UNIVERSITÀ
DI PAVIA

Dipartimento di Scienze Economiche e Aziendali

Corso di Laurea Magistrale in Economics, Development and Innovation

AUSTERITY, WORKFORCE CUTS, AND PATIENT DISPLACEMENT:

A SYNTHETIC CONTROL ANALYSIS OF ITALY'S REGIONAL RECOVERY PLANS

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Tesi di Laurea
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Matr. n. 558701

Anno Accademico 2025-2026

Austerity, Workforce Cuts, and Patient Displacement: A Synthetic Control Analysis of Italy's Regional Recovery Plans

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Abstract

This thesis estimates the causal effects of Italy's regional healthcare recovery plans (*Piani di Rientro*, PdR) on public healthcare personnel per 1,000 inhabitants and patient out-migration as a share of discharged residents. Introduced from 2007, the plans imposed binding fiscal adjustment on ten Italian regions with large structural deficits in their health services. Applying the Synthetic Control Method separately to each treated region, with a donor pool of ten never-treated regions and annual Istat data spanning 1994 to 2023, I construct region-specific counterfactuals. This is the first study to apply the method to health inputs and outcomes across the full set of PdR regions.

Personnel reductions are significant and persistent in most treated regions, ranging from 1 to 4 fewer employees per 1,000 inhabitants relative to the counterfactual. Where workforce compression was substantial, patient out-migration followed, rising by 1 to 7 percentage points above the counterfactual. Null results arise where the mechanism predicts them: in regions with voluntary and mild plans, where hospital capacity was already constrained, and where statutory autonomy and island geography suppressed both effects.

An expenditure decomposition using Italian Treasury data shows that, before the plans began, PdR regions already spent as much as non-PdR ones on personnel, while carrying a large structural surplus in expenditure on contracted private providers. This was the true source of the fiscal imbalance. The plans did not address it: the automatic hiring freeze imposed by the central government compressed personnel spending further, while contracted private expenditure remained untouched throughout the programme. As the workforce shrank, the predictable result was a deterioration in service quality. The trade-off between fiscal balance and service quality was therefore real but not inevitable: acting on the surplus in contracted private expenditure was the natural path, but it would have required negotiations with providers, procurement reform, and likely litigation. The hiring freeze required none of this. It was an emergency brake: easy and immediate to implement, but aimed at the wrong expenditure component.

JEL Codes: C23, H51, H75, H77, I18

Keywords: Piani di Rientro; Synthetic Control Method; fiscal consolidation; healthcare personnel; patient out-migration; Italy.

Austerità, Tagli al Personale e Mobilità Passiva:

Un'Analisi con il Metodo del Controllo Sintetico dei Piani di Rientro Regionali

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Sommario

Questa tesi stima gli effetti causali dei Piani di Rientro (PdR) regionali italiani sul personale sanitario pubblico per 1.000 abitanti e sulla mobilità passiva come percentuale dei residenti dimessi. Introdotti a partire dal 2007, i Piani hanno imposto dei tagli vincolanti alle dieci regioni italiane con disavanzi strutturali nei propri sistemi sanitari. Applico il Metodo del Controllo Sintetico a ciascuna regione trattata, una per volta, usando un gruppo di controllo composto da dieci regioni mai trattate e dati Istat annuali che coprono il periodo 1994–2023; ottengo così dei controfattuali per ciascuna regione. Questo è il primo studio ad applicare a delle variabili sanitarie il Metodo del Controllo Sintetico su tutte le regioni sottoposte a Piano di Rientro.

Le riduzioni di personale sono significative e persistenti nella maggior parte delle regioni trattate, con effetti stimati compresi tra 1 e 4 addetti in meno per 1.000 abitanti rispetto al controfattuale. La mobilità passiva è di conseguenza aumentata laddove i tagli al personale sono stati consistenti, con incrementi da 1 a 7 punti percentuali rispetto al controfattuale. Risultati nulli emergono dove ce li si aspetta: nelle regioni con Piani volontari e di portata limitata, dove la dotazione ospedaliera era già ridotta, e dove l'autonomia statutaria e la geografia insulare hanno soppresso entrambi gli effetti.

Una scomposizione della spesa sanitaria regionale pro capite basata sui dati della Ragioneria Generale dello Stato mostra che, prima dell'avvio dei Piani, le regioni in a PdR già spendevano per il personale quanto le altre, ma presentavano un'eccessiva spesa per i fornitori privati convenzionati con il Servizio Sanitario Nazionale. I Piani non vi hanno posto rimedio: il blocco automatico del *turnover* imposto dal governo centrale ha compresso ulteriormente la spesa per il personale, mentre la spesa per i privati convenzionati è rimasta invariata per tutta la durata del programma. Con il ridursi del personale, il risultato prevedibile è stato un deterioramento della qualità dei servizi. Il *trade-off* tra sostenibilità finanziaria e qualità dell'assistenza è quindi reale, ma non inevitabile: si sarebbe infatti potuto intervenire sull'eccesso nella spesa convenzionata, ma ciò avrebbe richiesto trattative con i fornitori, riforme delle forniture e probabilmente contenziosi legali. Il blocco del *turnover* è quindi servito come freno d'emergenza: semplice e immediato da implementare, ma mirato alla componente di spesa sbagliata.

Codici JEL: C23, H51, H75, H77, I18

Parole chiave: Piani di Rientro; Metodo del Controllo Sintetico; consolidamento fiscale; personale sanitario; mobilità passiva; Italia.

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Chapter 1

Introduction

In countries where healthcare is publicly funded, fiscal crises tend to translate quickly into healthcare crises. The mechanism is straightforward: when public finances deteriorate, health budgets are among the largest and most visible expenditure lines available to cut. How those cuts are designed matters enormously. A well-targeted consolidation that removes genuine inefficiencies leaves service quality intact; one that compresses productive inputs leaves behind a healthcare system that costs less but also delivers less. Distinguishing between these two scenarios is not a mere accounting exercise: it requires evidence on what specific instruments a fiscal plan deployed, what their effects on healthcare inputs were, and whether patients ultimately bore the consequences through reduced local access.

Italy's *Piani di Rientro* (PdR) offer an unusually clean setting for this question. From 2007 onwards, ten Italian regions were required to sign multi-year financial recovery plans with the central government. The plans were introduced against a backdrop of deep structural imbalances: while the 2001 Constitutional reform had devolved responsibility for healthcare delivery to the regions, revenues remained predominantly controlled by the central government; this arrangement generated significant moral hazard, with regions overspending and then being repeatedly bailed out by the central government throughout the 1990s and early 2000s (France et al., 2005). The PdR framework was designed to eliminate this moral hazard by imposing a cost of failure borne by the regions themselves (Bordignon & Turati, 2009; Bordignon et al., 2020). Among the adjustment instruments formally available, the plans included caps on spending with accredited private providers, centralised procurement reform, rationalisation of hospital networks, and a hiring freeze on public healthcare personnel. In practice, the latter emerged as the dominant adjustment instrument, codified by Law 191/2009 as an automatic, legally enforceable hiring freeze for all regions subject to a PdR.

This thesis asks two questions. First, did the PdRs reduce public healthcare personnel in treated regions, relative to what those regions would have experienced without the plans? Second, did the resulting staffing compression increase patient out-migration, defined as the share of patients who sought inpatient care in a different region? These two outcomes, taken together, are designed to test a specific mechanism: that fiscal consolidation operated through workforce compression, and that this compression was severe enough to reduce local service quality to the point where patients sought care elsewhere.

Both outcomes are studied using the Synthetic Control Method (SCM), introduced by Abadie and Gardeazabal (2003) and formalised by Abadie et al. (2010). For each treated region, the SCM constructs a synthetic twin as a weighted average of never-treated regions, known as donors. For this synthetic control to serve as a credible counterfactual, its pre-treatment trajectory must closely match that of the actual region. If it does, the estimated treatment effect in any post-treatment year is the gap between the observed outcome and this synthetic counterfactual. Inference is conducted through in-space permutation tests: the same procedure is applied to each donor region in turn, as if it were treated, and the resulting distribution of placebo effects is used to assess whether the gap for the actual treated region is unusually large. The method is applied separately to each of the ten treated regions and both outcomes, yielding ten pairs of region-specific estimates. The data source is the Istat *Health for All* database, which provides annual region-level series on both outcomes from 1994 and 1999, respectively, through 2022 and 2023.

The SCM is particularly well suited to this setting for three reasons. First, it does not require the parallel-trends assumption: treated regions were selected precisely because they were systematically different from untreated ones, and deep structural differences between the Italian North and South make the assumption of common counterfactual trends implausible. Second, by producing region-specific rather than pooled estimates, the SCM can recover the substantial heterogeneity in outcomes that the institutional heterogeneity of the plans would lead one to expect: regions differed in treatment timing, commissioner appointment, choice of plan instruments and the degree to which these were actually implemented. Third, the graphical transparency of the method makes the comparison between observed and synthetic trajectories directly legible to a non-academic audience, which is especially valuable when evaluating a policy that remains politically contested.

This thesis contributes to two strands of literature.

The first is the empirical literature evaluating PdRs. Earlier studies establish that PdRs successfully reduced per-capita expenditure, primarily through cuts in hospital beds, staffing, and hospitalisations (Arcà et al., 2020; Bordignon et al., 2020; Depalo, 2019). The evidence on health consequences is more mixed: Bordignon et al. (2020) find no significant effect on mortality, while Arcà et al. (2020) document a significant increase in amenable mortality, and Depalo (2019) obtains bounds that are uninformative on the sign of the mortality effect for most regions. More recently, Ciaccio (2023), Guccio et al. (2024), and Cirulli and Marini (2023) confirm the pattern of deteriorating service quality, including significant increases in patient out-migration. Beraldo et al. (2023) study out-migration directly and find that it increased, especially in the regions where a commissioner was appointed, with hospital beds and healthcare employees as the proximate channels. All of these papers, however, estimate average treatment effects pooled across regions using panel DiD or IV estimators, and none applies the SCM to either of the outcomes studied here. This thesis offers three complementary contributions to this body of evidence. It applies the SCM, which sidesteps the parallel-trends assumption that DiD requires and that the Italian context renders doubtful. It produces region-specific estimates rather than pooled ATTs, making the heterogeneity in responses visible and interpretable against the specificity of each region and its plan. And it draws on the most recent data available, extending to 2022–2023, offering a genuinely long-run perspective on a programme that is still ongoing for most treated regions.

The second strand concerns the use of the SCM in health economics. Since its original applications to tobacco control (Abadie et al., 2010) and the economic costs of conflict (Abadie & Gardeazabal, 2003), the SCM has been most widely applied in fields such as tax policy, crime, and macroeconomics. Applications to healthcare policy remain comparatively rare. Depalo (2019) uses the SCM when evaluating PdRs as one of several benchmarks for a bounding exercise on Italian mortality, but the method is secondary to the nonparametric identification strategy. Rieger et al. (2017) apply the SCM to evaluate the effect of universal health coverage in Thailand on health financing outcomes and infant and child mortality. Most recently, Di Novi and Salari (2026) apply the SCM separately to each of seven European countries that have introduced sugar-sweetened beverage taxes, studying effects on soft drink sales and product reformulation. Relative to this literature, the present application is unusual in combining a large number of treated units (ten), two distinct outcomes, and a long panel that spans both the policy's introduction and subsequent enforcement cycles. To the best of my knowledge, this is the first study to apply the SCM separately to different regions within the same country for outcomes concerning healthcare inputs and quality.

Personnel reductions are large, persistent, and statistically significant in most treated regions, with estimated effects in the range of 1 to 4 fewer public healthcare employees per 1,000 inhabitants relative to the synthetic counterfactual in regions with adequate pre-treatment fit. Four regions constitute exceptions. Piemonte and Puglia entered the PdR voluntarily and operated without commissioners, and show no significant effect at any point. Sardegna shows a significant personnel reduction only during the three years the plan was formally active, after which the effect closes once the region invokes its Special Statute to exit; Sicilia shows no significant personnel effect throughout, reflecting the greater discretion that Special Statute autonomy afforded in deferring workforce provisions. Out-migration effects are more heterogeneous but coherent with the personnel results: significant increases are found in the regions where the full causal chain from staffing compression to reduced local access to increased patient mobility was most likely to operate, while null results are found where personnel was not significantly compressed (Piemonte, Puglia), where the infrastructure channel was structurally absent (Campania), or where the absence of meaningful staffing compression combines with island geography to make the mobility channel inoperative (Sardegna, Sicilia). The expenditure decomposition underlying these results reveals a further finding with direct policy implications: PdR regions of the first wave moved from large operating deficits to approximate balance, but fiscal convergence was achieved primarily by compressing personnel, which was already at or below the non-PdR baseline, rather than by restraining spending with contracted private providers, which exhibited a persistent structural excess throughout the programme. The hiring freeze was administratively convenient and politically low-resistance, but it operated on the wrong margin.

The thesis is structured as follows. Chapter 2 provides the institutional context: the organisation and financing of the Italian National Health Service, the background of fiscal imbalances that led to the PdR framework, the formal architecture of the plans, and the specific adjustment instruments they deployed. Chapter 3 describes the previous empirical literature on PdRs, presents the data and outcomes of interest, and explains the SCM and the inference procedure used throughout. Chapter 4 presents the results: a high-level overview of the findings across all ten regions for both outcomes, region-by-region SCM graphs with institutional interpretations, and a battery of robustness and validation checks. Chapter 5 discusses the results: the fiscal convergence achieved and its composition, the political economy of the hiring freeze as the dominant adjustment instrument, and the causal chain from staffing compression to quality deterioration to patient out-migration. Chapter 6 concludes.

Chapter 2

Institutional Context

2.1 The Italian National Health Service

The Italian National Health Service (*Servizio Sanitario Nazionale*, or SSN for short) was established by Law 833/1978, extending universal access to healthcare to all citizens regardless of employment status or ability to pay: universal coverage, social financing through general taxation, and non-discriminatory access were its founding principles. The Italian SSN was explicitly modelled after the United Kingdom's NHS, and both can be duly considered Beveridge systems (Fattore, 1999; Longo, 2016). Law 833/1978 absorbed existing mutual aid funds and organised service delivery through local health units (*Unità Sanitarie Locali*, USL), while healthcare planning and financing were retained at the national level. Crucially, USLs were administered by, and formally accountable to, local governments rather than to the regions or the central state. This arrangement was originally conceived to promote democratic participation by citizens in the SSN, but in practice it proved deeply dysfunctional: the high degree of vertical integration left USLs simultaneously responsible for provision and oversight, while supervision at higher levels was virtually non-existent. Far from fostering democratic accountability, the subordination of USLs to local political authorities led to an excessively bureaucratic and inefficient use of healthcare resources, and occasionally to corruption and the outright transformation of some USLs into instruments of political patronage, with managerial appointments and procurement decisions driven by electoral considerations rather than operational or clinical needs (Fattore, 1999; France et al., 2005). Costs escalated rapidly throughout the 1980s, and the accumulated deficits were regularly bailed out by the central government (Bordignon et al., 2020).

In 1992, facing a severe fiscal crisis and the requirements of the Maastricht Treaty, the government introduced major reforms via Legislative Decree 502/1992. With the aim of separating political, administrative, and operational functions, USLs were reorganised into local health authorities (*Aziende Sanitarie Locali*, ASL): vertically integrated public enterprises independent from local governments, whose managers would be professionals appointed by regions (Ricciardi & Tarricone, 2021). Simultaneously, major hospitals of national importance were "hived off" from the ASLs and transformed into semi-independent public hospital enterprises (*Aziende Ospedaliere*, AO), providing mainly tertiary and teaching hospital care. This reform gave rise to a tripartite hospital governance structure, ordered from least to most operational and financial autonomy: hospitals managed directly by the ASLs, the semi-independent AOs, and private for-profit providers accredited to deliver SSN-funded services under contractual arrangements. Regions were conferred increasing responsibility in the organisation of healthcare: besides the power to appoint the directors general of ASLs and AOs, they were also tasked with designing and implementing their own quasi-market model, although the central government remained heavily involved in financing the system (Longo, 2016).

The 1992 reform seemed to contain the basis for transforming the SSN into a system of *quasi-markets*, following once more the example set by the United Kingdom in 1991 (just as the founding Law 833/1978 had already drawn from the British NHS). In practice, however, the Italian reform would diverge significantly from its British inspiration. Two dynamics drove this divergence and, crucially, reinforced each other: first, three institutional factors (discussed below) prevented quasi-markets from ever fully materialising; and second, the extensive discretion granted to regions in configuring their own health services pushed Italy progressively away from a unified national model and towards twenty largely autonomous regional health services (de Belvis et al., 2022; Longo, 2016; Ricciardi & Tarricone, 2021). To understand what this entailed, it is necessary first to explain the payment instrument that was to underpin such a system. A Diagnosis-Related Group (DRG) is a classification scheme that groups hospital discharges into clinically homogeneous categories on the basis of diagnosis, procedures performed, patient age, and other clinical characteristics, each associated with a standardised measure of average expected resource use. Under a Prospective Payment System (PPS), the reimbursement received by a hospital for a given episode of care is determined in advance by the DRG tariff, rather than by the costs actually incurred, thereby creating direct financial incentives for providers to contain costs and improve throughput efficiency.

In the quasi-market vision embedded in the 1992 reform, a clear institutional separation between purchasers and providers would allow the latter to compete for service contracts: ASLs, funded by the region on a capitation basis and responsible for the healthcare needs of their enrolled population, would contract either with their own directly managed facilities, with the newly created semi-independent AOs, or with accredited private providers, all of which would be remunerated through DRG tariffs (de Belvis et al., 2022; Longo, 2016; Ricciardi & Tarricone, 2021). In this way, provider competition for ASL contracts, mediated by prospective DRG-based prices, was intended to replicate market-like efficiency incentives within a publicly financed framework. However, France et al. (2005) identify three institutional factors that prevented quasi-markets from actually materialising in the SSN.

(i) The decision on the extent of hiving-off was left to the regions, and by 2003 only one-third of the national public bed stock belonged to hived-off hospitals. Only Lombardia completed the process virtually in full, with nearly all public specialist in-patient, ambulatory, and psychiatric care provided by AOs rather than ASL-managed facilities (Brenna, 2011; de Belvis et al., 2022). This incomplete hiving-off is even more relevant when considering that regions have not generally applied PPS to hospitals managed directly by ASLs.

(ii) The effective role of the ASL as a purchaser varied considerably across regions, depending on how each region chose to configure the funding relationship between itself, the ASLs, and the AOs. The resulting variation can be described as a spectrum spanning two poles (de Belvis et al., 2022; France et al., 2005). In the region-centred model, regional governments keep the purchasing role in their own hands and largely bypass the ASLs. Liguria funded AOs directly and transferred only part of the regional health fund to the ASLs. Lombardia, despite almost complete hiving-off, also kept close control over AO funding; from 2003, it negotiated bilateral agreements with each AO, while ASLs mainly monitored compliance rather than signing contracts. Following the opposite model (ASL-centred approach), regions such as Emilia-Romagna, Umbria, and Puglia transferred almost all funding to the ASLs. The ASLs then negotiated multi-year service agreements with the AOs, using model contracts designed by the region. In these cases, ASLs acted more clearly as purchasers. Even so, AOs did not really compete for ASL contracts: they co-operated in planning services under ASL leadership. Between these two models, regions such as Veneto and Sicilia formally placed most funds with the ASLs but reserved specific allocations for the AOs. As a result, ASLs had only limited real autonomy.

(iii) All regions (except Lombardia) deployed the institutional accreditation mechanism to restrict the access of new providers to regional health markets on the basis of planned need, erecting administrative barriers to entry that further constrained competitive dynamics.

It is worth noting that the DRG-based PPS introduced by the 1992 reform determined the payment to providers (whether ASL-controlled, AOs, or private) prospectively rather than on the basis of costs actually incurred, thereby creating direct incentives for cost control and efficiency. National tariffs, calculated using cost data from a limited number of public hospitals, served as ceilings, and regions enjoyed some degree of freedom in setting their own tariff rates. This flexibility was exploited as a deliberate policy instrument: tariffs for DRG-classified in-patient admissions deemed treatable in out-patient settings were reduced to discourage provision in unnecessarily acute regimes, while activities with costs largely independent of volume (such as emergency services, intensive care, and organ transplants) were typically excluded from the PPS and financed through block grants (France et al., 2005). To counteract the high-powered incentive inherent in the PPS to inflate the volume of admissions, many regions also installed automatic mechanisms to reduce tariffs whenever hospital-sector expenditure exceeded pre-established thresholds (Fattore, 1999). National DRG tariffs also serve as the reference prices for funding interregional patient flows, a mechanism with important fiscal implications discussed below.

Beyond their role in provider payment, DRGs subsequently acquired a second institutional function: the definition of the catalogue of publicly guaranteed services. Until 2001, there was no formal specification of the benefit package to which SSN patients were entitled; in practice, patients received what was medically feasible and what doctors prescribed (Fattore, 1999). The 2001 Constitutional reform and the related decree (Prime Ministerial Decree of 29 November 2001) formally introduced the *Livelli Essenziali di Assistenza* (LEA) as a binding floor of essential services guaranteed uniformly across all regions, covering collective care in living and work environments, district-level care, and hospital care. The LEA were defined through a positive list and a negative list (de Belvis et al., 2022; France et al., 2005). The positive list enumerates the services that the SSN is obliged to provide uniformly in all regions, ranging from specific procedures to broad service categories; regions may provide additional non-LEA services but must finance these exclusively with own-source revenues. The negative list identifies three categories of excluded or restricted services. First, a small number of services are excluded outright on grounds of clinically proven ineffectiveness or because they are deemed to fall outside the SSN's remit; these include cosmetic surgery (except in cases of malformation or injury), ritual circumcision, non-conventional medicine, and certain types of physiotherapy. Second, certain ambulatory services (such as bone density testing, excimer laser surgery, and orthodontic care) are included in the entitlement only on a case-by-case basis, conditional on clinical appropriateness for the individual patient's condition. Third, the negative list includes an indicative catalogue of DRG-classified hospital admissions deemed potentially inappropriate in an in-patient regime, for which regions are expected to provide substitute treatment in day-case or ambulatory settings.

The progressive shift of healthcare governance towards regions was accompanied by a sequence of fiscal reforms that sought, with mixed success, to align spending responsibilities with financial accountability. D. Lgs. 446/1997 first introduced a regional tax on productive activities (IRAP) and a regional surcharge on personal income tax (*addizionale regionale IRPEF*), providing regions with a degree of own-source revenue and, in principle, curbing their bailout expectations vis-à-vis the centre (Bordignon et al., 2020). Building on this foundation, D. Lgs. 56/2000 formally abolished the national health fund (*Fondo Sanitario Nazionale*, FSN) and introduced fiscal federalism proper: regional health systems were henceforth to be financed primarily through IRAP and the *addizionale regionale IRPEF*, supplemented by a National Solidarity Fund (*Fondo di Solidarietà Nazionale*) financed by a share of centrally collected value-added tax (VAT). The goal was to reduce per capita revenue differences across regions and ensure that even less affluent ones could provide essential services (Longo, 2016; Tediosi et al., 2009). The 2001 Constitutional reform (L. Cost. 3/2001) then formally assigned regions primary responsibility for healthcare delivery, while the central government retained responsibility for defining the LEAs and for overall system funding (Bordignon et al., 2020; Ciaccio, 2023; Depalo, 2019). The cumulative effect of these reforms was the emergence of twenty distinct regional health services rather than a single unified national system, each with its own organisational configuration, funding mix, and service profile (de Belvis et al., 2022; Ricciardi & Tarricone, 2021).

However, this sequence of reforms produced what can best be described as *incomplete* fiscal federalism: regions acquired substantial autonomy over *expenditure* without a corresponding autonomy over *revenues*. As Di Novi et al. (2019) note, the fiscal reforms ultimately changed the *composition* of regional health budgets rather than their overall size: grants from the centre were calibrated to match the reduction in autonomous revenues, leaving total health resources broadly unchanged. Because IRAP and the *addizionale regionale IRPEF* are strictly tied to the regional income base, the degree of fiscal autonomy achieved varied enormously across regions. In 2007, in Lombardia (the wealthiest region) the two taxes covered approximately

60% of healthcare spending; in Calabria (the poorest) they funded barely 10%. Across the South more broadly, own revenues accounted for roughly 15% of health expenditure, compared with nearly 50% in Centre-Northern regions (Di Novi et al., 2019). Southern regions thus continued to rely predominantly on central transfers to finance their health systems, leaving the potential accountability and efficiency gains of fiscal decentralisation largely unrealised in precisely those regions where spending discipline was most needed.

