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Abstract

In this article we consider the impact on health care access and quality when decentralizing health spending down to local governments, based on data from 49 countries around the world over the period 1996 to 2015. Our empirical results, after controlling for a range of potentially confounding variables, indicate that decentralizing health spending is inimical to timely and effective health care. We moreover explore the role of two specific channels through which fiscal decentralization can undermine health outcomes namely, externalities and foregone economies of scale. We find that decentralizing health expenditure down to the local level may generate externalities to the detriment of health outcomes when it is accompanied by locally elected municipal politicians who are not subject to national parties. Our results also suggest that fiscal decentralization can improve health access and quality when two-thirds or more of the people in a country live in localities with more than 300,000 inhabitants, implying that below this threshold economies of scale may be foregone.

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Key words

Fiscal decentralization, health decentralization, health care access and quality, local governments, economies of scale, externalities

JEL codes

H11, H72, I18

Statement and declarations

The authors have no competing interest to declare that are relevant to the context of this article.

Introduction

Theoretically, fiscally decentralizing public health policy may improve health outcomes for a range of reasons. In a decentralized setting, mobile citizens can sort themselves across political jurisdictions according to their preferred level, quality, and price for public services. This matching of the demand for services with their supply is expected to enhance social welfare (Tiebout, 1956). Mobile citizens and capital can generate inter-jurisdictional competition for fiscal resources thus pushing sub-central governments to provide public health services more efficiently (Brennan and Buchanan, 1980). The decentralization of public policies can be beneficial even when mobility is limited. First, the greater proximity between service providers and users implies that there is more information on both the demand and supply side of public services (Oates, 1972; Seabright, 1996) including health services (Hurley et al., 1995). Second, citizens can use the performance of sub-central governments in neighboring or comparable jurisdictions as a benchmark for the performance of their own governments – a concept known as yardstick competition (Salmon, 1987; Besley and Case 1995). Third, decentralization allows for welfare improving innovations to emerge in one jurisdiction and, from there, to spread across the country (see, Hayek, 1937 and Oates, 1999 for the general argument and, again, Hurley et al., 1995 for the particular case of health services).

Decentralization can also lead to the inefficient provision of health services to the detriment of health outcomes. The inter-jurisdictional competition for fiscal resources can potentially lead to reduced tax pressure thus undermining the capacity of sub-central governments to effectively provide public services (Keen and Marchand, 1997). In the absence of suitably designed and funded fiscal transfers, decentralizing down to jurisdictions with unequal revenue raising capacities can also generate inequalities in fiscal resources and, ultimate, inequalities in health services and outcome across jurisdictions (for the general argument see Prud'homme, 1995 and for health inequalities see, Collins and Green, 1994; Sumah et al. 2016). In addition, fiscal decentralization may create inefficiencies if the public goods or services provided, experience externalities or economies of scale (Oates, 1972). This could certainly be relevant for health services. For example, externalities or spillovers may emerge in the case of immunization policies such that the benefits of immunization services may extend beyond the borders of a subcentral jurisdiction in which case the decentralization of these services may lead to them being under-provided as jurisdictions free-ride on the provision of these services by others (Khaleghian, 2004; Costa-i-Font, 2012). Economies of scale in health service delivery can take several forms. Cost savings can emerge because the centralized buying of drugs and medical equipment can increase the bargaining power of the public sector when dealing with private sector suppliers of these (Jiménez-Rubio, 2011a). Moreover, the per capita cost of medical technology with high sunk costs will be lower if these are financed at more centralized levels at the same time as the access of a larger share of the population to this technology at these levels reduces the risk that they are underutilized (for example, MRI devices or CAT scanners) (Kyriacou and Roca-Sagalés, 2019).

Existing empirical evidence of the effect of fiscal decentralization on health outcomes has mostly come out in favor of a positive effect, although there is also some evidence of negative or insignificant effects (for surveys see Channa and Faguet, 2016, Martinez-Vazquez et al., 2017 and Dwicaksono and Fox, 2018). As can be appreciated in the on-line Appendix Table OA.1, previous work differs on a range of dimensions including, on the one hand, the indicators employed to measure health outcomes, and fiscal decentralization and, on the other, the units of analysis. Health outcomes have mostly been measured by way of infant mortality rates (Robalino et al. 2001; Habibi et al., 2003; Asfaw et al., 2007; Enikolopov and Zhuravskaya, 2007; Cantarero and Pascual, 2008; Uchimura and Jutting, 2009; Jiménez-Rubio, 2011a,b; Jin and Sun, 2011; Soto et al., 2012; Cavalieri and Ferrante, 2016; Rocha et al., 2016; Arends, 2017; Jiménez-Rubio and Garcia-Gómez, 2017). Another group has measured health outcomes based on self-reported satisfaction with public health care (Antón et al., 2014; Diaz-Serrano and Rodríguez-Pose, 2015; Espasa et al., 2017 Huang et al., 2017) or the quality of public services more generally (Kyriacou and Roca-Sagalés 2019). Health outcomes have also been measured in terms of

immunization coverage rates (Khaleghian 2004; Enikolopov and Zhuravskaya 2007), life expectancy at birth (Montero-Granados et al., 2017; Cantarero and Pascual, 2008), change in the poor population covered by public health insurance (Faguet and Sánchez, 2014), public health expenditure (Arends, 2017; Arze de Granado et al., 2018) and efficiency scores generated by Data Envelopment Analysis or Stochastic Frontier Models and employing infant mortality rates as output variables (Adam et al. 2014; Porcelli 2014; Arends 2017).

Fiscal decentralization has also been measured in different ways. Most cross-country studies employ aggregate indicators capturing sub-central (regional and/or local) government spending or revenue as a percentage of total spending or revenue (Robalino et al., 2001; Khaleghian, 2004; Enikolopov and Zhuravskaya, 2007; Jiménez-Rubio, 2011b; Adam et al., 2014; Diaz-Serrano and Rodriguez-Pose, 2015; Arends, 2017; Arze de Granado et al., 2018). Two cross-country studies use a more focused measure of fiscal decentralization namely regional and/or local public health expenditure as a share of total health expenditure (Arends, 2017; Kyriacou and Roca-Sagalés, 2019). This more focused approach has also been adopted by some of the country-specific analyses of the impact of fiscal decentralization on health outcomes. Specifically, studies exploiting within-country variation of fiscal decentralization have tended to measure decentralization as public health expenditures by lower levels (local, county, provincial, regional) as a share of the health expenditures of higher levels (provincial, regional or national) (Cantarero and Pascual, 2008; Jiménez-Rubio, 2011a; Soto et al., 2012).

Insofar as the samples employed, of the 26 studies reviewed in the on-line Appendix Table OA.1, 17 exploit evidence from specific countries namely, Argentina (Habibi et al., 2003), India (Asfaw et al., 2007), Spain (Montero-Granados et al., 2007; Cantarero and Pascual, 2008; Antón et al., 2014; Espasa et al., 2017; Jiménez-Rubio and Garcia-Gómez, 2017), China (Uchimura and Jutting, 2009; Jin and Sun, 2011; Huang et al., 2017), Canada (Jiménez-Rubio, 2011a), Colombia (Soto et al., 2012; Faguet and Sánchez, 2014), Italy (Porcelli, 2014; Cavalieri and Ferrante, 2016; Di Novi al., 2019) and Brazil (Rocha et al., 2016). The 9 remaining studies are cross-country analyses. These can be broadly divided into two groups. First, studies that exploit evidence from a large number – between 42 to 140 – of developing, transition and/or developed countries (Robalino et al., 2001; Khaleghian, 2004; Enikolopov and Zhuravaskaya, 2007; Arze del Granado et al., 2018). Second, based on a group of – 20 to 32 – OECD or European countries (OECD: Jiménez-Rubio, 2011b; Adam et al., 2014; European: Diaz-Serrano and Rodríguez-Pose, 2015; Arends, 2017; Kyriacou and Roca-Sagalés, 2019). Generally, cross-country studies that include a relatively large number of countries tend to measure fiscal decentralization as sub-central government spending or revenue as a share of total public spending or revenue since this data is available for a larger number of countries. Studies centered on OECD countries go a step further by focusing on sub-central governments' own revenues – revenue sources controlled by sub-central governments, – as a share of total government revenues (Jiménez-Rubio, 2011b; Adam et al., 2014). As previously stated, Arends (2017) and Kyriacou and Roca-Sagalés (2019) are the only cross-country studies employing sub-central public health expenditure as share of total health expenditure to measure fiscal decentralization. The former covers up to 25 European countries while the latter extends to 30 countries across Europe.

