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HEALTH SPENDING, OUT-OF-POCKET CONTRIBUTIONS, AND MORTALITY RATES

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Health policies seek to achieve conflicting objectives. We argue that the objective of saving lives is best served by a careful balancing of fairness and efficiency considerations. Open, fair, and equitable access to health care for all citizens will lower overall mortality rates by enabling the very poor and chronically ill to satisfy their demand for necessary health care. But it will also result in higher costs, not least by also increasing demand for irrelevant, unnecessary, and inefficient health care. This undesirable demand and its associated costs can be reduced by increasing out-of-pocket contributions paid for by patients. Such payments are unpopular, though, as they are regarded as regressive and damaging to health of the relatively poor. We argue that properly enacted, no such apparent trade-offs exist. If the freed-up resources are used for more life-saving measures, then higher out-of-pocket contributions will lower overall mortality rates. However, this beneficial effect is conditional on what happens to total health spending. Ironically, out-of-pocket payments are most effective as health policies if they are not or only hardly used as a means of reducing total health expenditures. Our theoretical arguments are confirmed by an econometric analysis of aggregate mortality rates in OECD countries over the period 1984 to 2007.

INTRODUCTION

Policy-makers are faced with the challenge of designing health care policies that meet multiple objectives (Wagstaff 1991; Weale 1998; Cutler 2002). Saving the lives of citizens by lowering premature mortality rates clearly represents an important objective for any policy-maker concerned with social welfare. Yet, ageing societies (Besley and Gouveia 1994) and technological progress in the health sector (Cutler 2002) have put increasing pressure on health budgets, with total health expenditures continuing to rise faster than gross domestic product (GDP) in all countries of the Organisation for Economic Co-operation and Development (OECD). While spending more and more of a nation's available income on health will, all other things equal, lower mortality rates (Nixon and Ullmann 2006), OECD countries strive to contain the costs of health provision.

As many governments battle rising health costs, they also aim at providing comprehensive and non-discriminatory ('fair' and 'equitable') access to health services (Goddard and Smith 2001; Anand and Dolan 2005; Wendt 2009). Health policies ought to protect individuals from unbearably high health care costs. Therefore, virtually all health care schemes in countries of the OECD effectively redistribute income from healthy to chronically ill individuals and, typically, from the relatively affluent to the relatively poor parts of the population (Van Doorslaer *et al*. 1999; Wagstaff *et al*. 1999). Policy-makers are thus caught between the desire to seek efficiency gains necessitated by constraints on the absolute level of health spending on the one hand and the desire to provide a fair and equitable health system on the other (Green-Pedersen and Wilkerson 2006).

Besides other options such as increasing competition amongst health providers, which had ambiguous effects on cost containment (Bevan *et al*. 2010, pp. 257-258), policy-makers can resort to two distinct, but equally unpopular measures to combat rising health costs. On the one hand, administered solutions such as quantitative rationing of

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health services use more or less arbitrary criteria to deny the provision of health care to some (Aaron and Schwartz 1984; Goold 1996; Weale 1998; Oberlander *et al*. 2001; Irvine *et al*. 2005; Aaron 2008; Ubel 2008). These measures may keep spending under control but increase mortality (Sikora 1999). On the other hand, increasing out-of-pocket contributions and similar economic incentives can impose spending discipline by shifting some of the economic burden away from public budgets and insurance providers onto private individuals (Wagstaff *et al*. 1999; Chi *et al*. 2008). Yet, out-of-pocket contributions have a bad reputation among many public health policy scholars (Evans *et al*. 1993; Mossialos and Dixon 2002; Donaldson and Ruta 2005). It is questionable, as critics argue, whether out-of-pocket transfer schemes achieve cost containment or cost reductions given information asymmetries and principal–agent problems between patients and health care providers. Relative to the status quo out-of-pocket contributions also redistribute income 'in the wrong direction': from chronically ill to healthy individuals and, typically, from the relatively poor to the relatively affluent part of the population. This is likely to increase mortality among disadvantaged groups by reducing their health care demand through 'price rationing'. Adverse mortality effects are exacerbated if individuals fail to distinguish between necessary and unnecessary health care and reduce both in response to higher out-of-pocket contributions.

In this article, we argue that by carefully balancing efficiency and fairness considerations and by simultaneously employing the main policy options available to policy-makers, governments can significantly reduce total mortality rates without spending more and more on health. We agree that providing fair and equitable access health care to all – which is typically achieved by extending insurance coverage and by raising the share of public to total health expenditures – will, all other things equal, lower mortality rates. Unfortunately, though, all other things are not equal and open access health care to all will also increase demand for unnecessary, irrelevant, and inefficient health care. This reduces the overall efficiency of the health care system and, ultimately, leads to an explicit or hidden quantitative rationing of expensive health care services with ambiguous consequences on overall mortality rates as fewer resources are available for other more life-saving health services.