The allocation of central transfers through the Solidarity Fund proved a persistent source of intergovernmental conflict. The central government and the regions repeatedly failed to agree on funding arrangements, and fiscal federalism was never fully enforced (Longo, 2016; Tediosi et al., 2009). At the heart of this conflict was the transition from an allocation based on historical expenditure to one based on assessed need, incorporating criteria such as population size, age-specific utilisation rates, standardised mortality rates, and adjustments for interregional patient flows (France et al., 2005). Northern regions with older populations pressed for age-weighted criteria, while southern regions (structurally disadvantaged by the absence of a deprivation index in the formulae) argued that need-based criteria unfairly benefited already better-resourced areas; as a result, the shift towards a needs-based allocation was slow and incomplete. Compounding these structural tensions, the gap between actual regional health expenditure and available resources was systematically covered by the central government through periodic bail-outs (Bordignon et al., 2020; France et al., 2005; Tediosi et al., 2009). Since supplementary transfers were calculated as a fixed proportion of the absolute value of each region's deficit, larger deficits attracted proportionally larger transfers, rewarding fiscal laxity and creating a classic moral hazard problem in which regional governments could overspend without bearing the full fiscal consequences of doing so (France et al., 2005). The persistent expectation of central bail-outs thus fundamentally undermined the financial accountability that fiscal decentralisation had been intended to foster, and is central to understanding the emergence of the PdR framework (Bordignon et al., 2020).

The interregional patient mobility mechanism further compounded these fiscal dynamics, particularly for southern regions. Patients receiving hospital care outside their region of residence generate a financial transfer from the region of residence to the region of treatment, calculated at the national DRG tariff. Because this mechanism is financed retrospectively, regions attracting mobile patients receive additional resources through the central redistribution, while the regions generating patient outflows must bear the corresponding expenditure without immediate compensation (de Belvis et al., 2022). Given the structural disparities in health infrastructure, with southern regions reporting fewer hospital beds, greater reliance on private facilities, and a poorer endowment of advanced medical equipment, the South historically generated substantial outflows towards central and northern regions (Balia et al., 2018; Brenna & Spandonaro, 2015; Fattore et al., 2014). Because southern regions simultaneously faced high patient outflows (which reduced available resources for local services) and constrained own-source revenues, the mobility mechanism acted as a structural amplifier of fiscal imbalances, contributing to the accumulation of deficits that the PdR framework would eventually seek to address.

2.2 The Introduction of Recovery Plans

The national budget law for 2005 (Law 311/2004) constituted the first systematic attempt to impose binding financial discipline on regions running healthcare deficits. While bailing out the accumulated deficits of 2000–2003 for approximately €1.4 billion, it simultaneously introduced a conditional access mechanism. Indeed, central transfers for regional healthcare, covering the years 2005–2007, were split between a basic and a supplementary component; the latter, called *quota premiale*, would only be disbursed to regions that met a set of spending and performance requirements specified in a formal agreement between the state and each region (art. 1, comma 173). Non-compliant regions were excluded from this share and required to recover any sums already received (art. 1, comma 176). For regions in deficit, the law further mandated the elaboration of a multi-year operational programme for reorganising the regional health service, to be agreed with the Ministry of Health and the Ministry of Economy and Finance, as a precondition for the progressive restitution of withheld funding (art. 1, comma 180). In practice, however, this mechanism was never operationalised in any meaningful way (Bordignon et al., 2020). It nonetheless established the institutional logic that would underpin the PdR framework: access to central resources contingent on demonstrated financial correction.

Recovery Plans (*Piani di Rientro*, PdR) were formally introduced by the budget law for 2007 (Law 296/2006) and made compulsory for regions running deficits exceeding 5% of their total health funding, a threshold later codified more precisely by Law 191/2009 (art. 2, comma 77), which defined structural deficit as a shortfall exceeding 5% of ordinary funding and own health revenues, or any lower threshold if the region could not fully cover the residual gap through fiscal automatisms or other budgetary resources.

Under the PdR mechanism, a regional government was obliged to propose a three-year plan to be approved by the Ministry of Health and the Ministry of Economy and Finance. The plan had two simultaneous and formally co-equal objectives: restoring sound financial conditions, and maintaining or even improving the provision of healthcare services (Arcà et al., 2020; Bordignon et al., 2020; Ciaccio, 2023; Depalo, 2019). Regions under PdR were subject to quarterly monitoring by two dedicated bodies established under the State-Regions Agreement of 23 March 2005: the *Tavolo per la verifica degli adempimenti regionali*, responsible for periodic reviews of regional health budgets and PdR implementation, and the *Comitato LEA*, responsible for verifying that essential services continued to be delivered with appropriate efficiency and quality. If a region failed to meet its objectives, the plan was automatically renewed for a further three years.

In the most severe cases of financial imbalance, the central government could appoint a commissioner to oversee plan implementation directly, giving rise to a harder variant of the plan (hereafter RPC, for *Piano di Rientro con Commissario*). In practice, the role of commissioner was typically assumed by the elected regional president rather than by a truly external figure, a constitutionally awkward arrangement that remained politically contentious throughout the period. Art. 25-septies of Decree-Law 119/2018 attempted to resolve the ambiguity by formally introducing an incompatibility between the roles of regional president and commissioner; however, the Constitutional Court subsequently declared the provision unconstitutional (Constitutional Court Judgment no. 247/2019), thereby confirming the compatibility of the two roles and leaving the question effectively open. To compensate for the limitations inherent in self-commissioning, one or two sub-commissioners were generally appointed alongside the main commissioner; unlike the latter, sub-commissioners were typically professionals with proven technical competence in health service management, not former politicians (Bordignon et al., 2020).

Table 2.1 summarises the history of PdR adoption. Following the legislative introduction of PdRs, Abruzzo, Campania, Lazio, Liguria, Molise, Sardegna, and Sicilia signed their plans in 2007. Calabria joined only in 2009, after a prolonged auditing process. In 2010, Piemonte and Puglia voluntarily entered the PdR framework in order to recover supplementary funding for 2005–2007 (quota premiale) that had not been disbursed to them. Commissioner-led plans (RPCs) were introduced progressively: Lazio became the first region to enter RPC in 2008, followed by Campania in 2009, Molise and Abruzzo in 2010, and Calabria in 2011. The year 2010 also marked the exit of Liguria and Sardegna from the PdR process, the former after restoring financial balance and the latter by invoking its special statute. Abruzzo exited RPC in 2016, Piemonte exited its PdR entirely in 2017, and Lazio and Campania exited

RPC in 2020 (Ministero della Salute, 2025).

Table 2.1: Timeline of *Piani di Rientro* (✓) and commissioner-led plans (C)

Region	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Abruzzo	✓	C	C	C	C	C	C	C	C	C	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Calabria	—	—	✓	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Campania	✓	✓	C	C	C	C	C	C	C	C	C	C	C	C	✓	✓	✓	✓	✓	✓
Lazio	✓	C	C	C	C	C	C	C	C	C	C	C	C	C	✓	✓	✓	✓	✓	✓
Liguria	✓	✓	✓	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Molise	✓	✓	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Piemonte	—	—	—	✓	✓	✓	✓	✓	✓	✓	✓	—	—	—	—	—	—	—	—	—
Puglia	—	—	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sardegna	✓	✓	✓	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sicilia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: Ministero della Salute (2025).

2.3 Nation-wide Benchmarks for Personnel and Structural Endowments

The legal framework of PdR operated through two main categories of instruments: revenue-side measures (automatic increases in regional tax rates) and cost-containment measures targeting personnel and structural endowments. The latter were anchored to national benchmarks that applied, with varying degrees of strictness, to all regions.

- **Personnel spending**. The 2007 budget law (art. 1, comma 565, Law 296/2006) capped personnel spending for all regions over 2007–2009 at 2004 levels minus 1.4%, a constraint renewed by successive budget laws for the periods 2010–12 (Law 191/2009) and 2013–15 (Decree-Law 95/2012, converted by Law 135/2012). For PdR regions specifically, Law 191/2009 (art. 2, comma 71) introduced an automatic hiring freeze (*blocco del turnover*) applicable whenever monitoring bodies detected a financial imbalance that the region had failed to adequately correct. The freeze remained in effect until at least 31 December of the second year following its introduction, and contracts concluded in violation of this provision were declared null and void. From 2011, a derogation of up to 10% of the frozen positions was introduced (Law 220/2010), conditional on the technical monitoring body certifying at least partial achievement of plan objectives and the derogation being deemed necessary to guarantee LEA provision. This ceiling was subsequently raised to 15% from 2012 (art. 4-bis, Decree-Law 158/2012, converted by Law 189/2012). The effects were substantial and differentiated across the two programming cycles. During the first cycle (2007–09), PdR regions experienced average annual workforce reductions of approximately 1.2%, driven entirely by a fall in permanent-contract workers. During the second cycle (2010–12), enforcement tightened, partly through judicial extension of spending constraints to flexible contracts, and total workforce reduction accelerated to an average of 1.7% per year, affecting permanent workers and flexible-contract staff alike. By contrast, non-PdR regions experienced only marginal overall contraction over the same period (Aimone Gigio et al., 2018).

- **Structural endowments**. A parallel set of national targets governed hospital capacity and hospitalisation rates. The State-Regions Agreement of 23 March 2005 (art. 4, comma 1, lett. a and b) established a standard of no more than 4.5 accredited hospital beds per 1,000 inhabitants, including rehabilitation and long-term care, and a hospitalisation rate not exceeding 180 per 1,000 residents, of which the day-hospital component should represent at least 20%. These targets were to be achieved by 2007, with intermediate milestones in 2005 and 2006. The subsequent national spending review (Decree-Law 95/2012, art. 15, comma 12, lett. c), implemented by Ministerial Decree 70/2015, tightened these standards further: a maximum of 3.7 beds per 1,000 inhabitants (3.0 for acute care and 0.7 for rehabilitation and long-term care), a maximum hospitalisation rate of 160 per 1,000, an average length of stay below 7 days, and a bed occupancy rate of at least 80%, ideally 90%. The reduction in hospital beds proceeded faster in PdR regions than elsewhere: PdR regions reduced hospital beds by 0.36 units per 1,000 residents during the first cycle (2007–09) and then by 0.59 per 1,000 afterwards (2010–14), compared to respectively -0.07 (2007–09) and -0.43 (2010–14) in non-PdR regions (Aimone Gigio et al., 2018).

2.4 The Five Pillars of Regional Recovery Plans

While PdR regions operated under common national benchmarks, the specific configuration of each plan was negotiated between the central government and the individual region. Aimone Gigio et al. (2018) identify five recurring intervention pillars, calibrated with varying intensity and timing across regions.

1. **Hospital network reorganisation (*riorganizzazione della rete ospedaliera*).** The primary objective was to bring hospitalisation rates and bed-to-population ratios

into conformity with national standards, which most PdR regions exceeded at the time of plan adoption. Concrete measures included the closure of small public hospitals, particularly those with fewer than 60–80 beds or very low occupancy rates, the merger of wards, the downgrading of facilities to lower-tier structures, and the conversion of deactivated hospitals into community health hubs (*Centri di Assistenza Primaria Territoriale*) without surgery or emergency departments. Ministerial Decree 70/2015 provided a structured three-tier framework (*ospedali di base*, first-level, and second-level) with progressively increasing clinical complexity and catchment area requirements.

2. **Staffing freeze (*blocco del turnover*).** As described above, automatic hiring bans were applied under Law 191/2009 to PdR regions failing to meet their objectives.

3. **Pharmaceutical expenditure containment (*contenimento della spesa farmaceutica*).** Plans typically combined several instruments: the introduction or increase of patient co-payments (*ticket*) on drugs to limit over-consumption; mandated generic substitution at the pharmacy, with patients bearing out-of-pocket the price difference for branded drugs; and the dispensing of drugs through public health facilities (*distribuzione diretta*) or, under specific regional agreements, through accredited community pharmacies acting on behalf of the ASL (*distribuzione per conto*, DPC). The financial advantage of this mechanism lies in the fact that hospital procurement prices can be substantially lower than retail prices. Plans also included monitoring of prescribing appropriateness by general practitioners, with targets for reducing unnecessary or high-cost prescriptions.

4. **Centralised procurement (*centralizzazione degli acquisti*).** Rather than each ASL procuring independently, regions established or strengthened regional *Centrali Uniche di Acquisto* (CUA), which concentrated the purchasing of pharmaceuticals, diagnostic devices, medical equipment, and support services to leverage economies of scale and competitive tendering.

5. **Regulation of private accredited providers (*tetti di spesa per enti accreditati*).** Private hospitals providing SSN-funded services operate under annual spending caps (*tetti di spesa*). Regions under PdR tightened these caps, renegotiated contracts, and accelerated the *accreditamento istituzionale* process, the formal quality certification required for continued SSN contracts. In regions under RPC, a significant effect on the renegotiation of contracts with private providers was documented (Bordignon et al., 2020).

A final observation concerns the sequencing of objectives within the PdR framework. Although plans formally pursued financial consolidation and LEA maintenance simultaneously from the outset, it was only from the second programming cycle (2010–12) that service quality and access received systematic monitoring alongside financial targets (Aimone Gigio et al., 2018). This temporal lag has direct implications for the interpretation of the empirical results in Section 4.

2.5 Region-Specific Recovery Plans

The national framework described above established the objectives and the binding constraints, but left regions considerable discretion in choosing which combination of the available levers to deploy, and in what sequence. As noted above, the devolution process that began in the 1990s produced effectively twenty separate health systems (de Belvis et al., 2022; Longo, 2016; Ricciardi & Tarricone, 2021). PdRs did not eliminate this heterogeneity: rather, they imposed a common financial discipline while allowing regional governments, and in some cases commissioners, to calibrate the mix of interventions according to local conditions, institutional capacity, and the specific sources of their deficits.

Table 2.2 below synthesises the main region-specific measures adopted under each PdR, drawing on the documentation of the Ministry of Health and the Ministry of Economy and Finance, as reported by Aimone Gigio et al. (2018). The variation across regions in the relative emphasis placed on hospital restructuring, territorial care development, personnel management, pharmaceutical governance, and private provider regulation will serve as the institutional backdrop against which the empirical results in Section 4 are interpreted.

Table 2.2: Region-specific measures adopted under each PdR

Region	Target timeline	Hospital network rationalisation	Territorial care development	Pharmaceuticals	Procurement	Personnel	Private providers
Abruzzo • **PdR status:** 2007–ongoing • **Commissioner status:** 2008–2016 • **Comment:** Commissioner appointed in 2008 due to implementation delays. Implementation delays in 2007–2009 led to persistently high deficit. Some progress from 2010, but not complete implementation due to TAR annulling some hospital reconversion decisions. Once financial balance had been reached, the focus switched in 2013–2015 to improving quality and territorial care.	• Hosp. 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 • Small hospital reconversion *[delayed to PO 2010–12]* • Redistribution of personnel across units *[PO 2010–12]* • Reorganisation of emergency services *[PO 2010–12]*	• Outpatient specialist network strengthening *[PO 2013–15]* • Home care expansion *[PO 2013–15]* • Prevention measures *[PO 2013–15]* • GP/primary care integration *[2016–18]*	• Citizen co-payment introduction ("ticket")	• Goods and services cost reduction *[PO 2013–15]*	• Hiring freeze • Fixed-term contract reduction	• Cap on spending at accredited private providers *[PO 2010–12]*
Calabria • **PdR status:** 2009–ongoing • **Commissioner status:** 2010–ongoing • **Comment:** Only region requiring pre-PdR accounting audit (2-year delay). Commissioner appointed in 2010. Persistently high deficit and low quality of services due to inadequate implementation throughout. Cuts in hospitalisations and beds, although financially insufficient, were not balanced by improvements in territorial care or other regimes.	• Hosp. 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 of hospitalisations, partly through a shift to in-patient regime • Reorganisation of the hospital network *[largely delayed]*	• Home care expansion (for elderly) *[largely delayed]* • Prevention measures expansion *[largely delayed, monitoring revealed low oncology screening rate]* • Territorial care network restructuring and strengthening *[largely delayed]*	• Prescriptive appropriateness promotion • Direct distribution expansion • Promotion of generic-drug prescriptions	• Centralised purchasing • Expenditure forecasting & control system implementation	• Hiring freeze *[inadequate implementation due to breaches]*	• Cap on spending at accredited private providers
Campania • **PdR status:** 2007–ongoing • **Commissioner status:** 2009–2020 • **Comment:** Private provider litigation plus implementation delays led to the appointment of a commissioner in 2009. As the number of beds and the quality of services were already below the benchmarks, interventions focused on reducing inappropriate hospitalisations (in-patient regime promotion) and increasing administrative efficiency. Once financial balance had been reached, the focus switched in 2013–2015 to improving quality.	• Hosp. 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 to in-patient regime • Reorganisation of the hospital network *[largely delayed]* • Reorganisation of emergency services *[PO 2016–18]*	• Territorial care network restructuring and strengthening *[largely delayed]* • Creation of a network for lab diagnostics *[PO 2011–12]* • Bed increase (acute) *[PO 2016–18]*	• Prescriptive appropriateness promotion • Direct distribution expansion • Promotion of generic-drug prescriptions • Citizen co-payment revision (increases and elimination of many exemptions) *[PO 2010–12]*	• Centralised purchasing	• Hiring freeze • Fixed-term contract reduction • Staffing level revision • Personnel redistribution to facility complexity needs *[PO 2010]*	• Accreditation of private providers *[delayed at least after 2010 due to litigation with private providers]* • Cap on spending at accredited private providers *[repeatedly breached, redefined with PO 2013–15]*
Lazio • **PdR status:** 2007–ongoing • **Commissioner status:** 2008–2020 • **Comment:** Private provider litigation plus implementation delays led to the appointment of a commissioner in 2008. For 2007–2009 and 2010–2012, main savings principally came from cost cuts in personnel and pharmaceuticals. Hospital network reorganisation largely delayed until PO 2013–15. Lack of territorial care development noticed in 2016 monitoring.	• Hosp. 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 2010–2012, largely delayed]* • Small hospital reconversion *[PO 2010–2012, largely delayed]*	• Specialist care network reorganisation *[PO 2010–2012, largely delayed]* • Territorial care network restructuring and strengthening *[PO 2016–18]*	• Generic prescription promotion *[PO 2010–12]* • Direct distribution expansion *[PO 2010–12]* • Citizen co-payment increase *[PO 2010–12]*	No specific measures documented.	• Hiring freeze	• Definitive accreditation of private providers *[PO 2010–12]* • Spending ceiling for private providers *[PO 2013–15]* • Inter-regional agreements to reduce active in-mobility *[PO 2013–15]*
Liguria • **PdR status:** 2007–2010 • **Commissioner status:** No commissioner • **Comment:** Characterised by an old population, which puts pressure on its regional health system. Only 1st-wave region to exit without commissioner. Interventions focused on reducing inappropriate hospitalisations and ER usage rather than cutting beds, as they were already in line with the national benchmark. Post-exit voluntary structural measures enacted to ensure long-term financial sustainability.	• Hosp. 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)	• Hospital enterprise reduction • Inappropriate hospitalisation reduction • Inappropriate emergency attendance reduction • *Post-exit (voluntary, 2010):* bed supply remodulation; maternity unit rationalisation; surgical & admin service rationalisation; facility mergers	• Outpatient specialist network strengthening • Home care expansion (for elderly)	• Direct distribution expansion • Promotion of generic-drug prescriptions • Citizen co-payment increase	• Centralised purchasing • Online/electronic purchasing • Centrally managed procurement tenders	• Hiring freeze • Staffing level revision	No specific measures documented.

continued on next page

Region	Target timeline	Hospital network rationalisation	Territorial care development	Pharmaceuticals	Procurement	Personnel	Private providers
Molise • **PdR status:** 2007–ongoing • **Commissioner status:** 2009–ongoing • **Comment:** Commissioner appointed in 2009 due to implementation delays. Financial improvement came almost entirely from regional tax hikes, not cost cuts. Monitoring repeatedly certified inadequate implementation. Cuts in hospitalisations and beds, although insufficient, were not balanced by improvements in territorial care or other regimes.	• Hosp. 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]* • Small hospital reconversion *[largely delayed]*	• Territorial care network restructuring and strengthening *[largely delayed]*	• Prescriptive appropriateness promotion • Promotion of generic-drug prescriptions • Drug traceability	• Centralised purchasing *[largely delayed]*	• Hiring freeze *[largely not implemented]* • Fixed-term contract reduction *[largely not implemented]*	• Redefinition of accredited providers *[largely not implemented]*
Piemonte • **PdR status:** 2010–2017 • **Commissioner status:** No commissioner • **Comment:** Not legally mandated, adopted to recover lost *quota premiale* for 2004. No commissioner. Highest compliance with LEA among all PdR regions. Monitoring noticed implementation delays in 2010–13, but then confirmed achievements of objectives in 2013–15. Exited via a €1.5bn debt repayment deal (10-year horizon). Remaining issue: insufficient SSR liquidity at exit.	• Hosp. 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)	• Bed reduction *[required from 2012]*	• Laboratory and diagnostic network restructuring • Territorial care network restructuring and strengthening *[PO 2013–15]*	• Regional formulary revision • Prescriptive appropriateness monitoring	• Centralised purchasing	• Partial hiring freeze • Atypical contract reduction • Additional remuneration suspension	• Revision of the cap on spending at accredited private providers
Puglia • **PdR status:** 2010–ongoing • **Commissioner status:** No commissioner • **Comment:** Not legally mandated, adopted to recover lost *quota premiale* for 2006–09. No commissioner. Savings in terms of pharmaceutics and personnel improved the deficit in 2010–12; LEAs improved in 2013–15, as Puglia became the only major southern region to achieve full compliance; finally, PO 2016–18 focused on addressing the remaining delays in terms of reorganisation of the hospital network and territorial care.	• Hosp. 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]* • Small hospital reconversion *[largely delayed]*	• Territorial care quality improvement *[PO 2013–15, but delayed to PO 2016–18]* • Home care expansion *[PO 2013–15, but delayed to PO 2016–18]*	• Citizen co-payment increase • Prescriptive appropriateness monitoring *[largely delayed]*	• Centralised purchasing *[largely delayed]*	• Hiring freeze	• Revision of the cap on spending at accredited private providers
Sardegna • **PdR status:** 2007–2010 (Special Statute) • **Commissioner status:** No commissioner • **Comment:** 2009 monitoring noticed inadequate implementation, confirmed by the Court of Auditors; the region however still exited the PdR process via its Special Statute. Very short PdR exposure. Post-exit: growing deficits led to new voluntary restructuring plan in 2015.	• Hosp. 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]* • Inappropriate hospitalisation reduction • Inappropriate emergency attendance reduction • Corporatisation of university hospitals	• Laboratory diagnostic network rationalisation	• Pharmaceutical expenditure rationalisation [specific sub-measures not documented]	• Goods and services procurement rationalisation [specific sub-measures not documented]	• Personnel expenditure rationalisation [specific measures not documented]	No specific measures documented.
Sicilia • **PdR status:** 2007–ongoing • **Commissioner status:** No commissioner • **Comment:** Only region with Special Statute under standard PdR. No commissioner. Deficit stayed high in 2007–2009 due to implementation delays, then decreased in 2010–12, and finally zeroed in 2013–15. In 2016–2018, the focus switched to improving quality, which had remained low.	• Hosp. 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)	• Inappropriate hospitalisation reduction • Inappropriate emergency attendance reduction • Hospital enterprise reduction *[delayed to 2009]* • Reorganisation of the hospital network *[PO 2010–12]*	• Territorial care network restructuring and strengthening *[largely delayed]* • Home care expansion *[PO 2010–12]* • Maternity unit rationalisation *[PO 2010–12]*	• Direct distribution expansion • Promotion of generic-drug prescriptions • Citizen co-payment increase	• Centralised purchasing *[delayed to PO 2010–12]*	• Hiring freeze • Managerial position reduction	• Cap on spending at accredited private providers *[largely delayed]*

Source: Aimone Gigio et al. (2018), Sezione II, §§ a–j, pp. 45–72.
National benchmarks (binding all regions):
• **Hospitalisations: Intesa Stato-Regioni 23 Mar 2005 set $\leq$180/1,000 inh.; DL 95/2012 + DM 70/2015 tightened to $\leq$160/1,000.**
• **Beds: Intesa 2005 set $\leq$4.5/1,000; DM 70/2015 tightened to $\leq$3.7/1,000 (of which $\leq$3.0 acute).**
• **Personnel: L. 296/2006 capped at 2004 level $-$1.4%; L. 191/2009 introduced the automatic hiring freeze for PdR regions only.**

Chapter 3

Empirical Strategy

3.1 Review of Previous Evaluations of Recovery Plans

The causal evaluation of Recovery Plans poses a fundamental identification challenge. Regions were not assigned to the programme at random: they were selected because of large and persistent healthcare deficits, making them systematically different from non-treated regions in precisely the dimensions that determine health outcomes. Any naïve post-2007 comparison between treated and untreated regions therefore risks conflating the causal effect of the plans with pre-existing structural differences. The papers reviewed below each address this identification problem using a different strategy, and together offer complementary evidence on how PdRs affected healthcare expenditure, supply of inputs (primarily beds and personnel), quality of care, and health outcomes.