In this article we will follow this last set of contributions by employing fiscal decentralization measures that account for local government health spending as share of total spending on public health. We will go beyond this work in several ways. First, our country sample includes 49 countries and covers developing, transition and developed countries across the world. Second, we will consider how fiscal decentralization affects health outcomes by way of a health indicator that is based on the concept of amenable mortality that reflects the rates of death considered preventable by timely and effective care (known as the HAQ index or the Health Care Access and Quality index). As will be more fully explained below, empirically considering the impact of fiscal decentralization on outcomes such as infant mortality, immunization coverage or life expectancy may be difficult given that such outcomes may depend on many factors beyond the influence of health policy. Alternatively, the timeliness and

effectiveness of health care is potentially more directly influenced by health policy design which includes the degree of decentralization of health expenditure. Third, we will empirically explore the theoretical arguments suggesting that externalities or spillover effects and economies of scale may affect the impact of fiscal decentralization on health outcomes. To the best of our knowledge, these interaction effects have yet to be empirically examined. Our empirical evidence from a sample of 49 countries over the period 1996 to 2015 and after controlling for a host of potentially confounding covariates are strongly suggestive of the view that decentralizing health expenditure down to the municipal level has a negative impact on health care outcomes. Moreover, we find that fiscal decentralization can improve health outcomes when two-thirds or more of the people in a country live in localities with more than 300,000 inhabitants suggesting a role for economies of scale. Finally, we find some support for the idea that fiscal decentralization may worsen health outcomes because it gives rise to externalities or spillover effects in the context of locally elected politicians who are not subject to national party discipline.

The rest of this article is structured as follows. In the following section we carefully describe the key indicators employed to measure health outcomes and fiscal decentralization as well as the empirical methodology. After that we report and discuss our empirical findings before concluding.

Data and empirical methodology

Our main measure of healthcare system performance is the Healthcare Access and Quality (HAQ) index from Murray et al. (2017). This index is based on the concept of amenable mortality that reflects the rates of death considered preventable by timely and effective care. Specifically, it uses age-standardized, risk-standardized mortality rates for 32 causes of death that timely and effective health care could potentially prevent. The HAC index is scaled from zero to 100 and is increasing with lower mortality rates for causes amenable to health care, thus reflecting better access to, and quality of, care. In our sample of countries, it ranges from 44.70 to 93.60 with a mean value of 77.56. Countries on the low end include Indonesia, South Africa and Kazakhstan, those around the mean include Estonia, Israel and Latvia, and the countries with the lowest amenable mortality rates are Iceland, Switzerland and Sweden. The HAQ index is available every five years between 1990 and 2015.

As stated in the Introduction, much of previous work has focused on the impact of fiscal decentralization on mortality rates and life expectancy, both of which are based on infant mortality rates (see full definitions of these and all the variables employed in this article in the on-line Appendix Table OA.2). The difficulty with such “raw” mortality-based indicators is that they can be affected by many other factors above and beyond the design of fiscal policy. For example, writing on life expectancy, Lewer and Bibby (2021, p.e623) explain that it is “the result of the social and economic history of the past century—the prevalence of smoking, treatment for cardiovascular diseases, road safety, housing quality, safety of childbirth, and many other social changes.” Ideally, studies examining the impact of fiscal decentralization on “raw” mortality-based indicators should account for such factors which is certainly a challenging task. This problem is mitigated when using a health indicator based on the concept of amenable mortality and that reflects the timeliness and effectiveness of health care, since these attributes are more likely to be directly impacted on by health policy design of which fiscal decentralization in the health sector is one dimension. This said, in an effort to relate our work to existing work, we also explore the extent to which decentralizing health spending down to local governments impacts on life expectancy and infant and child mortality rates.

To measure fiscal decentralization in the health sector we turn to the IMF’s Fiscal decentralization data set that provides a range of fiscal decentralization indicators (LLedó et al., 2018). We focus on variable health_lg, defined as local health expenditure as a share of general government health expenditure. This variable is available annually from 1995 to 2016. Given the availability of the HAQ index we average the fiscal decentralization measures coincident to four, five-year periods starting in 1996 and ending in 2015 (1996-2000, 2001-05, 2006-10, 2011-15). We match these averages to the

corresponding value of the HAC index at the end of each five-year period thus allowing fiscal policy to impact on health outcomes with a lag of up to four years. We apply the same approach to all the time variant variables employed in the empirical analysis. The degree of fiscal decentralization of health spending ranges widely in our sample of countries, from zero to 98.58%. Local governments spend nothing on health in countries such as Cyprus, Malta and New Zealand while they undertake almost all the spending in this area in Denmark, Italy and Sweden. The mean percentage of fiscal decentralization in health down to local governments is 27.03 and the country closest to this is Hungary.

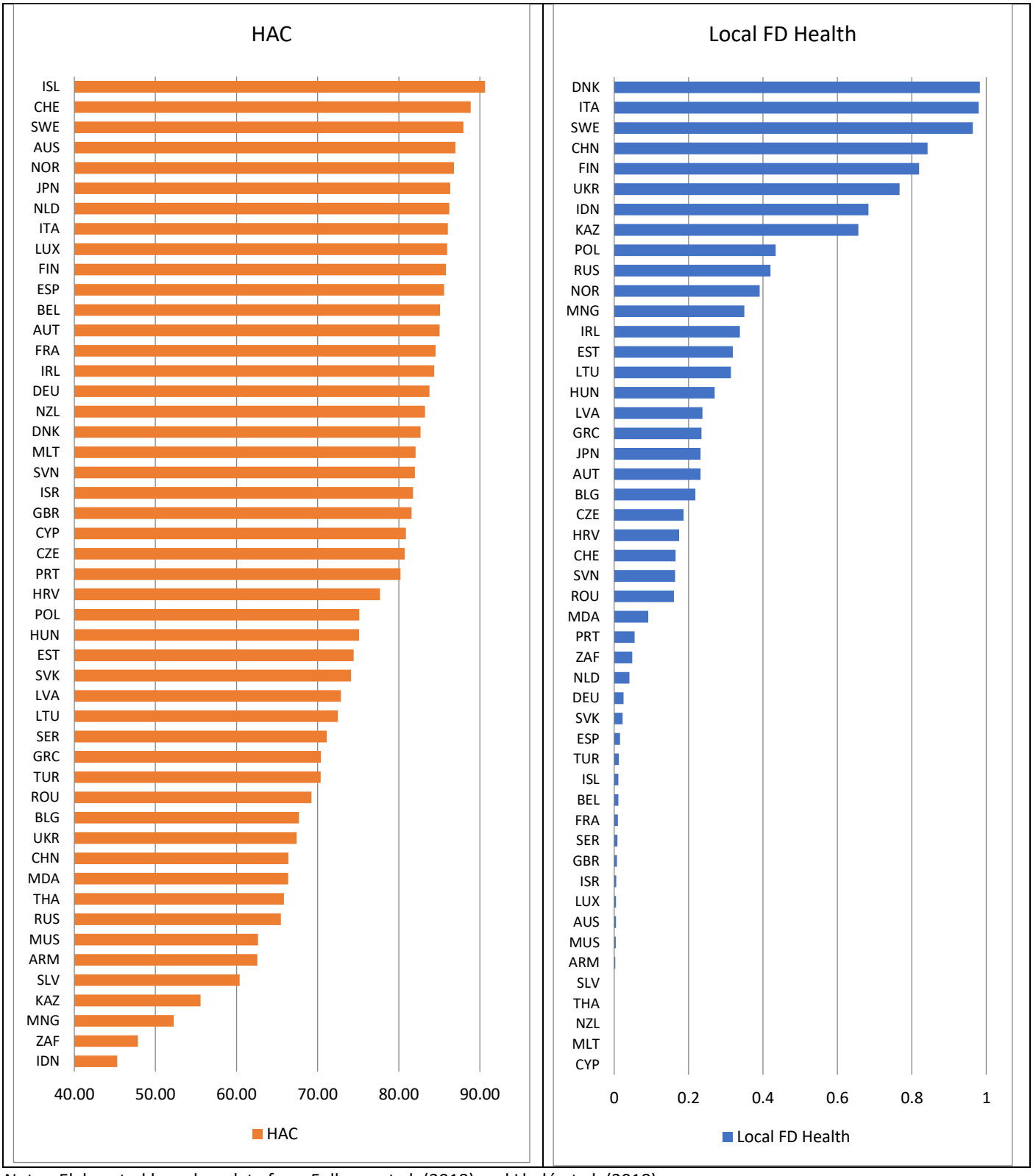
The overlap between these two variables and a set of control variables (explained below) leads to a sample of up to 49 countries over the period 1996 to 2015. Figure 1 shows the differences across these countries in both the HAC and fiscal decentralization indices, taking average values of each variable over the sample period (see Appendix Table A.1 for full country names).