These inefficiencies, we argue, can be counteracted by increasing the share of out-of-pocket contributions. We are of course not the first to argue that higher out-of-pocket payments reduce excessive consumption of health services – see, for example, the pioneering work by Feldstein (1973) and Feldstein and Gruber (1995). Our original contribution is to explore the mortality effects of these efficiency gains and to show that these effects are conditional on changes to the total level of spending. While higher out-of-pocket contributions will inevitably also reduce demand for necessary health care, particularly by the relatively poor, they do not necessarily increase overall aggregate mortality because by reducing demand for irrelevant, unnecessary, and inefficient health care, they release resources, which can be used for more life-saving measures. Whether a higher share of out-of-pocket to total health expenditures will lower or raise overall mortality rates thus crucially depends on whether these released resources are used to lower total health expenditures or are spent on other health measures. If a higher share of out-of-pocket expenditures goes hand in hand with lower total expenditures, then the negative health consequences will dominate the aggregate. Conversely, however, for a constant or only slightly decreasing expenditure level, the positive health effects from a higher out-of-pocket to total expenditure share will dominate, leading to lower overall mortality rates.

Inevitably, higher out-of-pocket contributions will, to some extent, restrict the redistributive component of health systems (Costa-Font and Gil 2009). However, any regressive effects of higher out-of-pocket payments can be mitigated by exempting the very poor and restricting the size of such payments to a defined percentage of income, as some OECD countries do (Wagstaff *et al*. 1999, p. 288). Any remaining regressive effect can be redressed by redistributing more income via the general tax system and social policies. Whilst there is clearly some trade-off between fairness and efficiency within the health system, the trade-off can be overcome if fairness is achieved by means other than using the health system for redistributive motives.

We test our arguments by analyzing the determinants of mortality rates at the international macro-level in a cross-country time-series panel of OECD countries over the period 1984 to 2007. First, we add evidence to the controversy in the empirical macro-level literature and corroborate the finding that increasing the share of public to total health expenditures lowers overall mortality rates. Second, and more importantly, we are the first to analyze the effect of the out-of-pocket to total health expenditure share on mortality rates. We show that despite concerns about affordability, a higher share of out-of-pocket to total expenditures lowers overall mortality rates, unless the efficiency gains are predominantly used to lower total health spending.

FAIR AND EQUITABLE HEALTH SYSTEMS AND THEIR MORTALITY EFFECTS

There is an extensive literature analyzing the broader links between inequities and health – see Beckfield and Krieger (2009) for a comprehensive review. Here, we exclusively focus on factors directly related to aggregate mortality effects. We define fair and equitable access to health care as equal access to the same quality of health care for all individuals resident in a country in similar need of health care independently of their income position (ability to pay), age, gender, or ethnicity.

Most OECD countries have implemented some form of compulsory health insurance system and have extended coverage over time to universal or close to universal insurance coverage. In the absence of a compulsory universal health insurance system covering the entire population, a sizable number of individuals remain uninsured, as is most clearly visible in the USA (Lasser *et al*. 2006). Some of these – the young and healthy ones – will rationally abstain from seeking insurance. Others – the very poor or the very sick – cannot afford insurance coverage or cannot find an insurance that will cover them given their state of health. Evidence suggests that the very poor or very sick dominate the group of uninsured individuals (Jovanovic *et al*. 2003). As one would expect, therefore, empirical research from the micro-level shows that mortality rates among the uninsured exceed mortality rates of insured individuals by between 25 and 40 per cent (Franks *et al*. 1993; Wilper *et al*. 2009) and strongly suggests beneficial health effects to affected individuals following from extending insurance coverage.

However, it would be an ecological fallacy to automatically presume that extending insurance coverage will lower overall mortality rates. This is because extending insurance coverage to the previously uninsured may have negative knock-on consequences on the already insured if there is a fixed overall health budget that now needs to be shared among more individuals. Of course, extending insurance coverage may go hand in hand with increased health expenditures, but this is often politically difficult to achieve. Alternatively, increased health expenditures following extended insurance coverage can partly be compensated for by wiser and more efficient health spending on the

already insured – something that can be achieved by higher out-of-pocket contributions, discussed in more detail below – leaving overall spending practically unchanged. Even with a constant overall health budget and no efficiency gains, one would probably expect the macro-level effect on aggregate mortality rates of extending insurance coverage to the previously uninsured to be beneficial – simply because the health benefits to the previously uninsured are substantively so strong as to more than compensate any adverse effects on the already insured. Existing studies thus not surprisingly find a negative effect of insurance coverage rates on mortality (Berger and Messer 2002; McWilliams *et al*. 2004; Winegarden and Murray 2004; Arah *et al*. 2005).

Not all insurances are equal though – far from it – and even universal insurance coverage does not guarantee equitable and fair access to health services. It may well be that private health insurance companies serve the healthy and wealthy, coercing 'bad risks' into underfinanced public health systems, thus coercing public insurers to ration health care. Despite the boundaries between public and private health systems being somewhat blurred (Saltman 2003), many have suggested that more equitable and fair access is facilitated by a larger share of public to total health expenditures on the grounds that public health facilities or publicly funded semi-private facilities are less likely to discriminate against the poor, against ethnic minorities, or against individuals with certain medical pre-conditions than private health facilities (Or 2000, 2001; Conley and Springer 2001; Navarro and Shi 2001; Berger and Messer 2002). Many of the caveats raised above with respect to extending insurance coverage apply also to extending the share of public to total health expenditures, however. A higher public contribution to health care is likely to lead to rationing if it is not accompanied by higher total spending or efficiency gains.