Depalo (2019) approaches the problem through set identification, or bounding, rather than point identification. The intuition underlying the approach is straightforward. Any causal estimate requires a counterfactual, that is, an estimate of what the outcome would have been in the treated region had the plan not been introduced. Standard methods construct this counterfactual by imposing a precise assumption: Difference-in-Differences (DiD) assumes that treated and untreated regions would have followed parallel trends; the Synthetic Control Method (SCM) assumes that a weighted average of untreated regions exactly replicates the treated region's pre-treatment trajectory. Depalo (2019) shows directly, for mortality rates, that both assumptions are rejected by the pre-treatment data. Rather than replacing one rejected assumption with another weak one, the paper introduces a scalar parameter that controls how far the true counterfactual is allowed to deviate from each benchmark. When this parameter equals zero, the approach collapses to the standard point estimate; as it increases, the bounds on the causal effect widen but often retain a consistent sign, allowing informative directional conclusions without precise parametric commitments. The two benchmarks used jointly are a time-invariance estimator and a synthetic control (Abadie & Gardeazabal, 2003; Abadie et al., 2010), and the tightest bounds attainable under each uncertainty level are derived following Manski and Pepper (2018). The analysis covers the seven first-wave treated regions. On the outcomes most relevant to this thesis, hospitalisation rates fall robustly across virtually all treated regions over a wide range of uncertainty values, consistent with the intended supply compression of the plans. The mortality rate is inconclusive: the bounds cover zero for most regions once any modest uncertainty is admitted, with the partial exception of two regions where both bounds point upward. No efficiency gains are found in any treated region by the end of the first round.

Bordignon et al. (2020) estimate the effect of PdRs using a Two-Way Fixed-Effects (TWFE) DiD model on a panel of fifteen ordinary-statute regions observed from 2000 to 2014. The design exploits variation in treatment status across regions over time, with region fixed effects absorbing time-invariant regional characteristics and year fixed effects removing common shocks such as the 2008 financial crisis. The key identifying assumption is parallel trends: absent the PdR, treated and untreated regions are assumed to have followed the same average trajectory. For outcomes where pre-treatment event-study tests reveal divergences, most notably for per-capita expenditure, the authors augment the DiD with an instrumental variable (IV) strategy. Their instrument is the interaction of a pre-treatment proxy for regional governance quality with a post-2007 indicator. The exclusion restriction requires that this governance measure affects health outcomes only through its influence on the probability of PdR assignment, which is argued to hold on the grounds that civic perceptions in 2005 predate the intervention and have no direct biological pathway to health. PdRs are found to have significantly reduced per-capita expenditure, hospital beds, and the personnel rate. A slight increase in cross-regional patient migration is detected in the OLS specification, but the IV estimate is statistically insignificant. No significant effects are found on overall or infant mortality, leading the authors to conclude that fiscal consolidation was achieved without measurable harm to health.

Arcà et al. (2020) combine a TWFE model with an IV strategy, but pursue a different estimand. Rather than estimating the reduced-form effect of PdR assignment, they recover the structural effect of health expenditure on outcomes, using the PdR indicator as an instrument for per-capita spending. In the first stage, PdR exposure predicts a significant reduction in per-capita expenditure; in the second stage, the predicted expenditure from the first stage is used to estimate how spending cuts affect health and utilisation outcomes. The exclusion restriction requires that PdRs affect outcomes only through the spending channel, a condition supported by first-stage F-statistics well above conventional thresholds. The analysis covers all twenty Italian regions from 2004 to 2014. On the outcomes most relevant to this thesis, spending cuts led to a significant reduction in both hospital beds and healthcare employment, a fall in total hospitalisations, and a significant increase in cross-regional patient migration. The central finding concerns amenable mortality, defined as deaths preventable with timely and effective care (Nolte & McKee, 2004): expenditure cuts caused a significant increase in such deaths for both males and females. The paper therefore traces a clear causal chain from the plans through input compression to deteriorating access and higher avoidable mortality, and frames the rise in out-migration as both a symptom of reduced capacity and a source of inequality, since the ability to seek care in other regions is unevenly distributed across socioeconomic groups.

A set of more recent papers extends this evidence. Ciaccio (2023) addresses the staggered rollout of PdRs directly. Since three treatment cohorts can be identified, a standard TWFE estimator produces biased estimates when treatment effects are heterogeneous across cohorts, because already-treated units serve as implicit controls for later-treated ones (Borusyak et al., 2021; de Chaisemartin & d'Haultfoeuille, 2022; Goodman-Bacon, 2021). The paper uses the Two-Way Mundlak estimator (Wooldridge, 2021) to recover cohort-specific average treatment effects on the treated (ATTs), and finds that PdRs reduced expenditure but failed to generate efficiency gains, while producing a persistent deterioration in service quality including a significant increase in patient out-migration from the fourth post-treatment period onwards. Guccio et al. (2024) combine a matching estimator with a DiD design at the municipal level and find negative effects on mortality, concentrated in peripheral areas and among vulnerable populations. Cirulli and Marini (2023) apply a TWFE-IV model and document increases in general, amenable, and preventable mortality, as well as indicators of psychological distress. Beraldo et al. (2023) are of particular interest because they focus specifically on patient out-migration (measured as the share of residents who sought ordinary acute hospital care in a different region) as the primary outcome, similarly to this thesis. They find that out-migration increases significantly under commissioner-led plans, and the proposed causal chain is that PdRs reduce hospital beds and total healthcare employees, contracting local care capacity and pushing residents to seek treatment elsewhere. Their main identification strategy is a TWFE-DiD design, supported by pre-treatment event-study tests.

As a robustness check for the staggered rollout of PdRs, the authors apply the Callaway and Sant'Anna (2021) estimator, which avoids the contamination bias that affects standard TWFE when already-treated units serve as controls for later-treated ones, and obtain results consistent with the main specification. However, three limitations of Beraldo et al. (2023) are worth noting, as they help clarify the contributions of the present thesis. First, passing a pre-trends test is a necessary condition for the validity of DiD, not a sufficient one: it provides no guarantee that trends would have remained parallel in the post-treatment period absent the plans. Second, the Callaway and Sant'Anna (2021) estimator requires not only parallel trends but also absorbing treatment, that is, that once a region enters a PdR it stays in it permanently. This assumption is directly violated in the data, since Liguria, Sardegna, and Piemonte all exited the programme; the authors work around this by treating exiting regions as persistently treated from their first treatment year onwards, but this is a modelling choice that imposes the assumption rather than verifying it. Third, whether estimated via TWFE or the Callaway and Sant'Anna (2021) estimator, the reported causal estimates are ATTs averaged across all treated regions, offering no region-specific results and therefore concealing the heterogeneity in plan design, intensity, and governance that the institutional evidence documents.

Taken together, these papers point to a broad consensus on two findings: PdRs were effective as fiscal instruments, reducing per-capita expenditure primarily through cuts in hospital beds, staffing, and hospitalisations; and this supply compression was accompanied by a deterioration in local care quality, reflected most consistently in rising patient out-migration. The debate remains open on mortality, where Depalo (2019) and Bordignon et al. (2020) find inconclusive evidence while Arcà et al. (2020), Cirulli and Marini (2023), and Guccio et al. (2024) find significant negative effects. On intermediate outcomes, the personnel rate and patient out-migration have received less systematic attention, and no study has applied the SCM to either of them. This thesis fills that gap on several dimensions. First, it applies the SCM, which constructs a separate counterfactual for each treated region as a weighted combination of never-treated regions that closely matches the treated region's pre-treatment trajectory, without requiring parallel trends. This is particularly important in the Italian context, where deep North–South structural differences make parallel trends implausible. Second, unlike DiD-based approaches, the SCM produces region-specific estimates rather than pooled ATTs, making it possible to detect and quantify heterogeneity in how individual regions responded to the plans. Third, by exploiting the most recent data available, extending to 2022 for the personnel rate and 2023 for out-migration, this thesis offers a genuinely long-run perspective on a programme that was introduced in 2007 and is still ongoing for most treated regions. This extended time horizon also makes it possible to examine, at least descriptively, how the COVID-19 pandemic interacted with the pre-existing differences in healthcare capacity between PdR and donor regions, a question that shorter-window studies could not address. The graphical transparency of the method is an additional advantage, since the comparison between the observed and synthetic trajectories is directly legible to non-specialist audiences, including the policy-makers and voters whose decisions will shape the future of the programme.

3.2 Data and Outcomes of Interest

All outcome variables and covariates used in this thesis are drawn from the Istat *Health for All* database (Istat, 2023), the main statistical repository of the Italian National Institute of Statistics for health-related indicators. The database contains approximately 4,000 variables covering a broad spectrum of dimensions (demographic, epidemiological, clinical, and administrative) and is periodically updated as new administrative records become available. Observations are typically recorded at the regional level, though a subset of indicators is also available at the provincial or municipal level. Among the papers reviewed in the previous section, Bordignon et al. (2020) and Ciaccio (2023) explicitly draw their variables from the Istat Health for All database, while Depalo (2019) and Arcà et al. (2020) use comparable Istat administrative health data.

The first outcome is the **SSN personnel rate** (*tasso di personale dipendente del SSN*): the number of SSN employees per 10,000 inhabitants, compiled by Istat from Ministry of Health administrative records on the managerial and economic activities of ASLs and AOs. The numerator covers all staff employed by ASLs, including personnel of directly managed hospitals and residual psychiatric institutions, as well as those employed by AOs. From 1999 onwards, the data are collected through the *Conto Annuale*, a joint annual survey of the Ministry of Health and the Ministry of Economy and Finance. The series runs from 1994 to 2022, and in the analysis the variable is rescaled from per 10,000 to per 1,000 inhabitants for ease of interpretation.

The second outcome is the **patient out-migration rate** (*percentuale di emigrati per ricoveri ordinari acuti in altra regione*): the share of ordinary acute hospital discharges of residents who chose a facility in a different region, commonly referred to in the Italian literature as *mobilità passiva*. The underlying data come from the Ministry of Health's hospital discharge records (*Schede di Dimissione Ospedaliera*, SDO), covering both public and accredited private facilities under ordinary hospitalisation, restricted to acute care. Spinal unit, rehabilitation, neuro-rehabilitation, long-term care, and residual psychiatric departments are excluded. The series runs from 1999 to 2023.

The two outcomes examined in this thesis are chosen because together they are consistent with a plausible causal pathway: PdRs imposed binding expenditure ceilings on treated regions, most directly compressing personnel; reduced staffing capacity in turn impairs the ability of regional health systems to deliver timely and adequate care, inducing residents to seek treatment elsewhere. This second outcome, patient out-migration, carries its own policy relevance as an indicator of redistributive failure: healthcare travel is costly in terms of time, money, and logistics, and these costs burden disproportionately those with fewer resources. For both outcomes, all available years are considered, that is, 1994–2022 for the personnel rate and 1999–2023 for the out-migration rate, so as to maximise the pre-treatment window available for constructing synthetic controls. In addition, a broader set of variables, besides the two outcomes of interest, is imported from the same database for descriptive purposes and to assess the pre-treatment covariate balance between PdR and donor regions. Further details on the data import and cleaning process are provided in Appendix A.

3.3 The Synthetic Control Method

The starting point for any causal evaluation is the question of what would have happened to a treated unit had it not been treated. Using the potential outcomes framework from Rubin (1974), for each unit i and time period t two potential outcomes can be defined: Y^1_{it}, the outcome if the unit is treated, and Y^0_{it}, the outcome if it is not. The observed outcome is given by the switching equation

$$Y_{it} = D_{it} \cdot Y^1_{it} + (1 - D_{it}) \cdot Y^0_{it}, \tag{3.1}$$

where $D_{it} \in \{0, 1\}$ is a binary treatment indicator. For the treated unit $i = 1$ and any post-treatment period $t > T_0$, where T_0 is the last pre-treatment period, the treatment effect is

$$\alpha_{1t} = Y^1_{1t} - Y^0_{1t}. \tag{3.2}$$

Since Y_{1t}^1 is directly observed, the problem reduces to estimating the counterfactual Y_{1t}^0: what the treated unit's outcome would have been without the treatment. This is the fundamental problem of causal inference (Holland, 1986), and addressing it requires imposing some structure on how the counterfactual is built from observable data.

The Synthetic Control Method, introduced by Abadie and Gardeazabal (2003) and formalised by Abadie et al. (2010), addresses this problem by constructing a tailor-made counterfactual for the treated unit as a weighted average of donor (never-treated) units, chosen so that the combination reproduces the treated unit's pre-treatment trajectory as closely as possible. Let unit $i = 1$ be the treated unit and units $j = 2, \ldots, J + 1$ be the J donors. Any $(J \times 1)$ vector of non-negative weights $\mathbf{W} = (w_2, \ldots, w_{J+1})$ satisfying

$$w_j \geq 0 \quad \forall\, j, \qquad \sum_{j=2}^{J+1} w_j = 1 \tag{3.3}$$

defines a synthetic control, whose outcome at period t is $\sum_{j=2}^{J+1} w_j Y_{jt}$. The constraints on $\mathbf{W}$ ensure that the synthetic control is an interpolation within the range of the donor pool rather than an extrapolation, so the counterfactual always stays within the empirical support of the data.

Among all possible sets of weights, it is possible to identify the optimal weights $\mathbf{W}^*$. Abadie et al. (2010) show that the estimated treatment effect at each post-treatment period is

$$\hat{\alpha}_{1t} = Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}, \qquad t > T_0. \tag{3.4}$$

The optimal weights $\mathbf{W}^*$ are found by matching the treated unit to its synthetic counterpart on a set of pre-treatment characteristics. Let $\mathbf{X}_1$ be a $(k \times 1)$ vector of such characteristics for the treated unit and $\mathbf{X}_0$ the corresponding $(k \times J)$ matrix for the donor pool. These characteristics typically include observed covariates $\mathbf{Z}_i$ and a set of linear combinations of pre-treatment outcome values, such as annual values or sub-period averages. For a given $(k \times k)$ positive semi-definite diagonal matrix $\mathbf{V}$, the optimal weights are those that minimise the $\mathbf{V}$-weighted distance between the treated unit's characteristics $\mathbf{X}_1$ and those of the synthetic control $\mathbf{X}_0\mathbf{W}$:

$$\mathbf{W}^*(\mathbf{V}) = \arg\min_{\mathbf{W}} \sqrt{(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W})'\mathbf{V}(\mathbf{X}_1 - \mathbf{X}_0\mathbf{W})}. \tag{3.5}$$

The matrix $\mathbf{V}$ controls how much importance is given to each predictor: a larger diagonal entry means that matching on that variable matters more, while a zero entry excludes it. Abadie et al. (2010) note that the inferential procedure holds for any choice of $\mathbf{V}$, but that the mean squared error of the estimator depends on it. A natural data-driven approach is to choose $\mathbf{V}$ to minimise the pre-treatment root mean squared prediction error of the outcome,

$$\text{RMSPE}_1^{pre} = \sqrt{\frac{1}{T_0}\sum_{t=1}^{T_0}\left(Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}\right)^2}, \tag{3.6}$$

so that the synthetic control tracks the treated unit's pre-treatment outcome trajectory as precisely as possible. Alternatively, when the goal is simply to match the pre-treatment outcome path without assigning differential importance to other covariates or to specific sub-periods, one can use only the annual pre-treatment values of the outcome as predictors and fix $\mathbf{V} = \mathbf{I}$. With the identity matrix, all pre-treatment periods are equally considered, and the problem reduces to finding the donor weights that minimise the simple pre-treatment RMSPE of the outcome directly, without privileging any particular year.

Since the SCM typically involves a single treated unit, conventional asymptotic inference is not applicable. Abadie et al. (2010) instead propose a permutation-based procedure, formalised and extended by Galiani and Quistorff (2017). The idea is to apply the SCM to each donor unit in turn, treating it as if it had received the treatment at time T_0 and constructing its synthetic control from the remaining $J-1$ donors; the actual treated unit is excluded from the donor pool when estimating placebo synthetic controls. This produces, for each donor $j \in \{2, \dots, J+1\}$, a placebo gap $\hat{\alpha}_{jt} = Y_{jt} - \sum_{k\neq j} w_k^* Y_{kt}$ for every post-treatment period $t > T_0$. One then has J placebo gap sequences alongside the gap sequence for the actual treated unit.

Galiani and Quistorff (2017) organise the resulting inference options into four p-values, which differ along two dimensions: whether the statistic summarises the entire post-treatment period jointly or is computed separately for each post-treatment year, and whether or not it is standardised by the quality of the pre-treatment fit. Each p-value is defined as the proportion of placebo units whose statistic is at least as large as the treated unit's, computed over the J placebos only (the treated unit is not included in the reference distribution).

The first p-value summarises the joint post-treatment fit for each unit into a single scalar, the post-treatment RMSPE,

$$\text{RMSPE}_j^{post} = \sqrt{\frac{1}{T - T_0} \sum_{t=T_0+1}^{T} \hat{\alpha}_{jt}^2}, \tag{3.7}$$

and computes the fraction of placebos whose post-treatment RMSPE is at least as large as the treated unit's:

$$p^{(1)} = \frac{\sum_{j=2}^{J+1} \mathbf{1}\left(\text{RMSPE}_j^{post} \geq \text{RMSPE}_1^{post}\right)}{J}. \tag{3.8}$$

A low $p^{(1)}$ indicates that the treated unit's average post-treatment prediction error is unusually large relative to the placebo distribution. Its weakness is that it ignores pre-treatment fit: a placebo whose synthetic control already tracks it poorly before the treatment date will tend to generate a large post-treatment RMSPE for mechanical reasons, inflating the reference distribution and making genuine effects harder to detect.

The second p-value corrects for this by replacing the raw post-treatment RMSPE with the ratio of post-treatment to pre-treatment RMSPE. A large post-treatment error is informative only relative to how well the synthetic control matched the unit before treatment: if the pre-treatment fit was already poor, a large post-treatment RMSPE is unsurprising; if the fit was close, the same error after the treatment is much harder to dismiss as chance. The statistic for each unit is therefore $\text{RMSPE}_j^{post}/\text{RMSPE}_j^{pre}$, and the p-value is

$$p^{(2)} = \frac{\sum_{j=2}^{J+1} \mathbf{1}\left(\frac{\text{RMSPE}_j^{post}}{\text{RMSPE}_j^{pre}} \geq \frac{\text{RMSPE}_1^{post}}{\text{RMSPE}_1^{pre}}\right)}{J}. \tag{3.9}$$

Placebos with a poor pre-treatment fit are naturally down-weighted: their large pre-treatment RMSPE inflates the denominator of their ratio, reducing their chance of exceeding the treated unit's ratio even if their post-treatment error is also large.

Both $p^{(1)}$ and $p^{(2)}$ are joint tests: they collapse the entire post-treatment trajectory into a single number, so they can only answer whether the overall post-treatment divergence is unusual, not when it becomes unusual. The remaining two p-values are computed period by period, yielding one value for each post-treatment year $t > T_0$.

The third p-value, for each year t, is the fraction of placebos whose absolute estimated effect in that year is at least as large as the treated unit's:

$$p_t^{(3)} = \frac{\sum_{j=2}^{J+1} \mathbf{1}(|\hat{\alpha}_{jt}| \geq |\hat{\alpha}_{1t}|)}{J}. \tag{3.10}$$

The fourth p-value standardises the period-specific effect by the pre-treatment RMSPE of each unit before making the comparison, so that a given absolute effect counts for more when it comes from a unit that was closely matched before treatment:

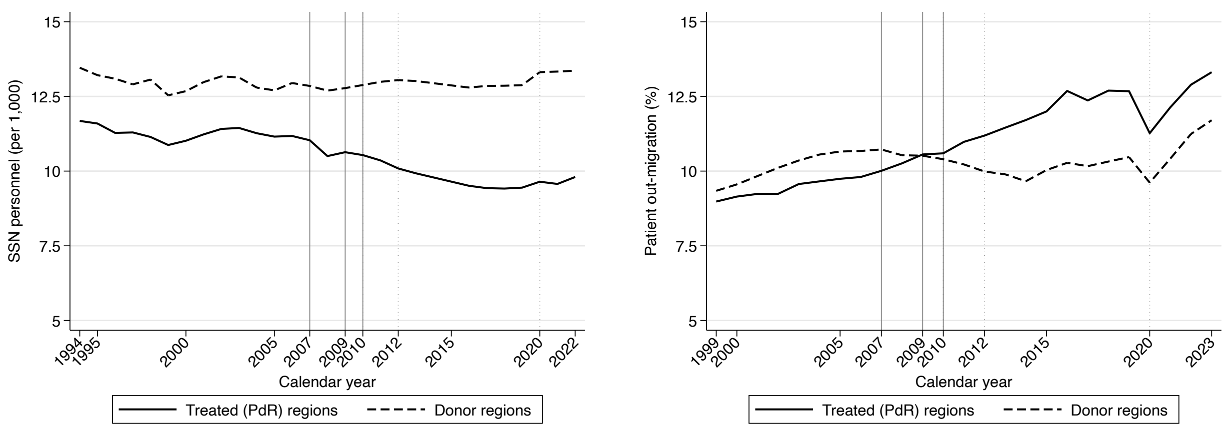
$$p_t^{(4)} = \frac{\sum_{j=2}^{J+1} \mathbf{1}\left(\frac{|\hat{\alpha}_{jt}|}{\text{RMSPE}_j^{pre}} \geq \frac{|\hat{\alpha}_{1t}|}{\text{RMSPE}_1^{pre}}\right)}{J}. \tag{3.11}$$

In all four cases the p-value is a proportion n/J, where $n \in \{0, 1, \ldots, J\}$ is the number of placebos whose statistic meets or exceeds the treated unit's. With $J = 10$ donor regions, the achievable values are therefore $0, 0.1, 0.2, \ldots, 1.0$. A value of 0 means no placebo beats the treated unit; a value of 0.1 means exactly one does; and so on up to 1.0, when every placebo matches or exceeds the treated unit.

3.4 Identification

The choice of SCM for the context of Italian PdRs stems from a variety of reasons. First of all, Figure 3.1 provides a first look at the raw data and already suggests that naïve comparisons are inadequate. Panel (a) plots the simple mean of the personnel rate over time for PdR and non-PdR regions: there is a visible level difference, with treated regions consistently reporting fewer SSN personnel per 1,000 inhabitants, and the two groups' trends look broadly parallel in the pre-treatment period. Panel (b) tells a different story for out-migration: here there is no appreciable level difference between the two groups before 2007, but the pre-treatment trajectories diverge, with treated regions exhibiting a rising out-migration rate while donor regions remained broadly flat. These patterns motivate excluding both forms of naïve comparison. A simple before-after comparison within each treated region would conflate any treatment effect with the underlying time trend: outcomes would have evolved over the observation window regardless of the plans, due to economic growth or contraction, technological change in medicine, and the macroeconomic shocks of the period, most notably the 2008 financial crisis and the 2011 sovereign debt crisis, both of which triggered further austerity measures across the Italian public sector. A cross-sectional comparison between PdR and non-PdR regions in the post-treatment period would instead conflate the effect with the pre-existing level differences, which are visible for the personnel rate and confirmed, more broadly, by the pre-treatment balance analysis discussed below.

Figure 3.1: Mean outcome trajectories for PdR and non-PdR regions



(a) Personnel rate

(b) Out-migration rate

Table 3.1 below reports pre-treatment covariate means for PdR and donor regions across a range of variables capturing the key determinants of healthcare demand and indicators of supply quality, averaged over all years before 2007. The differences are pronounced for several variables. Treated regions have a substantially lower GDP per capita (approximately €16,300 against €22,000 for donors, significant at the 1% level), and a notably higher share of public healthcare expenditure relative to regional GDP (7.4% against 5.6%, significant at the 1% level). They also report a much higher unemployment rate (14.5% against 6.2%, significant at the 1% level) and somewhat lower average education levels (significant at the 10% level). Finally, they employ less SSN healthcare workers per 1,000 inhabitants (11.3 against 13.0, significant at the 5% level). By contrast, most proxies for the demand side of healthcare, including the beds rate, the age dependency ratio, smoking rates, and the prevalence of chronic conditions such as diabetes and heart disease, are not significantly different between the two groups in the pre-treatment period. The out-migration rate, too, does not show a statistically significant pre-treatment level difference (consistent with panel (b) of Figure 3.1), confirming that the selection bias for this outcome operates primarily through differential trends rather than through levels. Taken together, Table 3.1 paints a clear picture: PdR regions are systematically poorer and fiscally more fragile than donor regions, but the two groups are broadly comparable in terms of population health status.