We estimate the following empirical model:

$$\text{Health Outcome}_{it} = \beta_0 + \beta_1 \text{LDHealth}_{it} + \beta_2 X_{it} + \mu_t + \varepsilon_{it} \qquad (1)$$

Where i and t refer to countries and time-periods respectively, the Health Outcome is the dependent variable, LDHealth is decentralization of health expenditure down to the local level, X is a vector of control variables and ε an error term. Our main variable to measure health outcomes is the HAC index, but we also consider 3 variables related to life expectancy (life expectancy at birth, healthy life expectancy at birth and healthy life expectancy at 60) and 2 mortality variables (infant and child mortality). This model is estimated by way of OLS based on panel corrected standard errors (PCSE) that are robust to heteroscedasticity and serial correlation between the residuals of a given cross-section (Period SUR). We include period fixed effects (μ_t), to account for the impact of time varying factors common to all countries. To account for the influence of time constant factors specific to each country, country fixed effects would be used. However, we do not include these because of the limited within-country variation compared to the cross-section variance in our key variables of interest. Thus, as can be appreciated in Table A.2 in the Appendix, the within standard deviation of the HAQ index is 2.98, compared to a between standard deviation of 10.98. In the case of the local decentralization of health spending the corresponding numbers are 0.10 versus 0.32.

Figure 1. Health Access and Quality and Decentralization of Health Spending (average over 1996-2015)



Notes: Elaborated based on data from Fullman et al. (2018) and Lledó et al. (2018).

Our choice of control variables is inspired by previous work and is ultimately guided by the need to reduce omitted variable bias. Specifically, we control for GDP per capita, the size of a country's population, income inequality, the degree of ethnic heterogeneity, the level of democracy, the per capita spending on health, the degree of fiscal decentralization of health expenditure at the regional level and the extent of tax autonomy enjoyed by local governments.

We control for GDP per capita, to capture a range of unobserved factors impacting on health outcomes that may depend on economic development. We measure this variable in constant USD and PPP terms to take into account the differences in the cost of living. Previous work has related greater wealth per capita with better health outcomes (see, for example, Pritchett and Summers, 1996; Filmer and Pritchett, 1999). We account for the population as a proxy of the size of the country because smaller countries tend to be more centralized (Panizza, 1999). We control for interpersonal income inequality given the results of Pickett and Wilkinson (2009) showing the benefits from greater equality, in terms of a range of physical and mental health dimensions including infant mortality, life expectancy, mental illness and drug use and obesity. We control for the extent to which the country is ethnically fractionalized since ethnic heterogeneity can undermine consensus regarding public goods provision (Alesina et al. 1999) at the same time as it can be an important driver of decentralization (Panizza 1999; Arzaghi and Henderson 2005). The level of democracy is another potentially confounding covariate since previous work has reported that democracy improves health outcomes, for instance, by reducing infant and child mortality (Gerring et al. 2012; Pieters et al., 2016; Wigley & Akkoyunlu-Wigley, 2017; Wang et al. 2019). Democracy could also be conducive towards greater decentralization (Panizza, 1999; Alesina and Spolaore, 2003; Arzaghi and Henderson 2005). We also include total health expenditure per capita (public and private) to account for the possibility that such spending may positively affect health outcomes (see Nixon and Ulman, 2006; Anyanwu and Erhijakpor, 2009; Novignon et al., 2012). Moreover, because health spending is also undertaken by regional governments in 6 out of 49 countries in our sample – Australia, Austria, Russia, South Africa, Spain and Switzerland, – we control for this spending as a share of total health expenditures. Finally, we control for local tax autonomy as a proxy for local government's decision-making autonomy since fiscal decentralization as we measure it here may not necessarily reflect the ability of local governments to decide health policy due to restrictions or regulations established at the national level including "earmarked grants, mandatory spending and national standards" (Beazley et al., 2019; p 16).

Empirical results

Column 1 of Table 1 presents the estimation of equation 1 as described in the previous section. Decentralizing health expenditure down to the local level has a clear negative impact on health care access and quality. The result is both statistically and economically significant. A one standard deviation increase in the degree of fiscal decentralization reduces the HAC index by 1.747 points or 16.37 % of a standard deviation of this measure. The negative effect of decentralizing health expenditure also emerges when employing alternative measures of health outcomes namely, life expectancy (also in terms of healthy life expectancy) and mortality (both infant and child mortality). Overall, these results suggest that when decentralizing health spending down to the local level, the expected negative effects of fiscal decentralization in the guise of reduced and unequally distributed fiscal resources, foregone economies of scale and spillover effects, tend to outweigh the expected positive effects due to sorting and competition effects, information advantages and innovations. These results are in line with those reported

by previous cross-country work that has focused on the decentralization of health expenditure (Arends, 2017 and Kyriacou and Roca-Sagalés, 2019).

Before further exploring these findings, a word also about the estimated effect of the control variables. We find a robust negative impact of income inequality and ethnic fractionalization on health outcomes and some evidence that GDP per capita, health expenditure per capita, and local tax autonomy improve health outcomes. We do not find population size or the level of democracy to be associated with health outcomes in our sample.