By its nature, evidence on the mortality effects of a higher public to total health expenditure share can only come from aggregate macro-studies. While Conley and Springer (2001) and Or (2000, 2001) suggest that a higher public share leads to lower mortality, Berger and Messer (2002) come to the opposite conclusion. The problem with these existing macro-studies is that they inadequately control for the strong downward trend in mortality rates over time in all countries caused by factors that have nothing to do with an increasing share of public to total expenditures, which leads to potentially biased estimates, as well as fail to account for the fact that observations within one country in a cross-national time-series sample are not truly independent observations, which leads to an underestimation of standard errors. In this study, we correct for both shortcomings in our empirical research design.

EFFICIENCY: HIGHER OUT-OF-POCKET CONTRIBUTIONS AND THEIR MORTALITY EFFECTS

With limited financial resources and a drive to contain the costs of health, efficiency gains become extremely important. We define efficiency gains as achieving lower mortality rates with constant health expenditures or as reducing expenditures with constant mortality rates. An extensive literature broaches the issue of measurement of efficiency and productivity of health care delivery - see Hollingsworth (2008) for an excellent survey. However, the vast majority of studies examine output or throughput measures, such as inpatient days, or discharges relative to input variables, such as number of staff and capital employed. Our use of efficiency is radically different, *focusing on the effect of different health policies on aggregate mortality rates*.

One way to achieve efficiency is to induce final customers to be more disciplined with respect to the type and quantity of health services consumed, which can be achieved by out-of-pocket contributions. Basic economic theory tells us that individuals over-consume goods provided free of a direct charge, that is, consume a good beyond the point where marginal benefit equals marginal cost. The incentives to demand 'unnecessary' health care do not entirely disappear with out-of-pocket payments. However, by increasing out-of-pocket expenditures individuals are prompted to think more carefully whether the health care demanded provides sufficient health benefits. Empirical evidence also suggests that out-of-pocket contributions limit 'excessive' health care spending (Feldstein 1973; Feldstein and Gruber 1995; Zweifel and Manning 2000).

Thus, out-of-pocket transfers affect the efficiency of the health care system in three ways. First, the demand for unnecessary health care declines. This reduces health care spending but does not affect mortality rates and thus efficiency increases. Second, if governments hold total expenditure constant, the lower demand for unnecessary heath care allows health institutions to reduce the barriers to certain types of health care for relatively old patients. Of course, this effect can only occur in health care systems that ration health care and undersupply necessary health care for the elderly (or according to any other discriminatory principle). And third, out-of-pocket transfers reduce necessary health care among the relatively poor part of the population. This leads to declining expenditures but increasing mortality rates and thus has an ambiguous effect on efficiency. Yet, if the savings are used to finance demand for health care for which otherwise there would not have been sufficient resources available, then the effect of declining demand for necessary health care remains minor. We develop the argument that the effect of out-of-pocket expenditures is conditional on total expenditures in more detail below.

Out-of-pocket transfers come in different forms and types and vary largely across countries. For example, some require individuals to co-pay a certain percentage or fixed cost (usually per year or per quarter) for each medical treatment or for prescription drugs only, other governments limit total out-of-pocket contributions to a defined share of income. As different as these schemes are, they have in common that they affect individual demand for health care. Since only a share of the total expenditure of a treatment is covered by the health insurance or the public, each patient has to contribute an individual share of the total cost of the treatment and will therefore no longer regard the treatment as a free good.

The debate on out-of-pocket contributions often overlooks any aggregate health effects and focuses mainly on social effects or, where health effects are taken into account, on the health consequences for the relatively poor only. From this perspective, the case appears clear: out-of-pocket contributions have a bad reputation as they 'shift the funding burden away from population-based, risk-sharing arrangements – such as funding based on tax or social insurance – and towards payments by individuals and households' (Mossialos and Dixon 2002, p. 23; see also Creese 1991). Such a shift cannot be socially neutral and conflicts with the objective of ensuring equity, defined as 'access by need and not by ability to pay' (Bevan *et al*. 2010, p. 252). The larger the share of out-of-pocket contributions to total health expenditures, the smaller, ceteris paribus, the redistributive effects of the health care system. Relatively poor parts of the population will respond more elastically to increasing out-of-pocket costs of health care and reduce unnecessary as well as necessary health care. In addition, they may also reduce their expenditures for disease recognition and prevention before they become ill.

That out-of-pocket contributions reduce demand for unnecessary and necessary health care is a well established finding – see the excellent overview in Zweifel and Manning (2000, pp. 429–44) of the available empirical evidence coming from natural experiments, observational comparisons of individuals, and randomized controlled experiments. The 'gold standard' (Bajari *et al*. 2006, p. 5) of this evidence is provided by the Rand Corporation's Health Insurance Experiment conducted between November 1974 and January 1982 (Brook *et al*. 1984). The experiment funded by the US Department of Health, Education and Welfare was designed to analyze whether the generosity of health insurance affects individual demand for health care. Fourteen different health plans, ranging from free medical treatment to substantive out-of-pocket payments, were assigned to approximately 6000 participants that followed an invitation to participate. The main result of this experiment was that, unsurprisingly, free medical treatment leads to significantly higher demand for medical services. Participants benefitting from free treatment received roughly 50 per cent more medical treatments, thereby incurring approximately 33 per cent higher costs.