Table 3.1: Pre-treatment covariate balance (year < 2007): donor vs. treated regions

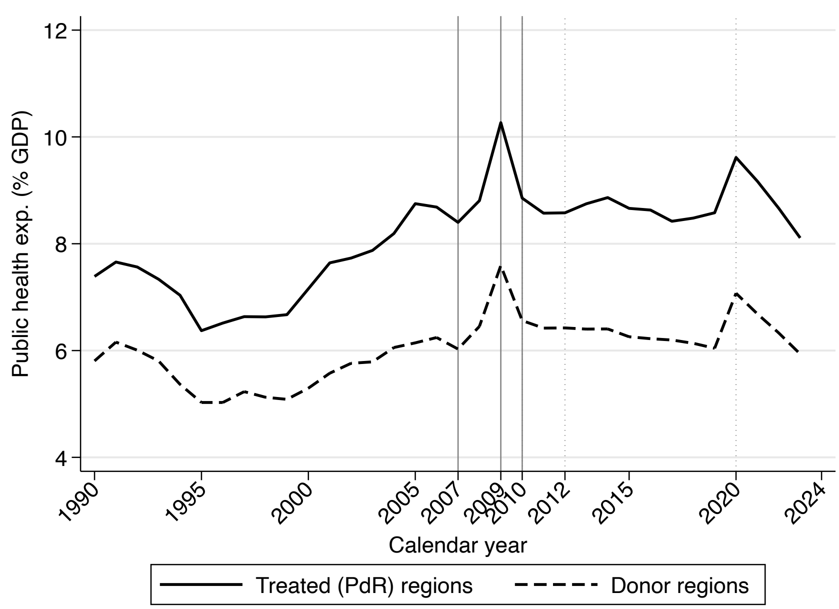
Variable	Donors	Treated	Difference	p-value
Expenditure				
GDP per capita	22025	16301	-5724^{***}	0.008
Public health expenditure (% of GDP)	5.62	7.40	1.78^{***}	0.002
Socio-economic context				
Old-age dependency ratio	28.6	26.1	-2.41	0.258
Has upper-secondary diploma (%)	28.1	26.2	-1.95^{*}	0.094
Unemployment rate	6.235	14.5	8.28^{***}	0.001
Lifestyles				
Smoking prevalence	23.4	24.1	0.70	0.421
Diabetes prevalence	38.3	42.1	3.84	0.190
Heart disease prevalence	53.9	48.7	-5.28	0.113
Used medications in last two days (%)	35.2	31.9	-3.32^{*}	0.051
Supply and quality of healthcare services				
Ordinary hospital beds per 10,000 inh.	40.2	37.7	-2.46	0.314
SSN personnel per 1,000 inh.	13.0	11.3	-1.70^{**}	0.030
Patient out-migration (%)	10.1	9.42	-0.71	0.791

Donors ($n = 10$): Valle d'Aosta, Lombardia, Trentino-A.A., Veneto, Friuli-V.G., Emilia-Romagna, Toscana, Umbria, Marche, Basilicata. *Treated* ($n = 10$): Piemonte, Liguria, Lazio, Abruzzo, Molise, Campania, Puglia, Calabria, Sicilia, Sardegna. Means over all available pre-treatment observations (year < 2007), the effective window depends on the variable. Difference = treated mean − donor mean. Two-sample Welch t-test, two-tailed: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Difference-in-differences, and more specifically the Two-Way Fixed Effects (TWFE) estimator used in several prior evaluations of Recovery Plans (Arcà et al., 2020; Beraldo et al., 2023; Bordignon et al., 2020; Cirulli & Marini, 2023), represents a natural candidate. The parallel trends assumption underlying TWFE states that, in the absence of treatment, outcomes would have evolved at the same rate across PdR and donor regions. Intuitively, this allows the estimator to isolate the treatment effect by removing two sources of confounding simultaneously: region fixed effects absorb the time-invariant pre-existing differences between groups, and time fixed effects absorb the common shocks affecting all regions in a given year, so that any remaining post-treatment gap between treated and untreated regions can be attributed to the intervention itself. As already noted, however, Figure 3.1b does not clearly support parallel pre-treatment trends for out-migration, which is a first reason for caution.

The more fundamental problem is that treatment assignment is endogenous. Recovery Plans were not assigned randomly, nor did they follow an administrative rule unrelated to the regions' healthcare trajectories. They were triggered by a targeting rule: a region entered the programme when its healthcare deficit, defined as the gap between expenditure and its health fund allocation, exceeded a statutory threshold. Figure 3.2 shows that public healthcare expenditure as a share of regional GDP was not only persistently higher in PdR regions throughout the pre-treatment period, but that the gap was actively widening year after year. This means that regions entered the programme precisely because they were on diverging fiscal trajectories relative to donor regions, and it is difficult to maintain that these diverging trajectories in fiscal capacity would have had no diverging effects on the supply and quality of healthcare services going forward. This is exactly the situation that Cunningham (2021) identifies as structurally incompatible with parallel trends: when treatment assignment is directly driven by pre-treatment trends in a variable correlated with the outcome, extending pre-treatment trend similarity into the post-treatment period requires an additional untestable assumption.

Figure 3.2: Mean public healthcare expenditure as a share of GDP for PdR and non-PdR regions



To see why this is so damaging for TWFE, it is useful to formalise the data-generating process following Abadie et al. (2010), augmented with a treatment indicator. The observed outcome for region i at time t is modelled as

$$Y_{it} = \delta_t + \boldsymbol{\theta}_t \mathbf{Z}_i + \boldsymbol{\lambda}_t \boldsymbol{\mu}_i + \alpha D_{it} + \varepsilon_{it}, \tag{3.12}$$

where $D_{it} = 1$ for treated regions in post-treatment periods and zero otherwise, α is the treatment effect, and ε_{it} is an idiosyncratic zero-mean error. The remaining terms capture the untreated potential outcome. The scalar δ_t is a common time factor absorbing aggregate forces that affect all regions equally in a given year, much like a time fixed effect. The term $\boldsymbol{\theta}_t \mathbf{Z}_i$ captures the contribution of observed, time-invariant regional characteristics $\mathbf{Z}_i$, such as demographic structure or geographic features, whose effect on the outcome is allowed to change over time through the time-varying coefficients $\boldsymbol{\theta}_t$. The central term is $\boldsymbol{\lambda}_t \boldsymbol{\mu}_i$. Here, $\boldsymbol{\lambda}_t$ is a vector of *unobserved common factors*: latent forces that evolve over time and affect all regions, but with an intensity that varies across regions according to their *factor loadings* $\boldsymbol{\mu}_i$. The loadings are time-invariant structural characteristics of each region that determine how sensitive it is to each latent force. Because $\boldsymbol{\lambda}_t$ changes over time while $\boldsymbol{\mu}_i$ differs across regions, the contribution of unobserved forces to each region's outcome shifts in a region-specific way from one period to the next, generating diverging trends even in the complete absence of any intervention.

TWFE corresponds to the special case of model (3.12) in which $\boldsymbol{\lambda}_t = \boldsymbol{\lambda}$ for all t: the unobserved common factors are constant over time. Under this restriction, $\boldsymbol{\lambda}_t \boldsymbol{\mu}_i$ collapses to a time-invariant region-specific term $\phi_i = \boldsymbol{\lambda} \boldsymbol{\mu}_i$, which can be removed by the within-transformation, yielding the familiar specification $Y_{it} = \delta_t + \phi_i + \alpha D_{it} + \varepsilon_{it}$. Taken at face value, this assumption requires that the broader setting in which regions operate remains fundamentally stable: the latent forces that differentiate regions in their healthcare outcomes are fixed, so that, after removing region-specific constants and common year effects, all regions follow parallel trajectories.

This assumption is not credible over the three-decade window covered by this thesis. Consider what $\boldsymbol{\lambda}_t$ might plausibly contain: the macroeconomic environment and its shocks, most notably the 2008 financial crisis and the 2011 sovereign debt crisis, which contracted public budgets sharply but with intensities that varied across regions depending on their fiscal exposure; the pace of technological progress in healthcare management, including the national rollout of the electronic health record (*fascicolo sanitario elettronico*), improvements in diagnostic infrastructure, and advances in data governance; successive rounds of regional decentralisation and national targets on hospital beds and personnel; and broader population health shocks, including the rise of vaccine hesitancy, seasonal epidemic cycles, and the COVID-19 pandemic. Each of these forces constitutes a shift in $\boldsymbol{\lambda}_t$, and each one interacted differently with the structural characteristics $\boldsymbol{\mu}_i$ of individual regions: a fiscal shock hits regions with weaker institutions harder; a technology wave benefits regions with more capable administrations first; a pandemic strains regions with older populations and lower pre-existing capacity more severely. TWFE would require all of these differential reactions to be zero, after partialling out fixed region characteristics. In the Italian regional context, where the structural differences between regions are among the most persistent and documented in Europe, this is an assumption too strong to maintain.

The SCM does not require it. As Abadie et al. (2010) put it, "the difference-in-differences model allows for the presence of unobserved confounders but restricts the effect of those confounders to be constant in time, so they can be eliminated by taking time differences. In contrast, the factor model presented in this section allows the effects of confounding unobserved characteristics to vary with time." Rather than differencing out the unobserved term, the SCM chooses weights $\mathbf{W}^*$ such that the factor loadings of the synthetic control approximate those of the treated region:

$$\sum_{j=2}^{J+1} w_j^* \boldsymbol{\mu}_j \approx \boldsymbol{\mu}_1. \tag{3.13}$$

When condition (3.13) holds, the synthetic control responds to the evolving factors $\boldsymbol{\lambda}_t$ in the same way the treated region would have without the intervention, producing a valid counterfactual even as the broader landscape shifts. The factor loadings $\boldsymbol{\mu}_j$ are not directly observed, but Abadie et al. (2010) show that a synthetic control that closely reproduces the treated region's pre-treatment outcome trajectory will also approximately satisfy condition (3.13), provided the pre-treatment window is sufficiently long. The practical implication is direct: a good pre-treatment fit on the outcome is both the identifying condition and the operational criterion for a credible synthetic control, and a poor fit is a transparent, visible signal that the counterfactual should not be trusted.

3.5 Synthetic Control Method Implementation

A region is defined as treated if it entered a PdR at any point during the observation window 1994–2023, regardless of when it entered or whether it subsequently exited. The donor pool consists exclusively 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. Regions that entered a PdR at any point were excluded from the donor pool, even if they subsequently exited. This restriction addresses two distinct threats to the validity of the counterfactuals. The first arises from a defining feature of the SCM: the synthetic control for each treated region is constructed once and for all, using pre-treatment data, as a weighted average of donor regions, and those weights remain fixed for the entire post-treatment period. If a donor later enters a PdR, its outcome from that point onwards no longer reflects an untreated trajectory, and any synthetic control that assigned it positive weight is contaminated. Piemonte and Puglia entered the programme in 2010; including them as donors when analysing first-wave regions would produce a valid counterfactual only through 2009, as the post-2009 portion of the synthetic control would be partially driven by two regions themselves under a PdR. The second threat concerns regions that exited the programme. Liguria and Sardegna were both under a PdR from 2007 to 2009 and formally exited in 2010. Including them as donors when analysing Piemonte and Puglia may seem safe, since the latter two regions started their PdRs only in 2010. The problem is persistence: three years of PdR exposure may have left lasting effects on the outcomes of Liguria and Sardegna, meaning their post-2010 trajectories do not represent a genuinely untreated path, and a synthetic control built on them would thus not be a clean counterfactual. Restricting the donor pool to never-treated regions avoids both threats to validity: at the cost of a smaller pool of ten regions, the benefit is a counterfactual that is uncontaminated at every point in the post-treatment period.

The SCM is applied separately to each of the ten treated regions (using only never-treated regions as donors), for each of the two outcome variables, producing 20 independent estimations. The procedure is carried out in Stata 18 using the `synth_runner` command from Galiani and Quistorff (2017); detailed instructions are provided in Appendix B. Estimating region by region, rather than pooling, follows from two considerations. First, PdR regions entered the programme at different times and, in three cases, exited at different points, so a pooled estimator would require imposing a common treatment window that does not fit the institutional record. Second, the substantial heterogeneity in PdR design, intensity, and governance documented in Chapter 2 means that treatment effects plausibly differ across regions; compressing them into a single average conceals precisely the variation that motivates the analysis. As seen in Section 3.1, the previous literature on PdRs reports ATTs averaged across all treated regions; this thesis departs from that practice to deliver region-specific estimates that can be read against the institutional detail of each plan. This approach is consistent with an established strand of the SCM literature. Billmeier and Nannicini (2013) investigate the impact of economic liberalisation on real GDP per capita in a worldwide sample, running a separate synthetic control for each treated economy across Africa, Asia, Latin America, and the Middle East. Adhikari et al. (2018) study the effects of waves of labour and product market reforms on GDP per capita, constructing one synthetic control for each of six reform episodes: Australia, New Zealand, Denmark, Ireland, the Netherlands, and Germany. Pinotti (2015) applies a separate synthetic control to each of two southern Italian regions, Apulia and Basilicata, to estimate the economic costs of organised crime. Kraemer and Lehtimäki (2024) study how EU membership and the Stability and Growth Pact have affected government debt, running individual synthetic controls for each EU member state as well as for various country groupings. In health economics specifically, Kurz and König (2021) run separate synthetic control analyses for France and Hungary to assess the causal impact of sugar taxes on soft drink sales; and Di Novi and Salari (2026) apply the SCM separately to each of the seven European countries that have adopted taxes on sugar-sweetened beverages, so as to study the effects of such taxes on soft drink sales and product reformulation. The common rationale is that policy interventions in structurally heterogeneous units are more informative when studied as individual cases than when compressed into a pooled estimate.

The choice to rely exclusively on lagged outcomes as predictors, rather than adding structural covariates, follows Abadie et al. (2010) and rests on both practical and theoretical grounds. Both outcomes studied here are complex phenomena shaped by a large number of factors. The personnel rate depends on health policy decisions, hiring practices, institutional capacity, and the endowment of equipment and infrastructure, for which no systematic regional data are available. The out-migration rate depends on perceived service quality but also on geography, transport infrastructure, and the proximity of high-quality facilities in neighbouring regions. Selecting a handful of covariates to capture all of this would inevitably involve arbitrary choices, and any omitted relevant predictor would reintroduce bias. Restricting the predictors to pre-treatment outcome lags sidesteps this entirely and yields a fully transparent specification with no room for cherry-picking. This approach also has theoretical support: as anticipated above, Abadie et al. (2010) argue that when the pre-treatment window is long, matching on pre-intervention outcomes allows the researcher to implicitly control for heterogeneous responses to multiple unobserved factors, thus producing a good synthetic counterfactual that is structurally similar to the real region in both observables and unobservables. This intuition is confirmed by Ferman et al. (2020), who find using Monte Carlo simulations that SCM specifications using more pre-treatment outcome lags as predictors do a better job of controlling for unobserved confounders, while those restricting the number of lags misallocate weights and should be avoided. The present thesis therefore uses the full sequence of annual pre-treatment outcome values available for each region and outcome.

Among the four inference approaches available in `synth_runner`, this thesis adopts the per-period standardised p-value $p_t^{(4)}$. The core intuition is that a post-treatment gap is evidence of an effect only if it is large relative to how well the synthetic control tracked the treated region before treatment: a region whose synthetic control was already drifting away in the pre-treatment period should be held to a higher bar than one whose fit was nearly perfect. Standardising by the pre-treatment RMSPE operationalises this directly. Beyond fit quality, the per-period structure serves a second purpose: by computing a separate p-value for each post-treatment year, it is possible to track when an effect first becomes statistically detectable and whether it persists, intensifies, or fades over time. The joint p-values $p^{(1)}$ and $p^{(2)}$, by averaging over the entire post-treatment window, can mask this evolution: a large early effect that subsequently reverses and a steadily growing effect may produce the same joint statistic, yet carry very different policy interpretations. The per-period unstandardised $p_t^{(3)}$ avoids that compression but does not correct for pre-treatment fit. $p_t^{(4)}$ combines both advantages. With $J = 10$ donor regions, the minimum achievable value is 0 (no placebo beats the treated region in that year) and the next achievable level is 0.1 (exactly one does), so results are reported at these two levels only. The same inferential approach is adopted by Di Novi and Salari (2026), who report per-period standardised p-values, noting that the raw post-treatment RMSPE can be misleading when pre-treatment fit varies across placebos.

Two limitations of the causal interpretation apply across the full set of results and should be stated before turning to them.

(i) The first concerns the three regions that exited the programme before the end of the observation window: Liguria and Sardegna in 2010 and Piemonte in 2017. During each region's active PdR years, the estimated gap between the treated region and its synthetic control has a clean causal reading. After exit, because neither the treated region nor its synthetic control is under any plan, the gap between them can no longer be attributed to a currently active policy difference. Instead, the post-exit trajectory reveals how persistent the effects are once the PdR is lifted. Three patterns are possible: the gap may close, indicating reversibility; it may remain stable, indicating lock-in through institutional or demographic structures that are slow to reverse; or it may continue to widen, consistent with a path-dependent snowball dynamic in which earlier workforce compression has set in motion processes, such as workforce ageing or reputational deterioration of local services, that amplify independently of formal plan status. It must be noted that there is no way to separate how much of such persistence is due to the PdR itself, how much to post-exit choices made by the region, and how much to other concurrent factors. These post-exit trajectories should therefore be read as descriptive accounts of effect persistence rather than as causal estimates of the PdR's continuing impact.

(ii) The second limitation concerns the COVID-19 period. The factor model of Section 3.4 is designed to accommodate shocks that affect regions differentially according to their structural characteristics, provided those characteristics are captured, at least implicitly, by the pre-treatment outcome match. COVID-19, however, was not simply a common shock with heterogeneous intensities: it was a staggered shock that struck the northern Italian regions composing the donor pool with substantially greater severity and earlier timing than the southern and central regions in the treated group, particularly during the first wave of 2020. The differential lethality of the virus across Italian regions may have been further amplified by factors, most notably chronic air pollution (Hernandez Carballo et al., 2022), that the pre-treatment outcome trajectories do not encode and that the SCM therefore cannot control for. The causal interpretation of the estimates is therefore restricted to the 2007–2019 window. Observations from 2020 onwards are retained and presented as a descriptive complement, offering a stress-test of how PdR and non-PdR regions compared during the pandemic period.

Chapter 4

Results

4.1 Main Results

Tables 4.1 and 4.2 report the year-by-year SCM estimated effects on, respectively, SSN personnel per 1,000 inhabitants and patient out-migration as a share of the regional population, for all ten treated regions across the full post-treatment period.

For the personnel outcome, the results point to a strong and persistent reduction in the SSN workforce across the majority of treated regions. Significant negative effects, frequently at the 1% level, emerge in most regions and years, with magnitudes ranging from 1 to 4 fewer personnel per 1,000 inhabitants relative to the synthetic counterfactual. Two regions constitute clear exceptions, both of which entered the PdR framework voluntarily and under lighter constraints, and show no significant effect at any point in the post-treatment window. Elsewhere in the sample, the timing and depth of the estimated gaps vary across regions in ways that broadly correspond to the institutional features of each plan, including entry date, commissioner appointment, and enforcement intensity, as discussed in detail in Section 4.2.

One data-quality caveat applies to several southern regions: the pre-treatment RMSPE is elevated for a subset of treated units, reflecting the structural difficulty of constructing a close synthetic counterfactual when virtually all southern regions are themselves treated and the donor pool is consequently dominated by central and northern regions. Where this concern is material, the estimates should be interpreted with appropriate caution, and the region-level graphs in Section 4.2 allow a closer visual assessment of pre-treatment fit.

For the out-migration outcome, the pattern is more heterogeneous. A significant increase relative to the synthetic counterfactual is detected for only a subset of regions, but where the effect does emerge it is sizeable and consistent in sign, with estimates in the range of 1 to 7 percentage points above the counterfactual. The timing follows the personnel results with a degree of lag broadly consistent with a mechanism whereby workforce compression reduces local service availability and eventually prompts patients to seek care elsewhere. Regions for which no significant personnel effect is found generally show no significant out-migration effect either, lending coherence to the overall picture. Notably, the pre-treatment fit is uniformly good across all regions for this outcome, including the southern ones, so the heterogeneity in results reflects genuine variation in treatment responses rather than estimation quality. The region-specific patterns underlying these aggregate findings are examined in Section 4.2.

Table 4.1: SCM estimated effects of PdR on public healthcare personnel per 1,000 residents

Year	Abruzzo	Calabria	Campania	Lazio	Liguria	Molise	Piemonte	Puglia	Sardegna	Sicilia
2007	−0.503***		−1.631	−2.205*	0.087	−0.101			−0.361*	−1.311
2008	−0.687***		−1.578	−2.221*	−1.504***	−0.345			−1.402***	−1.442
2009	−1.102***	−0.246	−1.973	−2.629	0.101	−0.758***			−1.475***	−1.785
2010	−1.537***	−0.246	−2.319	−2.938*	0.112	−1.057***	0.152	−0.791	−1.333***	−2.418*
2011	−1.707***	−0.359	−2.570	−2.608	−2.997***	−1.573***	0.209	−0.686	−0.054	−1.733
2012	−1.368***	−1.187***	−3.031***	−3.020***	−3.178***	−2.230***	−0.271	−1.182	−0.188	−1.756
2013	−1.432***	−1.608***	−3.423***	−3.522***	−3.335***	−2.402***	−0.433	−1.276	0.140	−2.048*
2014	−1.380***	−1.703***	−3.522***	−3.695***	−3.408***	−2.629***	−0.465	−1.270	0.248	−2.159
2015	−1.328***	−1.799***	−3.622***	−3.867***	−3.480***	−2.856***	−0.496	−1.264	0.356	−2.269
2016	−1.276***	−1.895***	−3.721*	−4.039***	−3.553***	−3.083***	−0.527	−1.258	0.464	−2.379
2017	−1.344***	−1.837***	−3.852***	−4.206***	−3.803***	−3.447***	−0.576	−1.280	0.324	−2.458*
2018	−1.503***	−1.893***	−4.018*	−4.254***	−3.795***	−3.804***	−0.540	−0.966	0.211	−2.214
2019	−1.424***	−1.894***	−3.811***	−3.971***	−3.736***	−3.219***	−0.435	−0.906	0.334	−2.155
2020	−1.896***	−1.948***	−3.413*	−3.455***	−4.321***	−3.427***	−0.417	−0.458	−0.210	−1.950
2021	−1.920***	−1.832***	−3.084*	−3.224***	−4.547***	−3.883***	−0.531	−0.343	−1.068***	−1.974*
2022	−1.601***	−1.792***	−2.495*	−3.003***	−4.164***	−3.525***	−0.310	−0.337	−1.051***	−1.752*
pre-RMSPE	0.1623	0.3104	0.9715	0.8993	0.2355	0.1781	0.3995	1.2776	0.1708	0.7346

Effects: treated outcome − synthetic control outcome. Significance stars are based on the per-period standardised p-value $p_t^{(4)}$ of Galiani & Quistorff (2017): for each post-treatment year, the fraction of the $J = 10$ placebo regions whose standardised effect (absolute gap divided by pre-treatment RMSPE) meets or exceeds the treated region's. ***: $p = 0.0$, no placebo region meets or exceeds the treated region in that year. *: $p = 0.1$, exactly one placebo region does. *pre-RMSPE*: root mean squared prediction error in the pre-treatment period (measure of synthetic control fit).

Table 4.2: SCM estimated effects of PdR on patient out-migration (as % of resident patients)

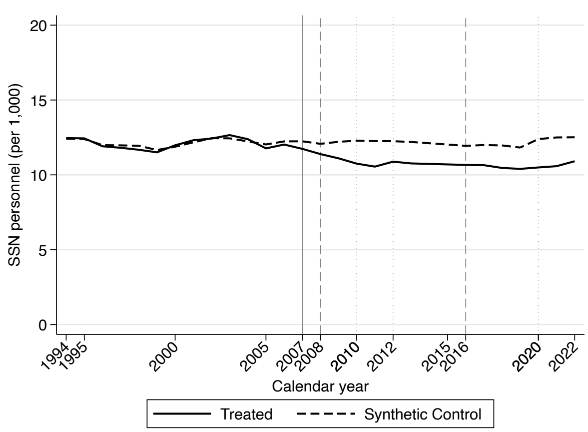
Year	Abruzzo	Calabria	Campania	Lazio	Liguria	Molise	Piemonte	Puglia	Sardegna	Sicilia
2007	1.774*		−0.108	−0.005	0.719*	−1.837***			0.710	−0.130
2008	4.030*		−0.303	−0.259	1.191*	−0.929			0.768	0.050
2009	5.838***	2.833*	0.036	−0.063	1.250***	0.324			0.739	0.342
2010	6.825***	2.790	0.581	0.273	1.952***	−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	0.4479	0.5820	0.1543	0.1278	0.1873	0.4035	0.3653	0.2834	0.3601	0.4741

Effects: treated outcome − synthetic control outcome. Significance stars are based on the per-period standardised p-value $p_t^{(4)}$ of Galiani & Quistorff (2017): for each post-treatment year, the fraction of the $J = 10$ placebo regions whose standardised effect (absolute gap divided by pre-treatment RMSPE) meets or exceeds the treated region's. ***: $p = 0.0$, no placebo region meets or exceeds the treated region in that year. *: $p = 0.1$, exactly one placebo region does. *pre-RMSPE*: root mean squared prediction error in the pre-treatment period (measure of synthetic control fit).

