Containing costs in the Italian local healthcare market

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Keywords: cost containment, local health markets, goods, services.

Abstract

We aim to investigate the cost containment effects of the creation in 2005 of agencies specifically responsible for all technical and administrative services within the regional healthcare system of the Tuscany region of Italy. We seek to contribute to the existing literature on the centralisation and decentralisation of purchases and technical services by assessing the amount of savings produced by these agencies at the intermediate level between local authorities and hospitals and the regional administration. We use the balances of all Italian local health authorities and hospital trusts combined with the synthetic control procedure to create from a donor pool of untreated units a weighted average of observations resembling the exposed units before and after the policy change in 2005. The magnitude of the effect is significant as the creation of these agencies is estimated to have reduced expenditures on auxiliary goods and contracted services by 6% in the period from 2006-2014. Moreover, we find that the cost reduction is not associated with a decrease in the provision of healthcare services and procedures to the general population or in the quality or efficiency of the regional healthcare system itself.

Keywords: cost containment, local health markets, goods, services.

1 Introduction and institutional background

Industrialised countries are experiencing population ageing, which is one of the most powerful drivers of increased healthcare costs (Zweifel et al., 1999). There is a large body of literature that estimates the increase in healthcare costs in advanced economies due to population change, with some recent examples being Ha et al. (2014) in Australia, Rice and Howdon (2018) in the UK, Lopreite and Mauro (2017) in Italy, Sirven and Rapp (2017) in France, Gopffarth et al. (2015) in Germany, and, less recently, Meerding et al. (1998) in the Netherlands.

Moreover, unhealthy behaviours (Cawley and Ruhm, 2011) and macroeconomic downturns (see Ruhm, 2013 for an extensive review) play important roles in determining healthcare demand increases, with severe consequences for the associated healthcare costs. Governmental expenditures for the healthcare sector in Italy account for approximately 6.8% of the GDP, which is slightly below the European average (7.2% for EU-15 countries, EUROSTAT, 2020a). Italy has the second-highest life expectancy at birth among EU countries, equal to 83.4 years in 2018 (EUROSTAT, 2020b); is experiencing dramatic population ageing; and is still in the midst of an economic recession. Thus, it is necessary to account for all these dimensions from a policy perspective.

Although national accounts for the healthcare sector are balanced (Armeni et al., 2019), there are serious concerns about the sustainability of the Italian National Health System (NHS) in the near future; therefore, different strategies are necessary to maintain universal healthcare provision, particularly when regional differences or the precarious national economic situation are considered. The question that arises is whether this free access type of welfare provision will still be sustainable in the near future (Lopriete and Mauro, 2017), as population ageing is likely to (i) lower the government's net fiscal position through an increase in expenditures for pensions and a reduction in revenues from income taxation and (ii) contribute to increased healthcare service utilisation rates. The direct consequences of these factors justify a focus on healthcare cost containment policies, as it is becoming more crucial to keep public expenses under control and put forth even more effort in doing so than in past decades (Carone et al., 2012). Especially during the 1990s, but more generally in the last few decades, a change in course aimed at shifting health expenditures from national to local budgets has taken place (Hood, 1991), *de facto* abandoning the pre-existing rationale for direct and indirect controls on healthcare supply (Abel-Smith et al., 1994, Stabile et al., 2013).

The Italian NHS is funded through general taxation and provides full coverage, supplied by regional and local regulators. The NHS is made up of different levels, each of them with specific duties and tasks. The role played by the central government and Ministry of Health, alongside national health agencies, is to annually define and – when necessary – update a package of statutory health and health-related benefits, namely the "essential levels of care" (*Livelli Essenziali di Assistenza* – LEA), that local providers must grant and supply to the resident population in terms of level and quality of care, waiting times and effectiveness of treatments (Donatini, 2015); they are necessary to regulate ties between the central government and regional administrators (Torbica and Fattore, 2005). A constitutional reform in 2001 established regional autonomy in terms of the provision of healthcare services, generating great variability in the quality and overall efficiency of regional healthcare systems (Lo Scalzo et al., 2009). The NHS is, therefore, currently decentralised at the regional level, consisting of 19 regions and two independent autonomous provinces. Within the framework of autonomy, the regional and autonomous provincial administrations are free to decide on their own internal organisational structures, budgetary policies, rules for public-private mix and accreditation of private structures, strategic plans (e.g., building of new hospitals), number and geographical boundaries of local health authorities (LHAs) and the creation and regulation of teaching or research hospitals. LHAs are funded by regional administrations through a capitated budget and are responsible for a wide variety of services in geographical areas (France et al., 2005). Some regions, namely Valle d'Aosta, the Autonomous Province of Trento, the Autonomous Province of Bolzano, Marche and Molise, currently have only one LHA within their borders, as these regions are small, with few inhabitants. The heterogeneity in each regional healthcare market is undoubtedly considerable (France et al., 2005, Nuti et al., 2016), as regional administrations are also responsible for strategic planning, resource allocation and rules for co-payments from citizens (Lo Scalzo et al., 2009). Regional administrations can also decide whether public hospitals have to be directly managed by LHAs operating in the local geographical area in which the hospital is settled or, alternatively, are allowed to operate as independent trusts, generating another source of heterogeneity across regions. In both cases, however, hospitals are reimbursed according to their volumes of activity through a DRG-type system. Finally, as already hinted, in some regions, private hospitals can be recognised as public providers and have access to the same type of volume reimbursement scheme. Consequently, political and public debate regarding the regulation of the healthcare sector at the national, regional and local levels is still vibrant, as each region *de facto* runs a different healthcare system.

During the last decades, Italian regions have dealt with increasingly tougher budget constraints (Bordignon and Turati, 2009) and have pursued different policies to face increasing demand for public services and to avoid the financial collapse of the system (Jommi et al., 2001; Longo, 2016). In particular, there is an overall tendency towards centralisation in the governance of regional health systems (France et al., 2005), alongside the creation of unified regional authorities with specific duties, such as purchasing goods and supplying services (France et al., 2005), to unlock scale effects, save money and allocate resources effectively. There are several works in the literature that have investigated potential mechanisms for the creation of economies of scale, processes and information (Callea et al. 2017). In particular, potential mechanisms have been studied by Johnson (1999), who found that purchasing groups would support more specialisation of staff and would also provide a supply of greater resources and stronger management capabilities; Nollet and Beaulieu (2005), who investigated market power increases and benefits from a long-term perspective; and Tella and Virolainen (2005), who focused on the mechanisms of economies of information. The regional government of Tuscany in 2005 decided to assign the twelve existing LHAs to three geographical areas called *Area Vasta* (AVs) to serve as intermediaries between LHAs and the regional administration. For each AV, an agency with administrative, organisational, accounting, management and technical autonomy was created. Called *ESTAV* (*Enti per i Servizi Tecnico Amministrativi di Area Vasta* – AV Authorities for Technical and Administrative Services), these agencies also act as commission centres on behalf of the LHAs and teaching hospitals. ESTAVs are unique to the Italian context in several dimensions. First, they exclusively operate within the healthcare sector, i.e., their duties do not refer to other contexts of regional or local administration (Marsilio et al., 2016). Second, ESTAV competences refer to the entirety of technical and administrative services, thus *including* purchases (rather than purchases only), following the philosophy of rationalisation of available resources (Cusumano et al., 2017). ESTAVs are responsible for tender bidding processes, stocking and storehouse services, IT, maintenance, technological services and medical devices and personnel (Cusumano et al., 2017) as well as logistics (Skipworth et al., 2020). The unification of existing LHAs with respect to technical and administrative procedures could offer an optimal intermediate solution (Brusoni and Marsilio, 2007) between regional and local governance of the healthcare public sector, leaving the provision of healthcare services to LHAs or hospitals and strategic planning to the regional administration.

