Death by austerity?
The impact of cost containment on avoidable mortality in Italy

Emanuele Arcà†
Francesco Principe♦
Eddy Van Doorslaer‡

Abstract
Does austerity in healthcare affect health and healthcare outcomes? We examine the intended and unintended effects of the Italian austerity policy Piano di Rientro aimed at containing the cost of the healthcare sector. Using an instrumental variable strategy that exploits the temporal and geographical variation induced by the policy rollout, we find that the policy was successful in alleviating deficits by reducing expenditure, mainly in the southern regions, but also resulted in a 3% rise in avoidable deaths among both men and women, a reduction in hospital capacity and a rise in south-to-north patient migration. These findings suggest that - even in a high income country with relatively low avoidable mortality like Italy - spending cuts can hurt survival.

JEL Codes: I10; I18.

Keywords: avoidable mortality; health care expenditure; recovery plan.

†Erasmus School of Health Policy and Management, Erasmus University Rotterdam, The Netherlands; E-mail: arcaemanuele@gmail.com
♦Erasmus School of Economics, Erasmus University Rotterdam, The Netherlands; E-mail: principe@ese.eur.nl
‡Erasmus School of Economics, Erasmus School of Health Policy and Management, Erasmus University Rotterdam, The Netherlands; E-mail: vandoorslaer@ese.eur.nl

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1 Introduction

While in most industrialised countries expenditures on health care have kept rising for decades, both in absolute level and as a share of GDP, estimates of the marginal health benefits of health care spending vary widely between studies, not only because they often refer to very different times and places, but also because they rely on different methodologies. Most have focused on attempting to estimate the marginal health gains of additional spending. In this paper, we add to the much smaller literature on the health effect of spending cuts. Most studies that examined the effect of austerity policies implemented after the Great Recession of 2008 had difficulties constructing a counterfactual because generally the entire country population was affected.

Several studies have made an attempt to identify the marginal effects of additional healthcare spending. Among the first to establish a relationship between health care spending and health outcomes was Cremieux et al. (1999) showing that lower health care spending was associated with a statistically significant increase in infant mortality and a decrease in life expectancy in Canada. Similarly, Martin et al. (2008) used budgeting data of 295 English Primary Care Trusts to model the link between health spending and health outcomes of two specific programmes of care: cancer and circulatory diseases. By using instrumental variables methods, the authors found that the cost of a life year saved in cancer was about £13,100, and in circulation about £8000 in the UK.

More recently, Edney et al. (2018) used an instrumental variable approach with local data to account for endogeneity of healthcare spending to health outcomes in Australia. Their results suggest that, based on the conditional mean, a 1% increase in public health spending was associated with a 2.2% reduction in the number of standardised years of life lost. Lomas et al. (2018) used panel data at local level to assess the marginal productivity of the English National Health System (NHS) over a ten-year period. Interestingly, the authors found that the point estimates of the amount of resources, in nominal terms, to produce an additional unit of health benefit has ranged from £5,000 to £15,000 per quality-adjusted life year between 2003/04 and 2012/13.

Finally, Vallejo-Torres et al. (2018) exploited variation across 17 regional health services in Spain and the exogenous changes in expenditure that took place as a consequence of the economic crisis over 5 years of data. Using a fixed effects model and an instrumental variable approach, the authors found that health expenditure has a positive and significant effect on population health, with an average spending elasticity estimate of 0.07. This translates into a cost per QALY of between 22,000€ and 25,000€.

For Italy, to the best of our knowledge, the only causal evidence is provided by Depalo (2019) who uses similar regional data to estimate effect bounds of PdR on total (not amenable) mortality and hospitalization rates. He relies on milder nonparametric assumptions than the common trend assumption required for DID to identify the treatment effect bounds. The estimates suggest negative effects on hospitalization and positive effects on total mortality rates, but only in some regions.
Our contribution to this literature is twofold. First, we exploit an austerity intervention that was specifically targeted at healthcare expenditure and at certain regions, while most of the existing studies use any shocks induced by the general economic crisis country-wide. Second, we estimate the effect of the austerity policy only on causes of mortality that are considered amenable to medical intervention, which is the subset of mortality that is likely to be most sensitive to spending variation and therefore a better measure to evaluate health consequences.

The cost containment/austerity reform enacted in Italy since 2008 – Piano di Rientro (financial recovery plan, PdR henceforth) – provides a unique opportunity to compare health effects in districts with and without spending cuts. It was imposed by the central government on Italian regions, but did not affect all of the regions, not at the same time and not to the same extent. And while the regional exposure to this reform was not random but dictated by the degree of budgetary deficits incurred, this natural experiment still allowed for an evaluation of the consequences of spending cuts.

The overall effect of this reform has been a sizable decrease in the national health budget deficit, from six billion in 2006 to a bit over one billion in 2014, with a considerable reduction in the average annual contribution to national healthcare system deficit of the regions with PdR, from 72.3% in 2006 to 43% in 2015 (Ministero Economia e Finanze, 2014). This rather drastic deficit reduction suggests that PdR may have been effective in reaching its financial targets. But, has PdR also had unintended effects on health and health care outcomes? The aim of this paper is to test whether, at the margin, health spending affects health and healthcare outcomes. The Italian healthcare system reform is used as an instrument to assess causal effects, although its effects on spending are also of interest in their own right.

We exploit the staggered rollout of recovery plans across regions in Italy between 2004 and 2014 and use an instrumental variable approach coupled with two-way fixed effects for region and time to identify the causal effects of healthcare spending on healthcare provision and quality/health and healthcare outcomes.