Unfortunately, due to the experimental design, the high hopes social scientists usually have in experiments do not come to fruit here. The main result – generosity of the health insurance increases demand for health care – is clearly overestimated, because participants knew that the duration of the experiment was limited (to 3 or 5 years). As a consequence, participants on a generous scheme had an obvious incentive to antedate expensive health treatments, while participants on a very parsimonious scheme had an incentive to delay expensive health treatment. One would thus expect that, because of the experimental design, demand for health care was higher for individuals with a generous health insurance plan during the duration of the experiment. In other words, the experimental design partly generated the major finding of the study, and the reduction in health care utilization as a result of higher out-of-pocket contributions is likely to be exaggerated. Nevertheless, a reduction in both necessary and unnecessary health demand as a consequence of higher out-of-pocket contributions is very likely for theoretical reasons and is supported by a battery of other empirical studies (see Zweifel and Manning 2000, pp. 429–44).

If out-of-pocket transfers influence demand for health care, then they are likely to have redistributive effects (Deininger and Mpuga 2005; Limwattananon *et al*. 2007). Xu *et al*. (2003) have shown that the extent to which health care regimes manage to shelter the chronically ill population from economic hardship due to extreme health expenses depends on a country's poverty level, average income, and the size of out-of-pocket contributions. The higher the out-of-pocket contributions to health care, the more likely individuals will suffer economically when they acquire a disease or a condition that is expensive to treat. However, the authors also conclude that 'catastrophic health expenditures' remain almost irrelevant in developed countries. Disastrous economic effects of out-of-pocket contributions only occur in countries with both a substantial share of the population below the poverty line and where out-of-pocket contributions exceed more than 20 per cent of total health care costs, which does not typically hold for OECD countries. This does not mean that out-of-pocket contributions remain socially neutral. Ceteris paribus, out-of-pocket contributions will reduce the redistributive effect of health insurance schemes.

What about the mortality consequences of higher out-of-pocket contributions? At first glance, the case against these also seems strong. Since these contributions not only reduce unnecessary demand for health care but also necessary demand, mortality of some groups of individuals will increase. This does not imply, however, that higher

out-of-pocket expenditures increase overall mortality. How out-of-pocket contributions affect aggregate mortality crucially depends on total health care expenditures. Higher out-of-pocket contributions will reduce demand for necessary health care, predominantly by the relatively poor, as critics argue, but they will also reduce demand for non-health relevant expenditures such as cosmetic surgery, for unnecessary health care with no health benefits, and for inefficient health care where high treatment costs have low positive health benefits (Feldstein 1973; Feldstein and Gruber 1995). This decline in demand for irrelevant, unnecessary or inefficient health expenditures will reduce overall health expenditures. Crucially, the question is what governments and health insurance providers do with the freed-up resources, whether they use them to reduce health care spending or keep the resources in the health system to be deployed elsewhere, in which case the availability of resources for necessary health care and more life-saving measures improves. If this is the case, then the effect of out-of-pocket-contributions on health care becomes ambiguous. On the one hand, demand for necessary health care declines, particularly by the poor. This potentially kills individuals who decide to reduce their demand of health care because of the out-of-pocket contributions. They would have survived with a more generous health care system. On the other hand, if governments and health insurance providers use the efficiency gains to make more resources available for necessary treatments, this saves the lives of patients which would otherwise be denied life-saving health care.

The net effect of out-of-pocket contributions, in other words, depends on these two effects. If the demand effect exceeds the supply effect, mortality increases; if the supply effect exceeds the demand effect, mortality declines. This, in short, predicts that the effect of out-of-pocket-contributions on mortality rates is conditional on what happens to overall healthcare spending. But in addition to being indirectly dependent on overall healthcare spending, the effect of higher out-of-pocket contributions is also likely to be directly conditional on the level of spending. In other words, the marginal effect of out-of-pocket contributions depends on changes in the level of total health spending. If health spending remains stable or is allowed to grow as a result of the additional resources raised from increased out-of-pocket contributions, then the efficiency gains from these contributions create more room for manoeuvre. Health care institutions can propel additional resources to high cost health treatments or effectively reduce rationing in price sensitive areas. If, however, the government and health insurance providers use the additional resources from higher out-of-pocket payments to reduce other financial contributions to the health system, then efficiency gains will still be achieved, but health care institutions have less leeway to use these gains for life-saving measures and thus less leeway to reduce overall mortality rates.

EMPIRICAL RESEARCH DESIGN

Health scholars generally seem to prefer, and for good reasons, micro-level data. However, our theoretical arguments can only be tested by employing macro-level data at the international level since we need sufficient variation in macro-level policies to test the effect of these on total mortality rates. To analyze how the main policy choices open to policy-makers affect aggregate mortality, we use data on age-standardized mortality rates for all causes of death (mortality per 100,000 people) from the OECD (2010) Health Data, where the source uses the total OECD population for 1980 as reference population. The same source also provides data on all other variables. Mortality rates

per 100,000 people vary in our sample, from a minimum of 428 in Japan in 2006 to a maximum of 1004.5 in Ireland in 1986, with a mean of 660 and a standard deviation (S.D.) of 105.6.

