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Fiscal Discipline, Uneven Regional Consequences: Evidence from the Italian National Health Service

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Abstract

Fiscal consolidation in decentralised public-service systems may produce uneven territorial consequences. In Italy's National Health Service, regional governments are responsible for organising healthcare but differ substantially in fiscal capacity and service provision. Between 2007 and 2010, ten of the country's twenty regions entered negotiated recovery plans combining stricter budget constraints with organisational reforms and, in some cases, recruitment restrictions. Using annual regional data spanning 1994–2023, this article examines how public healthcare staffing and patient out-migration evolved following the introduction of these plans. The two outcomes capture, respectively, an essential input into regional service capacity and residents' reliance on hospital care outside their region of residence. We construct a separate synthetic control for each treated region using regions that never entered the programme. Public healthcare personnel per 1,000 residents fell persistently below the estimated counterfactual in several regions but showed no systematic divergence in others. Patient out-migration followed a less uniform pattern, with a clear persistent increase in only one region and period-specific increases elsewhere. The findings show that a common national framework of fiscal discipline was associated with markedly different trajectories across regional healthcare systems. Evaluations of fiscal recovery should therefore consider its territorial distribution and implications for service capacity, rather than financial outcomes alone.

JEL Classification: H51; H77; I11; I18.

Keywords: fiscal consolidation; regional healthcare; synthetic control method; healthcare personnel; patient mobility; Italy.

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1 Introduction

National fiscal-consolidation policies may have uneven territorial consequences when they are implemented through decentralised public-service systems. Regional governments differ in their fiscal capacity, institutional arrangements, initial service endowments, and ability to absorb expenditure reductions. Common financial constraints may therefore improve efficiency in some regions while weakening service provision in others. In publicly funded healthcare systems, whether consolidation can restore financial sustainability without compromising care depends not only on the size and composition of the adjustment, but also on the regional context in which it is implemented.

Italy's *Piani di Rientro* (PdRs) provide a particularly informative setting in which to examine this trade-off. Between 2007 and 2010, ten Italian regions entered multi-year recovery plans negotiated with the Ministry of Health and the Ministry of Economy and Finance (MEF).[1] The plans were introduced in response to persistent regional healthcare deficits and an incomplete process of fiscal decentralisation. Reforms implemented during the 1990s, and consolidated by the 2001 constitutional reform, gave regional governments extensive responsibility for organising and delivering healthcare. Their ability to finance these services through regional taxation, however, varied substantially with local fiscal capacity. Poorer regions consequently remained heavily dependent on equalising transfers from the central government. The mismatch between expenditure responsibilities and revenue autonomy, combined with the recurrent use of additional central transfers to cover regional deficits, weakened financial accountability (France et al., 2005; Bordignon and Turati, 2009; Bordignon et al., 2020). The PdR framework sought to strengthen regional budget constraints by making access to additional central funding conditional on the adoption and implementation of corrective measures. Non-compliance could result in automatic increases in regional tax rates, restrictions on personnel recruitment, and, in the most severe cases, the appointment of a commissioner to oversee the regional health service. Recovery plans were negotiated separately with each region and differed in their content, timing, and enforcement. They combined measures to contain expenditure with organisational reforms intended to restructure hospital networks, reduce inappropriate care, and strengthen community-based services.

The central question is whether the recovery plans improved fiscal sustainability primarily through efficiency gains or whether they also weakened the capacity of regional health systems to provide care. This article addresses that question by examining two related margins of adjustment: public healthcare staffing and patient out-migration. Staffing is a key input into the capacity of regional health services. Patient out-migration captures a distinct but complementary dimension: whether residents increasingly relied on hospital care outside their region following the introduction of a PdR. Considering these outcomes within the same empirical framework allows us to examine both the evolution of an essential supply-side input and a revealed response of patients to the availability and perceived adequacy of care in their region of residence. The analysis does not presume that changes in staffing mechanically cause changes in mobility; rather, it uses the two outcomes to provide a broader account of how regional healthcare provision evolved under fiscal consolidation.

[1] Abruzzo, Campania, Lazio, Liguria, Molise, Sardegna, and Sicilia entered the programme in 2007; Calabria entered in 2009; and Piemonte and Puglia entered in 2010. At the time of writing, Campania, Liguria, Sardegna, and Piemonte were no longer subject to a recovery plan. Abruzzo, Calabria, Lazio, Molise, Puglia, and Sicilia remained subject to a recovery plan, while Calabria and Molise also remained under commissioner-led administration.

Interpreting changes in public healthcare staffing requires distinguishing between two layers of personnel restrictions. A nationwide expenditure ceiling applied to all regional health systems, whereas regions subject to a PdR could face an additional turnover freeze preventing the replacement of departing staff. This distinction allows us to examine the evolution of staffing in PdR regions against a national policy environment in which personnel expenditure was constrained in treated and untreated regions alike. The relevant empirical question is therefore not whether restrictions on recruitment and turnover can reduce public healthcare employment. Rather, it is whether the PdR framework produced staffing shortfalls relative to the trajectories that treated regions would otherwise have followed, whether such shortfalls emerged systematically across regions, and how long they persisted. These effects cannot be inferred directly from the formal content of the plans because the additional restrictions differed across treated regions in their timing, implementation, and intensity, while all regions were subject to the national personnel-expenditure ceiling. Section 2 describes the two measures and their legal basis in greater detail.

We use the Synthetic Control Method (SCM), introduced by Abadie and Gardeazabal (2003) and formalised by Abadie et al. (2010), to trace the evolution of staffing and patient out-migration following the introduction of the PdRs. For each treated region, the SCM constructs a counterfactual as a weighted combination of regions that never entered the programme. When the synthetic control closely reproduces the treated region's pre-treatment trajectory, the post-treatment difference between the observed and synthetic outcomes provides an estimate of the changes associated with the introduction of the PdR. This region-specific approach is well suited to a setting in which programme participation was selective and treatment experiences were heterogeneous. Treated regions entered the programme because of persistent healthcare deficits and differed systematically from never-treated regions in their economic conditions, fiscal capacity, healthcare resources, and pre-treatment trajectories. These differences make the common-trends assumption required by conventional difference-in-differences designs difficult to sustain. The SCM instead constructs a separate counterfactual for each treated region by matching its pre-treatment outcome trajectory with a weighted combination of never-treated regions (Di Novi and Salari, 2026).

The analysis uses annual region-level data from the Istat *Health for All* database (Istat, 2026). The combined dataset spans 1994–2023, although the period of availability differs between the two outcomes. Public healthcare personnel are observed from 1994 to 2022, while patient out-migration is observed from 1999 to 2023. These long pre-treatment periods constitute an important advantage for the SCM, as they allow us to assess whether the synthetic controls closely reproduce the treated regions before the introduction of the plans. The long post-treatment period also makes it possible to distinguish short-run adjustments from persistent changes and to follow regional outcomes beyond the initial implementation of the PdRs, including after some regions exited the programme.

This article contributes to a growing literature on the effects of Italy's regional recovery plans. Existing studies find that the PdRs reduced per-capita healthcare expenditure and contracted the supply of hospital beds, personnel, and inpatient care (Depalo, 2019; Bordignon et al., 2020; Arcà et al., 2020). Evidence on health outcomes is less uniform. Bordignon et al. (2020) find no significant effect on mortality, while Arcà et al. (2020), Cirulli and Marini (2023), and Guccio et al. (2024) report increases in amenable, preventable, or overall mortality. For most treated regions, the bounds estimated by Depalo (2019) do not identify the direction of the mortality effect. A more recent strand of the literature examines

healthcare access and service quality. Ciaccio (2023) finds a persistent deterioration in service quality, including an increase in patient out-migration. Beraldo et al. (2023) focus directly on interregional patient mobility and find larger effects under commissioner-led plans, with hospital beds and healthcare employment identified as relevant channels.

Within this literature, the article makes three contributions. First, it shows how a common national framework of fiscal discipline was associated with markedly different trajectories across regional healthcare systems. The ten PdRs differed in treatment timing and duration, policy content, implementation, and subsequent institutional trajectories. Four regions exited the programme during the period considered, while the remaining regions continued under successive operational programmes. By estimating a separate synthetic control for each treated region, the analysis preserves this heterogeneity and identifies where, when, and for how long regional outcomes diverged from their estimated counterfactuals.

Second, the article provides a systematic region-by-region account of the medium- and long-run evolution of public healthcare staffing after the introduction of the PdRs. Although previous studies document a contraction in personnel as part of a broader reduction in healthcare inputs, the formal inclusion of personnel restrictions in the plans does not establish whether they produced staffing shortfalls relative to the trajectories that individual regions would otherwise have followed. Our analysis therefore treats staffing as an outcome of primary interest and examines whether, where, and for how long such shortfalls emerged, as well as whether they persisted as the plans evolved or after regions formally exited the programme. Third, it examines staffing and patient out-migration within a common empirical framework. This brings together the evolution of an essential healthcare input and a patient-mobility margin of adjustment without imposing a causal relationship between the two. The analysis thereby complements existing evidence on expenditure, mortality, service quality, and interregional mobility by examining changes in both regional service capacity and residents' reliance on care outside their region.

The public healthcare personnel rate fell persistently below its estimated counterfactual in several treated regions, although the magnitude and timing of the divergence varied substantially. Increases in patient out-migration were concentrated in fewer regions and periods. The findings therefore show that the consequences of a common fiscal-recovery framework were strongly region-specific and cannot be adequately represented by a single average pattern.

The remainder of the article is organised as follows. Section 2 describes the institutional background and the main policy instruments included in the recovery plans. Section 3 presents the data, the Synthetic Control Method, and the permutation-based inference procedure. Section 4 reports the results and diagnostic checks. Section 5 discusses their interpretation and policy implications, while Section 6 concludes.

2 Institutional Background

2.1 The Italian National Health Service

The Italian National Health Service (*Servizio Sanitario Nazionale*, SSN) was established in 1978, replacing a Bismarckian system of health insurance funds with a tax-financed Beveridge-type system designed to guarantee universal access to healthcare throughout the country (Fattore, 1999; Longo, 2016). Since then, successive reforms have progressively decentralised the organisation, management, and financing of healthcare while preserving

nationally defined entitlements.

Reforms introduced during the 1990s transformed local health units into local health authorities (*Aziende Sanitarie Locali*, ASLs), established semi-autonomous public hospital enterprises, and introduced prospective hospital reimbursement based on Diagnosis-Related Groups (DRGs). At the same time, regional governments assumed increasing responsibility for organising and financing healthcare, while the central government retained responsibility for defining the legislative framework and nationally guaranteed standards of care (France et al., 2005; Longo, 2016; de Belvis et al., 2022; Di Novi et al., 2018). The 2001 constitutional reform consolidated this process by assigning regions primary responsibility for organising and delivering healthcare.

The central government nevertheless retained responsibility for defining the *Livelli Essenziali di Assistenza* (LEAs), the nationally guaranteed package of preventive, community, and hospital services that must be provided throughout the country. Compliance with the LEAs is monitored by the Ministry of Health.

The SSN therefore combines universal national coverage with considerable regional autonomy in the organisation and delivery of healthcare services. Regions differ substantially in governance, hospital capacity, staffing, technology, and the balance between public and accredited private providers (Ricciardi and Tarricone, 2021; de Belvis et al., 2022). These differences are particularly pronounced between northern and southern Italy and imply that common fiscal interventions may have different consequences across regional health systems. These institutional differences were accompanied by substantial differences in regional fiscal capacity, which became increasingly important as healthcare financing was progressively decentralised.

2.2 Fiscal decentralisation and regional imbalances

The decentralisation of expenditure responsibilities was not accompanied by equivalent revenue-raising autonomy. Regional healthcare is financed through a combination of own-source revenues and resources redistributed through the national financing system. The main funding sources include the regional tax on productive activities (*Imposta Regionale sulle Attività Produttive*, IRAP), the regional surcharge on personal income tax (*addizionale regionale IRPEF*), and a regional share of value added tax (VAT) revenues. Because the revenue generated by these sources depends, directly or indirectly, on regional economic activity and income, regions differ substantially in their capacity to finance healthcare from their own fiscal bases. Equalising transfers are therefore required to enable regions with weaker fiscal capacity to provide the LEAs.

These disparities were already pronounced when the PdR programme was introduced. Regional taxes financed approximately 60% of healthcare expenditure in Lombardia but only around 10% in Calabria. More generally, own-source revenues covered approximately 15% of healthcare expenditure in southern regions, compared with almost 50% in central and northern regions (Di Novi et al., 2019; Turati, 2013). Regions consequently faced similar expenditure responsibilities but markedly different degrees of effective financial autonomy. Regional accountability was further weakened by the recurrent use of additional central transfers to cover healthcare deficits. Because regional governments did not necessarily bear the full financial consequences of overspending, this arrangement contributed to the moral-hazard problem that the recovery plans were intended to address (France et al., 2005; Tediosi et al., 2009; Bordignon et al., 2020).

Interregional patient mobility also has financial implications. When residents receive

hospital treatment outside their region, the region of residence compensates the region providing the treatment through an interregional settlement system. Patient outflows therefore generate financial liabilities for regions of origin and revenues for destination regions. Net patient outflows have historically been concentrated in southern Italy, while several central and northern regions have been net recipients. These patterns reflect persistent territorial differences in service availability, hospital capacity, specialist care, technology, and perceived quality (Fattore et al., 2014; Brenna and Spandonaro, 2015; Balia et al., 2018). Patient mobility may consequently reinforce existing disparities, as regions with weaker healthcare systems incur payments for services delivered elsewhere.

2.3 Regional recovery plans

The recovery-plan framework originated in the 2005 budget law, which made part of central healthcare funding conditional on regional compliance with financial and service-delivery requirements. Regions with healthcare deficits were required to prepare a multi-year programme of financial and organisational measures agreed with the Ministry of Health and the MEF. Although this initial mechanism was only partially implemented, it established the principle that access to additional central funding should depend on verifiable corrective action (Bordignon et al., 2020).