The remainder of the paper is organised as follows. The next section explains the implementation of the recovery plans (PdR) and their timelines. Section 3 describes data and empirical approach. Section 4 presents the results. While, the last section summarises and concludes.

2 Institutional setting: Piano di Rientro

In 2001, the Italian constitutional reform led to the decentralization and federalization of the healthcare system, granting almost complete administrative and financial autonomy to each of the twenty-one regions and autonomous provinces. Since then, healthcare funding targets are fixed by the Ministry of Health and modulated at the regional level in accordance with regional planning targets. However, relatively soon after the federalization, ten out of twenty regions, due to weak managerial
capacity and lower health service performance, failed to reach the set goals and the regional health budgets quickly ran into severe deficits. Therefore, recent history of healthcare expenditure is marked by attempts to place stricter control over regions’ health spending.

Since 2006, a process of re-centralization has been underway, with a new player intervening in the healthcare system: the Ministry of Finance. In particular, the central government has prompted the defaulting regions to adopt financial recovery plans (PdR) in the form of agreements between the region and the central government. Such agreements constitute a formal commitment from the regions with budget deficit towards the Ministry of Health and the Ministry of Finance to design and implement consolidation path. The ministries became actively involved in designing and approving healthcare services delivery in regions with budget deficits, as well as in the evaluation of regional health services through ex ante and ex post monitoring (Depalo 2019). The aim of such agreements was to restore financial stability and address structural organizational failures (Ministero della Salute, 2018).

However, PdR schemes were not implemented homogenously in all regions. Two main periods of implementation can be distinguished, i.e. since 2007 (in the regions Lazio, Abruzzo, Liguria, Campania, Molise, Sicilia and Sardegna) and since 2010 (in Calabria, Piemonte and Puglia). Moreover, for those regions that were not administratively capable to achieve the goals set for the first year of implementation, the national government decided to appoint an (external) commissioner in order to pursue the central government’s targets (Ministero Economia e Finanze, 2009). The regions commissioned were Lazio, Abruzzo, Campania, Molise, and Calabria. Notably, the external commissioner acted as an agent on behalf of the central government for the implementation and rollout of PdR and for the attainment of its objectives. As a result, the regions with a commissioner lost decision-making power on healthcare-related decisions, particularly on those decisions relevant for the achievement of PdR objectives. Despite the heterogeneity both in the type and timing of PdR implementation, several common elements of spending cuts and reduction of resources use can be identified among regions with PdR against regions without PdR (Aimone Gigio et al. 2017). These characteristics are the focus of the present analysis to assess the effects of the overall PdR policy on health outcomes, while accounting and adjusting for inter-regional variances. Therefore, and for the purpose of this analysis, the 20 Italian regions can be divided into two groups: ten regions without PdR (regions that were never subjected to any PdR) and ten regions with PdR.

Overall, PdR can be defined as plans for restructuring aimed at affecting the cost factors that led to the drastic increase of regional healthcare budget deficits. There were mainly six areas of cost reduction actions: (i) hospital network reorganization: focused on reduction in hospital beds and incentivization of de-hospitalization; (ii) pharmaceutical consumption management: control over direct pharmaceutical distribution and implementation of reimbursement mechanisms for less expensive drugs; (iii) healthcare system workforce reorganization: hiring stop and freezing of turnover; (iv) accredited private sector management: reducing volumes of services provided by - and the number of - accredited private facilities; (v) centralized purchasing: centralization of purchasing and close monitoring of purchasing to avoid increases in level of spending; (vi) appropriateness of prescription:
utilization of health insurance card system for the improvement of prescription behaviour and appropriateness (Ministero Economia e Finanze, 2009).

The regional spending cuts have not passed unnoticed. Throughout the years of implementation, PdRs have received societal attention and media coverage. For example, a recent article analysed the long-term effects of PdRs over the last eight years in Campania (a southern Italian region) (Gaita, 2019). It reported the effects of over 45,000 units cut in workforce, closure of hospitals, and severe shortages in hospital beds availability. Similar patterns have been reported in Puglia and Calabria (Marino, 2016). All three are southern Italian regions under PdR.

Of particular concern is that PdRs may have exacerbated geographical health inequalities. Unequal cuts in health spending per capita may have led to a decrease in the volume of healthcare facilities and services available, which may have in turn resulted in worsened population health outcomes. The consequences of PdR policies are particularly relevant in a country like Italy where geographical and regional differences have persisted for decades despite allocation formulas aimed at equalizing the distribution of financial resources (Ferré et al. 2014; Ricciardi et al. 2011).

The availability of amenable mortality statistics at the regional level has been argued to be a powerful indicator of regional health sector performance (Fantini et al. 2012). As our main health outcomes, we will analyse regional amenable mortalities, defined as preventable and treatable causes of deaths. We will first test whether decreasing healthcare financing and provision has had a positive marginal effect on amenable mortality rates. We then extend the concept to include healthcare utilization and an index of migration. Since people in Italy can access medical care regardless of the region of residence, we anticipate that PdRs may also have influenced the utilization and inter-regional migration patterns of patients, as suggested in a recent national newspaper article (Russo, 2019).

3 Data and methods

Our data were obtained from the Italian National Institute of Statistics (ISTAT). We have assembled a panel data set for all variables for all 20 regions for 11 years (2004 through 2014). As a result, we use variation across 220 observations of regional health spending rates and other covariates.