There are already important contributions in the literature describing trends in centralisation for purchases in the Italian healthcare sector, such as Brusoni and Marsilio (2007) and Marsilio et al. (2016). Among the regions, the experience of the Tuscany regional administration represents a *unicum*, as it introduced intermediate authorities responsible not only for the purchase and efficient allocation of goods and services in the health sector (Cusumano et al., 2017), as other regions did, but also for the delegation of all technical and administrative services to these agencies (Marsilio et al., 2016). Only one other region, namely, Friuli Venezia Giulia, opted for the centralisation of all technical and administrative services rather than purchases only. However, in that case, a single authority was established (in 2004) at the regional level, whereas ESTAVs are situated at the sub-regional level, leaving the provision of healthcare services to the local level. Indeed, at the beginning of 2015, ESTAV competences were shifted to a unique regional agency (ESTAR) aimed at rationalising available resources (Cusumano et al., 2017), which marked the end of the ESTAV experiment.

There are also some recent contributions in the literature that study the impact of centralisation and de-centralisation in the Italian healthcare sector, such as those on choice among and prices of medical devices (Callea et al., 2017) and access to primary care (Garattini et al., 2016). In addition, there are some recent works that investigate decentralisation and public health spending. Arends (2017), for example, found that decentralisation can lead to a higher level of health-related expenditures. There is also a rich literature that explores different regional healthcare settings and the efficient use of public resources (De Nicola et al., 2014). Except for a recent study on the OECD (Dougherty et al., 2019), we are not aware of any studies that examine the effect of the introduction of intermediate authorities between the regional and local unit levels in Italy. The authors of the OECD study highlight how a moderate degree of decentralisation reduces public health spending (and increases life expectancy), whereas excessive decentralisation is generally a poor driver of public resources savings. In conclusion, they suggest that a *moderate* level of decentralisation is optimal in terms of cost containment, keeping quality of care constant.

The aim of this paper, therefore, is to analyse the impact of the introduction of ESTAVs in 2005 and estimate whether, in the following years, the creation of these sub-regional intermediate agencies produced effects in terms of cost containment for auxiliary goods and services compared to the situation in other Italian regions without such agencies or with different organisational schemes. The focus of the paper is on auxiliary goods and services only, as centralised procurement is more effective for standardised needs (and, therefore, goods or services), as found in Callea et al. (2017). Auxiliary (i.e., nonclinical) goods and services were homogeneous over time both within Tuscany and across the Italian regions, as they are mainly related to basic needs (e.g., cafeteria or cleaning services), rather than heterogeneity in clinical needs. In fact, Skipworth et al. (2020) studied outsourcing procedures and identified three different sources of variability when considering healthcare processes, namely, (i) clinical variability due to heterogeneous needs, (ii) unpredictability of patient needs and flows and (iii) variability due to preferences, approaches and levels of ability of professionals. None of the above-mentioned factors have an impact on basic needs. Consequently, we can conclude that relevant changes in costs cannot be imputed to changes in the provision of service itself. Lastly, effective reductions in costs devoted to the purchase of auxiliary goods and services are not associated with changes in non-monetary outcomes, such as quality of care or waiting times, which should be included as costs when focusing on health-related goods and services, such as medical devices or surgical procedures.

Our major findings show that the creation of ESTAVs in Tuscany in 2005 had a positive effect in terms of cost containment. The paper is structured as follows: section 2 describes the data sources and collection along with the econometric model; section 3 reports the empirical results; and section 4 provides a discussion of the empirical results and outlines policy conclusions.

2 Data and methods

2.1 Data

We use annual balance data for the period from 1997-2014 from the Ministry of Health database[1] to estimate the effect in terms of cost containment of the introduction of ESTAVs in Tuscany in 2005 relative to the set of remaining Italian LHAs. We therefore need a balanced panel of units of observation from the considered period. Unfortunately, some LHAs were merged with other existing LHAs over the timespan considered, and others were created. In addition, regions were allowed to decide whether public hospitals can be directly managed by LHAs or operate as independent trusts; therefore, for some of the regions, we cannot see the balances of hospitals, as they are included in the balances of the relevant LHA. Conversely, for some other regions, we see the balances of independent trusts, as these are separate from the balances of the LHAs. To overcome these issues, we decided to combine the balances of independent trusts and LHAs and to add balances of dismissed LHAs to build a set of aggregate units of observations that can be observed through the entire period of observation. Details of the aggregation procedure are provided in Appendix A1.

We use balance forms to determine the yearly cost faced by each unit of observation in Italy for the purchase of non-sanitary goods and externally subcontracted services. In Appendix A2, we report the relevant codes and detailed items. The outcome variable considered in the paper is the sum of two main expenditure variables:

(i) The cost of auxiliary *goods*, i.e., expenditures on grocery and cafeteria products; clothes; lubricants and fuel; and cleaning, technological, stationery and maintenance materials.

(ii) The cost of auxiliary and subcontracted *services*, namely, laundry, dining, cleaning, heating, IT, and maintenance services.

Potentially, there may be several shifts in total expenditures from goods to services over time, depending on the managing board's willingness to move from "internal production" (e.g., a cafeteria) to "external provision" (a catering service), or vice versa. The willingness to outsource is reflected in terms of the shift from purchases of goods to purchases of services; the opposite is therefore the willingness to insource, although this is less common. Given the impossibility of controlling for the heterogeneity among units in terms of their willingness to outsource services, it is crucial to calculate the cost as the sum of the two variables above. Furthermore, we express the cost variables in the logarithm of thousands of euros, expressed in 2015 prices to correct for inflation.

We also collect several potential drivers of demand for public services that may be relevant for correctly assessing the overall increase (or decrease) in aggregate costs for the local public health sector. From the Italian National Institute of Statistics (ISTAT), we retrieve the yearly age distribution within each unit of observation. We therefore calculate the (log) total resident population and the (log) number of residents over 80 years old. From the Ministry

[1] http://www.salute.gov.it/portale/temi/p2_6.jsp?lingua=italiano&id=1314&area=programmazioneSanitariaLea&menu=dati

of Finance statistical office[2], we obtain the GDP per capita, which we consider in logarithms to be consistent with the variable transformation.

From the Ministry of Health Annual Report on Hospital Discharges[3], we collect information on the volume of treatment within each region, namely, the number of discharges and patients' total number of days spent in the healthcare system. These figures are available for different types of care, namely, for acute, rehabilitative and long-term care patients. From the same source, we collect indicators for the quality of care and efficiency of the system. These variables are available at the regional level. We also collect another indicator frequently used by the Ministry of Health offices to address how regions perform in terms of the complexity of care and efficiency of the system, namely, the *comparative performance indicator* (*indicatore comparativo di performance* – ICP). This is calculated for each region as the ratio between the average hospital stay length standardised by a case mix (i.e., complexity) indicator and the gold standard fixed by the Ministry of Health itself. This is a standardised measure calculated as though each region faced the same case complexity, and it is used to compare efficiency and efficacy among different units. Higher ICP values indicate lower efficiency with respect to the standard, denoting that, *ceteris paribus*, at the same standardised level of treatment, the in-hospital stay is longer. Conversely, lower ICP values indicate that the considered unit has higher performance with respect to the standard. From the same source, we also retrieve an indicator of overall quality. We consider the hospital misallocation rate, which is the number of discharges with surgical DRG from non-surgical wards, as a proxy for overall quality. This measure is often used by the Ministry of Health to assess whether hospitals have sufficient room for patients and are able to cope with hospital physical constraints. Moreover, patients who are treated in wards that are not adequate for their needs have a higher probability of experiencing unsuitable treatments. Ideally, we would have these measures for each unit of observation, rather than at the regional level; however, it was not possible to obtain these data at this detailed level. Indeed, as is detailed in the methods section, we use regional-level data to see whether the introduction of ESTAVs yielded substantial changes in terms of healthcare provision or quality.