The framework became operational with the 2007 budget law and was subsequently strengthened by Law No. 191/2009. A region could be required to adopt a PdR when its structural healthcare deficit exceeded 5% of ordinary funding and own healthcare revenues, or when a smaller deficit could not be covered through automatic tax increases or other regional resources. Each plan was intended to restore financial balance while maintaining the provision of the LEAs (Arcà et al., 2020; Depalo, 2019; Bordignon et al., 2020; Ciaccio, 2023).

Implementation was assessed periodically by two central monitoring bodies. The *Tavolo per la verifica degli adempimenti regionali* examined regional accounts and compliance with the financial commitments included in the plan, while the *Comitato LEA* assessed the provision of essential services. Failure to meet the agreed objectives could lead to additional corrective measures, automatic increases in regional tax rates, restrictions on personnel recruitment, and the continuation of the recovery programme. Persistent non-compliance could also result in commissioner-led administration. In these cases, the central government appointed a commissioner responsible for implementing the plan. The position was often assigned to the regional president, assisted by technically qualified sub-commissioners, rather than to an external administrator (Bordignon et al., 2020).

Ten regions entered the PdR framework between 2007 and 2010, but their subsequent trajectories differed substantially (Table 1). Four regions eventually exited the programme, while the other six remained subject to successive operational programmes.

2.4 Policy instruments

Each recovery plan was negotiated individually and combined revenue measures with expenditure controls affecting hospital capacity, pharmaceuticals, procurement, accredited private providers, and healthcare personnel (Aimone Gigio et al., 2018). Their precise composition and implementation varied across regions.[2]

[2]A region-by-region summary of the principal measures adopted under each PdR is provided in Appendix E.

Table 1: Regional recovery plans and commissioner-led administration

Region	PdR entry	Commissioner-led period	PdR status
Abruzzo	2007	2008–2016	Ongoing
Calabria	2009	2010–present	Ongoing
Campania	2007	2009–2020	Exited in 2026
Lazio	2007	2008–2020	Ongoing
Liguria	2007	—	Exited in 2010
Molise	2007	2009–present	Ongoing
Piemonte	2010	—	Exited in 2017
Puglia	2010	—	Ongoing
Sardegna	2007	—	Exited in 2010
Sicilia	2007	—	Ongoing

Notes: "Ongoing" indicates that the region remained subject to the PdR framework at the time of writing. Exit from commissioner-led administration does not imply exit from the PdR. Sardegna exited the programme under the provisions associated with its special autonomous status.

On the revenue side, the plans could trigger automatic increases in the regional surcharge on personal income tax (*addizionale regionale IRPEF*) and the regional tax on productive activities (IRAP) when monitoring identified persistent deficits. On the expenditure side, hospital-network reorganisation included closing or merging small hospitals and wards, reducing acute-care hospital capacity, and converting some facilities to rehabilitation, long-term, or community care. These interventions represented an important component of fiscal adjustment in many PdR regions (Depalo, 2019; Arcà et al., 2020; Bordignon et al., 2020).

The plans also sought to contain pharmaceutical expenditure through measures such as patient copayments, generic substitution, direct distribution, and closer monitoring of prescribing behaviour. Procurement reforms centralised purchases of pharmaceuticals, medical equipment, and support services to exploit economies of scale. Further measures affected accredited private providers through expenditure ceilings, contract renegotiation, limits on the volume of publicly financed services, and revised accreditation requirements. The capacity to implement these measures differed across regions, and commissioner-led administrations were generally more effective in renegotiating contracts with private providers (Bordignon et al., 2020).

Personnel policies were shaped by both national and PdR-specific restrictions. National legislation (Law No. 296/2006, subsequently extended by Law No. 191/2009) required all regions to limit SSN personnel expenditure to the amount recorded in 2004, reduced by 1.4%. This was a ceiling on aggregate personnel expenditure rather than a general prohibition on recruitment. Regions outside the PdR framework could therefore recruit and replace departing employees provided that they complied with the ceiling.

Regions under a PdR could face an additional and more restrictive constraint. Law No. 191/2009 provided for an automatic turnover freeze when the annual monitoring process established that a region had failed, wholly or partly, to meet the objectives of its recovery plan and an uncovered healthcare deficit remained. Once activated, the freeze prevented regional healthcare providers from replacing departing personnel until the end of the second subsequent year, even when recruitment would otherwise have complied with the national expenditure ceiling. Hiring decisions and employment contracts concluded

in violation of the freeze were legally invalid. Limited exemptions were subsequently permitted when recruitment was considered necessary to maintain the LEAs. Because each recovery plan combined personnel restrictions with other expenditure and organisational measures, our estimates capture the effect of the overall PdR policy package and do not separately identify the contribution of the turnover freeze.

The resulting policy packages were implemented in regional health systems that differed in their initial capacity, fiscal conditions, institutional arrangements, and administrative capacity. This heterogeneity motivates our region-specific analysis of the effects of the PdRs.

3 Data and Empirical Strategy

3.1 Data and outcomes

The analysis uses annual region-level data from the Istat *Health for All* database (Istat, 2026). The database provides a harmonised system of regional indicators for monitoring the health status of the Italian population and the organisation and performance of the SSN. It covers three broad domains: population health, lifestyles, and health risks; healthcare resources, expenditure, and service use; and the demographic, socioeconomic, and environmental characteristics of the regional context. Our analysis draws primarily on indicators of healthcare resources and hospital use.

We examine two distinct outcomes. The first is the *SSN personnel rate*, defined as the number of employees of the Italian SSN per 1,000 inhabitants. It includes personnel employed by local health authorities (*Aziende Sanitarie Locali*, ASLs), hospitals directly managed by ASLs, and public hospital enterprises (*Aziende Ospedaliere*, AOs). The indicator captures changes in an important input into the capacity of regional health services. The series covers 1994–2022. The original Istat series is unavailable for 2014 and 2015 for all Italian regions. We replace these two missing observations by linear interpolation between the values observed in 2013 and 2016. Because the same procedure is applied to every treated and donor region, it does not introduce region-specific information into the construction of the synthetic controls.[3] The second outcome is the *patient out-migration rate*, defined as the percentage of ordinary acute-care hospitalisations of regional residents taking place outside their region of residence. This outcome is particularly relevant because many recovery plans included measures affecting the supply of hospital care, including hospital closures and mergers, reductions in acute-care hospital capacity, and the reorganisation of hospital networks. Such interventions may increase residents' reliance on hospital services provided outside their regional health system. The indicator, commonly referred to as *mobilità passiva*,[4] is constructed from hospital discharge records covering public hospitals and accredited private providers. It measures interregional mobility for ordinary acute inpatient care rather than patient mobility across all healthcare settings. Outpatient treatments, day-hospital admissions, rehabilitation, long-term care, neuro-rehabilitation, spinal-unit care, and psychiatric admissions are not covered. These exclusions are based on the care setting rather than the patient's diagnosis: patients with chronic conditions are included whenever they receive an ordinary acute-care hospitalisation.

[3] Appendix D presents a robustness check showing that the results are not affected by the interpolation.

[4] In Italian institutional terminology, *mobilità passiva* denotes hospital care received outside the region by residents of that region. The region of residence compensates the region providing the treatment through the interregional settlement system.

The series covers 1999–2023. Patient out-migration indicates the extent to which residents rely on hospital services provided outside their regional health system.

3.2 The Synthetic Control Method

Most previous evaluations of the PdRs estimate effects averaged across treated regions. Such estimates may conceal substantial heterogeneity because the plans differed in timing, duration, enforcement, and implementation. We therefore estimate a separate counterfactual for each treated region, allowing the effects of the programme to vary across regional health systems.

The Synthetic Control Method (SCM) constructs this counterfactual as a weighted average of regions that never entered a recovery plan (Abadie and Gardeazabal, 2003; Abadie et al., 2010). The post-treatment difference between the observed outcome and its synthetic counterpart provides a region-specific estimate of the effect associated with the PdR.

Let region $i = 1$ be treated after period T_0, and let regions $j = 2, \ldots, J+1$ form the donor pool. The treatment effect for the treated region in post-treatment year t is

$$\alpha_{1t} = Y_{1t}^{1} - Y_{1t}^{0}, \qquad t > T_0, \tag{1}$$

where Y_{1t}^{1} is the observed outcome under treatment and Y_{1t}^{0} is the unobserved outcome that would have occurred in the absence of the recovery plan.

The SCM estimates the untreated counterfactual as

$$\widehat{Y}_{1t}^{0} = \sum_{j=2}^{J+1} w_j^{*} Y_{jt}, \tag{2}$$

where the donor weights satisfy

$$w_j^{*} \geq 0, \qquad \sum_{j=2}^{J+1} w_j^{*} = 1. \tag{3}$$

These constraints ensure that the synthetic control is an interpolation within the donor pool rather than an extrapolation beyond the observed data. The estimated treatment effect is therefore

$$\widehat{\alpha}_{1t} = Y_{1t}^{1} - \sum_{j=2}^{J+1} w_j^{*} Y_{jt}, \qquad t > T_0. \tag{4}$$

The weights are selected to minimise the discrepancy between the treated and synthetic regions during the pre-treatment period. We use the complete sequence of annual pre-treatment outcome values as predictors, assigning equal weight to each year. The optimisation therefore minimises the pre-treatment root mean squared prediction error:

$$\mathrm{RMSPE}_1^{pre} = \sqrt{\frac{1}{T_0} \sum_{t=1}^{T_0} \left(Y_{1t} - \sum_{j=2}^{J+1} w_j^{*} Y_{jt} \right)^2}. \tag{5}$$

Using the complete pre-treatment outcome trajectory avoids selecting an arbitrary subset of structural covariates and allows the synthetic control to reproduce the combined influence of observed and unobserved determinants of the outcome. When the pre-treatment

period is sufficiently long, a close match on the outcome trajectory may approximate the treated region's exposure to time-varying unobserved factors (Abadie et al., 2010; Ferman et al., 2020).

3.3 Identification

Identification requires the synthetic control to provide a credible estimate of the trajectory that each treated region would have followed in the absence of the PdR. A direct comparison between treated and never-treated regions would be inappropriate because entry into the programme was determined by persistent healthcare deficits rather than assigned randomly. We therefore construct a separate counterfactual for each treated region and outcome by matching its complete pre-treatment trajectory. This trajectory reflects the combined influence of the observed and unobserved determinants of the outcome before the introduction of the plan.

Following Abadie et al. (2010), the untreated outcome can be represented by the factor model

$$Y_{it}^0 = \delta_t + \boldsymbol{\lambda}_t' \boldsymbol{\mu}_i + \varepsilon_{it}, \tag{6}$$

where δ_t denotes common time effects, $\boldsymbol{\mu}_i$ represents region-specific loadings on unobserved factors, and $\boldsymbol{\lambda}_t$ captures the time-varying effects of those factors. If a weighted combination of donor regions reproduces a sufficiently long sequence of pre-treatment outcomes, it may also approximate the treated region's exposure to the factors that generated those outcomes. Under this condition, the post-treatment trajectory of the synthetic control provides an estimate of the untreated potential outcome.

This interpretation relies on three additional conditions. First, the treated region should not respond to the recovery plan before its formal introduction. A divergence beginning before entry may indicate anticipation or fiscal adjustment preceding the formal agreement and weakens the causal interpretation. Second, the outcomes of donor regions should not be materially affected by the recovery plan imposed on the treated region. Third, in the absence of treatment, the relationship between the treated region and its synthetic counterpart should remain sufficiently stable after the intervention.

The credibility of the estimates is assessed separately for each region–outcome combination. We inspect the pre-treatment trajectories and report the corresponding RMSPE, with values closer to zero indicating a better fit. Because RMSPE depends on the scale and variability of the outcome, it does not provide a universal threshold for accepting a synthetic control. A poor pre-treatment fit cannot support a strong causal interpretation, even when the post-treatment gap is large. The permutation procedure described below accounts for differences in pre-treatment fit when assessing whether the estimated gaps are unusual relative to those obtained for donor regions.

3.4 Treatment and donor pool

A region is classified as treated if it entered a PdR at any point during the observation period. The ten treated regions are Abruzzo, Calabria, Campania, Lazio, Liguria, Molise, Piemonte, Puglia, Sardegna, and Sicilia. The treatment year corresponds to the year in which each region formally entered the programme.

The donor pool consists of the ten regions that never entered the programme: Valle d'Aosta, Lombardia, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna,

Toscana, Umbria, Marche, and Basilicata.

All ever-treated regions are excluded from the donor pool throughout the analysis, including before their own entry into the programme and after their exit. This restriction avoids two potential sources of contamination. First, a region entering a PdR during another region's post-treatment period would cease to provide an untreated trajectory. Second, the outcomes of regions that exited the programme may continue to reflect the effects of earlier exposure. Restricting the donor pool to never-treated regions therefore ensures that its members are not directly exposed to a PdR at any point during the observation period.

The SCM is estimated separately for each of the ten treated regions and each of the two outcomes, producing 20 region–outcome analyses. Each analysis generates a sequence of annual post-treatment estimates rather than a single average effect. This design accommodates differences in treatment timing and preserves heterogeneity across regions.

The estimations are performed in Stata 17 using the `synth_runner` command developed by Galiani and Quistorff (2017).

3.5 Permutation inference

Inference is based on in-space placebo tests implemented using the `synth_runner` command developed by Galiani and Quistorff (2017). For each treated region, the Synthetic Control Method is re-estimated after assigning placebo treatment status, in turn, to each region in the donor pool. This produces a distribution of placebo gaps against which the gap observed for the treated region can be evaluated. A direct comparison of treated and placebo gaps may be affected by differences in the quality of their pre-treatment synthetic-control fits. We therefore use the standardised permutation measure generated by `synth_runner` (`pvals_std`). For each post-treatment year, the absolute treated–synthetic gap and the corresponding placebo gaps are divided by their respective pre-treatment RMSPEs. The period-specific permutation measure is defined as

$$p_t^{\text{std}} = \frac{1}{J} \sum_{j=2}^{J+1} \mathbf{1} \left(\frac{|\widehat{\alpha}_{jt}|}{\text{RMSPE}_j^{\text{pre}}} \geq \frac{|\widehat{\alpha}_{1t}|}{\text{RMSPE}_1^{\text{pre}}} \right), \tag{7}$$

where $\widehat{\alpha}_{1t}$ is the estimated gap for the treated region, $\widehat{\alpha}_{jt}$ is the corresponding gap for placebo region j, and J is the number of regions in the donor pool. This standardisation does not make a poorly fitted synthetic control a valid counterfactual, but it reduces the likelihood that a large gap generated by poor pre-treatment fit is interpreted as evidence of a treatment effect. We also report a joint permutation measure based on the ratio of post-treatment to pre-treatment RMSPE. It is calculated as the proportion of donor-region placebos whose post-/pre-treatment RMSPE ratio is at least as large as that observed for the treated region. Unlike the year-specific measures, the joint statistic summarises the overall deterioration in fit following the introduction of the PdR. Because the donor pool contains ten regions, the permutation measures have a discrete support: $0, 0.1, 0.2, \ldots, 1$. A value of zero indicates that none of the donor-region placebos produces an equally large standardised gap, while a value of 0.1 indicates that exactly one placebo does. These values are therefore interpreted as finite-sample permutation rankings rather than as conventional parametric significance levels.