3.1 Avoidable mortality by region

The concept of avoidable mortality, denoting a subset of causes of mortality that are potentially preventable given effective and timely healthcare, has been developed and analysed by different authors, including Nolte and McKee (2003, 2004, and 2008) and Tobias and Yeh (2009). However, in line with previous publications on amenable mortality in Europe (Mackenbach et al., 2017) and Italy (Fantini et al., 2012), in this paper, we use the list of amenable mortality causes for certain age groups developed by Nolte and McKee (Nolte & McKee, 2004).
From the full list of amenable mortalities developed by Nolte and McKee, we could only use the cause-specific rates of amenable mortality for which regional data for the period 2004-2014 are available from ISTAT. The list of included causes of amenable mortality is presented in Table 1. For most causes, avoidable mortality is restricted to those under 75, but for some causes, other age limits apply. All rates of amenable mortality included were also aggregated to population-weighted averages for both males and females (Male mortality and Female mortality). Furthermore, to obtain disease-specific estimates, we also examine amenable mortalities disaggregated into five disease areas: circulatory system, neoplasms, infectious diseases, respiratory system and diabetes.

3.2 Other regional outcome variables

As indicators of regional healthcare resources, we use data on regional per-capita public healthcare expenditure (Expenditure), ordinary hospital bed rate (Beds) and healthcare employee rate (Employees).

Public healthcare expenditure accounts for the great majority of total healthcare expenditure in Italy, from 75% in 2001 to 80% in 2009 and down to 76.8% of 2014. Overall, private healthcare expenditure never accounted for more than 25% of the total healthcare expenditure (ISTAT, 2019) and mainly consisted of out-of-pocket expenditure (Ferré et al., 2014).

As measures of regional healthcare utilization, we use the hospitalization rate for any condition (Hospitalizations ALL), hospitalization rate for cardiovascular diseases (Hospitalizations CD), hospitalization rate for cancers/tumours (Hospitalizations T), and cross-regional border hospital care seeking (X Border).

The rate of cross-regional border (hospital) care seeking behaviour (i.e. the percentage of patients seeking hospital care in another region) is particularly relevant in the context of the federal Italian healthcare system. It measures of the extent to which patients seek hospital care in another region – primarily residents from southern regions going to northern region hospitals. While the patients bear the cost of going there, the cost of the cross-border care delivered is still to be paid for by the home region.

Finally, we use a set of control variables at the regional level, including population size registered on the 1st January, average disposable income per capita and GDP per capita.

3.3 Effect identification

In order to estimate the causal effect of cost containment induced by the recovery plans (PdRs) on rates of amenable mortality, we combine an instrumental variable approach with a two-way fixed effects model. We exploit the temporal and geographical variation induced by the administrative changes due to the policy rollout as an instrumental variable in a standard two-stage least squares (2SLS) approach. Thus, we estimate the following first-stage equation:

\[ \text{Exp}_{rt} = \alpha + \sum \beta_k PdR_{rk} + \delta X_{rt} + \gamma_r + \mu_t + \epsilon_{rt} \]
where $Exp_{rt}$ is the per capita health expenditure in region r in time t. PdR is an indicator which takes the value 1 if the region r is under PdR in each time period k, and the value 0 otherwise. $X_{rt}$ is a vector of control variables at regional level including population size (recorded on 1st January), pro-capita disposable income and GDP per capita. $\gamma_r$ and $\mu_t$ are region and time fixed effects. The region fixed effects capture the unobserved regional heterogeneity that is time-invariant while the time fixed effects capture the time trend that is common across regions. The predicted values of expenditure $\hat{Exp}_{rt}$ derived from equation (1) are then used in the second stage regression equation as follows:

$$\log(Y)_{rt} = \alpha + \beta \hat{Exp}_{rt} + \delta X_{rt} + \gamma_r + \mu_t + \epsilon_{rt}$$

(2)

where $Y_{rt}$ is the population health outcome of interest observed in region r in time t. $\beta$ is our coefficient of interest and captures the effect of expenditure changes on health outcomes.

The rationale behind making use of PdR as an instrument deserves some further discussion. There are two main conditions to hold for an instrument to be reliable. First, the IV must be valid, which means that the instrument cannot be correlated with the error term in the second stage. In other words, PdR may only affect the outcome through expenditure, not through any other route. As highlighted above, the main aim of the PdR implementation was to restore financial stability of the regions. It was a national policy imposed on the regions running the larger deficits. It directly affected the regional per-capita health expenditure resulting from austerity measures that included the reduction of the regional hospital bed capacity and medical human resources. As such, it identifies plausibly exogenous variation in health expenditure.

Second, it must be powerful. In this case, the instrument is highly correlated with the expenditure per capita since the main consequence of PdRs rollout was to contain costs and decrease health expenditure. Thus, PdRs are expected to explain much of the observed variation across time and region in expenditure. Moreover, we check for the power of the instrument in the first-stage using the F-test on whether the excluded instrument significantly differs from zero (Staiger and Stock, 1997). These values are substantially above both the rough, but commonly used, rule of the thumb of 10 and the more formal cut-offs provided by Stock and Yogo (2005).

Using PdR in an instrumental variable framework allows us to make our contribution threefold. In the first stage, we are able to estimate the average impact of the policy intervention on the regional healthcare spending. In the second stage, we exploit this variation to estimate the health consequences at the margin of the budget cuts. Third, we employ a similar IV strategy to examine potential mechanisms of the austerity measures, by estimating the expenditure effect on intermediate outcomes like hospital beds per capita and other measures of regional health care capacity and utilization.
4 Results

This section presents the main results of our empirical analysis in four steps. First, we provide some descriptive findings through a graphical analysis. Second, we document the intended effect of PdR in terms of cuts in expenditure. Third, we estimate the effect of austerity in healthcare on overall amenable mortality and then for the distinct causes of mortality, separately for males and females. Finally, we estimate expenditure effects on intermediate health care outcomes like hospital capacity and utilization as potential pathways that help explaining these results.