Table 1 – Local decentralisation on health spending and health outcomes

Dependent variable:	**HAC (1)**	**Life Expectancy (2)**	**HALE at birth (3)**	**HALE at 60 (4)**	**Infant Mortality (5)**	**Child Mortality (6)**
Dec. of health spending - local	-5.246**	-2.432*	-2.423**	-1.189**	0.276*	0.269*
	(2.033)	(1.320)	(1.126)	(0.473)	(0.148)	(0.139)
Log of per capita GDP (PPP)	4.734	2.067	2.193	0.582	-0.492**	-0.557***
	(2.936)	(1.910)	(1.619)	(0.689)	(0.214)	(0.200)
Log of population	0.321	0.424	0.382*	0.117	-0.007	-0.008
	(0.395)	(0.257)	(0.219)	(0.092)	(0.029)	(0.027)
Income inequality	-0.379***	-0.220**	-0.185**	0.008	0.023**	0.026***
	(0.129)	(0.084)	(0.071)	(0.030)	(0.009)	(0.009)
Ethnical fractionalisation	-5.761*	-3.440*	-3.839**	-1.596**	0.392*	0.387*
	(3.118)	(2.026)	(1.725)	(0.734)	(0.228)	(0.214)
Democracy	0.175	0.096	0.053	0.024	-0.020	-0.019
	(0.195)	(0.127)	(0.108)	(0.046)	(0.014)	(0.013)
Log of health expenditure pc	3.445**	1.481	0.766	0.926**	-0.121	-0.093
	(1.651)	(1.074)	(0.911)	(0.388)	(0.120)	(0.113)
Dec. of health spending - state	1.042	-0.781	-1.315	-0.207	0.169	0.145
	(3.266)	(2.127)	(1.810)	(0.770)	(0.238)	(0.223)
Local tax autonomy	11.906*	1.468	1.911	1.646	-0.984**	-0.851**
	(6.228)	(4.053)	(3.444)	(1.460)	(0.451)	(0.424)
Constant	*11.034*	*45.589****	*39.964****	*1.908*	*7.131****	*7.756****
	(22.783)	*(14.775)*	*(12.569)*	*(5.341)*	*(1.663)*	*(1.559)*
Adjusted R^2	0.854	0.754	0.724	0.766	0.828	0.853
Countries	49	49	49	49	49	49
Observations	166	166	165	165	166	166

Notes: All regressions report period SUR panel corrected standard errors in parentheses and include period fixed effects. *, **, *** measures statistical significance at the 10, 5 and 1 per cent levels respectively.

In Table 2 we conduct an interaction analysis employing variables that can help identify the economies of scale and spillover effects channels through which fiscal decentralization may undermine health outcomes. In columns 1 to 5 we focus on economies of scale, and we deal with spillover or externality effects in columns 6 to 10. Specifically, we capture the role of economies of scale considering two different urbanization variables. First, in columns 1 and 3 respectively, we include a variable defined as the percentage of the country population living in an urban center with more than 50.000 inhabitants (urban_50), and alternatively, with more than 300.000 inhabitants (urban_300). The intuition here is that in countries where a greater share of the population resides in larger municipalities, economies of scale in the form of greater negotiating strength when purchasing drugs and medical equipment, reduced per capita cost of medical technology with high sunk costs and higher utilization rates, are more likely to emerge in decentralized settings. Interestingly, the first urban variable is not significant, while the second one is, indicating that health access and quality is higher in countries with a higher share of the population in larger municipalities. In columns 2 and 4 we interact both urban indicators with our variable of interest to consider their potential moderating effect, and again the

interaction with urban_50 is not statistically relevant, while the interaction with urban_300 is positive and statistically significant, suggesting that local health decentralization will improve health outcomes in countries with a higher percentage of population living in relatively large urban areas. Specifically, the threshold value of urban_300 which changes the estimated effect of local health decentralization from negative to positive is 0.66, meaning that the marginal effect of local health decentralization on health outcomes becomes positive in countries where two thirds or more of the population live in urban areas of more than 300.000 inhabitants. Decentralizing health expenditures down to the local level in these countries can still harness economies of scale to the benefit of health care access and quality. This result is maintained after controlling, in column 5, for population density given the possibility that the urbanization variable is picking up density differences and because distance from health centers can affect patient access to health care (Hanlon et al., 2012). In our sample of 49 countries, there are 8 countries with more than two thirds of their population living in this kind of urban areas (Australia, China, Israel, Japan, Mongolia, South Africa, Thailand and Turkey). In the remaining countries, decentralizing health expenditure down to the local level potentially foregoes economies of scale, to the detriment of health access and quality. Our results help inform a previous, unsubstantiated claim that the optimal size of a decentralized jurisdiction in the health sector could be "a geographically compact area of 50,000-500,000 people, often a local government unit, which can provide a comprehensive health service for most conditions." (Mills, 1994, p.284; see also WHO, 1988).

Table 2 – The interaction effects: Economies of scale and externalities

Dependent variable: HAC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
Dec. of health spending – local	-4.551**	-0.055	-5.320***	-11.605***	-11.123***	-5.856***	-5.678*	-6.009***	-4.087*	-4.175*
	(2.024)	(6.146)	(1.892)	(3.722)	(3.872)	(2.074)	(2.891)	(2.006)	(2.205)	(2.238)
Log of per capita GDP (PPP)	4.830*	5.386*	6.767**	5.935**	5.860**	6.184*	6.184*	6.896**	7.854***	7.792**
	(2.871)	(2.926)	(2.790)	(2.692)	(2.708)	(3.182)	(3.193)	(3.064)	(2.955)	(2.991)
Log of population	0.296	0.429	-0.220	-0.220	-0.282	0.557	0.556	0.466	0.447	0.469
	(0.386)	(0.423)	(0.410)	(0.393)	(0.422)	(0.456)	(0.459)	(0.439)	(0.417)	(0.423)
Income inequality	-0.435***	-0.439***	-0.524***	-0.553***	-0.554***	-0.373***	-0.373***	-0.358***	-0.343***	-0.346***
	(0.132)	(0.132)	(0.128)	(0.123)	(0.123)	(0.130)	(0.131)	(0.125)	(0.120)	(0.121)
Ethnical fractionalisation	-5.130*	-4.603	-8.819***	-7.827***	-7.606**	-2.977	-2.952	-2.127	-2.294	-2.298
	(3.065)	(3.188)	(3.020)	(2.941)	(2.990)	(3.286)	(3.305)	(3.207)	(3.043)	(3.053)
Democracy	0.205	0.206	0.225	0.267	0.248	0.154	0.158	0.201	0.164	0.148
	(0.191)	(0.192)	(0.181)	(0.175)	(0.179)	(0.193)	(0.198)	(0.185)	(0.175)	(0.188)
Log of health expenditure pc	3.306**	2.951*	1.673	2.232	2.273	3.176*	3.186*	2.893*	2.279	2.080
	(1.617)	(1.657)	(1.616)	(1.566)	(1.575)	(1.694)	(1.708)	(1.627	(1.573)	(1.687)
Dec. of health spending - state	1.043	0.648	2.544	2.534	2.722	-0.361	-0.368	-0.376	-0.458	-0.455
	(3.194)	(3.258)	(3.046)	(2.916)	(2.967)	(3.266)	(3.278)	(3.149)	(2.987)	(2.997)
Local tax autonomy	11.687*	11.626*	11.390*	10.802*	11.180**	12.533**	12.522*	13.377**	13.264**	13.151**
	(6.090)	(6.103)	(5.784)	(5.555)	(5.629)	(6.575)	(6.595)	(6.349)	(6.055)	(6.089)
Urban_50	0.068	0.089	---	---	---	---	---	---	---	---
	(0.047)	(0.056)								
Urban_50* LFD_health	---	-0.141	---	---	---	---	---	---	---	---
		(0.179)								
Urban_300	---	---	0.094***	0.072**	0.074**	---	---	---	---	---
			(0.032)	(0.033)	(0.034)					
Urban_300* LFD_health	---	---	---	0.176*	0.168*	---	---	---	---	---
				(0.089)	(0.091)					
Density					0.185					
					(0.411)					
DemDecPartyInt	---	---	---	---	---	2.505**	2.576*			
						(1.101)	(1.496)			
DemDecPartyNonInt	---	---	---	---	---			-3.233	-1.450	-1.501
								(1.076)	(1.337)	(1.355)
DemDecPartyInt* LFD_health	---	---	---	---	---	---	-0.260			
							(3.459)			

DemDecPartyNonInt*	---	---	---	---	---	---			-6.744**	-6.606**
LFD_health									(3.023)	(3.064)
Governance quality	---	---	---	---	---	---	---	---		0.103
										(0.381)
Adjusted R^2	0.858	0.859	0.870	0.877	0.877	0.861	0.860	0.869	0.878	0.876
Countries	49	49	49	49	49	46	46	46	46	46
Observations	166	166	166	166	166	154	154	154	154	154

Notes: All regressions report period SUR panel corrected standard errors in parentheses and include period fixed effects and a constant (not shown). *, **, *** measures statistical significance at the 10, 5 and 1 per cent levels respectively. The three countries lost in regression 6 to 10 are China, Iceland, and Malta.