4 Results

4.1 Overall effects

Tables 2 and 3 report the year-specific estimated treatment effects for each treated region, defined as the difference between the observed outcome and the corresponding synthetic-control estimate. For the SSN personnel rate, negative values indicate fewer SSN employees per 1,000 inhabitants relative to the counterfactual trajectory. For patient out-migration, positive values indicate a higher proportion of residents receiving hospital care outside their region relative to the counterfactual trajectory.

The symbols attached to the annual estimates are based on the period-specific standardised permutation p-values described in Section 3.5. A dagger indicates $p_t^{\text{std}} = 0$, while an asterisk indicates $p_t^{\text{std}} = 0.1$.[5]

The tables also report the pre-treatment RMSPE and a joint standardised permutation p-value. Lower pre-treatment RMSPE values indicate a closer match between the treated region and its synthetic control, while lower joint p-values indicate that the overall post-treatment divergence is more unusual relative to the donor-region placebo distribution.

The joint standardised permutation p-values reported in Tables 2 and 3 are computed both over the full available post-treatment period and over the period ending in 2019. We use the latter as the primary window for inference because, from 2020 onwards, the COVID-19 pandemic affected healthcare systems in treated and donor regions with different timing and intensity, complicating the interpretation of subsequent outcomes as consequences of the recovery plans. Extending the analysis to the full post-treatment period does not alter the results: for all twenty region–outcome combinations reported in Tables 2 and 3, the joint p-value for the period ending in 2019 is numerically identical to its full-period counterpart. The joint p-values discussed below can therefore be interpreted as applying to either window.

The estimated treatment effects on the SSN personnel rate are negative and persistent in several treated regions. Abruzzo, Calabria, and Molise combine a close pre-treatment fit with joint standardised permutation p-values equal to zero. In these regions, the estimated effects remain negative following entry into the programme and generally become more pronounced over time. Lazio also displays a persistent negative effect and a joint p-value of zero, although its pre-treatment fit is less close than in Abruzzo, Calabria, and Molise. Campania follows a similar negative trajectory, with a joint p-value of 0.1, but its synthetic control also reproduces the pre-treatment trajectory less closely. The estimates for Sicilia are predominantly negative, although their annual permutation p-values are less consistent and the pre-treatment fit is comparatively weak.

Liguria and Sardegna require separate consideration because both regions exited the programme in 2010. In Liguria, the negative effect on the SSN personnel rate becomes persistent only after the region left the PdR. The post-exit estimates may reflect persistent or delayed consequences of earlier exposure, but they do not measure the effect of continued participation in the programme. In Sardegna, the initial negative effect is concentrated in the years in which the plan was active and subsequently disappears. Negative estimates re-emerge in 2021–2022, more than a decade after exit and during the pandemic period.

[5] With ten donor regions, the attainable standardised permutation p-values are $0, 0.1, \ldots, 1$. A value of zero means that none of the ten placebos produces an equally large or larger absolute standardised effect and represents the strongest ranking attainable with the available donor pool. A value of 0.1 means that exactly one placebo produces an equally large or larger effect. These values should be interpreted as finite-sample permutation rankings rather than as conventional parametric significance levels.

Piemonte and Puglia show no systematic effect on the SSN personnel rate, with joint standardised permutation p-values of 0.7 and 1.0, respectively.

Although personnel restrictions make a contraction in staffing plausible ex ante, their realised effects are not mechanical. The national personnel-expenditure ceiling applied to treated and donor regions alike, while the activation, enforcement, and duration of the additional restrictions associated with the PdRs varied across regions. The consequences of these restrictions also depended on the number of employees leaving the workforce and on whether exemptions allowed regions to replace some of them. The personnel analysis therefore examines whether, where, and for how long the PdR framework generated staffing shortfalls relative to a region-specific counterfactual, rather than simply testing whether hiring restrictions can reduce staffing.

The estimated treatment effects on patient out-migration are less consistent across regions than those obtained for the SSN personnel rate. Pre-treatment RMSPEs range from 0.127 in Lazio to 0.582 in Calabria, but the joint standardised permutation p-values are generally higher than those obtained for personnel. Liguria provides the clearest evidence of a persistent positive effect. Its out-migration rate rises above that of its synthetic control during the active PdR period and remains higher after exit. The joint standardised permutation p-value is zero, indicating that none of the donor-region placebos exhibits an equally large deterioration in fit over the post-treatment period. Estimates following Liguria's exit indicate persistence of the divergence rather than an effect of continued exposure to the programme.

Abruzzo, Lazio, and Molise also exhibit positive estimated effects in several post-treatment years, but their joint standardised permutation p-values are 0.2. In Abruzzo, the positive effect emerges immediately after entry and remains sizeable during much of the following decade, although the period-specific p-values become larger in later years. In Lazio and Molise, the positive effects emerge more gradually and are concentrated in particular post-treatment periods. These results provide evidence of region- and period-specific increases in patient out-migration, but weaker evidence of an unusual divergence over the post-treatment period as a whole.

In Calabria, visual inspection of the pre-treatment trajectories shows that observed patient out-migration begins to rise above its synthetic counterpart approximately two years before formal entry into the PdR. This divergence preceding treatment complicates the attribution of the subsequent positive estimates to the programme. Campania, Sardegna, and Sicilia show no systematic effect on patient out-migration. Piemonte records a negative estimate with a standardised permutation p-value of zero in its first treatment year but no persistent divergence, while Puglia presents a positive estimate with a standardised permutation p-value of 0.1 only in 2017. Neither estimate is supported by a comparable pattern in neighbouring years or by the corresponding joint p-value.

Taken together, the results show that negative effects on the SSN personnel rate were more widespread, persistent, and consistently unusual relative to the placebo distribution than positive effects on patient out-migration. The mobility response was concentrated in a smaller number of regions and displayed a different regional pattern from that observed for the SSN personnel rate.

Table 2: Year-specific estimated treatment effects on the SSN personnel rate

Year	Abruzzo	Calabria	Campania	Lazio	Liguria	Molise	Piemonte	Puglia	Sardegna	Sicilia
2007	$-0.503^{\dagger}$		-1.631	-2.205^{*}	0.087	-0.101			-0.361^{*}	-1.311
2008	$-0.687^{\dagger}$		-1.578	-2.221^{*}	$-1.504^{\dagger}$	-0.345			$-1.402^{\dagger}$	-1.442
2009	$-1.102^{\dagger}$	-0.246	-1.973	-2.629	0.101	$-0.758^{\dagger}$			$-1.475^{\dagger}$	-1.785
2010	$-1.537^{\dagger}$	-0.246	-2.319	-2.938^{*}	0.112	$-1.057^{\dagger}$	0.152	-0.791	$-1.333^{\dagger}$	-2.418^{*}
2011	$-1.707^{\dagger}$	-0.359	-2.570	-2.608	$-2.997^{\dagger}$	$-1.573^{\dagger}$	0.209	-0.686	-0.054	-1.733
2012	$-1.368^{\dagger}$	$-1.187^{\dagger}$	$-3.031^{\dagger}$	$-3.020^{\dagger}$	$-3.178^{\dagger}$	$-2.230^{\dagger}$	-0.271	-1.182	-0.188	-1.756
2013	$-1.432^{\dagger}$	$-1.608^{\dagger}$	$-3.423^{\dagger}$	$-3.522^{\dagger}$	$-3.335^{\dagger}$	$-2.402^{\dagger}$	-0.433	-1.276	0.140	-2.048^{*}
2014	$-1.380^{\dagger}$	$-1.703^{\dagger}$	$-3.522^{\dagger}$	$-3.695^{\dagger}$	$-3.408^{\dagger}$	$-2.629^{\dagger}$	-0.465	-1.270	0.248	-2.159
2015	$-1.328^{\dagger}$	$-1.799^{\dagger}$	$-3.622^{\dagger}$	$-3.867^{\dagger}$	$-3.480^{\dagger}$	$-2.856^{\dagger}$	-0.496	-1.264	0.356	-2.269
2016	$-1.276^{\dagger}$	$-1.895^{\dagger}$	-3.721^{*}	$-4.039^{\dagger}$	$-3.553^{\dagger}$	$-3.083^{\dagger}$	-0.527	-1.258	0.464	-2.379
2017	$-1.344^{\dagger}$	$-1.837^{\dagger}$	$-3.852^{\dagger}$	$-4.206^{\dagger}$	$-3.803^{\dagger}$	$-3.447^{\dagger}$	-0.576	-1.280	0.324	-2.458^{*}
2018	$-1.503^{\dagger}$	$-1.893^{\dagger}$	-4.018^{*}	$-4.254^{\dagger}$	$-3.795^{\dagger}$	$-3.804^{\dagger}$	-0.540	-0.966	0.211	-2.214
2019	$-1.424^{\dagger}$	$-1.894^{\dagger}$	$-3.811^{\dagger}$	$-3.971^{\dagger}$	$-3.736^{\dagger}$	$-3.219^{\dagger}$	-0.435	-0.906	0.334	-2.155
2020	$-1.896^{\dagger}$	$-1.948^{\dagger}$	-3.413^{*}	$-3.455^{\dagger}$	$-4.321^{\dagger}$	$-3.427^{\dagger}$	-0.417	-0.458	-0.210	-1.950
2021	$-1.920^{\dagger}$	$-1.832^{\dagger}$	-3.084^{*}	$-3.224^{\dagger}$	$-4.547^{\dagger}$	$-3.883^{\dagger}$	-0.531	-0.343	$-1.068^{\dagger}$	-1.974^{*}
2022	$-1.601^{\dagger}$	$-1.792^{\dagger}$	-2.495^{*}	$-3.003^{\dagger}$	$-4.164^{\dagger}$	$-3.525^{\dagger}$	-0.310	-0.337	$-1.051^{\dagger}$	-1.752^{*}
pre-RMSPE	0.160	0.310	0.972	0.899	0.234	0.174	0.400	1.278	0.171	0.735
joint p (2019)	0.000	0.000	0.100	0.000	0.000	0.000	0.700	1.000	0.000	0.100
joint p (2022)	0.000	0.000	0.100	0.000	0.000	0.000	0.700	1.000	0.000	0.100

Notes: Entries report the year-specific estimated treatment effects, defined as the observed SSN personnel rate in the treated region minus the corresponding synthetic-control estimate. Negative values indicate fewer SSN employees per 1,000 inhabitants relative to the estimated counterfactual trajectory. Blank cells denote pre-treatment years. Symbols are based on the period-specific standardised permutation measure proposed by Galiani and Quistorff (2017). † indicates $p_t^{\text{std}} = 0$, meaning that none of the ten donor-region placebos produces an equally large absolute standardised estimate; * indicates $p_t^{\text{std}} = 0.1$, meaning that exactly one placebo does. The symbols represent placebo rankings rather than conventional parametric significance levels. *pre-RMSPE* is the pre-treatment root-mean-squared prediction error, which measures synthetic-control fit, with values closer to zero indicating a closer fit. *joint p (2022)* is the joint standardised permutation p-value computed over the full available post-treatment period (through 2022), defined as the proportion of donor-region placebos whose post-/pre-treatment RMSPE ratio is at least as large as that observed for the treated region. *joint p (2019)* reports the same statistic restricted to the period ending in 2019, before the confounding effect of the COVID-19 pandemic (see Section 5).

Table 3: Year-specific estimated treatment effects on patient out-migration (percentage points)

Year	Abruzzo	Calabria	Campania	Lazio	Liguria	Molise	Piemonte	Puglia	Sardegna	Sicilia
2007	1.774*		−0.108	−0.005	0.719*	−1.837†			0.710	−0.130
2008	4.030*		−0.303	−0.259	1.191*	−0.929			0.768	0.050
2009	5.838†	2.833*	0.036	−0.063	1.250†	0.324			0.739	0.342
2010	6.825†	2.790	0.581	0.273	1.952†	−0.720	−1.163†	−0.419	0.645	0.435
2011	6.848†	3.185	0.799	0.856	3.126†	1.323	−1.028	−0.093	0.720	0.749
2012	5.924†	3.905	0.963	1.151	4.244†	1.922	−0.925	0.341	0.729	0.340
2013	5.843*	4.791	1.002	1.551*	4.481†	2.905	−0.624	0.598	0.698	0.354
2014	6.267*	6.124	1.262	2.254†	5.023†	3.888	−0.604	0.988	0.468	0.406
2015	5.993*	6.152*	0.837	2.160*	4.953†	3.880	−0.632	1.262	0.660	0.514
2016	5.619*	6.131	1.004	2.317†	6.362†	5.703*	−0.380	1.144	0.888	0.732
2017	5.217*	5.405*	1.436	1.946*	4.971†	6.247*	−0.510	1.595*	−0.517	0.784
2018	5.701	5.211*	1.520	1.764	4.599†	6.946†	−0.759	1.680	1.046	0.762
2019	5.859	4.385	1.286	1.701	3.931†	6.875*	−1.233	1.561	1.293	0.601
2020	3.939	3.993	0.734	0.140	3.609*	5.734	−1.574	1.436	0.312	−0.959
2021	3.459	4.927	0.617	−0.302	4.741*	5.881	−1.573	1.512	0.263	−1.327
2022	3.986	4.509	0.529	−0.580	4.726*	5.710	−1.933	1.958	1.246	−0.811
2023	3.635	4.097	0.160	−1.013	4.734*	6.985*	−2.025	1.603	1.563	−1.013
pre-RMSPE	0.448	0.582	0.154	0.127	0.187	0.404	0.365	0.283	0.360	0.474
joint p (2019)	0.200	0.400	0.400	0.200	0.000	0.200	0.600	0.300	0.800	1.000
joint p (2023)	0.200	0.400	0.400	0.200	0.000	0.200	0.600	0.300	0.800	1.000

Notes: Entries report the year-specific estimated treatment effects, defined as patient out-migration in the treated region minus the corresponding synthetic-control estimate, measured in percentage points. Positive values indicate greater patient out-migration relative to the estimated counterfactual trajectory. Blank cells denote pre-treatment years. Symbols are based on the period-specific standardised permutation measure proposed by Galiani and Quistorff (2017). † indicates $p_t^{\text{std}} = 0$, meaning that none of the ten donor-region placebos produces an equally large absolute standardised estimate; * indicates $p_t^{\text{std}} = 0.1$, meaning that exactly one placebo does. The symbols represent placebo rankings rather than conventional parametric significance levels. *pre-RMSPE* is the pre-treatment root-mean-squared prediction error, which measures synthetic-control fit, with values closer to zero indicating a closer fit. *joint p (2023)* is the joint standardised permutation p-value computed over the full available post-treatment period (through 2023), defined as the proportion of donor-region placebos whose post-/pre-treatment RMSPE ratio is at least as large as that observed for the treated region. *joint p (2019)* reports the same statistic restricted to the period ending in 2019, before the confounding effect of the COVID-19 pandemic (see Section 5).