Our main explanatory variables are the share of public to total health expenditures, the share of out-of-pocket to total health expenditures as well as total health expenditures, once measured in per capita terms, once relative to GDP in constant purchasing-power-parity dollars of 2000. Total health expenditures are defined as all medical, paramedical, nursing, and technology expenditures with the goal of promoting health and preventing disease, curing illness and reducing premature mortality, caring for persons with illnesses and health impairments, providing and administering public health, health programmes, health insurance, and other funding arrangements. Public health expenditures are defined as expenditures incurred by public funds, i.e. state, regional, or local government bodies and social security schemes. They include public capital formation expenditures on health facilities plus capital transfers to the private sector for hospital construction and equipment. Out-of-pocket expenditures comprise cost-sharing, self-medication, and other expenditures paid directly by private households, irrespective of whether the contact with the health care system was established on referral or on the patient's own initiative.

We do not include the share of the population covered by health insurance schemes (public/social security or private) in our main estimations as this variable has no or practically no over-time variation in most countries and thus cannot be efficiently estimated in a country fixed effects model, on which more below. The public share in total health expenditures varies in our sample from a low of 45.3 per cent in the United States in 1999 to a high of 92 per cent in Luxembourg in 2004 (with mean of 78.3 and S.D. of 10.4). The out-of-pocket contribution share varies in our sample from 6.5 per cent in Luxembourg in 2001 and 2005 to 38.5 per cent in Switzerland in 1987 (with mean of 16.7 and S.D. of 6.2). Total health spending relative to income was lowest at 5.8 per cent in Luxembourg in 1999 and 2000 and highest at 15.7 per cent in the USA in 2005 (with mean of 8.7 and S.D. of 1.7), while total health spending per capita was lowest at $890 in Ireland in 1984 and highest at $5801 in the USA in 2005 (with mean of $2268 and S.D. of $801). Our source data does not allow us to distinguish among different types of out-of-pocket contributions.

To these explanatory variables of interest, we add GDP per capita as well as its squared term to account for the fact that mortality is likely to decline with rising incomes, but at a decreasing rate. We also add the temporally lagged dependent variable as well as year- and country-specific fixed effects, resulting in a stringent model specification that improves on existing studies. Mortality rates are trended downward over time. To account for this trend we include the temporally lagged dependent variable and period fixed effects, the inclusion of which also largely eliminates the potential for serial correlation in the errors, a necessary condition for obtaining unbiased estimates of the effects of regressors (Beck and Katz 1995; Plümper *et al*. 2005). With up to 24 periods (years), so-called Nickel bias from the simultaneous inclusion of fixed effects and the lagged dependent variable remains negligible. Estimated coefficients of the other explanatory variables are to be interpreted as short-term effects, yet it is possible to derive long-term effects from the coefficients of the independent variables and the lagged dependent variable. The year-specific time fixed effects also capture common trends in the data, thereby accounting for changes in medical technology, awareness etc. that affect mortality rates and vary over time, but approximately affect all countries equally.

To control for factors such as differences in climatic conditions, differences in the genetic composition of the population and in health-relevant behaviour that remain largely constant over time, but differ across countries, we include country-specific fixed effects. Failure to control for these time-invariant factors would lead to omitted variable bias. This specification is also appropriate for testing our theoretical argument with respect to out-of-pocket contributions, which predicts that changes in overall health spending condition the effect of changes in out-of-pocket contributions on mortality rates. Country fixed effects models capture all between variation in the data by demeaning all variables in the estimation model (Wooldridge 2002; Plümper *et al*. 2005). This ensures that only differences in the behaviour of units (here: countries) over time affect the estimation results. We thus, in effect, estimate whether changes in our main explanatory variables affect changes in mortality rates, not whether the levels of our main explanatory variables affect the levels of mortality rates. In other words, we test whether a country in years in which it has relatively high (low) levels of out-of-pocket contributions and relatively high (low) levels of total health spending relative to other years achieves relatively low mortality rates, also relative to other years. A significantly negative interaction effect of out-of-pocket contributions and total public health expenditure thus suggests that countries on average have lower mortality rates when out-of-pocket contributions and total health expenditures are high relative to years in which they had lower out-of-pocket contributions and/or lower total health expenditures. This is exactly what our theory predicts.

Our sample covers 21 Western developed countries over the period 1984 to 2007. The panel is unbalanced since we do not have data for all countries in all years, but the gaps, which occur mainly towards the beginning and towards the end of our sample period, are not systematically related to our explanatory variables, such that our results do not suffer from sample selection bias. The standard errors of estimations are clustered on countries to account for the fact that observations from one country at different points in time are not truly independent observations in a cross-national time-series sample. The clustering of standard errors also ensures that findings are robust to arbitrary heteroscedasticity and serial correlation in the data (Cameron and Trivedi 2010). We see no strong reason for any concern about endogeneity bias, which can be caused by measurement error, reverse causality, or omitted variables. The variables are fairly well measured by national statistical agencies in OECD countries, there is no direct reverse causality because of the budget constraint faced by health institutions and our model is stringently specified with the lagged dependent variable, country and time fixed effects and a set of control variables, to which more are added in further robustness tests. Non-stationarity of the dependent variable could be an issue (total health expenditures per GDP or per capita are likely to be stationary and the share of public and out-of-pocket contributions to total health expenditures are by definition stationary). However, whilst mortality rates are downward trending over time, it is not clear whether our dependent variable is non-stationary given that our estimation model includes the lagged dependent variable as well as time and country fixed effects. In any case, first differencing the data typically renders such data stationary and in non-reported analysis, we found that the results from Arellano and Bond's (1991) first-difference system generalized method of moments estimator produces estimated effects that have the same coefficient signs and are statistically indistinguishable from the results reported below.