2.2 Empirical methods

We use the synthetic control (SC) procedure described in Abadie and Gardeazabal (2003) and Abadie et al. (2010, 2015) to estimate the causal effect of the establishment of ESTAVs in the Tuscany regional healthcare sector. SC is a relatively new approach that extends the most widely known and traditional counterfactual models (e.g., difference-in-differences – DiD) by building a theoretical unit of observation from a convex linear combination of control units. SC has been implemented to estimate the effect of policy interventions on a single unit (Abadie et al., 2003, 2010, 2015) or on multiple treated units (Kreif et al., 2015), comparing the evolution after a policy intervention of an outcome variable with respect to the evolution of the same outcome in a donor pool of untreated units.

SC has been used in comparative politics to estimate the effect of macro shocks on economic outcomes in Abadie et al. (2015) for German reunification, Billmaier and Nannicini (2013) for a liberalisation policy and Coffman and

[2] https://www1.finanze.gov.it/finanze3/pagina_dichiarazioni/dichiarazioni.php
[3] http://www.salute.gov.it/portale/temi/p2_6.jsp?id=1237&area=ricoveriOspedalieri&menu=vuoto

Noy (2012), Cavallo et al. (2013) and Barone and Mocetti (2014) for the measurement of the size of natural disasters. The SC method has also been used to evaluate health policies (Kreif et al., 2015; O'Neill et al., 2020), wage interventions for healthcare workers (Okeke, 2009), health outcomes (Courtemanche and Zapata, 2014) and health insurance (Lo, 2013).

We use the SC method to assess the causal effect of the introduction of ESTAVs on the reduction in aggregate expenditure for auxiliary goods and services. In its first specification, the SC method was used to compare a single "treated" or "affected by the policy" unit and a set of "non-treated" or "non-affected" units as a control group. Kreif et al. (2015) proposed an extension to the classical SC method to evaluate a policy change when the policy simultaneously affects multiple units. This approach is particularly helpful in our case, as the effect of the introduction of ESTAVs affected all LHAs and independent hospital trusts in Tuscany. We therefore calculate the outcome variable as if Tuscany were a single unit, using a population weighted average for the three ESTAVs (i=3) of the (log) cost c_{1t} faced in year t for the purchase of auxiliary goods and externally subcontracted services, as shown in Equation 1 and described in Kreif et al. (2015):

$$c_{1t} = \frac{\sum_{i:1}^{3} \log(c_{it}) * pop_{it}}{\sum_{i:1}^{3} pop_{it}} \tag{1}$$

We view the SC procedure as more than adequate in this case for several reasons. First, given the large heterogeneity across Italian regions in terms of cost trends, this procedure is optimal because it allows us to obtain an unbiased estimate for the treated or exposed unit and to measure the effect through the differences with a donor pool of heterogeneous units assigned different weights. This result has been confirmed by previous literature (O'Neill et al., 2016), particularly when the parallel trend assumption is violated and classical DiD estimates are biased. Second, the SC method provides estimates comparing previous outcome values in both exposed and unexposed units and thus can address potential endogeneity caused by omitted variable bias (Billmaier and Nannicini, 2013). The SC method is in fact aimed at assigning weights to the set of unexposed units and to a set of control variables in the donor pool before policy implementation occurred so that the outcome trajectory of the unexposed units and controls can resemble that of the treated units in the pre-intervention period (Abadie and Gardeazabal, 2003). Therefore, SC weights are assigned to variables and donor pool units in the post-intervention time period to build a counterfactual theoretical prediction of expenditures for exposed units in the absence of the policy. Thus, we are able to compare the theoretical results for Tuscany with the real expenditure values and, through the differences between these two outcomes, measure the effect of the policy. In addition, we do not face potential anticipation effects of cost containment because managerial boards were not incentivised to reduce costs for the purchase of goods and services before the policy's introduction.

From a statistical point of view, as proven by Xu (2017), the SC method in the case of multiple treated units converges and identifies the *average treatment effect on the treated* (ATT) parameter, as is done in the classical DiD estimation procedure. The rationale behind SC is that comparing units in the pre-treatment period and obtaining a linear combination aimed at reproducing the exposed units enables us to reproduce the hidden counterfactual as a weighted average for unexposed units in the absence of the policy introduction.

Let us denote the (log) unit cost for observation j in year t_0, before policy implementation as c_{jt_0} (t_0 ranges within T_0, from 1997 to 2005) and a vector of r yearly measured covariates as described in the data section in the pre-intervention period for each unit. We define X_0 as a $((T_0 + r) \times J)$ matrix of pre-treatment covariate and outcome values for different units of observation. Similarly, we define X_1 as a $((T_0 + r) \times 1)$ vector of pre-treatment covariate and outcome values for Tuscany. Following the classical SC specification, we calculate W as a $(J \times 1)$ vector of weights that minimises the difference between the treated unit and the donor pool of untreated units, as shown in Equation 2:

$$\|X_1 \; - X_0 \; W\|_V == \sqrt{(X_1 \; - X_0 \; W)' \, V \, (X_1 \; - X_0 \; W)} \tag{2}$$

where V is an $(r \times r)$ symmetric and positive semidefinite matrix of the relative weight of covariates.

For each year t_1 in the post-intervention period (t_1 ranges within T_1 after 2005), we can estimate the causal effect α_{t_1} of the introduction of ESTAVs as the difference between the observed average outcome c_{1t_1} and its estimated counterfactual if no policy change had occurred, applying the vector W to the J units in the post-intervention period, as shown in Equation 3.

$$\hat{\alpha}_{1t_1} = c_{1t_1} - \sum_{j:1}^{J} w_j \;\; c_{jt_1} \tag{3}$$

3 Results and discussion

Figure 1 shows the per capita costs in Tuscany (blue line) and Italian LHAs (red line) over the time span considered for the purchase of auxiliary goods and externally contracted services.

[Figure 1]

Tuscany shows a per capita cost for auxiliary goods and services that is higher than the Italian average, and the difference between the two lines diverges up until 2004, whereas it decreases in the years immediately after the introduction of ESTAVs, remaining constant in the last years of observation. Therefore, it seems that in the years immediately after the policy implementation in 2005, the gap narrowed. However, the costs faced by Tuscany were higher than the Italian average both before and after the introduction of ESTAVs (dashed line), and this is the major reason why an (unweighted) average of national trends is not an adequate counterfactual for the estimation of the policy effects.

As described in the previous sections, we average the (log) costs faced by units in Tuscany as proposed by Kreif et al. (2015) to obtain a single treated unit. We therefore construct a *synthetic* Tuscany as a combination of different units of observation that most resembles the *real* Tuscany in the pre-ESTAV period. We include in the possible set of potential candidates all the units (as described in the previous section) in Italy, leaving different specifications and exclusions for robustness checks. Table 1 reports the weights assigned to the units of observation used to construct the synthetic Tuscany, showing that the trends in real values of (log) costs can be best reproduced by a combination of eight units.

[Table 1]

The estimates of the causal effect of the introduction of ESTAVs are the differences between the (log) costs of Tuscany and those of its synthetic representation calculated with the set of weights presented in Table 1. We find a significant reduction in expenditure due to the introduction of ESTAVs (Figure 2), as the two lines diverge after 2005. The SC procedure has a good fit in the pre-treatment period, as, graphically, the two lines overlap before 2005 (Figure 2) and the value of the root mean square prediction error (RMSPE) is equal to 0.017. The RMSPE, the indicator proposed for SC procedure by Abadie et al. (2010), is the root of the average of the squared discrepancies between costs in Tuscany and those of its synthetic counterpart during the period from 1997-2005. Covariate predictor means are provided in Appendix A3.