4.2 Regional heterogeneity

The region-specific trajectories reveal three broad descriptive patterns. The first comprises regions with persistent negative gaps in the SSN personnel rate and at least some evidence of increased patient out-migration. The second includes regions for which the evidence is clearer for the SSN personnel rate than for patient out-migration. The third consists of regions with limited, non-persistent, or less conclusive evidence across the two outcomes.

The first category includes Abruzzo, Lazio, Molise, and Liguria. Abruzzo displays persistent post-treatment effects on both outcomes. Its synthetic control closely reproduces the pre-treatment SSN personnel rate. Following entry into the PdR, a negative estimated effect emerges, becomes more pronounced during the first few years, and persists through the end of the observation period. Patient out-migration begins to rise above its synthetic trajectory around the treatment boundary and remains higher during much of the following decade. Several annual effects have standardised permutation p-values of zero or 0.1, although the joint p-value is 0.2. The evidence therefore indicates persistent divergence in both outcomes, with stronger overall permutation evidence for the SSN personnel rate.

Lazio also records persistent negative effects on the SSN personnel rate and a later increase in patient out-migration. The observed personnel series lies below its synthetic counterpart during part of the pre-treatment period, resulting in a weaker pre-treatment fit than in Abruzzo, Calabria, and Molise. The estimated post-treatment effects are nevertheless consistently negative, and the joint standardised permutation p-value is zero. The synthetic control provides a closer pre-treatment match for patient out-migration, with positive annual effects and standardised permutation p-values of zero or 0.1 concentrated between 2013 and 2017. The joint mobility p-value is 0.2, indicating weaker evidence for the post-treatment period as a whole.

Molise combines a close pre-treatment personnel fit with an increasingly negative post-treatment effect. Its patient out-migration rate, which was already comparatively high before the PdR, initially remains close to the synthetic trajectory and begins to diverge more clearly after 2015. The largest positive annual effects occur between 2016 and 2019 and again in 2023. Since the joint standardised permutation p-value for mobility is 0.2, the evidence is better characterised as a delayed and period-specific divergence than as a consistently unusual effect over the entire post-treatment period.

Liguria differs from the other regions in this category because it exited the PdR in 2010. The SSN personnel rate does not display a persistent negative effect during the active treatment period; the divergence becomes pronounced only after exit and should therefore be interpreted as a post-exit development. Patient out-migration, by contrast, rises during the active PdR period and remains above its synthetic control thereafter. Liguria is the only region for which the overall mobility divergence is associated with a joint standardised permutation p-value of zero. The persistence of this divergence after 2010 indicates that it did not reverse when the plan formally ended.

The second category comprises Calabria and Campania, for which the evidence is clearer for the SSN personnel rate than for patient out-migration. In Calabria, the observed and synthetic personnel trajectories remain relatively close immediately after entry and separate more clearly from approximately 2012 onwards. For patient out-migration, the observed series begins to rise above its synthetic counterpart around 2007, approximately two years before formal entry into the PdR. This pre-treatment divergence complicates the attribution of the subsequent positive estimates to the programme. [6]

[6]The pre-treatment divergence in Calabria coincided with a period of substantial institutional reorgani-

In Campania, the SSN personnel rate falls progressively relative to its synthetic trajectory, although the observed series already lies below its synthetic control during much of the pre-treatment period. The direction and persistence of the post-treatment gap are clear, but its magnitude should be interpreted in light of the weaker pre-treatment fit. Campania's patient out-migration rate remains comparatively close to its synthetic control, and none of its annual estimates has a standardised permutation p-value of zero or 0.1.

The third category comprises Piemonte, Puglia, Sardegna, and Sicilia, for which the evidence is limited, non-persistent, or less conclusive across the two outcomes. Piemonte and Puglia show no persistent effect on the SSN personnel rate. Piemonte's personnel trajectory remains comparatively close to its synthetic control during and after the active PdR period, and its joint standardised permutation p-value is 0.7. Patient out-migration begins to move below the synthetic trajectory shortly before entry in 2010. The negative estimate in the first treatment year has a period-specific p-value of zero but is not sustained in subsequent years. Puglia's personnel counterfactual has the highest pre-treatment RMSPE among the treated regions, and its joint p-value of 1.0 provides no evidence of an unusual post-treatment divergence. Its positive mobility gap increases gradually after treatment, but only the 2017 estimate has a period-specific p-value of 0.1, while the joint p-value is 0.3.

In Sardegna, the negative effect on the SSN personnel rate is concentrated in the active PdR period and disappears after the region exits in 2010. Negative estimates re-emerge only in 2021–2022, more than a decade after exit and during the pandemic period. No systematic effect on patient out-migration emerges. Sicilia displays a persistent negative difference in the SSN personnel rate, but its comparatively high pre-treatment RMSPE and intermittent period-specific p-values limit the strength of the evidence. Its patient out-migration trajectory remains close to the synthetic control throughout most of the observation period, with a joint standardised permutation p-value of 1.0.

The regional estimates therefore do not support treating the PdRs as a homogeneous intervention. They reveal substantial variation in the timing, persistence, and strength of the estimated effects. For Liguria, Sardegna, and Piemonte, estimates following exit from the programme describe subsequent outcome trajectories rather than the effect of continued exposure to the PdR. Estimates from 2020 onwards are treated as descriptive because the pandemic affected healthcare systems in treated and donor regions with different timing and intensity. The observed and synthetic-control trajectories underlying this region-by-region discussion are plotted in Appendix A.

4.3 Diagnostic checks

We assess the credibility of the estimates using four complementary diagnostic checks: pre-treatment fit, in-space placebo tests, a placebo-outcome exercise, and the exclusion of

sation and documented difficulties in the regional health system. Regional Law No. 9/2007 consolidated eleven local health authorities into five provincial health authorities (Regione Calabria, 2007). During the same period, a parliamentary inquiry documented fragmentation of the hospital network, inadequate facilities, implementation difficulties, and serious concerns about the quality and safety of hospital care in the region (Camera dei deputati, 2008). Independent data also show that the share of Calabrian residents receiving ordinary acute hospital care outside the region increased from 16.3% in 2007 to 16.6% in 2008 and 16.9% in 2009 (Consiglio regionale della Calabria, 2014). These developments may have contributed to the increase in patient out-migration before formal entry into the PdR, although their separate effects cannot be identified.

the interpolated 2014–2015 personnel observations. We also report the donor weights to document the composition of each synthetic control.

The first and most important diagnostic is the ability of the synthetic control to reproduce the treated region's outcome before the introduction of the PdR. Pre-treatment fit is generally close for patient out-migration. For the SSN personnel rate, the fit is closer in Abruzzo, Calabria, Liguria, Molise, Piemonte, and Sardegna, but weaker in Campania, Lazio, Puglia, and Sicilia. For the latter regions, the available donor pool cannot reproduce the pre-treatment personnel trajectories as accurately. The corresponding estimates are therefore interpreted with caution. Standardising the estimated effects by the pre-treatment RMSPE accounts for differences in fit when constructing the permutation p-values, but it does not eliminate the uncertainty associated with a weakly fitted counterfactual.

The donor weights, reported in Appendix B, document the composition of each synthetic control. All synthetic controls for the two main outcomes assign positive weight to at least two donor regions, although some rely heavily on a limited number of donors. Concentrated weights are not necessarily problematic: their relevance depends primarily on whether the resulting weighted combination reproduces the treated region's pre-treatment trajectory.

The in-space placebo tests described in Section 3.5 assess whether the estimated effects for the treated regions are unusual relative to those obtained by assigning treatment to the donor regions. Since the donor pool contains ten regions, the resulting period-specific permutation p-values are discrete and can take the values $0, 0.1, \ldots, 1$. A value of zero indicates that none of the donor-region placebos produces an absolute standardised effect as large as that observed for the treated region. The joint permutation p-value instead compares the post-/pre-treatment RMSPE ratio of the treated region with the corresponding ratios for the donor-region placebos, providing a summary assessment of the entire post-treatment trajectory.

We also repeat the analysis using the total fertility rate as a placebo outcome. Fertility was not directly targeted by the healthcare recovery plans and therefore provides a useful test of whether the empirical procedure mechanically identifies a break at PdR entry. However, fertility may respond indirectly to broader economic and fiscal conditions and is therefore an imperfect placebo outcome. The exercise uses the same donor pool, pre-treatment outcome predictors, and permutation procedure as the main analysis, with the complete results reported in Appendix C.

The placebo-outcome results do not reveal a common discontinuity at the introduction of the PdRs. Most regions show no persistent sequence of unusually ranked post-treatment estimates. Abruzzo records only intermittent deviations, while Piemonte exhibits a more persistent negative divergence towards the end of the observation period. Pre-treatment fit is weak for Campania and Sicilia and less close for some other regions, reducing the evidential value of those estimates. Overall, the exercise suggests that the empirical procedure does not mechanically generate a break at PdR entry, although it should be regarded as a diagnostic rather than as a formal validation of the main results.

Finally, we re-estimate the SSN personnel rate after dropping the two interpolated years, 2014 and 2015, for every region in the sample. Because these years always fall within the post-treatment period for the ten treated regions, their removal leaves the pre-treatment predictors, and therefore the donor weights, unchanged. Every surviving point estimate is consequently identical to the corresponding entry in Table 2. The only quantity that changes is Puglia's joint standardised permutation p-value for the period ending in 2019, which falls from 1.000 to 0.800 and continues to provide no evidence of an unusual post-treatment divergence. The complete results are reported in Appendix D.

5 Discussion

The results show that the consequences of the PdRs varied considerably across regions and between the two outcomes examined. The SSN personnel rate fell below its synthetic counterfactual in several treated regions, often persistently, whereas increases in patient out-migration were concentrated in fewer regions and periods. Evidence of a sustained divergence from the counterfactual was therefore more widespread for public healthcare staffing than for patient out-migration.

The evidence for personnel is strongest in Abruzzo, Calabria, and Molise, where relatively close pre-treatment fit is accompanied by persistent reductions relative to the synthetic control and joint standardised permutation p-values equal to zero. Lazio and Campania also experience substantial reductions relative to their synthetic controls, although their weaker pre-treatment fit makes the estimated magnitude less certain. By contrast, no systematic personnel divergence emerges in Piemonte or Puglia.

Liguria and Sardegna illustrate the importance of distinguishing active treatment from the period following formal exit. Liguria does not display a sustained personnel reduction during its short period under the PdR; the large downward divergence begins only after the region has left the programme. Sardegna exhibits the opposite pattern, with a reduction relative to the synthetic control concentrated in the active-plan period and subsequently closing. Post-exit trajectories may reflect persistent consequences of earlier exposure, subsequent regional policies, or other developments and cannot be interpreted as effects of continued PdR participation.

Patient out-migration presents a less uniform pattern. Liguria provides the clearest evidence of a persistent increase relative to its synthetic control, supported by both the annual permutation comparisons and the joint permutation statistic. Abruzzo, Lazio, and Molise also record increases and, in some years, unusually ranked estimates, but their joint permutation p-values are less conclusive. The annual permutation evidence is stronger in particular periods, while the joint p-values indicate that the overall post-treatment divergence is not especially unusual relative to the placebo distribution. Evidence is weaker for the remaining regions. In Calabria, moreover, out-migration begins to diverge before formal entry into the programme, complicating attribution of the subsequent gap to the PdR.

The results do not establish that reductions in the SSN personnel rate caused patients to seek hospital treatment elsewhere. The two outcomes are estimated separately, and the empirical strategy does not identify the causal effect of staffing on mobility. Although reductions in personnel and increases in patient out-migration occurred within some of the same regional healthcare systems, the regional patterns of the two outcomes do not consistently coincide.

This variation is plausible because patient mobility depends on more than local staffing capacity. Geographical accessibility, transport connections, the availability and reputation of providers in other regions, referral networks, the type of treatment required, and patients' ability to bear the costs of travelling may all influence the decision to obtain care elsewhere. Conversely, the absence of increased out-migration does not imply that local provision was unaffected. Patients who cannot or do not wish to travel may postpone treatment, rely on private or outpatient services, or accept more limited local provision.

Patient out-migration should therefore be interpreted as an indicator of reliance on ordinary acute hospital care outside the region rather than as a comprehensive measure of healthcare access or quality. The outcome excludes outpatient services, day-hospital

activity, rehabilitation, long-term care, and other forms of treatment, and records realised hospitalisations rather than unmet need. These features are particularly relevant when comparing regions with different geography, infrastructure, and transport accessibility.