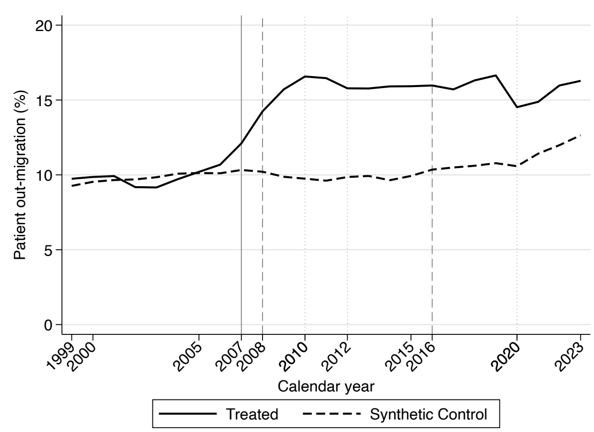
4.2 Region-Specific Trends

Abruzzo. Abruzzo's results are among the most credible in the sample, with excellent pre-treatment fit on both outcomes and sharp divergences from 2007. The personnel gap opens immediately upon PdR introduction in 2007 and deepens through 2011, reflecting the commissioner enforcement from 2008 and the automatic turnover block from 2010. It then stabilises at roughly 1.3 to 1.5 personnel per 1,000 inhabitants below the synthetic control through the 2010s, consistent with the partial derogations introduced from 2011 to ensure LEA delivery. With the COVID outbreak, a notable widening in 2020–2021 appears driven by an upward shift in the synthetic control rather than a further decline in Abruzzo: northern donor regions could exploit emergency provisions to increase healthcare personnel spending (Decree-Law 14/2020), while Abruzzo, still under PdR, could not benefit to the same extent; from 2022, the treated line begins recovering, suggesting the region is gradually rebuilding its workforce. However, note that the post-COVID SCM analysis has mainly descriptive, rather than causal, value. On out-migration, the rate diverges sharply from 2007, reaches a gap of roughly six to seven percentage points by 2010 to 2011, and remains statistically significant through 2017, providing strong evidence that workforce compression reduced local service availability and pushed patients to seek care elsewhere. Significance then fades, coinciding with the end of the *commissariamento* in 2016 and the deployment of territorial care investments under the 2016–2018 operational programmes, which appear to have partially offset the access deficit. In 2020, out-migration drops because of COVID-related movement restrictions. After 2020, both lines rise together, suggesting a generalised COVID-induced increase in patient mobility not attributable to the PdR.

Figure 4.1: Synthetic control estimates for Abruzzo



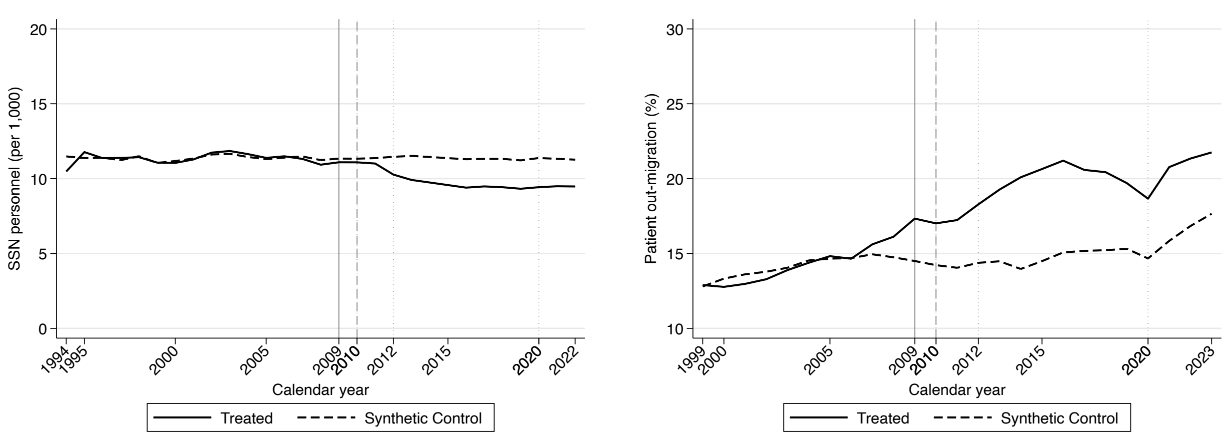
(a) Personnel rate



(b) Out-migration rate

Calabria. Calabria entered the PdR only in 2009, two years after the first wave, due to a mandatory pre-entry accounting audit, and its commissioner was not appointed until 2010. This delayed and weakly enforced start is visible in the personnel graph: no divergence from the synthetic control appears in 2009 to 2011, when the hiring freeze was repeatedly breached; the gap widens sharply only from 2012, once commissioner enforcement tightened and the national spending review of Decree-Law 95/2012 added further pressure, and stabilises at roughly 1.8 to 1.9 personnel per 1,000 inhabitants below the synthetic control through 2022. The out-migration picture is more complex and demands interpretive caution. The treated line begins rising before the formal 2009 treatment date, which cannot be attributed to personnel reductions since those had not yet materialised. More plausible channels are: (i) the *quota premiale* mechanism introduced by Law 311/2004, which from 2005 began withholding supplementary central transfers from non-compliant regions, directly compressing Calabria's available health budget, and (ii) the pre-PdR audit period of 2007 to 2008, which likely generated anticipation effects and informal spending restraint. It is worth noting that, had the treatment date been set to 2007 to account for these anticipation effects, the pre-treatment fit would likely be cleaner and the estimated effects on out-migration more consistently significant. The estimated gaps, while sizeable, reach statistical significance only intermittently, partly reflecting the elevated pre-treatment RMSPE. After 2016, treated out-migration declines noticeably, which may reflect the gradual implementation of the hospital network standards mandated by Ministerial Decree 70/2015 and, secondarily, the progressive erosion of Calabrian residents' ability to bear the financial costs of seeking care elsewhere after years of economic stagnation. After 2020, both lines rise in parallel, suggesting a generalised COVID-induced increase in patient mobility across regions.

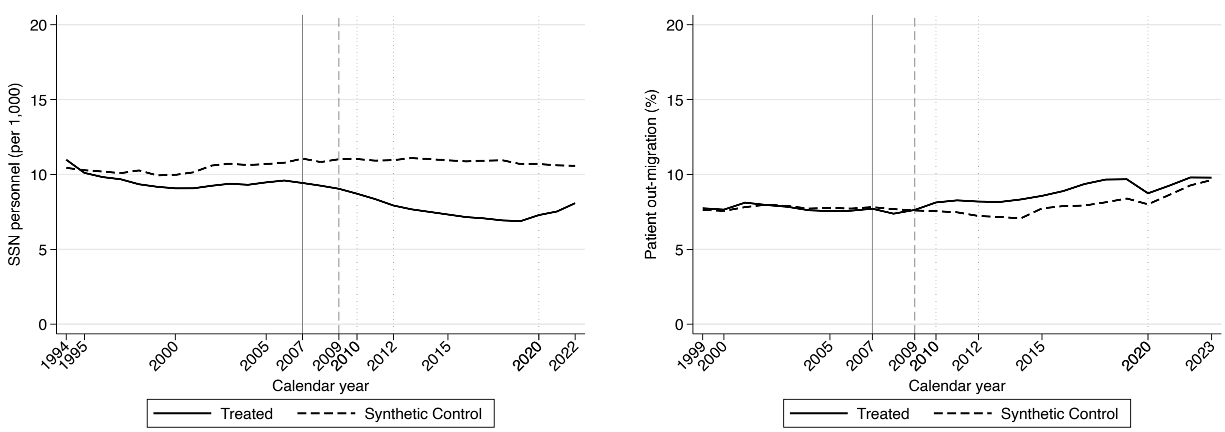
Figure 4.2: Synthetic control estimates for Calabria



(a) Personnel rate **(b)** Out-migration rate

Campania. Campania entered the PdR in 2007 in an unusual starting position: its bed supply was already below the national benchmark, so the plan focused not on cutting hospital infrastructure but on reducing inappropriate hospitalisations, increasing administrative efficiency, and controlling pharmaceutical and private provider expenditure. On personnel, the estimated reduction is statistically significant and grows progressively after 2009, consistent with the 2009 *commissariamento*, the 2010 hiring freeze, and the 2012 national spending review. The pre-treatment RMSPE is the second-highest in the sample at 0.97, however, due to a structural SCM limitation: Campania's personnel rate hovers around 10 per 1,000 inhabitants, a floor that donor regions all exceed, and the convex hull constraint prevents the synthetic control from reproducing through a weighted average such low values, which are outside the range of the donor pool. That said, the estimates that do reach significance should not be dismissed: since the RMSPE-ratio test penalises poor pre-treatment fit, any significant result is conservative rather than inflated. The caution applies primarily to the magnitude of the effects, not to their sign or existence. On out-migration, the treated and synthetic control lines track each other closely throughout the post-treatment period, with no statistically significant divergence detected at any point. This null result is arguably consistent with Campania's specific PdR design: since hospital capacity was already constrained before 2007 and the plan prioritised reducing inappropriate use rather than sharply cutting beds, the marginal reduction in accessible services may not have been sufficient to induce a measurable increase in patient mobility on top of an already structurally high baseline.

Figure 4.3: Synthetic control estimates for Campania

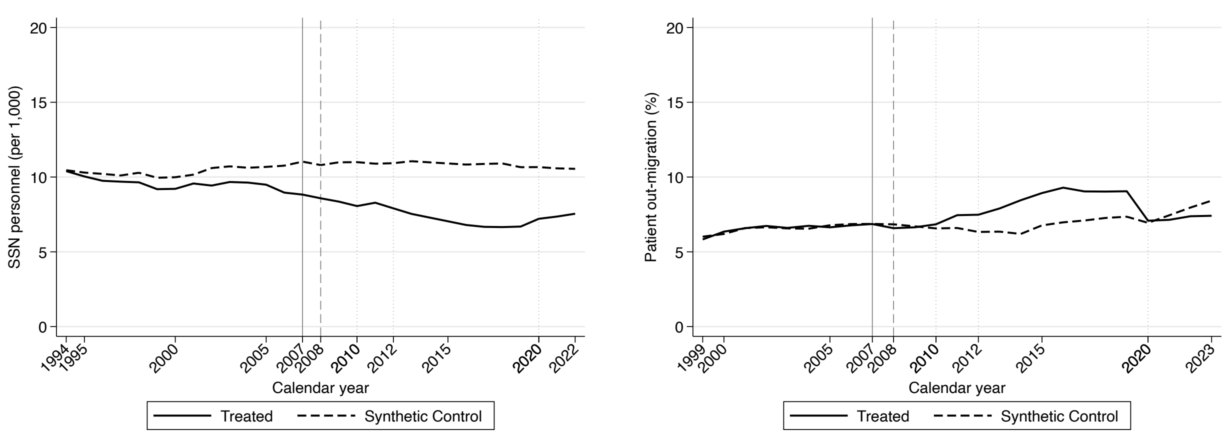


(a) Personnel rate

(b) Out-migration rate

Lazio. Lazio entered the PdR in 2007 and received a commissioner in 2008 following implementation delays and litigation with accredited private providers. The plan's early phases relied almost entirely on the hiring freeze and pharmaceutical cost cuts, with hospital network reorganisation largely deferred to the 2013–2015 operational programme. On personnel, a significant reduction is visible from 2007. As with Campania, the pre-treatment RMSPE is elevated at 0.90 due to the same convex hull constraint, and the same caveats on the magnitude of estimates apply. On out-migration, the effect is positive and builds gradually, reaching statistical significance from 2013 through 2017, a timing consistent with capacity reductions becoming most acute once hospital reorganisation was finally enacted alongside the earlier personnel compression. After 2020, the pattern is puzzling: the synthetic control rises, as expected from generalised COVID-induced patient mobility, while Lazio's actual out-migration declines and then stagnates. Absolute mobility volumes from the AGENAS interregional mobility report reveal that the total volume of passive mobility fell from 63K to 51K between 2019 and 2023, with roughly 74% of this drop concentrated in mid/low-complexity and inappropriate DRG cases, which fell from 33K and 6.8K to 26K and 5.0K respectively, while high-complexity cases were essentially stable at around 9K (AGENAS, 2022). One possible interpretation is that patients who had been migrating for routine procedures stopped doing so once northern destination regions were themselves overwhelmed by COVID pressures, while those with genuinely complex needs continued to travel regardless; however, given that the post-COVID period falls outside the causal window, this reading should be treated as descriptive only.

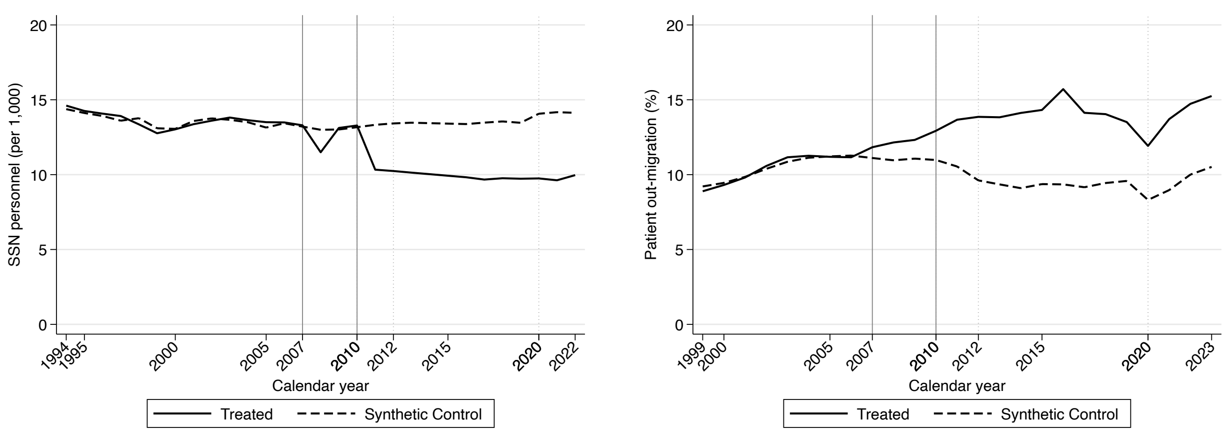
Figure 4.4: Synthetic control estimates for Lazio



(a) Personnel rate **(b)** Out-migration rate

Liguria. Liguria is the only first-wave PdR region to have exited the programme without a commissioner, doing so in 2010 after restoring financial balance. Its plan focused on reducing inappropriate hospitalisations and emergency room attendance rather than cutting beds, which were already within the national benchmark. On personnel, no significant gap is visible during the active PdR years 2007–2009, consistent with the plan's focus on channels other than direct workforce cuts. A large and persistent negative gap then opens from 2010 onwards, stabilising at around 3 to 4 personnel per 1,000 inhabitants below the synthetic control. Since this falls outside the clean causal window, it is best read as a snowball dynamic: the national personnel spending cap (binding on all regions after 2010), combined with the voluntary structural measures Liguria itself enacted upon exit, further compressed the workforce as a deliberate long-term sustainability choice. On out-migration, the effect is among the strongest and most consistently significant in the sample: an increase of 4 to 6 percentage points relative to the control is observed from 2007 and remains statistically significant across virtually all post-treatment years. The active PdR years carry a clean causal interpretation; the persistence of the gap after 2010 is best read as a lock-in effect, reinforced by Liguria's particularly aged population, which generates above-average demand for specialist care and faced fewer local alternatives as SSN capacity was compressed. After 2020, both lines rise in parallel, suggesting a generalised COVID-induced increase in patient mobility across regions.

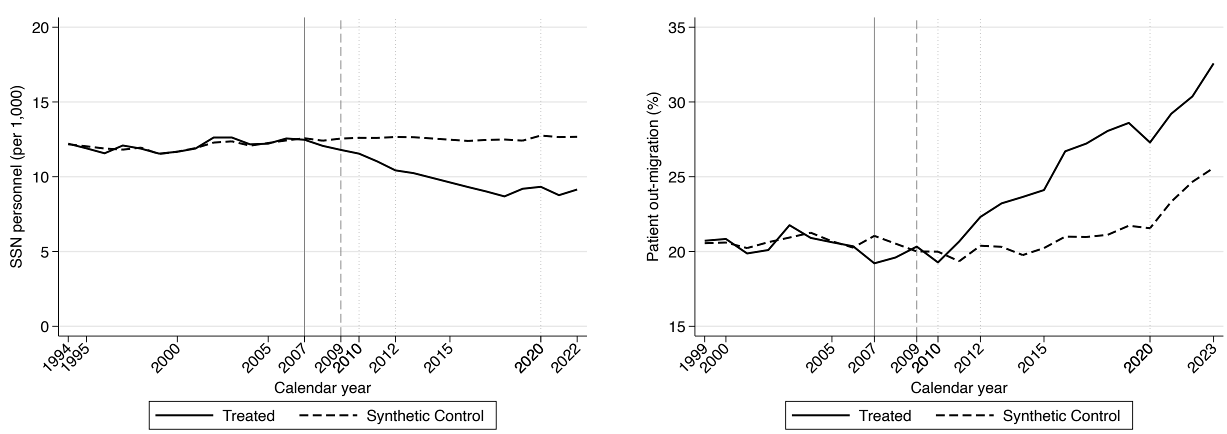
Figure 4.5: Synthetic control estimates for Liguria



(a) Personnel rate **(b)** Out-migration rate

Molise. Molise presents one of the most unusual profiles in the sample. Its PdR relied almost entirely on regional tax hikes for financial consolidation, with monitoring bodies repeatedly certifying inadequate implementation of virtually all structural measures. Despite this, a significant and persistent personnel gap opens from 2009 and deepens through the rest of the sample, reaching roughly 1.5 to 2 personnel per 1,000 inhabitants below the synthetic control by the later years. This likely reflects the combined effect of commissioner enforcement from 2009 and the automatic hiring freeze imposed by Law 191/2009 on all PdR regions with unresolved imbalances, both of which could produce workforce compression independently of the region's own compliance. On out-migration, Molise's baseline is exceptionally high, with rates well above 20%, reflecting its structural condition as a very small region with limited hospital capacity and a long-established pattern of patients seeking specialist care elsewhere. In 2007, the estimates record a significant decrease of roughly 1.8 percentage points relative to the synthetic control, the only such result in the sample; this is difficult to attribute to any PdR channel and likely reflects a transient dynamic in the synthetic control rather than a genuine treatment effect. No significant effect is then detected through 2015, consistent with the absence of meaningful structural reform. A positive and significant increase of roughly 2 to 3 percentage points emerges from 2016 to 2019, plausibly reflecting the lagged effect of sustained personnel compression without any compensating development of territorial care. After 2020, both lines rise in parallel, consistent with the generalised COVID-induced increase in patient mobility observed across the sample.

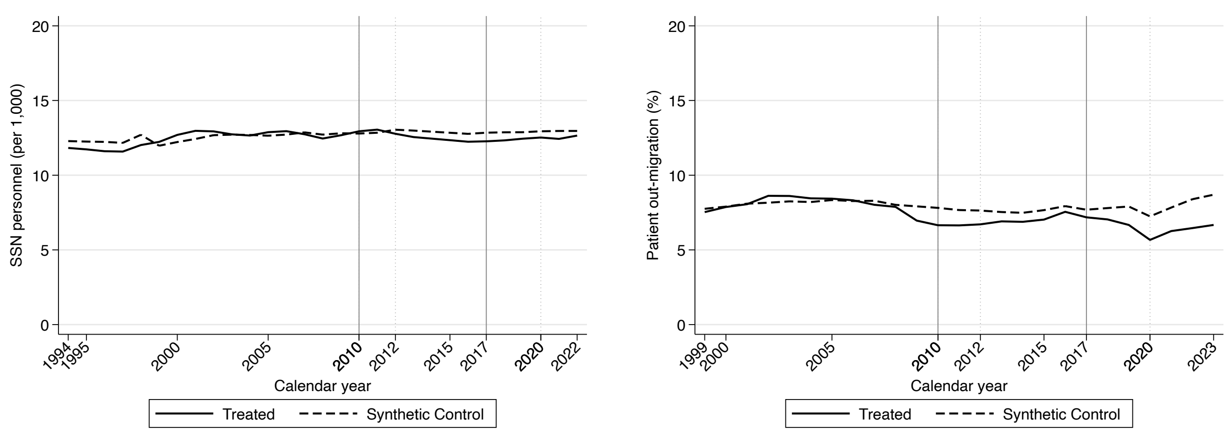
Figure 4.6: Synthetic control estimates for Molise



(a) Personnel rate **(b)** Out-migration rate

Piemonte. Piemonte entered the PdR voluntarily in 2010 to recover withheld conditional transfers (*quote premiali*). It operated without a commissioner, achieved the highest LEA compliance among all PdR regions, and exited the programme in 2017 via a negotiated debt repayment agreement. Its personnel measures were correspondingly light: a partial rather than full hiring freeze, a reduction of atypical contracts, and a suspension of additional remuneration. Consistently with this, the personnel graph shows no meaningful divergence between the treated and synthetic control lines throughout the post-treatment period, with estimates uniformly insignificant: no effect is detectable within the clean causal window 2010–2017, and, after Piemonte's 2017 exit, the two lines continue to track closely, suggesting the plan left no lasting imprint on the workforce trajectory. On out-migration, both lines track closely throughout the sample, and no significant effect is detected in any post-treatment year except 2010. A mild downward drift in Piemonte's out-migration is visible from around 2007, which may reflect a demand-side dynamic: as neighbouring northern regions either entered PdRs themselves (Liguria) or absorbed growing inflows of patients from southern PdR regions (most notably Lombardia, Emilia-Romagna, and Toscana), waiting times in those destinations may have lengthened, reducing the incentive for Piemonte residents to seek care elsewhere. However, this drift is never statistically significant except in 2010, the single year that coincides with Piemonte's own PdR entry. That isolated result should not be given much weight: with around thirteen post-treatment observations, a significant result in a single year with no adjacent significant estimates on either side is most plausibly attributable to chance. Taken together, Piemonte's results are consistent with a light, voluntary, and well-implemented plan that contained costs without meaningfully compressing workforce capacity or degrading healthcare access.

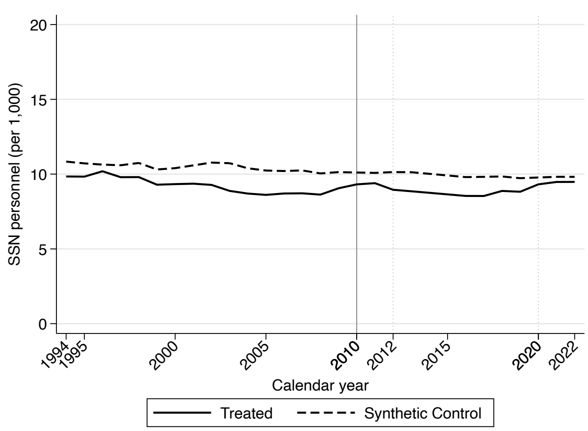
Figure 4.7: Synthetic control estimates for Piemonte



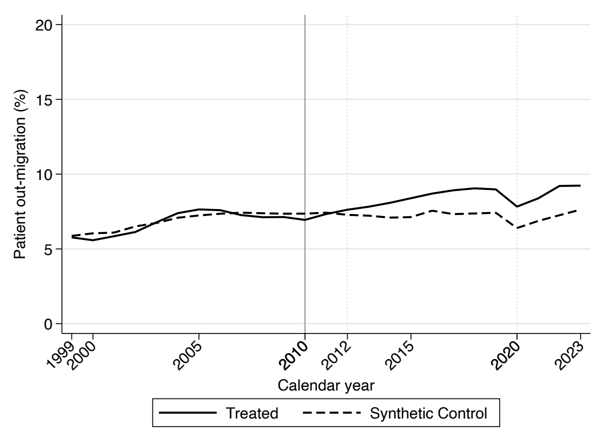
(a) Personnel rate **(b)** Out-migration rate

Puglia. Puglia, like Piemonte, entered the PdR voluntarily in 2010 to recover withheld conditional transfers (*quote premiali*), operated without a commissioner, and was the only major southern region to achieve full LEA compliance by the 2013–2015 operational programme. Its plan included a partial hiring freeze alongside largely delayed measures on hospital reorganisation and territorial care. On personnel, the estimates are uniformly insignificant throughout the post-treatment period, consistent with the plan's voluntary and relatively light nature. However, the same convex hull constraint discussed for Campania and Lazio applies here: Puglia's personnel rate hovers at or below 10 per 1,000 inhabitants, a level that falls outside the range spanned by the donor pool, making a close pre-treatment fit mechanically unattainable and producing the highest pre-treatment RMSPE in the sample at 1.28. Unlike for Campania and Lazio, the most plausible interpretation here is a genuine lack of effect, since Puglia's trajectory remains flat; nevertheless, the convex hull constraint still requires caution. On out-migration, both lines track closely throughout the post-treatment period, with just a mild upward drift in the treated series. A significant positive increase of 1.6 percentage points is detected in a single year, 2017; however, as argued for Piemonte, a single significant result unsupported by adjacent years is most plausibly attributable to chance, and the overall picture is consistent with a plan too mild to generate a detectable effect on personnel and patient mobility.