4.1 Graphical analysis

Figure 1 displays the trends for health care expenditure per capita and mortality across PdR (red lines) and non-PdR regions (black lines). It clearly shows that after the gradual PdR rollout in 2007, 2009, and 2010, there was a closing of the expenditure gap across regions. However, on the other side, this was accompanied by a widening of the mortality gap between PdR and non-PdR regions, with the gap gradually becoming wider over time. The same patterns emerge for both female as for male mortality, which are displayed in Figure 2.

4.2 Model estimates

The first-stage regression results in Table 2 show that the implementation of PdR has led to a significant reduction in per capita expenditure of about 66 Euros, corresponding to a drop of about 3.7%. This is likely to represent the intended effects of the policy, which was aimed at restoring the financial stability through budget cuts. While the 66 Euro annual reduction may seem small compared to the average budget deficits running up to 7-10% annually, we will examine next whether they may have had any unintended effects on mortality that was potentially avoidable.

Table 3 shows the estimates of our baseline IV model with two-way fixed effects (years and regions) as well as some time-varying controls like population size, income per capita and GDP. Columns (1) and (2) report the estimates of the effect of health expenditure on total amenable mortality for males and females, respectively. Columns (3) and (4) report the same effect in terms of elasticity.

We find that a decrease of 100 Euro in per-capita expenditure on health caused a 4.6% rise in amenable mortality, which is consistent for both males and females. In terms of elasticity, we estimate an
elasticity of amenable mortality with respect to health expenditure of approximately -0.8. In other words: the average 3.7% spending cut resulted in a 3% rise in the avoidable death rates. All these estimates are fairly precise and statistically significantly different from zero at the 5% level.

Next, we examine the disaggregated effects of austerity in healthcare by cause-specific mortality, stratified by sex. Table 4 displays parameter estimates for males (Panel A) and females (Panel B), respectively.

Concerning male mortalities, we find a negative and statistically significant effect for circulatory system amenable mortality and neoplasms amenable mortality (mainly due to colorectal cancer for men), with a coefficient -0.0005 and -0.002, respectively. The analysis also reveals negative coefficients for infectious disease mortality (column 3) and respiratory diseases mortality (column 4). However, in both cases the results are not statistically significant at conventional levels. For females, we find a negative, and statistically significant, effect only on neoplasms amenable mortalities (i.e., mainly breast and cervical cancers).

Finally, we explore some potential pathways for the mortality effects we find. Table 5 displays estimates of the effect of cost containment, induced by PdR schemes, on the utilization of several measures of healthcare resources and utilization: hospitalizations (columns 1-3), healthcare-related migration (column 4), hospital bed rates (column 5), and healthcare employment (column 6).

Overall hospitalizations show a reduction of about 13% for a 100 Euro change in per capita expenditure, which is statistically significant at 1% level. For the cause-specific hospitalizations we find a significant 3.5% drop in those for cardiovascular diseases, and 2% with respect to tumours. However, the latter is not statistically significant.

With respect to the healthcare-related cross-border migration, column (4) shows that the austerity has had a strong and statistically significant effect on regional border crossing in care seeking, which amounts to a 7% increase for a 100 Euro reduction in per capita expenditure. This result highlights a major concern for both between and within-region inequality. First, cross-border care use tends to increase the (travel) access cost for those who seek care from other regions, but the hospital bill is still picked up by the home region. Secondly, it increases the within-region access gap between individuals with different ability to pay for seeking treatments in other regions. For equity reasons, both patterns seem undesirable and PdR is likely to have further promoted treatment differences that favour those able and willing to travel to other regions to obtain potentially better (or at least quicker) care. In that sense, PdR may have further worsened equity in health care access between rich and poor.
Finally, column (5) and (6) show strong effects on capacity measures like hospital beds and the healthcare system workforce that amount to about 10% and 6%, both of which statistically significant. These findings strongly suggest that the spending cuts were translated mainly into medical capacity reductions in PdR regions that in turn induced hospital utilization drops and patient migration patterns.

4.3 Robustness checks

In order to examine the robustness of our results we perform two main checks. First, we investigate the first-stage linking PdR to expenditure. In particular, we perform a simulation exercise through randomization-based statistical inference for significance tests. We simulate the effect of PdR by randomly assigning a placebo policy to regions at different points in time, in place of the real one.

We repeat this procedure 2,000 times in order to generate a distribution of placebo treatment effects. Figure 3 presents the non-parametric distributions of these placebo estimates for both expenditure and its logarithm transformation, separately.

[Figure 3 around here]

Figure 3 shows that the average of the placebo treatments is zero and the actual coefficients, which are depicted by the red vertical lines, fall far from the tail of the distribution. This clearly indicates that the negative and significant effect that we find in the first stage is very unlikely to have occurred for reasons other than PdR.

Second, we estimate our model using as dependent variables the overall mortality rates and the non-amenable mortality rates, for both males and females, separately. In fact, by definition, these are not supposed to be affected by the cost containment. Indeed, the results in Table 6 show no significant effect on any of the outcomes considered.

[Table 6 around here]

However, the point estimates are still of some interest, since they allow us to compare our results to previous findings and thus to check for the plausibility of our estimates. Gallet and Doucouliagos (2017), through a meta-regression analysis, find that the spending elasticity for overall mortality is about -0.13. The one we estimate here is very close, ranging between -0.18 (males) and -0.14 (females). Concerning the Italian case, these estimates also go in the same direction of those provided by Depalo (2019), who identifies treatment bounds on total mortality for each treated region.