The heterogeneity of the estimates also cautions against treating the PdRs as a uniform intervention. Although the plans operated within a common national framework, regions entered at different times and differed in programme duration, financial conditions, commissioner appointment, institutional capacity, and implementation. The region-specific SCM estimates preserve differences that would be concealed by a single pooled average effect. At the same time, institutional comparisons must remain cautious. For example, the absence of systematic personnel effects in Piemonte and Puglia is consistent with the possibility that implementation arrangements mattered, but the small number of regions entering under different institutional conditions does not permit identification of the causal effects of entry arrangements or commissioner appointment.

The results are consistent with previous evidence that the PdRs reduced healthcare expenditure, hospital capacity, and public healthcare employment (Depalo, 2019; Bordignon et al., 2020; Arcà et al., 2020), and complement studies examining patient mobility and other dimensions of healthcare access and service quality (Ciaccio, 2023; Beraldo et al., 2023). The present analysis adds evidence that these consequences were unevenly distributed across treated regions and that personnel compression was more widespread than increased patient out-migration.

The findings also highlight the distinction between restoring financial balance and improving productive efficiency. Reductions in personnel expenditure may contribute to deficit reduction without necessarily representing efficiency gains, particularly where staffing capacity is already limited. By limiting the replacement of departing employees, recruitment restrictions may contribute directly to containing personnel expenditure, but prolonged reliance on them may also reduce staffing capacity. This does not imply that fiscal consolidation must weaken healthcare provision. Its consequences depend on the composition of the adjustment and on regional conditions before implementation. Measures that remove inefficient expenditure may improve financial performance without compromising care, whereas adjustment concentrated on essential inputs may create a tension between budgetary balance and the local provision of services.

Several limitations qualify the interpretation of the results. First, pre-treatment fit is weaker for the SSN personnel rate in some regions because their observed trajectories cannot be closely reproduced by any weighted average of the available donor regions. Standardising the permutation statistics by the pre-treatment RMSPE accounts for differences in fit when assessing the estimated effects, but does not make a weakly fitted synthetic control a valid counterfactual. Second, the donor pool contains only ten never-treated regions, producing a discrete permutation distribution with limited inferential resolution. Third, the analysis estimates the overall effect of the PdR framework and cannot isolate the contribution of individual measures, including recruitment restrictions. Finally, the COVID-19 pandemic affected Italian regions with different timing and intensity. The main causal interpretation is therefore restricted to the period ending in 2019, while later observations describe the subsequent evolution of the outcomes.

Overall, the findings indicate that fiscal recovery programmes should be evaluated not only by their ability to eliminate deficits but also by the composition and territorial consequences of the adjustment. Monitoring healthcare resources and access alongside financial targets is particularly important in a decentralised universal system, where formally uniform entitlements may coexist with substantial differences in regional service

capacity.

6 Conclusion

This article examines the territorial consequences of Italy's regional healthcare recovery plans (*Piani di Rientro*, PdRs) within a decentralised National Health Service in which regional governments are responsible for organising care but differ substantially in fiscal capacity, institutional arrangements, and service provision. We focus on two complementary outcomes: the SSN personnel rate, which captures an essential input into regional service capacity, and patient out-migration, which measures residents' reliance on ordinary acute hospital care outside their region of residence.

Using annual regional data spanning 1994–2023, we construct a separate synthetic control for each of the ten regions that entered a recovery plan between 2007 and 2010. This region-specific approach preserves differences in treatment timing, programme duration, implementation, and subsequent institutional trajectories that would be obscured by a single average estimate.

The SSN personnel rate fell persistently below its synthetic counterfactual in several treated regions, while no systematic divergence emerged in others. The magnitude and timing of the estimated gaps also varied considerably, and regional trajectories did not always coincide with the period of active participation in the programme. In some cases, divergences persisted, emerged, or disappeared following formal exit. These findings refine existing evidence on the contraction of healthcare inputs under the PdRs by showing that staffing adjustments were neither uniform across regions nor confined to the period of formal programme participation.

Patient out-migration followed a less uniform pattern. A clear and persistent increase relative to the synthetic control emerged in only one region, while increases elsewhere were concentrated in particular periods and were supported by less conclusive joint permutation evidence. For several regions, the analysis identifies no systematic divergence from the counterfactual trajectory. Sustained departures from the counterfactual were therefore more widespread for public healthcare staffing than for patient mobility.

Taken together, the findings show that a common national framework of fiscal discipline was associated with markedly different trajectories across regional healthcare systems. The consequences of the recovery plans cannot be adequately represented by a single average pattern. Because each plan combined multiple fiscal and organisational measures, the estimates concern the overall recovery-plan framework and do not isolate the contribution of individual instruments.

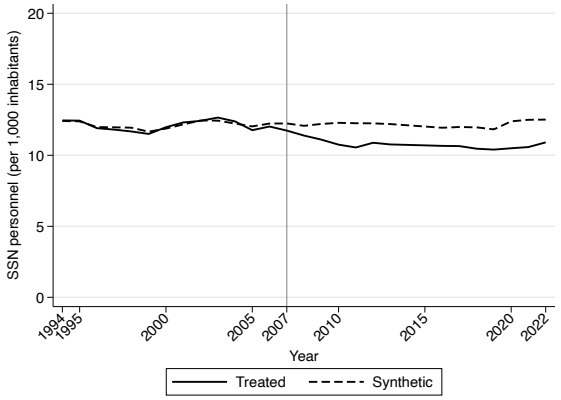
The results highlight the importance of evaluating fiscal recovery not only in terms of deficit reduction but also in terms of the composition and territorial distribution of the adjustment. Financial consolidation and universal access need not be conflicting objectives, but their compatibility depends on whether adjustment removes inefficiencies or constrains resources essential to service provision. Monitoring staffing capacity, local service availability, and territorial inequalities alongside conventional financial indicators should therefore form an integral part of healthcare recovery programmes.

APPENDIX

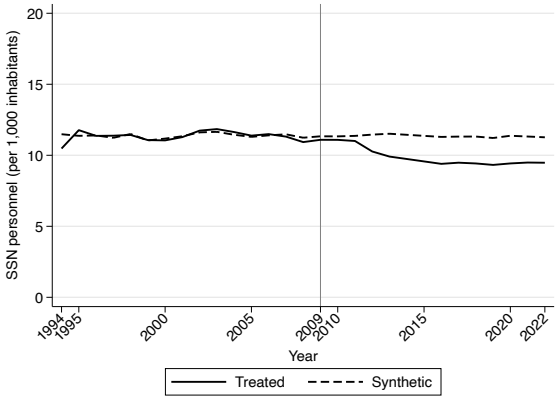
A Regional synthetic-control trajectories

Figure 1 compares the observed SSN personnel rate in each treated region with the corresponding synthetic-control trajectory. Figure 2 presents the analogous comparisons for patient out-migration. One vertical line in each panel indicates the region-specific year of entry into the PdR; a second vertical line, where present, indicates the year of exit. The figures should be interpreted together with the pre-treatment RMSPEs and placebo statistics reported in Tables 2 and 3.

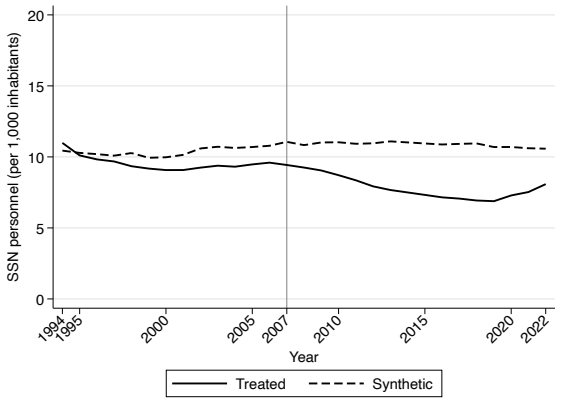
Figure 1: Observed and synthetic SSN personnel rates



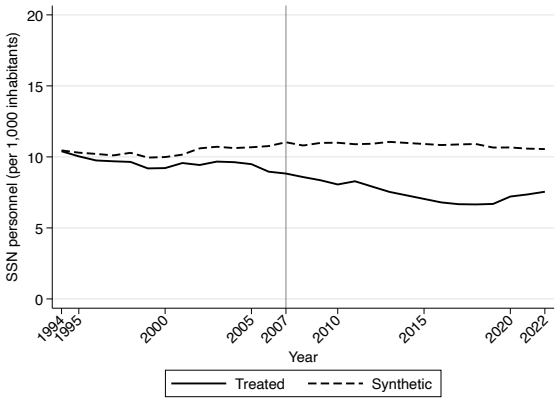
(a) Abruzzo



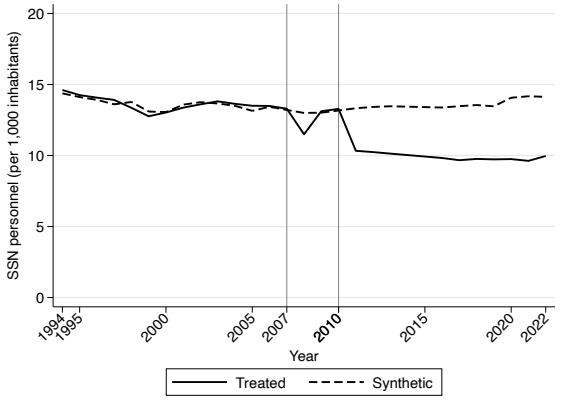
(b) Calabria



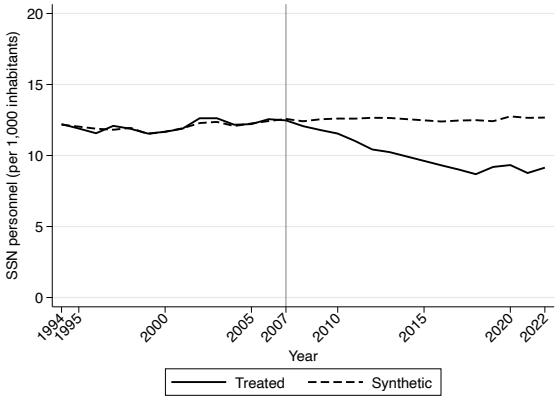
(c) Campania



(d) Lazio



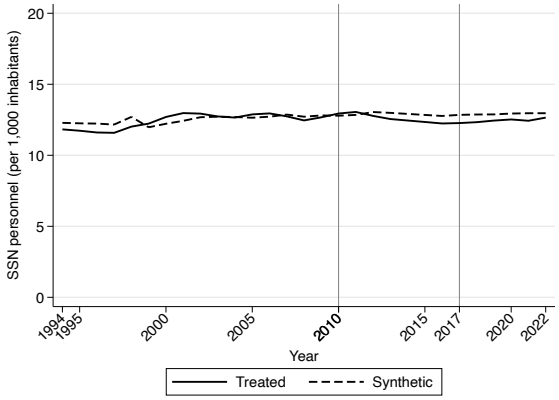
(e) Liguria



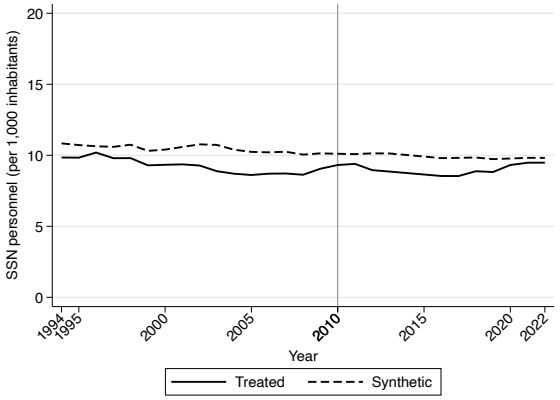
(f) Molise

Notes: Each panel compares the observed SSN personnel rate in the treated region with its synthetic-control counterpart. One vertical line marks entry into the PdR; a second line, where present, marks exit. Post-exit observations for Liguria describe the subsequent evolution of the outcome rather than the effect of continued exposure to the PdR.

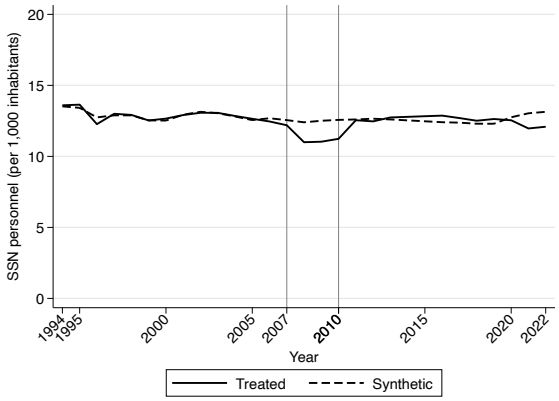
Figure 1: Observed and synthetic SSN personnel rates (continued)



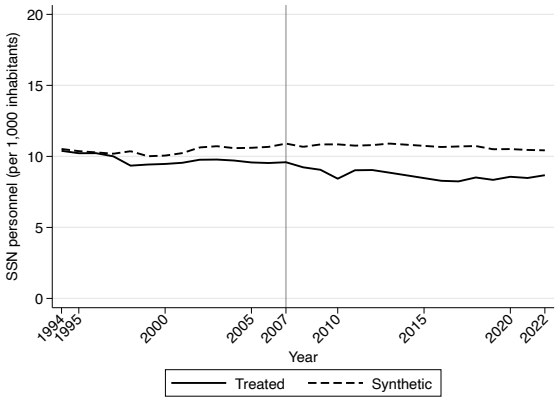
(g) Piemonte



(h) Puglia



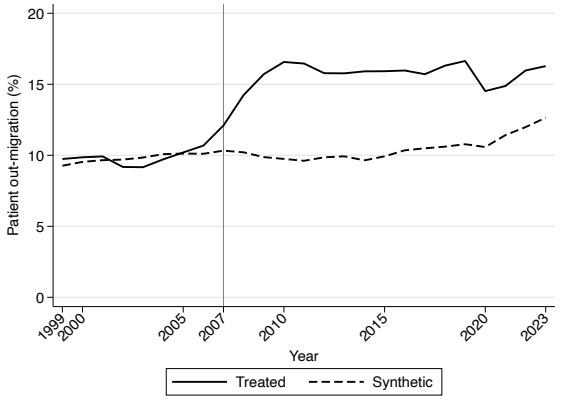
(i) Sardegna



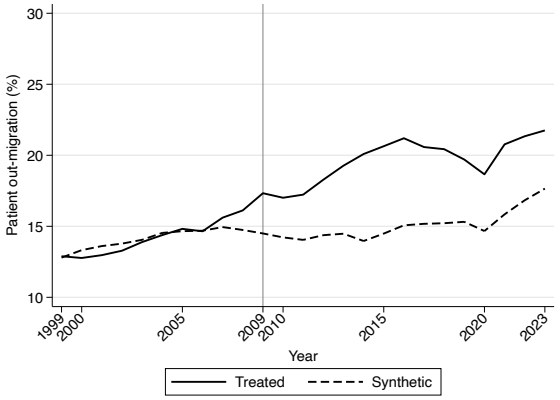
(j) Sicilia

Notes: Each panel compares the observed SSN personnel rate in the treated region with its synthetic-control counterpart. One vertical line marks entry into the PdR; a second line, where present, marks exit. Post-exit observations for Piemonte and Sardegna describe the subsequent evolution of the outcome rather than the effect of continued exposure to the PdR.