Figure 4.8: Synthetic control estimates for Puglia



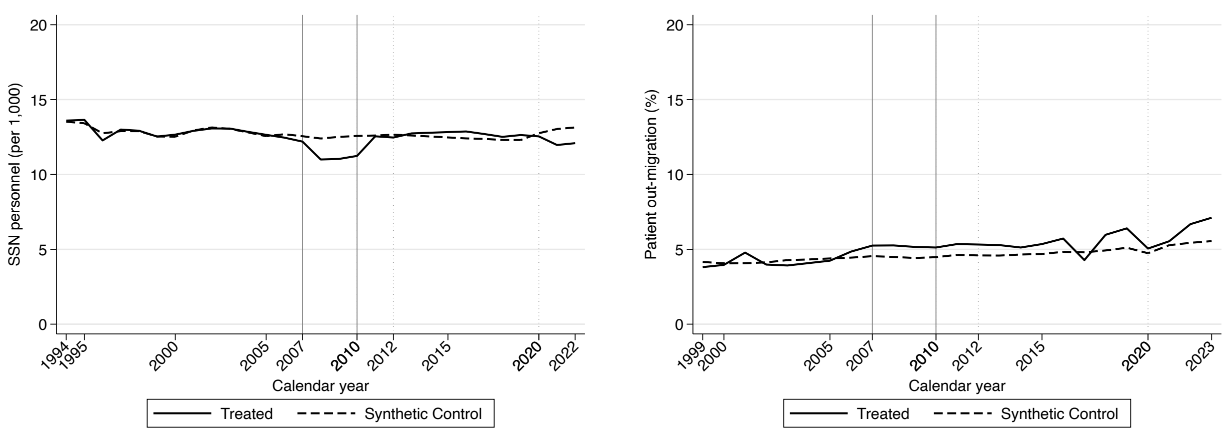
(a) Personnel rate



(b) Out-migration rate

Sardegna. Sardegna entered the PdR in 2007 as a Special Statute region and exited in 2010 by invoking that statute, despite monitoring bodies and the Court of Auditors certifying inadequate implementation. On personnel, a significant negative gap opens from 2007 and persists through the PdR years, then closes after the 2010 exit, tracing the plan's timeline with some precision. This fade-away pattern is consistent with the region's exit route: by invoking its Special Statute rather than completing the plan, Sardegna returned to its previous institutional trajectory without embedding the structural adjustments the PdR required, a choice that, while reversing the workforce compression in the short term, contributed to the renewed financial deterioration that forced the region to adopt voluntary restructuring plans from 2015 onwards. Interestingly, the gap reopens and becomes significant again in 2021 to 2022. Both limitations discussed in Section 3.5 apply here: this period falls after the 2010 exit, so no clean causal interpretation in terms of the PdR is available, and it also falls within the post-COVID window, which further complicates inference. Descriptively, the result is at least consistent with the voluntary restructuring plans from 2015, compounded by pandemic-era constraints. On out-migration, no significant effect is detected at any point in the post-treatment period, and the two lines track closely throughout the sample. Beyond the plan's short duration and weak implementation, Sardegna's island geography likely plays a structural role here: seeking care on the mainland requires flying or taking a ferry, making healthcare travel substantially more costly than for continental regions, and this physical barrier may suppress the out-migration channel even when local capacity is under pressure.

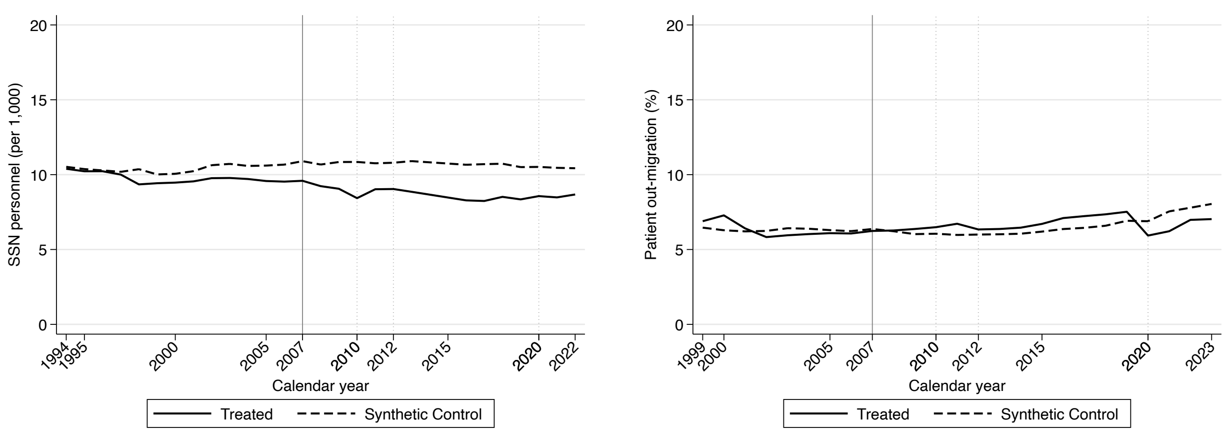
Figure 4.9: Synthetic control estimates for Sardegna



(a) Personnel rate **(b)** Out-migration rate

Sicilia. Sicilia is the only region subject to a standard mandatory PdR from 2007 while holding Special Statute status, and the only first-wave mandatory PdR region never placed under *commissariamento*. Its plan was characterised by persistent implementation delays in the early years, with financial balance achieved only over the period 2013–2015, and a subsequent shift towards quality improvement rather than further cost cuts. On personnel, the graph shows a mild downward drift of the treated line relative to the synthetic control, with significant negative estimates of roughly 2 personnel per 1,000 inhabitants appearing in only a handful of years rather than consistently. The same convex hull constraint encountered for Campania, Lazio, and Puglia applies here: Sicilia's personnel rate hovers near the 10 per 1,000 floor, below the range spanned by the donor pool, mechanically limiting the quality of the synthetic control and producing an elevated pre-treatment RMSPE. As with those regions, the significant results that do emerge are if anything conservative, since the RMSPE-ratio test already penalises poor fit, but caution on the size of the effect remains warranted. On out-migration, the two lines track closely throughout the post-treatment period and no significant effect is detected at any point. As with Sardegna, this null result is consistent both with the lighter institutional pressure the region faced, given the absence of a commissioner and its greater statutory autonomy, and with the structural barrier imposed by island geography, which raises the cost of seeking care on the mainland sufficiently to suppress the out-migration channel even under conditions of local capacity compression.

Figure 4.10: Synthetic control estimates for Sicilia



(a) Personnel rate **(b)** Out-migration rate

4.3 Robustness and Validation

The main results are supported by three checks: a verification that the synthetic controls are well-formed, an in-space placebo test, and a "fake-outcome" placebo test (using an outcome variable that PdRs have no credible mechanism to affect).

A first check concerns the structure of the synthetic controls themselves. If the optimisation assigns all weight to a single donor, the SCM collapses to a nearest-neighbour match, where the entire counterfactual rests on one other region. In practice, this would mean treating, say, Basilicata as the sole counterfactual for Campania, or Toscana alone as the counterfactual for Lazio, comparisons that are difficult to defend on any substantive grounds. Tables C.1 and C.2 in Appendix C show that this never occurs: in every case, positive weight is assigned to at least two donor units and no single unit receives the entire weight, so all synthetic controls represent genuine combinations of the donor pool.

The significance reported in Tables 4.1 and 4.2 is based on the per-period standardised p-value $p_t^{(4)}$ of Galiani and Quistorff (2017), described in Section 3.3. One important property of this measure is that it handles poor pre-treatment fit in a self-correcting way. A region whose synthetic control tracks it imprecisely before treatment will have a high pre-treatment RMSPE. Since this enters the denominator of the standardised effect, the treated region's own ratio of post-treatment gap to pre-treatment RMSPE will be smaller than it would be under a close fit, making it easier for placebo regions to exceed it by chance, and thus pushing the p-value upward. In other words, poor pre-treatment fit is not ignored: it is penalised directly through the test statistic, reducing the probability of finding spurious significance. Two limitations remain, however. The first concerns inferential resolution. Each p-value is a proportion n/J with $J = 10$ placebos, so $n \in \{0, 1, \ldots, 10\}$ and the only achievable significance levels are $p = 0.0$, when no placebo region achieves as large a standardised effect as the treated region in that year, and $p = 0.1$, when exactly one does. The second limitation is the convex hull constraint. When the treated region's pre-treatment trajectory lies outside the convex hull of the donor pool, no weighted combination of donors can reproduce it, and the pre-treatment RMSPE is high not because the fit is noisy but because the counterfactual is structurally misspecified. Here two arguments pull in opposite directions. On the one hand, the standardisation already penalises the treated region for its high pre-treatment RMSPE, making significance harder to achieve and providing some protection against spurious results. On the other hand, if the synthetic control cannot track the treated region's pre-treatment trajectory in the first place, it is not clear that the post-treatment gap measures the causal effect of the PdR rather than the continuation of a pre-existing misfit. This tension cannot be fully resolved, and the results for Campania and Lazio in the personnel outcome, where pre-treatment RMSPEs are the highest in the sample, should be read with this in mind: neither straightforwardly accepted nor straightforwardly dismissed. Puglia and Sicilia also have elevated pre-treatment RMSPEs, but their post-treatment trajectories are mostly flat and statistically insignificant; a misspecified counterfactual that yields a null result is less troubling, since it does not generate spurious evidence of an effect.

A natural complement to the in-space permutation test is the in-time placebo, in which the treatment date is reassigned to an earlier year and the absence of a spurious effect in that window is taken as further evidence against confounding. This test requires, however, that the period between the start of the data and the fake treatment date be long enough to construct a reliable synthetic control, and that the period between the fake and actual treatment dates be long enough to assess whether a fake effect appears. For the first-wave 2007 regions, which have the shortest pre-treatment window in the sample, spanning only from the start of the data series (1994 for personnel, 1999 for out-migration) to the treatment year, neither condition is comfortably met. Abadie et al. (2010) themselves recommend in-time placebos only when the pre-treatment period is long enough to allow them; applying the test here would produce unreliable results for most treated units.

To further probe identification, the full SCM specification is re-run on a variable that PdRs have no credible mechanism to affect. The idea is to test the model itself, by checking if a synthetic counterfactual built on a placebo outcome closely tracks the actual post-treatment trajectory of the real region for that outcome. If it does, this means the model is successfully capturing the underlying dynamics of each region, and we can be more confident that when the same model is applied to personnel and out-migration, the divergence between the treated region and its synthetic control reflects the PdR rather than some pre-existing structural difference that the method failed to absorb. Conversely, large post-treatment gaps on this unrelated outcome would suggest that the synthetic controls are not adequate representations of the treated regions, and that the effects found in the main analysis may partly reflect this inadequacy rather than the policy itself. The variable chosen for this purpose is the total fertility rate, a summary measure of the average number of children a woman would have over her lifetime at current age-specific fertility rates, drawn from the Istat *Health for All* database (Istat, 2023). Fertility outcomes are governed by economic conditions, cultural norms, female labour market participation, and family policy, none of which are plausibly connected to healthcare workforce levels or patient migration dynamics. Crucially, the timing and depth of the fertility decline differ substantially between northern and southern regions, and the partial recovery of the 2000s played out differently across the country, so achieving a good pre-treatment fit on this variable genuinely requires the model to identify structurally similar regions rather than simply following a common national trend. The analysis spans the full available series from 1980 to 2024, using a specification identical to that in the main analysis: the same donor pool, the same lagged-outcome predictor structure, and the same inferential procedure. The results are reported in full in Appendix D, and they broadly support the validity of the main findings: for seven of the ten treated regions the post-treatment effects are close to zero and statistically insignificant throughout. Two regions must be excluded from inference on methodological grounds, as detailed in Appendix D, and one further region, Piemonte, shows isolated significant results that are best attributed to overfitting and post-COVID demographic divergence rather than a genuine PdR effect.

Chapter 5

Discussion

5.1 Fiscal convergence, but on the wrong margin

Recovery Plans were, by their primary objective, a fiscal success. Table 5.1 reports the operating result (*risultato di esercizio*) as a percentage of effective financing for all twenty regions over the period 2006–2018, together with three aggregate series designed to improve comparability over time: non-PdR regions, PdR Wave-1 regions (Lazio, Abruzzo, Molise, and Campania, excluding regions with Special Statutes), and Light PdR regions (Piemonte and Puglia). The Wave-1 aggregate moved from a deficit of 13.6% in 2006 to near-balance by 2018 (−1.1%), with individual regions converging at different speeds: Lazio, which entered the programme with the most severe deficit in the sample (−22.9% in 2006), reached approximate balance (+0.1%) by 2018, as did Campania (+0.3%), Abruzzo (0.0%) and Sicilia (0.0%). Molise represents a partial success: it remained in significant deficit in 2018 (−4.9%), but improved markedly from −13.2% in 2006. The Light PdR aggregate followed a milder but parallel path, from −4.1% to −0.4%. Non-PdR regions were broadly in balance throughout. The only exception is Sardegna (−6.7% in 2018), whose Special Statute allowed it to exit without having achieved the PdR goals.

Table 5.1: Operating result as percentage of effective financing, by region and year

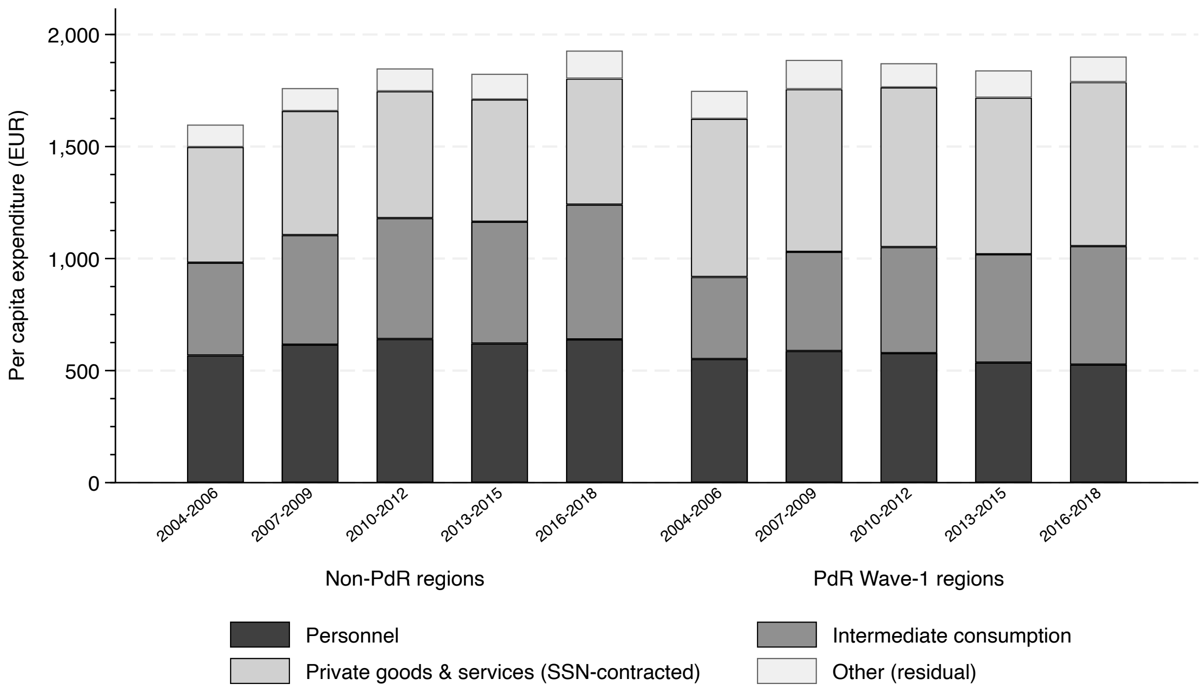
Region	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Piemonte [W3]	-4.6	-2.3	-4.7	-4.9	-5.2	-3.4	-1.5	-0.5	0.7	0.1	0.1	0.0	-0.1
† Valle d'Aosta	-40.4	-29.8	-31.0	-17.1	-26.7	-20.5	-21.1	-23.7	-14.9	-10.8	-11.1	-9.3	-8.5
Lombardia	-0.0	0.0	0.0	0.1	-0.2	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0
† Trentino-A.A.	-55.7	-51.5	-50.8	-44.6	-50.2	-50.1	-55.1	-44.2	-37.4	-20.2	-22.6	-47.1	-45.6
Veneto	-1.9	-1.7	-1.8	-1.2	-0.1	1.3	0.1	0.0	0.2	0.0	0.1	0.5	0.1
† Friuli-V.G.	-0.2	-2.1	-1.9	-2.9	-3.3	-2.9	-2.7	-1.6	2.1	0.2	0.4	-2.2	-4.1
Liguria [W1,E]	-3.3	-3.5	-3.6	-4.0	-3.0	-4.6	-1.5	-2.5	-2.0	-3.2	-2.0	-1.8	-1.6
Emilia-Romagna	-4.1	-1.2	-0.5	-1.5	-1.6	-1.2	-0.5	0.0	0.1	0.0	0.0	0.0	0.0
Toscana	-1.6	0.7	-0.0	-2.4	-1.0	-1.6	-0.7	-0.4	0.1	-0.3	-0.6	-1.3	-0.2
Umbria	-3.9	0.8	0.3	0.5	0.4	0.6	0.3	0.3	0.6	0.2	0.2	0.2	0.0
Marche	-2.0	0.6	1.3	0.5	-0.9	0.8	-1.6	1.7	2.2	2.2	0.9	0.0	0.0
Lazio [W1]	-22.9	-18.6	-18.3	-14.5	-10.5	-7.6	-5.9	-6.7	-3.4	-3.2	-1.3	-0.4	0.1
Abruzzo [W1]	-9.5	-7.5	-4.8	-1.9	0.1	1.6	0.4	0.4	0.3	-0.2	-1.6	-1.7	0.0
Molise [W1]	-13.2	-12.6	-13.8	-13.0	-10.8	-6.1	-8.9	-16.5	-9.9	-7.4	-6.6	-5.6	-4.9
Campania [W1]	-8.9	-9.8	-9.0	-8.3	-5.2	-2.5	-1.1	0.1	1.3	0.5	0.3	0.1	0.3
Puglia [W3]	-3.5	-4.1	-3.2	-5.2	-4.8	-1.6	0.1	-0.6	0.2	-0.8	-0.5	0.1	-0.7
Basilicata	0.3	-2.1	-3.5	-2.5	-3.5	-4.8	0.4	0.0	0.1	-0.7	0.9	0.4	0.0
Calabria [W2]	-1.9	-9.0	-6.2	-7.7	-5.8	-3.4	-2.1	-1.0	-2.0	-1.8	-3.0	-3.0	-5.9
† Sicilia [W1]	-14.6	-8.3	-4.4	-3.3	-1.1	-0.3	-0.1	0.0	0.0	0.2	-0.0	-0.0	0.0
† Sardegna [W1,E]	-5.2	-4.5	-6.8	-9.6	-10.0	-12.0	-13.6	-13.3	-12.3	-11.2	-10.9	-8.0	-6.7
Non-PdR regions	-1.9	-0.4	-0.6	-0.9	-1.0	-0.7	-0.3	0.3	0.5	0.2	0.2	-0.0	0.0
PdR Wave-1 regions	-13.6	-12.1	-11.5	-9.4	-6.6	-3.7	-3.9	-5.7	-2.9	-2.6	-2.3	-1.9	-1.1
Light PdR regions	-4.1	-3.2	-4.0	-5.0	-5.0	-2.5	-0.7	-0.5	0.4	-0.3	-0.2	0.0	-0.4

Percentages; negative values indicate a deficit. † Special-statute regions. Superscripts: W1 PdR from 2007; W2 PdR from 2009; W3 PdR from 2010; E exited before 2018. *Non-PdR*: Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Marche, Basilicata. *PdR Wave-1*: Lazio, Abruzzo, Molise, Campania. *Light PdR*: Piemonte, Puglia.

A non-negligible share of the improvement came from the revenue side. Law 191/2009 introduced automatic increases in the IRAP surcharge and in the *addizionale regionale* IRPEF for regions failing to meet their PdR targets, and Aimone Gigio et al. (2018) confirm that PdR regions applied these maximisations from the second programming cycle onwards at rates above the non-PdR average. That said, it is worth noting that the autonomous revenue contribution was second-order; the bulk of the turnaround was on the expenditure side.

To understand what drove expenditure convergence, it is necessary to look beyond aggregate totals. Figure 5.1 provides an intuitive decomposition of per-capita health expenditure into its main components across five three-year periods (2004–06 through 2016–18), offering a first visual sense of how non-PdR and PdR Wave-1 regions differ over time. For more precise values, Tables 5.2–5.5 report per-capita health expenditure and its four components for all individual regions and the three aggregate groups. Both the figure and the tables draw on data from Ragioneria Generale dello Stato (2020) for 2002–2014 and Ragioneria Generale dello Stato (2025) for 2015–2024.

Figure 5.1: Per-capita health expenditure by component, non-PdR and PdR Wave-1 regions



Note: The left panel reports non-PdR regions, while the right panel reports PdR Wave-1 regions. Values are averaged over five three-year periods (2004–2018) and decomposed into four per-capita health-expenditure components. Sources: Ragioneria Generale dello Stato (2020) for 2002–2014 and Ragioneria Generale dello Stato (2025) for 2015–2024.

The total expenditure series (Table 5.2) shows that in 2004–06 Wave-1 regions spent €1,749 per capita on average, compared with €1,598 for non-PdR regions. By 2016–18 the gap had not only closed but reversed: Wave-1 regions stood at €1,902 against non-PdR regions at €1,928. Convergence was achieved, yet the composition of that convergence reveals a more complicated picture.

The personnel component (Table 5.3) is the most instructive. In 2004–06, Wave-1 regions spent €551 per capita on personnel, already *below* the non-PdR average of €567. By 2016–18, non-PdR regions had risen to €639 while Wave-1 regions had fallen to €527, a gap of €112 now running against PdR regions from a baseline at which there had been no pre-existing excess. Light PdR regions show the same pattern. This is directly consistent with the SCM estimates in Chapter 4, which document significant and persistent workforce reductions in most treated regions relative to their synthetic counterfactuals.

The intermediate consumption component (Table 5.4) grew at roughly parallel rates in both groups, from €414 to €601 for non-PdR regions and from €366 to €529 for Wave-1 regions. The gap between non-PdR and Wave-1 regions was €48 in 2004–06 and €72 in 2016–18, a slight increase rather than evidence of significant compression in PdR regions.

The most diagnostically important component is SSN-contracted private goods and services (Table 5.5), which covers the costs borne by the SSN for care purchased from private providers operating under *convenzione* and *accreditamento* contracts. In 2004–06, Wave-1 regions spent €706 per capita on this component, against €517 for non-PdR regions, a structural gap of €189 representing an excess of roughly 37%. By 2016–18, the figures were €733 and €563 respectively, a gap of €170, virtually unchanged over the entire period. The component that most distinguished PdR regions at baseline, and that represented the true structural source of their excess expenditure, was left essentially untouched.

The fiscal turnaround was therefore achieved primarily by compressing the one budget line that was not elevated to begin with, while leaving intact the one that was. The next section examines why this occurred and what it implies for the instrument design of the plans.

Table 5.2: Total healthcare expenditure per capita (EUR)

Region	2004–06	2007–09	2010–12	2013–15	2016–18
Piemonte [W3]	1691	1843	1909	1850	1907
† Valle d'Aosta	1835	2040	2186	2066	2024
Lombardia	1555	1722	1844	1872	1944
† Trentino-A.A.	1887	2065	2175	2184	2260
Veneto	1591	1740	1791	1739	1880
† Friuli-V.G.	1625	1881	2029	1957	2007
Liguria [W1,E]	1845	2005	2016	1894	2074
Emilia-Romagna	1702	1866	1958	1944	2027
Toscana	1656	1835	1907	1812	1984
Umbria	1641	1780	1837	1849	1947
Marche	1555	1666	1795	1765	1846
Lazio [W1]	1905	2019	1957	1801	1855
Abruzzo [W1]	1654	1779	1750	1768	1869
Molise [W1]	1838	2031	2091	2138	2122
Campania [W1]	1598	1718	1691	1653	1761
Puglia [W3]	1467	1687	1723	1701	1817
Basilicata	1484	1718	1808	1791	1869
Calabria [W2]	1447	1715	1723	1713	1790
† Sicilia [W1]	1584	1658	1682	1710	1821
† Sardegna [W1,E]	1578	1748	1920	1952	2174
Non-PdR regions	1598	1761	1849	1825	1928
PdR Wave-1 regions	1749	1887	1872	1840	1902
Light PdR regions	1579	1765	1816	1776	1862

Values are period means of annual per-capita expenditure (EUR) over the three years within each period. † Special-statute regions. Superscripts: W1 PdR from 2007; W2 PdR from 2009; W3 PdR from 2010; E exited before 2018. *Non-PdR*: Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Marche, Basilicata. *PdR Wave-1*: Lazio, Abruzzo, Molise, Campania. *Light PdR*: Piemonte, Puglia (lighter/shorter plans; entered 2010).

Table 5.3: Personnel expenditure per capita (EUR)

Region	2004–06	2007–09	2010–12	2013–15	2016–18
Piemonte [W3]	595	645	664	637	644
† Valle d'Aosta	802	864	892	889	901
Lombardia	458	499	523	502	502
† Trentino-A.A.	742	884	940	951	967
Veneto	518	551	564	543	563
† Friuli-V.G.	610	726	776	767	781
Liguria [W1,E]	684	712	722	656	709
Emilia-Romagna	614	663	688	668	679
Toscana	625	672	696	647	690
Umbria	618	667	688	688	710
Marche	595	622	661	640	660
Lazio [W1]	516	553	534	466	466
Abruzzo [W1]	548	582	583	576	587
Molise [W1]	621	660	665	630	588
Campania [W1]	520	554	528	471	465
Puglia [W3]	454	501	516	483	508
Basilicata	544	636	666	657	669
Calabria [W2]	563	634	637	592	592
† Sicilia [W1]	522	588	579	563	567
† Sardegna [W1,E]	595	656	705	717	811
Non-PdR regions	567	616	641	621	639
PdR Wave-1 regions	551	587	578	536	527
Light PdR regions	525	573	590	560	576

Values are period means of annual per-capita expenditure (EUR) over the three years within each period. † Special-statute regions. Superscripts: W1 PdR from 2007; W2 PdR from 2009; W3 PdR from 2010; E exited before 2018. *Non-PdR*: Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Marche, Basilicata. *PdR Wave-1*: Lazio, Abruzzo, Molise, Campania. *Light PdR*: Piemonte, Puglia (lighter/shorter plans; entered 2010).