[Figure 2]

In Table 2, we report for each year after the policy introduction the differences between the real and synthetic outcomes along with savings from the policy intervention expressed in thousand euro in logarithmic terms (left columns) and nominal terms (central columns). As shown in Figure 2, after 2005, the synthetic estimates are above the real values, which indicates that the introduction of ESTAVs helped to reduce expenditures on auxiliary goods and services. The cumulative effect is approximately 77.7 million euros over the nine years considered, equal to a 6.0% reduction, ranging from 2.7% in 2010 to 8.3% in 2007 without a clear trend over the years.

[Table 2]

The creation of ESTAVs brought a substantial reduction in costs, and the effect is amplified over time in absolute terms, as the procedures become solidified. To evaluate the statistical significance of our estimates, we follow the approach presented by Abadie et al. (2010), iteratively running the SC method to every other unit moving Tuscany into the donor pool of untreated unit itself. We, therefore, estimate a set of results, as every LHA would have created in 2005 its own agency for technical and administrative services. In addition, for every model, we calculate the corresponding RMSPE and the differences between real and synthetic outcomes. For any given year, we calculate the proportion of SC models showing (i) a smaller pre-treatment RMSPE than the one found for Tuscany and (ii) a higher difference between the real and synthetic trends than the one found for Tuscany. We interpret the proportion of SC models showing a better fit and yearly specific greater differences than the ones found for Tuscany as a *p-value*. These p-values are reported in the last column of Table 2 and show that statistical significance is stronger immediately after policy implementation in 2005. Accordingly, Figure 3 represents the results of the aforementioned placebo tests in terms of gaps between the real values and synthetic combinations, where the red line represents the gap between the real and synthetic values for Tuscany and the black lines represent the gaps for the different placebo tests performed for untreated units of observation. It is important to note that we are particularly conservative in our inference, as we decided to drop from our analysis *placebos* with a pre-intervention RMSPE higher than the one obtained for Tuscany. The cumulative effect across years is significant at the 0.05 level, meaning that fewer than 5% of the placebo tests we conducted that showed a good fit in the pre-intervention period produced cumulative savings (2006-2014) higher than those observed for Tuscany.

[Figure 3]

We also perform another placebo study using the method presented in Abadie and Gardeazabal (2003) comparing the results in terms of gaps between the real and synthetic Tuscany and another region, namely, Friuli Venezia Giulia. We use Friuli Venezia Giulia as it is the only region that opted for the centralisation of all technical and administrative services rather than purchases only, unlike the remaining regions and autonomous provinces in Italy. However, the difference between the two regions lies in the fact that whereas ESTAVs operate at the sub-regional level in Tuscany, Friuli instead has a unique regional agency. Therefore, we are able to compare two similar experiences of agencies responsible for all technical and administrative services but operating at the local or regional level. The results for Friuli Venezia Giulia are calculated as a population-weighted average of the results obtained iteratively by running an SC procedure on each unit in the donor pool and moving Tuscany into the donor pool itself, as explained above. The results are shown in the appendix (Figure A4.1). In this case, we can conclude that even when comparing Tuscany with a region that chose a similar centralisation policy, we still find differences in favour of the introduction of ESTAVs.

We also perform an additional comparison between Tuscany and all other Italian regions. We decided to average – analogously to Tuscany, as shown in Equation 1 – the results of placebo tests at the regional level. The results are shown in the appendix in Figure A4.2. In Figure A4.2, we present the gaps between the real values and the synthetic combination for Tuscany (red line) and for the other Italian regions (black). Once again, we excluded from the analysis (two) regions with poor pre-2005 fit. Unfortunately, due to the limited sample size, our control group was inadequate to perform statistical inference. Nonetheless, from the introduction of ESTAVs up until 2010, the comparison between the results obtained for Tuscany and the other regions suggests that the policy was effective in reducing costs. In line with existing literature, we also examined whether the SC results were driven by a few influential controls. We iteratively dropped from the donor pool each of the units of observation in the donor pool estimating new synthetic Tuscany, and we found that our results are robust to the exclusion of one control unit at the time.

However, one could still argue that a reduction in costs associated with auxiliary goods and services could not have been caused by ESTAVs creation, but rather by a reduction in the volumes of treatment as a consequence of diminished healthcare demand in the population or a negative shock in the supply side of healthcare provision (e.g., bed closing or personnel reduction). As the demand for healthcare services is relatively inelastic (Riganti et al., 2017), a negative shock on the supply side would increase waiting time and, in turn, diminish access to healthcare services, arising unmet need or foregone medical care (Elstad, 2016) or widen the gap for access to healthcare services in the population (as in Detollenaere et al., 2017) generating inequalities. Moreover, as for public hospitals, the reimbursement system is volume-based. A negative shock on the supply side of healthcare provision could potentially induce hospital managers to try to compensate by encouraging medical staff to reduce the average stay of patients in public structures. If the latter were true, we would expect a decrease in the overall quality of care in public hospitals with potentially dangerous consequences for healthcare provision. To assess whether this is the case, in Figure 4, we compare trends in the treatment volumes (panels a and b), global efficiency (c) and quality (d) of the system before and after the introduction of ESTAVs.

[Figure 4]

The introduction of ESTAVs was not associated with a change in the reduction trend in the volume of treatment. Considering overall system quality (4d), we noticed that a reduction in expenditures was associated with a change in the misallocation rate only immediately after the introduction of ESTAVs, whereas it returned to its pre-intervention trend after three years. The most interesting result in this second-stage analysis is the one observed in Figure 4 (panel c). Before the introduction of ESTAVs, the regional comparative performance indicator was constant between 0.95 and 1. However, after 2006, it decreased to 0.9. It is important to recall that higher values of the comparative performance indicator denote low efficiency, and lower values denote high performance relative to other regions. Tuscany did not change its patterns of care or quality after the introduction of ESTAVs. In contrast, it provided at a *de facto* lower price a health service that is more efficient than its counterfactual. Therefore, we can conclude that the creation of ESTAVs and the subsequent cost reduction in Tuscany are not associated with changes in treatment volume or poorer value in terms of overall quality (misallocation rate) or efficiency (comparative performance indicator), meaning that the establishment of ESTAVs did not entail an expenditure reduction that damaged clinical outcomes.

4 Conclusions and Policy Implications

Over the past 15 years, to keep health expenditures under control, regional administrations and the Ministry of Health in Italy have introduced several measures that are likely to imply a reduction in the number of health authorities with the minimum effects of increased LHA market power over external providers, more efficient allocation of resources, and reduced opportunities for corruption. In addition, regional administrations face the challenge of achieving some key performance results in terms of health service quality, waiting time reduction and effective use of resources.

In 2005, Tuscany created three centralised authorities charged not only with purchasing auxiliary goods and outsourcing auxiliary services but also with managing all technical and administrative services for LHAs and public hospitals. The policy aimed to replace several local purchase offices with fewer local ones, exploiting economies of scale and taking advantage of increased market power and a possibly higher level of expertise in administrative offices.

Using the SC procedure, we estimated overall savings equal to 6% with respect to the total balance devoted to the purchase of auxiliary goods and services in other Italian regions, and this effect is statistically significant. These savings do not appear to have caused any treatment volume reduction or a generalised increase in public healthcare inefficiencies or diseconomies. Therefore, ESTAVs may have helped to implement higher and more efficient levels of public procurement by moving from the local level to a more aggregated level. In public debate, regional administrations are often depicted as “too large to be efficient”, and LHAs are sometimes too small to have adequate market power or expertise to face problems. In 2015, Tuscany replaced the three ESTAVs with a unique agency operating within the entire regional jurisdiction, namely, ESTAR. The experience of three different agencies at the sub-regional level might have facilitated the shift from the local to the regional level, even if some adjustments, particularly those related to processes, necessarily had to be made (Cusumano et al., 2017). Thus, the approach followed by Tuscany in 2005 and 2014 could represent a feasible alternative to centralising purchases only or creating a unique regional agency. Moreover, the Tuscany regional administration and ESTAV management boards were able to execute such an achievement without affecting the overall quality of care, internal efficiency or volume of discharges, which could have led to increased waiting lists. Our results are in line with those of Dougherty et al. (2019), who suggest a moderate level of decentralisation as the optimum choice for cost containment that leaves quality of care indicator values unaffected.