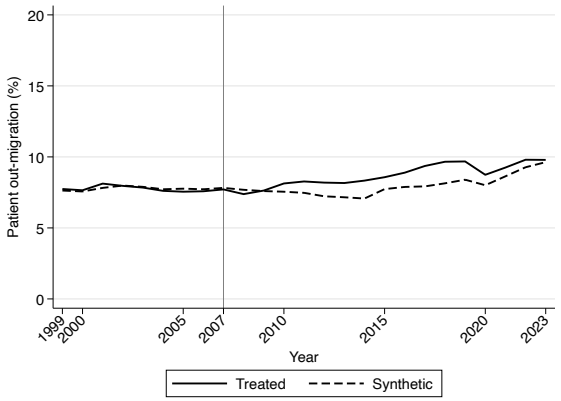
Figure 2: Observed and synthetic patient out-migration rates



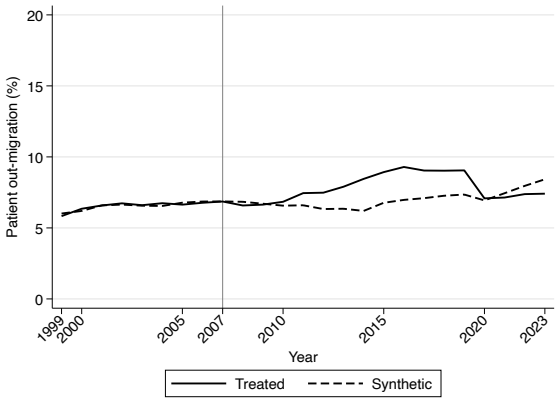
(a) Abruzzo



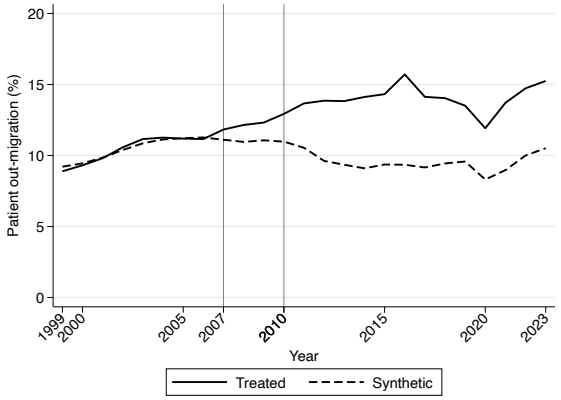
(b) Calabria



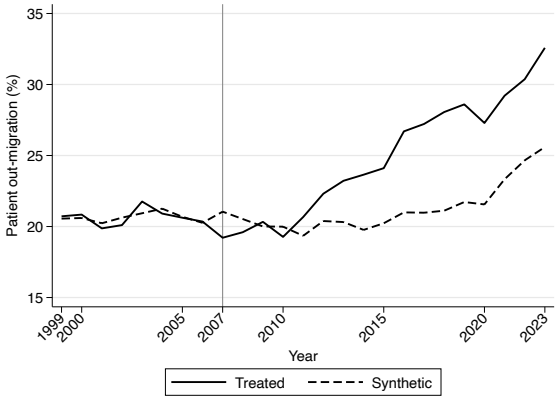
(c) Campania



(d) Lazio



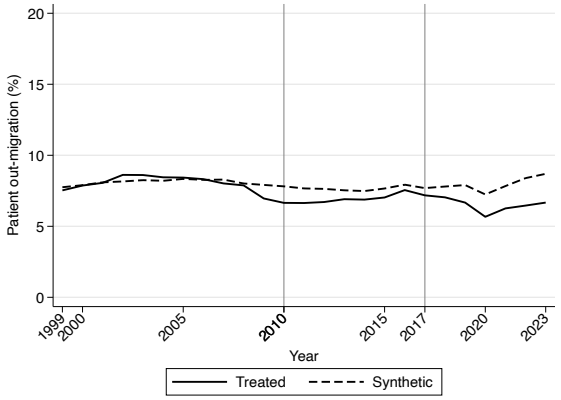
(e) Liguria



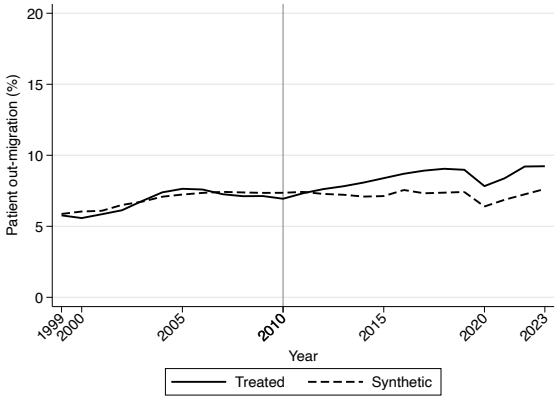
(f) Molise

Notes: Each panel compares the observed patient out-migration rate in the treated region with its synthetic-control counterpart. One vertical line marks entry into the PdR; a second line, where present, marks exit. Post-exit observations for Liguria describe the subsequent evolution of the outcome rather than the effect of continued exposure to the PdR. The indicator is expressed in percentage points.

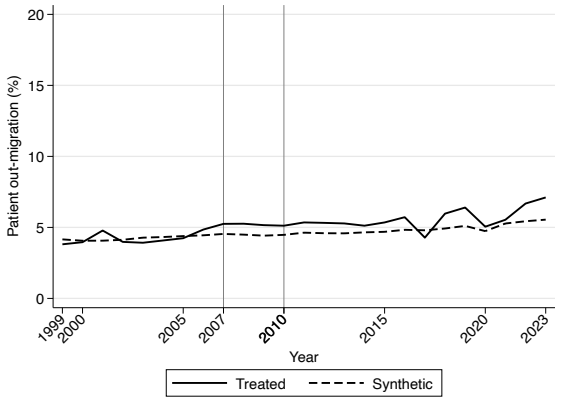
Figure 2: Observed and synthetic patient out-migration rates (continued)



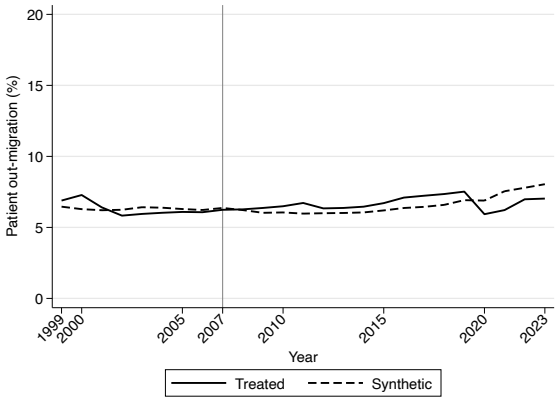
(g) Piemonte



(h) Puglia



(i) Sardegna



(j) Sicilia

Notes: Each panel compares the observed patient out-migration rate in the treated region with its synthetic-control counterpart. One vertical line marks entry into the PdR; a second line, where present, marks exit. Post-exit observations for Piemonte and Sardegna describe the subsequent evolution of the outcome rather than the effect of continued exposure to the PdR. The indicator is expressed in percentage points.

B Synthetic-control donor weights

Tables 4 and 5 report the donor weights used to construct the synthetic controls for the personnel and patient out-migration outcomes. The weights are estimated exclusively from pre-treatment outcome trajectories. They are non-negative and sum to one within each treated region.

The distribution of the weights varies across regions and outcomes. In several personnel applications, particularly Campania, Lazio, Puglia, and Sicilia, the synthetic control is concentrated on Basilicata and Lombardia. This concentration reflects the difficulty of reproducing the relatively low pre-treatment personnel levels of these regions using the available donor pool. The out-migration weights are generally more dispersed, consistent with the closer pre-treatment fit obtained for this outcome. The concentration or dispersion of the weights is descriptive and does not, by itself, establish the validity of a synthetic control.

Table 4: Synthetic-control donor weights for the personnel rate

Region	BAS	E.-R.	F.-V.G.	LOM	MAR	TOS	T.-A.A.	UMB	VdA	VEN
Abruzzo	0.31			0.07		0.41				0.21
Calabria	0.41			0.38		0.03	0.06		0.11	0.01
Campania	0.79			0.21						
Lazio	0.77			0.23						
Liguria	0.01		0.13		0.10	0.10		0.46	0.21	
Molise	0.46	0.14				0.15	0.14			0.11
Piemonte	0.36			0.17		0.06	0.40		0.01	
Puglia	0.40			0.60						
Sardegna			0.12				0.08	0.04		0.76
Sicilia	0.71			0.29						

Notes: All available pre-treatment outcome values are used as predictors. Weights are non-negative and sum to one within each treated region, subject to rounding. Non-zero weights are reported; zero weights are left blank. BAS = Basilicata; E.-R. = Emilia-Romagna; F.-V.G. = Friuli-Venezia Giulia; LOM = Lombardia; MAR = Marche; TOS = Toscana; T.-A.A. = Trentino-Alto Adige; UMB = Umbria; VdA = Valle d'Aosta; VEN = Veneto.

Table 5: Synthetic-control donor weights for the patient out-migration rate

Region	BAS	E.-R.	F.-V.G.	LOM	MAR	TOS	T.-A.A.	UMB	VdA	VEN
Abruzzo	0.18			0.46	0.05			0.32		
Calabria	0.23				0.27			0.45	0.05	
Campania	0.12		0.56	0.32						
Lazio	0.01		0.43	0.33				0.24		
Liguria						0.43	0.33		0.23	0.01
Molise	0.77			0.04	0.19					
Piemonte	0.10	0.58		0.26					0.05	
Puglia							0.37			0.63
Sardegna				0.65						0.35
Sicilia	0.12			0.88						

Notes: All available pre-treatment outcome values are used as predictors. Weights are non-negative and sum to one within each treated region, subject to rounding. Non-zero weights are reported; zero weights are left blank. BAS = Basilicata; E.-R. = Emilia-Romagna; F.-V.G. = Friuli-Venezia Giulia; LOM = Lombardia; MAR = Marche; TOS = Toscana; T.-A.A. = Trentino-Alto Adige; UMB = Umbria; VdA = Valle d'Aosta; VEN = Veneto.

C Placebo-outcome analysis

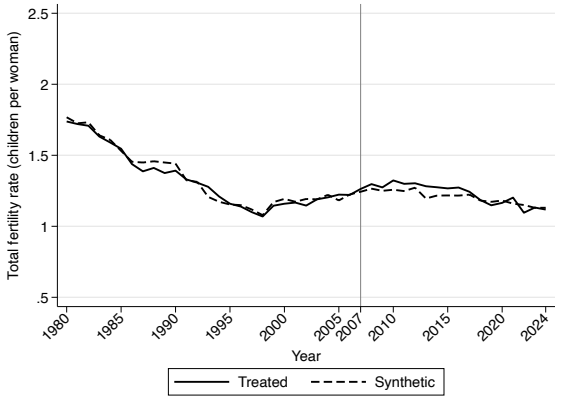
As an additional diagnostic, we apply the same synthetic-control procedure to the total fertility rate, observed from 1980 to 2024. Fertility was not directly targeted by the healthcare recovery plans and therefore provides a useful test of whether the empirical procedure mechanically identifies a break at PdR entry. However, fertility may respond indirectly to broader economic, demographic, and fiscal conditions and is therefore an imperfect placebo outcome. Table 6 reports the year-specific placebo-outcome estimates, the corresponding pre-treatment RMSPEs, and the joint standardised permutation p-values. Figure 3 compares the observed and synthetic fertility trajectories, with the underlying donor weights reported in Table 7. The results do not reveal a common discontinuity at the introduction of the PdRs. Most regions show no persistent sequence of unusually ranked post-treatment estimates. Abruzzo, Lazio, Molise, and Sardegna record only isolated deviations. Piemonte exhibits a more persistent negative divergence, initially in 2018 and again between 2022 and 2024. These estimates occur after Piemonte's formal exit from the programme in 2017 and therefore cannot be interpreted as effects of continued PdR exposure. Pre-treatment fit is comparatively weak for Campania and Sicilia, reducing the evidential value of their post-treatment estimates. Overall, the exercise suggests that the empirical procedure does not mechanically generate a common break at PdR entry, although it should be regarded as a diagnostic rather than as a formal validation of the main results.