Table 5.4: Intermediate consumption per capita (EUR)

Region	2004–06	2007–09	2010–12	2013–15	2016–18
Piemonte [W3]	416	486	529	527	557
† Valle d'Aosta	494	646	764	675	636
Lombardia	315	382	441	486	564
† Trentino-A.A.	506	515	541	550	567
Veneto	425	498	541	536	566
† Friuli-V.G.	452	581	669	652	669
Liguria [W1,E]	451	541	562	541	629
Emilia-Romagna	459	524	560	574	636
Toscana	486	574	627	599	660
Umbria	462	532	585	584	649
Marche	395	473	536	530	580
Lazio [W1]	396	489	518	494	519
Abruzzo [W1]	381	450	497	522	586
Molise [W1]	382	455	499	498	517
Campania [W1]	307	376	381	419	493
Puglia [W3]	321	401	453	471	548
Basilicata	355	440	487	496	554
Calabria [W2]	236	309	367	419	464
† Sicilia [W1]	272	311	331	388	470
† Sardegna [W1,E]	349	460	550	595	648
Non-PdR regions	414	489	540	544	601
PdR Wave-1 regions	366	443	473	483	529
Light PdR regions	369	443	491	499	552

Values are period means of annual per-capita expenditure (EUR) over the three years within each period. † Special-statute regions. Superscripts: W1 PdR from 2007; W2 PdR from 2009; W3 PdR from 2010; E exited before 2018. *Non-PdR*: Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Marche, Basilicata. *PdR Wave-1*: Lazio, Abruzzo, Molise, Campania. *Light PdR*: Piemonte, Puglia (lighter/shorter plans; entered 2010).

Table 5.5: SSN-contracted goods & services per capita (EUR)

Region	2004–06	2007–09	2010–12	2013–15	2016–18
Piemonte [W3]	552	617	631	585	592
† Valle d'Aosta	465	442	454	446	420
Lombardia	678	733	776	761	782
† Trentino-A.A.	468	493	492	480	491
Veneto	565	597	592	546	571
† Friuli-V.G.	434	478	503	465	453
Liguria [W1,E]	505	533	524	467	489
Emilia-Romagna	509	542	546	544	549
Toscana	448	484	496	442	471
Umbria	459	481	476	468	491
Marche	466	480	497	494	515
Lazio [W1]	862	857	794	741	784
Abruzzo [W1]	633	626	570	563	592
Molise [W1]	690	779	836	852	868
Campania [W1]	638	642	652	639	686
Puglia [W3]	619	686	687	682	697
Basilicata	490	563	581	565	560
Calabria [W2]	588	647	614	598	615
† Sicilia [W1]	669	661	684	655	668
† Sardegna [W1,E]	525	541	584	581	600
Non-PdR regions	517	554	566	546	563
PdR Wave-1 regions	706	726	713	699	733
Light PdR regions	585	652	659	634	644

Values are period means of annual per-capita expenditure (EUR) over the three years within each period. † Special-statute regions. Superscripts: W1 PdR from 2007; W2 PdR from 2009; W3 PdR from 2010; E exited before 2018. *Non-PdR*: Lombardia, Veneto, Emilia-Romagna, Toscana, Umbria, Marche, Basilicata. *PdR Wave-1*: Lazio, Abruzzo, Molise, Campania. *Light PdR*: Piemonte, Puglia (lighter/shorter plans; entered 2010).

5.2 Political economy of the fiscal adjustment

The persistence of excess SSN-contracted expenditure in the face of nominally binding recovery plans is not incidental. It reflects structural features of the pre-PdR fiscal regime and the political economy of private provider relationships that the plans, as designed and implemented, were not equipped to overcome. The theoretical baseline is provided by Piacenza and Turati (2014), who use a stochastic frontier model to separate efficient from inefficient regional health spending and find that bailout expectations affect only the inefficient component, leaving the efficient, quality-producing component untouched. The normative prediction is straightforward: well-designed fiscal discipline should eliminate waste without compressing structural inputs. The question is why PdRs diverged from this prediction.

The pre-PdR regime created strong incentives to overspend. Bordignon and Turati (2009) show that Italian regional health expenditure responded to bailout expectations rather than to underlying medical need, and that the central government's repeated deficit bail-outs prior to 2005 validated those expectations. A further structural layer is identified by Di Novi et al. (2019): because own revenues (IRAP and *addizionale* IRPEF) covered only about 10–15% of health spending in southern regions, compared with roughly 50% in Centre-Northern ones, fiscal accountability was structurally weak precisely where spending discipline was most needed. Where own revenues are negligible, the incentive to overspend through opaque SSN-contracted channels faces no effective electoral constraint, since the cost falls primarily on central transfers rather than local taxpayers. The excess in SSN-contracted expenditure is the natural result of this environment: bilateral agreements with private providers, national DRG tariffs with effectively uncapped volumes, and accumulated contractual obligations that became politically difficult to unwind. PdRs formally included instruments to address this, notably centralised procurement through *Centrali Uniche di Acquisto* and tighter spending caps on accredited private providers (Aimone Gigio et al., 2018). But these were implemented slowly, inadequately, or not at all. In Lazio and Campania, for instance, protracted litigation with accredited private providers delayed contract renegotiation for years.

Against this backdrop, the hiring freeze emerged as the path of least resistance. Law 191/2009 introduced an automatic staffing ban for regions failing to meet their PdR targets, requiring no negotiation, no procurement reform, and no legal challenge from private provider interest groups. Personnel was the second-largest budget line and the only major expenditure category that could be reduced at essentially zero administrative cost in the short run, thus functioning as a sort of emergency brake for healthcare expenditure. The paradox is that personnel was not the source of the problem. As the expenditure tables show, Wave-1 regions already spent less on personnel per capita than non-PdR regions before the plans began. The hiring freeze was therefore an instrument applied to a component with no structural excess, while the component with the large structural excess persisted.

5.3 A real but avoidable trade-off: staffing, quality, and out-migration

The results reported in Chapter 4 document a persistent reduction in SSN personnel in most treated regions, followed in many cases by a significant increase in patient out-migration. Taken together with the findings of Section 5.1 and Section 5.2, they point to a clear conclusion: the plans did generate a trade-off between fiscal sustainability and service quality, but this trade-off was not inherent to fiscal consolidation. It was the direct consequence of compressing a budget line that was not the source of the problem, while leaving the true structural excess untouched. This section traces the causal chain from staffing to quality to out-migration, situates the SCM results within the existing literature, and examines what the regional heterogeneity reveals about the conditions under which the chain operates.

The international evidence establishes the staffing-to-quality link at the clinical level. Needleman et al. (2011) exploit shift-by-shift variation in nurse staffing and find a significant association between below-target nurse staffing and increased in-hospital mortality. Aiken et al. (2014) draw on data from over 400,000 surgical patients across 300 hospitals in nine European countries and find that each additional patient per nurse increases 30-day surgical mortality by 7%, an effect that holds after adjusting for hospital and patient characteristics, and frame their results explicitly as a warning against staffing cuts motivated by austerity. Aiken et al. (2014) also find that a higher share of degree-educated nurses independently reduces mortality, which is relevant here: the hiring freeze produced a marked ageing of the medical workforce in PdR regions, where the share of doctors under 50 fell from 46% in 2006 to 24% in 2015, against a decline from 50 to 39% in non-PdR regions (Aimone Gigio et al., 2018). An older workforce is less likely to hold up-to-date clinical training, and is also less able to sustain the high workloads and stress that characterise the medical profession, particularly in under-resourced settings, so the skill-composition effect of the freeze represents a further, less visible channel through which service quality may have deteriorated.

The Italian evidence connecting quality deterioration to patient mobility was already reviewed in Section 3.1. Arcà et al. (2020) show, using PdR assignment as an instrument for per-capita spending, that the plans produced workforce employment falls of around 4% alongside hospital bed cuts of around 6.5%, with a resulting decline in hospitalisations and a significant rise in cross-regional care-seeking. Beraldo et al. (2023) interpret patient out-migration as a reliable indicator of perceived poor service quality and find that it increases significantly under commissioner-led plans through the same beds-and-workforce compression mechanism. Balia et al. (2018) establish that supply-side features, particularly hospital capacity and performance, are the dominant determinants of inter-regional patient flows, so depleting them in PdR regions directly alters the structural conditions that govern where patients seek care. At the aggregate level, the *indice di fuga* (the share of residents who seek inpatient care outside their home region) rose from 4.7% in 2007 to 5.9% in 2015 in PdR regions, while remaining stable at 1.7% in non-PdR regions throughout (Aimone Gigio et al., 2018). The SCM results add region-level texture to this picture that the aggregate literature cannot provide, and the ten treated regions fall into four groups whose patterns are mutually coherent.

The first and clearest group consists of Abruzzo, Calabria, Liguria, and Molise, where the full causal chain is operative: a significant personnel reduction is followed, with a plausible lag, by a significant out-migration increase. This applies across very different institutional settings, which strengthens the interpretation. The Liguria result is particularly informative on mechanism: because the plan was short (2007–2010) and the region exited without a commissioner, the out-migration effect cannot be attributed to prolonged enforcement intensity or concurrent hospital network cuts, suggesting that workforce compression alone is sufficient to trigger a detectable mobility response. Molise's pattern, where out-migration rises significantly only from 2016 onwards despite personnel compression beginning in 2009, illustrates that the mobility response may require cumulative capacity deterioration to build above a threshold before it becomes detectable, a dynamic relevant for regions that already carry structurally high baseline out-migration rates.

Campania and Lazio present a more nuanced picture. Both show significant personnel reductions, though the convex hull constraint discussed in Section 4.2 prevents any weighted combination of donors from fully reproducing their pre-treatment trajectories, yielding elevated pre-treatment RMSPEs. As noted in Section 4.3, the standardised test already penalises poor pre-treatment fit, so the significance provides some evidence on the direction of the effect; the estimated magnitudes, however, cannot be taken at face value. Their out-migration results diverge, and the difference is institutional rather than statistical. Campania entered the

PdR with hospital bed supply already below the national benchmark, and its plan focused on reducing inappropriate use rather than cutting infrastructure. The region had therefore likely already absorbed most of its potential mobility response before treatment, leaving little margin for a further detectable shift. Lazio, by contrast, entered with substantially more hospital infrastructure in place, and shows a significant out-migration effect, but only from 2013 onwards, when hospital network reorganisation was finally enacted on top of the earlier personnel compression. The Lazio result therefore suggests that workforce reduction and structural bed cuts need to operate jointly to push out-migration above a detectable threshold, and Campania, where the infrastructure channel was largely absent, is consistent with this reading.

The third group, Piemonte and Puglia, shows no significant effect on either outcome. This is the expected result for regions that entered voluntarily, operated without commissioners, and deployed only partial workforce constraints. The null results lend internal consistency to the overall picture: the mechanism predicts no effect where inputs were not meaningfully compressed.

The fourth group, Sardegna and Sicilia, requires a distinction. Sicilia shows no significant effect on either outcome. The absence of personnel compression is attributable to Special Statute autonomy and the absence of a commissioner, which gave the region substantially more discretion in deferring workforce provisions; with the first link in the chain not materialising, the null out-migration result follows directly, reinforced by the structural barrier of island geography. Sardegna tells a more precise story: a significant personnel gap opens during the three years the region is formally under the PdR (2007–2010), then closes once it invokes its Special Statute to exit. No significant out-migration effect is detected at any point, reflecting both the brevity of the intervention and the physical cost of mainland travel. Sardegna's trajectory functions as a near-natural experiment within the sample, tracing the plan's timeline with unusual precision. The island geography point carries a broader implication. The mobility channel that operates on the continent cannot function where physical barriers to exit are binding. This does not mean island residents are unaffected by capacity compression; it means the harm takes a form that out-migration rates cannot capture, and that the welfare cost may in fact be larger, since residents who cannot seek care elsewhere must absorb the quality deterioration locally.

The equity dimension is relevant more broadly. Even on the continent, the capacity to bear the cost of healthcare travel is unevenly distributed across socioeconomic groups (Arcà et al., 2020). The regions most affected by the plans are predominantly in the South, where incomes are lower and private substitutes fewer. Out-migration is therefore not merely a quality signal; it also reflects a redistribution of the burden of quality deterioration towards those least able to manage it.

Chapter 6

Conclusion

This thesis has examined the causal effects of Italy's *Piani di Rientro* on two outcomes: SSN personnel per 1,000 inhabitants and patient out-migration as a share of the regional population. Using the Synthetic Control Method applied separately to each of ten treated regions, it has produced region-specific estimates across a panel extending from the mid-1990s to 2022–2023, a time horizon long enough to assess both the sustained effects of enforcement and the persistence of those effects after plans were lifted or enforcement softened.

Two findings stand out.

The first concerns the effects on personnel and out-migration. Significant, persistent SSN personnel reductions are detected in eight of the ten treated regions, with gaps of 1 to 4 fewer employees per 1,000 inhabitants relative to the counterfactual. Significant increases in out-migration appear only in a subset of regions, but where they emerge they are sizeable: 1 to 7 percentage points above the counterfactual. In four of these regions (Abruzzo, Calabria, Liguria, and Molise), the full causal chain is operative: personnel compression is followed, with a plausible lag, by a significant increase in patient out-migration. Campania and Lazio both show significant personnel reductions (though the convex hull constraint inflates the pre-treatment RMSPE for both regions, so the direction of the effect is better supported than the magnitude), but, interestingly, their out-migration results diverge. In Campania, no significant out-migration effect is detected at any point: the region entered the PdR with hospital bed supply already below the national benchmark, and the plan focused on reducing inappropriate use rather than cutting infrastructure, so the marginal compression of accessible services was not sufficient to trigger a detectable mobility shift. In Lazio, out-migration rises significantly but only from 2013 onwards, when hospital network reorganisation was finally enacted on top of the earlier workforce compression, consistent with the hypothesis that both channels must operate jointly to push mobility above a detectable threshold. Piemonte and Puglia show no significant effect on either outcome, as expected given their voluntary entry and the absence of a commissioner. Sardegna shows a significant personnel reduction during the three years the plan was formally active, but no significant out-migration effect at any point: the brevity of the intervention and the physical cost of mainland travel precluded a detectable mobility response even where staffing was genuinely compressed. Sicilia shows no significant effect on either outcome: Special Statute autonomy and the absence of a commissioner afforded the region considerably more discretion in deferring workforce provisions, so the first link in the causal chain did not materialise, and island geography would have suppressed the mobility response in any case.

The second finding is that fiscal consolidation was achieved, but through the wrong expenditure margin. Wave-1 PdR regions moved from an average operating deficit of 13.6% in 2006 to near-balance by 2018. That turnaround, however, was driven primarily by a compression of personnel spending, a component in which treated regions had no pre-existing excess: in 2004–06, Wave-1 regions already spent less on personnel per capita (€551) than non-PdR regions (€567). The component that did exhibit a large structural excess, spending with SSN-contracted private providers (a gap of roughly €189 per capita at baseline), remained essentially unchanged throughout the entire programme. Plans formally included instruments to address this excess, but these were implemented slowly or not at all, while the automatic hiring freeze introduced by Law 191/2009 provided an immediately enforceable alternative requiring no negotiation and no legal confrontation with private providers. The result was fiscal convergence achieved at the cost of compressing the quality-sensitive input rather than the wasteful one.

Taken together, these findings support a clear normative conclusion, stated most precisely by Piacenza and Turati (2014): well-designed fiscal consolidation should compress only inefficient spending, leaving structural, quality-producing inputs intact. The PdRs did not achieve this. They compressed personnel that was already at or below the non-PdR baseline, while the large structural excess in SSN-contracted expenditure persisted. The trade-off between fiscal sustainability and healthcare quality was real, but it was not inherent to the consolidation objective: it followed directly from the political choice of instrument.

Three limitations of the analysis should inform how the results are read and extended. First, for the three regions that exited the programme before the end of the observation window

(Liguria and Sardegna in 2010, Piemonte in 2017), the estimated gap between treated and synthetic control after exit no longer has a clean causal reading: it reveals how persistent the effects are once the plan is lifted, but cannot separate the contribution of the PdR itself from subsequent regional choices or concurrent shocks. Second, COVID-19 struck Italian regions with markedly different timing and severity, complicating the causal reading of post-2019 estimates; these are retained as descriptive complements rather than causal evidence. Third, for Campania and Lazio the personnel rate lies below the range of the donor pool, so the convex hull constraint prevents any weighted combination of donors from fully reproducing their pre-treatment trajectory. The standardised permutation test already penalises this poor fit, and a visible post-treatment discontinuity in the time series supports the direction of the estimated effects; the magnitudes, however, should be treated with caution.

Three directions for future research follow naturally from these findings. The first is a causal evaluation of the SSN-contracted private expenditure channel: the evidence assembled here establishes that this component was the structural source of the pre-PdR excess and that it was not effectively restrained, but whether and when specific procurement reforms reduced it, and at what cost to service continuity, remains to be assessed. The second concerns the workforce ageing effect. The hiring freeze compressed not only the level of staffing but its age composition: in PdR regions the share of doctors under 50 fell from 46% in 2006 to 24% in 2015 (Aimone Gigio et al., 2018). The long-run consequences of this demographic shift for clinical quality and institutional capacity represent a persistent cost of the plans that the personnel rate alone does not capture, and that will likely continue to accumulate well beyond the period studied here. The third direction concerns the distributional consequences of the plans. The evidence assembled here documents average regional effects, but leaves open whether the burden of supply compression fell uniformly across the socioeconomic distribution. Lower-income patients have limited access to private alternatives and are therefore most exposed to rationing in a contracting public system. Applying the SCM to regional time series of a needs-adjusted concentration index for hospitalisation and outpatient service use would deliver the first region-specific causal estimates of whether PdR-induced cuts worsened inequality in healthcare access.

Appendix

A. Data preparation. Each indicator can be downloaded from the Istat *Health for All* database (Istat, 2023) as a univariate time-series panel in .txt format, with regions as rows and years as columns. These files are converted to .csv and imported into Stata, where `data_preparation_HAF_(1).do` handles all subsequent processing. A dedicated program, `import_wide_csv`, reads each file, drops the two-row header block, retains only the 20 Italian regions (discarding national and macro-regional aggregates), renames the year columns to their numeric values, and reshapes the data from wide to long, yielding one intermediate `.dta` file per variable. The two main outcome variables are the personnel rate (`personnel`, Istat code 9110) and the out-migration rate (`out_migr`, Istat code 7343). In addition, a broader set of variables is imported from the same database for descriptive purposes and to assess the pre-treatment covariate balance between PdR and donor regions: these include indicators of expenditure and fiscal pressure, supply and quality of healthcare services, demographic structure, socioeconomic conditions, and health status. All datasets are merged on the region-by-year key and the panel structure is declared with `xtset`.

One data irregularity requires attention. The personnel indicator presents a systematic reporting gap in 2014 and 2015 for all 20 Italian regions, a known absence in the Istat source data not specific to any individual region. To fill these two missing years, linear interpolation is applied between the last observed value in 2013 and the first post-gap value in 2016 using Stata's `ipolate` command, placing the interpolated values at $\hat{y}_{2014} = y_{2013} + \frac{1}{3}(y_{2016} - y_{2013})$ and $\hat{y}_{2015} = y_{2013} + \frac{2}{3}(y_{2016} - y_{2013})$. This approach is justified by the nature of the variable: personnel rates are slow-moving by construction. The denominator, regional population, is effectively stable given Italy's demographic stagnation over this period. The numerator, SSN headcount, changes gradually because public employees such as doctors and nurses enjoy strong employment protections and cannot easily be dismissed: in practice, workforce reduction under PdRs operated almost exclusively through attrition, as retiring staff were not replaced. Sudden discontinuities in the series are also unlikely from a legislative standpoint:

unlike 2010, when the nationwide hiring freeze was introduced, or 2012, when the spending review imposed a further round of cuts, no comparable policy shock falls in 2014 or 2015. There are therefore no grounds to expect sudden spikes or drops in either year, making linear interpolation between adjacent observed values a reasonable and conservative choice. Since both boundary years are observed for all regions, no extrapolation is required. After interpolation, no missing values remain in the 1994–2022 window. The out-migration variable presents no systematic gaps in its 1999–2023 window. The final dataset is a balanced panel covering all 20 Italian regions and all available years for each variable.

B. SCM implementation in Stata. The `synth_runner` command of Galiani and Quistorff (2017) extends `synth` of Abadie et al. (2010) by automating the process of running placebo estimations, computing p-values, and producing diagnostics. For each call, it estimates the main SCM for the treated unit, then replicates the same estimation for each donor unit in turn, treating it as if it had received the treatment at the same time, and uses the resulting distribution of placebo effects to compute the four p-values described in Section 3.3. The p-value used throughout this thesis is the per-period standardised $p_t^{(4)}$, stored by `synth_runner` in the matrix `e(pvals_std)`. A representative call, for Abruzzo and the personnel rate, takes the following form:

```
synth_runner personnel                                ///
    personnel(1994) personnel(1995) personnel(1996)   ///
    personnel(1997) personnel(1998) personnel(1999)   ///
    personnel(2000) personnel(2001) personnel(2002)   ///
    personnel(2003) personnel(2004) personnel(2005)   ///
    personnel(2006),                                  ///
    trunit(13) trperiod(2007)
```

The dependent variable is `personnel`, the treated unit is Abruzzo (identified by its panel code in `trunit`), and the treatment year is `trperiod(2007)`. The predictors are the annual pre-treatment values of the personnel rate from 1994 to 2006, which serve as the sole matching criterion. As discussed in Section 3.3, using only lagged outcomes with $\mathbf{V} = \mathbf{I}$ means the weights are chosen to minimise the uniformly weighted pre-treatment RMSPE of the outcome, without assigning differential importance to any particular year. The same structure is repeated for all ten treated regions and both outcomes, substituting the relevant outcome variable, region identifier, and pre-treatment lag sequence, and adjusting the treatment year to 2007, 2009 or 2010 depending on the wave to which the specific region belongs.

C. SCM weights. Tables C.1 and C.2 report the donor weights assigned by the SCM for each treated region for the personnel and out-migration outcomes respectively. In no case does the synthetic control collapse to a single donor unit, confirming that the estimator produces genuine convex combinations of the donor pool rather than degenerate nearest-neighbour matches. The weights are nonetheless unevenly distributed across outcomes and regions. For personnel, the controls for Campania, Lazio, Puglia, and Sicilia draw exclusively on Basilicata and Lombardia, reflecting the floor effect discussed in Section 4.2: since these regions' personnel rates lie near or below the lower bound of the donor pool, the SCM assigns most weight to the two donors that come closest to that floor, one southern and one northern. For out-migration, the weights are generally more dispersed across the donor pool, consistent with the more uniformly good pre-treatment fit documented for this outcome. Basilicata receives substantial weight in several southern treated regions for both outcomes, as the only southern donor, which further motivates the caution expressed in Section 4.1 regarding the synthetic controls for those regions.

Table C.1: SCM donor weights for 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**				**0.20**
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**	**0.20**	
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**						

Specification: lagged outcomes only (all pre-treatment years used as predictors). Weights are non-negative and sum to 1 within each treated region (up to rounding). Non-zero weights are in **bold**; zero weights are left blank. Weights depend only on pre-treatment data. Donor headings use abbreviations: 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 C.2: SCM donor weights for 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**				**0.23**		
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**						

Specification: lagged outcomes only (all pre-treatment years used as predictors). Weights are non-negative and sum to 1 within each treated region (up to rounding). Non-zero weights are in **bold**; zero weights are left blank. Weights depend only on pre-treatment data. Donor headings use abbreviations: 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. Fake-outcome placebo. Table D.1 and Figure D.1 present the full results of the placebo exercise described in Section 4.3. The outcome is the total fertility rate, from the Istat Health for All database (Istat, 2023), observed over the full available series from 1980 to 2024 using the same specification as the main analysis.

For seven of the ten treated regions the results are consistent with the absence of any PdR effect on fertility. Four regions, Abruzzo, Lazio, Liguria, and Molise, show good pre-treatment fit and post-treatment effects that are close to zero and statistically insignificant throughout. Calabria, Puglia, and Sardegna display somewhat larger pre-treatment RMSPEs, reflecting that their fertility trajectories are harder to reproduce from the available donor pool. This imperfect fit does not compromise the validity of the null results: as discussed in Section 4.3, a higher pre-treatment RMSPE enters the denominator of the standardised effect $p_t^{(4)}$ (Galiani & Quistorff, 2017), making significance harder to achieve for these regions rather than easier. The post-treatment effects for all three remain statistically insignificant, confirming that the test is functioning as intended.

