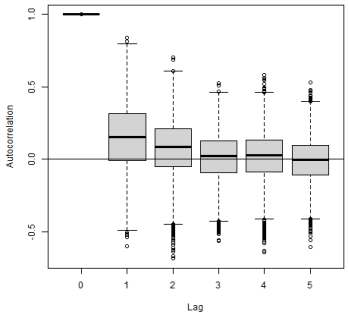


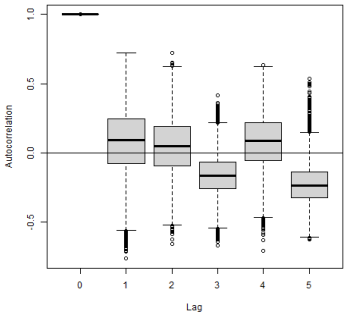
(c) Greece



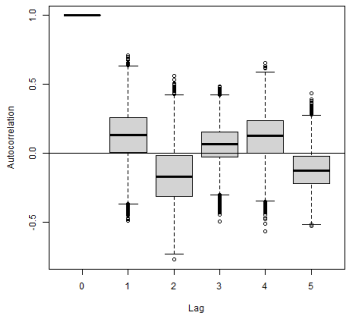
(d) Italy



(e) Poland



(f) Portugal



(g) Spain

Figure 15: Posterior distribution of the residual autocorrelation function (ACF) shown using side-by-side boxplots. Each boxplot corresponds to the posterior distribution of the ACF at a given lag. The box shows the interquartile range (middle 50% of posterior draws), the horizontal line inside the box indicates the posterior median, and the whiskers reflect the dispersion of the remaining posterior mass.

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The authors thank Philip Lane, Óscar Arce, Wolfgang Modery, the participants of an ECB workshop and an anonymous referee for insightful comments.Preliminary results from this analysis, covering only data up to 2022, were published in a compressed and policy-oriented format in Bánkowski et al. (2024).
The views expressed in this paper are those of the authors and do not necessarily reflect those of the ECB.

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