TABLE 1 *Main estimation results*

	Model 1 **Spending per GDP**	**Model 2** **Spending per capita**
Mortality rate (t–1)	0.641***	0.650***
	(0.0571)	(0.0576)
Public as % of total health expenditures	−1.678***	−1.775***
	(0.526)	(0.523)
Total health expenditures	−4.391*	−0.00903*
	(2.386)	(0.00470)
Out-of-pocket as % of total health expenditures	−3.535***	−3.506***
	(0.726)	(0.804)
Total expenditures * out-of-pocket share	−0.182**	−0.00038*
	(0.0857)	(0.000223)
GDP per capita (ln)	−465.7**	−446.0**
	(222.9)	(174.4)
[GDP per capita (ln)]^2	21.01*	20.79**
	(11.43)	(9.208)
R-squared (within)	0.969	0.968
Observations	329	329
Number of countries	21	21

Notes: Year-specific and country-specific fixed effects included. Standard errors adjusted for clustering on countries in parentheses.
*Significant at 0.1 level, **at 0.05 level, ***at 0.01 level.

RESULTS

Table 1 presents our main estimation results. The model fit as indicated by the within-R^2 value is very good, as one would expect with the temporally lagged dependent variable included in the estimation model. Our theory posits an interaction effect between the out-of-pocket and the total spending variables. Since in interaction effect models the coefficients of the two constituent variables represent the effect where the respective other variable is set to zero and no observations in our sample have either a zero out-of-pocket contribution share or zero health expenditures, we centre both variables at mean sample values so that each constituent variable coefficient shows the effect of that variable at mean values of the other constituent variable. Model 1 specifies total health spending relative to a country's income, while Model 2 specifies total health spending relative to population size.

Our estimation results suggest that mortality rates are lower the higher the share of public to total health expenditures. In both model specifications, a higher share of out-of-pocket to total expenditures also lowers mortality rates at mean levels of total health spending. This is a striking finding given that the public and the out-of-pocket shares of total expenditures are strongly negatively correlated with each other. The simultaneous presence of these effects shows that in order to reduce mortality it is important to ensure fair and equitable access to health services for individuals (as proxied by the share of public to total health expenditures), but also to impose some discipline on their consumption choices (as proxied by the share of out-of-pocket contributions to total health expenditures), i.e. to find the right balance between equity and fairness on the one hand and efficiency on the other. One potential reason why a higher share of out-of-pocket contributions does not lead to higher mortality rates is that many countries exempt the

very poor or the very ill from such payments, thus reducing any negative effects on health, while still allowing for any positive health effects greater spending discipline has for other parts of the population.

Higher total health spending, expressed as either a share of GDP or in per capita terms, lowers mortality rates at mean levels of out-of-pocket expenditures. More importantly, however, the statistically significant coefficient of the interaction term suggests that the effect of out-of-pocket contributions is indeed conditioned by total health spending. The negative coefficient suggests that the effect is in line with our expectations: the mortality-reducing effect of a higher share of out-of-pocket to total health spending increases with increased levels of total spending. In other words, when increased out-of-pocket transfers are used to reduce total health spending, the effect on mortality rates is smaller than when governments increase out-of-pocket transfers alongside maintaining or increasing total health expenditure. Finally, an increasing per capita income lowers mortality rates, but at a decreasing rate, as one would expect: richer countries have better health care and better access to advanced medical technology.

In substantive terms, increasing the share of public to total health expenditures by one percentage point leads to a reduction in mortality rates by 1.7 deaths per 100,000 people (90% confidence interval (CI): 0.6, 2.8) in the short-run and by 5.2 deaths per 100,000 people (90% CI: 2.3, 7.1) in the long run. The substantive effects of increasing out-of-pocket contributions are more complex due to the interaction effect with total health spending. To illustrate some predicted marginal effect changes in mortality rates based on 'real world' changes in these two variables (results based on Model 1): between 1988 and 1996, Australia increased out-of-pocket transfers from 14.8 per cent by 2.2 percentage points to 17 per cent, while total health spending (as a share of the economy) rose from 6.5 to 7.6 per cent. These two factors (and the interaction effect between them) would result in an immediate or short-run predicted decline in mortality rates by 11.8 deaths per 100,000 people (90% CI: 6.4, 17.2). In the long run, the effect increases to a decline of 32.8/100,000 (90% CI: 17.7, 47.8). If Australia wanted to achieve the same decline in mortality rates by just increasing spending on health, the government would have to increase health spending by a little over 3 percentage points of GDP. In contrast, Finland increased out-of-pocket transfers from 15.6 per cent by 6.2 percentage points to 21.8 per cent between 1991 and 1995, but simultaneously reduced total health expenditures by 0.9 percentage points to 7.9 per cent of GDP. Given this scenario, our model predicts a decline in mortality rates by only 17.2/100,000 (90% CI: 9.7, 24.7) in the short run and 47.9/100,000 (90% CI: 27.0, 68.8) in the long run.