Piemonte is a partial exception, showing isolated significant effects in 2010 and 2018, and then from 2022 to 2024. Two features of the estimation suggest this should not be read as evidence of a genuine PdR effect on fertility. First, Piemonte has the lowest pre-treatment RMSPE in the sample, meaning the denominator of the post-to-pre ratio is very small; even minor random deviations in the post-treatment period therefore produce mechanically large standardised ratios. Second, the cluster of significant results in 2022–2024 coincides with the post-COVID period, during which Piemonte's fertility trajectory may have diverged from its synthetic control for demographic reasons entirely unrelated to the PdR, which had ended in 2017. The absolute size of the estimated effects, at most around 0.05 children per woman, is small in substantive terms compared to a baseline between 1.0 and 1.5.

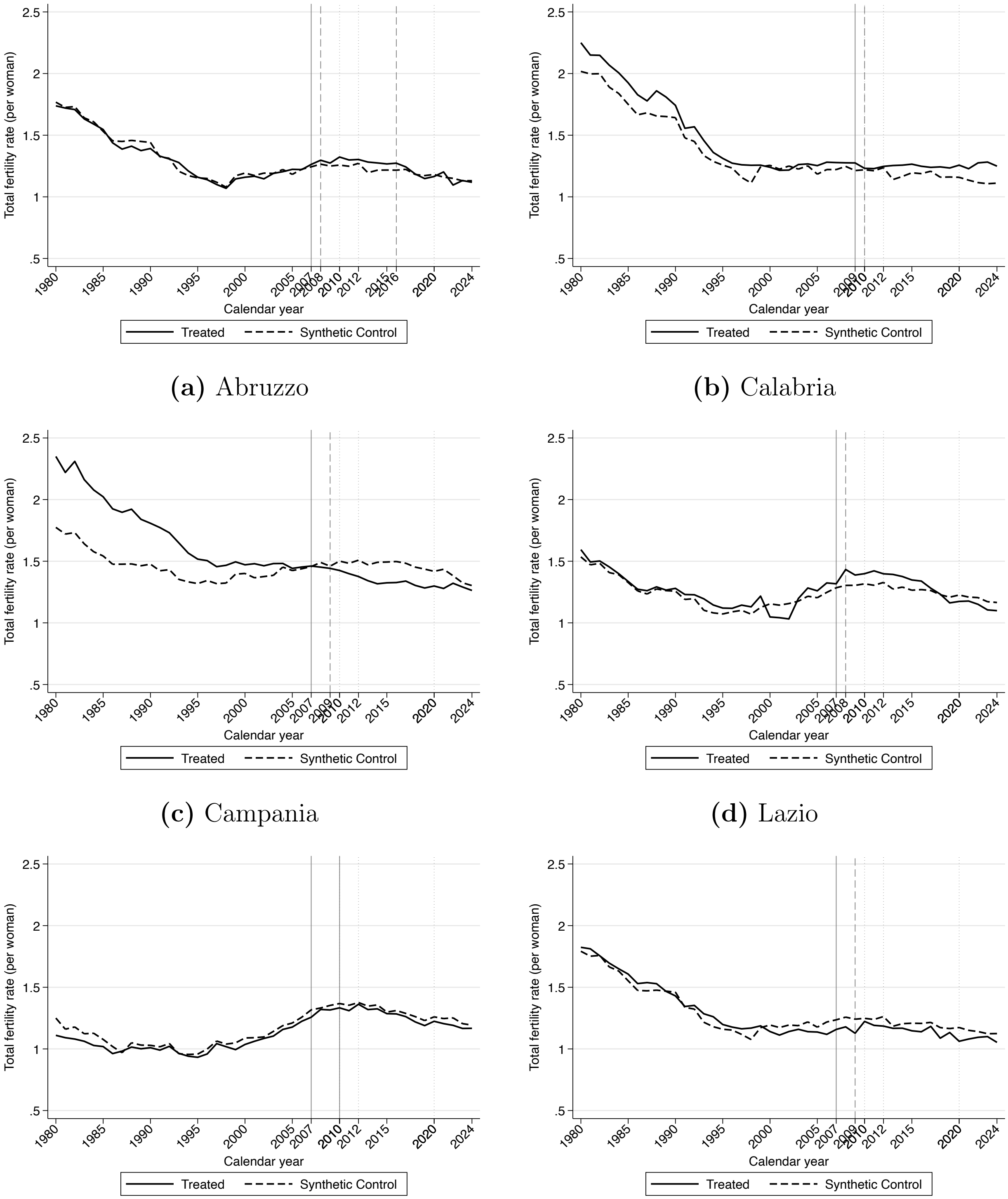
The remaining two regions must be excluded from inference on methodological grounds. Campania and Sicilia both have pre-treatment RMSPEs that are far above the rest of the sample, at 0.33 and 0.24 respectively, reflecting that their fertility trajectories lie outside the convex hull of the donor pool throughout the pre-treatment period. No convex combination of the ten donors can reproduce these trajectories, so the synthetic controls are not valid counterfactuals and the permutation test provides no meaningful inference for either region.

Table D.1: Placebo SCM estimated effects on total fertility rate (per woman)

Year	ABR	CAL	CAM	LAZ	LIG	MOL	PIE	PUG	SAR	SIC
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	0.0330	0.1167	0.3334	0.0583	0.0519	0.0522	0.0183	0.1058	0.1089	0.2352

Effects: treated outcome − synthetic control outcome. Significance stars are based on the per-period standardised p-value $p_t^{(4)}$ of Galiani & Quistorff (2017): for each post-treatment year, the fraction of the $J = 10$ placebo regions whose standardised effect (absolute gap divided by pre-treatment RMSPE) meets or exceeds the treated region's. ***: $p = 0.0$, no placebo region meets or exceeds the treated region in that year. *: $p = 0.1$, exactly one placebo region does. *pre-RMSPE*: root mean squared prediction error in the pre-treatment period (measure of synthetic control fit). Region headings use abbreviations: ABR = Abruzzo, CAL = Calabria, CAM = Campania, LAZ = Lazio, LIG = Liguria, MOL = Molise, PIE = Piemonte, PUG = Puglia, SAR = Sardegna, SIC = Sicilia.

Figure D.1: Placebo SCM on total fertility rate



(a) Abruzzo

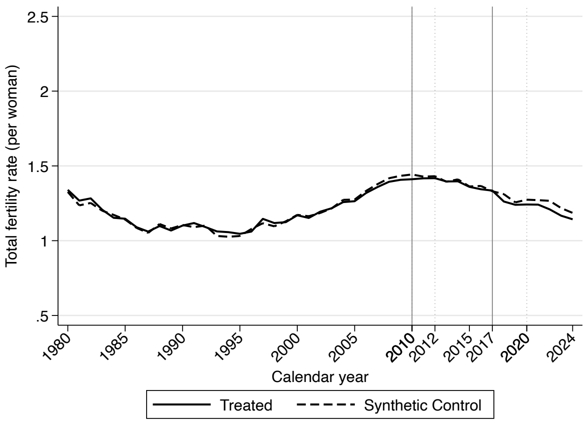
(b) Calabria

(c) Campania

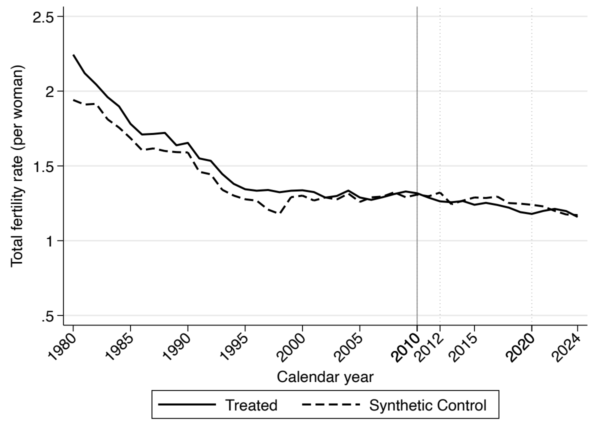
(d) Lazio

(e) Liguria

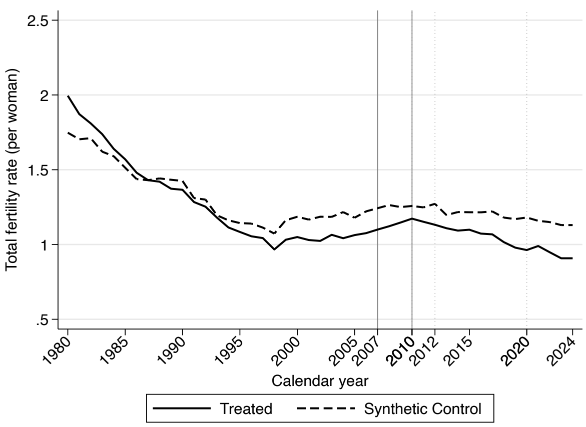
(f) Molise



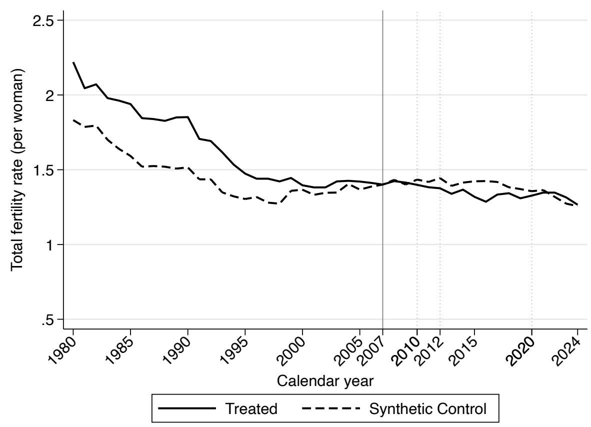
(g) Piemonte



(h) Puglia



(i) Sardegna



(j) Sicilia

References

Abadie, A., Diamond, A., & Hainmueller, J. (2010). Synthetic control methods for comparative case studies: Estimating the effect of california's tobacco control program. *Journal of the American Statistical Association*, *105*(490), 493–505. https://doi.org/10.1198/jasa.2009.ap08746

Abadie, A., & Gardeazabal, J. (2003). The economic costs of conflict: A case study of the basque country. *American Economic Review*, *93*(1), 113–132. https://doi.org/10.1257/000282803321455188

Adhikari, B., Duval, R., Hu, B., & Loungani, P. (2018). Can reform waves turn the tide? some case studies using the synthetic control method. *Open Economies Review*, *29*(4), 879–910. https://doi.org/10.1007/s11079-018-9490-3

AGENAS. (2022, October 27). *Mobilità sanitaria interregionale* [Report published 27 October 2022 and updated in 2025]. Retrieved May 19, 2026, from https://stat.agenas.it/web/index.php?r=public%2Findex&report=10

Aiken, L. H., Sloane, D. M., Bruyneel, L., Van den Heede, K., Griffiths, P., Busse, R., Diomidous, M., Kinnunen, J., Kózka, M., Lesaffre, E., McHugh, M. D., Moreno-Casbas, M. T., Rafferty, A. M., Schwendimann, R., Scott, P. A., Tishelman, C., van Achterberg, T., & Sermeus, W. (2014). Nurse staffing and education and hospital mortality in nine european countries: A retrospective observational study. *The Lancet*, *383*(9931), 1824–1830. https://doi.org/10.1016/S0140-6736(13)62631-8

Aimone Gigio, L., Alampi, D., Camussi, S., Ciaccio, G., Guaitini, P., Lozzi, M., Mancini, A. L., Panicara, E., & Paolicelli, M. (2018). *La sanità in italia: Il difficile equilibrio tra vincoli di bilancio e qualità dei servizi nelle regioni in piano di rientro* (Occasional Papers No. 427). Banca d'Italia. https://www.bancaditalia.it/pubblicazioni/qef/2018-0427/index.html

Arcà, E., Principe, F., & van Doorslaer, E. (2020). Death by austerity? the impact of cost containment on avoidable mortality in italy. *SSRN Scholarly Paper*, (3529892). https://doi.org/10.2139/ssrn.3529892

Balia, S., Brau, R., & Marrocu, E. (2018). Interregional patient mobility in a decentralized healthcare system. *Regional Studies*, *52*(3), 388–402. https://doi.org/10.1080/00343404.2017.1307954

Beraldo, S., Collaro, M., & Marino, I. (2023). Patient migration as a response to the regulation of subnational healthcare budgets. *Regional Studies*, *57*(11), 2207–2219. https://doi.org/10.1080/00343404.2023.2171379

Billmeier, A., & Nannicini, T. (2013). Assessing economic liberalization episodes: A synthetic control approach. *Review of Economics and Statistics*, *95*(3), 983–1001. https://doi.org/10.1162/REST_a_00324

Bordignon, M., Coretti, S., Piacenza, M., & Turati, G. (2020). Hardening subnational budget constraints via administrative subordination: The italian experience of recovery plans in regional health services. *Health Economics*, *29*(11), 1378–1399. https://doi.org/10.1002/hec.4138

Bordignon, M., & Turati, G. (2009). Bailing out expectations and public health expenditure. *Journal of Health Economics*, *28*(2), 305–321. https://doi.org/10.1016/j.jhealeco.2008.12.008

Borusyak, K., Jaravel, X., & Spiess, J. (2021). Revisiting event study designs: Robust and efficient estimation. *arXiv preprint arXiv:2108.12419*.

Brenna, E. (2011). Quasi-market and cost-containment in beveridge systems: The lombardy model of italy. *Health Policy*, *103*(2), 209–218. https://doi.org/10.1016/j.healthpol.2011.10.003

Brenna, E., & Spandonaro, F. (2015). Regional incentives and patient cross-border mobility: Evidence from the italian experience. *International Journal of Health Policy and Management*, *4*(6), 363–372. https://doi.org/10.15171/ijhpm.2015.65

Callaway, B., & Sant'Anna, P. H. C. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, *225*(2), 200–230. https://doi.org/10.1016/j.jeconom.2020.12.001

Ciaccio, A. (2023). The impact of a cost-containment measure on the quality of regional health services in italy: A parametric and a non-parametric approach. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4603295

Cirulli, V., & Marini, G. (2023). Are austerity measures really distressing? evidence from italy. *Economics & Human Biology*, *49*, 101217. https://doi.org/10.1016/j.ehb.2022.101217

Cunningham, S. (2021). *Causal inference: The mixtape*. Yale University Press. https://doi.org/10.2307/j.ctv1c29t27

de Belvis, A. G., Meregaglia, M., Adduci, A., Perilli, A., Cascini, F., Solipaca, A., Fattore, G., Ricciardi, W., Maresso, A., & Scarpetti, G. (2022). *Italy: Health system review* (Health Systems in Transition No. 4). European Observatory on Health Systems and Policies. https://eurohealthobservatory.who.int/publications/i/italy-health-system-review-2022

de Chaisemartin, C., & d'Haultfoeuille, X. (2022). Two-way fixed effects and differences-in-differences with heterogeneous treatment effects: A survey. *The Econometrics Journal*, *26*(3), C1–C30. https://doi.org/10.1093/ectj/utac017

Depalo, D. (2019). The side effects on health of a recovery plan in italy: A nonparametric bounding approach. *Regional Science and Urban Economics*, *78*, 103466. https://doi.org/10.1016/j.regsciurbeco.2019.103466

Di Novi, C., Piacenza, M., Robone, S., & Turati, G. (2019). Does fiscal decentralization affect regional disparities in health? quasi-experimental evidence from italy. *Regional Science and Urban Economics*, *78*, 103465. https://doi.org/10.1016/j.regsciurbeco.2019.103465

Di Novi, C., & Salari, P. (2026). Shaping soft drinks: Sugar taxes, consumption, and reformulation in europe. *SSRN Scholarly Paper*, (6718350). https://doi.org/10.2139/ssrn.6718350

Fattore, G. (1999). Clarifying the scope of italian nhs coverage. is it feasible? is it desirable? *Health Policy*, *50*(1–2), 123–142. https://doi.org/10.1016/S0168-8510(99)00068-8

Fattore, G., Petrarca, G., & Torbica, A. (2014). Traveling for care: Inter-regional mobility for aortic valve substitution in italy. *Health Policy*, *117*(1), 90–97. https://doi.org/10.1016/j.healthpol.2014.03.002

Ferman, B., Pinto, C., & Possebom, V. (2020). Cherry picking with synthetic controls. *Journal of Policy Analysis and Management*, *39*(2), 510–532. https://doi.org/10.1002/pam.22206

France, G., Taroni, F., & Donatini, A. (2005). The italian health-care system. *Health Economics*, *14*(S1), S187–S202. https://doi.org/10.1002/hec.1035

Galiani, S., & Quistorff, B. (2017). The synth_runner package: Utilities to automate synthetic control estimation using synth. *The Stata Journal*, *17*(4), 834–849. https://doi.org/10.1177/1536867X1801700404

Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, *225*(2), 254–277. https://doi.org/10.1016/j.jeconom.2021.03.014

Guccio, C., Pignataro, G., & Vidoli, F. (2024). It never rains but it pours: Austerity and mortality rate in peripheral areas. *Economics & Human Biology*, *54*, 101408. https://doi.org/10.1016/j.ehb.2024.101408

Hernandez Carballo, I., Bakola, M., & Stuckler, D. (2022). The impact of air pollution on covid-19 incidence, severity, and mortality: A systematic review of studies in europe and north america [Epub 2022 Aug 27. PMID: 36030916; PMCID: PMC9420033]. *Environmental Research*, *215*(Part 1), 114155. https://doi.org/10.1016/j.envres.2022.114155

Holland, P. W. (1986). Statistics and causal inference. *Journal of the American Statistical Association*, *81*(396), 945–960. https://doi.org/10.1080/01621459.1986.10478354

Istat. (2023). *Health for all - italia* [Dataset. Published December 2023. Updated 1 April 2025]. Retrieved May 6, 2026, from https://www.istat.it/sistema-informativo-6/health-for-all-italia/

Kraemer, R., & Lehtimäki, J. (2024). Government debt, european institutions and fiscal rules: A synthetic control approach. *International Tax and Public Finance*, *31*(4), 1112–1157. https://doi.org/10.1007/s10797-023-09791-z

Kurz, C. F., & König, A. N. (2021). The causal impact of sugar taxes on soft drink sales: Evidence from france and hungary. *The European Journal of Health Economics*, *22*(6), 905–915. https://doi.org/10.1007/s10198-021-01297-x

Longo, F. (2016). Lessons from the italian nhs retrenchment policy. *Health Policy*, *120*(3), 306–315. https://doi.org/10.1016/j.healthpol.2016.02.001

Manski, C. F., & Pepper, J. V. (2018). How do right-to-carry laws affect crime rates? coping with ambiguity using bounded-variation assumptions. *Review of Economics and Statistics*, *100*(2), 232–244. https://doi.org/10.1162/REST_a_00689

Ministero della Salute. (2025, January 13). *Piani di rientro. punto della situazione*. https://www.salute.gov.it/new/it/tema/piani-di-rientro/il-punto-della-situazione/

Needleman, J., Buerhaus, P., Pankratz, V. S., Leibson, C. L., Stevens, S. R., & Harris, M. (2011). Nurse staffing and inpatient hospital mortality. *New England Journal of Medicine*, *364*(11), 1037–1045. https://doi.org/10.1056/NEJMsa1001025

Nolte, E., & McKee, M. (2004). *Does health care save lives? avoidable mortality revisited*. The Nuffield Trust.

Piacenza, M., & Turati, G. (2014). Does fiscal discipline towards subnational governments affect citizens' well-being? evidence on health. *Health Economics*, *23*(2), 199–224. https://doi.org/10.1002/hec.2910

Pinotti, P. (2015). The economic costs of organised crime: Evidence from southern italy. *The Economic Journal*, *125*(586), F203–F232. https://doi.org/10.1111/ecoj.12235

Ragioneria Generale dello Stato. (2020). *Il monitoraggio della spesa sanitaria, rapporto n. 7*. Ministero dell'Economia e delle Finanze. Roma.

Ragioneria Generale dello Stato. (2025). *Il monitoraggio della spesa sanitaria, rapporto n. 12*. Ministero dell'Economia e delle Finanze. Roma.

Ricciardi, W., & Tarricone, R. (2021). The evolution of the italian national health service. *The Lancet*, *398*(10317), 2193–2206. https://doi.org/10.1016/S0140-6736(21)01733-5

Rieger, M., Wagner, N., & Bedi, A. S. (2017). Universal health coverage at the macro level: Synthetic control evidence from thailand. *Social Science & Medicine*, *172*, 46–55. https://doi.org/10.1016/j.socscimed.2016.11.022

Rubin, D. B. (1974). Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology*, *66*(5), 688–701. https://doi.org/10.1037/h0037350

Tediosi, F., Gabriele, S., & Longo, F. (2009). Governing decentralization in health care under tough budget constraint: What can we learn from the italian experience? *Health Policy*, *90*(2–3), 303–312. https://doi.org/10.1016/j.healthpol.2008.10.012

Wooldridge, J. M. (2021). Two-way fixed effects, the two-way mundlak regression, and difference-in-differences estimators. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3906345

List of Legislation

Legge 23 dicembre 1978, n. 833. *Gazzetta Ufficiale della Repubblica Italiana*, 28 dicembre 1978. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:1978-12-23;833

Decreto Legislativo 30 dicembre 1992, n. 502. *Gazzetta Ufficiale della Repubblica Italiana*, 30 dicembre 1992. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:1992-12-30;502

Decreto Legislativo 15 dicembre 1997, n. 446. *Gazzetta Ufficiale della Repubblica Italiana*, 23 dicembre 1997, n. 298, Suppl. Ordinario n. 252. Entrata in vigore della legge: 1 gennaio 1998. Ultimo aggiornamento all'atto pubblicato il 27 marzo 2026. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:1997-12-15;446

Decreto Legislativo 18 febbraio 2000, n. 56. *Gazzetta Ufficiale della Repubblica Italiana*, 15 marzo 2000, n. 62. Entrata in vigore del decreto: 30 marzo 2000. Ultimo aggiornamento all'atto pubblicato il 5 febbraio 2025. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legislativo:2000;56

Legge Costituzionale 18 ottobre 2001, n. 3. *Gazzetta Ufficiale della Repubblica Italiana*, 24 ottobre 2001, n. 248. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge.costituzionale:2001-10-18;3

Decreto del Presidente del Consiglio dei Ministri 29 novembre 2001. *Gazzetta Ufficiale della Repubblica Italiana*, 8 febbraio 2002, n. 33. https://www.gazzettaufficiale.it/eli/id/2002/02/08/02A00907/sg

Legge 30 dicembre 2004, n. 311. *Gazzetta Ufficiale della Repubblica Italiana*, 31 dicembre 2004. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2004-12-30;311

Intesa del 23 marzo 2005. *Gazzetta Ufficiale della Repubblica Italiana*, 7 maggio 2005, n. 105. Retrieved April 25, 2026, from https://www.gazzettaufficiale.it/eli/id/2005/05/07/05A03665/sg

Legge 27 dicembre 2006, n. 296. *Gazzetta Ufficiale della Repubblica Italiana*, 27 dicembre 2006. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2006-12-27;296

Legge 23 dicembre 2009, n. 191. *Gazzetta Ufficiale della Repubblica Italiana*, 30 dicembre 2009. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2009-12-23;191

Legge 13 dicembre 2010, n. 220. *Gazzetta Ufficiale della Repubblica Italiana*, 21 dicembre 2010. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2010;220

Decreto-Legge 6 luglio 2012, n. 95. *Gazzetta Ufficiale della Repubblica Italiana*, 6 luglio 2012. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legge:2012-07-06;95

Legge 7 agosto 2012, n. 135. *Gazzetta Ufficiale della Repubblica Italiana*, 14 agosto 2012. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2012-08-07;135

Decreto-Legge 13 settembre 2012, n. 158. *Gazzetta Ufficiale della Repubblica Italiana*, 13 settembre 2012. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legge:2012-09-13;158

Legge 8 novembre 2012, n. 189. *Gazzetta Ufficiale della Repubblica Italiana*, 10 novembre 2012. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2012-11-08;189

Decreto 2 aprile 2015, n. 70. *Gazzetta Ufficiale della Repubblica Italiana*, 4 giugno 2015, n. 127. https://www.normattiva.it/uri-res/N2Ls?urn:nir:ministero.salute:decreto:2015-04-02;70

Decreto-Legge 23 ottobre 2018, n. 119. *Gazzetta Ufficiale della Repubblica Italiana*, 23 ottobre 2018. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legge:2018-10-23;119

Sentenza 22 ottobre 2019, n. 247. *Gazzetta Ufficiale della Repubblica Italiana*, 11 dicembre 2019, n. 50. Retrieved April 25, 2026, from https://www.gazzettaufficiale.it/eli/id/2019/12/11/T-190247/s1

Decreto-Legge 9 marzo 2020, n. 14. Entrata in vigore del provvedimento: 10 marzo 2020; ultimo aggiornamento all'atto pubblicato il 29 aprile 2020. *Gazzetta Ufficiale della Repubblica Italiana*, 9 marzo 2020, n. 62. https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:decreto.legge:2020-03-09;14