Our results are robust to standard statistical inference procedures, even if they are not exempt from some small limitations, particularly with respect to the quality and availability of data. In fact, to correctly assess the impact of the introduction of ESTAVs on the regional balance, we would have also needed the costs related to implementation of an aggregation procedure. Not having these data make the exercise incomplete. In addition, it is difficult to assess the impact of intra-regional mobility of patients on costs for auxiliary goods and services. From an econometric perspective, our models could suffer from a potential covariate selection problem, even if the capitation mechanism of reimbursement guarantees us a trend that is close to linear over the timespan considered. In addition, we do not believe that this is a meaningful problem for us because changes in reimbursement would simultaneously affect all regions in Italy.

We are not aware of studies in the Italian healthcare context that use the SC method to evaluate a relevant policy change, even though there is a great deal of literature on the causal framework for the healthcare sector and a plethora of studies that use SC. We are also not aware of studies that focus on the provision of auxiliary services or the purchase of auxiliary goods rather than clinical outcomes at the local level. Our analysis contributes to the cost containment literature that addresses local healthcare sector issues. Additionally, it provides some insights on the differences between the centralisation of all technical and administrative services, rather than solely of purchases, yielding the finding that the former are more efficient in reducing costs and impose no trade-offs in terms of the quality and volume of healthcare service.

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Figure legends

Figure 1: Per capita expenditures for auxiliary goods and services in Tuscany vs the Italian average

Source: Our calculation using Ministry of Health data and ISTAT data on the resident population. Cost variables are expressed in per capita 2015 euros.

Figure 2: Trends for real Tuscany and synthetic control estimates

Source: Our calculation using Ministry of Health data and the SC procedure. Outcome variables are expressed in (log) 2015 euros (thousand).

Figure 3: Tuscany and other units of observation.

Source: Our calculation using Ministry of Health data and the SC procedure. Outcome variables are expressed in 2015 euros (thousand).

Figure 4: Regional aggregates for treatment volume, quality of care and system efficiency

Source: Our calculations using Ministry of Health data. In panels (a) and (b), values in 2005 are taken as the reference and set equal to 100. The dashed line (2005) represents the introduction of ESTAVs.

Table 1: Unit weights.

Unit	*Weight*
Padua	0.312
Turin	0.293
Sardinia	0.145
Bologna	0.073
Rome	0.072
Chieti	0.047
Lecco	0.035
Catanzaro	0.023

Weights in Synthetic Tuscany

Table 2: Overall savings.

Year	Real values	Synthetic comb.	Real values	Synthetic comb.	Savings	Variation (%)	*p*
	thousand euros, log		thousand euros				
2006	11.62	11.67	111,072	116,768	5,696	5.1	**
2007	11.66	11.74	116,230	125,867	9,638	8.3	***
2008	11.74	11.81	125,678	135,158	9,480	7.5	***
2009	11.84	11.88	138,404	144,373	5,969	4.3	*
2010	11.88	11.91	144,868	148,789	3,921	2.7	
2011	11.95	12.02	155,142	165,277	10,136	6.5	*
2012	12.02	12.09	166,838	178,552	11,714	7.0	*
2013	12.03	12.10	167,401	179,555	12,154	7.3	
2014	12.05	12.10	170,838	179,787	8,949	5.2	
Total			1,296,470	1,374,126	77,656	6.0	**

Note: *p* indicates the proportion of permutations reporting theoretically higher savings than Tuscany. ***: p<1%; **: p<5%; *: p<10%.

Appendix A1: Units of observation

Aggregation procedure for different Regions and Autonomous Provinces (AP).

Region/AP	*Changes over time and over unit of observation*	*n obs*
Abruzzo	LHAs of L'Aquila and Avezzano-Sulmona have been merged in 2010, we therefore consider them as a single unit; LHAs of Chieti and Lanciano-Vasto have been merged in 2010, we therefore consider them as a single unit.	4: L'Aquila, Chieti, Pescara, Teramo
AP of Bolzano	LHAs of Bolzano, Merano, Bressanone and Brunico have been merged in 2008, we therefore consider them as a single unit.	1: Bolzano
AP of Trento	--	1: Trento
Basilicata	LHAs of Matera and Montalbano Jonico have been merged in 2009, we therefore consider them as a single unit; LHAs of Potenza, Venosa and Lagonegro have been merged in 2009, we therefore consider them as a single unit.	2: Matera, Potenza
Calabria	LHAs of Catanzaro and Lamezia Terme have been merged in 2008, we therefore consider them as a single unit; LHAs of Cosenza, Paola, Castrovillari and Rossano have been merged in 2008, we therefore consider them as a single unit; LHAs of Reggio Calabria and Palmi (and Locri) have been merged in 2009 (2010), we therefore consider them as a single unit.	5: Catanzaro, Cosenza, Crotone, Reggio Calabria, Vibo Valentia
Campania	LHAs of Avellino 1 and 2 have been merged in 2009, we therefore consider them as a single unit; LHAs of Caserta 1 and 2 have been merged in 2009, we therefore consider them as a single unit; LHAs of Salerno 1, 2 and 3 have been merged in 2009, we therefore consider them as a single unit;	5: Avellino, Benevento, Caserta, Napoli, Salerno
Emilia-Romagna	LHAs of Forlì, Cesena, Ravenna and Rimini have been merged in LHA of Romagna, we therefore consider them as a single unit. LHAs of Bologna Sud, Imola and Bologna Nord have been considered as the unit "of Bologna" due to un-availability of administrative covariates.	7: Bologna, Ferrara, Modena, Parma, Piacenza, Reggio Emilia, Romagna
Friuli- Venezia Giulia	LHAs have been aggregated at administrative province level. Therefore, LHAs Isontina has been added to LHA of Gorizia; Friuli Occidentale to Pordenone; Alto Friuli, Medio Friuli – Collinare and Bassa Friulana have been merged into Udine.	4: Gorizia, Pordenone, Trieste, Udine
Lazio	--	5: Roma, Frosinone, Latina, Rieti, Viterbo
Liguria	LHA of Chiavari has been added to unit of Genova due to un-availability of administrative covariates.	4: Genova, Imperia, La Spezia, Savona
Lombardia	LHAs of Bergamo, Albino, Ponte San Pietro and Treviglio have been merged in 1998, we therefore consider them as a single unit; LHAs of Brescia, Chiari, Breno, Gardone Val Trompia, Salò and Leno have been merged in 1998, we therefore consider them as a single unit; LHAs of Como and Cantù have been merged in 1998, we therefore consider them as a single unit; LHAs of Cremona and Crema have been merged in 1998, we therefore consider them as a single unit; LHAs of Lecco and Merate have been merged in 1998, we therefore consider them as a single unit; LHAs of Mantova, Viadana and Ostiglia have been merged in 1998, we therefore consider them as a single unit; LHAs of Milano 1-6, Melegnano, Crenusco, Desio, Cinisello, Garbagnate, Rho, Legnano, Magenta, Vimercate and Monza have been mergerd in different LHAs in 1998 and the administrative province of Monza and Brianza has been created only in 2009, we therefore consider them as a single unit; LHAs of Pavia, Vigevano and Voghera have been merged in 1998, we therefore consider them as a single unit; LHAs of Varese,	11: Bergamo, Brescia, Como, Cremona, Lecco, Lodi, Mantova, Milano, Pavia, Sondrio, Varese