Table 6: Year-specific placebo-outcome estimates for the total fertility rate

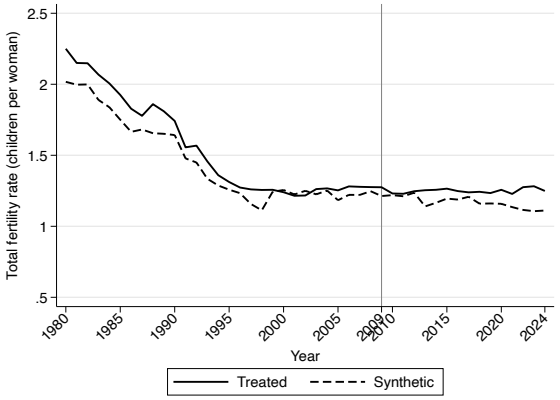
Year	Abruzzo	Calabria	Campania	Lazio	Liguria	Molise	Piemonte	Puglia	Sardegna	Sicilia
2007	0.020		0.004	0.032	−0.060	−0.078			−0.143	0.000
2008	0.032		−0.038	0.129*	−0.012	−0.079			−0.142	−0.009
2009	0.024	0.062	−0.018	0.084	−0.037	−0.114			−0.103	0.013
2010	0.065*	0.012	−0.076	0.082	−0.035	−0.025	−0.032*	0.009	−0.085	−0.035
2011	0.051	0.018	−0.084	0.117	−0.044	−0.048	−0.011	−0.009	−0.096	−0.035
2012	0.031	0.010	−0.132	0.070	−0.014	−0.078*	−0.013	−0.059	−0.140	−0.068
2013	0.086	0.114	−0.128	0.118	−0.028	−0.017	0.002	0.013	−0.088	−0.053
2014	0.059*	0.091	−0.174	0.086	−0.032	−0.037	−0.013	−0.003	−0.124	−0.047
2015	0.050	0.070	−0.169	0.083	−0.013	−0.061	−0.003	−0.049	−0.117	−0.104
2016	0.057	0.060	−0.171	0.069	−0.027	−0.068	−0.022	−0.032	−0.142	−0.138
2017	0.020	0.031	−0.145	0.019	−0.026	−0.032	0.004	−0.056	−0.153	−0.084
2018	0.004	0.083	−0.148	0.005	−0.043	−0.086	−0.049†	−0.031	−0.164	−0.040
2019	−0.024	0.073	−0.153	−0.047	−0.041	−0.032	−0.016	−0.056	−0.191*	−0.062
2020	−0.017	0.099	−0.119	−0.052	−0.036	−0.112	−0.032	−0.061	−0.218	−0.029
2021	0.042	0.093	−0.156	−0.032	−0.041	−0.071	−0.030	−0.030	−0.168	−0.017
2022	−0.054	0.160	−0.061	−0.054	−0.061	−0.047	−0.057*	0.014	−0.202	0.028
2023	0.002	0.175	−0.034	−0.067	−0.039	−0.023	−0.051†	0.023	−0.222	0.042
2024	−0.012	0.138	−0.039	−0.066	−0.026	−0.071	−0.043*	−0.012	−0.222	0.009
pre-RMSPE	0.033	0.117	0.334	0.058	0.052	0.052	0.018	0.106	0.109	0.235
joint p (2019)	0.500	0.800	1.000	0.500	0.800	0.500	0.200	1.000	0.500	1.000
joint p (2024)	0.500	0.800	1.000	0.500	0.800	0.500	0.200	1.000	0.500	1.000

Notes: Entries report the difference between the observed total fertility rate in each treated region and the corresponding synthetic-control estimate. Symbols are based on the period-specific standardised permutation p-values described in Section 3.5. † indicates $p_t^{\text{std}} = 0$, meaning that none of the ten donor-region placebos produces an equally large absolute standardised estimate. * indicates $p_t^{\text{std}} = 0.1$, meaning that exactly one placebo does. Because the permutation distribution contains ten donor regions, the attainable values are $0, 0.1, \ldots, 1$. *pre-RMSPE* is the pre-treatment root-mean-squared prediction error, which measures how closely the synthetic control reproduces the treated region's fertility trajectory before PdR entry, with values closer to zero indicating a closer fit. *joint p (2024)* is the joint standardised permutation p-value computed over the full available period (through 2024), defined as the proportion of donor-region placebos whose post-/pre-treatment RMSPE ratio is at least as large as that observed for the treated region. *joint p (2019)* reports the same statistic restricted to the period ending in 2019, before the confounding effect of the COVID-19 pandemic (see Section 5).

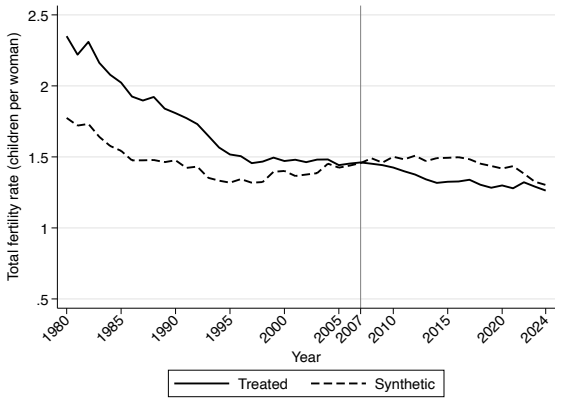
Figure 3: Placebo synthetic controls for the total fertility rate



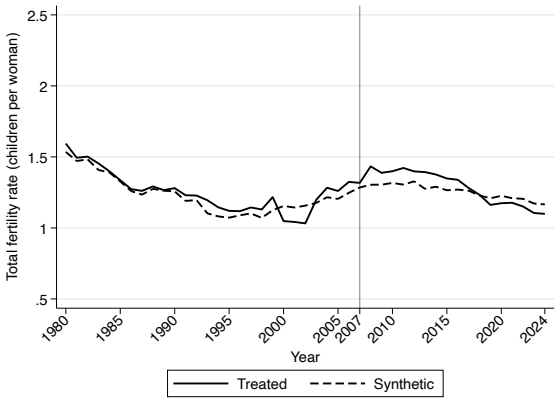
(a) Abruzzo



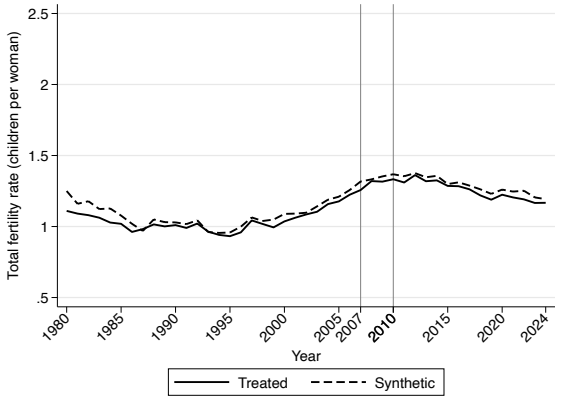
(b) Calabria



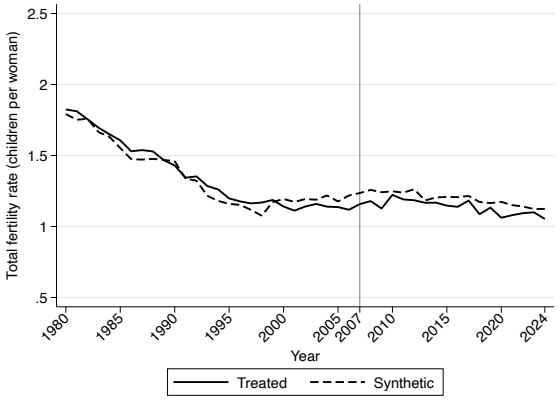
(c) Campania



(d) Lazio



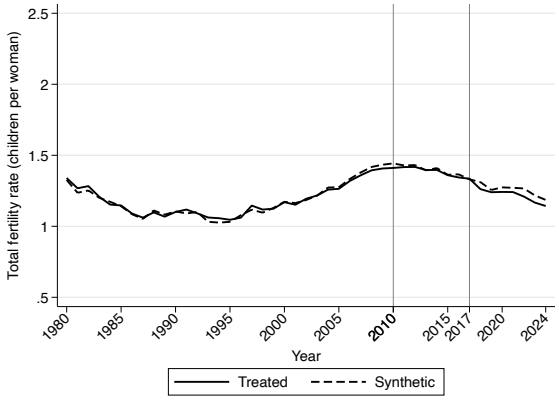
(e) Liguria



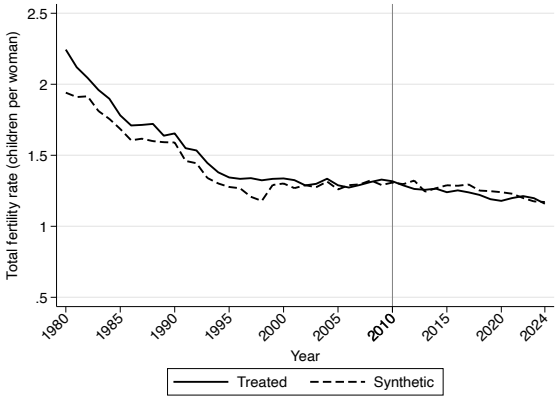
(f) Molise

Notes: Each panel compares the observed total fertility rate with its synthetic-control counterpart. One vertical line marks entry into the PdR; a second line, where present, marks exit. Fertility is used as a placebo outcome and was not directly targeted by the recovery plans.

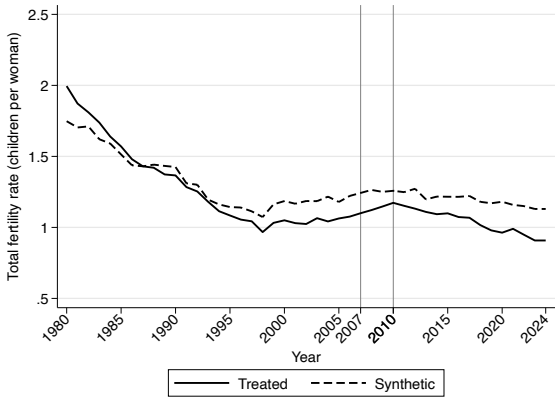
Figure 3: Placebo synthetic controls for the total fertility rate (continued)



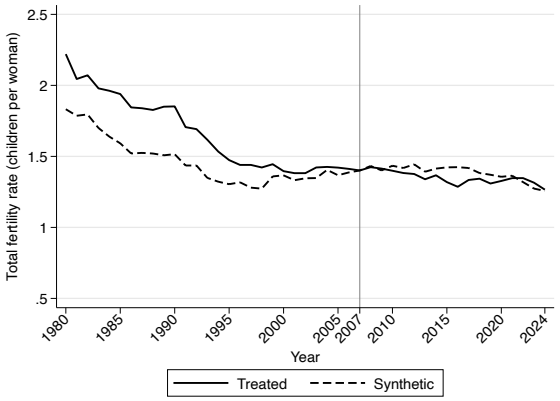
(g) Piemonte



(h) Puglia



(i) Sardegna



(j) Sicilia

Notes: Each panel compares the observed total fertility rate with its synthetic-control counterpart. One vertical line marks entry into the PdR; a second line, where present, marks exit. Fertility is used as a placebo outcome and was not directly targeted by the recovery plans.

Table 7: Synthetic-control donor weights for the placebo outcome (total fertility rate)

Region	BAS	E.-R.	F.-V.G.	LOM	MAR	TOS	T.-A.A.	UMB	VdA	VEN
Abruzzo	0.65		0.34				0.01			
Calabria	0.94						0.06			
Campania	0.29						0.71			
Lazio	0.34		0.62				0.03			
Liguria			1.00							
Molise	0.69		0.31							
Piemonte		0.16	0.49		0.11	0.03	0.10		0.10	
Puglia	0.74						0.27			
Sardegna	0.63		0.37							
Sicilia	0.44						0.56			

Notes: All available pre-treatment outcome values are used as predictors. Weights are non-negative and sum to one within each treated region, subject to rounding. Non-zero weights are reported; zero weights are left blank. The total fertility rate is a placebo outcome that is not directly targeted by the recovery plans; these weights therefore describe the synthetic controls underlying the placebo-outcome estimates in Table 6 and Figure 3. BAS = Basilicata; E.-R. = Emilia-Romagna; F.-V.G. = Friuli-Venezia Giulia; LOM = Lombardia; MAR = Marche; TOS = Toscana; T.-A.A. = Trentino-Alto Adige; UMB = Umbria; VdA = Valle d'Aosta; VEN = Veneto.

D Robustness to the interpolation of 2014–2015

As discussed in Section 3.1, the SSN personnel rate is unavailable for all Italian regions in 2014 and 2015. For these two years, it is therefore constructed by linear interpolation between the values observed in 2013 and 2016. To verify that this interpolation does not drive the results reported in Table 2, we re-estimate the synthetic control for each treated region after excluding 2014 and 2015 from the sample for both treated and donor regions. Because these two years fall within the post-treatment period for all treated regions, their exclusion does not affect the pre-treatment predictors used to construct the donor weights. Consequently, the point estimates for all remaining post-treatment years are numerically identical, for each region and year, to those reported in Table 2. The joint standardised permutation p-values are also unchanged for nine of the ten treated regions, both over the full period and when the analysis is restricted to 2019. The only exception is Puglia, for which the joint p-value in the analysis restricted to 2019 decreases from 1.000 in the baseline specification to 0.800 when the interpolated years are excluded. Its full-period joint p-value remains equal to 1.000 in both specifications. Because the main analysis already provides no evidence of a systematic personnel effect in Puglia, this change does not affect the interpretation of the paper's results.

E Region-specific measures adopted under each PdR

Table 8 summarises the principal measures adopted under each regional recovery plan. It documents differences across regions in the timing and duration of the plans, hospital-network rationalisation, the development of community-based care, pharmaceutical policy, procurement, personnel restrictions, and the regulation of accredited private providers.