Both checks – of the reform timing and the main dependent variable – therefore increase the confidence in our main estimates of mortality effects of PdR.
5 Conclusion and discussion

We have taken advantage of the natural experiment of the Piano di Rientro (PdR) austerity policy that was implemented in selected regions in Italy to revisit an old question in health economics: at the margin, what does additional spending buy in terms of health gains? Interestingly, this was a period of fairly severe cuts in health spending in a relatively high-income and high-spending country, where it is has often been argued that what is achieved at the margin is not extension of life expectancy but mainly improvement of quality of life. Our findings suggest otherwise.

Confronted with rising health budget deficits, PdR reforms were implemented in 10 of 20 regions – mainly those located in the south of Italy – with the main goal to reduce these deficits by reducing expenditure. We find that – on average – this policy was successful and resulted in annual spending cuts of 3.7% after PdR, or about 66 euros per capita. But these cuts were not without consequences: they resulted – again on average – in a 3% rise in avoidable deaths among both men and women. Cause-specific estimates suggest that most of these were cancer related; mainly colorectal cancer and circulatory diseases for males, breast and cervical cancers for females. These are deaths that were avoidable and that could have been prevented through timely detection and treatment of cases.

Robustness checks confirm that these rises only occurred for amenable mortality causes and that they were only due to PdR.

We also find plausible mechanisms for these harmful effects on mortality amenable to intervention. PdR’s spending cuts have led to substantial capacity cuts in hospital beds (-6.5%) and health workforce employment (-4%). These may, in turn, have led to reductions in the rate of hospitalization (-8.5%). The spending cuts also seem to have spurred ‘medical care seeking behaviour from patients in PdR regions in non-PdR regions’, as indicated by the rise in (hospital) care seeking in non-PdR regions. The latter finding causes concern, not so much for health reasons, but for equity reasons: it suggests that those who were able and willing to pay extra to seek care in other - usually northern Italian – regions, have managed to escape the budgetary cuts that may have led to additional health risks. The findings obtained with our IV approach are in line with those of Depalo (2019) but appear to be stronger and more informative because we focus on specific types of amenable mortality and hospitalization.

Overall, we can conclude the following. First, even in rich, high spending countries like Italy, budgetary cuts for austerity reasons can lead to substantial loss of life. In Italy, the austerity induced by the fiscal recovery plans has led to cuts that were harmful to health and survival. Second, the reform led to cuts in especially hospital capacity that reduced utilization which in many cases must have been essential use of services, as indicated by the rise in premature deaths of males and females. Especially the rise in some preventable causes of cancer mortality are reasons for concern in an era where many new and very expensive new cancer treatments are knocking on the reimbursement door. Third, it also has had implications for equity within and between regions. Between regions, the gap in spending and mortality has increased, with especially the Southern Italian regions bearing the brunt of the cuts.
Within these regions, it is likely to have increased inequity in access as patients that were able and willing to go and seek hospital care in the North of the country.

All in all, Piano di Rientro seems to have reached its fiscal goals – i.e. regional budget deficit reductions – at a high price: an increase in preventable deaths, as well as a rise in inequity in health care access both within and between regions. In the recent OECD Health at a Glance comparison (OECD, 2019b), Italy still stands out as a country with a relatively low average spending rate (fourth lowest in the OECD) at 3,428 US$ (based on purchasing power parity). However, its 2017 ranking in terms of “treatable mortality” (13th) is not as good as its ranking in terms of “preventable mortality”. The latter category is defined as causes of death that can be mainly avoided through timely and effective health care interventions, including secondary prevention and treatment (i.e. after the onset of diseases, to reduce case-fatality). It is quite likely that Piano di Rientro has contributed to this lower ranking of Italy given that its real health expenditure growth rate for the period 2013-2018 -- a mere 0.8% per year -- has lagged far behind the OECD average of 2.4% over the same period. Our results suggest that especially the poorer south of Italy has suffered the survival consequences of this limited expenditure growth.

References

Aimone Gigio, L., D. Alampi, S. Camussi, G. Ciaccio, P. Guaitini, M. Lozzi, A. L. Mancini, E. Panicara, and M. Paolicelli (2017). La sanità in Italia: il difficile equilibrio tra vincoli di bilancio e qualit dei servizi nelle Regioni in Piano di Rientro. Technical report.

Crémieux, P. Y., Meilleur, M. C., Ouellette, P., Petit, P., Zelder, M., & Potvin, K. (2005). Public and private pharmaceutical spending as determinants of health outcomes in Canada. *Health Economics*, 14(2), 107-116.

Crémieux, P. Y., Ouellette, P., & Pilon, C. (1999). Health care spending as determinants of health outcomes. *Health Economics*, 8(7), 627-639.

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.

Edney, L. C., Afzali, H. H. A., Cheng, T. C., & Karnon, J. (2018). Mortality reductions from marginal increases in public spending on health. *Health Policy*, 122(8), 892-899.

Fantini, M. P., Lenzi, J., Franchino, G., Raineri, C., Burgio, A., Frova, I., ... & Damiani, G. (2012). Amenable mortality as a performance indicator of Italian health-care services. *BMC health services research*, 12(1), 310.

Electronic copy available at: https://ssrn.com/abstract=3529892
Ferré, F., de Belvis, A. G., Valerio, L., Longhi, S., Lazzari, A., Fattore, G., … Maresso, A. (2014). Italy: Health system review. *Health Systems in Transition, 16*(4), 1–166.