	Gallarate, Busto Arsizio and Saronno have been merged in 1998, we therefore consider them as a single unit.	
Marche	LHAs have been merged in 2006, we therefore consider them as a single unit	1: Marche
Molise	-	1: Molise
Piemonte	LHAs of Alessandria, Casale Monferrato and Novi Ligure have been merged in 2008, we therefore consider them as a single unit; LHAs of Cuneo, Mondovì, Savigliano and Alba have been merged in 2008, we therefore consider them as a single unit; LHAs of Torino I, II, III, IV, Collegno, Ciriè, Chivasso, Chieri, Ivrea and Pinerolo have been merged in 2008, we therefore consider them as a single unit.	8: Alessandria, Asti, Biella, Cuneo, Novara, Torino, VCO, Vercelli
Puglia	LHAs of Foggia 1, 2 and 3 have been merged in 2007, we therefore consider them as a single unit; LHAs of Lecce 1 and 2 have been merged in 2007, we therefore consider them as a single unit.	5: Bari, Brindisi, Foggia, Lecce, Taranto,
Sardegna	Due to several changes in LHAs and administrative provinces burdens, all LHAs have been aggregated in single unit.	1: Sardegna
Sicilia	--	9: Agrigento, Caltanissetta, Catania, Enna, Messina, Palermo, Ragusa, Siracusa, Trapani
Umbria	LHAs of Perugia, Foligno and Città di Castello have been merged in 2013, we therefore consider them as a single unit; LHAs of Terni, Orvieto ave been merged in 2013, we therefore consider them as a single unit.	2: Perugia, Terni
Valle d'Aosta	-	1: Aosta
Veneto	LHAs have been aggregated ad administrative province level. Therefore, LHAs of Feltre has been added to LHA of Belluno; Cittadella and Este to Padova; Adria to Rovigo; Asolo and Pieve di Soligo to Treviso; Mestre, Mirano and Chioggia to Venezia; Legnago to Verona; Bassano del Grappa, Arzignano and Thiene to Vicenza.	7: Belluno, Padova, Rovigo, Treviso, Venezia, Verona, Vicenza

In addition to what has been already described in data section, we decided to collapse at a single unit some LHAs when more than one LHA was insisting within the same municipality (as for metropolitan areas of Milano, Roma, Napoli, Torino and Bari), or within the same administrative province (as for Veneto and Friuli Venezia Giulia).

Appendix A2: Balance items

Several balance forms have been used by Italian Local Health Authorities in the reference period. To obtain aggregate expenditures for goods and services we follow a two-step procedure. We first consider specific items, than we aggregate them across different versions to obtain harmonised and comparable cost aggregates over time. In detail, we consider the following codes:

- Foodstuffs (goods): BA0320, B01075, B0110, 1090, 120;
- Closet (goods): BA0330, B01080, B0120, 1100, 123;
- Fuel (goods): BA0340, B01085, B0130, 1110, 1120, 129;
- Stationery (goods): BA0350, B01090, B0140, 1130, 132;
- Maintenance (goods): BA0360, B01095, B0150, 2010, 2020, 2030, 126;
- Cleaning and laundry (services): BA1580, BA1590, B02510, B02515, B0600, B0610, 11010, 11020, 139;
- Mensa (services): BA1600, B02520, B0620, 11030, 142;
- Heating (services): BA1610, B02525, B0630, 11040, 145;
- IT (services): BA1620, B02530, B0640, 11050, 146;
- Maintenance (services): BA1910, B03000, B0700, 2040, 2050, 2060, 2070, 187, 190, 193;
- Utility (services): BA1650, BA1660, BA1670, B02545, B02550, B02555, B0670, B0680, 9030, 174, 177, 180;

We therefore calculate the aggregate variable referring to the sum of costs associated to purchases of good and provision of services as the sum of the above described categories.

Appendix A3: Expenditures predictor means

	Year	Real	Synthetic
Expenditures (log)	1997	10.74	10.75
Expenditures (log)	1998	10.83	10.83
Expenditures (log)	1999	10.87	10.88
Expenditures (log)	2000	11.01	11.00
Expenditures (log)	2001	11.21	11.24
Expenditures (log)	2002	11.36	11.35
Expenditures (log)	2003	11.43	11.43
Expenditures (log)	2004	11.52	11.49
Expenditures (log)	2005	11.58	11.60
Population (log)	1997	14.00	14.04
Population (log)	1998	14.00	14.04
Population (log)	1999	14.00	14.04
Population (log)	2000	14.00	14.04
Population (log)	2001	14.00	14.04
Population (log)	2002	14.00	14.04
Population (log)	2003	14.00	14.05
Population (log)	2004	14.02	14.06
Population (log)	2005	14.03	14.07
Population, over 80 (log)	1997	11.11	10.84
Population, over 80 (log)	1998	11.08	10.82
Population, over 80 (log)	1999	11.05	10.79
Population, over 80 (log)	2000	11.04	10.79
Population, over 80 (log)	2001	11.10	10.84
Population, over 80 (log)	2002	11.16	10.90
Population, over 80 (log)	2003	11.21	10.95
Population, over 80 (log)	2004	11.26	10.99
Population, over 80 (log)	2005	11.29	11.05
GDP per capita (log)	2000	9.32	9.30
GDP per capita (log)	2001	9.38	9.36
GDP per capita (log)	2002	9.41	9.40
GDP per capita (log)	2003	9.45	9.44
GDP per capita (log)	2004	9.47	9.46
GDP per capita (log)	2005	9.50	9.48

NOTE: Expenditure variables are expressed in 2015 euro.