Table 8: Region-specific measures adopted under each PdR

Region	Benchmark attainment	Hospital-network rationalisation	Development of community-based care	Pharmaceuticals	Procurement	Personnel	Private providers
Abruzzo • **PdR status:** 2007–ongoing • **Commissioner-led period:** 2008–2016 • **Comment:** A commissioner was appointed in 2008 because of implementation delays. Delays during 2007–2009 contributed to a persistently high deficit. Progress was made from 2010 onwards, but implementation remained incomplete after the Regional Administrative Court annulled several hospital-conversion decisions. Once financial balance had been restored, the focus shifted in 2013–2015 towards improving service quality and community-based care.	• Hospitalisation rate (per 1,000) 2007 *[×]* (209.9) 2010 *[✓]* (169.8) 2015 *[✓]* (138.0) • Beds (per 1,000) 2007 *[×]* (4.79) 2010 *[✓]* (4.03) 2014 *[✓]* (3.32)	• Reorganisation of the hospital network • Conversion of small hospitals *[delayed until PO 2010–12]* • Redistribution of personnel across units *[PO 2010–12]* • Reorganisation of emergency services *[PO 2010–12]*	• Strengthening of the outpatient specialist-care network *[PO 2013–15]* • Expansion of home care *[PO 2013–15]* • Expansion of preventive services *[PO 2013–15]* • Integration of general practitioners into primary care *[2016–18]*	• Introduction of patient co-payments (“ticket”)	• Reduction in expenditure on goods and services *[PO 2013–15]*	• Provision for a conditional turnover freeze • Reduction in fixed-term contracts	• Spending cap for accredited private providers *[PO 2010–12]*
Calabria • **PdR status:** 2009–ongoing • **Commissioner-led period:** 2010–ongoing • **Comment:** Calabria was the only region required to undergo a pre-PdR accounting audit, which delayed its entry by two years. A commissioner was appointed in 2010. The deficit remained persistently high and service quality low because implementation was inadequate throughout. Reductions in hospitalisations and beds, although insufficient to restore financial balance, were not offset by improvements in community-based care or other care settings.	• Hospitalisation rate (per 1,000) 2007 *[×]* (213.1) 2010 *[✓]* (170.9) 2015 *[✓]* (127.7) • Beds (per 1,000) 2007 *[✓]* (4.47) 2010 *[✓]* (4.00) 2014 *[✓]* (2.98)	• Reduction in hospitalisations, partly through a shift away from inpatient care • Reorganisation of the hospital network *[largely delayed]*	• Expansion of home care for older people *[largely delayed]* • Expansion of preventive services *[largely delayed; monitoring revealed low cancer-screening rates]* • Restructuring and strengthening of the community-based care network *[largely delayed]*	• Promotion of appropriate prescribing • Expansion of direct distribution • Promotion of generic prescribing	• Centralised purchasing • Implementation of an expenditure forecasting and control system	• Provision for a conditional turnover freeze *[weakly enforced, with repeated breaches]*	• Spending cap for accredited private providers
Campania • **PdR status:** 2007–2026 • **Commissioner-led period:** 2009–2020 • **Comment:** Litigation involving private providers and implementation delays led to the appointment of a commissioner in 2009. Because bed capacity was already below the national ceiling, while service quality remained poor, interventions focused on reducing inappropriate hospitalisations by promoting alternatives to inpatient care and improving administrative efficiency. Once financial balance had been restored, the focus shifted in 2013–2015 towards improving service quality.	• Hospitalisation rate (per 1,000) 2007 *[×]* (228.7) 2010 *[×]* (197.8) 2015 *[×]* (164.6) • Beds (per 1,000) 2007 *[✓]* (3.83) 2010 *[✓]* (3.69) 2014 *[✓]* (3.31)	• Shift away from inpatient care • Reorganisation of the hospital network *[largely delayed]* • Reorganisation of emergency services *[PO 2016–18]*	• Restructuring and strengthening of the community-based care network *[largely delayed]* • Creation of a diagnostic laboratory network *[PO 2011–12]* • Increase in acute-care beds *[PO 2016–18]*	• Promotion of appropriate prescribing • Expansion of direct distribution • Promotion of generic prescribing • Revision of patient co-payments, including higher charges and the removal of many exemptions *[PO 2010–12]*	• Centralised purchasing	• Provision for a conditional turnover freeze • Reduction in fixed-term contracts • Review of staffing levels • Redistribution of personnel according to facility complexity *[PO 2010]*	• Accreditation of private providers *[delayed beyond 2010 because of litigation involving private providers]* • Spending cap for accredited private providers *[repeatedly breached and revised under PO 2013–15]*

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Table 8 continued

Region	Benchmark attainment	Hospital-network rationalisation	Development of community-based care	Pharmaceuticals	Procurement	Personnel	Private providers
Lazio • **PdR status:** 2007–ongoing • **Commissioner-led period:** 2008–2020 • **Comment:** Litigation involving private providers and implementation delays led to the appointment of a commissioner in 2008. During 2007–2009 and 2010–2012, savings came mainly from reductions in personnel and pharmaceutical expenditure. Hospital-network reorganisation was largely delayed until PO 2013–15. The 2016 monitoring round identified insufficient development of community-based care.	• Hospitalisation rate (per 1,000) 2007 *[×]* (195.8) 2010 *[✓]* (172.8) 2015 *[✓]* (136.7) • Beds (per 1,000) 2007 *[×]* (5.21) 2010 *[×]* (4.71) 2014 *[×]* (3.77)	• Reorganisation of the hospital network *[PO 2010–12; largely delayed]* • Conversion of small hospitals *[PO 2010–12; largely delayed]*	• Reorganisation of the specialist-care network *[PO 2010–12; largely delayed]* • Restructuring and strengthening of the community-based care network *[PO 2016–18]*	• Promotion of generic prescribing *[PO 2010–12]* • Expansion of direct distribution *[PO 2010–12]* • Increase in patient co-payments *[PO 2010–12]*	No specific measures documented.	• Provision for a conditional turnover freeze	• Final accreditation of private providers *[PO 2010–12]* • Spending cap for private providers *[PO 2013–15]* • Interregional agreements to reduce inward patient mobility *[PO 2013–15]*
Liguria • **PdR status:** 2007–2010 • **Commissioner-led period:** No commissioner • **Comment:** Liguria is characterised by an ageing population, which placed pressure on its regional health system. It was the only first-wave region to exit the PdR without entering commissioner-led administration. Interventions focused on reducing inappropriate hospitalisations and emergency-department use rather than cutting bed capacity, which was already in line with the national benchmark. After exit, voluntary structural measures were adopted to ensure long-term financial sustainability.	• Hospitalisation rate (per 1,000) 2007 *[×]* (199.8) 2010 *[✓]* (183.9) 2015 *[✓]* (139.3) • Beds (per 1,000) 2007 *[✓]* (4.14) 2010 *[✓]* (4.10) 2014 *[✓]* (3.46)	• Reduction in the number of hospital trusts • Reduction in inappropriate hospitalisations • Reduction in inappropriate emergency-department use • *Post-exit measures (voluntary, 2010):* reconfiguration of bed capacity; rationalisation of maternity units; rationalisation of surgical and administrative services; and facility mergers	• Strengthening of the outpatient specialist-care network • Expansion of home care for older people	• Expansion of direct distribution • Promotion of generic prescribing • Increase in patient co-payments	• Centralised purchasing • Electronic procurement • Centrally managed tenders	• Provision for a conditional turnover freeze • Review of staffing levels	No specific measures documented.
Molise • **PdR status:** 2007–ongoing • **Commissioner-led period:** 2009–ongoing • **Comment:** A commissioner was appointed in 2009 because of implementation delays. The improvement in the financial balance came almost entirely from increases in regional taxes rather than expenditure reductions. Monitoring repeatedly identified inadequate implementation. Reductions in hospitalisations and beds were insufficient and were not offset by improvements in community-based care or other care settings.	• Hospitalisation rate (per 1,000) 2007 *[×]* (221.5) 2010 *[×]* (193.5) 2015 *[✓]* (156.1) • Beds (per 1,000) 2007 *[×]* (6.04) 2010 *[×]* (5.32) 2014 *[×]* (4.00)	• Reorganisation of the hospital network *[largely delayed]* • Conversion of small hospitals *[largely delayed]*	• Restructuring and strengthening of the community-based care network *[largely delayed]*	• Promotion of appropriate prescribing • Promotion of generic prescribing • Improved drug traceability	• Centralised purchasing *[largely delayed]*	• Provision for a conditional turnover freeze *[largely not implemented]* • Reduction in fixed-term contracts *[largely not implemented]*	• Revision of the accreditation framework for private providers *[largely not implemented]*
Piemonte • **PdR status:** 2010–2017 • **Commissioner-led period:** No commissioner • **Comment:** The plan was not legally mandated but was adopted to recover the performance-related funding withheld for 2004. Piemonte recorded the highest level of compliance with the essential levels of care among PdR regions. Monitoring identified implementation delays during 2010–2013 but subsequently confirmed that the objectives had been achieved during 2013–2015. The region exited following a €1.5 billion debt-repayment agreement with a ten-year horizon. Insufficient regional health-service liquidity remained an issue at exit.	• Hospitalisation rate (per 1,000) 2007 *[✓]* (160.8) 2010 *[✓]* (145.0) 2015 *[✓]* (119.6) • Beds (per 1,000) 2007 *[✓]* (4.06) 2010 *[✓]* (4.17) 2014 *[×]* (3.91)	• Reduction in bed capacity *[required from 2012]*	• Restructuring of the laboratory and diagnostic network • Restructuring and strengthening of the community-based care network *[PO 2013–15]*	• Revision of the regional formulary • Monitoring of prescribing appropriateness	• Centralised purchasing	• Partial restrictions on personnel turnover • Reduction in non-standard employment contracts • Suspension of supplementary remuneration	• Revision of the spending cap for accredited private providers

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Table 8 continued

Region	Benchmark attainment	Hospital-network rationalisation	Development of community-based care	Pharmaceuticals	Procurement	Personnel	Private providers
Puglia • **PdR status:** 2010–ongoing • **Commissioner-led period:** No commissioner • **Comment:** The plan was not legally mandated but was adopted to recover the performance-related funding withheld for 2006–2009. Reductions in pharmaceutical and personnel expenditure improved the financial balance during 2010–2012. Compliance with the essential levels of care improved during 2013–2015, making Puglia the only large southern region to achieve full compliance. PO 2016–18 then focused on addressing the remaining delays in hospital-network reorganisation and the development of community-based care.	• Hospitalisation rate (per 1,000) 2007 *[×]* (214.7) 2010 *[×]* (206.0) 2015 *[✓]* (135.4) • Beds (per 1,000) 2007 *[✓]* (4.12) 2010 *[✓]* (4.01) 2014 *[✓]* (3.24)	• Reorganisation of the hospital network *[largely delayed]* • Conversion of small hospitals *[largely delayed]*	• Improvement in the quality of community-based care *[planned under PO 2013–15 but delayed until PO 2016–18]* • Expansion of home care *[planned under PO 2013–15 but delayed until PO 2016–18]*	• Increase in patient co-payments • Monitoring of prescribing appropriateness *[largely delayed]*	• Centralised purchasing *[largely delayed]*	• Provision for a conditional turnover freeze	• Revision of the spending cap for accredited private providers
Sardegna • **PdR status:** 2007–2010 (special-statute region) • **Commissioner-led period:** No commissioner • **Comment:** The 2009 monitoring round identified inadequate implementation, as subsequently confirmed by the Court of Auditors. Nevertheless, the region exited the PdR process under the provisions associated with its special autonomous status. Exposure to the PdR was therefore brief. After exit, rising deficits led to the adoption of a new voluntary restructuring plan in 2015.	• Hospitalisation rate (per 1,000) 2007 *[×]* (196.3) 2010 *[✓]* (173.4) 2015 *[✓]* (151.2) • Beds (per 1,000) 2007 *[×]* (4.53) 2010 *[✓]* (4.28) 2014 *[✓]* (3.56)	• Reorganisation of the hospital network *[largely not implemented]* • Reduction in inappropriate hospitalisations • Reduction in inappropriate emergency-department use • Corporatisation of university hospitals	• Rationalisation of the diagnostic laboratory network	• Rationalisation of pharmaceutical expenditure *[specific measures not documented]*	• Rationalisation of procurement for goods and services *[specific measures not documented]*	• Rationalisation of personnel expenditure *[specific measures not documented]*	No specific measures documented.
Sicilia • **PdR status:** 2007–ongoing • **Commissioner-led period:** No commissioner • **Comment:** Sicilia was the only special-statute region subject to the standard PdR framework. The deficit remained high during 2007–2009 because of implementation delays, declined during 2010–2012, and was eliminated during 2013–2015. During 2016–2018, the focus shifted towards improving service quality, which had remained low.	• Hospitalisation rate (per 1,000) 2007 *[×]* (237.6) 2010 *[×]* (185.6) 2015 *[✓]* (117.6) • Beds (per 1,000) 2007 *[✓]* (4.13) 2010 *[✓]* (3.68) 2014 *[✓]* (3.35)	• Reduction in inappropriate hospitalisations • Reduction in inappropriate emergency-department use • Reduction in the number of hospital trusts *[delayed until 2009]* • Reorganisation of the hospital network *[PO 2010–12]*	• Restructuring and strengthening of the community-based care network *[largely delayed]* • Expansion of home care *[PO 2010–12]* • Rationalisation of maternity units *[PO 2010–12]*	• Expansion of direct distribution • Promotion of generic prescribing • Increase in patient co-payments	• Centralised purchasing *[delayed until PO 2010–12]*	• Provision for a conditional turnover freeze • Reduction in managerial positions	• Spending cap for accredited private providers *[largely delayed]*

Notes: PO denotes an Operational Programme. The essential levels of care establish the services that the Italian National Health Service is required to provide to all residents. A tick indicates that the relevant national benchmark was met; a cross indicates that it was not met. "Provision for a conditional turnover freeze" refers to the measure provided for by Law No. 191/2009, which was activated when annual monitoring established both non-compliance with the objectives of the recovery plan and the persistence of an uncovered healthcare deficit.
Source: Aimone Gigio et al. (2018), Section II, subsections (a)–(j), pp. 45–72.
National benchmarks applicable to all regions: Hospitalisations: the State–Regions Agreement of 23 March 2005 established a ceiling of 180 hospitalisations per 1,000 inhabitants; DL 95/2012 and DM 70/2015 subsequently lowered the ceiling to 160 per 1,000 inhabitants. Beds: the 2005 State–Regions Agreement established a ceiling of 4.5 beds per 1,000 inhabitants; DM 70/2015 subsequently lowered the ceiling to 3.7 beds per 1,000 inhabitants, of which no more than 3.0 could be acute-care beds. Personnel: Law No. 296/2006 capped personnel expenditure at 1.4% below its 2004 level; Law No. 191/2009 provided for an automatic turnover freeze when annual monitoring established that a PdR region had failed, wholly or partly, to meet the objectives of its recovery plan and an uncovered healthcare deficit remained.

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