Table 3 – Robustness

Dependent variable: HAC	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Dec. of health spending - local	-2.249*	-2.594**	-6.501**	-10.027***	-9.647***	-5.253**	-5.040**	-5.314**
	(1.220)	(1.274)	(2.763)	(3.209)	(3.201)	(2.033)	(2.072)	(2.039)
Log of per capita GDP (PPP)	3.728*	4.543**	5.650	4.003	4.390	4.334	5.160*	4.995*
	(2.191)	(2.270)	(4.040)	(3.758)	(3.714)	(2.997)	(3.089)	(2.992)
Log of population	-0.222	-0.260	0.430	0.207	0.214	0.356	0.362	0.276
	(0.247)	(0.266)	(0.486)	(0.460)	(0.457)	(0.401)	(0.403)	(0.403)
Income inequality	-0.061	-0.022	-0.467***	-0.572***	-0.568***	-0.388***	-0.360**	-0.367***
	(0.101)	(0.107)	(0.153)	(0.153)	(0.153)	(0.129)	(0.144)	(0.131)
Ethnical fractionalisation	-5.436**	-5.628**	-4.645	-3.010	-3.454	-5.249	-6.079*	-5.489*
	(2.443)	(2.600)	(3.675)	(3.731)	(3.707)	(1.623)	(3.185)	(3.162)
Democracy	0.082	0.086	0.256	0.177	0.194	0.185	0.206	0.152
	(0.426)	(0.453)	(0.234)	(0.209)	(0.211)	(0.196)	(0.206)	(0.198)
Log of health expenditure pc	3.363***	2.918**	2.968	3.429*	3.183	3.761**	3.479**	3.160*
	(1.221)	(1.267)	(2.170)	(2.054)	(2.008)	(1.725)	(1.680)	(1.741)
Dec. of health spending - state	4.171**	3.998*	-0.252	1.098	0.736	0.868	0.914	1.269
	(1.900)	(2.032)	(3.650)	(3.514)	(3.518)	(3.279)	(3.293)	(3.292)
Local tax Autonomy	13.608***	14.224***	---	14.941	12.678	12.205*	11.395*	11.996*
	(4.295)	(4.534)		(9.941)	(9.789)	(6.236)	(6.255)	(6.246)
Local policy scope in health	-1.006**	---	---	---	---	---	---	---
	(0.506)							
Local effective political discretion in health	---	-0.393	---	---	---	---	---	---
		(0.594)						
Local revenue decentralization	---	---	17.398*	---	---	---	---	---
			(9.096)					
Local transfer dependence	---	---	---	0.271	---	---	---	---
				(4.600)				
Local vertical fiscal imbalance	---	---	---	---	-1.253	---	---	---
					(4.539)			
Local transfer conditionality	---	---	---	---	---	-1.094	---	---
						(1.905)		
EU	---	---	---	---	---	---	-0.551	---
							(1.196)	
Soviet	---	---	---	---	---	---	0.536	---
							(1.606)	
Government size	---	---	---	---	---	---	---	4.749
								(8.139)

Adjusted R^2	0.916	0.908	0.857	0.880	0.880	0.854	0.853	0.854
Countries	35	35	39	35	35	49	49	49
Observations	127	127	123	106	106	166	166	166

Notes: All regressions report period SUR panel corrected standard errors in parentheses and include period fixed effects and a constant (not shown). *, **, *** measures statistical significance at the 10, 5 and 1 per cent levels respectively.

We next examine the role played by spillovers or externalities considering two different variables from Hankla et al. (2019) capturing the extent of democratic decentralization and party integration and focusing on the municipal level. These authors argue that democratic decentralization in the form of locally elected municipal governments increases democratic accountability and, as a result, can contribute towards the efficient provision of local public goods. Moreover, and importantly for our purposes here, integrated party systems imply that subnational elections are contested by national parties, and these have an incentive to internalize the positive or negative spillovers of local policies on other localities and, by controlling their access to the ballot, influence locally elected members to do the same. The willingness of local politicians to be responsive to national party wishes is increased if they desire to move up within their parties and acquire national office (for the original argument see Riker, 1964 and for a previous discussion see Enikolopov and Zhuravaskaya, 2007). The two dichotomous variables are labelled DemDecPartyInt and DemDecPartyNonInt for democratic decentralization and party integration or non-integration respectively. The residual category in both cases is the absence of municipal elections.

Columns 6 and 7 indicate a positive association between democratic decentralization and party integration on the one hand and health care access and quality on the other. No such association emerges in the case of democratic decentralization and party non-integration (columns 8 and 9). Our results are consistent with those reported by Hankla et al. (2019) who regress a range of health variables – including child immunization, TB detection and treatment rates and infant mortality rates – against these measures. They find that democratic decentralization and party integration generally has a positive effect on health outcomes while the non-integration variant's positive effect is generally weaker, sometimes not statistically significant, and sometimes the effect is negative. More relevant for our purposes are the interaction effects reported in columns 7 and 9. While combining fiscal decentralization with democratic decentralization and integrated party systems has no effect on health outcomes, fiscal decentralization in democratically decentralized countries where moreover parties are not integrated has a clear negative impact on health care access and quality. This result is consistent with the idea that non-integrated municipal parties have little incentive to internalize spillover effects and, as such, is supportive of the argument that fiscal decentralization may worsen health outcomes because it can generate externalities. In column 10 we consider the interaction effect of democratic decentralization and non-integrated party systems after controlling for governance quality. We do so, because, according to Enikolopov and Zhuravaskaya (2007) strong national parties could also create incentives to resist local special interests who may target (capture) the resources available in decentralized settings. And previous work has identified good governance (the opposite of capture) as a potential determinant of better health outcomes (see, for example, Gupta et al., 2002 and more recently Li et al., 2018). Thus, if we don't control for governance, the estimated negative interaction effect of party non-integration on health could be driven more by capture rather than spillover effects. The negative interaction effect of democratic decentralization and party non-integration is maintained suggesting the importance of spillovers.

In Table 3 we explore the robustness of the estimated negative impact of fiscal decentralization on health care access and quality. In the first two columns, we include two indicators from Ladner et al. (2016) that capture the extent to which local governments are autonomous with regards to health policy. Again, decentralized health expenditure does not necessarily imply the capacity of sub-central units to freely decide on health policy and as such controlling for the degree of autonomy in this area is useful. Unfortunately, this data is only available for European

countries allowing the inclusion of just 35 of our sample of 49 countries. In column 1 of Table 3 we include the variable named 'local policy scope in health' that captures the extent to which local governments are formally autonomous when taking decisions related to primary health services, the construction and maintenance of health centers, and doctors' employment and payment. Column 2 includes the variable 'local effective political discretion in health' that captures the extent to which local government has real influence (can decide on service aspects) over primary health services, the construction and/or the maintenance of health centers, and the organization and functioning of specialized health centers. The inclusion of these qualitative indicators of health policy autonomy does not change the estimated negative impact of health expenditure decentralization on health care access and quality.