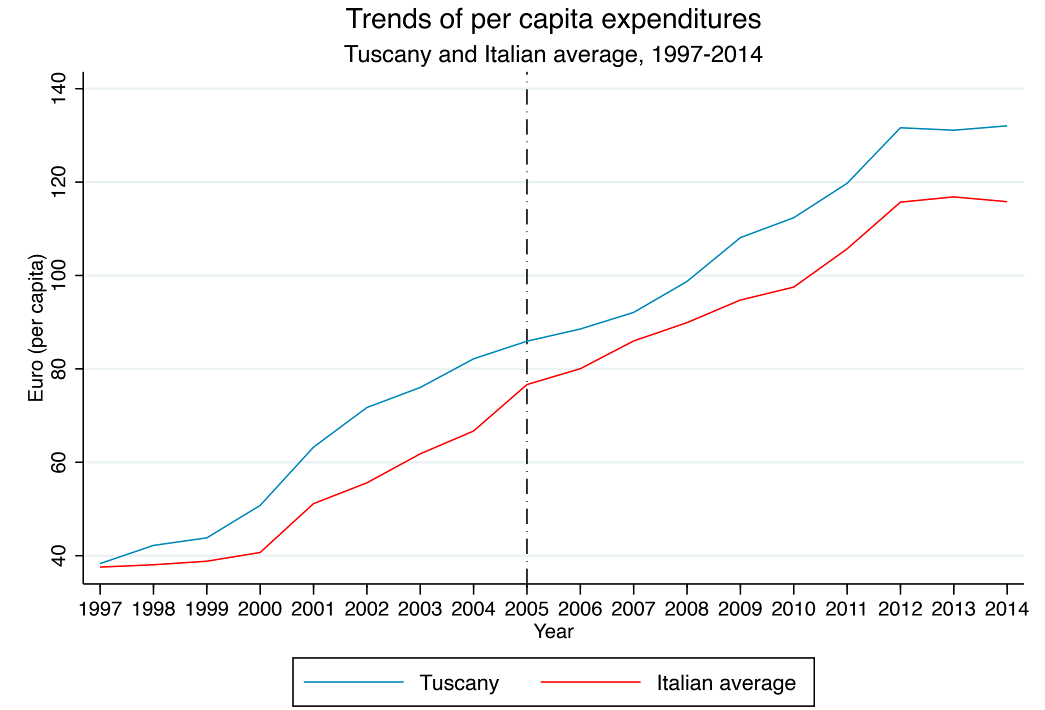
Appendix A4: Robustness checks

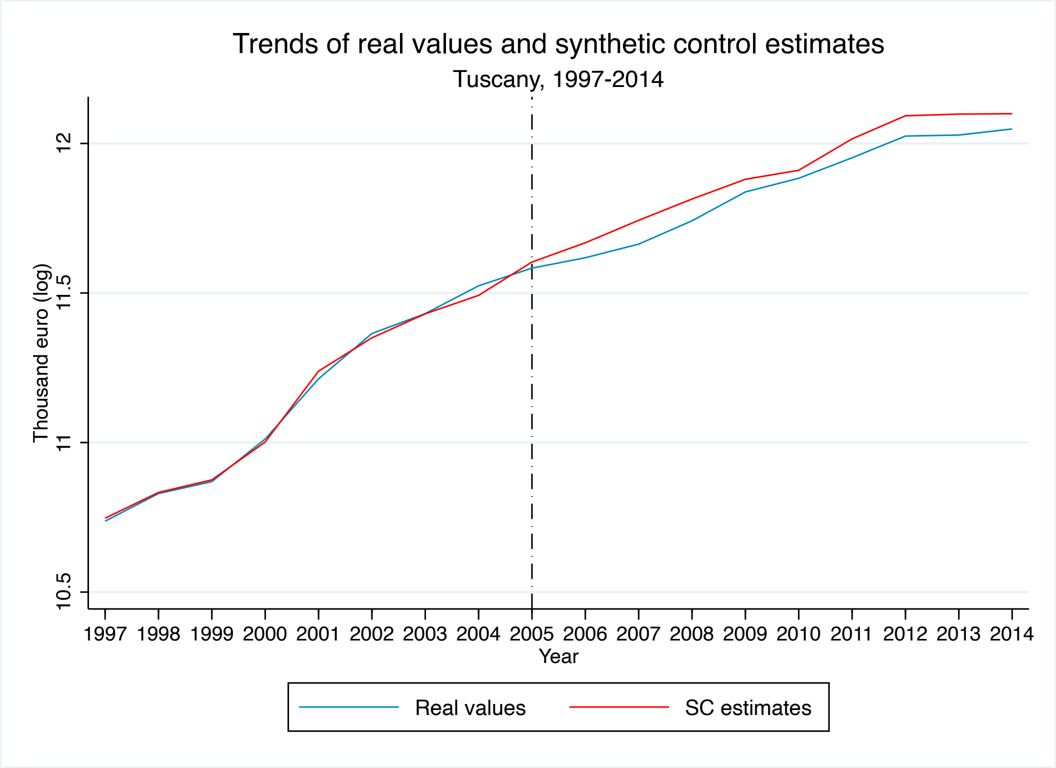
[Figure A4.1]

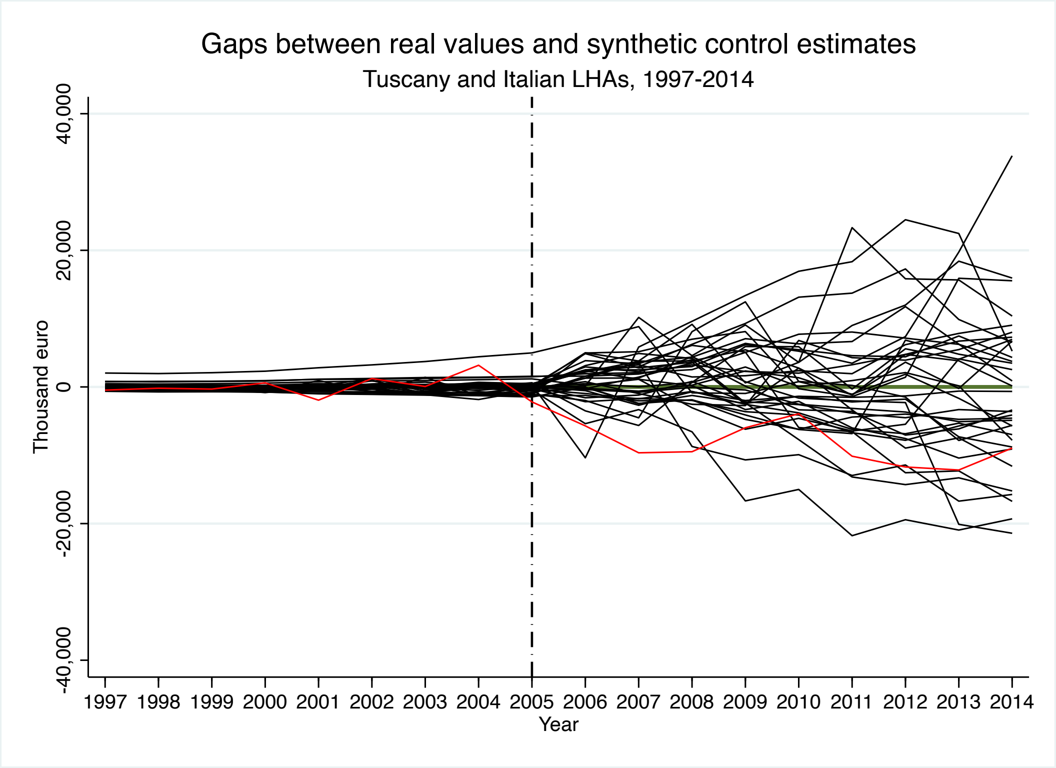
Source: Our calculation using Ministry of Health data and the SC procedure. Outcome variables are expressed in 2015 euros (thousand).

[Figure A4.2]

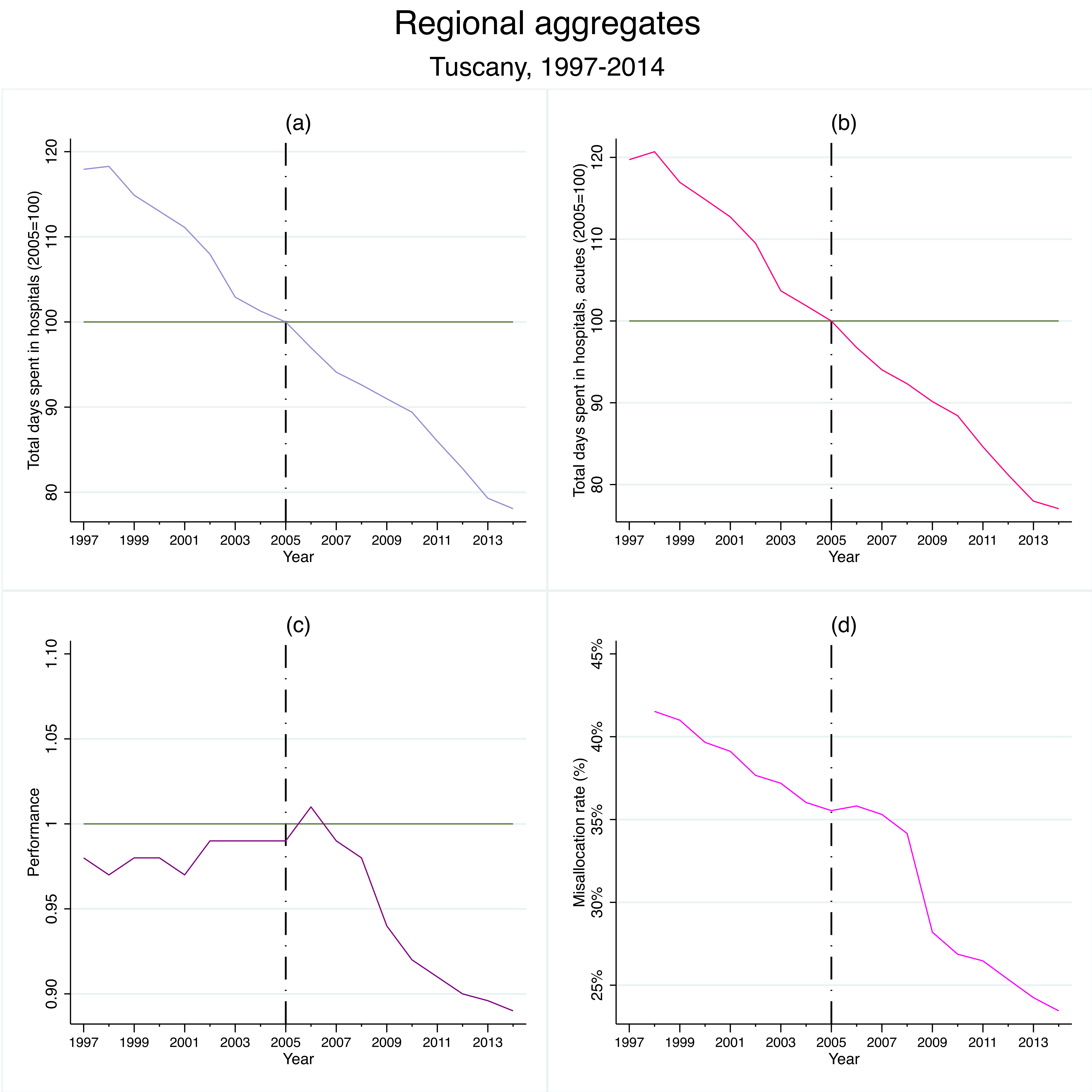
Source: Our calculation using Ministry of Health data and the SC procedure. Outcome variables are expressed in 2015 euros (thousand).