During the same years in which Finland increased out-of-pocket transfers, 1991 and 1995, Italy implemented the largest increase in out-of pocket transfers of all countries in our sample. In these five years, out-of-pocket transfers increased from 17.2 to 26.6 per cent of total health care expenditures. At the same time, total expenditures declined from 7.9 to 7.3 per cent of GDP. These changes account for a short-term decline of 28.1/100,000 (90% CI: 16.7, 39.5) and a long-term decline of 78.2/100.000 (90% CI: 46.4, 109.9) in mortality rates. Italy then went on to reduce the out-of-pocket contribution share again to 22.4 per cent in 2003, while raising total expenditures per GDP to 8.3 per cent. Our estimation model predicts that the rise in expenditures was not enough to counteract the effect of the relatively strong decrease in the share of out-of-pocket payments and mortality is predicted to rise by 8.3 deaths per 100,000 people (90% CI: 1.9, 14.8). Naturally, other factors such as technical progress captured by the period dummies and GDP per capita brought mortality rates down during this period. These predictions should therefore be

interpreted as our model predicting that mortality went down by 8.3 deaths per 100,000 less than it otherwise would have in Italy over this period. Interestingly, while actual mortality declined in Italy between 1995 and 2003 from 648 to 554/100,000, the average in the other OECD countries for which there are data in both years declined from 686 to 559/100,000 and thus declined stronger both absolutely and in percentage terms. This is consistent with the predictions of our model that about one third of the lower decline in Italy (as compared to the other OECD countries) was due to *reducing* out-pocket-transfers – a policy reform that made the Italian system less efficient.

In sum, the health policy options open to policy-makers – total health expenditures and the share of public as well as the share of out-of-pocket expenditures therein – have substantively important effects on overall mortality rates, and while the strong downward trend in mortality rates (between 1984 and 2007 the mean mortality rate in OECD countries declined from 846 to 548 per 100,000 people) is undoubtedly for the most part due to advances in medical technology, governments exert an influence on the development of mortality rates which is by no means trivial or negligible.

In table 2, we check whether our results are robust to a number of modifications to the model specification. We focus on the specification with total health spending as a percentage of GDP rather than spending per capita, since GDP provides the budget constraint for what a nation can spend on health. In Model 3, we allow for the possibility that societies with a higher fertility rate and a higher share of elderly people might have higher mortality rates. We find no evidence for this. One needs to keep in mind that we include country fixed effects estimations in our model, without which both fertility and the share of elderly have the expected positive effect. In Model 4, we account for the effect of short-term business cycles on mortality. Consistent with mounting evidence that economic boom times are bad for health at least in developed countries (Ruhm 2000; Neumayer 2004), we find that a lower unemployment rate, indicating economic boom times, is associated with higher mortality rates. Our main results are unaffected. In Model 4, we add two behavioural variables that may affect mortality, namely the average per capita consumption of alcohol and fat. We do not add the incidence of smoking as this variable has too many missings; this is unlikely to lead to omitted variable bias since the incidence of smoking is unlikely to be strongly correlated with our explanatory variables. Adding alcohol and fat consumption as explanatory variable means losing two countries and several years of observations due to missing data, but the results on our main explanatory variables uphold. The effect of total health spending becomes marginally insignificant at mean levels of the out-of-pocket contribution share to total expenditures. Conditional on the other explanatory variables in the estimation model, the average per capita consumption levels of neither alcohol nor fat have an effect on aggregate mortality rates.

One concern about studies like ours with macro-level estimations at the country level is that they treat all country observations equally despite large differences in country sizes. In Model 5, we weight observations by the population size of countries, thus giving more weight to observations from larger relative to smaller countries. While the non-linear effect of GDP per capita becomes insignificant, all the other results uphold. In Model 6, we exclude the United States and Luxembourg from the sample on the grounds that these two countries often have extreme values on our health policy variables and could thus constitute a priori outliers. Results are robust, however, and are thus not driven by the presence of these two countries in the sample. Lastly, in Model 7, we exclude mortality from external effects from our overall mortality rates measure. Mortality from external