In columns 3 to 6 we control for a set of additional fiscal variables that can account for the degree of fiscal autonomy at the municipal level and thus reduce the danger that the health expenditure decentralization variable that we employ may misrepresent the degree of autonomy enjoyed by local governments when deciding on health policy. Specifically, in column 3 we account for revenue decentralization (ratio of own revenues to general government revenues) which, unsurprisingly is strongly correlated with local tax autonomy (correlation 0.933 with a p-value of 0) and so we drop the latter when including the former. In columns 4, 5 and 6 we control for the ratio of net transfers to local government to own spending (local transfer dependence), 1 minus the ratio of own revenue to own spending (local vertical fiscal imbalance) and a variable capturing the extent to which transfers are conditional or unconditional (local transfer conditionality). The inclusion of these variables does not alter our main results: decentralizing health expenditure down to the local level has a negative impact on health access and quality.

We finally examine the sensitivity of our main finding when controlling, for membership of the European Union (EU) or the former Soviet Union and government size. We control for membership of the EU since EU laws, policies and fiscal rules may have an impact on public health spending. Controlling for prior membership of the Soviet Union is due to work that has pointed to significant increases in communicable diseases (mainly HIV and tuberculosis) in these countries (Saltman et al, 2007). Finally, we control for the size of government defined as government expenditures as share of GDP to consider the possibility that the size of the public sector can be associated with health care access and quality for reasons unaccounted for by the fiscal variables employed in the regressions. Our main result such that decentralizing health expenditures down to the local level has a negative effect on health is maintained.

Conclusion

In this article we have considered the impact of fiscal decentralization on health care access and quality based on a cross-country sample covering 49 developed, transition and developing countries over the period 1996 to 2015. To measure fiscal decentralization, we have employed an indicator that reflects local government health spending as share of total spending on public health. To measure health access and quality we have employed an indicator that reflects the rates of death considered preventable by timely and effective care. Our empirical evidence suggests that decentralizing public health expenditure down to the local level has a negative effect on health care access and quality. As such it indicates that the expected negative effects of fiscal decentralization in the form of reduced and unequally distributed fiscal resources, foregone economies of scale and externalities or spillover effects tend to outweigh the expected benefits due to sorting and competition effects, information advantages and innovations.

We moreover strive to unravel some of the channels through which fiscal decentralization may undermine health outcomes namely economies of scale and spillover effects. We find that fiscal decentralization can improve health access and quality when two-thirds or more of the people in a country live in localities with more than 300,000 inhabitants. Decentralizing health expenditures down to the local level in such settings can still harness economies of scale to the benefit of health care outcomes. Interestingly, this implies that decentralizing health policy down to localities may become increasingly feasible in the future since the UN Population Division (UN, 2018) forecasts that in 2030, 61.9% of the world's population will live in urban areas with more than 300.000 inhabitants – a percentage that has been increasing during the last decades (from 49,9% in 1990 to 58,5% in 2018). Our empirical results also indicate that fiscal decentralization combined with locally elected municipal politicians who are not subject to national parties (non-integrated party systems) may worsen health outcomes. This is consistent with the presence of externalities in decentralized settings because local politicians in such systems have little incentive to internalize spillover effects or externalities. Alternatively, positive or negative externalities may be internalized in the presence of integrated party systems since national parties will pressure local politicians to take them into account.

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Appendix

Table A.1 – List of countries

ARM - Armenia	FIN – Finland	LTU – Lithuania	RUS – Russian Fed.
AUS – Australia	FRA – France	LUX – Luxembourg	SER – Serbia
AUT – Austria	GBR – United Kingdom	LVA – Latvia	SLV – El Salvador
BEL – Belgium	GRC – Greece	MDA – Moldova	SVK – Slovakia
BGR – Bulgaria	HRV – Croatia	MLT – Malta	SVN – Slovenia
CHE – Switzerland	HUN – Hungary	MUS – Mauritius	SWE – Sweden
CHN – China	IDN – Indonesia	NLD – Netherlands	THA – Thailand
CYP – Cyprus	IRL – Ireland	MNG – Mongolia	TUR – Turkey
CZE – Czech Rep.	ISL – Iceland	NOR – Norway	UKR – Ukraine
DEU – Germany	ISR – Israel	NZL – New Zealand	ZAF – South Africa
DNK – Denmark	ITA – Italy	POL – Poland	
ESP – Spain	JPN – Japan	PRT – Portugal	
EST – Estonia	KAZ – Kazakhstan	ROU – Romania	

Table A.2 – Descriptive statistics

Variable		Mean	Std. Dev.	Min	Max	Observations
Healthcare access and quality	overall	77.56	10.67	44.70	93.60	N = 166
(HAQ) index	between		10.97	47.80	90.65	n = 49
	within		2.98	70.54	84.54	T-bar = 3.38776
Life expectancy at birth	overall	76.539	5.287	53.400	83.900	N = 166
	between		5.254	57.900	83.067	n = 49
	within		1.526	72.039	81.239	T-bar = 3.38776
Healthy life expectancy	overall	67.024	4.307	49.000	74.000	N = 165
(HALE) at birth	between		4.339	51.000	73.167	n = 49
	within		1.175	63.774	70.774	T-bar = 3.36735
Healthy life expectancy	overall	16.245	1.995	10.340	20.040	N = 165
(HALE) at 60	between		2.001	10.660	19.648	n = 49
	within		0.598	14.779	17.531	T-bar = 3.36735
Infant mortality (in logs)	overall	1.725	0.712	0.531	3.906	N = 166
	between		0.719	0.826	3.700	n = 49
	within		0.232	1.040	2.367	T-bar = 3.38776
Child mortality (in logs)	overall	1.992	0.725	0.892	4.329	N = 166
	between		0.734	1.182	4.096	n = 49
	within		0.238	1.350	2.620	T-bar = 3.38776
Dec. of health spending - Local	overall	0.270	0.333	0.000	0.986	N = 166
	between		0.321	0.000	0.982	n = 49
	within		0.099	-0.152	0.804	T-bar = 3.38776
Dec. of health spending - State	overall	0.082	0.221	0.000	0.923	N = 166
	between		0.209	0.000	0.814	n = 49
	within		0.040	-0.164	0.391	T-bar = 3.38776
GDP per capita PPP (in logs)	overall	10.214	0.643	8.388	11.606	N = 166
	between		0.662	8.471	11.520	n = 49
	within		0.159	9.691	10.656	T-bar = 3.38776
Population (in logs)	overall	16.055	1.672	12.523	21.029	N = 166
	between		1.712	12.612	21.003	n = 49
	within		0.045	15.902	16.200	T-bar = 3.38776
Gini (income inequality)	overall	0.3118	0.0623	0.2162	0.5856	N = 166
	between		0.0647	0.2385	0.5812	n = 49
	within		0.0091	0.2824	0.3432	T-bar = 3.38776
Ethnic fractionalisation	overall	0.298	0.222	0.012	0.929	N = 166
	between		0.225	0.012	0.929	n = 49
	within		0.000	0.298	0.298	T-bar = 3.38776
Democracy	overall	8.320	3.850	-7.000	10.000	N = 166
	between		3.831	-7.000	10.000	n = 49
	within		0.363	6.620	9.720	T-bar = 3.38776
Health expenditure per capita	overall	7.173	1.232	4.025	8.975	N = 166