Gaila L. (2019, April 12). Campania, i conti della Sanità tornano in ordine. Ma il prezzo del commissariamento è sulle spalle dei malati. *Il Fatto Quotidiano*. https://www.ilfattoquotidiano.it/2019/04/12/campania-i-conti-della-sanita-tornano-in-ordine-mi-l-prezzo-del-commissariamento-e-sulle-spalle-dei-malati/5103626/. Last Accessed: 09/11/2019.

Gallet, C. A., & Doucouliagos, H. (2017). The impact of healthcare spending on health outcomes: A meta-regression analysis. *Social Science & Medicine, 179*, 9-17.

Hitiris, T., & Posnett, J. (1992). The determinants and effects of health expenditure in developed countries. *Journal of Health Economics, 11*(2), 173-181. Nixon, J., & Ulmann, P. (2006). The relationship between health care expenditure and health outcomes. *The European Journal of Health Economics, 7*(1), 7-18.

Lomas, J. R. S., Martin, S., & Claxton, K. P. (2018). Estimating the marginal productivity of the English National Health Service from 2003/04 to 2012/13.

Mackenbach, J. P., Hu, Y., Artnik, B., Bopp, M., Costa, G., Kalediene, R., … Nusselder, W. J. (2017). Trends in inequalities in mortality amenable to health care in 17 European countries. *Health Affairs, 36*(6), 1110–1118.

Marino D. (2016, February 22). Gli effetti perversi del Piano di rientro sanitario. *Corriere della Calabria*. https://www.corrieredellacalabria.it/politica/item/43388-gli-effetti-perversi-del-piano-di-rientro-sanitario/. Last Accessed: 09/11/2019.

Martin, S., Rice, N., & Smith, P. C. (2008). Does health care spending improve health outcomes? Evidence from English programme budgeting data. *Journal of Health Economics, 27*(4), 826-842.

Ministero della Salute. (2018). FAQ - Domande più frequenti sui Piani di Rientro. Retrieved from http://www.salute.gov.it/portale/p5_1_1.jsp?lingua=italiano&id=145. Last Accessed: 09/11/2019.

Ministero Economia e Finanze. (2009). PIANI DI RIENTRO DELLA SPESA SANITARIA. In Relazione Unificata sull'Economia e la Finanza Pubblica per il 2009 (pp. 180–183).

Ministero Economia e Finanze. (2014). Il monitoraggio della spesa sanitaria (Vol. 1). http://www.rgs.mef.gov.it/_Documenti/VERSIONE-I/Attivit--i/Spesa-soci/Attivit-monitoraggio-RGS/2015/IMDSS-RS02_15_09_2015.pdf. Last Accessed: 09/11/2019.

Ministro dell'Economia e delle Finanze. (2015). Finanziamento e risultati di esercizio - RAPPORTO CREA SANITA’. Retrieved July 10, 2018, from http://www.rapportosanita.it/finanziamento/21-189/contributo-alla-formazione-del-disavanzo-da-parte-delle-regioni-in-pdr-e-da-parte-diquelle-non-in-pdr-anni-2006-2015. Last Accessed: 09/11/2019.

Nolte, E., & McKee, M. (2003). Measuring the health of nations: analysis of mortality amenable to health care. *Journal of Epidemiology & Community Health, 58*(4), 326-326.

Nolte, E., & McKee, M. (2004). *Does health care save lives? Avoidable mortality revisited* (p. 139). The Nuffield Trust.
Nolte, E., & McKee, C. M. (2008). Measuring the health of nations: updating an earlier analysis. *Health affairs, 27*(1), 58-71.

Organisation for Economic Co-operation and Development (OECD) (2019a). Avoidable mortality: OECD/Eurostat lists of preventable and treatable causes of death (2019 version). Retrieved from: [https://www.oecd.org/health/health-systems/Avoidable-mortality-2019-Joint-OECD-Eurostat-List-preventable-treatable-causes-of-death.pdf](https://www.oecd.org/health/health-systems/Avoidable-mortality-2019-Joint-OECD-Eurostat-List-preventable-treatable-causes-of-death.pdf). Last Accessed: 09/11/2019.

Organisation for Economic Co-operation and Development (OECD) (2019b). Health at a Glance 2019 – Italy. Retrieved from: [http://www.oecd.org/italy/health-at-a-glance-italy-EN.pdf](http://www.oecd.org/italy/health-at-a-glance-italy-EN.pdf). Last Accessed: 23/12/2019.

Redazione BaryToday. (2012, June 6). Sanità, approvato piano di rientro. Chiude l'ospedale di Conversano. *BaryToday*. Retrieved from: [http://www.baritoday.it/politica/sanita-approvato-piano-di-rientro-chiude-l-ospedale-di-conversano.html](http://www.baritoday.it/politica/sanita-approvato-piano-di-rientro-chiude-l-ospedale-di-conversano.html). Last Accessed: 09/11/2019.

Ricciardi, W., Belvis, A. G. De, Marino, M., Santoro, A., & Silenzi, A. (2011). Inequalities in Public Health development in Italy, an ecolving-to-federalism country. *Epidemiologia & Prevenzione, 35*(5–6), 1–136.

Russo, D. (2019, December 5). I migranti della salute a caccia di un letto. Un milione di pazienti fuggono dal Sud Italia. *La Stampa*. Retrieved from: [https://www.lastampa.it/topnews/primo-piano/2019/12/05/news/i-migranti-della-salute-a-caccia-di-un letto-un-milione-di-pazienti-fuggono-dal-sud-italia_1.38059518](https://www.lastampa.it/topnews/primo-piano/2019/12/05/news/i-migranti-della-salute-a-caccia-di-un letto-un-milione-di-pazienti-fuggono-dal-sud-italia_1.38059518). Last Accessed: 23/12/2019.