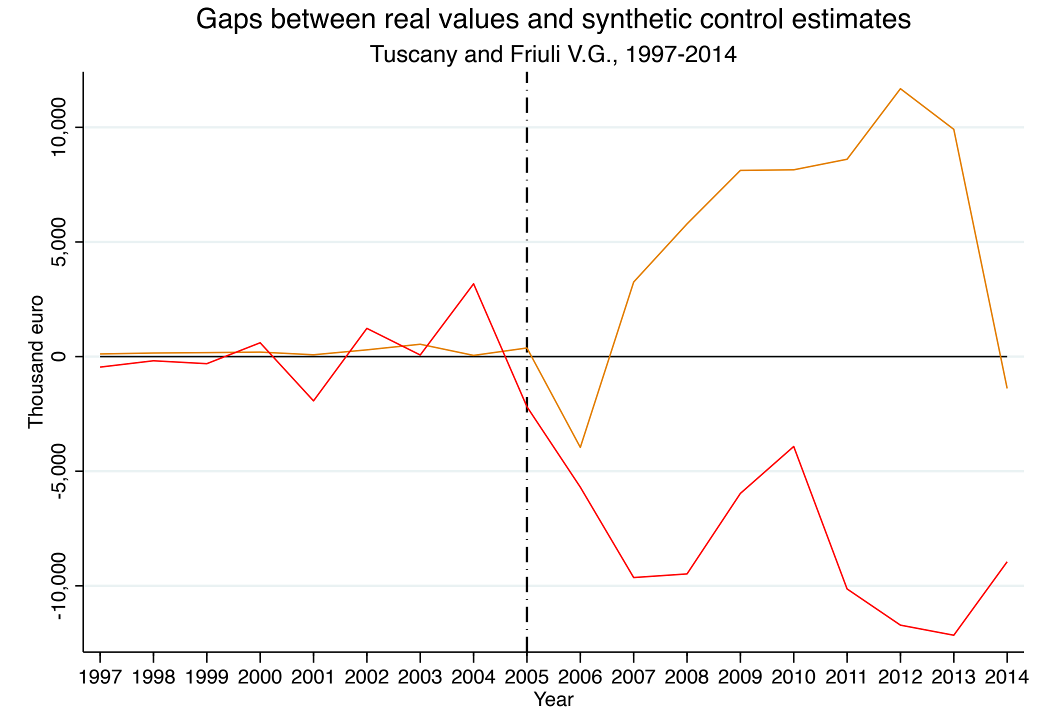

Trends of per capita expenditures
Tuscany and Italian average, 1997-2014
Euro (per capita)
40
60
80
100
120
140
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
Year
Tuscany
Italian average

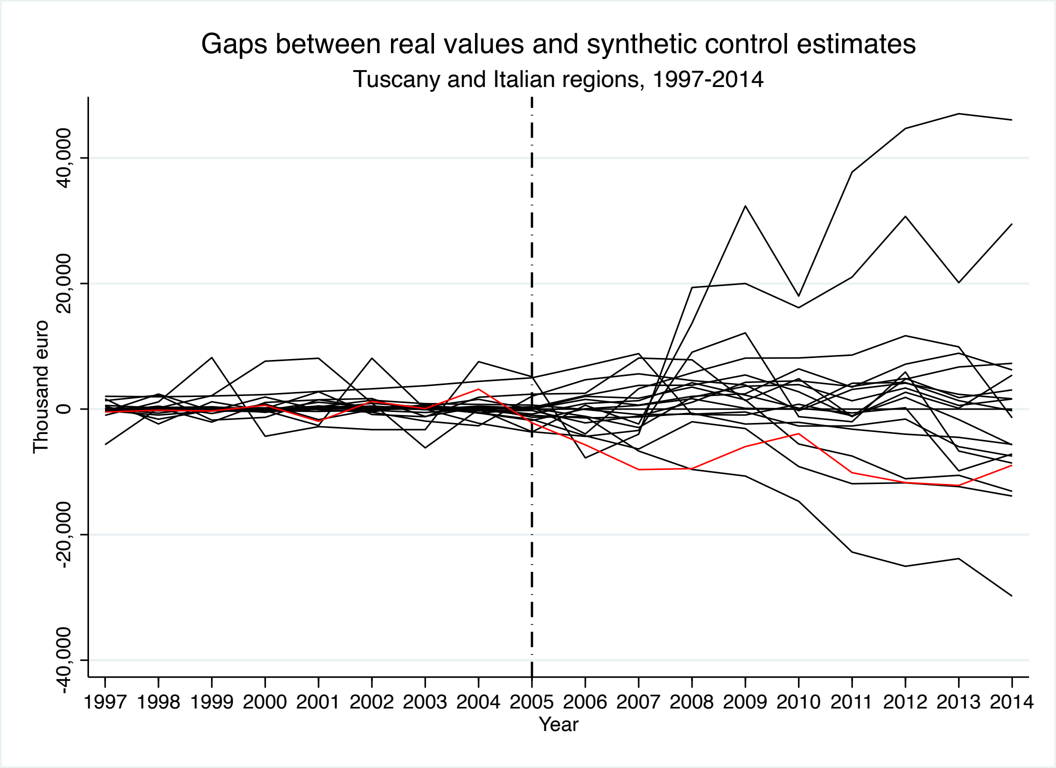

Trends of real values and synthetic control estimates
Tuscany, 1997-2014
Thousand euro (log)
12
11.5
11
10.5
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year
Real values
SC estimates



Gaps between real values and synthetic control estimates
Tuscany and Italian LHAs, 1997-2014
Thousand euro
40,000
20,000
0
-20,000
-40,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year


Regional aggregates
Tuscany, 1997-2014
(a)
Total days spent in hospitals (2005=100)
120
110
100
90
80
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year
(b)
Total days spent in hospitals, acutes (2005=100)
120
110
100
90
80
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year
(c)
Performance
1.10
1.05
1
0.95
0.90
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year
(d)
Misallocation rate (%)
45%
40%
35%
30%
25%
1997
1999
2001
2003
2005
2007
2009
2011
2013
Year


Gaps between real values and synthetic control estimates
Tuscany and Friuli V.G., 1997-2014
Thousand euro
10,000
5,000
0
-5,000
-10,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year



Gaps between real values and synthetic control estimates
Tuscany and Italian regions, 1997-2014
Thousand euro
40,000
20,000
0
-20,000
-40,000
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year