(in logs)	between		1.300	4.164	8.917	n = 49
	within		0.214	6.584	7.617	T-bar = 3.38776
Local tax autonomy	overall	0.145	0.119	0.000	0.503	N = 166
	between		0.115	0.000	0.468	n = 49
	within		0.037	-0.022	0.352	T-bar = 3.38776
Urban population 50	overall	0.3563	0.1241	0.1350	0.6700	N = 166
	between		0.1255	0.1462	0.6687	n = 49
	within		0.0170	0.3163	0.4138	T-bar = 3.38776
Urban population 300	overall	0.36.043	0.2197	0.0000	0.8710	N = 166
	between		0.2195	0.0000	0.8605	n = 49
	within		0.0175	0.3139	0.4703	T-bar = 3.38776
Density (in logs)	overall	4.309	1.388	0.410	7.201	N = 166
	between		1.385	0.434	7.153	n = 49
	within		0.045	4.155	4.454	T-bar = 3.38776
Governance quality	overall	3.636	3.339	-3.454	8.487	N = 166
	between		3.420	-2.911	8.143	n = 49
	within		0.367	2.612	4.458	T-bar = 3.38776
Local policy scope in health	overall	0.709	0.678	0.000	2.000	N = 127
	between		0.672	0.000	2.000	n = 35
	within		0.093	0.184	1.184	T-bar = 3.62857
Local effective political	overall	0.596	0.610	0.000	2.000	N = 127
discretion in health	between		0.606	0.000	2.000	n = 35
	within		0.077	0.096	1.096	T-bar = 3.62857
Local revenue decentralization	overall	0.147	0.114	0.002	0.626	N = 123
	between		0.108	0.002	0.575	n = 39
	within		0.035	0.014	0.329	T-bar = 3.15385
Local transfer dependency	overall	0.417	0.241	-0.045	0.936	N = 106
	between		0.236	0.061	0.890	n = 35
	within		0.069	0.073	0.707	T-bar = 3.02857
Local vertical fiscal imbalance	overall	0.423	0.239	-0.093	0.911	N = 106
	between		0.228	0.059	0.879	n = 35
	within		0.074	0.058	0.714	T-bar = 3.02857
Local transfer conditionality	overall	0.732	0.326	0.000	1.000	N = 166
	between		0.320	0.000	1.000	n = 49
	within		0.000	0.732	0.732	T-bar = 3.38776
Government size	overall	0.4098	0.0894	0.1746	0.5738	N = 166
	between		0.0927	0.1782	0.5439	n = 49
	within		0.0234	0.3326	0.5388	T-bar = 3.38776

Notes: Does not include dummy variables.

Fiscal Decentralization and Health Care Access and Quality: Evidence from Local Governments Around the World

On-line Appendix

Table OA.1 – Review of empirical work

Study	Health outcome	Fiscal decentralization measure	Sample	Impact of FD on Health outcome
Robalino et al., (2001)	Infant mortality rate	Subnational expenditure as a share of central government expenditure	Up to 70 low- and high-income countries over the period 1970-1995	FD reduces infant mortality and the effect is higher in poorer countries
Habibi et al., (2003)	Infant mortality rate	Ratio of provincially controlled resources to total provincial resources; ratio provincial taxes to total provincially controlled resources	23 Argentine provinces over 1970 to 1994	FD reduces infant mortality rates
Khaleghian (2004)	Immunization coverage rates	Dummy variable capturing the presence of taxing, spending or regulatory authority on the part of subnational authorities (state, provincial, district or municipal); subnational expenditures as a share of total government expenditures; health spending as a share of subnational expenditures	140 low- and middle-income countries from 1980 to 1997	Decentralization increases vaccine coverage in low income countries and reduces coverage rates in middle income ones
Asfaw et al. (2007)	Rural infant mortality rates	Factor analysis to combine the following three variables: share of Panchayats (rural local governments) in the total state expenditure, total Panchayats' expenditure per rural population, and share of Panchayats' own revenue in the total Panchayats' expenditure	14 Indian states from 1990 to 1997	FD can reduce rural infant mortality rates when combined with political participation measured at the state level as voter turnout, women's participation in polls and number of polling stations per electors
Enikolopov and Zhuravskaya (2007)	Immunization coverage rates; infant mortality rate	Subnational expenditures or revenues as a share of total expenditures or revenues	Up to 73 developing and transition countries over the period 1975-2000	Cross-section evidence that FD combined with strong national parties improves health outcomes and FD combined

				with elected rather than appointed state executives worsen infant mortality
Montero-Granados et al., (2007)	Sigma and beta convergence in life expectancy at birth and infant mortality rate	Decentralization of health policy down to Spanish regions in 1981 and 2002	17 Spanish regions and 50 Spanish provinces over the period 1980-2001	Decentralization either does not affect convergence or leads to divergence in health.
Cantarero and Pascual (2008)	Life expectancy at birth; infant mortality rate	Ratio of sub-national health care expenditure to the total health expenditure for all the levels of government.	Panel of Spanish regions for the period 1992 to 2003	FD is associated with reduced mortality rate
Uchimura and Jutting (2009)	Provincial infant mortality rates	Ratio of county expenditure to total provincial expenditure	26 Chinese provinces of the period 1995-2001	FD reduces mortality rates, especially when, moreover, more of a county's aggregate expenditure is financed by its own revenue (smaller vertical imbalance)
Jiménez-Rubio (2011a)	Infant mortality rate	Sub-national health spending (municipal, provincial and Worker's Compensation Boards) over total health expenditure	10 Canadian provinces from 1979 to 1995	FD reduces infant mortality
Jiménez-Rubio (2011b)	Infant mortality rate	Share of local government taxes (where the local governments control the tax rate, tax base or both) over general government tax revenue	20 OECD countries over the period 1970 to 2001	FD reduces infant mortality
Jin and Sun (2011)	Infant mortality rate	Dummy variable capturing 1994 tax decentralization reform; ratio of per capita provincial budgetary expenditures to total (provincial and central) per capita budgetary expenditures	31 Chinese provinces over the period 1980-2003	FD has increased infant mortality
Soto et al., (2012)	Infant mortality rate	Locally controlled health expenditure as a proportion of total health expenditure	1080 Colombian municipalities over the period 1998-2007	FD decreased infant mortality rates and the effect was stronger in non-poor municipalities

Adam et al., (2014)	Infant mortality attained by spending on health as a share of GDP (Efficiency)	Sub-central government own revenues as a share of general government total tax revenue; subcentral government expenditure as a share of total general government expenditures	21 OECD countries, between 1970 and 2000	Efficiency increases with FD up to a certain degree and then decreases (inverted U-shape)
Antón et al. (2014)	Self-reported satisfaction with public health care across a range of services grouped by primary, specialized and hospital care	Dummy variable capturing the decentralization of health policy to certain regions in 2002	Individual data from a national health barometer over the period 1996 to 2009 across 17 Spanish regions	Health policy decentralization has not improved citizens' satisfaction with different features of the health services and for some services there are small negative effects
Porcelli (2014)	Infant mortality attained by spending on health as a share of GDP (Efficiency)	Regional tax revenues earmarked for the health care sector	21 Italian regions over the period 1991-2005	FD increases the efficiency of health spending
Faguet and Sánchez (2014)	Change in the poor population covered by public health insurance	Revenue raised from local taxes and charges as a share of total health expenditure; Dummy variable capturing the extent to which local governments are subject to regional government interventions in their policy-making; share of total health expenditure accounted for by central transfers;	Over 95% of Colombian municipalities from 1994 to 2004	FD improves access of the poor to health services
Diaz-Serrano and Rodríguez-Pose (2015)	Self-reported satisfaction with public health care	Sub-central revenue and expenditure as a share of total revenue and expenditure	31 European countries at 2002, 2004, 2006 and 2008	FD has a positive impact on health care satisfaction
Cavalieri and Ferrante (2016)	Infant mortality rates	Ratio of tax revenues controlled by regional government to total regional tax revenues; ratio of transfers from state to regions over total regional expenditures	20 Italian regions over the period 1996-2012	FD reduces infant mortality, and this effect is stronger in poorer regions
Rocha et al., (2016)	Infant mortality rates	Share of health expenditures financed by municipalities own resources	Brazilian municipalities from 2000-2007	FD not associated with infant mortality