TABLE 2 *Results from robustness tests*

	Model 3 Full sample	**Model 4 Full sample**	**Model 5 Full sample**	**Model 6 Full sample (population weighted)**	**Model 7 Excl. USA & LUX**	**Model 8 Excl. external causes**
Mortality rate (t–1)	0.625***	0.614***	0.566***	0.644***	0.667***	0.651***
	(0.0597)	(0.0543)	(0.0855)	(0.0548)	(0.0540)	(0.0616)
Public as % of total health expenditures	−1.755***	−1.866***	−1.518*	−1.867***	−1.655***	−1.551***
	(0.553)	(0.504)	(0.746)	(0.550)	(0.538)	(0.513)
Total health expenditures	−4.458*	−4.458*	−4.192	−6.886*	−4.251	−4.871*
	(2.223)	(2.223)	(2.778)	(3.558)	(2.559)	(2.343)
Out-of-pocket as % of total health expenditures	−4.145*	−3.542***	−3.269***	−3.907***	−3.415***	−3.465***
	(2.164)	(0.786)	(1.094)	(0.715)	(0.771)	(0.690)
Total expenditures * out-of-pocket share	−3.582***	−0.174*	−0.210*	−0.262**	−0.156	−0.141*
	(0.749)	(0.0921)	(0.118)	(0.123)	(0.0942)	(0.0795)
GDP per capita (ln)	−368.8	−647.1**	−827.8**	−305.5	−419.9*	−478.9**
	(258.7)	(253.8)	(343.4)	(232.1)	(218.9)	(218.8)
[GDP per capita (ln)]^2	16.11	28.85**	38.71**	14.39	18.87	21.37*
	(13.42)	(13.27)	(17.36)	(11.29)	(11.29)	(11.17)
Fertility rate	10.80					
	(14.10)					
Share of population aged above 64	−0.556					
	(1.213)					
Unemployment rate		−1.404**	−1.344*			
		(0.644)	(0.742)			
Per capita alcohol consumption			0.610			
			(1.893)			
Per capita fat consumption			−0.0758			
			(0.327)			
R-squared (within)	0.969	0.969	0.957	0.983	0.971	0.966
Observations	329	328	273	329	300	329
Number of countries	21	21	19	21	19	21

Notes: Total health spending is measured as spending per GDP. Year-specific and country-specific fixed effects included.
Standard errors adjusted for clustering on countries in parentheses.
*Significant at 0.1 level, ** at 0.05 level, *** at 0.01 level.

effects (mainly accidents, violent crime, and suicide) is arguably least amenable to health care measures. Nolte and McKee (2004, 2008) go much further and exclude entire groups of causes of death and age cohorts from their definition of which diseases are 'potentially amenable to health care' (Nolte and McKee 2008, p. 60). We explicitly do not follow their lead here since our arguments on the mortality effects of health care policies relate as much to preventive health care measures preventing the occurrence of diseases as to measures once a disease or condition has set in. So, for example, it would be biasing our results to follow Nolte and McKee (2008) and exclude half of all deaths from ischaemic heart disease on the basis that in their judgement only up to half of these cases are potentially amenable to health care. Our results are robust to excluding external causes from our mortality measures.

CONCLUSION

Governments simultaneously try to reduce mortality rates, keep the budget under control by seizing efficiency gains, and seek to grant equal and fair access to health care. Unfortunately, these objectives create apparent conflicts and trade-offs. This article has demonstrated that policy-makers can achieve efficiency gains and lower mortality rates by increasing the share of out-of-pocket to total health expenditures, as long as the efficiency gains are not predominantly used for lowering total expenditures. At the same time, an increase in the ratio of public to total health expenditures also lowers mortality rates. By choosing an optimal combination of out-of-pocket contributions, which promotes efficiency but also increases inequality in the health care system, and a high public health expenditure share, which lowers inequality in access to the health care system, governments may achieve a significant reduction in mortality at negligible social cost.

Many health scholars are opposed to raising out-of-pocket contributions as part of a reform of health systems (see, for example, Evans *et al*. 1993; Mossialos and Dixon 2002; Donaldson and Ruta 2005). This literature does not contradict our findings since they do not systematically analyze the effect of such contributions on aggregate mortality, but oppose them on grounds of equity and fairness, focusing exclusively on the health effects of the very poor or very ill. Does the regressive effect of higher out-of-pocket contributions provide sufficient reason against using this policy option if policy-makers are predominantly concerned with equity and fairness rather than overall mortality? We think not. The historically strong link between health and social policies was a major achievement and integral component of the creation of a social welfare state in the late nineteenth and twentieth centuries, but governments can now promote social equity and fairness by other means. Contemporary governments command over a wide set of redistributive taxes and social policies and can reduce income inequality without having to (mis-)use health care policies for redistributive purposes. Health policies should first and foremost aim at improving the health of citizens, allowing them to live longer. As this article has demonstrated, this can be achieved by increasing out-of-pocket contributions, and strictly opposing this on social grounds costs lives. On the other hand, there can be little doubt that everything else equal, out-of-pocket transfers reduce the degree of income redistribution and contribute to health inequality.

Yet, there is no reason to keep everything else equal. Policy-makers face the challenge of designing a sustainable health care system. Forbearing possible efficiency gains in health care – efficiency gains that translate into a significant reduction in mortality – because of social concerns does not seem to be rational if economic hardship due to high health care costs can easily be avoided. For example, some proponents of these contributions suggest that some of the additional money raised by these payments can be used to mitigate the socially regressive consequences by (partially) exempting very poor people and by ensuring that more expensive life-saving forms of treatment remain available to them (RAND Corporation 2006). Policy-makers can also restrict the amount of out-of-pocket contributions to a certain percentage of income above the poverty line. In this way, very poor people would be exempt from paying out-of-pocket transfers while the effect on the middle class is limited. More generally, any apparent trade-off between efficiency and fairness exists within the health care system only. It can be avoided by compensating social and tax policies.

We have shown that out-of-pocket contributions can have positive effects on reducing mortality. Future research should try to distinguish among different types of out-of-pocket contributions and different regimes for limiting the burden of such payments on individuals. With saving lives at stake, such research promises high pay-off in terms of potential impact.

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