Tobias, M., & Yeh, L. C. (2009). How much does health care contribute to health gain and to health inequality? Trends in amenable mortality in New Zealand 1981–2004. *Australian and New Zealand journal of public health, 33*(1), 70-78.

Vallejo-Torres, L., García-Lorenzo, B., & Serrano-Aguilar, P. (2018). Estimating a cost-effectiveness threshold for the Spanish NHS. *Health Economics, 27*(4), 746-761.
Figures and Tables

Figure 1. Time trends in (logs of) health care expenditure per capita and overall avoidable mortality: PdR and non-PdR regions

Note: The figure shows the time trends of the logarithm of health care expenditure per capita (left axis) and the logarithm of total amenable mortality (right axis). The two vertical dotted lines depict the two periods of PdR rollout.
Figure 2. Time trends in (logs of) female and male avoidable mortality: PdR and non-PdR regions

Note: The figure shows the time trends for the logarithm of total amenable mortality for female (Panel A) and male (Panel B).
Figure 3. Randomization inference

Note: The figures show the distributions of the placebo estimates based on 2,000 permutations for expenditure and log(expenditure), separately. The vertical red lines depict the respective first-stage coefficients in Table 2.
## Table 1. Description of outcome variables

| Total amenable mortality | Disease-area mortality | Specific mortality | Description | Mean 2004 | Mean 2014 |
|--------------------------|------------------------|-------------------|-------------|-----------|-----------|
| Female Mortality         | Infectious             | Tuberculosis      | Age-standardized mortality rate for Tuberculosis per 10.000 females | 0,010     | 0,012     |
|                          |                        | Pneumonia and Influenza | Age-standardized mortality rate for pneumonia and influenza per 10.000 females | 0,011     | 0,099     |
| Neoplasms                | Colorectal             |                   | Age-standardized mortality rate for Colon, Rectal, and Anal Cancer per 10.000 females | 1,071     | 0,908     |
|                          | Breast                 |                   | Age-standardized mortality rate for Breast cancer per 10.000 females | 2,084     | 1,893     |
|                          | Cervical and Uterus    |                   | Age-standardized mortality rate for Cervical and Uterus cancer per 10.000 females (< 45 y) | 0,042     | 0,046     |
| Diabetes                 | Diabetes               |                   | Age-standardized mortality rate for Diabetes mellitus per 10.000 females (< 45 y) | 0,008     | 0,010     |
| Circulatory              | Ischemic               |                   | 50 % of Age-standardized mortality rate for heart diseases per 10.000 females | 1,731     | 1,053     |
|                          | Cerebrovascular        |                   | Age-standardized mortality rate for cerebrovascular diseases per 10.000 females | 1,294     | 0,907     |
| Respiratory              | Respiratory            |                   | Age-standardized mortality rate for all respiratory disease (excl. pneumonia/influenza) per 10.000 females (0-14 y) | 0,110     | 0,049     |
| Male Mortality           | Infectious             | Tuberculosis      | Age-standardized mortality rate for Tuberculosis per 10.000 males | 0,035     | 0,026     |
|                          |                        | Pneumonia and Influenza | Age-standardized mortality rate for pneumonia and influenza per 10.000 males | 0,201     | 0,188     |
| Neoplasms                | Colorectal             |                   | Age-standardized mortality rate for Colon, Rectal, and Anal Cancer per 10.000 males | 0,741     | 0,609     |
| Diabetes                 | Diabetes               |                   | Age-standardized mortality rate for Diabetes mellitus per 10.000 males (< 45 y) | 0,019     | 0,023     |
| Circulatory              | Ischemic               |                   | 50 % of Age-standardized mortality rate for ischemic heart diseases per 10.000 males | 5,148     | 3,449     |
|                          | Cerebrovascular        |                   | Age-standardized mortality rate for cerebrovascular diseases per 10.000 males | 2,008     | 1,462     |
| Respiratory              | Respiratory            |                   | Age-standardized mortality rate for all respiratory disease (excl. pneumonia/influenza) per 10.000 males (1-14 y) | 0,122     | 0,044     |
| Expenditure              | Regional per-capita Public Healthcare Expenditure | | | 1550,95  | 1852,50  |
| Beds                     | Ordinary Hospital Bed rate per 10.000 people | | | 38,530  | 32,685   |
| Employees                | Healthcare System Employee (workforce) rate per 10.000 people | | | 120,320  | 114,704  |
| Hospitalizations ALL     | Hospitalization rate for any condition per 1.000 people | | | 138,102  | 116,648  |
| Hospitalizations CD      | Hospitalization rate for Cardiovascular Diseases per 10.000 people | | | 2639,88  | 2009,88  |
| Hospitalizations T       | Hospitalization rate for Tumours per 10.000 people | | | 1356,29  | 1147,15  |
| X Border:                | Index of migration (% of migrants) to other region for hospitalization | | | 10,105  | 10,685   |

Note: Age limit is 75 years except if otherwise mentioned. Source: ISTAT (National Institute of Statistics)
Table 2. First-stage estimates

|         | (1) Expenditure |         | (2) Ln(Expenditure) |         |
|---------|----------------|---------|---------------------|---------|
| PdR     | -66.594***     |         | -0.037***           |         |
|         | 14.715         |         | 0.008               |         |
| Controls| yes            |         | yes                 |         |
| Year FE | yes            |         | yes                 |         |
| Region FE| yes          |         | yes                 |         |