Arends (2017)	Public health expenditure as share in total government expenditure; infant mortality rates and the same variable attained by number of hospital beds and the practicing physicians per 1000 population (Efficiency)	Sub-central public health expenditure as percentage of total public health expenditure; ratio of local and state government spending to total government spending; total of local and state tax revenue as share of total general government tax revenue	32 OECD countries over the period 1995-2013	FD (spending) increases public health spending and worsens health outcomes; FD (tax) has no impact on health sector spending and may improve health outcomes
Espasa et al., (2017)	Self-reported satisfaction with public health care	Dummy variable capturing the timing and extent of decentralization of health policy across Spanish regions since 1982	17 Spanish regions from 1980 to 2011	Decentralization is associated with more satisfaction with public health care but not for larger regions
Huang et al., (2017)	Self-reported satisfaction with public health care	Share of a county's expenditure on general government expenditures in per capita terms	Individual information from 2005 and 93 Chinese counties.	FD has a positive impact on health care satisfaction in wealthier counties and for permanent city dwellers
Jiménez-Rubio and García-Gómez (2017)	Infant and neonatal mortality rates	Dummy variable capturing the timing and extent of decentralization of health policy across Spanish regions since 1981	50 Spanish provinces over the period 1980 to 2010	Health policy decentralization does not impact on health outcomes. The exception are 'foral regions´ where fiscal autonomy is more extensive and where health decentralization has improved health outcomes
Arze del Granado et al., (2018)	Ratio of public health expenditures to total public expenditures	Share of subnational government expenditures to general government expenditures	42 developing, transition and developed countries from 1990 to 2012	FD increases public health expenditures
Di Novi et al., (2019)	Coefficient of variation of self-assessed health indicator to measure between region differences and median based measure of the indicator to	Dummy variable capturing 1998 Tax decentralization reform down to regions and interacted with regional GDP per capita on the assumption that richer regions have more fiscal	20 Italian regions and micro-level data on self-assessed health over the period 1994-2007	FD does not affect between-region inequalities in health but it reduces within-region health inequalities

	measure within region health inequality	resources and are thus more fiscally autonomous		
Kyriacou and Roca-Sagalés (2019)	Perception-based measures of the quality of public services	Local spending on public health as a share of general government health spending	30 European countries over the period 1996–2015	FD worsens the perceived quality of public services

Table OA.2 – Definition of variables and sources

Variable	Definition	Sources
Healthcare access and quality (HAQ) index	The HAQ index is measured on a scale from 0 (worst) to 100 (best) based on death rates from 32 causes of death that could be avoided by timely and effective medical care (also known as 'amenable mortality')	Murray et al. (2017)
Life expectancy at birth	Number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life	World Development Indicators (WDI)
Healthy life expectancy (HALE) at birth	Average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury	World Health Organization (WHO)
Healthy life expectancy (HALE) at 60	Average number of years that a person at age 60 can expect to live based on current rates of ill-health and mortality	WHO
Infant mortality rate (per 1000 live births) (in logs)	The number of infants dying before reaching one year of age, per 1,000 live births in a given year	WHO
Child mortality rate (per 1000 live births) (in logs)	The number of children dying before reaching five years of age, per 1,000 live births in a given year	WHO
Local fiscal decentralisation on health	Local health expenditure as a share of General Government health expenditure	Lledó, et al (2018)
State fiscal decentralisation on Health	State health expenditure as a share of General Government health expenditure	Lledó, et al (2018)
GDP per capita (in logs)	Gross Domestic Product (GDP) per capita PPP (constant 2017 U$S)	WDI
Population (in logs)	Population (in thousands)	WDI
Inequality	Gini coefficient based on net income inequality	Solt (2020)
Ethnic fractionalisation	The probability that two randomly selected individuals belongs to different ethnical groups, and so increases with the number of	Alesina et al. (2003)

	groups. Complete ethnic homogeneity (an index of 0) to complete heterogeneity (an index of 1)	
Democracy	Competitiveness of elections, recruitment and participation, and constraints on the executive (Polity2)	Marshall (2020)
Health expenditure per capita	General Government health expenditure plus private health expenditure (both per capita)	Government Finance Statistics of the International Monetary Fund (GFS-IMF) and Global Health Expenditure of the WHO
Local tax autonomy	Tax revenue decentralisation at local level (local taxes / general government taxes)	Lledó, et al (2018)
Urban population 50	Percentage of Urban Population living in an urban center. Urban center must have a minimum of 50,000 inhabitants plus a population density of at least 1500 people per square kilometer (km2) or density of build-up area greater than 50%	GHSL - Global Human Settlement Layer, European Commission
Urban population 300	Percentage of Urban Population in Cities with more than 300.000 inhabitants	United Nations, Department of Economic and Social Affairs, Population Division (2018). World Urbanization Prospects: The 2018 Revision, Online Edition
Democratic decentralization, party integration	Takes the value of 1 when: 1) there are municipal council elections, 2) municipal executives are not appointed by a higher tier, 3) at least half of the parties have a permanent organization, 4) more than 75% of the municipal council seats are held by national parties and 5) national party leaders control party nomination in municipal elections	Hankla et al. (2019)
Democratic decentralization, party non-integration	Takes the value of 1 when: there are municipal council elections, and (2) municipal executives are not appointed by a higher tier, and when one or more of the following is true: 3) fewer than half of the parties have a permanent organization, 4) 75% or fewer of municipal council seats are held by national parties, or 5) national party leaders do not control party nomination in municipal elections	Hankla et al. (2019)

Density (in logs)	Population (in thousands) divided by surface	WDI
Governance quality	Average of the following dimensions: government effectiveness, rule of law, regulatory quality, and control of corruption with higher values indicating more quality of governance	World Governance Indicators (WGI). Kaufmann et al. (2011)
Local policy scope on health	The extent to which local government is formally autonomous and can choose the tasks they want to perform. Not at all; partly; fully responsible for: (0-2): Refers to primary health services - + 1 point if the local government is fully responsible for the construction and/or the maintenance of clinics or health centres (not hospitals or specialised health services); + 1 point if the local government is fully responsible for doctors' employment and payment	Ladner et al. (2016)
Local effective political discretion on health	The extent to which local government has real influence (can decide on service aspects) over these functions. No, some, or real authoritative decision-making in: Health (0-2): Refers to primary health services + 1 point if local government can decide on the construction and/or the maintenance of health centres (not hospitals or specialised health services); + 1 point if local government can decide on the organisation and functioning of specialised health centres	Ladner et al. (2016)
Local revenue decentralization	Ratio of own revenues to General Government revenues, Local Government	Lledó, et al. (2018)
Local transfer dependency	Ratio of net transfers to own spending, Local Government	Lledó, et al. (2018)
Local vertical fiscal imbalance	1- ratio of own revenue to own spending, Local Government	Lledó, et al. (2018)
Transfer conditionality	1 – at least half of transfers (to LG budgets from same- or upper-tier governments) are unconditional and formula-based; 0.5 – quarter to half of transfers are unconditional and formula-based; 0 – all transfers are either conditional or discretionary; 0.25 or 0.75 – LG are treated asymmetrically	Ivanyna and Shah (2014)

EU member	Dummy variable taking the value of 1 if the country is a member of the European Union	Eurostat
Soviet	Dummy variable that takes the value of 1 if the country was a member of the Soviet Union	La Porta et al. (1999)
Government size	Expenditure of General Government as a share of GDP	GFS-IMF