**Obs.** 220  220

Note: Parameter estimates of Equation (1). Controls include population size recorded on 1st January, pro-capita disposable income and GDP. Standard Errors in *italics*. ***, **, * indicate statistical significance at 1%, 5%, and 10% respectively.
Table 3. Estimates of the effect on overall amenable mortality by sex

|                  | (1) Male mortality | (2) Female mortality | (3) Male mortality | (4) Female mortality |
|------------------|--------------------|----------------------|--------------------|----------------------|
| IV               | -0.00047**         | -0.00046**           | -0.833**           | -0.823**             |
|                  | 0.0002             | 0.0002               | 0.3963             | 0.4096               |
| Ln(Expenditure)  |                    |                      |                    |                      |
| Controls         | yes                | yes                  | yes                | yes                  |
| Year FE          | yes                | yes                  | yes                | yes                  |
| Region FE        | yes                | yes                  | yes                | yes                  |
| First stage F-test | 25.586             | 25.586               | 24.738             | 24.738               |
| Obs.             | 220                | 220                  | 220                | 220                  |

Note: Parameter estimates of Equation (2). Dependent variable is the logarithm of amenable mortality. Controls include population size, per-capita disposable income and GDP per capita. Standard Errors in italics. ***, **, * indicate statistical significance at 1%, 5%, and 10% respectively.

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Table 4. Estimates of the effect on amenable mortality by cause and sex

|                  | (1) Circulatory | (2) Neoplasms | (3) Infectious | (4) Respiratory | (5) Diabetes |
|------------------|----------------|---------------|----------------|----------------|--------------|
| Expenditure      | -0.00049**     | -0.00242***   | -0.00021       | -0.00211       | 0.00108      |
|                  | 0.0002         | 0.0009        | 0.0011         | 0.0024         | 0.0022       |

**Panel A: Males**

|                  | (1) Circulatory | (2) Neoplasms | (3) Infectious | (4) Respiratory | (5) Diabetes |
|------------------|----------------|---------------|----------------|----------------|--------------|
| Expenditure      | -0.00034       | -0.00087***   | -0.00099       | -0.00238       | 0.00302      |
|                  | 0.0003         | 0.0004        | 0.0012         | 0.0033         | 0.0019       |

**Panel B: Females**

| Controls         | yes            | yes            | yes            | yes            | yes          |
| Year FE          | yes            | yes            | yes            | yes            | yes          |
| Region FE        | yes            | yes            | yes            | yes            | yes          |
| **Obs.**         | 220            | 220            | 220            | 220            | 220          |

Note: Parameter estimates of Equation (2). Dependent variable is the logarithm of amenable mortality by cause. Controls include population size recorded on 1st January, per capita disposable income and GDP per capita. Standard Errors in italics. ***, **, * indicate statistical significance at 1%, 5%, and 10% respectively.
Table 5. Estimates of the effect on health care utilization outcomes

|                  | (1) Hospitalizations | (2) Hosp. CD | (3) Hosp. T | (4) X Border | (5) Beds | (6) Employees |
|------------------|----------------------|--------------|-------------|--------------|----------|--------------|
| Expenditure      | IV                   | IV           | IV          | IV           | IV       | IV           |
|                  | 0.00138***           | 0.00035**    | 0.00023     | -0.00073**   | 0.00100** | 0.00057**    |
|                  | 0.00037              | 0.00016      | 0.00016     | 0.00032      | 0.00031  | 0.00024      |
| Controls         | yes                  | yes          | yes         | yes          | yes      | yes          |
| Year FE          | yes                  | yes          | yes         | yes          | yes      | yes          |
| Region FE        | yes                  | yes          | yes         | yes          | yes      | yes          |
| First stage F-test | 25.586              | 25.586       | 25.586      | 25.586       | 25.586   | 25.586       |
| Obs.             | 220                  | 220          | 220         | 220          | 200      | 200          |

Note: Parameter estimates of Equation (2). Dependent variable is the logarithm of utilization outcome. Controls include population size recorded on 1st January, per capita disposable income and GDP per capita. Standard Errors in italics. ***, **, * indicate statistical significance at 1%, 5%, and 10% respectively.
Table 6. Robustness checks

| Panel A | (1) Overall Male Mortality | (2) Overall Female Mortality | (3) Non-Amenable Male Mortality | (4) Non-Amenable Female Mortality |
|---------|-----------------------------|------------------------------|--------------------------------|----------------------------------|
| IV – Elast. | IV – Elast. | IV – Elast. | IV – Elast. |
| Log(Expenditure) | -0.18349 | -0.14620 | -0.13243 | -0.07820 |
| Controls | yes | yes | yes | yes |
| Year FE | yes | yes | yes | yes |
| Region FE | yes | yes | yes | yes |
| First stage F-test | 24.738 | 24.738 | 24.738 | 24.738 |

| Panel B | (1) IV | (2) IV | (3) IV | (4) IV |
|---------|-------|-------|-------|-------|
| Expenditure | -0.00010 | -0.00008 | -0.00007 | -0.00004 |
| Controls | yes | yes | yes | yes |
| Year FE | yes | yes | yes | yes |
| Region FE | yes | yes | yes | yes |
| First stage F-test | 25.586 | 25.586 | 25.586 | 25.586 |

*Obs.* | 220 | 220 | 220 | 220

Note: Parameter estimates of Equation (2). Dependent variable is the logarithm of mortality. Controls include population size recorded on 1st January, per capita disposable income and GDP per capita. Standard Errors in italics. ***, **, * indicate statistical significance at 1%, 5%, and 10% respectively.